SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING

by

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DECLARATION

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DEDICATION

I would like to dedicate this thesis to my parents, Pieter and Marietjie, for awakening in me a thirst for knowledge, a love of teaching and a yearning to always work to the betterment of myself and others.

"Lord, make me an instrument of Thy peace.
Where there is hatred, let me sow love;
where there is injury, pardon;
where there is doubt, faith;
where there is despair, hope;
where there is darkness, light;
and where there is sadness, joy.
O, Divine Master,
grant that I may not so much seek
to be consoled as to console;
to be understood as to understand;
to be loved as to love;
for it is in giving that we receive;
it is in pardoning that we are pardoned;
and it is in dying that we are born to eternal life".

Prayer of St. Francis of Assissi (1182 – 1226)

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LIST OF ACRONYMS

ABMS	American Board of Medical Specialties
ACGME	Accreditation Council for Graduate Medical Education
ACS	American College of Surgeons
ACLS	Advanced Cardiovascular Life Support
AJHPE	African Journal for Health Professions Education
APMEC	Asia Pacific Medical Education Conference
ATLS	Advanced Trauma and Life Support
BC	Before Christ
BLS	Basic Cardiovascular Life Support
BSS	Basic Surgical Skills
CMSA	The Colleges of Medicine of South Africa
CPG	Clinical Practice Guidelines
ECUFS	Ethics Committee of the University of the Free State
FCCS	Fundamental Critical Care Support
FC Plast Surg (SA)	Fellow of the College of Plastic Surgeons of South Africa
HF	High Fidelity
HIV	Human Immunodeficiency Virus
HPCSA	Health Professions Council of South Africa
HPE	Health Professions Education
HSREC	Health Sciences Research Ethics Committee
ID	Instructional Design
IICE	The Ireland International Conference on Education
IJCDSE	International Journal for Cross-Disciplinary Subjects in Education
LF	Low Fidelity
LICEJ	Literacy Information and Computer Education Journal
MBChB	Bachelor of Medicine and Bachelor of Surgery
MHPE	Master of Health Professions Education
MMED	Master of Medicine
MMED Plast. Surg.	Master of Medicine in Plastic Surgery
SA	South Africa
SAMJ	The South African Medical Journal
SBME	Simulation-Based Medical Education
SP	Simulated Patient/Standardised patient

UFS	University of the Free State
UK	United Kingdom

SUMMARY

Key terms: cognitive levels; development of guidelines; effective learning; Delphi process; learning theories; semi-structured interviews; simulation; postgraduate plastic surgery education and training

Simulation can play an important role in building a safer health care system and may have the potential to address a number of challenges facing postgraduate medical training. Simulation-based learning is becoming widely established within medical education and offers benefits to inexperienced residents learning procedural skills in a climate of decreasing clinical exposure. Simulation in health care is increasingly being used for teaching and training and the development of competencies related to patient safety and teamwork. The ability to perform clinical procedures safely on patients is a key skill and requires a combination of various skills and competencies – some of which may be obtained by introducing simulation into registrars' training.

An in-depth study was done on simulation in postgraduate plastic surgery education and training. The problem that was addressed in this study was the lack of clarity about whether, and, if so, to what extent simulation can contribute by playing a role, and will be of value in postgraduate plastic surgery education and training, and whether it would enhance the effectiveness of learning at various cognitive levels. The research was therefore aimed at identifying the contribution that simulation can make to plastic surgery education and training.

The methods used to achieve this aim included a literature study, Delphi survey and semi-structured interviews. The conceptualisation and contextualisation of simulation-based education and training in plastic surgery were accomplished through the literature study that focussed on the role and value of simulation, the features and uses of simulation that lead to effective learning and theory underlying a process to developing and formulating guidelines. Through the Delphi questionnaire, the Delphi experts had to indicate the importance of simulation as one of the methods to train a plastic surgeon. They, if they wished to do so, had to complete a questionnaire regarding what type of simulation modality is/can be applicable as far as simulation is concerned and had to indicate the cognitive level of training that is/can be addressed by simulation. The identification of a number of outcomes that may be reached by applying simulation as a possible method,

including suggestions on the type of simulation modality to be used, as well as the possible cognitive level, was established by this method. In this study, the purpose of the individual semi-structured interviews with role-players in clinical simulation was to investigate and establish clarification on simulation in postgraduate plastic surgery education and training. It informed decisions on the development of the proposed guidelines by the in-depth overview of the contribution that simulation can make and recommendations as far as the challenges to the implementation of simulation into plastic surgery education and training.

The results and findings of the research (prepared in manuscript/article format), contributed to achieving the aim of the research, and were used for the creation of a framework structure that can be applied to propose/suggest guidelines with recommendations for the implementation of simulation in postgraduate plastic surgery education and training. For simulation to be introduced as a teaching method and a learning opportunity for residents with a view to impact on plastic surgery education and training, it should include (i) a clear set of recommendations on how simulation can enhance the effectiveness of learning; (ii) a description of the contribution, including the role and value of simulation, based on a scientific research process; (iii) the development of an argument to enhance plastic surgery training by including simulation in education and training programmes; and (iv) the development of a framework structure that can be applied to propose guidelines for teaching through simulation as part of training programmes for evidence-based plastic surgery education and practice.

The outcome of the study will serve as a directive for postgraduate plastic surgery education and training by means of suggested guidelines including recommendations on how simulation may be utilised to improve students' knowledge, skills and professional conduct.

In conclusion, the researcher recommends that further research may be undertaken, by an interdisciplinary group within the discipline of plastic surgery, based on a systematic review of evidence and within the parameters of sufficient resources, finances, expertise and knowledge, skills and competencies, to compile valid and usable guidelines on simulation by the profession for the profession. This research is seen as the first step taken in this process or direction.

SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

In this research project, an in-depth study was done on simulation in postgraduate plastic surgery education and training. This was done by identifying the contribution that simulation can make in postgraduate plastic surgery education and training. One aspect in this study was to determine the different cognitive levels of learning addressed by simulation in plastic surgery education and training, including the types of simulation modalities that were indicated to be suitable for use in the various sub-disciplines of plastic surgery. The results and findings were used to develop a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes in postgraduate plastic surgery education.

This doctoral thesis is presented in the form of a manuscript published in conference proceedings and four publishable articles (cf. Chapter 2-6), written and submitted for publication in peer-reviewed journals.

This chapter, Chapter 1, first, aims to orientate the reader to the research that was done. Second, it provides a discussion on the background to the research problem, giving a description of and context to the study, followed by the problem statement, including the research questions, the goal, aim and objectives of the study as well as the demarcation of the field and scope of study and highlights the value and significance of the study. A discussion on the research design and approach as well as a description of the methods followed. The chapter is concluded by giving a systematic presentation of the study process, including a layout of the subsequent chapters of the thesis and a short summative conclusion.

The purpose of the research is to provide clarification on the role and value of simulation in postgraduate plastic surgery education and training, including the features and uses of simulation that may lead to effective learning in this field and on the specific and relevant cognitive level.

The outcome of the study will serve as a directive for postgraduate plastic surgery education and training on how simulation may be used to enhance learning, and how simulation may be utilised to improve students' knowledge, clinical competence, skills, and professional conduct.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

Evidence of the role of simulation in medical education has placed increased reliance on simulation technology over the past number of decades in efforts to facilitate the growth of learner knowledge, to provide controlled and safe practice opportunities, and to shape the acquisition of doctors' clinical skills (Fincher & Lewis 2002:91-95; Gaba 2000:236; Issenberg, McGaghie, Hart, Mayer, Felner, Petrusa, Waugh, Brown, Safford, Gessner, Gordon & Ewy 1999:861–866).

Applications of many forms of simulation technology in medical education are presently available. According to Gaba (2000:236) and Issenberg *et al.* (1999:861-866), simulation is becoming an integral part of medical education at all levels. Issenberg, McGaghie, Petrusa, Gordon and Scalese (2005:10–28) identify factors contributing to the increased use of simulation in medical education, namely problems with clinical teaching; new technologies for diagnosis and management; assessing professional competence; medical errors; patient safety; team training; and the role of deliberate practice.

Changes in the delivery of health care triggered major shifts in medical education methods. According to Issenberg *et al.* (2005:20), "…for instance, in the United States, the pressures of managed care are shaping the form and frequency of hospitalisations, resulting in higher percentages of acutely ill patients and shorter in-patient stays. This results in less opportunity for medical learners to assess patients with a wide variety of diseases and physical findings. Despite increased cost-efficiency, reductions in physician reimbursement and shrinking financial resources constrain the educational time that physicians in training receive. Consequently, at all educational levels, doctors find it increasingly difficult to keep abreast of skills and topics that frequently appear in practice".

In South Africa, the smaller teaching platform, as well as the smaller variety of conditions (case mix) admitted to the academic hospitals (due to the burden of HIV and related diseases as well as financial constraints) available for training purposes (CMSA 2009:3;10) has an impact on the quality and competence of health care professionals leaving medical schools. South Africa (SA) does not have enough medically skilled professionals in all areas of health care to meet the people's needs. To cope with this burden, Mayosi (2009:7) suggests that the existing specialities and specialities for the public sector be increased. Medical education, however, is a long and expensive process and it is not possible to address the problem with a "quick-fix" solution (Matlatla 2009:9).

The situation is not unique to South Africa. The problem that arises when increasing the number of students entering medical schools is that more students have to compete for clinical cases, as described by Maran and Glavin (2003:22). The number of conditions primary health care professionals are expected to deal with (case mix) leads to simulation being used to fill the gap in medical training (Maran & Glavin 2003:22). Patients nowadays are better informed, have greater expectations and may exercise their right not to be involved in student education (Bradley & Postlethwaite 2003:6), resulting in an even smaller teaching platform.

Training in plastic surgery is not exempted from this. The increased competition for surgical exposure and practice, combined with smaller teaching platforms and shorter training times might have an impact on the quality and surgical competence of the resident (in SA called registrar) leaving the training programme.

Scalese (2009:65) highlights the trend to utilise simulators for teaching, learning and assessment. Ziv, Erez, Munz, Vardi, Barsuk, Levine, Benita, Rubin and Berkenstadt (2006:1091) posit that Simulation-Based Medical Education (SBME) plays a significant role in minimising risk to patients and enhancing medical training. These authors (Ziv *et al.* 2006:1091) also mention that medico-legal issues and demands for accountability can be critical driving forces for the incorporation of simulation training in health care education.

The question that came to mind was: *Can simulation in postgraduate plastic surgery education and training enhance the effectiveness of learning in this discipline?* Therefore, would it be worthwhile examining the use of simulation in a postgraduate plastic surgery training environment to determine if it might be useful in addressing the problem of a lack of opportunities for clinical exposure and practice? These are questions that instigated the desire to seek a solution to the problems experienced with medical training, as discussed above.

Worldwide, different models exist for education and training in plastic surgery, including the model of learning through an apprenticeship relationship with senior clinical colleagues, own observation or self-directed learning – motivated by a candidate's own internal drive. In some cases, registrars receive little guidance in terms of the knowledge, competencies, skills and attitudes that they are expected to acquire during residency.

Rosen, Long, McGrath and Greer (2009:729) point out that in contrast to the traditional apprenticeship model, twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, hospital resources and minimise errors. The driving forces behind this came from developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy, simulation can improve results and also lower risk and procedure cost because of fewer procedures and less operating room time (Rosen *et al*. 2009:730). Simulation in training allows students ample opportunity to hone their skills and competencies in safe, no risk circumstances.

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) identify six core competencies for residents: "… Patient care, medical knowledge, practice-based learning and improvement, inter-personal and communication skills, professionalism, and systems-based practice" (Mittal, Dumon, Edelson, Acero, Hashimoto, Danzer, Selvan, Resnick, Morris & Williams 2012:147).

A joint initiative of the ACGME and the ABMS, *The Plastic Surgery Milestone Project,* compiled descriptors and targets for resident performance, based on the above-mentioned core competencies which can be categorised into five training levels, moving from Level 1 where the resident demonstrates the mastering of milestones expected of an incoming resident up to Level 5 where the resident has advanced beyond performance targets set for residency and completing graduation (ABMS & ACGME 2013:Online).

These levels were used as points of departure when compiling the Delphi questionnaire for this study.

Simulators represent a safe and standardised postgraduate training method, and also provide a yardstick for gauging residents' practical capabilities regarding procedures, surgery and teamwork in a clinical setting. The American College of Surgeons (ACS) has decided to introduce simulation in training and education for general surgery in three phases: Skills training, procedure training, and team training. Mittal *et al.* (2012:148) propose that plastic surgery should follow this simulation initiative with modifications appropriate to the specialty. Phase 1, Skills, is attended to in the resident's general surgery training, but Phase 2, Procedures, focuses on the development of procedures specific to plastic surgery. For Phase 3, Competencies in teamwork, the competencies for plastic surgery resemble those for general surgery and include team-training simulators to improve communication in emergency departments, clinics, operating rooms, and hospital wards.

Arbogast and Rosen (2012:235-252) propose in their article, *Simulation in Plastic Surgery Training: Past, Present and Future,* that this three-phase strategy be adapted for plastic surgery residency, by modifying it to address challenges specific to the field. They are of the view that a unified commitment by medical educators to use simulation "…to simultaneously standardize the training curriculum, individualize the method of acquiring information, and objectively evaluate the training process" is necessary (Arbogast & Rosen 2012: 252).

1.2.1 Simulation in medical education and plastic surgery

1.2.1.1 *What is simulation?*

Medical simulators are educational tools that lie within the broad context of SBME, which in its broadest sense may be defined as "any educational activity that utilises simulative aids in order to enable medical educators to enhance the educational message by simulating the clinical scenario" (Dent & Harden 2009:216). Simulation devices serve as an alternative to the real patient and permit educators to gain full control of a pre-selected clinical scene without the risk of distressing patients or encountering other harmful aspects of learning on real patients. It must be stressed that SBME is not an alternative to bedside teaching, but rather a valuable, complementary addition (Dent & Harden 2009:216).

McGaghie (1999:9) defines a simulation as follows: "….Simulation is a person, device or set of conditions, which attempts to present education and evaluation problems authentically. The student or trainee is required to respond to the problems as he/she would under natural circumstances. Frequently the trainee receives performance feedback as if he/she were in the real situation".

According to Chiniara, Cole, Brisbin, Huffman, Cragg, Lamacchia, Norman and the Canadian Network for Simulation in Healthcare, Guidelines Working Group (2013:e1380), "healthcare simulation" describes the wide range of simulation experiences. It is an "instructional medium used for education, assessment, and research, which includes several modalities that have in common the reproductions of certain characteristics of clinical reality". "Simulation-based education activities rely on experiential learning and must allow participants to affect to different degrees, the course of the educational experience through verbal or physical interaction with the simulated component or patients" (Chiniara *et al.* 2013:e1380).

1.2.1.2 ***Simulation modalities***

According to Dent and Harden (2009:216), simulation is now in widespread use for professional health education and includes trained persons, devices, lifelike virtual environments, and artificial social situations that mimic problems, events or conditions that arise in professional encounters. SBME consists of two main families, low-tech and high-tech simulation modalities.

Low-tech simulation modalities: These are characterised by tools that are not computer-driven and serve as models for various educational purposes. The low-tech simulation modalities represent traditional simulation tools that have been in use in medical education for many years. According to Dent and Harden (2009:216–217), these simulation modalities include the following: Simple three-dimensional organ models; basic plastic manikins and simple skills trainers; animal models; human cadavers; and simulated or standardised patients.

High-tech simulation modalities: Such modalities are characterised by models operated by computers, utilising advanced hardware and software technologies to enhance the realism of the simulation experience and to increase the anatomical and physiological validity of the training tools. According to Dent and Harden (2009:218–219), these include the following: Screen-based simulators; realistic, high-fidelity procedural simulators (task trainers); realistic, high-tech interactive patient simulators; and virtual reality. Among these, task-trainers may be referred to as moderate or medium fidelity simulators. Welman (2013:14) describes this modality as a "…useful instructional tool and… used for deeper understanding of specific, increasingly complex subject matter and competencies. An example is a model with breath and heart sounds, but without the chest movements seen with high-fidelity simulators".

Chiniara *et al.* (2013:e1380) refer to a simulation modality as the "broad description of the simulation experience and includes four modalities (computer-based simulation, simulated patient (SP), simulated clinical immersion, and procedural simulation) in addition to mixed, hybrid simulations.

For the purposes of this study, and the Delphi Questionnaire, reference will be made only to low-tech and high-tech simulation modalities.

1.2.1.3 *Driving forces behind medical simulation*

SBME is recognised as an increasingly powerful, complementary teaching methodology in the medical profession. According to Gordon, Oriol and Cooper (2004:23–27), Issenberg *et al.* (1999:866), and Ziv, Wolpe, Small and Glick (2003:783–784), SBME is driven by a combination of the following forces: the patient safety movement; simulated patient-based examinations; patient rights movements and patient ethics issues; lesser use of animals for procedural training purposes; risk management and the medico-legal atmosphere, which demand accountability and high safety and quality standards; reduced patient accessibility and decreased training opportunities; and new technologies and high-fidelity training devices.

1.2.1.4 *Benefits of and rationale for medical simulation*

Various authors (Gaba, Howard & Flanegan 1998:2; Gordon *et al*. 2004:26; Maran & Glavin 2003:24) are of the view that the rationale for incorporating simulation in medical education has a solid educational and social grounding, and give the following reasons: Medical simulation provides a safe environment where trainees can learn from their errors without the risk of harming a real patient; simulation offers a trainee-centred environment that can provide full attention to the student's individual needs, pace, strengths and deficiencies; simulation is an experiential learning education modality acknowledged by adult learning theories to be effective; simulation provides unique opportunities for team training; and it provides a reproducible, standardised, objective setting for both formative assessment that includes debriefing and feedback, and summative assessment via testing.

According to Arbogast and Rosen (2012:235–256) in their article, *Simulation in Plastic Surgery Training: Past, Present and Future*, the face of medicine is characterised by rapid and constant evolution. New procedures, new technology, and new solutions to clinical challenges are forever changing the field. However, according to these authors, medical education has been historically stagnant.

The earliest record of surgical simulators dates back to 600BC when in India clay and leaf models were used to simulate forehead-flap nasal reconstructions. Other early examples of simulation in plastic surgery include Le Fort's use of cadavers to study facial fractures, and Rad Tanzer's use of plaster ears prior to completing reconstructive surgery on patients. (Arbogast & Rosen 2102:235).

Today, "new challenges in medical education demand a metamorphosis of transformation" (Arbogast & Rosen 2012:235). Present undergraduate medical education is rooted in lectures, laboratories, simulated/standardised patients and in some cases simulators. Problems with this system include limited integration of basic and clinical sciences; a biology-centric rather than patient-centric focus; and an emphasis on knowledge and discreet skill over critical thinking, decision-making, and teamwork. According to Arbogast and Rosen (2012:235), this last issue is especially problematic, as physicians are routinely faced with the complex tasks of diagnosis and treatment in chaotic environments, in which information is often inadequate, inaccurate, or not readily available.

Satava (2010:623-633) cites three concepts that will be key in revolutionising medical education, namely: an increased efficiency of education by standardising curriculum; an individualisation of education; and a shift from time-based training to competency-based training.

Arbogast and Rosen (2012:241-244) listed 20 skills required of postgraduate residents in general surgery and plastic surgery respectively that can be simulated in year one and two as well as procedures required of residents in plastic surgery in years three, four and five that can be simulated.

In future, simulation needs not be restricted to residency; simulation has a role to play in medical education from the undergraduate level to the senior physician's maintenance of certification. The incorporation of innovative technology into today's curriculum will be an essential step in not only preparing for the future, but shaping it as well (Arbogast & Rosen 2012:252).

Soltanian (2016:773) defines simulation as the replication of a real-world process or system over time and urges more surgeon educators to become involved in the development of simulators for training the next generation of plastic surgeons. The required technology has become more readily available lately and surgical simulations have improved significantly in recent years. The most common types of models in surgical simulation include physical models (e.g. to train fundamentals of laparoscopic surgery); mathematic models (e.g. commonly used within a computer simulation); graphical models (e.g. graphical depiction of an object or system), and finite element models (e.g. large and complex systems are divided into smaller and simpler parts with more predictable behaviour with a view to replicating the more complex objects (Soltanian 2016:773).

Neumeister (2016:777) mentions that many plastic surgery programmes find it problematic to balance clinical, hands-on education and training with their didactic programme. Work and duty hour restrictions add another layer of complexity to surgical education. Furthermore, the rate-limiting step in learning is not the transmission of information from the teacher to the learner, but rather the processing of the information by the learner. According to Neumeister (2016:777), the current trends in educational technology include internet-based instruction, hands-on simulation devices, mobile devices, virtual and augmented reality, point-of-care learning and assessment, and learning analytics. Telemedicine combined with holograms brings distant expertise into the classroom for learners at all levels. Before entering the operating room, interactive mobile applications allow the residents opportunities to practise procedures over and over again to solidify the understanding of each aspect of any given surgery skill (Neumeister 2016:777). "Educators need to use innovation and technology to make the best use of data and knowledge to train next generations of plastic surgeons. Educational technology offers unique tools to help learners acquire and process the information needed to become masters of their surgical specialty" (Neumeister 2016:777).

1.2.2 Learning theories, strategies, cognitive levels of learning, and adult learning

Many theories exist that explain how adults learn; for example, instrumental learning theories, humanistic theories, transformative learning theory, social theories of learning, as well as motivational and reflective models (Taylor & Hamdy 2013:e1561-e1572).

To understand the concept of **learning effectiveness and learning at different cognitive levels** or **domains of competence,** it is necessary to examine learning theories and also make these applicable to a clinical discipline such as plastic surgery (cf. 7.3.1 & 7.3.2). It is also necessary to discuss in context the use of simulation for developing and demonstrating higher-order levels of thinking required in clinical practice; clinical competence and the assessment of clinical skills; as well as to offer ideas on instructional design (ID) to assist educators in creating appropriate simulation learning experiences.

According to Kolb's learning cycle, learners must have a concrete experience upon which they can reflect (Taylor & Hamdy 2013:154). Through their reflection, students are able to formulate abstract concepts, and make appropriate generalisations, after which they solidify their understanding by testing the implications of their knowledge in new situations. This then provides them with an objective experience, and the cycle continues. Learners with different learning preferences will have strengths in different quadrants of the (Kolb) cycle. In Kolb's terminology "Activists" feel and do, "Reflectors" feel and watch, "Theorists" watch and think, and "Pragmatists" think and do.

From the educator's point of view, it is important to design learning activities that allow the cycle to be followed, engaging each of the quadrants. Although it is often quoted, and easily understood, the learning style inventory developed from the Kolb cycle has poor reliability and validity (Coffield, Moseley, Hall & Ecclestone 2004). Figure 1.1 is a representation of Kolb's experiential learning cycle.

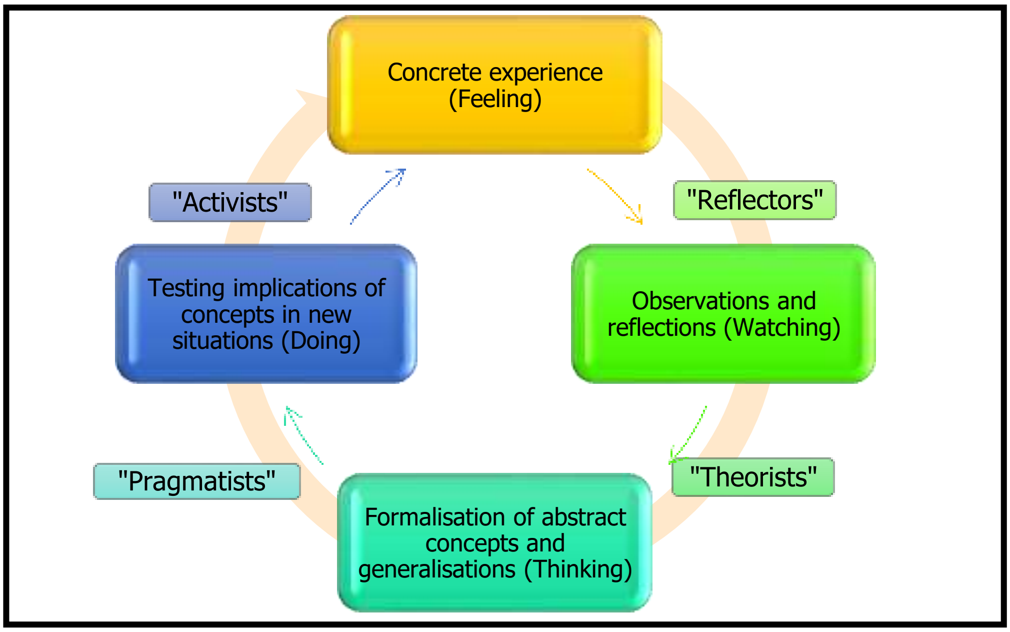

FIGURE 1.1: KOLB'S EXPERIENTIAL LEARNING CYCLE [ADAPTED FROM TAYLOR & HAMDY 2013:E1564]

To build our knowledge and understanding, we need to have "some idea of where things fit, how they fit together, and some idea of how the individual pieces are part of a greater whole, otherwise the learners will experience a sense of discomfort when they do not understand the context of an unknown learning situation" (Taylor & Hamdy 2013:e1564). This is called "scaffolding" and includes programme level organisers, which are dependent on both the content and the context in which it is being learned. Programme organisers include the syllabus, lectures, planned experiential learning and reading lists. Most commonly, scaffolding includes providing learners with a list of intended learning outcomes when they enter the programme or a new clinical environment (Taylor & Hamdy 2013:e1564). Learning outcomes can be refined using Bloom's taxonomy (Bloom, Engelhart, Furst, Hill, Kratwohl 1956). In Figure 1.2, Bloom's taxonomy is shown, and Anderson's later development of the taxonomy is shown in Figure 1.3.

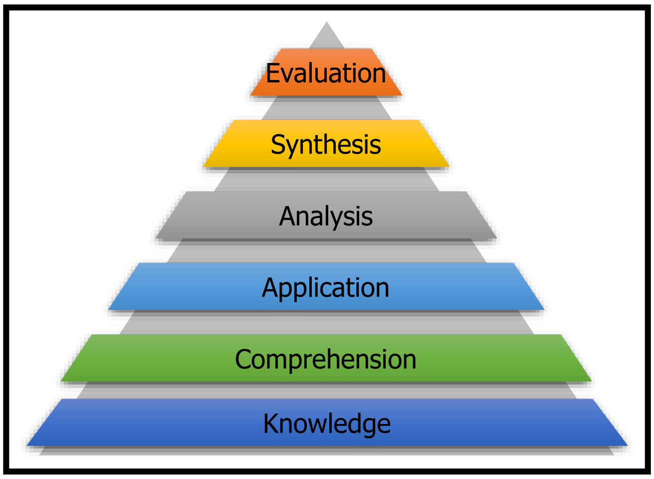

FIGURE 1.2: BLOOM'S TAXONOMY
[ADAPTED FROM ATHERTON 2011:ONLINE]

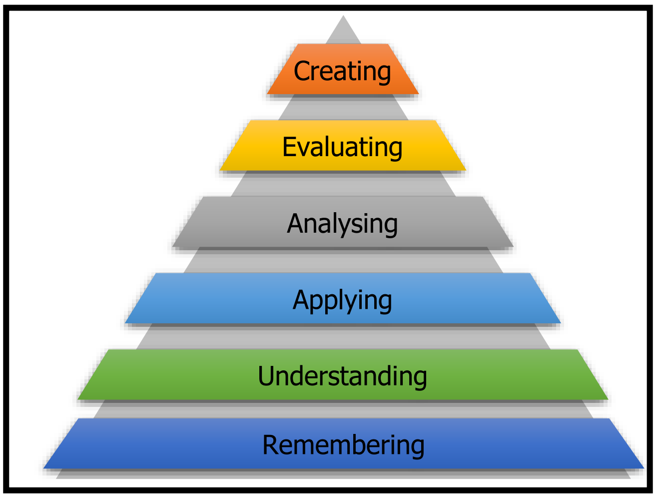

FIGURE 1.3: REVISED TAXONOMY OF THE COGNITIVE DOMAIN
[ADAPTED FROM ANDERSON & KRATWOHL 2001; IN ATHERTON 2011:ONLINE]

In medical education, the most frequently encountered is Miller's pyramid (Miller 1990:S64), which can be used as a guide for planning and assessing student learning, especially the mastery of skills, within a curriculum (cf. Figure 1.4). The pyramid is important, because in training students for the healthcare professions it is essential to remember that the outcome of training is intended to be graduates who can take their place in the workforce (action).

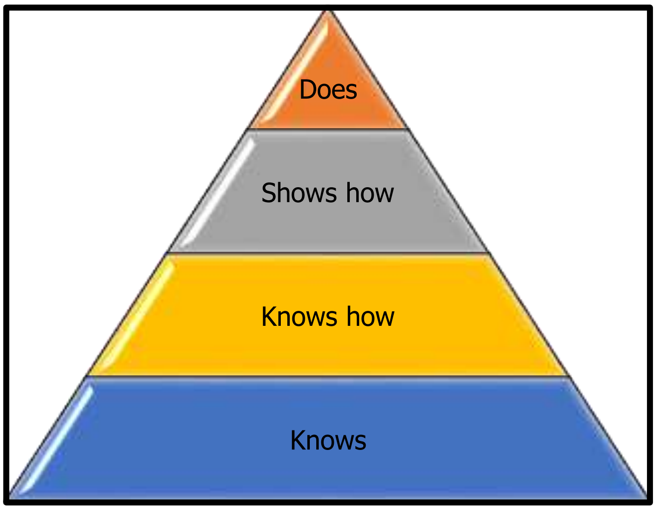

FIGURE 1.4: MILLER'S PYRAMID
[FROM MILLER 1990:S64]

Knowledge and the levels of knowledge form the foundation of the pyramid (Miller 1990:S65) (cf. Figure 1.5).

FIGURE 1.5: MILLER'S PYRAMID FOR ASSESSING CLINICAL COMPETENCE
[FROM NORCINI 2007:2]

Alinier (2007:e246–247) discusses the relationship between Miller's pyramid for developing skills competence, the type of simulator most appropriate for each level, the degree of simulator fidelity and the nature of skills that can be developed with each type of simulator. Labuschagne (2012:224–225) draws a comparison between Bloom's taxonomy and Miller's pyramid, and proposes the use of simulation for developing and demonstrating higher-order levels of thinking, which approximates the levels of thinking required in clinical practice. With the development of simulator technology providing greater degrees of fidelity, simulators can readily be employed as precision instruments in the measurement of performance in the clinical setting.

Cregan and Watterson (2005:99-104) claim that simulation makes it possible to assess the development from the "knows how" to the "shows how" category in Miller's framework. Simulators therefore, are valid instruments for assessment, on condition that the simulator type has sufficient fidelity to elicit the expected competencies and performance level (Alinier 2007:e246–247; Labuschagne 2012:87; Tavakol, Mohagheghi & Dennick *et al.* 2008:78).

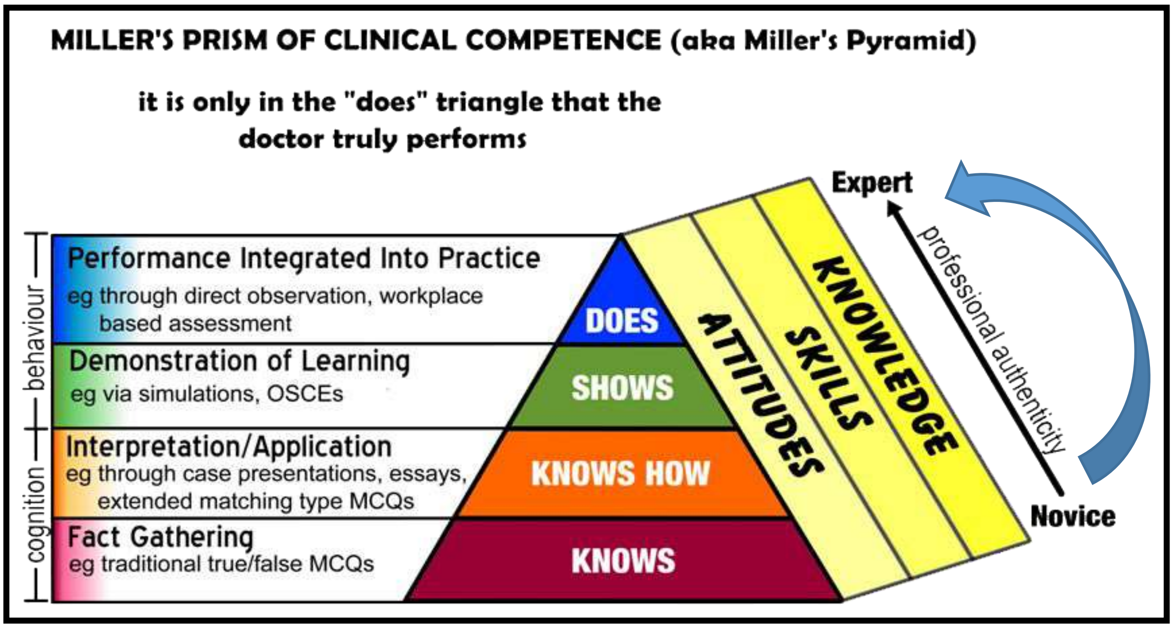

FIGURE 1.6: MILLER'S PRISM OF CLINICAL COMPETENCE
[ADAPTED BY MEHAY & BURNS 2009. FROM MILLER. *ACAD. MED.* 1990:65(9) S63-S67]

Miller proposed a framework for assessing levels of clinical competence. "The lower two levels (cf. Figure 1.7) only test cognition (or knowledge) and this is the area where inexperienced students find themselves (cognition zone). The upper two levels test behaviour – so that they can apply what they know (behaviour zone): It is important that students practice what they know" (Mehay & Burns 2009:Online) to enhance learning.

Mehay and Burns (2009:Online) adapted Miller's pyramid to include the knowledge, skills and attitudes domains of learning and thus called it "Miller's Prism" (cf. Figure 1.6). Dent and Harden have added a fifth level called "Mastery" that sits above "Does" to make the "distinction between one who can perform a skill with competence to one who can perform it an expert or masterful way" (Mehay & Burns 2009:Online). "This Model can be used to match assessment method to the competency being tested; can help to formulate objectives for a particular teaching/learning session; design a course programme; or to tailor a teaching session to the level of the trainee" (Mehay & Burns 2009:Online).

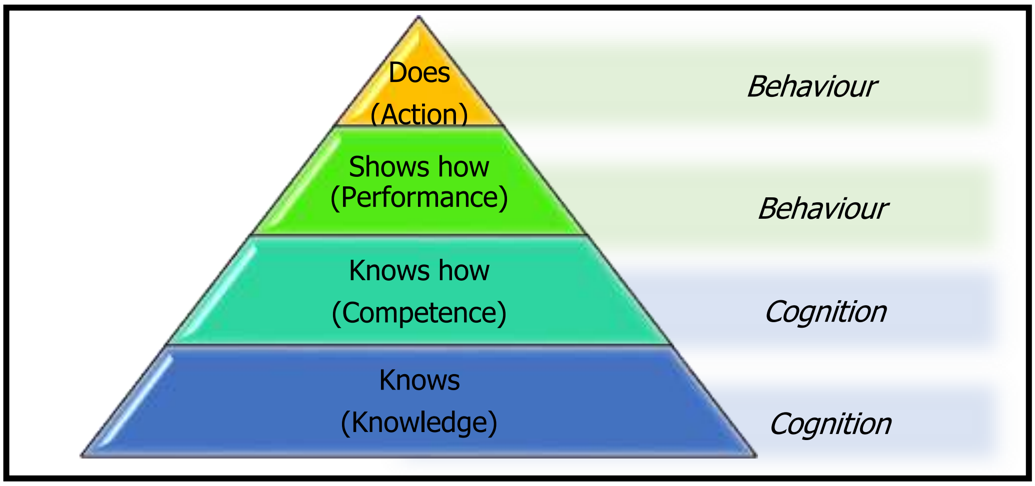

FIGURE 1.7: MILLER'S MODEL OF CLINICAL COMPETENCE
[COMPILED BY LABUSCHAGNE 2012:82. FROM MILLER 1990:S63]

According to Labuschagne (2012:82), simulation can be used for formative and summative assessment. Simulation can be used to assess all levels of Bloom's taxonomy, but the use of scenarios and interdisciplinary teamwork lends itself especially to the higher levels of Bloom's taxonomy (Pugh 2008:657). "With high-fidelity simulation the higher-order thinking skills like application, analysis, synthesis and evaluation are being evaluated. With simulation, one can assess skills, behaviour and attitude and not only knowledge. Simulation assessment fits in well with the Miller's pyramid as a framework for assessing clinical competence" (Labuschagne 2012:82) (cf. Figure 1.8).

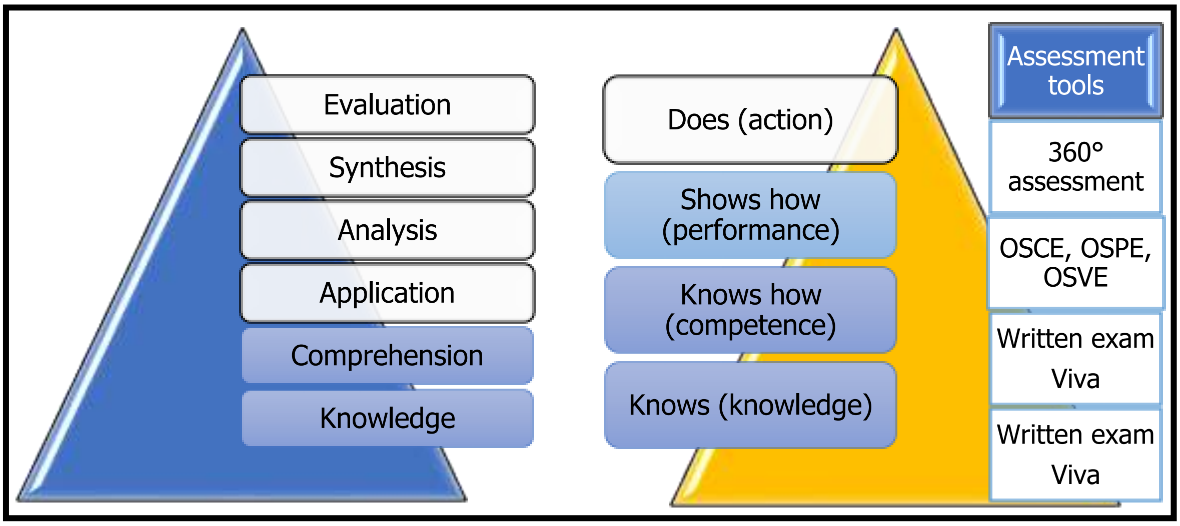

FIGURE 1.8: COMPARISON BETWEEN BLOOM'S TAXONOMY AND MILLER'S PYRAMID FOR METHODS OF ASSESSMENT IN MEDICAL EDUCATION AND ASSESSMENT TOOLS [COMPILED BY LABUSCHAGNE 2012:224]

Labuschagne (2012:224) gives a comparison between Bloom's taxonomy and the assessment of clinical skills of Miller (Miller 1990:S63), to explain the higher order thinking skills (cf. Figure 1.8). "According to Bloom, the higher order thinking skills are application, analysis, synthesis and evaluation and the lower order skills are knowledge and comprehension. Knowledge and competence are the lower levels on Miller's pyramid. Methods to test skills and performance generally falls in the performance ('Shows how') category. Assessment tools to assess the levels of the pyramid include: written exams, vivas, OSCES, and 360° assessment" (Labuschagne 2012:224).

Chiniara *et al.* (2013:e1380-e1395) propose a framework for instructional design (ID) and media selection to assist educators in creating appropriate simulation experiences for students. They give clarity on several definitions of simulation terminology. The framework consist of four levels and can serve as an educational and theoretical directive when planning to include simulation in a training programme and includes Level 1: Instructional medium; Level 2: Simulation modality; Level 3: Instructional methods; and Level 4: Presentation. This model can be adapted and serve in order to design effective curricula and research in simulation (cf. Figure 1.9).

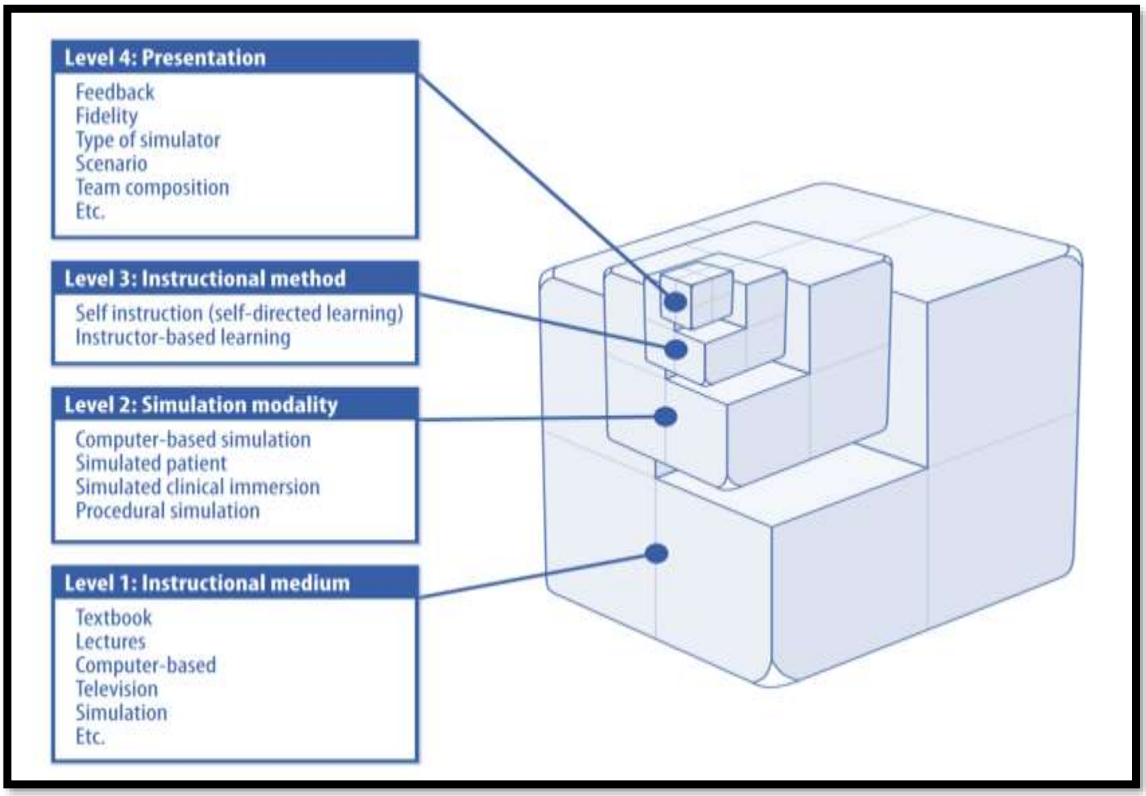

FIGURE 1.9: THE LEVELS OF INSTRUCTIONAL DESIGN FOR AN EDUCATIONAL EXPERIENCE USING HEALTHCARE SIMULATION
[FROM CHINIARA *et al.* 2013:E1382]

1.2.2.1 *Psychomotor skills*

Given the various ways in which movement is reflected in simulation modalities, attention should also be devoted to psychomotor skills. According to the Britannica Online Encyclopaedia, psychomotor learning refers to the development of structured patterns of muscular activities in relation to information from the environment. Such patterns can be observed in eye-hand coordination tasks such as catching a ball or playing piano. As the term implies and as emphasised in the Online Medical Dictionary, such skills relate to movement or muscular activity associated with neural activity. Psychomotor skills are also called sensorimotor or perceptual-motor skills and represent research topics in experimental psychology of human learning and performance, specifically regarding the learning of coordinated activity involving arms, hands, fingers and feet - as opposed to spoken language. These skills are also important with regard to plastic surgery and the related focus on the sense of touch as well as the phenomenon that psychomotor slowing occurs with aging (Gabbard 2004:12). As far as psychomotor levels are concerned, the relationship between cognitive functions and physical movement (in the form of manipulation, grace, strength and speed) demonstrates a fine motor skill such as using precision instruments.

"Bloom never completed work on the Psychomotor domain, and there have been several attempts to complete it. One of the simplest versions has been suggested by Dave (1975): *it fits with the model of developing skill put forward by Reynolds (1965), and it also draws attention to the fundamental role of Imitation in skill acquisition"* (Atherton 2011:Online). The other levels include Manipulation, Precision, Articulation and Naturalisation (Atherton 2011:Online).

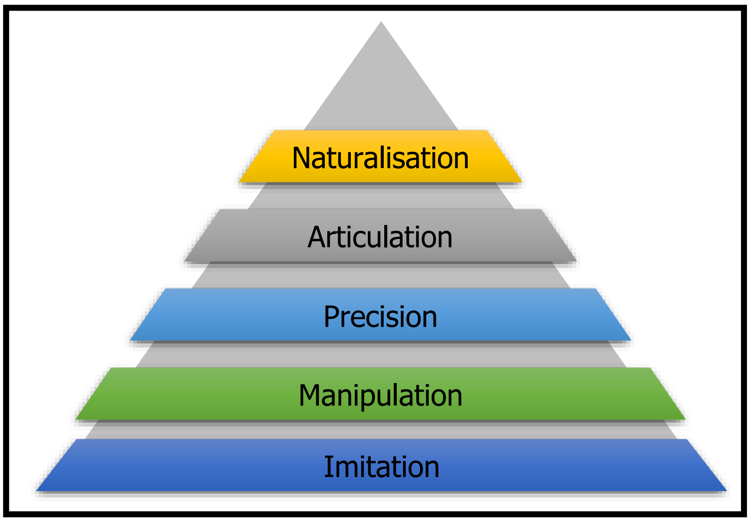

FIGURE 1.10: TAXONOMY OF THE PSYCHOMOTOR DOMAIN [BASED ON DAVE (1975) IN ATHERTON 2011:ONLINE]

Based on the literature study (including simulation and educational theory) together with the results and findings in the study, the researcher would endeavour to compile a framework structure with the view to propose guidelines and recommendations to enhance postgraduate plastic surgery education and training.

1.2.3 Development of guidelines

In general, theses, articles and guideline manuals (cf. Swain 2014) provide guidelines without specifying the process of developing guidelines comprehensively. This study will trigger and facilitate the establishment of a system of simulation practice guidelines and recommendations. The process of developing guidelines outlined below is based on models that determine the process in North America and Britain (Gronseth, Woodroffe & Getchius 2011; Qaseem, Snow, Owens & Shekelle 2010; Shekelle, Woolf, Eccles & Grimshaw 1999) and for other specialisations than plastic surgery, teaching or simulation: the very principles are broadly applicable and will inform the envisioning of practical guidelines for the fields relevant to this thesis and study.

The research design of this study is such that it advantageously allows for the concurrent process of guideline development, as will be explained below. Objective 5 (making recommendations to enhance the effectiveness of learning in postgraduate plastic surgery education and training) (cf. 1.4.3) and Objective 6 (developing a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes in postgraduate plastic surgery education) (cf. 1.4.3) capture the process in that it is stipulated that the data collected from the literature studied, the Delphi questionnaire and the semi-structured interviews were processed, analysed and interpreted. This process is described below. It is necessary, though, to define some terms before such an exposition, and, crucially, first of all, to distinguish between recommendations and guidelines.

A recommendation can be defined as "an official suggestion about the best thing to do" (Wehmeier 2005). A recommendation differs from the closely related word 'advice' in that 'recommend' is often used with positive advice to tell someone about potential benefits and 'advice' with more negative advice to warn a person about potential dangers (Wehmeier 2005). Guidelines, in turn, can be defined as "rules or instructions that are given by an official organization telling you how to do something, especially something difficult" (Wehmeier 2005).

In the context of this study and in view of proposing or suggesting guidelines, it should be remembered that guidelines will include recommendations – in accordance with the definition of Clinical Practice Guidelines (CPG), that guidelines are considered to be "statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options" (Gronseth *et al.* 2011:1).

In health care guidelines, the terms *patient* and *treatment* are key to the exposition. A patient usually is "a person who is receiving medical treatment, especially in a hospital" (Wehmeier 2005). In writing the guidelines following from this study and the context of simulation in plastic surgery, these terms are phrased carefully.

The process involves the development of a framework structure that can be used to propose guidelines for teaching through simulation as part of the training for evidence-based plastic surgery practice. Within an evidence-based approach, evidence is one of the three knowledge pillars used for decision-making (Gronseth *et al.* 2011:1); the other two being principles and judgement. The guidelines to be proposed from this study will be based on the evidence sources that inform the thesis, namely the literature study, the Delphi rounds and the information obtained via the semi-structured interviews. The advantage of this finely delineated study is that financial cost and number of experts required are limited appropriately.

Principles are assumed to be part of guidelines. A principle can be defined as "a moral rule of strong belief that influences your actions" (Wehmeier 2005). In this regard, the principle of, for instance, care (Gronseth *et al.* 2011:17) is assumed in a health-related context. Principles here will also refer to subject-specific principles, such as the neuroanatomical principles that "enable neurologists to know that a patient has a lesion in the lateral medulla just by examining the patient" (Gronseth *et al.* 2011:1). For Shekelle *et al.* (1999:596) three principles are fundamental to the development of valid and usable guidelines, namely:

i. *The development of guidelines requires sufficient resources, experts, finances and research skills;*
ii. *A systematic review of the evidence is essential to every guideline; and*
iii. *A multidisciplinary group should translate the evidence into a guideline.*

According to Gronseth *et al.* (2011:1), judgement refers to the intuitive sense clinicians rely on for decision-making when there is uncertainty or in the absence of sufficient evidence.

In this section of the study, the focus is on the process of compiling guidelines. A process is "a series of things that are done to achieve a particular result; a method of doing or making something" (Wehmeier 2005). The first step in the evidence-based method in relation to compiling guidelines is asking a question. The relevant questions for this study are captured in the Delphi questionnaire. These questions are answered in the light of the evidence sources for this study; that is, the literature study, the Delphi technique and the semi-structured interviews – as explained above. Conclusions are then reached (cf*.* Gronseth *et al.* 2011:2) so that the evidence can be translated into recommendations within guidelines (cf*.* Shekelle *et al.* 1999:593).

Gronseth *et al.* (2011:20) emphasise that practice recommendations must be actionable; more specifically that the most important part of a recommendation is the verb used to indicate the unambiguous action that should be taken. Gronseth *et al.* (2011:20) refer to the standard list of 11 suggested action verbs for guideline recommendation statements: *test, prescribe, perform, educate/counsel, dispose, monitor, refer/consult, prepare, document, advocate*, and *diagnose/conclude*. These verbs tie in with the emphasis in this study on learning theories, strategies and cognitive levels of learning (cf*.* section 1.2.2) and are employed in this regard.

1.3 PROBLEM STATEMENT

The problem that was addressed in this study was the lack of clarity about whether, and if so, to what degree, simulation can contribute by playing a role, and will be of value in postgraduate plastic surgery education and training, and whether it would ensure higher effectiveness of learning at the various cognitive levels.

A number of articles have recently been published on topics such as the use and potential use, as well as the importance of simulation in plastic surgery (Arbogast & Rosen 2012:236-254; Mittal *et al.* 2012:147-154; Rosen *et al.* 2009:729-738); on the integration of surgical simulation in plastic surgery residency training (Stern, Oliker, Napier, Qualter, Deluccia, Sculli, Long, Rosen & Hazen 2012:497-498); and skills transferred to the operating room through surgical simulation (ASERNIP_S 2007:Online).

In conclusion, there seems to be limited educational research studies that could be traced concerning the contribution, role and value of simulation in the different sub-disciplines of postgraduate plastic surgery education and training aimed at ensuring effective learning at the various cognitive levels.

In order to address the problem stated, the following research questions were addressed:

i. *How can simulation be conceptualised and contextualised from a postgraduate plastic surgical training perspective as the theoretical framework of the study?*
ii. *Which features and uses of simulation in plastic surgery might lead to effective learning?*
iii. *(a) Does simulation influence student learning in postgraduate education and training?*
(b) Can simulation be used to enhance the effectiveness of student learning?
iv. *Can the effectiveness of learning be enhanced through the inclusion of simulation as one of the methods to train a plastic surgeon in postgraduate plastic surgery education and training, and if so, how?*
v. *Does simulation have a contribution to make and a role to play in postgraduate plastic surgery education and training, and if so, of what value will it be?*
vi. *How can simulation be used and implemented to be part of a training programme in plastic surgery education and training?*

The research was carried out and completed based on these research questions. The findings of the research served as a directive for developing a framework structure whereby guidelines may be proposed/suggested on simulation in postgraduate plastic surgery education and training.

1.4 OVERALL GOAL, AIM AND OBJECTIVES OF THE STUDY

The goal of this study arose from the problem the researcher felt compelled to find answers to, and by doing so to make a contribution to medical education as a field of study, and plastic surgery education and training in particular. The aim and objectives ensued from the clearly stated goal.

1.4.1 Overall goal of the study

The overall goal of the study was to enhance postgraduate plastic surgery education and training by means of developing and proposing guidelines for the use of simulation with a view to include medical simulation in training programmes if a need / application therefore is identified.

1.4.2 Aim of the study

The aim of this study was to do an in-depth study on simulation in postgraduate plastic surgery education and training. This was done by identifying the contribution (for example by the discussion of the role and value) that simulation can make in postgraduate plastic surgery education and training. An aspect of this study was to determine the different cognitive levels of learning addressed by simulation in plastic surgery education and training, including the types of simulation modalities that were indicated to be suitable for use in plastic surgery. The results and findings were used for the developing of a framework structure that can be applied to suggest proposed guidelines for the use of simulation in postgraduate plastic surgery education and training.

1.4.3 Objectives of the study

The following objectives were pursued in the study:

i. Conceptualising and contextualising simulation in order to serve as a theoretical framework for the study. This was done by means of a literature study.
This objective addresses research question 1.

ii. Identifying the features and uses of simulation in plastic surgery that lead to effective learning. Data were collected by using semi-structured interviews and a Delphi questionnaire.
This objective addresses research question 2.

iii. (a) Identifying whether simulation *influences* student learning in postgraduate education and training. This was determined by collecting data by means of semi-structured interviews.
(b) Identifying whether simulation can be used to *enhance the effectiveness* of student learning? This was accomplished by collecting data by means of semi-structured interviews.
These objectives address research question iii (a) and iii (b).

iv. Identifying whether simulation can be included as one of the training methods in postgraduate plastic surgery education and training. Data were collected by means of a Delphi questionnaire and by semi-structured interviews.
This objective addresses research question 4.

v. Describing the contribution simulation can make and the role it can play in postgraduate plastic surgery education and training. To this end, the data collected from the literature studied, the Delphi questionnaire and the semi-structured interviews were processed, analysed and interpreted.

This objective addresses research questions 1-5.

vi. Developing a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes in postgraduate plastic surgery education. This was done based on conclusions drawn from all the findings.

This objective addresses research question 6 with a view to a holistic and scientific Ph.D. product.

1.5 DEMARCATION OF THE FIELD AND SCOPE OF THE STUDY

This study was done in the field of Health Professions Education and falls in the domain of clinical simulation education. The study is interdisciplinary as it reaches across and between Health Professions Education and Plastic Surgery.

The participants in the Delphi questionnaire survey were individuals who all have a postgraduate qualification in plastic surgery as well as specific expertise in the field or subfields of plastic surgery and/or knowledge and experience of education and training in plastic surgery and/or knowledge and/or experience in simulation and/or as well as an exceptional international standing.

The participants who took part in the semi-structured interviews were individuals with experience in postgraduate education, experience in and knowledge of simulation, as well as a proven academic and scientific standing.

In a personal context, the researcher in this study is a qualified plastic surgeon and registered with the Health Professions Council of South Africa (HPCSA). During the period after completion of his Bachelor degree in Medicine and Bachelor degree in Surgery (MBChB), he had the opportunity to do his two internship years, followed by a year community service in state facilities. After completing a Master's degree in Health Professions Education (MHPE) – with a dissertation entitled "A framework for achieving excellence as clinical educator in the School of Medicine, University of the Free State, Bloemfontein, South Africa" – he worked in a department of general surgery in a state hospital for a number of years. Following this, he moved to a department of plastic surgery where he completed his specialist training in plastic surgery. He worked as consultant in the Department of Plastic Surgery at the University of KwaZulu-Natal, Durban, South Africa and is currently in private practice since January 2016.

Through the years, he developed an interest in Medical Education with an emphasis on postgraduate education and simulation. He holds a Fellowship of the College of Plastic Surgeons and Reconstructive Surgery (FC Plast. Surg. (SA)) and has a Master of Medicine degree in Plastic and Reconstructive Surgery (MMed Plastic & Reconstructive Surgery).

As far as the timeframe of the study is concerned the study was conducted between 2015 and 2018, with the empirical research phase from March 2015 – July 2018. (Ethics approval number: ECUFS 122/2015).

1.6 THE VALUE AND SIGNIFICANCE OF THE STUDY

Limited educational research studies have been reported that describes the role and value of simulation in postgraduate plastic surgery education and training, or the features and uses of simulations that may lead to effective learning in this field at a specific level. The study was undertaken to enhance professional education in the field of study by taking into account the changing clinical educational environment and other factors. The study also explores the cognitive levels of learning that can be addressed during education and training in plastic surgery using simulation.

The value of the study is realised in the contribution it will make by means of offering recommendations with regard to postgraduate programme planning, learning situations and strategies, and the articulation of the enhancement of learning and the final outcome of professional education. This, in turn, will have a positive impact on health care, as applicable in the plastic surgery sub-disciplines in South Africa and also, to a greater or lesser extent, internationally.

This study endeavours to explore the role and value that simulation may play in, as well as to identify the characteristics and uses of simulations that may lead to the enhancement and effectiveness of learning in the discipline of plastic surgery. This study places emphasis on the importance and contribution of simulation in plastic surgery training and education.

1.7 RESEARCH DESIGN OF THE STUDY AND METHODS OF INVESTIGATION

This part deals with the research design and research methodology used in the study. In the first place, theoretical perspectives on the research design are provided. It is followed by a detailed explanation of the process of each technique, namely the methodologies and procedures applied in designing the Delphi questionnaire for the expert panellists, the interview guide for the semi-structured interviews with the interviewees, and the pilot studies and explorative studies, respectively, while sample selection, data gathering and analysis are also described.

The research design is the plan or 'blueprint' for the study and must clearly describe how the theory forms the rationale on which the study is built. It steers the research to clearly argue theory building and lays the foundation, together with the literature, to develop the conceptual framework for the study. It further directs the researcher to identify the best research methods to answer the research questions.

In this study, a descriptive research design was followed with the view to describe the existing situation or identify problems to include medical simulation in training programmes if a need/application is therefore identified. A quantitative and qualitative approach was best suited to find answers to the research questions.

Firstly, the concepts of theory are identified explaining the essence of theory. Secondly, how these concepts interact with and relate to each other, have to be described – this includes the empirical study consisting of the methods followed, as well as the research findings and the interpretation thereof. Lynham (2002:223) describes theory building as a continuous research cycle with the first part being theoretical and the second part being operational.

The Delphi questionnaire survey followed a quantitative approach, but included qualitative elements by including open-ended questions where the Delphi panellists were asked to give examples of simulation or describe a simulation that they have done or that can be done at a specific education and training level. They were also invited to provide any further comments specific to that level. With the semi-structured interviews, a qualitative approach was followed.

The research design, including the methods followed, is displayed in Figure 1.11.

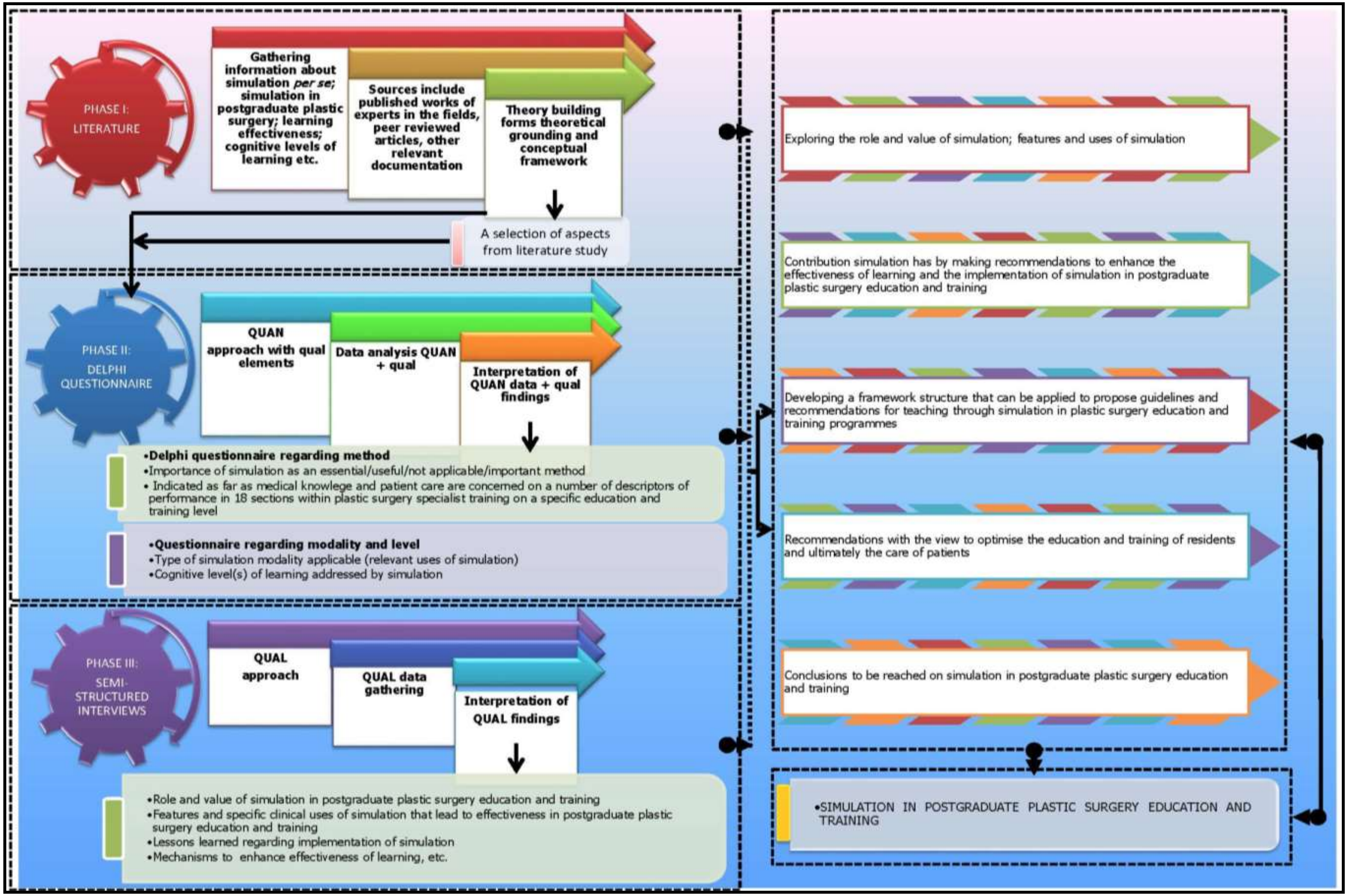

FIGURE 1.11: THE RESEARCH DESIGN IN THIS STUDY
[COMPILED BY THE RESEARCHER, NEL 2017]

The methods that were used to collect data for the study comprised a literature study, and, as empirical study, a Delphi survey followed by semi-structured interviews. Permission to execute the study was sought (cf. Appendices A-C).

The literature study was followed up with a Delphi questionnaire survey amongst nine experts in the fields of plastic surgery and simulation. The target population was individuals who all possess specific expertise in the field of plastic surgery, medical education and simulation. The data obtained by the Delphi questionnaires were analysed by the researcher. The open-ended questions were processed and interpreted by the researcher and the opinions and comments of the Delphi panellists were used to adapt the formulated set of statements for each subsequent round of Delphi, if necessary. The process was repeated until 66.7% (as approved by evaluation- and ethics committees of the UFS) consensus or stability had been reached. The Delphi experts had to evaluate whether simulation is important to reach the stated descriptor of performance (formulated as a statement) at a specific education and training level. The experts had to indicate what type of simulation modality is or can be applicable to reach the specific descriptor of performance and their opinion was also sought on which cognitive level of learning was addressed by simulation.

Semi-structured interviews were used to investigate and to establish clarification on simulation in postgraduate plastic surgery education and training. The interviews were also conducted with a view to obtain a more in-depth, comprehensive overview of the contribution that simulation can make in postgraduate plastic surgery education and training. The features and uses of simulation that may lead to more effective learning in postgraduate plastic surgery were also discussed. The lessons learned regarding implementation of simulation in a postgraduate programme, as well as the biggest challenge to implementation, were identified. Interviewees were further asked to make recommendations that may be used in compiling guidelines on simulation in postgraduate plastic surgery.

The results and findings from the literature study, the Delphi survey and the semi-structured interviews were used to describe the contribution simulation might make and offer recommendations to enhance the effectiveness of learning in plastic surgery education and training. These were used to compile a framework structure that serve as a point of departure for proposing guidelines on simulation in postgraduate plastic surgery education and training.

A schematic overview of the study process is given in Figure 1.12.

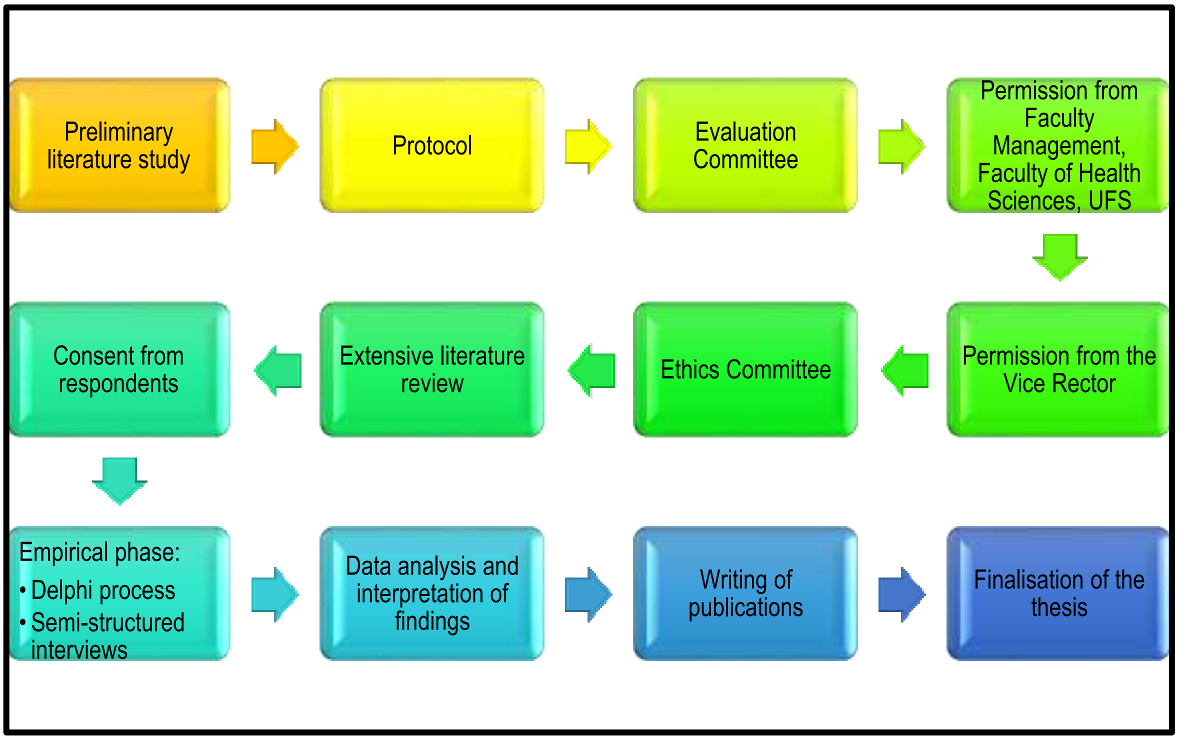

FIGURE 1.12: A SCHEMATIC PRESENTATION OF THE STUDY

The methods that were used to collect data for the study comprise a literature study, and, as empirical study, a Delphi survey followed by semi-structured interviews. The outcomes of the study accumulated into publications and discussions in Chapters 7 and 8 (cf. Table 1.1).

TABLE 1.1: THE RELATIONSHIP BETWEEN STUDY OBJECTIVES AND OUTCOMES

(Table continues on next page)

OBJECTIVES		OUTCOMES
OBJECTIVE 1	i. Conceptualising and contextualising simulation in order to serve as a theoretical framework for the study. This was done by means of a literature study.	CHAPTER 1 • Orientation to the study CHAPTER 2 • Article 1 (Conference presentation published in proceedings): Simulation in Plastic Surgery: A research agenda to improve teaching, learning and clinical expertise/professional competence • *(Paper presented at Ireland International conference on Education (IICE 2016); Published in: The proceedings of the IICE)* CHAPTER 3 • Article 2: Why is research needed on simulation to enhance plastic surgery education and training? • *(Published in: International Journal for Cross-Dissiplinary Subjects in Education (IJCDSE)* Volume 9, Issue 1, March 2018, pp. 3301-3308)
OBJECTIVE 2	ii. Identifying the features and uses of simulation in plastic surgery that lead to effective learning. Data were collected by using semi-structured interviews and a Delphi questionnaire.	CHAPTER 4 • Article 3: Simulation in plastic surgery: Features and uses that lead to effective learning • *(Submitted for publication in: African Journal of Health Professions Education (AJHPE). January 2019)*
OBJECTIVE 3	iii. (a) Identifying whether simulation *influences* student learning in postgraduate education and training. This was determined by collecting data by means of semi-structured interviews. iii. (b) Identifying whether simulation can be used to *enhance the effectiveness* of student learning? This was accomplished by collecting data by means of semi-structured interviews.	CHAPTER 4 • Article 3: Simulation in plastic surgery: Features and uses that lead to effective learning • *(Submitted for publication in: African Journal of Health Professions Education (AJHPE). January 2019)*

OBJECTIVE 4	iv. Identifying whether simulation can be included as one of the training methods in postgraduate plastic surgery education and training. Data were collected by means of a Delphi questionnaire and by semi-structured interviews.	**CHAPTER 5** • Article 4: Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes (as well as parts of Article 3 & 5). • *(Submitted for publication in: African Journal of Health Professions Education (AJHPE) January 2019)*
OBJECTIVE 5	v. Describing the contribution simulation can make and the role it can play in postgraduate plastic surgery education and training. To this end, the data collected from the literature studied, the Delphi questionnaire and the semi-structured interviews were processed, analysed and interpreted.	**CHAPTER 6** • Article 5: Simulation in Plastic Surgery: Role, value and contribution in education and training. • *(Submitted for publication in: The South African Medical Journal (SAMJ) January 2019)*
OBJECTIVE 6	vi. Developing a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes in postgraduate plastic surgery education. This was done based on conclusions drawn from all the findings.	**CHAPTER 7** • Simulation in postgraduate plastic surgery education and training
OBJECTIVES 1-6		**CHAPTER 8** • Conclusion, recommendations and limitations of the study

1.7.1 Method 1: Literature study

According to Singleton and Straits (1999:544), a literature review explains a problem in context and based on related theory and research. It also enables the researcher to become adequately versed in the topic.

The literature review was used to gather information about simulation per se, and simulation in postgraduate plastic surgery education and training, as well as information on learning effectiveness, with special reference to learning theories and the cognitive levels of learning. The literature study forms the theoretical grounding for the publications. Sources included published works of experts in the fields, peer-reviewed articles and other relevant documentation.

Both printed and electronic (computer-based & internet-transmitted) material was studied from a document analysis perspective. The analysis of documentation requires that information be processed, examined and interpreted in order to gain insight and practical knowledge (Corbin & Strauss 2008:217-221; Rapley 2007:34-92). The analytical procedure entails finding, selecting, understanding and integrating data from documents. By way of content analysis, such data can be categorised into major themes, categories and case examples (Labuschagne 2003:Online). Document analysis is generally used with other research methods as a means of triangulation – "the combination of methodologies in the study of the same phenomenon" (Denzin 1970:291). The qualitative researcher is expected to draw upon multiple (at least two) sources of evidence for the sake of analysis and conclusions. By triangulating data, the researcher endeavours to provide "a confluence of evidence that breeds credibility" (Eisner 1991:110). Patton (2002:66) emphasises that triangulation helps the researcher guard against bias and slanting.

The objective of the literature study was to review and synthesise the existing evidence that addresses the following questions: *1. "What are the role and value of simulations in postgraduate plastic surgery education and training?" 2. "What are the features and uses of simulations in plastic surgery education and training that lead to effective learning?" 3. "What is learning effectiveness and which factors influence it?" 4. "What is the theory underlying the process of developing and formulating guidelines?".*

The literature search covers various databases (e.g. Pubmed, EMBASE, MEDLINE, ProQuest Dissertations and Theses databases). Data were extracted from trustworthy journal articles, and other published works and documentation. Key terms that were used, for example, are simulation, postgraduate plastic surgery education and training, effective learning, learning theories, cognitive levels, Delphi process, semi-structured interviews, and the development of guidelines. Trustworthy articles are published in peer-reviewed and renowned journals.

1.7.2 Method 2: Delphi technique

Theoretical aspects, the Delphi process, target and survey populations, sample size and description, pilot study and data gathering and analysis are described.

1.7.2.1 *Theoretical aspects*

Consensus methods, such as the Delphi technique, are particularly useful when empirical evidence is lacking, limited or contradictory (Humphrey-Murto, Varpio, Wood, Gonsalves, Ufholz, Mascioli, Wang & Foth 2017:1491). According to these authors (Humphrey-Murto *et al.* 2017:1491), in medical education, there are several important areas of enquiry that are plagued by high levels of uncertainty and a limited evidence-based literature. "Consensus methods are particularly relevant to medical educators because of their presumed capacity to extract the profession's collective knowledge, which is often tacit and difficult to verbalize and formalize" (Humphrey-Murto *et al.* 2017:1491).

According to Jones and Hunter (1995:376) the Delphi technique is a consensus method providing another means of "synthesising information, but liable to use a wider range of information than is common in statistical methods, and where published information is inadequate or non-existent", this method "provide a means of harnessing the insights of appropriate experts to enable decisions to be made". The aim of a consensus method is to determine the extent to which experts agree about a given issue. The term "agreement" takes two forms, which need to be distinguished: firstly, "the extent to which each respondent agrees with the issue under consideration and, secondly, the extent to which respondents agree with each other, the consensus element of these studies" (Jones & Hunter 1995:376).

The Delphi technique used a multistage self-completed questionnaire with individual feedback, to determine consensus from a larger group of experts. According to McMillan, King and Tully (2016:655), the Delphi technique is commonly used to develop guidelines with health professionals. The aim is "to achieve a general agreement or convergence of opinion around a particular topic and is used in research that is directed at problem-solving, idea generation or determining priorities" (McMillan *et al.* 2016:655). Consensus methods raise potential solutions or answers to a question, which can then be prioritised or agreed upon (McMillan *et al*. 2016:655).

Diamond, Grant, Feldman, Pencharz, Ling, Moore and Wales (2014:402) express the concern that many Delphi studies do not adequately define criteria for achievement of consensus and that even when consensus has been defined, it is not always clear whether the pre-specified criteria for consensus have been a factor in deciding when to stop the Delphi process. "Failure to adequately define and use criteria for consensus challenges the notion that the results of a Delphi study reflect the consensus of the group of experts" (Diamond *et al.* 2014:402). These authors state that the attainment of consensus is infrequently used as a criterion for ending a Delphi study. Most Delphi studies were run for a pre-specified number of rounds (Diamond *et al.* 2014:404). Keeney, Hasson and McKenna (2005:210) argue that the percentage agreement for consensus will differ from study to study and is based on what the researcher accepts as synonymous with consensus. The answer may lie with the importance of the research topic - if it is a life and death issue, a 100% consensus level may be desirable; alternatively, if the topic was related to a less important issue, it might be 51%. According to the literature, it might differ, but 70% to 80% is the average (Keeney *et al.* 2006:210). If the researchers plan to only "qualify the degree of consensus, but not have consensus as a criterion" to stop the Delphi study, this should also be explicitly stated (Diamond *et al.* 2014:406).

Bezuidenhout (2002:100) summarises the origin of the Delphi technique and concept as follows: "The derivation of the term Delphi relates to the 'Delphi Oracle', an ancient Greek myth which held that a 'chosen one' on the Island of Delphi was able to predict the future with infallible authority". The Delphi process thus originates from the Delphi oracle's skills of interpretation and foresight (Jones & Hunter 1995:377). Linstone and Turoff (2002:3; also see Critcher & Gladstone 1998:432) define the Delphi technique as "a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem". The definition of Delbecq, Van de Ven and Gustafsen (in Murry & Hammons 1995:423) describes the method in more detail, namely as "a method for the systematic solicitation and collection of judgements on a particular topic through a set of carefully designed sequential questionnaires interspersed with summarised information and feedback of opinions derived from earlier responses". According to Dils and Ziatz (2000:90) the Delphi process establishes "an expert consensus via a series of questionnaires with controlled feedback".

Nel (2007:80-82) states in his master's dissertation that "…The Delphi technique rests on two assumptions, namely, in the first place, that group decisions are more valid than those made by a single person (particularly if they are experts in the field of study), and, in the second place, that face-to-face interaction might be influenced by domineering members or by group bias (Murry & Hammons 1995:426). Since the decision-making is rarely left to a single person, the success, credibility and validity of the process are increased (Clayton 1997:373). According to Critcher and Gladstone (1998:432), the Delphi technique enables various experts from different backgrounds and locations to communicate on equal ground".

According to Clayton (1997:377) the Delphi method requires that a panel of experts on the subject under study be selected. This author defines an expert as ..."someone who possesses the knowledge and experience necessary to participate in a Delphi" (Clayton 1997:377). McMillan *et al.* (2016:659) define experts as…"people who have knowledge about the topic of concern".

Powel (2003:378) argues that the success of a Delphi study rests on the combined expertise of the participants who make up the expert panel and states that there are two key aspects to this, namely the panel size and the qualifications of the experts. There is very little evidence on the effect of the number of participants on the reliability or validity of consensus processes (Powel 2003:378). Powel (2003:378) further states that the Delphi does not call for an expert panel to be "representative samples" for statistical purposes. Representativeness is assessed on the qualities of the expert panel rather than its numbers. It is important that expert panel members are willing and able to make a valid contribution (Powel 2003:379). According to Clayton (1997:378), panel size depends on the purpose of the study, the complexity and the expertise required. The panel may be large or small and local, state, national or international (Clayton 1997:378). For example, 15-30 people for a homogeneous population and 5-10 people for a heterogeneous population with expertise on a particular topic but coming from different professional stratifications (e.g. subspecialties). From literature, it is clear that panel sizes vary (Mullen 2003:37). "There is no standard method to calculate a panel size for the Delphi technique, however, the aim of the study and available resources are important" (McMillan *et al.* 2016:658). Some authors argue that inviting more participants increases the variety of expertise, but eventually leads to diminishing returns (Black, Murphy, Lamping, McKee, Sanderson, Askham *et al.* 1999:238). McMillan *et al.* (2016:651) cautions that to involve more participants, the Delphi will take place over a much longer time-period.

From the literature, the following came to the fore as the main characteristics of the Delphi technique:

- Anonymity;
- Expert input;
- Physical separation;
- Constructive repetition using adapted versions of the questionnaire based on feedback from the previous rounds;
- A statistical analysis of the responses, available to participants;
- Controlled and anonymous feedback, which also gives each panellist the opportunity to change and/or amend his/her previous opinion; and
- Quantitative information about the subject of study in addition to qualitative information in the form of definitions and solutions to problems provided by the participants.

(Clayton 1997:377,385; Goodman 1987:730; Woudenberg 1991:133)

According to Powel (2003:377), the main advantages of the Delphi is reported to be the "achievement of consensus in a given area of uncertainty or lack of empirical evidence". Other advantages include that feedback between rounds widens knowledge, stimulates new ideas, and is motivating and offers an educational experience for panel experts. It can be argued that the Delphi is a quick and cheap and relatively efficient way to combine the knowledge and abilities of a group of experts but, however, other may argue that extensive time commitment is needed. It also may lead to a "watered" down version of the best opinion and the anonymity may lead to…"a lack of accountability and encourage hasty decisions" (Powel 2003:378). One of the advantages of the Delphi technique is its ability to guide group opinion towards a final decision (McKenna 1994:1223). It is stated that the Delphi technique is recognised as being cost-effective. McKenna (1994:1224) also finds from literature and describes the following limitations: "poor response rate that characterizes the final rounds; the lack of accountability based on ill-considered judgements and the anonymity of the technique". McKenna (1994:1224) emphasises the importance that the researcher stress both in verbal and written communication that experts must not discuss their responses with each other or colleagues. Clayton (1997:382) also recognises the following limitations, namely, that the background and experiences of each panel member, which may have directly affected their decision-making, are generally beyond the control of the Delphi study; the panel members are often limited in the amount of time each can dedicate to the decision-making process; feedback from the researcher may pressure them into conformity; and it is possible that the researcher's analysis of the results is not the only interpretation which can be made.

To summarise, Critcher and Gladstone's (1998:433) statement that the "Delphi straddles the divide between qualitative and quantitative methodologies", therefore, is particularly true. According to Smit and Cronje (2004:163), the strength of the Delphi technique has special meaning in terms of the way in which it can be used to finalise decisions experts are required to make. According to Jones and Hunter (1995:376), dissemination and implementation of the Delphi findings is the ultimate aim of consensus activities – for example…"the publication of consensus statements intended to guide health policy, clinical practice, and research".

1.7.2.2 *The Delphi process in this study*

The Delphi technique was used in this study for specific reasons, including that it is a cost-effective method of gathering experts' opinions, while the difficulties and problems encountered during face-to-face discussions do not come into play when using the Delphi process (Critcher & Gladstone 1998:432; Linstone & Turoff 2002:4; Murry & Hammons 1995:426). The study allows a range of experts from various backgrounds, but with expertise in the field of study, to participate equally in the process, which lends itself exceptionally well to an exploration of the topic. Participants can carefully consider their responses in their own time. For this study, a quantitative approach and a qualitative approach were required, and this was achieved through the Delphi process. The Delphi technique, therefore, was regarded as a suitable research method to use.

According to Nel (2007:80), the Delphi technique empowers the researcher to collect quantitative information as well as qualitative information about the research topic. For this study, the Delphi questionnaire was compiled from the available literature.

In this study, the Delphi technique entailed various processes such as clarifying documents and questionnaires (cf. Appendices D-N):

- A letter of invitation with a request to participate in the Delphi survey was sent to experts in the field of Plastic Surgery (cf. Appendix D).
- A form to obtain consent from panellists to take part in the Delphi process and questionnaire survey (cf. Appendix E).

- A letter was sent to the Delphi panellists to explain the instructions to complete Delphi questionnaire Round One process (cf. Appendix F).
- The questionnaire was forwarded electronically to participating panellists for the Delphi questionnaire process Round 1 (cf. Appendix G).

In each of these appendices, detailed information was included for the Delphi panel members – please refer to Appendices D-G. The Delphi follow-up rounds and processes were recorded in Appendices H-N.

1.7.2.3 *Target population*

The target population consisted of experts in the fields of plastic surgery or its sub-disciplines and clinical simulation. They had practical knowledge in medical education, and served as policy-makers, leaders and managers in postgraduate education. The experts were identified in terms of academic qualifications, specialisation in plastic surgery, teaching and learning approaches and experience, international academic standing, proven scientific research and publications.

1.7.2.4 *Survey population*

The survey population participating in the Delphi process comprised experts who had agreed to participate in the study as expert members in the fields of the different plastic surgery sub-disciplines, and clinical simulation, with expert knowledge of medical education, and some of them service as policy-makers, leaders and managers in postgraduate education. The survey population was selected according to the criteria set for the target population as had been explained in Chapter 1.7.2.3.

1.7.2.5 *Sample size*

The sample consisted of nine (9) expert members selected according to fixed criteria. The criteria were determined in cooperation with promoters and had been approved by the evaluation and ethics committees of the Faculty of Health Sciences, University of the Free State, Bloemfontein.

1.7.2.6 *Description of the sample*

For the selection of the sample, the following selection criteria (inclusion criteria) were applied:

- Postgraduate qualification in plastic surgery (compulsory);
- At least two years' experience in plastic surgery (registered as specialist) (compulsory);
- Knowledge and experience of education and training in plastic surgery (compulsory);
- Knowledge and/or experience in simulation; and
- Exceptional international standing.

Exclusion criteria were determined and were applied after the possible panellists had been chosen based on the inclusion criteria, which were:

- Not giving consent to participate; and
- Lack of availability.

A number of experts were identified by research via literature, websites, conference proceedings, analysing of qualifications and curriculum vitae.

The expertise of the panellists who had been selected according to the criteria was tested in a scoring matrix, which awarded points for the following:

- Qualifications (e.g. specific sub discipline, name/level of qualification);
- Experience in plastic surgery postgraduate education (e.g. two years plus, five years plus, specific discipline in plastic surgery, or other clinical disciplines);
- Teaching and learning experience (e.g. knowledge of and experience in teaching and learning; experience in postgraduate-specific training and/or training in other related disciplines; experience in assessment of student learning; and postgraduate supervision; involvement in policy making, leadership and management in postgraduate education); and
- International academic and scientific standing (e.g. publications, grant holder, proven scientific research, author/co-author of textbooks, participation in international conferences).

Experts were selected according to their scores before they had been invited to participate in the study. The sample comprised nine experts from plastic surgery, involved in clinical simulation, with exceptional international standing (e.g. qualifications, grant holders, proven scientific research, publications, textbooks and international conferences). The experts complied with all the above-mentioned criteria.

1.7.2.7 *The pilot study*

The pre-testing of the Delphi questionnaire was done by means of a pilot study. This was undertaken to ensure the reliability, validity and trustworthiness of the study. For the pilot study, an individual from plastic surgery, an individual from medical education, as well as a clinician using simulation were included. This was done to ensure that the questions were clear and that the statements were correctly numbered. No changes were suggested. These experts did not partake in the Delphi process.

1.7.2.8 *Data gathering*

Prior to commencing with the research, letters of invitation were sent to the persons selected as possible Delphi expert panel members to request their participation in the research (cf. Appendix D). Consent to participate in the study was obtained through personal and electronic communication. All the participants in the Delphi process had to agree to participate by giving written informed consent. This was accomplished by means of a consent form for the participants to complete, should they agree to the request (cf. Appendix E). The informed consent form was transmitted electronically, together with an accompanying letter, and the Delphi questionnaire, to the participants (cf. Appendices F-G).

According to Dajani, Sincoff and Talley (1979:83), "consensus is assumed to have been achieved when a certain percentage of responses fall within a prescribed range for the value being estimated". The aim of the Delphi process was to reach a level of consensus among the expert panel members on a specific statement. For this study, consensus was regarded to have been reached when 66.7% (6 out of 9 experts) agreed on a statement (decision taken at Evaluation Committee of Faculty of Health Sciences, 15/04/2015).

Stability is described as the "natural tendency for opinions of experts to centralise" (Linstone & Turoff 2000:277). Stability therefore can be declared when movement of the opinion of the group as a whole has reached stability.

The Delphi questionnaire was compiled based on literature studied. The questionnaire consisted of 18 sections (cf. Appendix G). Each section was divided into two main categories, namely medical knowledge and patient care. The categories comprised items that were formulated according to five education and training levels - level one being the more basic level of training and level five the most advanced training level. These levels and formulated items were based on the research findings of the ABMS and ACGME (2013).

1.7.2.9 *Data analysis*

The analysis of the outcomes of the two rounds of the Delphi process was done manually by the researcher and checked by an independent researcher/academic. Responses of each Delphi round were entered into a computer spreadsheet for calculations of consensus or stability. The results were reported separately for each round, discussing the measuring instrument, listing the experts' comments and the analysis of the responses of each round. The successive Delphi rounds consisted of questionnaires containing only items from the previous round on which consensus was not reached.

Members of the expert panel received identical questionnaires, which they had to complete and return to the researcher. The responses were then analysed and the original questionnaire was modified, removing some questions. The modified questionnaire and an anonymous summary of the experts' opinions from the previous round were then forwarded to the Delphi participants for the second round. Thus, experts were encouraged to revise their earlier responses in light of the responses of other members of the panel. The process was stopped after consensus and/or stability had been reached on all items.

Please see the following, namely: Letter on feedback: Delphi Round One (cf. Appendix H); Feedback: Questionnaire for Delphi panel: Round One (cf. Appendix I); Instructions for completion of the Delphi questionnaire: Round Two (cf. Appendix J); Questionnaire for Delphi panel: Round Two (cf. Appendix K); Letter on feedback: Delphi Round Two (cf. Appendix L); Feedback: Questionnaire for Delphi panel: Round Two (cf. Appendix M); and, Final outcome: Delphi process (cf. Appendix N).

The final results and findings of the Delphi survey were included in Chapter 5 as an article, namely: *Enhancement of Plastic Surgery Training by Including Simulation In Education and Training Programmes* (cf. Appendix N).

1.7.3 Method 3: Semi-structured interviews

Theoretical aspects, the interview process, target population, description of sample and sample size, the explorative study, data gathering and analysis are described.

1.7.3.1 *Theoretical aspects*

According to Speziale and Carpenter (2007:35), to implement a high-quality study, a researcher must make sure that the research questions (items) are clear, that the methods selected to answer the research question are appropriate, and that people and data sources needed are available. Data must be collected, analysed and synthesised, interpreted and conclusions drawn, and practice implications stated.

Robinson (2000:18) defines the formal qualitative interview as an "unstructured conversation with a purpose that usually features audiotape and verbatim transcription of data, and use of an interview guide rather than a rigid schedule of questions". In this study, use was made of such individual interviews.

According to Bianco and Carr-Chellman (2002:254), "Interviews range in type and length and are used for different purposes that are present in virtually all qualitative traditions".

Open-ended questions used during interviews provide participants (cf*.* description of sample) with the opportunity to describe their experiences exhaustively. It is sound practice to conduct the interview in a place and at a time most comfortable and convenient as far as the participant is concerned. The more comfortable the participant is, the more likely it is that he/she will share important information (Speziale & Carpenter 2007:37).

A structured interview is one in which researchers use a full set of preselected questions to which they need to find answers. A semi-structured interview provides the opportunity for greater latitude in the responses. The researcher asks open-ended questions without a "pre-determined advance response" (Speziale & Carpenter 2007:38).

1.7.3.2 *The semi-structured interview process*

Semi-structured interviews were conducted with a view to obtaining a more in-depth, comprehensive overview of the contribution (for example by the discussion of the role and value) that simulation can make in postgraduate plastic surgery education and training. The features and uses of simulation that may lead to more effective learning in postgraduate plastic surgery were also discussed. The lessons learned regarding the implementation of simulation in a postgraduate programme, as well as the biggest challenges to implementation, were identified. Interviewees were also asked to offer recommendations that may be used in compiling guidelines on simulation in postgraduate plastic surgery.

In this study, semi-structured, individual interviews were conducted. Letters to request participation and consent were sent to possible interviewees (cf. Appendices O-P).
The interviewees were not known to each other. The interview guide (cf. Appendix Q) included open-ended questions, and that gave the interviewer the opportunity to explore particular themes or responses further. The interviewer had a set of pre-planned core questions for guidance to ensure that the same areas are covered with each interviewee. The lack of a fixed structure allowed the interviewer the opportunity to raise new questions if additional information was needed.

1.7.3.3 *Target population*

For the semi-structured interviews used in this study, the target population consisted of individuals who were involved, or if not directly involved in, had a sound knowledge of simulation. The survey population for the semi-structured interviews comprised individuals who had agreed to be interviewed and had completed, signed and returned the consent forms.

1.7.3.4 *Description of sample and sample size*

For the selection of the sample, the following selection (inclusion) criteria were applied:

- Professionals with experience in both the fields of simulation and postgraduate education;
- Professionals with knowledge of and experience in education and training in plastic surgery and/or knowledge of simulation, and practical experience in simulation; and
- Surgeons/clinicians with knowledge of and experience in simulation in plastic surgery.

The sample was drawn from professionals and the sample size was determined by the point of data saturation. Eight interviews were conducted.

Exclusion criteria were the following and were applied only once compliance with the inclusion criteria had been confirmed:

- Not giving consent to participate; and
- Lack of availability.

1.7.3.5 *The explorative study*

The piloting or pretesting of the interview guide was done by conducting two exploratory interviews with interviewees that complied with the selection criteria. The feedback was analysed. The interviews conducted as part of the pilot study were included in the final analysis as no changes had been suggested to the questions of the semi-structured interviews. Formal, digitally recorded semi-structured interviews were conducted to establish the adequacy of the interview guide. The interviews were recorded and noted.

1.7.3.6 *Data gathering*

Prior to commencing with the research, letters of invitation were sent to potential participants, requesting their participation (cf. Appendix O). To indicate they agreed to participation, they had to sign a letter of consent (cf. Appendix P). All interviews were conducted by the researcher according to a semi-structured interview guide (cf. Appendix Q). The researcher acquainted himself with literature on the techniques of interviewing. With the consent of each participant, the interviews were audio- and/or visually recorded for the purpose of referencing and transcription. Interviews were scheduled on an appointment basis, after which an interview guide was sent to the interviewees. This was done to give interviewees an adequate opportunity to prepare for the interviews. They were also informed of the approximate time that would be required for the interview.

1.7.3.7 *Data analysis*

The audio tapes of the interviews were transcribed by an independent typist. The transcriptions and recordings were checked for correctness by an independent person.

The qualitative data were analysed by the researcher. Co-coding was done by an independent academic. Responses were processed by identifying and summarising concepts, followed by the grouping of themes to form specific categories (Porter in Cormack 2000:404). Leedy and Ormrod (2002:16) describe qualitative analysis as a process where …"responses can be processed by identifying patterns of behaviour followed by mapping out variations, limitations and exceptions to the pattern being examined. These patterns will require clarification and that conclusions are made, confirmed or modified". The findings had been tabulated (cf. Appendix R) and discussed by the researcher and this was done in context with the literature and results of the Delphi process (cf. Articles in Chapters 4, 5 & 6).

1.8 RELIABILITY, VALIDITY AND TRUSTWORTHINESS

The principles of reliability, validity and trustworthiness are fundamental to the scientific method. In any study, the credibility, validity and value of the findings must be ensured. In qualitative studies, the basic question to measure the quality of the findings is to ask: *What is the trust value of a study?*

1.8.1 Reliability

"Reliability" is defined as the "extent to which a measurement instrument yields consistent, stable, and uniform results over repeated observations of measurements under the same conditions each time" (Goodwin 1995:96). A reliable measuring instrument will yield the same or similar results, when administered at different times or to different subjects from the same population, under the same conditions (De Vos, Strydom, Fouché & Delport 2012:177; Maree 2007 in De Vos *et al*. 2012:178).

According to De Vos *et al.* (2012:420), in qualitative research, where the researcher is interested in the diversity and characteristics of the variables being studied, the important aspect is whether the research process is logical, well documented and audited. It is not whether the results are reproducible and consistent (Janse van Rensburg 2015:118). In this study, reliability was anchored by means of carefully considered and tested interview guides and Delphi questionnaires.

Reliability is not normally described as a quality concept in qualitative research. Stenbacka (2001:552), however, suggests that a "…. [t]horough description of the whole process enabling conditional inter-subjectivity should ensure good quality when employing qualitative research".

In this study, as far as the Delphi process is concerned, *reliability* was ensured by making use of pilot studies and the reviewing thereof by experts, by determining strict criteria in sample selection, using the carefully constructed Delphi questionnaire and having measures in place to ensure a high response rate.

As far as the semi-structured interviews are concerned, *reliability* was ensured by making use of explorative (pilot) studies, careful selection of core questions for the interviews (reviewed by experts in this field of research), determining strict criteria in sample selection, using the carefully constructed interview guide, having measures in place to ensure a high response rate (such as scheduled appointments, sending of interview guide, confirming of appointments), as well as an interview process that was described in the protocol that was presented at the evaluation committee and also submitted and approved at the Ethics Committee of the Faculty of Health Sciences, UFS as well as in the articles.

1.8.2 Validity

Leedy and Ormrod (2005 in De Vos *et al.* 2012) define "validity" as the "extent to which the instrument measures what it is supposed to measure". This concurs with Bowling's (2002:150) distinction between internal validity and external validity – which concerns the applicability of the research findings to the wider population (Bowling 2002:150). According to Janse van Rensburg (2015:119), Maree (2012:151) states that trustworthiness of quantitative research relies heavily on both internal validity and external validity of the measuring instrument.

As far as the Delphi process is concerned, *validity* was ensured by the expertise of the participants in the Delphi panel, the broad collaboration by means of which the research instrument was designed, as well as by the supportive expertise that the promoters provided to the researcher.

The validity of interviews was ensured by piloting the interview guide by means of explorative interviews, as well as the supportive expertise that the promoters provided to the researcher. The validity of the findings of this study is founded on the expertise of the participants in the Delphi panel, the broad collaboration by means of which the research instruments were designed, the supportive expertise that the promoters provided to the researcher, as well as the input from the biostatistician during the evaluation committee meeting.

1.8.3 Trustworthiness

Maykut and Morehouse (1994:64) explain the term "trustworthiness" as referring to the "believability" of a researcher's findings. Guba, as quoted in De Vos *et al.* (2012:351-352), associates four aspects with trustworthiness, namely credibility, transferability, dependability and confirmability. For Babbie and Mouton (2001:277-278), a qualitative study can only be deemed transferable if it is credible, which in turn implies that it must be dependable.

True value or credibility (thus termed by Lincoln & Guba 1985:321) lies within the subjects' personal experiences and how these are perceived (Krefting 1991:215). Powel (2003:380) mentions a number of features that are important to ensure credibility in Delphi findings: important is the inclusion of a "clear decision trail that defends the appropriateness of the method to address the problem selected choice of expert panel, data collection procedures, identification of justifiable consensus levels and means of dissemination and implementation".

Applicability or **transferability** refers to the degree to which findings of the research can be generalised outside of the study group (Sandelowski 1986:31). Guba (1981:81), instead argues that the term transferability be used as a criterion against which the applicability of qualitative data should be measured. Both authors refer to how well these findings may be applied in a wider context.

Consistency looks at whether findings would remain consistent if the research were replicated with the same subjects or in a similar context (Krefting 1991:216). In qualitative research, consistency is therefore defined in terms of dependability, which implies variability that can be ascribed to identified or explainable sources (Duffy 1985:230).

Neutrality, according to Sandelowski (1986:33), refers to the freedom from bias in the research procedure and results. In qualitative research, Guba (1981:318) shifts the emphasis of neutrality from the researcher to the data and suggests that conformability be the criterion of neutrality and that it can be achieved through both truth-value and applicability.

Trustworthiness was ensured by subjecting the protocol to the Evaluation Committee of the Faculty of Health Sciences; by conducting an in-depth literature study and by providing a thorough description of the whole research process. The *trustworthiness* of the Delphi process in this study, therefore, was demonstrated in the reliability and the validity of the quantitative research instrument – in this case, the credibility of the Delphi instrument, the Delphi method of research, as well as the Delphi panel compiled by set criteria. Trustworthiness of the Delphi process was ensured by providing the Delphi panel with individual and combined, written feedback of the results.

Trustworthiness of the interviewing process was ensured by the use of voluntary interviews with open-ended questions, combined with a clear understanding of what the interviewer wanted from the interviewees, as well as the transcription of the interviews and verifying the accuracy of data, which was accomplished by the researcher and an independent person. Scientific record keeping ensured dependability.

1.9 ETHICAL CONSIDERATIONS

When involved in research, especially research in the human sciences, a researcher must take cognisance of specific ethical considerations. Ethics refers to moral values and principles that should guide the study, and rules and expectations by which the researcher should abide. In this study, the researcher complied with the expectations of ethical research in a variety of ways.

1.9.1 Approval

Permission to conduct the study was obtained from the Vice-Rector (Research), Ethics Committee, and the Dean and Faculty Management Committee of the Faculty of Health Sciences at the University of the Free State. The allocated ethics number was used on all documents and correspondence pertaining to the study (cf. Appendix C).

1.9.2 Informed consent

The respondents in the empirical study (Delphi technique & semi-structured interviews) were fully informed about and gave written consent to partake in the research. The consent forms were available only in English. The participants received a description of the study and the expected duration of participation. Participation was voluntary and they had the choice of either participating or not. They were guaranteed that information would remain confidential and findings would be made public anonymously – that is, no names would be linked to the findings. The researcher's name and contact details were available to the participants. Participants will have access to the published results of the study.

1.9.3 Right to privacy

The information collected by means of the Delphi process and semi-structured interviews was dealt with in a strictly confidential manner and no names or personal information was made known. The nature and quality of the participants' responses were treated confidentially. Only code numbers were used in the final descriptions of findings (cf. consent forms and processes that serve as confidentiality agreements; Appendices E & P).

1.10 IMPLEMENTATION OF THE FINDINGS

This report, containing the study process and the findings of the research, will be brought to the attention of relevant authorities, policy makers and role players in the applicable fields of study.

The findings will be submitted to scientific journals with a view to publication. The researcher hopes to make a contribution to more effective postgraduate plastic surgery education and training. The findings will also be presented at conferences.

1.11 ARRANGEMENT OF THE THESIS

This thesis was written in article format as specified by the requirements as stated in the Policy on Master's and Doctoral Degrees of the UFS (2015:13).

A doctoral thesis usually is between 70 000 and 100 000 words, or three publishable articles. In the context of this policy, publishable articles are defined as manuscripts reporting on research that has been supervised extensively, and formatted according to journal submission guidelines, ready for submission for publication in an academic journal (UFS 2015:6).

Due to the scope of the data gathered on the six research questions, a manuscript published in conference proceedings, as well as four articles were included in this doctoral thesis and not only three as required. The researcher wishes to make a significant contribution to this field of study, namely simulation in plastic surgery as little research has been published on this field up to date. This was one of the reasons why the researcher chose to introduce this field of research during an international conference in Ireland, UK. The organisers of the conference invited the researcher to expand the abstract to a manuscript with the view to publishing it in the official conference proceedings. Thereafter, the conference Organising Committee, invited the authors to expand the manuscript further to be published as an article in a high-impact Journal (cf. Article 2). The researcher decided to include the manuscript, published in the proceedings of the conference, in Chapter 2 as the first of the series of manuscripts and/or articles (cf. point 8.2.1).

Each manuscript/article is presented and submitted, with its reference list attached in the style required by the specific journal (guidelines for authors of each journal included in the appendices). These references are also included in the reference list of the thesis in the style prescribed by the Division of Heath Sciences Education, Faculty of Health Sciences, UFS.

The arrangement of the chapters is as follows:

In this chapter, Chapter 1, **ORIENTATION TO THE STUDY,** the background to the study was provided and the problem, including the research questions, was stated. The overall goal, aim and objectives were stated and the research design and methods that were employed were explained in detail, as this thesis does not contain separate literature review and methodology chapters. The scope and demarcated field of study were explained, as well as the significance and value of the study. To provide more insight into the study, a schematic overview of the research process as well as the layout of the report was given. The chapter will serve as a theoretical directive for the study.

With Chapter 2, **SIMULATION IN PLASTIC SURGERY: A RESEARCH AGENDA TO IMPROVE TEACHING, LEARNING AND CLINICAL EXPERTISE/PROFESSIONAL COMPETENCE,** the aim was to report on the process of identifying aspects to be included in a research agenda with a view to improving teaching, learning and professional competence in plastic surgery education. It is clear that a scientific proposal to express the need for research in the field of plastic surgery and simulation with a clear agenda proposing research topics in a systematic way is necessary. Aspects discussed in this conference presentation (published in the conference proceedings), can contribute to addressing this need and to emphasise the lack of research on this terrain in the profession of plastic surgery. The methodology was based on the conceptualisation and contextualisation of simulation-based medical education. The first objective of this study is partially addressed in this article (cf. 1.4.3). The promoter and co-promoter of this study were co-authors. This manuscript was published in 2016 in the proceeding of an international conference in Ireland, UK (cf. Appendices S-T).

Chapter 3, deals with the question, **WHY IS RESEARCH NEEDED ON SIMULATION TO ENHANCE PLASTIC SURGERY EDUCATION AND TRAINING?** The first objective (cf. 1.4.3) of the study is addressed in full together with the conference paper published in the conference proceedings. This article serves as a theoretical research framework for this study. It reflects on the purpose and value of research into simulation in plastic surgery. The methodology is based on the conceptualisation and contextualisation of SBME. Incorporating simulation into plastic surgery education and training, the intention is to facilitate meaningful clinical experiences in a safe environment that students can refer to and transfer to an authentic clinical contexts, that is, to educate and train students in a non-threatening, simulated environment, providing opportunities for experimentation and practising in a non-threatening environment. The promoter and co-promoter of this study were co-authors of this article that was published in March 2018 in the International *Journal for Cross-Disciplinary Subjects in Education (IJCDSE)* (cf. Appendices U-V).

In Chapter 4, **SIMULATION IN PLASTIC SURGERY: FEATURES AND USES THAT LEAD TO EFFECTIVE LEARNING,** the second objective was addressed (cf. 1.4.3). The aim was to identify and describe whether simulation might enhance postgraduate and/or plastic surgery education and training, and to identify the features and uses of simulation having the potential to enhance learning in plastic surgery. Data were collected by means of semi-structured interviews with eight national and international role players in simulation. The results indicate the influence of simulation on postgraduate education and training and how learning may be enhanced in the areas of knowledge, skills, clinical competencies and professional conduct by specific features, uses and characteristics of simulation. Recommendations were made to enhance the effectiveness of learning in postgraduate plastic surgery education and training. The promoter and co-promoter of this study were co-authors of this article (cf. Article 3, Chapter 4) (cf. Appendices W-X).

In Chapter 5, **ENHANCEMENT OF PLASTIC SURGERY TRAINING BY INCLUDING SIMULATION IN EDUCATION AND TRAINING PROGRAMMES**, the fourth objective was addressed. The aim of the study was to identify and describe the learning outcomes in plastic surgery education and training where simulation may be important (essential and useful) as one of the methods to train a plastic surgeon, and to identify and describe simulation modalities, linked to specific cognitive levels, with the view to establish the influence of simulation on plastic surgery education and training as far as knowledge, skills, clinical competence and professional conduct is concerned. Data were collected by means of a Delphi survey comprising an expert panel of plastic surgeons, supplemented by semi-structured interviews conducted with national and international role-players on simulation and postgraduate education in order to generate data. The research suggested a number of aspects that can be included in a framework that can serve as a directive when it is considered to include simulation in a training programme in plastic surgery. The promoter and co-promoter of this study were co-authors of this article (cf. Article 4, Chapter 5) (cf. Appendices Y-Z).

In Chapter 6, **SIMULATION IN PLASTIC SURGERY: ROLE, VALUE AND CONTRIBUTION OF SIMULATION IN EDUCATION AND TRAINING – A DIRECTIVE FOR IMPLEMENTATION,** the fifth objective was addressed (cf. 1.4.3). In this research an in-depth study was done on the role and value of simulation in postgraduate plastic surgery education and training. The aim of the study was to identify and describe the role, value and contribution that simulation can make as well as the main considerations for implementation of simulation in a training programme. Data were collected by means of semi-structured interviews conducted with national and international role players in simulation. The contribution that simulation can make in the training of plastic surgeons according to suggested guidelines and recommendations can add value to specialist training. The promoter and co-promoter of this study were co-authors of this article (cf. Article 5, Chapter 6) (cf. Appendices AA-AB).

In Chapter 7, **SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING,** objectives five and six of the study were addressed (cf. 1.4.3). This chapter integrates the research findings of the first four objectives in the above-mentioned articles, focusing on the compilation of a framework structure that can be applied to suggest guidelines to enhance the effectiveness of learning in postgraduate plastic surgery education and training. The guidelines were compiled based on findings and conclusions drawn.

In Chapter 8, **CONCLUSION, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY**, evidence for achieving each of the objectives set for the study is provided for future consideration in other research. Conclusions, limitations and recommendations on the study are made.

1.12 CHAPTER SUMMARY

Chapter 1 provided the background and introduction to the research undertaken regarding simulation in postgraduate plastic surgery education and training; it further dealt with the conceptualisation and contextualisation of simulation. Postgraduate plastic surgery education and training, learning theories, including learning effectiveness and the cognitive levels of learning, as well as the development of guidelines based on scientific research, were discussed. The research design and the methodology applied were described in detail. The data collection methods and analysis of data were elucidated. Theoretical aspects concerning the Delphi technique and semi-structured interviews (data collection methods) were explained.

CHAPTER 2

ARTICLE 1:

SIMULATION IN PLASTIC SURGERY: A RESEARCH AGENDA TO IMPROVE TEACHING, LEARNING AND CLINICAL EXPERTISE/PROFESSIONAL COMPETENCE

Article 1 in this thesis, not to be included as one of the four publishable manuscripts (articles) for qualification requirements, although it was published as a manuscript in the proceedings of conference.

This was prepared according to the journal submission guidelines for the Proceedings of the IICE Conference, Ireland, UK in April 2016 (cf. Appendix S).

Proof of submission and publication (cf. Appendix T)

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Simulation in Plastic Surgery: A Research Agenda to Improve Teaching, Learning and Clinical Expertise/Professional Competence

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Abstract

Changes in health care triggered major shifts in health sciences education, including a move to simulation in education and training. Simulation enhances student learning, provides controlled and safe practice opportunities, and shapes the acquisition of doctors' clinical skills/professional competence. Myriad research opportunities exist in the field of simulation-based medical education (SBME). This research is aimed at presenting a research agenda to improve teaching, learning and professional competence in plastic surgery education. The methodology is based on the conceptualisation and contextualisation of SBME. The research agenda offers recommendations on the role and value of simulation in education; the enhancement of learning; integrating simulation-based education into training curricula; standardising plastic surgery training globally; the revalidation of competency in continuing medical education, and the engagement of teachers and students in educational research. Simulation has potential to play an integral role in developing better and safer health care services for patients worldwide.

1. Introduction

The role of simulation in surgical training is now beyond 'proof of concept' stages. The advantages of simulation in modern health care systems have been well described in numerous reports establishing the validity and transferability of skills learned in simulated clinical setting environments with demonstrable advantages to the system, and patients [1], [2]. Changes in health care triggered major shifts in health sciences education, including a worldwide move to utilising simulators in education and training [3],[4],[5]. According to Issenberg *et al.* [6],"… for instance, in the United States, the pressures of managed care are shaping the form and frequency of hospitalisations, resulting in higher percentages of acutely ill patients and shorter in-patient stays. This results in less opportunity for medical learners to assess patients with a wide variety of diseases and physical findings. Despite increased cost-efficiency, reductions in physician reimbursement and shrinking financial resources constrain the educational time that physicians in training receive. Consequently, at all educational levels, doctors find it increasingly difficult to keep abreast of skills and topics that frequently appear in practice".

Evidence of the value of simulation in education ensued in increased reliance on simulation technology to facilitate teaching innovation and enhancement of student learning, to provide controlled and safe practice opportunities, and to shape the acquisition of doctors' clinical skills/ professional competence [5]. Students are empowered to make decisions regarding diagnostic and therapeutic procedures, and to experience the full impact of success and mistakes in a safe and authentic educational environment [5], [6]. Simulation-based medical education is an educational method that makes use of simulation to bridge the gap between theory and practice in medical education [7]. Regarding medical simulation, the word simulation means the "imitation of the operation of a real-world process or system over time" [8].

In medicine this may mean any process and system designed and planned to recreate an authentic clinical context and environment, which provide opportunities for a student to assume a role of responsibility. The intention is to facilitate meaningful clinical experiences in a safe environment that the learner can refer to and transfer to authentic clinical contexts [9].

Simulator means a model that encapsulates the key characteristics or behaviours of a selected process or system found in the real world [8]. A medical simulator therefore demonstrates a key clinical characteristic or set of clinical responses that mimic real-life conditions and responses. Medical simulators include computer programmes, part-task trainers, human patient simulators (or full-scale mannequins), and standardised patients [10],[11],[12].

The problems caused by the increasing number of students entering medical schools, and the consequence of more students competing for clinical cases, as described by Maran and Glavin [13], as well as the number of conditions primary health care professionals are expected to deal with (case mix) lead to simulation being used to fill the gap in medical training. Patients nowadays are better informed, have greater expectations and may exercise their right not to be involved in student education [14], resulting in an even smaller teaching platform.

Issenberg *et al.* [6] identify five factors contributing to the increase in the use of simulations in medical education, namely problems with clinical teaching; new technologies for diagnosis and management; assessing professional competence; medical errors; patient safety, and team training; and the role of deliberate practice. Due to the pressure caused by these factors, the burden of proof for adoption need not consist of randomized control trials, but rather there is opportunity for a wide range of studies making use of simulation. Thus substantial opportunity exists for investigators to contribute new knowledge in the field of simulation-based medical education, and, more specifically, its use in Plastic Surgery education and training.

Scalese [15] highlights the trend to utilise simulators for teaching, learning and assessment. Ziv, Erez, Munz, Vardi, Barsuk, Levine, Benita, Rubin and Berkenstadt [16] posit that simulation-based medical education (SBME) plays a significant role in minimising risk to patients and enhancing medical training. These authors [16] also mention that medico-legal issues and demands for accountability can be critical driving forces for the incorporation of simulation training in health care education.

2. The problem statement and aim of the study

Training in plastic surgery is not exempted from these drivers. The increased competition for surgical exposure and practice, combined with smaller teaching platforms and shorter training times, might have an impact on the quality and surgical competence of the registrar leaving the training programme. Plastic surgery is falling behind other disciplines in adopting simulation-based medical education, as in many areas and disciplines great strides are made in implementing simulation in formal training programmes, with leaders in the field anaesthesia, emergency medicine and laparoscopic surgery.

A number of articles recently have been published on topics such as the use and potential use, as well as the importance of simulation in plastic surgery [17],[18]; on the integration of surgical simulation in plastic surgery residency training [19]; and skills transferred to the operating room by surgical simulation [20]. In response to these, two seemingly contradictory goals in education have been put forward as priorities. On the one hand, there is a push for further standardization of education. To this end, the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialities (ABMS) have defined six core competencies required of all residents [17]. Standardization aims to increase patient safety by reducing surgical errors and improving the quality of care, while at the same time maximizing hospital resources. On the other hand, the medical education model ought to allow for individualisation to reflect the fact that people learn knowledge and master competencies differently. In this line of reasoning, there should be room for one student's path to differ from another's to best accommodate the student's learning styles [18].

Satava [21] cites three concepts that will be key in revolutionising medical education, which exemplify these dual priorities: an increased efficiency of education by standardising curricula; an individualisation of education, and a shift from time-based training to competency-based training.

Substantial opportunities exist for researchers to contribute to new knowledge in the field of simulation-based medical education (SBME) and, more specifically, plastic surgery education. Medico-legal issues and demands for accountability are critical driving forces for the incorporation of simulation training in health care education.

The research reported here is aimed at identifying aspects to be included in a research agenda with the view to improving teaching, learning and professional competence in plastic surgery education. The methodology is based on the conceptualisation and contextualisation of SBME.

3. Residency programmes and simulation

Worldwide, different models exist for education and training in plastic surgery, including the models of learning through an apprenticeship relationship with senior clinical colleagues, own observation, or self-directed learning – motivated by a candidate's own internal drive. In some cases, registrars receive little guidance in terms of the knowledge, competencies, skills and attitudes that they are expected to acquire during residency. Residency programmes are responsible for producing technically competent surgeons, but not all of the necessary procedural skills are truly mastered during these training periods. "Classroom training" does not translate into effective procedural skills and competence does not always match confidence. Although residency programme directors are asked to attest to the competency of recent graduates, they are unable to evaluate the performance of every procedure by every resident. A further shortcoming is that systematic evaluation using structured objective criteria seldom is used to establish procedural competence, and except for a few procedures, it is not known how many times a specific procedure must be repeated to attain competence. Rosen, Long, McGrath and Greer [22] point out that in contrast to the traditional apprenticeship model, twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, and hospital resources, and minimise errors. The driving forces behind these changes are developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy, simulation can improve results and also lower risk and procedure cost because of fewer procedures and less operating room time [22].

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) identify six core competencies for residents:

> *"… Patient care, medical knowledge, practice-based learning and improvement, inter-personal and communication skills, professionalism, and systems-based practice"* [17].

Training thus is shifting from traditional apprenticeship to more objective, standardized approaches. A shift towards competency-based surgical training comes with two key concepts: objective assessments and simulation laboratory training. The time thus has come for residency programmes to explore and expand their use of simulation.

A joint initiative of the ACGME and the ABMS, *The Plastic Surgery Milestone Project*, compiled descriptors and targets for resident performance, based on the above-mentioned core competencies and can be categorised at five training levels: Moving from Level 1 where the resident demonstrates the mastering of milestones expected of an incoming resident up to Level 5 where the resident has advanced beyond performance targets set for residency and completing graduation [23].

The American College of Surgeons (ACS) has decided to introduce simulation in training and education for general surgery in three phases: Skills training, procedure training, and team training. Mittal *et al.* [17] propose that plastic surgery should follow this simulation initiative with modifications appropriate to the specialty. Phase 1, Skills, is attended to in the resident's general surgery training, but Phase 2, Procedures, focuses on the development of procedures specific to plastic surgery. For Phase 3, Competencies in teamwork, the competencies for plastic surgery resemble those for general surgery and include team-training simulators to improve communication in emergency departments, clinics, operating rooms, and hospital wards.

Arbogast and Rosen [18] in their article: *"Simulation in Plastic Surgery Training: Past, Present and Future"* propose that this three-phase strategy be adapted for plastic surgery residency by modifying it to address challenges specific to the field. They are of the view that a unified commitment by medical educators is required to use simulation "[t]o simultaneously standardize the training curriculum, individualize the method of acquiring information, and objectively evaluate the training process".

4. Aspects of simulation

Simulation is a useful aid in a variety of teaching, training, learning, and assessment situations.

4.1 In which ways can simulation be of help?

Simulation can play a valuable role in improving patient safety, facilitating better surgeon-patient interaction, maximizing hospital resources, lowering risks through increased precision, improving results by necessitating fewer procedures and decreasing operating room time and procedure cost.

Simulation shows great promise to change teaching methods - the traditional model of see one, do one, teach one is an inefficient and risky approach to acquiring technical skills and competencies. This, coupled with public demand for patient safety and an increasing reluctance to be "practised" on, has created ideal opportunities for simulation-based medical education to improve teaching.

Simulation methodologies enable tailored training interventions in a low-threat environment. Limited exposure to patients with low-incidence and high-complexity conditions can be addressed by means of simulation and render competency as outcome. Simulation also can be used to evaluate the outcome of training in a more objective and structured way. Harden [24] used this concept in the development of the objective structured clinical examination (OSCE). An adapted version of the OSCE was created to assess technical skills [25]. This is called the objective structured assessment of technical skills (OSATS).

4.2 Formative versus summative OSATS

Both formative and summative OSATS provide an excellent opportunity for feedback on observed performance. Some argue that the best predictor of the quality of performance is repetitive or deliberative practice - with supervisors providing corrective feedback until skill is mastered. This is an area in which simulation excels.

4.3 In which areas can simulation be implemented?

Simulation-based medical education can target different levels for intervention. It has a role to play at individual level (e.g. supplementing clinical experience, procedural simulation and task training), team and unit level (e.g. behavioural training, multi-disciplinary team interactions, and debriefing), as well as at an organizational level (e.g. on-site simulation to identify vulnerabilities in specific processes as well as broader systems, and disaster management).

4.4 Studying and improving performance

A critical on-going issue is identification and remediation of individuals who are underperforming. The simulation laboratory setting may help determine if an individual's deficits lie in history and examination taking, other data gathering skills, synthesis, decision making or prioritization. In this setting the following may also be determined:

Physical ability, lack of practice, effect of fatigue, or other similar areas that may contribute to underperformance. This is an often-underutilised utilisation of simulation with ample opportunity for future research.

4.5 Priorities for simulation-based medical education in plastic surgery and recommendations

Based on the foregoing the following may, as an example, be regarded as priorities for simulation-based medical education in plastic surgery. After each set of priorities a recommendation is provided for the realisation of the priorities:

Integration into training curricula

- The formal integration of simulation into curricula: It does not suffice to use simulation on a voluntary basis without protected simulation time, very few students make use of simulation facilities if simulation is not formally integrated in the programme.
- Simulation should be synchronised with clinical training – there is little benefit if simulation time clashes with clinical teaching.
- Ideally, simulation should be implemented on multiple tiers, namely skills rotations (must be completed to progress to next block/year), independent study/practice opportunities to allow students to progress/become proficient at their own pace, as well as evaluation and assessment of competency.

In order for the above to be achieved, the research question that must be answered is: Can simulation in postgraduate plastic surgery education and training enhance the effectiveness of learning in this discipline?

Standardization of plastic surgery training globally

- SBME should be employed to standardise plastic surgery training, due to the large variation in scope of plastic surgeons worldwide.
- SBME should be employed to counter a lack of clinical exposure opportunities, or (especially in the Third-World setting) programmes overburdened by a specific workload (for example, burns and burn reconstruction), which limits the time and resources available for exposure to other areas of the discipline (for example aesthetic surgery).
- SBME should set a basic standard that might enable educators and researchers to compare and contrast different training programmes worldwide.
- SBME should be available at all training facilities for plastic surgeons to enable the discipline to determine a basic core skills and competency list, which every plastic surgeon should master.

To achieve this, research is required to determine if simulation might be useful in addressing the problem of a lack of opportunities for clinical exposure and practice.

Skill maintenance and validation

- Simulation should play an important role in revalidation of competency on a continuing medical education basis. Currently, in most CME programmes, focus is placed on theoretical knowledge, but there is a large gap in validating and revalidating surgical competency. Simulation could fill this gap.
- Safe thresholds of surgical skill should be identified, validated and may then be used and implemented using simulation as the vehicle to help achieve this goal.
- On-going skills maintenance programmes should be developed where voluntary hours spent on simulators could be used to assist in skill maintenance, and with sufficient logging, could perhaps obviate the need to go for formal revalidation. In order to realize these priorities, further research is needed on the use of simulation to facilitate the transfer of skills to real world practice to assess the validity and reliability of procedural, clinical, and behavioural competency evaluation methods, and to determine the applicability of simulation to achieve these.

5. Challenges in simulation-based medical education and research

Simulation, like other methods in medical education, has some limits and pitfalls that should be kept in mind. These challenges provide ample opportunity for research, and we strongly advocate for research to be undertaken in these areas. The first challenge would be to utilise the wealth of opportunities for research in plastic surgery on procedural competence and to establish the benefit, if any, of deliberate practice in a simulation-based setting. The discipline also lends itself very well to research on defining minimum levels of competency, and the role of simulation in maintaining and validating this. The problem of availability of facilities for simulation poses a challenge in itself, as well as the general misconception that all simulation needs to be hi-fidelity, hi-tech, and expensive to be worthwhile. Given the resource demands of some simulation approaches, we should remain open to all solutions that meet desired educational objectives. Furthermore, simulation cannot completely substitute key clinical experiences and learning from actual surgical practice. This, combined with the possible perception from previously trained professionals, who might feel intimidated and vulnerable ('Are they saying that our training was inferior?') forms a formidable stumbling block, which will have to be addressed in order for simulation-based medical education to be incorporated in training curricula. The challenge to succeed in this regard would be engagement with both trainers and trainees before and after simulation-based medical education is implemented.

6. Future directions

Work needs to be done on developing case libraries of simulation scenarios, which have been peer reviewed. This will facilitate the spread of simulation further by encouraging multi-centre efforts, and providing the opportunity for educational mentoring. Multi-centre simulation research efforts will be required to further develop and share evaluation tools specifically developed for resident and fellowship evaluations, with priority emphasis on research on the transfer of skills into the real world, as well as the assessment of validity and reliability for procedural, clinical and behavioural competency evaluation.

7. Discussion

The research agenda needs to include aspects such as the role and value of simulation in education; the enhancement of student learning at different cognitive levels; the integration of simulation-based education into training curricula; the standardization of plastic surgery training globally; the revalidation of competency in continuing medical education and the engagement of teachers and students in educational research. Medical simulation promises to revolutionize health care education, and specifically education in plastic surgery – but more work is needed. Despite the development of various models and simulation-based learning tools in plastic surgery, the role of simulation in the specialty's training curriculum is less well established. It is necessary for simulation-based training to be fully integrated and funded in formal plastic surgery training programmes. It is also necessary to develop a skilled faculty of educators in well-coordinated simulation facilities. Medical simulation techniques have shown great promise in other specialities - we have outlined here the challenges and opportunities of realizing this promise in plastic surgery.

8. Conclusion

Further research is required to expand the role of simulation in plastic surgery within training, performance evaluation, standardization, certification and revalidation. Simulation has the potential to become an integral part of the development of better and safer plastic surgery services for patients. Simulation in health care education provides ample opportunity for research. Medical simulation promises to revolutionise health care education provided that a skilled cohort of educators be developed in well-coordinated simulation facilities. Simulation has the potential to play an integral role in developing better and safer health care services for patients worldwide. It is clear that a scientific proposal to express the need for research in the field of plastic surgery and simulation, with a clear agenda, proposing research topics in a systematic way is necessary. Aspects discussed in this article can contribute to this.

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CHAPTER 3

ARTICLE 2:

WHY IS RESEARCH NEEDED ON SIMULATION TO ENHANCE PLASTIC SURGERY EDUCATION AND TRAINING?

The article was prepared according to the journal submission guidelines for the *International Journal for Cross-Disciplinary Subjects in Education (IJCDSE)* (cf. Appendix U).

Proof of submission and publication (cf. Appendix V)

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Why is Research Needed on Simulation to Enhance Plastic Surgery Education and Training?

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Abstract

Changes in health care triggered major shifts in health sciences education, including a move to simulation in education and training. Simulation enhances student learning, provides controlled and safe practice opportunities, and shapes the acquisition of doctors' clinical skills/professional competence. Myriad research opportunities exist in the field of simulation-based medical education (SBME). The overall goal of this research was to reflect on the purpose and value of research on simulation and was aimed at improving plastic surgery education and training (teaching, learning and professional competence). The methodology is based on the conceptualisation and contextualisation of SBME. This article offers recommendations on the role and value of simulation in education; the enhancement of learning; integrating simulation-based education into training curricula; standardising plastic surgery training globally; the revalidation of competency in continuing medical education, and the engagement of teachers and students in educational research. Simulation has potential to play an integral role in developing better and safer health care services for patients worldwide.

1. Introduction

The role of simulation in surgical training is now beyond 'proof of concept' stages. The advantages of simulation in modern healthcare education and training systems have been well described in reports establishing the validity and transferability of skills learned in simulated clinical setting environments with demonstrable advantages to the system and patients [1]. Changes in health care triggered major shifts in health sciences education, including a worldwide move to utilising simulators in education and training [2]. According to Issenberg *et al.* [3],"…for instance, in the United States, the pressures of managed care are shaping the form and frequency of hospitalisations, resulting in higher percentages of acutely ill patients and shorter in-patient stays". A consequence of this is that medical students may have to forfeit opportunities to assess patients suffering from diverse and sometimes rare diseases and presenting with diverse symptoms. Efforts to increase cost-efficiency can no longer counter the decrease in training staff remuneration and financial resources available for education and training, resulting in less time spent on training at all levels and doctors having to find other ways to stay at the forefront of skills in and new knowledge on cases with which they are confronted.

Evidence of the value of simulation in education resulted in increased reliance on simulation technology to facilitate teaching and training innovation and enhancement of student learning and the mastering of skills, to provide controlled and safe practice opportunities, and to shape the acquisition of doctors' clinical skills/professional competence [2]. Simulation empowers students to make decisions regarding diagnostic and therapeutic procedures, and to experience the full impact of success and mistakes in a safe and authentic educational environment [2],[3].

Simulation-based medical education is an education and training strategy that makes use of simulation to bridge the gap between theory and practice in medical education. In terms of medical simulation, the word simulation means the "imitation of the operation of a real-world process or system over time" [4].

In medicine this may mean any process and/or system designed and planned to recreate an authentic clinical context and environment, providing opportunities for a student to assume a role of responsibility. The intention is to facilitate meaningful clinical experiences in a safe environment that the students can refer to and transfer to authentic clinical contexts [5] that is to educate and train students in a non-threatening, simulated environment, providing opportunities for experimentation and practising in a non-threatening environment. Here students can be brought to the level of application, taking them into the realm of real-word circumstance and helping them to overcome the gap between theory and reality, and to experience a feeling of what it is to be working with real patients in a real-world context. This plays an important role in reflection and the integration of theory with skills. Simulation offers a safe environment and context where students hone their skills and determine for themselves what their strengths and weaknesses are and what they should do about the areas they need to improve in and build out, and they build self-confidence.

Soltanian [6] defines simulation "as the replication of a real-world process or system over time" and makes an appeal to surgeon educators to employ their knowledge and skills in developing and enhancing simulators for training the next generation of plastic surgeons. The required technology has become more readily available lately and surgical simulations have improved significantly in recent years [6]. The most common types of models in surgical simulation include physical models (e.g. to train fundamentals of laparoscopic surgery); mathematic models (e.g. commonly used within a computer simulation); graphical models (e.g. graphical depiction of an object or system), and finite element models (e.g. large and complex systems are divided into smaller and simpler parts with more predictable behaviour with a view to replicating the more complex objects [6].

A simulator is a model that encapsulates the key features or behaviours of an identified process or system found in the real world [4]. A medical simulator, therefore, demonstrates a key clinical characteristic or set of clinical responses or situations that mimic real-life conditions and responses. Medical simulators include computer programmes, part-task trainers, human patient simulators (or full-scale mannequins), and standardised patients [7].

An increasing number of students enter medical schools each year, with the consequence of more students competing for clinical cases and the number of conditions health care professionals are expected to attend to (case mix), as well as the shorter duration of hospitalisation of patients deprive students of opportunities to do clinical work. Simulation is excellently suited to cover this hiatus in medical training. Patients nowadays are better informed, have greater expectations and may exercise their right not to be involved in student education, resulting in an even smaller teaching platform.

Issenberg *et al.* [3] identify five factors contributing to the increase in the use of simulations in medical education, namely a shortage of clinical education opportunities for clinical teaching; innovative technology for diagnosis and management; assessment of professional competence; medical errors; patient safety and team training; and the role of intentional practising. Due to the pressure caused by these factors, the burden of proof for adoption need not rely on randomized control trials, but rather, opportunities exist for a wide range of studies making use of simulation. Thus, investigators using these opportunities can contribute new knowledge in the field of simulation-based medical education, and, more specifically, its use in plastic surgery education and training.

Scalese [8] highlights the trend to utilise simulators for teaching, learning and assessment. It is posited that simulation-based medical education (SBME) plays a significant role in minimising risk to patients and enhancing medical training [9]. These authors [9] also posit that medico-legal issues and demands for accountability may be critical driving forces for the incorporation of simulation training in health care education.

2. Problem statement and aim of the study

Training in plastic surgery is not exempted from the drivers for the use of simulation mentioned. The increased competition for surgical exposure and practice, combined with smaller teaching platforms and shorter training times might have an impact on the quality and surgical competence of the registrar leaving the training programme. Plastic surgery is falling behind other disciplines in adopting simulation-based medical education, as in many areas and disciplines great strides are made in implementing simulation in formal training programmes, with leaders in the field anaesthesia, emergency medicine and laparoscopic surgery.

A number of articles recently have been published on topics such as the use and potential use, as well as the importance of simulation in plastic surgery [10], [11]; the integration of surgical simulation in plastic surgery residency training [12]; and skills transferred to the operating room by surgical simulation [13]. In response two seemingly contradictory goals in education have been put forward as priorities. On the one hand, there is a push for further standardisation of education. To this end, the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialities (ABMS) have defined six core competencies required of all residents [10]. The standardization of aims will increase patient safety by reducing surgical errors and improving the quality of care, while at the same time maximizing hospital resources. On the other hand, the medical education model ought to allow for individualisation to reflect the fact that people obtain knowledge and master competencies differently. According to this line of reasoning there should be room for one student's path to differ from another's to best accommodate the students' learning styles [11].

Satava [14] cites three concepts that will be key in revolutionising medical education that exemplifies these dual priorities: increased efficiency in education by standardising curricula; individualisation of education, and moving from time-based training to competency-based training.

Substantial opportunities exist for researchers to contribute to new knowledge in the field of simulation-based medical education (SBME) and, more specifically, plastic surgery education. Medico-legal issues and demands for accountability are critical driving forces for the incorporation of simulation training in health care education.

To generate research evidence in education and to establish a research foundation it is necessary to consider/reflect on the purpose of research directives in the specific field of education. Cook, Bordage and Schmidt [15] explored the research performed in Health Professions Education and suggest a framework for classifying the purposes of educational research. According to Cook *et al.* [15], indications are that research in medical education does not necessarily inform educational practice. These authors [15] mention that a best-evidence medical education (BEME) review by Issenberg *et al.* [3] found weak evidence supporting several conditions for effective high-fidelity simulation, but noted that few or no strong studies could be found. However, in the BEME guide *Features and uses of high-fidelity medical simulations that lead to effective learning*, Issenberg *et al.* [16] clearly state that research in this field "needs improvement in terms of rigor and quality. High-fidelity medical simulations are educationally effective and simulation-based education complements medical education in patient care settings". As far as research directives are concerned, Issenberg *et al.* [16] are of the opinion that the "lack of unequivocal evidence for much of the research on simulation-based medical education clearly calls for better research and scholarship in medical education".

Cook *et al.* [15] classify the purposes of research in a useful framework to understand and to give meaning to the research process, as well as to identify potential solutions consisting of three categories, namely description, justification and clarification. *Description* studies focus on the first step in the scientific method, namely observation, and asks: "What was done?"; *Justification* studies focus on the final step in the scientific method comparing educational interventions with each other to address the question: "Did it work?". *Clarification* studies employ each step in the scientific method, starting with observations (building on prior research) and models or theories, making predictions, and testing these predictions. Such studies ask the questions: "How does it work?" and "Why does it work?" [15].

A scientific approach and clear, direction-giving research that will advance the science in the specific field of study, namely plastic surgery and simulation, therefore, are not negotiable. It thus is imperative that any research directive suggested here has to follow this deeper approach when executed during different research initiatives and projects.

Nel, Labuschagne and van Zyl [17] at the IICE conference in 2016 in Ireland emphasised the importance of a scientific proposal with a clear agenda expressing the need for research in the field of plastic surgery and simulation, proposing research topics in a systematic way.

The problem addressed in the research reported here thus was a lack of profound research about the use of simulation in the education and training of plastic surgeons. The study was aimed at identifying aspects to be included as a research directive for studies conducted with a view to improving teaching, learning and professional competence in plastic surgery education and training. The methodology was based on the conceptualisation and contextualisation of SBME.

3. Residency programmes and simulation

Worldwide, different models exist for education and training in plastic surgery, including the models of learning through an apprenticeship relationship with senior clinical colleagues, own observation, or self-directed learning – motivated by a candidate's own internal drive. In some cases, registrars receive little guidance in terms of the knowledge, competencies, skills and attitudes they are expected to acquire during residency. Residency programmes are responsible for producing technically competent surgeons, but not all of the necessary procedural skills are truly mastered during these training periods. "Classroom training" does not translate into effective procedural skills and competence does not always match confidence. Although residency programme directors are required to attest to the competency of recent graduates, they cannot possibly evaluate the performance of every procedure carried out by every resident. A further shortcoming is that systematic evaluation using structured objective criteria seldom is used to establish procedural competence, and except for a few procedures, it cannot be determined and prescribed how many times a specific person should repeat a specific procedure to ensure competence.

Rosen, Long, McGrath and Greer [18] point out that in contrast to the traditional apprenticeship model, twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, and hospital resources, and minimise errors. The driving forces behind these changes are developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy simulation can improve results and also lower risk and procedure cost because of fewer procedures and less operating room time [18].

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) identify six core competencies for residents, namely

> *"*Patient care, medical knowledge, practice-based learning and improvement, inter-personal and communication skills, professionalism, and systems-based practice*"* [10].

Training thus has evolved from traditional apprenticeship to more objective, standardised approaches. A shift towards competency-based surgical training comes with two key concepts: objective assessments and simulation laboratory training. The time thus has come for residency programmes to explore and expand their use of simulation.

A joint initiative of the ACGME and the ABMS, *The Plastic Surgery Milestone Project*, compiled descriptors and targets for resident performance, based on the above-mentioned core competencies which may be categorised at five training levels, moving from Level 1 where the resident demonstrates the mastering of milestones that new residents have to achieve to Level 5 where the resident has advanced beyond performance targets the residents have to meet during residency and before graduation [19].

The American College of Surgeons (ACS) has decided to introduce simulation in training and education for general surgery in three phases: Skills training, procedure training, and team training. Mittal *et al.* [10] recommend that plastic surgery should follow this simulation initiative with modifications appropriate to the specialty. Phase 1, Skills, is attended to in the resident's general surgery training, but Phase 2, Procedures, focuses on the development of procedures specific to plastic surgery. For Phase 3, Competencies in teamwork, the competencies for plastic surgery resemble those for general surgery and include team-training simulators to improve communication in emergency departments, clinics, operating rooms, and hospital wards.

Arbogast and Rosen [11] in their article, *Simulation in Plastic Surgery Training: Past, Present and Future*, propose that this three-phase strategy be adapted for plastic surgery residency by modifying it to address challenges specific to the field. They are of the view that a unified commitment by medical educators is required to use simulation "[t]o simultaneously standardize the training curriculum, individualize the method of acquiring information, and objectively evaluate the training process".

4. Aspects of simulation

Simulation is a useful aid for honing skills and bridging the gap between theory and practice in a variety of teaching, training, learning, and assessment situations.

4.1 In which ways can simulation be of help?

Simulation can play a valuable role in improving patient safety, facilitating better surgeon-patient interaction, maximizing hospital resources, lowering risks through refining precision, improving results by demanding fewer procedures and decreasing operating room time and procedure cost.

Simulation shows great promise to change teaching methods - the traditional model of see one, do one, teach one is an inefficient and risky approach to acquiring technical skills and competencies. This, coupled with public demand for patient safety and an increasing reluctance to be "practised" on, has created ideal opportunities for simulation-based medical education to improve teaching.

Simulation methodologies enable tailored training interventions in a low-threat environment. Limited exposure to patients with low-incidence and high-complexity conditions may be addressed by means of simulation and render competency as outcome. Simulation also may be used to assess the outcome of training in a more objective and structured way. This concept is used in the development of the objective structured clinical examination (OSCE). An adapted version of the OSCE was created to assess technical skills. This is called the objective structured assessment of technical skills (OSATS).

Neumeister [20] mentions that many plastic surgery programmes find it problematic to balance clinical, hands-on education and training with their didactic programme. Work and duty hour restrictions add another layer of complexity to surgical education. Furthermore, the ultimate step in learning is not the transmission of information from the teacher to the learner but rather the processing of the information by the learner [20]. According to Neumeister [20] the current trends in educational technology "include internet-based instruction, hands-on simulation devices, mobile devices, virtual and augmented reality, point-of-care learning and assessment, and learning analytics". Telemedicine combined with holograms brings distant expertise into the classroom for learners at all levels. Before entering the operating room, interactive mobile applications allow the residents opportunities to practise procedures over and over again to solidify the understanding of each aspect of any given surgery skill [20]. "Educators need to use innovation and technology to make the best use of data and knowledge to train next generations of plastic surgeons. Educational technology offers unique tools to help learners acquire and process the information needed to become masters of their surgical specialty" [20].

4.2 Formative versus summative OSATS

Both formative and summative OSATS provide an excellent opportunity for feedback and reflection on observed performance. Some argue that the best predictor of the quality of performance is repetitive or deliberative practice - with supervisors providing corrective feedback until the skill is mastered. Formative OSATS thus represent an area in which simulation excels.

4.3 In which areas can simulation be implemented?

Simulation-based medical education can target different levels for intervention. It has a role to play at individual level (e.g. supplementing clinical experience, procedural simulation and task training), team and unit level (e.g. behavioural training, multi-disciplinary team interactions, and debriefing), as well as at an organisational level (e.g. on-site simulation to identify vulnerabilities in specific processes as well as broader systems, and disaster management).

4.4 Studying and improving performance

A critical on-going issue is identification and remediation of individuals who are underperforming. The simulation laboratory setting may help determine if an individual's deficits lie in history and examination taking, other data-gathering skills, synthesis, decision making or prioritization. In this setting the following may also be determined: Physical ability, lack of practice, effect of fatigue, or other similar areas that may contribute to underperformance. This is an often-underutilised application of simulation providing ample opportunity for future research.

4.5 Priorities for simulation-based medical education in plastic surgery and recommendations

Based on the foregoing the following, as an example, may be regarded as priorities for simulation-based medical education in plastic surgery. After each set of priorities a recommendation is provided for the realisation of the priorities:

<u>Integration into training curricula</u>

- The formal integration of simulation into curricula: It does not suffice to use simulation on a voluntary basis without protected simulation time. Very few students make use of simulation facilities if simulation is not formally integrated in the programme.
- Simulation should be synchronised with clinical training – there is little benefit if simulation time clashes with clinical teaching times.
- Ideally, simulation should be implemented at multiple tiers, namely skills rotations (must be completed to progress to next block/year), independent study/practice opportunities to allow students to progress/become proficient at their own pace, as well as evaluation and assessment of competency.

In order for the above to be achieved, the research question that must be answered is: Can simulation in postgraduate plastic surgery education and training enhance the effectiveness of learning in this discipline?

<u>Standardisation of plastic surgery training globally</u>

- SBME should be employed to standardise plastic surgery training, due to the large variation in the scope of plastic surgeons worldwide.
- SBME should be employed to counter a lack of clinical exposure opportunities, or (especially in the Third-World setting) programmes over-burdened by a specific workload (for example, burns and burn reconstruction), which limits the time and resources available for exposure to other areas of the discipline (for example aesthetic surgery).
- SBME should set a basic standard that might enable educators and researchers to compare and contrast different training programmes worldwide.
- SBME should be available at all training facilities for plastic surgeons to enable the discipline to determine a list of basic core skills and competencies which every plastic surgeon should master.

To achieve this, research is required to determine whether simulation might be useful in addressing the problem of a lack of opportunities for clinical exposure and practice.

<u>Skill maintenance and validation</u>

- Simulation should play an important role in revalidation of competency on a continuing medical education basis. Currently, in most CME programmes, the focus is on theoretical knowledge, but there is a large gap between theory and validating and revalidating surgical competency. Simulation could fill this gap.
- Safe thresholds of surgical skill should be identified, validated and may then be used and implemented using simulation as the vehicle to help achieve this goal.
- On-going skills maintenance programmes should be developed in which voluntary hours spent on simulators could be used to assist in skill maintenance, and with sufficient logging, could perhaps obviate the need to go for formal revalidation. To realize these priorities, the use of simulation stands in want of further research to facilitate the transfer of skills to real-world practice to assess the validity and reliability of procedural, clinical, and behavioural competency evaluation methods, and to determine the applicability of simulation to achieve these.

5. Challenges in simulation-based medical education and research

Simulation, like other methods in medical education, has some limits and pitfalls that should be kept in mind. These challenges provide ample opportunity for research, and we strongly advocate for research to be undertaken in these areas. The first challenge would be to utilise the wealth of research opportunities in plastic surgery on procedural competence and to establish the benefit, if any, of deliberate practice in a simulation-based setting. The discipline also lends itself very well to research on defining minimum levels of competency, and the role of simulation in maintaining and validating these levels. The problem of availability of facilities for simulation poses a challenge in itself, as well as the general misconception that simulation needs to be hi-fidelity, hi-tech, and expensive to be worthwhile. In the light of the resource demands of some simulation approaches, we should be susceptible to all solutions that comply with educational requirements. Furthermore, simulation cannot replace vital clinical actual observation and practical acquaintance with and learning from actual surgical practice. This, combined with the possible perception from previously trained professionals, who might feel intimidated and vulnerable (‘Are they saying that our training was inferior?’) forms a formidable stumbling block, which will have to be addressed in order for simulation-based medical education to be incorporated in training curricula. The challenge to succeed in this regard is found in meaningful involvement with trainers and trainees alike before embarking on simulation-based education.

6. Future directions

Work needs to be done on developing case libraries of simulation-based scenarios which have been peer reviewed. This will facilitate the promotion of simulation-based training by encouraging multi-centre efforts and providing the opportunity for educational mentoring. Multi-centre simulation research efforts will be required to further develop and share evaluation tools specifically developed for resident and fellowship evaluations, where research on the transfer of skills into the real world takes precedence, as well as studies of valid and reliable assessment of procedural, clinical and behavioural competency evaluation.

7. Discussion

The research on simulation needs to include aspects such as the role and value of simulation in education; the enhancement of student learning at different cognitive levels; the integration of simulation-based education in teaching and training curricula; the standardisation of plastic surgery training globally; the revalidation of competency in continuing medical education, and the engagement of teachers and students in educational research. Medical simulation promises revolutionizing health care education, and specifically education in plastic surgery – but more work is required. Despite the development of various models and simulation-based learning tools used in plastic surgery training, the role of simulation in the specialty’s training curriculum is not yet fully established. It is essential for simulation-based training to be an integral part of formal plastic surgery training programmes and be funded as such. It is also crucial to develop a skilled cadre of trainers and educators in well-managed simulation facilities. Medical simulation techniques have shown great promise in other specialities - we have outlined here the challenges and opportunities of realizing this promise in plastic surgery.

8. Conclusion

The purposes for developing research directives are to compile theoretical and conceptual frameworks for the conception and design of research studies. The ensuing better understanding of the teaching and learning process will positively influence practice, clinical expertise and professional competence.

Further research is required to enhance the role of simulation in plastic surgery training to the benefit of performance evaluation, standardisation, certification and revalidation. Simulation as integral part of plastic surgery training is the preferred way to go to foster a move towards improved and safer plastic surgery services to the benefit of patients. Simulation in health care education provides ample opportunity for research. Medical simulation promises to revolutionise health care education provided that a skilled cohort of educators be developed in well-coordinated simulation facilities. Simulation has the potential to play an integral role in developing better and safer health care services for patients worldwide, avoiding risk and providing real-life opportunities for students to hone their skills and enhance self-confidence. It is clear that a scientific proposal to express the need for research in the field of plastic surgery and simulation, with clear directives proposing research topics in a systematic way urgently needs to be developed and made available to researchers investigating ways in which to ensure validity, reliability and viability in the education, training and assessment of plastic surgeon students. . It is hoped that aspects discussed in this article will contribute to and lay the foundation for such a research framework.

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CHAPTER 4

ARTICLE 3:

SIMULATION IN PLASTIC SURGERY: FEATURES AND USES THAT LEAD TO EFFECTIVE LEARNING

The article was prepared according to the journal submission guidelines for the *African Journal in Health Professions Education (AJHPE)* (cf. Appendix W).

Proof of submission (cf: Appendix X)

Simulation in Plastic Surgery: Features and uses that lead to effective learning

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Author contribution.
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Abstract:

Background. Increased competition for surgical exposure and practice, smaller teaching platforms, and shorter training times impact the quality of training and competence of plastic surgery registrars. Demands for accountability and minimising patient risks are driving forces for incorporating simulation in health care education. The problem addressed was whether the features and uses of simulation would enhance postgraduate plastic surgery education and training and ensure more effective learning.
Objective. The objective was to identify and describe (a) the influence that simulation may have on student learning and how the effectiveness of learning may be enhanced in postgraduate and/or plastic surgery education and training, and (b) the features and uses of simulation that have the potential to enhance learning in plastic surgery.
Methods. Data were collected by means of semi-structured interviews with eight national and international role players in simulation.
Results. The results indicate the effect of simulation on postgraduate education and training and how learning may be enhanced in the areas of knowledge, skills, clinical competencies and professional conduct by specific features, uses and characteristics of simulation. Recommendations were made to enhance the effectiveness of learning in plastic surgery education and training by including simulation as teaching method and applying its unique features and uses.
Conclusion. Simulation-based education in postgraduate plastic surgery education and training is not often encountered. This research investigated the use of simulation to enhance plastic surgery education and training and promote safe patient care. Recommendations are made to enhance the effectiveness of learning in postgraduate plastic surgery education and training.

Keywords: Simulation, features and uses, education and training, learning effectiveness, plastic surgery, residency training

Introduction

Evidence of the role of simulation in medical education has emphasised the use of simulation technology over the past number of decades in efforts to increase learner knowledge, to provide students with controlled and safe practice opportunities, and to shape the acquisition of doctors' clinical skills.[1,2,3] Simulation is becoming an integral part of medical education at all levels[1,2,3], as medical education, for various reasons, has fast become subject to radical and innovative changes.

Many major shifts in medical education methods are due to changes in the delivery of health care. According to Issenberg *et al*., in the United States, for example, the pressures of managed care shape the form and frequency of hospitalisation, 'resulting in higher percentages of acutely ill patients and shorter in-patient stays'.[3] Medical students, therefore, have fewer opportunities to assess patients with a wide variety of diseases and physical findings, while reductions in physician remuneration due to shrinking financial resources constrain the educational time that doctors in training receive.[4] Consequently, at all educational levels, doctors find it increasingly difficult to keep abreast of skills and topics they need to practise successfully. [4]

Issenberg *et al*. identify five factors contributing to the increased use of simulations in medical education, namely lack of clinical teaching opportunities, therefore, less patient material due to changes in health care delivery; new technologies for diagnosis and management; assessing professional competence; medical errors, patient safety, team training; and the role of deliberate practice.[4]

Twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, and hospital resources, and minimise errors.[5] The driving forces behind this are developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy, simulation can improve results and also lower risk and procedure costs because of fewer procedures and less operating room time.[5] Simulation in training allows students ample opportunity to hone their skills and competencies in safe, no-risk circumstances. Insufficient and inefficient clinical teaching stressed the need for strategies to improve clinical education, including the use of simulation. [5]

Over the past 30 years new technologies in medicine have revolutionised patient diagnosis and care. Examples are the development of flexible sigmoidoscopy and bronchoscopy, and minimally invasive surgery, including laparoscopy, and robotics for orthopaedics, urology and cardiology. The benefits of these innovations include reduced postoperative pain and suffering, shorter hospitalisation and earlier resumption of normal activities, as well as significant cost savings.[6]

These newer techniques, however, demand psychomotor and perceptual skills that differ from traditional approaches, and these innovative methods may be associated with a higher complication rate than traditional practices.[7] Haluck *et al*. maintain that these 'newer technologies have created an obstacle to traditional teaching that included hands-on experience. For example, endoscopy requires guiding one's manoeuvres in a three-dimensional environment by watching a two-dimensional screen, requiring the operator to compensate for the loss of binocular depth cue with other depth cues'.[8] One of the corollaries to these new techniques was the introduction of simulation technology in the training and assessment of students. Research indicates that training programme directors emphasised that virtual reality and computer-based simulations had become indispensable technological tools in clinical education.[8]

The Accreditation Council for Graduate Medical Education (ACGME) in the USA in an endeavour to ensure and improve the quality of graduate clinical medical education and to attain a higher level of effectiveness listed six domains of clinical medical competence.[6] It is expected of postgraduate programmes to provide educational experiences that would ensure that graduates demonstrate competence in these ACGME project outcomes, namely patient care; medical knowledge; practice-based learning and improvement; interpersonal and communication skills; professionalism, and system-based practice.[9] These are the educational experiences that benefit from simulation most in the light of a lack of patients and clinical exposure.

Miller[10] proposed a framework (Miller's Pyramid) that argues that a medical learner's clinical skills should be assessed at four levels: (a) **knows** (knowledge) – recall of facts, principles and theories; (b) **knows how** (competence) – ability to solve problems and describe procedures; (c) **shows how** (performance) – demonstration of skills in a controlled setting; and (d) **does** (action) – behaviour in real practice.[4] Simulation technology is increasingly being used in each domain of competence to assess the first three of Miller's levels of learning because of its ability to programme and select learning-specific findings, conditions, and scenarios, to provide standardised experiences to all examinees, and to include outcome measures that yield reliable data.[11]

Methods

Elements of grounded theory were used to describe features and uses of simulation, and to relate why simulation lends itself perfectly to be included in educational programmes. Grounded theory was used to develop recommendations to promote learning in postgraduate plastic surgery education and training.
The study focused on the opinions and perspectives of medical and health care professionals regarding the features and uses of simulation, and whether and how simulation as education and training method might influence student learning. The study was aimed at developing a set of recommendations that might enhance the effectiveness of learning in postgraduate plastic surgery education and training by employing simulation as one of the education and training methods used.

Data were collected through semi-structured interviews with eight national and international role players in simulation and postgraduate education.
Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences, UFS (ECUFS 122/2015).

Semi-structured interviews

Semi-structured individual interviews were used to explore key national and international role players' opinions and perceptions on simulation-based medical education. The purpose was to investigate and to establish clarification on simulation in postgraduate education and training. The interviews were conducted to obtain an in-depth, comprehensive overview of the contribution that simulation might make to postgraduate plastic surgery education and training. The features and uses of simulation that might result in more effective education and training in postgraduate plastic surgery thus were determined. An interview guide (Table 1), developed by the author on the basis of a literature review was used. Occasionally, additional questions arose during the semi-structured interview process; the data thus collected were included in the research. Data on Questions 3, 4 and 7 of the interview guide are reported in this article.

Target population

National and international role players in simulation and postgraduate education were requested to participate in the semi-structured interviews. The eight participants were invited to participate in the interviews, and they all accepted the invitation. They were directors of simulation units, clinical heads of clinical medical departments, programme directors of medical and nursing programmes, and education management specialists, researchers and representatives from the simulation industry. Written consent was obtained from all the participants.

Data collection and analysis

Individual interviews based on a single interview guide were conducted with eight participants by the author (CPG). The interviews were audio-recorded, transcribed by the author (CPG) and checked by an independent person who was not part of the study. Field notes taken during the interviews contributed to the data. The data were analysed using the grounded theory approach that requires continuous comparison of data, following the data analysis steps of coding, categorisation and theory generation.[12] Theory building occurred by finding patterns in the data and this continued until saturation of data was reached.[13]

Reliability and trustworthiness

Reliability was ensured by making use of explorative studies, determining strict criteria for sampling, using the carefully constructed interview guide, as well as an interview process that was audio-taped and carefully described [14]. Trustworthiness of the interviewing process was ensured by involving voluntary interviewees with a clear understanding of what the interviewer expected from them, and using open-ended questions, as well as the transcription and verification of data. Scientific record keeping ensured dependability. [14]

Table 1: Interview guide for semi-structured interviews with national and international role players

Question	
1.	What experience with/exposure to simulation in the field of health education have you had in general? Briefly describe your experience with/exposure to simulation in terms of the type of simulation, your role, duration of involvement.
2.	Are you currently involved in simulation and/or postgraduate education and training? In what context are you involved?
3.	**Does/can simulation influence student learning in postgraduate education and training? In which regard?**
4.	**How can effectiveness of learning be enhanced in postgraduate and/or plastic surgery education and training (in the areas of knowledge, skills, clinical competence, professional conduct)?**
5.	Can simulation be used to enhance student learning at different cognitive levels? (Will the student only use simulation to remember knowledge / or understand / or apply / or analyse / or evaluate / or create new concepts and ideas?)
6.	Which types of simulation or simulation modalities might lead to effective learning?
7.	**Which features and applications of simulation in postgraduate/ or plastic surgery education and training will lead to more effective learning?**
8.	Does simulation have (a) a contribution to make to, (b) a role to play in, or (c) a specific value to add to postgraduate education?
9.	What would your main consideration be if you decided to include simulation in your teaching and training programme?
10.	If you have to guide a team of experts tasked to develop a curriculum with simulation as one of the training/learning methods, which important guidelines will you put on paper?

11.	Do you wish to make any recommendations that may be used in compiling guidelines on simulation for postgraduate plastic surgery?
12.	Any recommendation(s) you would like to make when considering including simulation in specialist training?
13.	Will you please share (a) some of the lessons learned regarding the implementation of simulation in a curriculum, (b) as well as the biggest challenge in implementing simulation in training?

Results

Data collected by means of Questions 3, 4 and 7 of the semi-structured interviews are reported in this article. Data were analysed and findings summarised and qualitative perspectives are shared on *the influence of simulation on student learning* (Table 2) and how *the effectiveness of learning can be enhanced* (Table 3). The features and uses of simulation that may enhance learning in postgraduate education and training served as basis for a number of *recommendations to enhance the effectiveness of learning* in postgraduate plastic surgery education and training (Table 4). Quotes from interviewees' responses are indicated in inverted commas, followed by a code number assigned to each of the participants.

Simulation influences student learning (Table 2) as it substitutes other learning strategies; it supports adult learning principles as it requires students to prepare, placing a responsibility on them as adult learners; it provides self-confidence and skills motivating students to confront life-threating situations, making a difference to a patient's life. Simulation provides the opportunity to learn by repetition; to work individually or in groups, and it fosters communication. Simulation ensures that the student attains and sustains a specific level of competency.

Table 2: The influence of simulation on student learning in postgraduate education and training

1. Simulation as a learning strategy

Simulation influences student learning in different ways:
• Simulation is a very specific learning and education strategy that can be described as a holistic process that ensures meaningful learning
  o 'To be effective it needs to be an important component in the curriculum' [S1]
  o 'Effectiveness can only be enhanced if there is proper integration' [S1]
• Simulation is based on an adult learning strategy as it is built on adult learning principles that can be combined in different ways
  o 'Different people learn in different ways' [C3]
Simulation can replace other educational strategies, for example theoretical lectures, by bringing simulated case engagement into the normal learning strategy:
  o 'Simulation will trigger more excitement' [D1]
  o 'Students will be more focused and remember more' [D1]
  o 'It gives students the opportunity to learn hands-on' [C1]

2. Motivation to make a difference
Simulation of rare clinical cases or life threatening, important scenarios is motivational: • '… students can be motivated to make a difference in a patient's life' [C1]
3. Importance of preparation
Theoretical grounding and preparation will influence student learning: • 'Students may attend a lecture, e-learning programme, read articles, do a self-test before visiting the simulation lab, which ensures that learning is more meaningful, and promotes deep learning and commitment' [D1] • Identify own shortcomings, evaluate own level of competence, against own tempo   o 'Students must be prepared when they come to simulation lab' [D2]
4. Learn by repetition
Practising non-technical and technical skills will influence student learning: • 'Giving students the opportunity to practise in the simulation lab so that they are more competent when performing certain procedures on a patient' [C1, D1]

5. Group simulations

Simulation scenarios that include different health professionals will foster and enhance learning:

- 'Debriefing provides students the opportunity not only to identify their own shortcomings but also those of the individual group members and group as a whole' [C1]
- Learn to work in groups and that communication among them is of great importance.
    - 'You have to have small group engagement' [S1]

6. Level of competence

The aim of simulation is to attain and sustain a certain level of competence or expertise:

- Ensure that the health professional/student maintains the same level of competence after the initial mastering of the procedure
    - 'Attaining some sort of competence level quicker before going to the patient' [C2]
    - 'Competent = bare minimum (knows/knows how)' [C2]
    - 'Proficient = level of skill above minimum (shows/does)' [C2]
    - 'As you practise a skill more, you become proficient = on your way to mastering' [C2]

Interviewees' opinions on how simulation can enhance the effectiveness of learning are indicated in Table 3 and emphasise the role of simulation as a non-threatening learning environment that enhances the effectiveness of learning. Students can practise with less stress in a completely safe environment before working with real patients; this highlights the advantages of training using simulation. Simulation also enhances the effectiveness of learning by fostering interpersonal, interprofessional patient communication, health communication and reasoning skills. Through deliberate, as well as repetitive practice, learning is enhanced (Table 3). The debriefing aspect offers another way of learning and allows students to decide on self-improvement. Authentic scenarios help the students to learn more effectively than when using paper cases. The assessment opportunities of simulation enhance student learning.

Table 3: Enhancing the effectiveness of learning in postgraduate and/or plastic surgery education and training by introducing simulation

1. Non-threatening environment

A non-threatening environment enhances the effectiveness of learning:

- Enhancement of learning
    - 'Students can practise with less stress' [D1, D2]
    - 'You learn in an environment where you are allowed to make mistakes' [D1]
    - 'To get learners to think about their actions, to analyse, taking ownership of own learning, reflective learning' [D2]
    - 'They learn in a completely safe, non-threatening environment' [D2]
- Patient safety
    - 'First learn through simulation, then on real patient' [D1]
    - 'Steep learning curve before practice on real patient' [D1]
    - 'Give them a plan according to which they can work when in a real situation' [D2]
    - 'It allows them to practise more on the simulator so there are fewer medical errors when working with real patients' [D2]

Advantage of using simulation in training:

- 'Operation time less; complications fewer; costs lower – big advantage to train postgraduate students/registrars' [D1]

2. Soft medical skills

Training of soft skills through simulation enhances the effectiveness of learning

- Interpersonal communication, interprofessional communication, patient communication, health communication, etc. to be included in simulation training
    - 'Some people may think it is not technical skills (as in AFRIMED/CANMED) so it is not assessed' [D1]
    - 'Colleges to include soft skills in evaluation' [D1]
    - 'Powerful tool to develop clinical reasoning' [S1]
    - 'Clinical reasoning will happen in a complex space' [S1]

- ‘Different reasoning in rural situations’ [S1]

3. Deliberate practice

Deliberate practice enhances the effectiveness of learning

- Bench models may be used to practise psychomotor skills by repetition or deliberate practice of specific procedures until students feel safe
  - ‘To make deliberate practice more successful, students may use a tick-sheet to test themselves’ [C2]
  - ‘To make deliberate practice more successful, the student must be accompanied by consultant/educator’ [D1]
  - ‘Student must know what he/she is doing correctly’ [D1]
  - ‘There must be scheduled times for practice as well as for feedback’ [D1]
  - ‘Registrars are adult learners and identify skills that need more practice’ [D1]

4. Feedback

Feedback enhances the effectiveness of learning

- Constructive feedback:
  - ‘Can be according to a debriefing manner: first focus on the positive; then focus on things which he/she should do in another way; then focus on these things without negative critique’ [D1]
  - ‘Give feedback directly after simulation/time slot; in writing or on video’ [D1]
  - ‘Feedback to be planned, structured according to a template or may be more personal’ [D1]
  - ‘For non-technical skills use the debriefing method – look at what was good; discuss what can be different’ [D1]
  - ‘For technical skills - then use a tick-sheet; it will allow for more constructive feedback and certain skills can be revisited’ [D1] [D1]
  - ‘Give feedback to students so that they can correct themselves’
- Feedback and assessment with a view to enhancing the effectiveness of learning:
  - ‘Formative feedback will help students to prepare for assessment and examination; then they will have time to correct their mistakes’ [D1]
  - ‘Timely feedback before assessment can help the student to lower stress levels’ [D1]
  - ‘Feedback on quality of operations can offer opinion where the registrar is safe; by using easy scenarios evaluate whether the registrar executes the technique in a good/proper way and/or quick enough – this is a good learning opportunity’ [C1]
  - ‘Students to be observed on a continuing basis’ [C2]
  - ‘Student can be observed during a skill performance’ [C2]

5. Debriefing

Debriefing enhances the effectiveness of learning

- The process of debriefing gives more insight:
  - ‘Debriefing is another way to learn’ [C1]
  - ‘It is the debriefing aspect that affects learning’ [D2]
  - ‘Do not use debriefing as a teaching opportunity, let learners think how they can improve’ [D2]
  - ‘Observation of skills, then debriefing after that, improves practical skills’ [C2]

6. Realism or fidelity

Realism of fidelity enhances the effectiveness of learning:

- The degree of realism of a scenario or patient influences the effectiveness of learning:
  - ‘In the beginning, students do not believe in the simulation scenario; later you can observe the ”overcoming of disbelief” – the suspension of disbelief – they think it is a real patient: that leads to more effective learning than using a paper case’ [D2]

7. Repetitive practice

Repetitive practice enhances the effectiveness of learning

- For learning to take place a medical or practical situation is necessary:
  - ‘You have to practise on a continuous basis – do it repeatedly over the time span of a month or year’ [C1, D1]

○ 'It must become a natural action – you learn by repeating – repeat soon after the first practice; one week; after weeks; months' [C1]
8. The training platform
The training platform enhances the effectiveness of learning: • As training platforms may become smaller in certain disciplines, simulation offers opportunities for learning ○ 'Platform varies from rural situation to complex' [S1]
9. Assessment
Assessment enhances the effectiveness of learning: • Evaluation of clinical skills in summative assessment of registrars plays a role in effective learning ○ 'In the field of specialists, assessment should include well-defined objectives and competencies' [C2] ○ 'Assess levels for competence' [C2] ○ 'Assessment to be reliable and statistically sound; use tick-sheet' [C2] ○ 'Use simulated patients for clinical examinations' [S2]

Recommendations to enhance the effectiveness of learning in postgraduate plastic surgery education and training are offered in Table 4. To apply the unique features and uses of simulation in a correct manner will influence the effectiveness of learning in a positive way.

Table 4: Recommendations to enhance the effectiveness of learning in postgraduate plastic surgery education and training by applying the unique features and uses of simulation

Environment
• The provision of a controlled non-threatening environment to registrars will unlock the opportunity to learn more effectively: • Simulation has the ability to create a safe environment enabling registrars to detect problems and patient care errors in a non-threatening way of learning, fostering reasoning skills and thought processes; learning takes place where it is acceptable to make mistakes and causes less stress. • The simulation environment is open to accommodate a process that can change from a uni- to a multi-purpose process where learning can be based on a single objective or on multiple objectives of learning; learning could span different cognitive levels and include variations from superficial to deep learning. • A simulation scenario may be changed or adapted to a more complex scenario where learning could take place at a totally different level of competence and applicability.
Curriculum
The integration of simulation in the curriculum of a postgraduate plastic surgery training programme will offer registrars the opportunity to learn more effectively: • Simulation should be integrated in the curriculum and training schedule and be directed by guidelines for teaching through simulation; the role of simulation should be clearly stated in curriculum documents and an explanation of how it will form part of the registrars' performance management. • Teaching and learning strategies should be aligned with educational goals and learning outcomes and should be adaptable to the learning situation. • Simulation offers the opportunity for large group training by developing scenarios for multi-professional teams where individual as well as group learning can take place with an opportunity for debriefing and constructive feedback; individualised learning according to the registrars' learning needs set to specific standards should be offered.
Clinical teaching and learning
• Simulation should offer to registrars opportunities for clinical learning to be more effective: • Registrars' engagement in deliberate practice should take place according to set learning outcomes based on real clinical problems in simulated settings; the realism of clinical problems and the hands-on experience should help them to master clinical outcomes and to transfer knowledge, skills, and competencies to real clinical settings.

• Learning outcomes will enhance the effectiveness of learning and processes must be in place to ensure they are met. • Smaller learning units can give registrars the opportunity to master learning outcomes at own pace; ensuring intrinsic motivation and fostering deep learning. • Effective learning is enhanced when registrars practise clinical skills across a wide range of difficulty levels; scenarios set on different levels of difficulty ensures that learning takes place at different cognitive levels. • By offering registrars the opportunity to engage in repetitive practice in a safe environment will give them the challenge to correct and hone their clinical skills and competencies.
Feedback
• Registrars should approach simulation opportunities in a different way when consultants are with them to give feedback and will experience scenarios as a direct learning opportunity and problems can be corrected immediately – they should see it as teaching them purposefully and deliberately: • Feedback should be planned, formally scheduled and be an integral part of the training programme. • Feedback should be built into simulations, or presented at scheduled times, on video or electronic media. • Registrars should use the opportunity of feedback to correct themselves by taking notice of feedback on accuracy and timing. • Constructive feedback should drive decisions as far as preparation for final assessment.
Technology
Technology should be seen as offering endless possibilities to enhance learning for registrars: • Technical skills, non-technical skills, as well as the softer skills can be explored for learning at different levels by adding or changing scenarios. • Sharing facilities between institutions will be beneficial as registrars can see or use a whole spectrum of simulations; standardisation of outcomes is possible, as well as offering quality learning opportunities and an opportunity to learn new skills.

Discussion

How simulation influences student learning and how the effectiveness of learning may be enhanced by including simulation as a learning method in postgraduate and/or plastic surgery education and training were addressed by the third and fourth semi-structured interview questions. The opinion was that simulation can enhance the effectiveness of learning as far as the mastery of knowledge, skills, clinical competence and professional conduct are concerned.

The features and uses of simulation in postgraduate and/or plastic surgery education and training were addressed by semi-structured interview question seven.

The data gathered by means of semi-structured interview Questions 3, 4 and 7 were compared with perspectives gained from the literature review with a view to making recommendations. Key outcomes of this research were the identification of the features and uses of simulation, and how simulation might be applied to enhance the effectiveness of learning when including it as a training method in plastic surgery.
As specific features and uses of simulation influence the effectiveness of learning, these should be maximised in simulation-based education and training in plastic surgery education.

According to Issenberg *et al.* [4], 'traditional medical training has focused on individual learning to care for individual patients. Medical education has neglected the importance of teamwork and the need to develop safe systems. The knowledge, skills, and attitudes needed for safe practice are not normally acquired, nor are they required, as part of medical education'.[4] Simulation is an appropriate method for team training - a prerequisite for interprofessional health care required from modern medical education.

Simulation offers the possibility of a cyclic learning dimension structure, namely a safe, purposefully planned learning environment, including variations of learning strategies/methods and the opportunity to select material offering different applicable learning opportunities and ensuring a unique learning experience where the learning can be evaluated by the registrar or feedback/debriefing can be done by a consultant to achieve competence, or to re-plan and/or deliberately practise specific, identified learning units.

Deliberate practice, not just time and experience in clinical settings, is the key to the development of medical clinical competence. [4] Deliberate practice involves '(a) repetitive performance of intended cognitive and psychomotor skills in a focused domain, coupled with (b) rigorous skills assessment, that provides learners with (c) specific, informative feedback, that results in increasingly (d) better skills performance, in a controlled setting.' [4] Simulation is the ideal way to ensure deliberate practice, regardless of whether patient material is available or not. Research emphasises the importance of repetition for clinical skills acquisition and maintenance, [15] and research evidence clearly shows that high-fidelity medical simulations facilitate learning. [4]

Simulation-based education allows students to practise and acquire patient care skills in controlled and safe learning environments. Feedback to students, the opportunity for deliberate and repetitive practice, multiple learning strategies, individualised learning within a controlled environment, and the opportunity for hands-on experiences foster students' self-confidence and plays a cardinal role in mastering educational outcomes.[6]

Simulation can play an important role in postgraduate education; however, it cannot substitute education involving real patients in genuine settings.

Conclusion

From the findings of this research it is clear that for simulation to be introduced as a teaching method and a learning opportunity for residents with a view to improving plastic surgery education and training, it should include (i) a clear set of recommendations on how simulation can enhance the effectiveness of learning, (ii) a description of the role and value of simulation based on a scientific research process, and (iii) the development of an argument to enhance plastic surgery training by including simulation in education and training programmes, and (iv) the development of guidelines for teaching through simulation as part of training programmes for evidence-based plastic surgery education/practice.

Further research is required to enhance the role of simulation in plastic surgery training. [16] 'Simulation has the potential to play an integral role in developing better and safer health care services for patients worldwide, avoiding risk and providing real-life opportunity for students to hone their skills' [16] It is foreseen that the features and uses of simulation, discussed in this article, will contribute to and lay the foundation for more effective learning in plastic surgery education and training in the future.

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CHAPTER 5

ARTICLE 4:

ENHANCEMENT OF PLASTIC SURGERY TRAINING BY INCLUDING SIMULATION IN EDUCATION AND TRAINING PROGRAMME

The article was prepared according to the journal submission guidelines for the *African Journal in Health Professions Education (AJHPE)* (cf. Appendix Y).

Proof of submission (cf: Appendix Z)

Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes

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Author contribution.
CPGN designed the study, wrote the protocol, collected data and performed analysis, interpreted data and wrote the manuscript. GJvZ and MJL were supervisors of the study, reviewed the protocol and manuscript and contributed substantially to the conceptualisation, design, analysis and interpretation of data and scientific content. All authors approved the final version of the manuscript submitted.

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None.

Abstract:

Background: This research investigated the possibility of integrating simulation in plastic surgery residency training. The problem addressed was the lack of knowledge about using simulation as an essential or useful method to enhance the training of plastic surgeons. A lack of empirical evidence existed concerning learning outcomes that could be mastered by simulation-based education and training and their specific cognitive levels.

Objective: The objective of the study was to identify and describe learning outcomes for plastic surgery education and training for which simulation might be an important (essential and useful) training method, and to identify and describe simulation modalities, linked to specific cognitive levels, to establish the influence of simulation on plastic surgery education and training as far as knowledge, skills, clinical competence and professional conduct are concerned.

Methods: Data were collected by means of a Delphi survey of an expert panel comprising nine plastic surgeons, supplemented by semi-structured interviews conducted with eight national and international role players in simulation and postgraduate education.

Results: Learning outcomes, levels of training, and possible simulation modalities, cognitive levels and descriptive verbs and phrases were described as these pertain to learning. Simulation in medical education, and its relation to simulation technology, were discussed. Recommendations regarding the inclusion of simulation in specialist training were offered.

Conclusion. A number of aspects surfaced that should be included in a framework that might serve as a directive for the inclusion of simulation in a training programme in plastic surgery.

Keywords: plastic surgery education and training, simulation, learning outcomes, cognitive levels

Introduction

Simulation is now in widespread use for professional health education; however, by itself, it is not a guarantee that adequate learning will occur. Simulation has to be integrated with the outcomes of the curriculum, applicable simulation modalities have to be used, the learning environment must be conducive to education and training, and the features and uses of simulation have to be optimally and correctly incorporated into the training programme.

Satava [1] is of the opinion that three concepts will be essential in revolutionising medical education, namely an increased efficiency of education by standardising the curriculum; an individualisation of education and a shift from time-based training to competency-based training.

Worldwide, different models exist for education and training in plastic surgery, including the model of learning through an apprenticeship relationship with senior clinical colleagues, own observation or self-directed learning – motivated by a candidate's own internal drive. In some cases, registrars receive little guidance in terms of the knowledge, competencies, skills and attitudes that they are expected to acquire during residency.

Rosen, Long, McGrath and Greer [2]point out that in contrast to the traditional apprenticeship model, twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, and hospital resources, and to minimise errors. The driving forces behind this came from developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy, simulation can improve results and also lower risk and procedure cost because of fewer procedures and less operating room time.[2]

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) identify six core competencies for residents: 'Patient care, medical knowledge, practice-based learning and improvement, inter-personal and communication skills, professionalism, and systems-based practice'.[3]

A joint initiative of the ACGME and the ABMS, *The Plastic Surgery Milestone Project*, compiled descriptors and targets for resident performance, based on the above-mentioned core competencies. These descriptors and targets (outcomes) can be categorised at five training levels, starting at Level 1 at which the resident demonstrates the mastering of milestones expected of an incoming resident, moving up to Level 5 where the resident has advanced beyond performance targets set for residency and is ready to graduate. [4]

Simulation represents a safe and standardised postgraduate training method, and also provides a yardstick for gauging residents' practical capabilities regarding procedures, surgery and teamwork in a clinical setting [3]. The American College of Surgeons (ACS) introduces simulation in training and education for general surgery in three phases, namely skills training, procedure training, and team training. Mittal *et al*.[3] propose that plastic surgery should follow this simulation initiative with modifications appropriate to the specialty. Phase 1, Skills, is attended to during the residents' general surgery training, but Phase 2, Procedures, focuses on the development of procedures specific to plastic surgery. For Phase 3, Competencies in teamwork, the competencies for plastic surgery resemble those for general surgery and include team-training simulators to improve communication in emergency departments, clinics, operating rooms, and hospital wards. [3]

Neumeister [5] mentions that many plastic surgery programmes find it problematic to balance clinical, hands-on education and training with their didactic programme. Work and duty hour restrictions add another layer of complexity to surgical education. Furthermore, the rate-limiting step in learning is not the transmission of information from the teacher to the learner, but rather the processing of the information by the learner.[5] Educational technology offers unique tools to help learners acquire and process the information needed to become masters in their surgical specialty.[5] Simulation in medical education and its relation to simulation technology have to be explored.

Many theories exist that explain how adults learn; for example, instrumental learning theories, humanistic theories, transformative learning theory, social theories of learning, as well as motivational and reflective models.[6] To understand the concept of learning effectiveness and learning at different cognitive levels or domains of competence, it is necessary to examine learning theories and for our purpose make these applicable to the discipline of plastic surgery.

According to Kolb's learning cycle, [6] learners must have a concrete experience on which they can reflect. Through their reflection, students are able to formulate abstract concepts, and make appropriate generalisations, after which they solidify their understanding by testing the implications of their knowledge in new situations. This then provides them with an objective experience, and the cycle continues. Learners with different learning preferences will have strengths in different quadrants of Kolb's cycle. [6]

To build knowledge and understanding, learners need to have 'some idea of where things fit, how they fit together, and some idea of how the individual pieces are part of a greater whole, otherwise learners will experience a sense of discomfort when they do not understand the context of an unknown learning situation'.[6] This can be achieved through a process called *instructional scaffolding* during which sufficient support is provided to promote learning when concepts and skills are introduced to students. This support may include resources, tasks, templates and guides, and/or guidance on the development of cognitive, social and practical skills. These *scaffolds* are gradually removed as students develop autonomous learning strategies to promote their own cognitive, affective, and psychomotor skills and knowledge. Most commonly, scaffolding includes providing learners with a list of intended learning outcomes when they enter the programme or a new clinical environment.[6] Learning outcomes should be formulated with Bloom's taxonomy in mind, designating the levels of cognition, namely knowledge, understanding, application, analysis, synthesis and evaluation.[7,8] Anderson's adapted version of this taxonomy uses verbs to describe the six levels of cognition, namely remember (level 1), understand, apply, analyse, evaluate and create (level 6).[8]

Bloom's original work led to several variants of scale to indicate competence. In medical education, the most frequently encountered is Miller's pyramid,[9] building up from knowledge of (knows how) to competence in performance, and independent action (shows how). This pyramid can be used as a guide for planning and assessing student learning, especially the mastery of skills, in a curriculum. [9]

Alinier[10] elucidates the relationship between Miller's pyramid for developing skills and competence, and the type of simulator most appropriate for each level, as well as the degree of simulator fidelity and the nature of skills that can be developed with each type of simulator. [10] Labuschagne [11] draws a comparison between Bloom's taxonomy and Miller's pyramid, and proposes the use of simulation for developing and demonstrating higher-order levels of thinking, which approximate the levels of thinking required in clinical practice. With the development of simulator technology providing greater degrees of fidelity, simulators readily can be employed as precision instruments in the measurement of performance in the clinical setting. Cregan and Watterson [12] claim that simulation makes it possible to assess the development from the 'knows how' to the 'shows how' category in Miller's framework. Simulators, therefore, are valid instruments for assessment, on condition that the simulator type has sufficient fidelity to elicit the expected competencies and performance level and students should have had previous exposure to the simulators during training (the first encounter with a simulator should not be during assessment). [10,11]

Methods

The study did not focus on a quantitative approach to learner outcomes or/and the assessment of the outcomes, neither did it include an educational intervention in which simulation was used. The focus was on giving feedback about the opinions and perspectives of medical and health care professionals regarding whether and how simulation as education and training method can be included in training programmes for plastic surgeons.

The study comprised two separate investigations, namely (i) a Delphi survey, which consisted of experts indicating the importance or not of a number of outcomes that may be addressed by simulation as one of the methods of training. They also had the opportunity to explore the use of simulation in attaining the outcomes by making suggestions on the applicable simulation modality, as well as the cognitive level of learning of each outcome. The second data collection method was (ii) semi-structured interviews with national and international role players in simulation and postgraduate education to investigate their ideas and opinions on simulation as teaching and learning method.

Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences (HSREC), UFS (ECUFS 122/2015).

The methods used in this research included a literature study, a Delphi survey and semi-structured interviews. The learning outcomes were developed (adapted) from literature,[4] and categorised in training levels used as point of departure in compiling the Delphi questionnaire. [4]

The Delphi survey

Data collection

The survey questionnaire sent to the Delphi panel consisted of three parts. Part 1 (the Delphi questions regarding the importance of simulation as a method) comprised items in two main categories, namely medical knowledge and patient care, with 18 sections in total, divided into five education and training levels totalling 453 learning outcomes. The panellists had to indicate the importance of simulation as an education and training method for each of the outcomes by indicating whether simulation was an essential method, a useful method, or not applicable/important in training a plastic surgeon as far as that specific outcome was concerned.

In Part 2 of the questionnaire (regarding simulation modalities) for the Delphi process, the members of the panel were asked to give their opinion on each learning outcome and indicate, if they wished to do so, which type of simulation modality (low-tech simulation or high-tech simulation), would be best suited for achieving that learning outcome. In Part 3 of the questionnaire (regarding the cognitive levels) the panellists had to indicate which level of learning should be addressed by simulation to achieve the specific outcome. After two Delphi rounds sufficient consensus (92,05%) was achieved and the process came to an end. On the remaining statements (7,95%) stability was reached after panellists indicated at the end of the second round that they would not be changing their answers in a third round. The results of Parts 1, 2 and 3 of the Delphi survey are reported here.

Target population

A letter of invitation to participate in the Delphi survey was sent to experts in the field of Plastic Surgery, selected according to a set of criteria. Nine experts in plastic surgery and clinical simulation agreed to participate in the Delphi .process . These experts were all qualified plastic surgeons; they were knowledgeable about medical education and served as policy makers, leaders and managers in postgraduate education. They are of high national and international academic and scientific standing.

Data analysis

The analysis of the data collected in the Delphi process was done by the researcher. Responses were entered into a computer spreadsheet for the calculation of consensus or stability. The results were reported separately, listing the experts' comments on simulation as a method to train plastic surgeons, the uses and applicability of simulation modalities, as well as the levels of cognition that might be addressed by simulation.

Reliability and trustworthiness

Reliability was ensured by making use of pilot studies, determining strict criteria in sample selection, and by using a carefully constructed Delphi questionnaire based on a detailed literature study. Trustworthiness was ensured by subjecting the research protocol to the Evaluation and Ethics Committees of the Faculty of Health Sciences; University of the Free State, South Africa; by conducting an in-depth literature study and by providing a thorough description of the whole research project.

Semi-structured interviews

Data collection

Semi-structured interviews were used to explore role-players' opinions and perceptions on simulation-based education. The purpose was to investigate simulation in postgraduate education and training. The interviews were conducted to obtain an in-depth, comprehensive overview of the contribution that simulation might make in postgraduate plastic surgery education and training. An interview guide, developed by the author on the basis of a literature review was used. Data on questions 5, 6 and 12 of the interview guide are reported on in this article to supplement the results and findings of the Delphi questionnaire.

Questions 5, 6 and 12 were formulated as follows in the interview guide:

- Can simulation be used to enhance student learning at different cognitive levels? (Will the student only use simulation to remember knowledge / or understand / or apply / or analyse / or evaluate / or create new concepts and ideas?)
- Which types of simulation or simulation modalities might lead to effective learning?
- Any recommendation(s) you would like to make when considering including simulation in specialist training?

Questions 1-4, 7-11 and 13 are not included here because their data are not directly applicable to the objectives of this article. The findings reported on questions 3, 4 and 7 were dealt with in an article, *Simulation in plastic surgery: features and uses that lead to effective learning* (Author CPG).[13]

Target population

Role players in simulation and postgraduate education were requested to participate in the semi-structured interviews. The eight participants were directors of simulation units, clinical heads of clinical medical departments, programme directors of medical and nursing programmes and education management specialists, researchers and representatives from the simulation industry. Written consent was obtained from the participants.

Data collection and analysis

Individual interviews based on a single interview guide were conducted with eight participants by the author (CPG). All interviews were audio-recorded, transcribed by the author (CPG) and checked by an independent person who was not part of the study. Field notes taken during the interviews contributed to the data. The data were analysed using the grounded theory approach that requires continued comparison of data, following the data analysis steps of coding, categorisation and theory generation.[14] Theory building occurred by finding patterns in the data and this continued until saturation of data was reached.[15]

Reliability and trustworthiness

Reliability was ensured by making use of explorative studies, determining strict criteria for sampling, using the carefully constructed interview guide, as well as an interview process that was audio-taped and carefully described.

Trustworthiness of the interviewing process was ensured by involving voluntary interviewees with a clear understanding of what the interviewer expected from them, and using open-ended questions, as well as the transcription of and verifying the accuracy of data. Scientific record keeping ensured dependability.

Results

Data collected through Parts 1–3 of the Delphi questionnaire survey and by means of Questions 5, 6 and 12 of the semi-structured interviews are reported. Data on simulation modalities and cognitive levels are summarised and qualitative perspectives are shared on whether simulation can be used to enhance student learning at different cognitive levels, as well as on the types of simulation modalities that may lead to effective learning. Recommendations that were made by the interviewees are discussed with a view to the possibility of the inclusion of simulation in specialist training.

Questionnaire for Delphi panel (Parts 1–3)

After completing Round 2 of the Delphi process, consensus was reached on 208 of the 453 learning outcomes (descriptors in the form of statements), indicating that simulation as a method of training for plastic surgeons was important (45,92%). Consensus was reached on 209 statements (46,14%), indicating that simulation was not applicable/not important as a method of training. Consensus could not be reached on 36 statements (7,95%), but stability was reached.

The results of the eighteen sections of the Delphi questionnaire were summarised. Each section dealt with the learning outcomes categorised on five education and training levels indicated from L1-5. The first statements related to medical knowledge, while the statements in the second part (in italics) related to patient care.

The Delphi experts indicated where simulation **might play a role of importance and be of value as one of the training methods in the specialist training of plastic surgeons**. The Delphi panel indicated which type of simulation modality, namely low-tech and/or high-tech could be applied, as well as the cognitive level that would be addressed by the simulation. The different descriptive phrases/verbs that were used to formulate these specific learning outcomes at the five education and training levels, as well as the proposed simulation modality and cognitive levels at which learning might take place are described. This is done to serve as an example and to provide an overview of the data that had been gathered during the Delphi process.

The **SECTION ON SURGICAL CARE**, for example, which consisted of the main categories, namely medical knowledge and patient care, resulted in 14 learning outcomes (covering five training levels) being indicated by the Delphi panel as outcomes for which simulation might be used as a training method.

Statements on medical knowledge are in ordinary print and statements on patient care are printed in italics.

The descriptive verbs (action verbs) used in the learning outcomes at **Training Level 1**, for example, were **demonstrates, examines, and performs. The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to reach the following outcomes:**

Demonstrates an understanding of the principles utilised to ensure surgical safety (e.g. consent, patient positioning, aseptic techniques, skin preparation, universal precautions and the use of appropriate instruments);
Examines surgical patients while using algorithms like ATLS (advanced trauma life support) and ACLS (advanced cardiac life support); and
Performs basic techniques in the management of a surgical patient independently (e.g. urethral catheterisation and nasogastric [NG] tube placement).

It was indicated that low-tech simulation modalities could be used to attain these outcomes, which were indicated as outcomes at the lower cognitive levels, namely **remembering, understanding and applying.**

The descriptive verbs used in the learning outcomes at **Training Level 2**, were **conducts, performs and recognises**. **The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to reach the following outcomes:**

Conducts (with assistance) surgical consultations;
Performs routine procedures independently (e.g., central line placement, biopsies, incision and drainage, chest tube placement, laceration repair and wound closure); and
Recognises patterns and prioritises management offering at least one solution.

It was indicated that low-tech simulation modalities and standardised patients might be used to **conduct** consultations, **recognise** patterns and **prioritise** management-offering solutions; while for **performing** routine procedures low-tech and high-tech modalities might be used and were indicated as outcomes at the cognitive levels of **remembering, understanding, applying and analysing.**

The descriptive verbs in the learning outcomes at **Training Level 3** were **manages, manages independently** and **identifies. The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to attain the following outcomes:**

Manages (under supervision) a surgical patient afflicted by multi-systemic disorders;
Independently manages multiple surgical consultations and patients; and
Identifies exceptions and offers at least three possible solutions.

It was indicated that low- and high-tech simulation modalities could be used to manage a surgical patient at the lower cognitive levels of **remembering** and **understanding.** To independently manage multiple surgical consultations and patients could be used at the level of **remembering, understanding and applying,** while to identify exceptions and offer solutions low- and high-tech simulation modalities were suggested at cognitive levels 1–3.

The descriptive verbs used in the learning outcomes at **Training Level 4,** for example, were **demonstrates, anticipates and manages. The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to reach the following outcomes:**

Demonstrates an understanding of the management of complicated multi-systemic surgical pathophysiological processes, ranging from intensive care to organ system support;
Anticipates potential problems and devises management plans of novel solutions; and
Manages a surgical firm.

It was indicated that low- and high-tech simulation modalities could be used to attain these outcomes, which were at cognitive levels 1–3, but to anticipate potential problems would require the higher cognitive level of **analysing** as well.

The descriptive verbs used in the learning outcomes at **Training Level 5,** for example, were **develops, implements and teaches**. **The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to reach the following outcomes:**

Develops or implements simulation for the teaching and evaluation of surgical skills; and
Teaches and supervises other learners involved in patient management.

Low-tech and high-tech simulation modalities were indicated for use at all six levels from remembering and knowledge up to the highest cognitive level of creating and evaluation.

It is important to understand by changing the action verb in an outcome or to formulate a simulation scenario at a higher difficulty level the learning that can take place will be at a higher cognitive level and will influence the effectiveness of learning.

The discussion on Section 1, namely surgical care, serves as an example. The other sections are wound care, tissue transfer, congenital anomalies, head and neck, maxillofacial trauma, facial aesthetics, non-cancer breast surgery, breast reconstruction, reconstruction of trunk and perineum, upper extremity trauma, non-trauma hand, cosmetic trunk and lower extremity, and lower extremity, lower extremity, system-based practice, practice-based learning and improvement, professionalism and interpersonal- and communication skills. Simulation was indicated as a possible method for training plastic surgeons at each training level, using low- and/or high-tech simulation modalities and simulated patients at different cognitive levels with the learning outcomes formulated for the first years of training at a lower level, while training in the later years would be at a higher cognitive level.

Only 20 learning outcomes were indicated to be trained by simulation in the sections on system-based practice (including patient safety, resource allocation and practice); six of the twenty were in the domain of patient safety. The section on practice-based learning and improvement, including investigate, evaluate, and assimilate, entailed five learning outcomes, while research and training had four learning outcomes.

In the section on professionalism (ethics and values, and personal accountability) the Delphi experts indicated only three learning outcomes that possibly might be reached by simulation, and these were in the domain of personal accountability.

In the final section, namely interpersonal and communication skills, only two learning outcomes were indicated that might be reached by simulation. Although a low applicability of simulation in the domain of the softer skills was indicated by the Delphi panel, it must be emphasised that they were of the opinion that it should be done at the higher cognitive levels, mostly cognitive level six, evaluate and create.

Semi-structured interviews

Table 1 shows the different interviewees' perspectives on the types of simulation modalities that might lead to effective learning.

Table 1: The types of simulation or simulation modalities that may lead to effective learning

1. Low-tech simulation modalities *(e.g. organ models; basic plastic manikins & simple skills trainers; animal models; human cadavers; simulated or standardised patients)*
<u>Using simulated patients (SPs) and/or standardised patients may result in effective learning</u>: • 'SPs play an important role in a controlled and safe environment' (D1) • 'SPs play an important role in teaching the resident communication skills – they can teach the student how to talk to a patient in a professional way' (D1) • 'SPs teach according a standardised manner (will make use of a script) and make an impact/impression with their feedback to a student' – e.g. 'You did not look me in the eye/ or did not even greet me' (D1) • 'SP's feedback is very important' –'It is a strong, powerful thing' (D1) • 'Standardised patients play an important role when used in assessment' (C1) <u>Task trainers play an important role in achieving effective learning</u>: • 'Heart of simulators' (I1) • 'How do you move from task training skill development' – 'you need to figure out what you want to train' (I1) • 'Task trainers' focus is on skills training, e.g. psychomotor skills for where you control procedure' (D1) • 'We used wet models for basic training' (D1)
2. High-tech simulation models *(e.g. screen-based simulators; realistic, high-fidelity procedural simulators (task trainers); realistic high-tech interactive patient simulators; (virtual reality) (cf. Delphi questionnaire)*
<u>High-tech simulation plays an important role in achieving effective learning</u>: • 'Important role not to be underestimated/underrated (laparoscopic skills)' (D1) <u>High fidelity simulation plays an important role in achieving effective learning</u>: • 'Used for resuscitation training, intensive care training' (D1) • 'High fidelity more focused on integrated type of scenarios' (D1) • 'You must get the feeling working the simulator in, for example, your clinical field – it must be high-fidelity' (C1) • 'Task trainers to learn hand skills – but high fidelity and high performance simulators have their place in high performance and critical incidents' [C1] <u>Other simulation principles that play an important role in attaining effective learning</u>: • 'All types of simulators have a role to play' (C1) • 'You don't need the most expensive – it may do more harm' (I1) • 'Outcomes in curriculum must be aligned with what you want to teach, e.g. psychomotor/communication/clinical skills, etc.' (D1)

• 'Include high fidelity simulation from year one of training' (D1) • 'Use high fidelity simulations to assess registrar's skills' (C2) • 'At conferences we practised on virtual reality simulation for cataract and retinal surgery' (D1) • 'Use bench models to practise psychomotor skills where necessary until they feel competent' (D1) • 'Practise soft skills, e.g. interpersonal communication and interprofessional collaboration, etc. with simulation' (D1) • 'Used to train registrars on flat screen to have hand skills – registrars practise skills but consultants make decisions' (C1)
3. Using low-tech and high-tech simulators
<u>The influence of low- and high-tech simulation modalities</u>: • 'We use both Low Fidelity (LF) and High Fidelity (HF) simulators. Students master the individual task components using the task-trainers (LF)' (D2) • 'To train and experience the holistic scenario with all its consequences we use the HF to put emphasis on integration, group work and the multidisciplinary approach' (D2) • 'Using both, but a higher fidelity simulator can take you to a higher level' (S1)

Where Table 1 focused on the types of simulation or simulation modalities that lead to effective learning, Table 2 shows the effect of simulation on the enhancement of learning at different cognitive levels.

Table 2: The enhancement of student learning through simulation at different cognitive levels

1. Simulation at different cognitive levels may enhance student learning *(A: Remembering / B: Understanding / C: Development and applying / D: Analysing / E: Evaluating / F: Creating)*
<u>Identify the level of competence or expertise</u> • 'It is important to first identify the competence or expertise, (in context) that is needed from the qualified professionals' (I1) • 'Then training the registrars it is necessary to master competence and maintaining it on the specific level of competence/expertise in the specific discipline' (I1) • 'Look at cognitive levels but also understand that human development is on emotional experience - having cognitive, motor, social and other skills to take into account' (I1) • 'The field of specialists should include well defined objectives and competencies – you have to assess the levels for competence' (C2) • 'The difference between competence and proficiency should be described clearly' (C2) • 'Research is needed to cover ethics and legal aspects as far as competence is concerned' (C) <u>Simulation gives the opportunity to learn at different cognitive levels</u> • 'The registrars can practice skills until they feel competent' (D)] • 'When the registrars are exposed to a specific situation/scenario they get the opportunity to go back and revisit what went wrong and how they can improve by doing so – thus they learn on different cognitive levels' (D1) • 'Registrars are exposed to critically ill patients, for example in surgery and intensive care disciplines'(D1) • 'It is important that they are trained in a safe environment – especially junior registrars who are not yet experienced' (D1) • 'It is also important that registrars be on the same level of competency (e.g. with resuscitation) – so simulation training on different cognitive levels takes place including they have to analyse the situation, interpret facts and act on what they see' (D1) • 'It is possible that simulation can also be done on various cognitive levels using task trainers for specific procedures' (D1) • 'Simulation can enhance student learning at different cognitive levels: remembering of knowledge (during preparation; understanding and applying using low fidelity simulators); analysing and evaluation (using high fidelity simulators) and developing and formulating new concepts and ideas' (D2)

• 'During simulation students can go from pure knowledge information to practical knowledge fast' (C2) • 'Through using interprofessional teams in multipurpose, complex scenarios, with real world experiences, can take you through all the cognitive levels of learning' (S1) • 'Ensures team-based competence' (S1) • 'Better outcomes for patients' (S1) • 'Using SP's for the development of team-based communication skills and professionalism' (S2) • 'Patient management and clinical decision making and skills development in postgraduate medical education: the importance increases because the seniority of the person going through the system increases – so it takes more and more responsibility in leading teams and decision-making – simulation on higher cognitive levels very important' (S1)

Recommendations (which were made by the interviewees when considering including simulation in specialist training) focus on curriculum and training initiatives, various aspects that must be in place, suggesting specific planning and supporting efforts with a view to ensuring the quality of training.

Table 3: Recommendations to consider when including simulation in specialist training

1. Training
<u>Development of training course</u> • 'It is recommended to develop and implement a 'train the trainer' course' (C3, D1, I1) • 'It is recommended to use a totally integrated education and training system: theoretical lectures, simulation sessions and clinical work on real patients – try to find a balance' (D1)
2. Curriculum
<u>Alignment of curriculum</u> • 'It is recommended that the role of feedback; deliberate practice; the contribution of SPs; integration of simulation into the programme; aligned curriculum outcomes; simulation learning outcomes; and assessment; as well as protected training time, etc. to be highly valued' (D1) • 'It is recommended to sit down and plan in detail: what are you going to take out of curriculum and/or with what are you going to replace it '(D1) • 'It is recommended to reach a point that you plan in detail to have an integrated, structured, compulsory and intrinsically motivated simulation included, specialized programme' (C1) • 'The person who has to develop the curriculum, should be knowledgeable about curriculum development; debriefing must be planned; suitable space; objective idea; way to transfer it effectively; outcomes necessary; support structures and safety must be planned; ventilation and light; bathrooms; medical equipment; staff, etc.' (C3) • 'Needs to be a coordinated process' [S1]
3. Assessment
<u>End evaluation</u> • 'It is recommended to try and find a system where you can use simulation in practical examinations (before end evaluation) to ensure that the registrar is 'safe' and 'quick' to operate/apply certain skills' (C1, D1)
4. Quality
<u>Workplace assessment and feedback</u> • 'Remember: the good trainees are always harder on themselves and bad trainees think they don't have problems – so self-evaluation is notoriously weak for weak candidates and notoriously over harsh on good candidates – they never think they are good enough' (S1) • 'Doing on a regular basis and feedback into your planning' (S1)

Perspectives on the use of simulation modalities and how simulation might enhance learning at different cognitive levels were addressed by semi-structured interview questions 5 and 6.

The data gathered by means of the semi-structured interview Questions 5, 6 and 12 were triangulated with the data gathered through Parts 1-3 of the questionnaire survey, and by means of the literature review with a view to identify aspects for compiling a framework to serve as a directive when considering the inclusion of simulation as one of the methods to train a plastic surgeon.

Discussion

A description of the learning outcomes, levels of training, and possible simulation modalities, cognitive levels and descriptive verbs and phrases as these pertain to learning, was given. Simulation in medical education, and its relation to simulation technology, were discussed. Recommendations for considering the inclusion of simulation in specialist training were offered.

It is clear from the feedback of the Delphi survey panel that respondents were positive that almost 46% of the proposed learning outcomes might be reached by including simulation as one of the instructional methods in the postgraduate education and training programme for plastic surgeons. The respondents were of the opinion that simulation might be implemented at all training levels, 1-5, during the training years – albeit less in the earlier years of training. In the earlier years of training students should concentrate more on remembering and understanding knowledge, followed by the mastering and application of skills, with analysing (analysis), evaluating (evaluation) and creating (synthesis) in later years of training.

The Delphi respondents further expressed the opinion that simulation might be important as a method for training students in medical knowledge, skills, competencies and patient care; however, they did not favour simulation as the better training method in the 'softer skills', for example, team training, patient safety, interpersonal and communication skills, professionalism, ethics, values and personal accountability, although literature suggests the opposite. The Delphi respondents, however, emphasised the importance of these skills being trained at higher cognitive levels to reach maximum competencies and proficiency in professional conduct.

As far as the type of simulators used is concerned the participants agreed that the simulation type should be in line with the objectives of the scenarios: Scenarios set at higher cognitive levels would enhance learning using high-tech simulators and simulated patients.

Simulation provides opportunities to learn at different levels. It is important to identify the competence or expertise that is needed at each training level as well as for the qualified professional.

When considering including simulation in specialist training the authors recommend the following:

1. Aligning the curriculum with the simulation plan according to a scientific and coordinated process and guidelines.
2. Developing a training course for the trainers before implementing simulation in the plastic surgery programme.
3. Researching the role of simulation in assessment carefully before implementation.
4. Assessing/evaluating the workplace environment on a continuous basis and carefully considering the feedback received from role players.

From the results of this study, and supported by literature cited [2-5, 12] we developed a clear reasoning process to build an argument favouring the implementation of simulation in postgraduate plastic surgery education and training programmes. It is clear that certain processes must be in place and steps should be taken to ensure that adequate learning will occur, and that simulation outcomes are integrated with the objectives and outcomes of the curriculum within an environment that is conducive to learning.

It is evident from the research that simulation in plastic surgery education and training programmes will enhance effective learning. Further research is needed on simulation to enhance plastic surgery education and training.[16]

Conclusion

Aspects worthy of further investigation with a view to developing a framework that can be applied to serve as a directive for including simulation in plastic surgery are the following: features and uses of simulation, types of simulation modalities, learning at different cognitive levels and the factors enhancing the effectiveness of learning; the role and value of simulation, the contribution that simulation can make, and the quality of training; main considerations and challenges to take into account for implementation, as well as recommendations to compile guidelines for implementation. A framework based on the proposed aspects will definitely make a contribution to postgraduate plastic surgery education and training.

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CHAPTER 6

ARTICLE 5:

SIMULATION IN PLASTIC SURGERY: ROLE, VALUE AND CONTRIBUTION OF SIMULATION IN EDUCATION AND TRAINING – A DIRECTIVE FOR IMPLEMENTATION

The article was prepared according to the journal submission guidelines for the *South African Medical Journal (SAMJ)* (cf. Appendix AA).

Proof of submission (cf. Appendix AB)

Simulation in Plastic Surgery: Role, value and contribution of simulation in education and training – a directive for implementation

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Abstract:

Background. In this research, an in-depth study was done on the role and value of simulation in postgraduate plastic surgery education and training. The question that was asked is whether it was worthwhile examining the use of simulation in a postgraduate plastic surgery training environment in order to determine if it might be useful in addressing the lack of opportunities for clinical exposure and practice. If simulation has a contribution to make; a role to play and be of specific value that it can add to postgraduate plastic surgery education and training, which points of departure and aspects must be considered to compile a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes?
Objective. The objective of the research was to identify and describe (a) the contribution that simulation can make, including the role, as well as (b) the main considerations for implementation of simulation in a training programme.
Methods. Data were collected by means of semi-structured interviews conducted with national and international role players in simulation.
Results. A description of the role that simulation can play, the value that simulation can add and the contribution that simulation can make, are given. The main considerations to take into account for the identification of aspects that might be considered in order to compile a framework structure that can be applied to proposed guidelines and recommendations for teaching through simulation as part of training programmes are described.
Conclusion. The contribution that simulation can make in the training of plastic surgeons according to suggested guidelines and recommendations can add value to specialist training. The outcome of the research, it is foreseen, will serve as a directive for postgraduate plastic surgery education and training on how simulation might be used to enhance learning, and how simulation might be used to improve students' knowledge, clinical competence, skills and professional conduct.

Keywords: Role, value and contribution of simulation, postgraduate plastic surgery education and training, directives for implementation.

Introduction

Clinical simulation plays an important and valuable role in the development of clinical skills and professional attributes, and in creating a safe, non-threatening training environment. Simulation can play an important role in building a safer health care system and may have the potential to address a number of challenges facing postgraduate plastic surgery education. The ability to perform clinical procedures is a key skill and requires a combination of various skills and competencies – some of which may be obtained by introducing simulation into registrars' training. Over the past number of years, the evidence of simulation as an integral part of medical education has placed increased emphasis on simulation technology to improve education and training opportunities. [1-4]

Scalese (2009: 65) points to the trend to utilise simulation for teaching, learning and assessment. [5] Simulation-based education plays a significant role in minimising risk to patients and enhancing medical training. [6] The question that is asked, is: Can the use of simulation be valuable in addressing the problem of a lack of opportunity for clinical exposure and practise?

The American College of Surgeons (ACS) has decided to introduce simulation in teaching and education for general surgery. [7,8] Mittal *et al*. (2012) have proposed that plastic surgery should follow the simulation initiative with modifications appropriate to the speciality of plastic surgery. [7,8] Arbogast and Rosen (2012: 235 – 252) proposed in their article, *Simulation in Plastic Surgery Training: Past, Present and Future,* that these modifications may address the challenges specified to the field of plastic surgery. [9] They are of the view that a unified commitment by medical educators to use simulation '…to simultaneously standardize the training curriculum, individualize the method of acquiring information, and objectively evaluate the training process' is necessary. [9]

Arbogast and Rosen (2012: 241 - 244) have listed 20 skills required of postgraduate residents in general surgery and plastic surgery respectively that can be simulated in year one and two, as well as procedures required of residents in plastic surgery in years three, four and five that can be simulated. [9] In this research project, the researcher (CPG) identified a number of learning outcomes on, for example, medical knowledge and patient care, distributed over five training levels, where simulation may have a role and be of value as an important method to be included in the training programme of plastic surgeons. [10]

'Simulation needs not to be restricted to residency: simulation has a role to play in medical education from undergraduate level to senior physician's maintenance of certification. The incorporation of innovative technology into today's curriculum will be an essential step in not only preparing for the future, but shaping it as well'. [9] This research article will, hopefully, facilitate the identification of aspects with the view to establishing a framework structure that can serve as a directive, in future, to propose a system of guidelines and recommendations to be used for the implementation of simulation in plastic surgery education and training programmes.

Methods

The research was designed as a descriptive study that includes a literature overview, a Delphi process and semi-structured interviews. The results and findings of five questions put to the interviewees during the interviews are described in this article.

Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences, UFS (ECUFS 122/2015).

Semi-structured interviews

Semi-structured interviews were used to explore key national and international role players' opinions and perceptions on simulation-based medical education. The purpose was to investigate and to establish clarification on simulation in postgraduate education and training. The interviews were conducted to obtain an in-depth, comprehensive overview of the contribution that simulation might make to postgraduate plastic surgery education and training. An interview guide developed by the author on the basis of a literature review was used. Occasionally, additional questions arose during the semi-structured interview process; the data thus collected were included in the research. Data on Questions 8, 9, 10, 11 and 13 of the interview guide are reported in this article. The questions are selected from the interview guide and presented in Table 1.

Table 1. Questions for semi-structured interviews with role players

Does simulation have (a) a contribution to make to, (b) a role to play in, or (c) a specific value to add to postgraduate education?
What would your main consideration be if you decided to include simulation in your teaching and training programme?
If you have to guide a team of experts tasked to develop a curriculum with simulation as one of the training/learning methods, which important guidelines will you put on paper?
Do you wish to make any recommendations that may be used in compiling guidelines on simulation for postgraduate plastic surgery?
Will you please share (a) some of the lessons learned regarding the implementation of simulation in a curriculum, (b) as well as the biggest challenge in implementing simulation in training?

Target population

National and international role players in simulation and postgraduate education were requested to participate in the semi-structured interviews. The participants were directors of simulation units, clinical heads of clinical medical departments, programme directors of medical and nursing programmes, and education management specialists, researchers and representatives from the simulation industry. Written consent was obtained from the participants.

Data collection and analysis

Individual interviews (based on a single interview guide) were conducted by the author (CPG) with eight participants. All interviews were audio-recorded, transcribed by the author (CPG) and checked by an independent person who was not part of the study. Field notes taken during the interviews contributed to the data. The data were analysed using the grounded theory approach that requires continuous comparison of data, following the data analysis steps of coding, categorisation and theory generation. [11] Theory building occurred by finding patterns in the data and this continued until saturation of data was reached. [12]

Reliability and trustworthiness

Reliability was ensured by making use of explorative studies, determining strict criteria for sampling, using the carefully constructed interview guide, as well as an interview process that was audio-taped and carefully described. Trustworthiness of the interviewing process was ensured by involving voluntary interviewees with a clear understanding of what the interviewer expected from them, and using open-ended questions, as well as the transcription and verifying of the accuracy of data. Scientific record-keeping ensured dependability.

Results

The contribution, role and value as well as the main considerations for implementation of simulation in a teaching/training programme are given. It is followed by suggestions from the interviewees on a number of key issues in the form of proposed guidelines to direct a team of experts developing a curriculum with simulation as one of the teaching/learning methods. They also make recommendations that may be used to compile these guidelines. The lessons learned and challenges to implement simulation as part of a training programme are offered.

The contribution of simulation in postgraduate plastic surgery education and training

It is clear from the opinions of the interviewees that simulation makes an important contribution to patient safety. Registrars/specialists in training can practise their skills in a non-threatening, pre-selected and controlled, safe environment that prepares them beforehand and provides them with the opportunity to learn gradually, in their own time and according to their own pace. Once they are competent, the acquired knowledge, skills, clinical competencies and professional conduct and behaviour can be transferred to real clinical settings and patients. This minimises the risk to patients and ensures a proficient and competent registrar, while delivering an excellent outcome. Simulation training also exposes registrars to higher levels of critical thinking and complexity; interdisciplinarity; and high-fidelity simulation during large group simulations - triggering effective learning.

In addition, simulation simultaneously offers an alternative training method. While a clinical facilitator or head of department is training registrars on a flat screen simulator to master certain skills, the consultants are responsible for making the decisions; thus, in such a situation, two different groups are trained at the same time at different cognitive levels to become competent or proficient - reaching difficult objectives. Through *training the trainer* you can add value to simulation as a training method as well as to clinical education. The contribution that simulation can make incorporates the role that simulation plays and the value that simulation adds.

The role and value of simulation

The findings on the role that simulation can play and the value that simulation can make to postgraduate education are tabulated in Tables 2 and 3.

Table 2 sets out the opinions expressed by interviewees on the role that simulation may play in postgraduate education. Responses of the interviewees were organised into themes (in Table 2), followed by the themes together with quotes based on their verbatim responses.

Table 2. The role of simulation in postgraduate education

Simulation provides a non-threatening environment for teaching and learning
Simulation facilitates student learning
Simulation enhances the effectiveness of learning
Simulation plays a role in clinical training and has an increased application
Simulation gives the opportunity for deliberate practise
Simulation gives the opportunity to practise safely on patients
Simulation offers a solution to problems experienced in postgraduate education and training

Simulation provides a non-threatening environment for teaching and learning

Interviewees expressed the opinion that simulation provides controlled and safe practise opportunities by giving registrars time to hone their skills and competencies in safe, no-risk circumstances. Registrars also have the opportunity to practise in an environment where they feel safe and relaxed:

Quote 1: 'Simulation leads to less stress where registrar has the opportunity to practice in a safe environment'

Quote 2: 'What happens here, stays in the simulation lab.'

Simulation facilitates student learning

Simulation facilitates student learning, knowledge, clinical competence, skills and professional behaviour:

Quote 1: 'Simulation is a very good learning situation and provides the opportunity to learn in another way'.

Simulation enhances the effectiveness of learning

Simulation can enhance learning effectiveness at different cognitive levels. Feedback during or after simulation influences the effectiveness of learning:

Quote 1: 'Simulation enhances learning – registrar can identify own problems and rectify where and when necessary '

Quote 2: 'Simulation provides the opportunity for registrars to learn gradually and progress to higher competency and/or cognitive levels.'

Simulation plays a role in clinical training and has an increased application

Simulation has an important role in clinical training and plays a definite role in holistic and integrated health care training. Simulation provides the registrar in a specific discipline the opportunity to practise specific (certain) skills individually or it can provide the opportunity that training can take place in a multi-professional health care group, where learning various types of skills through complex scenarios takes place. A decreasing number of training platforms that become smaller in certain disciplines, shrinking financial resources, as well as a demand for more health care professionals require that additional options for clinical training and assessment be investigated: these constrain the education time that registrars in training receive - but at the same time, however, simulation gives registrars the opportunity to experience clinical cases that they would perhaps not see in certain disciplines:

Quote 1: 'By making use of simulated patients during simulation you can teach and train a wide range of material for example history taking, transfer of bad news, and/or medio-legal issues'

Quote 2: 'To practice certain procedures beforehand through simulation makes it easier for registrars when they do it for the first time on real patients'

Quote 3: 'Simulation gives registrars the opportunity to experience clinical cases that they perhaps won't see in their discipline'.

Simulation gives the opportunity for deliberate practise

Simulation gives the opportunity for deliberate practise, which together with repetitive practise plays an important role to master skills:

Quote 1: 'Helps to keep abreast of skills and topics'

Quote 2: 'Proficient: competent: excellent outcome'.

Simulation gives the opportunity to practise safely on patients

Simulation gives the opportunity to practise safely on patients:

Quote 1: 'Learning on simulated patients minimises the risk on real patients'

Quote 2: 'Simulation enhances medical training'.

Simulation offers a solution to problems experienced in postgraduate education and training

Simulation addresses the problem of a lack of opportunity for clinical exposure and practise as more exposure leads to fewer medical errors:

Quote 1: 'Assess students with the view to identify what have been missed or lack of opportunity'

Quote 2: 'Simulation training according to a specific schedule is a way to protect registrars' training time'

Quote 3: 'Simulation is useful to teach registrars patient communication skills'

Quote 4: 'Simulation definitely meets a need'.

Table 3 sets out the opinions expressed by interviewees on the value that simulation may add to postgraduate education. Responses of the interviewees were organised into themes (listed in Table 3), followed by the themes together with quotes based on their verbatim responses.

Table 3. The value of simulation in postgraduate education

Simulation is an alternative to a real patient strategy
Simulation is a solid educational and social grounding strategy
Simulation improves clinical grounding: care and increased patient safety
Simulation allows individualisation of education and training

Simulation is an alternative to a real patient strategy

Simulation offers an alternative training option and learning strategy in a more relaxed and less stressful environment:

Quote 1: 'Very specific strategy that can be used to learn'

Quote 2: 'Simulation must be seen as an education and training aid and not the end goal: simulation is not the purpose but a way or method to do or learn something'

Quote 3: 'Valuable additional alternative to bedside teaching'.

Simulation is a solid educational and social grounding strategy

Simulation is a solid educational and social grounding strategy that provides a safe environment where registrars can learn from their errors without the risk of harming a patient:

Quote 1: 'The privileges of simulation is that simulation provides you a safe psychological environment for training / learning'

Quote 2: 'Simulation provides a training environment where registrars' individual needs, strengths and deficiencies can be attended to'

Quote 3: 'Simulation provides an opportunity for both formative assessment (debriefing, feedback) as well as summative assessment

Quote 4: 'Competency-based training environment'.

Simulation improves clinical grounding: care and increased patient safety

Simulation improves clinical grounding such as patient care and patient safety. Simulation is a valuable method to train a variation of skills in a controlled clinical environment:

> Quote 1: 'Through surgical simulation skills can be transferred to the operating theatre, decreasing operation time, complications and costs'

Quote 2: 'Evaluation of skills through simulation can give feedback on competency level of registrar by using rubrics for procedures and may predict whether the candidate is ready to sit for final exam'

Quote 3: 'Simulation can be used to evaluate whether a registrar is "safe" to operate on a patient and under pressure before the final examination'

Quote 4: 'Offers registrars to advance along a learning curve'.

Simulation allows individualisation of education and training

Simulation allows individualisation of education and training; for example, through the standardisation of the curriculum, accommodating the learning styles of registrars as well as the opportunity for deliberate practise:

Quote 1: 'Feedback during simulation helps registrar to identify problems and he/she can deliberately practice certain skills as needed'

Quote 2: 'Constructive feedback and debriefing during simulation add value to the learning process'.

It is clear that simulation has a role to play and can add value to postgraduate education and training.

<u>The main considerations for implementation of simulation in a teaching/training programme</u>

The interviewees in this research project expressed their views on four aspects that should be taken into account when considering the inclusion of simulation in a postgraduate teaching and training programme, namely: revisiting the curriculum outcomes of the current postgraduate programme with integration on simulation; decisions to be taken on what to simulate; reviewing of available simulation facilities and equipment; as well as the role and value of assessment.

The first consideration to deal with is to revisit the curriculum outcomes in the current postgraduate training programme. Two points were emphasised, namely that simulation has to be integrated into and be part of the outcomes of the curriculum and that decisions should be reached as to where simulation is going to fit into the programme. The interviewees suggested:

Quote 1: 'Try to identify the outcomes that the registrars find difficult to reach, for example specific skills'

Quote 2: 'Develop a basic surgeon across all plastic surgery disciplines'.

These recommendations entail that curriculum developers need to go back to the drawing board and rethink, not only the purpose and outcomes of their education and training programme, but also the knowledge, skills, clinical competencies and professional conduct qualities they want a plastic surgeon to have in order to practice safely and to be proficient / competent / excellent.

The second consideration is to identify and decide what to simulate. The following four points were emphasised: To identify the plastic surgeons' role in practice is important. Plan and structure clinical scenarios well, develop complete scenarios with clear outcomes. Although you might have a good programme, the environment may change: improve, reform and make adaptions to facilitate effective learning within the aims of education and training for the specific profession. The interviewees suggested:

Quote 1: 'You need to know what your starting point is – it's looking what is actually called zone of simulation – designer simulation'

Quote 2; 'You can't have to simulate everything – what is designer simulation – things are in a high risk and low frequency – that is where your critical area to simulate is'

Quote 3: 'Try to identify the scarce clinical conditions that is difficult to see – things you really want the registrars to see and be able to treat – the life-threatening conditions/cases that you really do not see regularly'

Quote 4: 'Identify discipline unique things to simulate'

Quote 5: 'Identify problem areas that can be simulated'

Quote 6: 'Push simulation to develop all competencies for basic general plastic surgeons in SA'.

From these perspectives, it is clear that decisions on what to simulate in a specific training programme and what meets the needs of that profession are of utmost importance.

The third consideration that was mentioned is to review available simulation facilities and equipment, not only in your institution or nationally, but also to get a world perspective in order to identify what type of simulation facilities are available and decide whether and how your facilities can fit in with other facilities. The interviewees suggested:

Quote 1: 'Identify what is already available in your training platform – simulation not better than real patient'

Quote 2: 'Don't invent the wheel again'.

It is important to plan in detail how you can use available simulators, as high fidelity simulation is adaptable to a large extent.

The fourth consideration to take into account is the opportunities offered by such a new simulation initiative implemented in the programme that can be of value as far as assessment is concerned. Two points were emphasized, namely that feedback during and after assessment should lead to effective learning experiences; and that simulation can be used to be part of different forms of examinations and certification. The interviewees suggested the following:

Quote 1: 'Assess the registrar on a continuing basis on preparation, knowledge, skills, oral expertise, professional behaviour, making a correct diagnosis, executing procedures, and not harming patients.'

Quote 2: 'Maintenance of a specific field'.

The role and value of simulation in assessment should be investigated in depth to the benefit of the registrar and profession.

Guiding a team of experts in developing a curriculum with simulation as one of the training/learning methods

The interviewees were asked to propose guidelines to direct a team of experts developing a curriculum with simulation as one of the teaching/learning methods. They responded on three key issues, as follows and in their own words:

Training curricula and outcomes

Identifying the holistic bigger picture

- You should form a mind set or framework as far as simulation is concerned and how it will fit in into the holistic bigger training picture/process
- You should decide what the expectation are at the end of specialisation as far as knowledge, skills, competencies, attitudes, etc. are and decide what the role will be of simulation – what are the characteristics that need to be in place – decide then how simulation will fit in
- You should identify the current curricula available that has the same content as yours.

Alignment of outcomes

- You should revisit and develop curriculum outcomes as well as learning outcomes for simulation scenarios that fit your requirements and needs
- You should align teaching, learning and assessment.

Content and place

- You should make simulation a compulsory part of the curriculum
- You should decide beforehand where simulation fits into the curriculum.

Scheduled time and overload of the curriculum

- You should schedule simulation and debriefing sessions into your teaching and training programme as well as the character/nature of the simulation sessions
- You should protect the training time for your registrars including time for simulation
- You should decide how you are going to get people to progress through the training years.
- You should take care not to overload the curriculum.

Expertise and staff

- You should identify content experts and develop new and innovative materials for simulation to overcome a resource constraint environment

- You should use all the expertise available
- You should develop and offer a course to *train the trainers*
- You should identify champions per department who can drive simulation in a department.

Market analysis and research

- You should do market analysis to identify applicable research, best practices and available simulator modalities
- You should use research to test new concepts and identify clinical needs.

It seems that the development of curricula and the alignment of outcomes are important, as well as building staff expertise – these actions should be based on sound scientific research.

Recommendations that may be used in compiling guidelines on simulation for plastic surgery

The interviewees were asked whether they wish to make recommendations for compiling guidelines on simulation for plastic surgery and responded as follows:

- It is recommended not to attach the wrong value or weight on simulation in your curriculum – see it as a method for training, not the main aim of clinical education and training
- It is recommended, if it is decided to include simulation in the programme, to make it a compulsory component of the curriculum and it should be integrated into the curriculum as a required component and that it must promote aspects that are difficult to train on real patients
- It is recommended that there should be synergy on alignment between theory, practice and assessment
- It is recommended that training is standardised and individualised
- It is recommended that you decide beforehand which learning objectives are you going to eliminate from the curriculum and will be replaced/reserved for simulation
- It is recommended to take note that registrars/specialists in training, do not understand the process from fast training in simulation moving to integrated practice (skills transference) in a clinical environment
- It is recommended to take note that staff are not necessarily trained for teaching by means of simulation
- It is recommended to keep guidelines clearly formulated.

The suggested guidelines and recommendations will be of value and noteworthy when decisions need to be reached as far as introducing and implementing simulation into a training programme.

Lessons learned regarding implementation of simulation into a curriculum

The interviewees shared the perspective that it is necessary that people realise that simulation does not replace real patients. It is important to replan and rethink curriculum and learning outcomes and to schedule enough time for compulsory simulation sessions. You have to identify beforehand what you want to simulate. Remember that observation and feedback improve the effectiveness of learning.

Challenges in implementing simulation as part of a training programme

The interviewees identified a number of challenges, namely:

Time challenges and student numbers

- Not enough dedicated schedule time for teaching and training registrars (service delivery, underutilisation of simulation)
- Time constraints, student numbers account for pressure and lower quality – reformulate objectives and compile smaller groups.

Cost-effectiveness challenges

- To keep the programme cost-effective is one of the biggest challenges
- Financial strains and the availability / non-availability to cover expenditure.

Staff resource challenges

- To get staff to work in a team in integrated scenarios as staff members have different personalities
- Staff resources and the willingness to run a simulation lab
- Staff have to be trained – time and cost of the challenge

- To overcome the *pushback action* of older lecturers as far as simulation is concerned
- To get staff to buy in and to identify and appoint an academic leader (driver).

Curriculum challenges
- Identify what you want to simulate
- Simulation that is not integrated into the curriculum
- To do group scenarios including different but similar clinical disciplines as well as other health care professionals
- To get continuity in simulation as part of the curriculum.

Student challenges
- The biggest challenge is to ensure that students are not afraid of real patients.

Space for training challenges
- The challenge is to provide a relaxed atmosphere, practice on a continuous basis, and practice skills until competency is obtained
- First get the space and then buy the equipment
- Plan storage space in advance
- Start with simulators and buy equipment over time.

It is important to take note of the lessons learned and the challenges faced by simulation when it is introduced or implemented in a postgraduate training programme.

Discussion

Factors influencing simulation and the impact of simulation on postgraduate plastic surgery education and training need attention (Figure 1).

Influence of simulation on student learning

Simulation influences student learning in postgraduate education and training as it is a very specific and holistic learning and education strategy that is built on adult learning principles and ensures meaningful learning. The importance of preparation before simulation begins ensures the theoretical grounding necessary to facilitate learning. The simulation of rare clinical cases or life-threatening scenarios will be motivational, while the inclusion of health professionals from different disciplines will foster collaboration. Repetition to learn skills before practising on patients, and ensuring the attainment or maintenance of a certain level of competence will have a direct influence on learning. [13]

Simulation enhances the effectiveness of learning in postgraduate education and training (including aspects such as cognitive levels of learning, simulation types, application of features and uses of simulation)

The non-threatening environment that simulation provides enhances the effectiveness of learning; causes less stress to registrars; and holds various advantages for clinical teaching - such as patient safety, shorter operation time, fewer complications and lower costs. Through deliberate and repetitive practising, constructive feedback and debriefing, realism of clinical scenarios and quality assessment procedures, the effectiveness of learning can be ensured. Applying the unique features and uses of simulation in education and training - such as the provision of a controlled, non-threatening environment, integration of simulation into the curriculum, sound clinical teaching and learning practices as well as constructive feedback - will enhance the effectiveness of learning. Simulation can enhance learning at different cognitive levels by changing the learning outcomes and clinical scenarios. [10]

Identifying and describing learning outcomes

Identifying and describing learning outcomes for postgraduate education and training for which simulation might be an important training method, as well as the application of simulation modalities linked to specific cognitive levels are important factors that influence simulation and impact on simulation during implementation. [10]

Contribution that simulation can make; considerations to take into account; lessons learned; challenges posed by simulation; guidelines and recommendations

Other factors influencing the implementation of simulation in a programme are, for example, the contribution - including role and value - that simulation can make and add to training; considerations to take into account when compiling guidelines; taking note of lessons learned and challenges as far as simulation is concerned and as described in this article.

In order to compile guidelines for implementation of simulation into a programme, the factors/forces influencing simulation and the implementation of simulation on postgraduate education and training should be taken into account.

The final outcome of the research project will be to develop a framework structure that can be used to propose guidelines for teaching through simulation as part of the training of plastic surgeons. These inclusive and comprehensive guidelines will be reported and discussed in a forthcoming article based on the challenges, recommendations and suggestions in this article.

Guidelines can be defined as 'rules or instructions that are given by an official organization telling you how to do something, especially something difficult'. [14] A recommendation differs from the closely related word 'advice' in that 'recommend' is often used with positive advise to tell someone about potential benefits and 'advice' with more negative connotations to warn a person about potential dangers. [14] In clinical practice guidelines are considered to be 'statements that include recommendations intended to optimize patient care'. [15]
A principle can be defined as a 'moral rule of strong belief that influences your actions'. [14] For Shekelle *et al.* (1999) three principles are fundamental to the development of valid and useable guidelines namely:

i. *The development of guidelines requires sufficient resources, experts, finances and research skills;*
ii. *A systematic review of the evidence is essential to every guideline; and*
iii. *A multidisciplinary group should translate the evidence into a guideline.* [16]

The abovementioned three principles should be applied during the drawing up of guidelines for implementation of simulation in plastic surgery in future research.

Conclusion

It was worthwhile examining the use of simulation in a postgraduate plastic surgery training environment in order to determine if it might be useful in addressing the lack of opportunities for clinical exposure and practise. Simulation has a specific role and can definitely add value to postgraduate training. Aspects were identified to compile a framework structure that can serve as a point of departure and can be applied to propose guidelines and recommendations for training through simulation as part of the training programme in plastic surgery. These factors will act as forces in education and training that will influence and drive the implementation of simulation in a postgraduate programme and will serve as a directive in successful implementation.

The contribution that simulation can make in the training of plastic surgeons according to suggested guidelines and recommendations so far can add value to specialist training. The outcome of the research will serve as a 'roadmap' for postgraduate plastic surgery education and training on how simulation might be used to enhance learning, and how simulation might be used to improve students' knowledge, clinical competence, skills and professional conduct.

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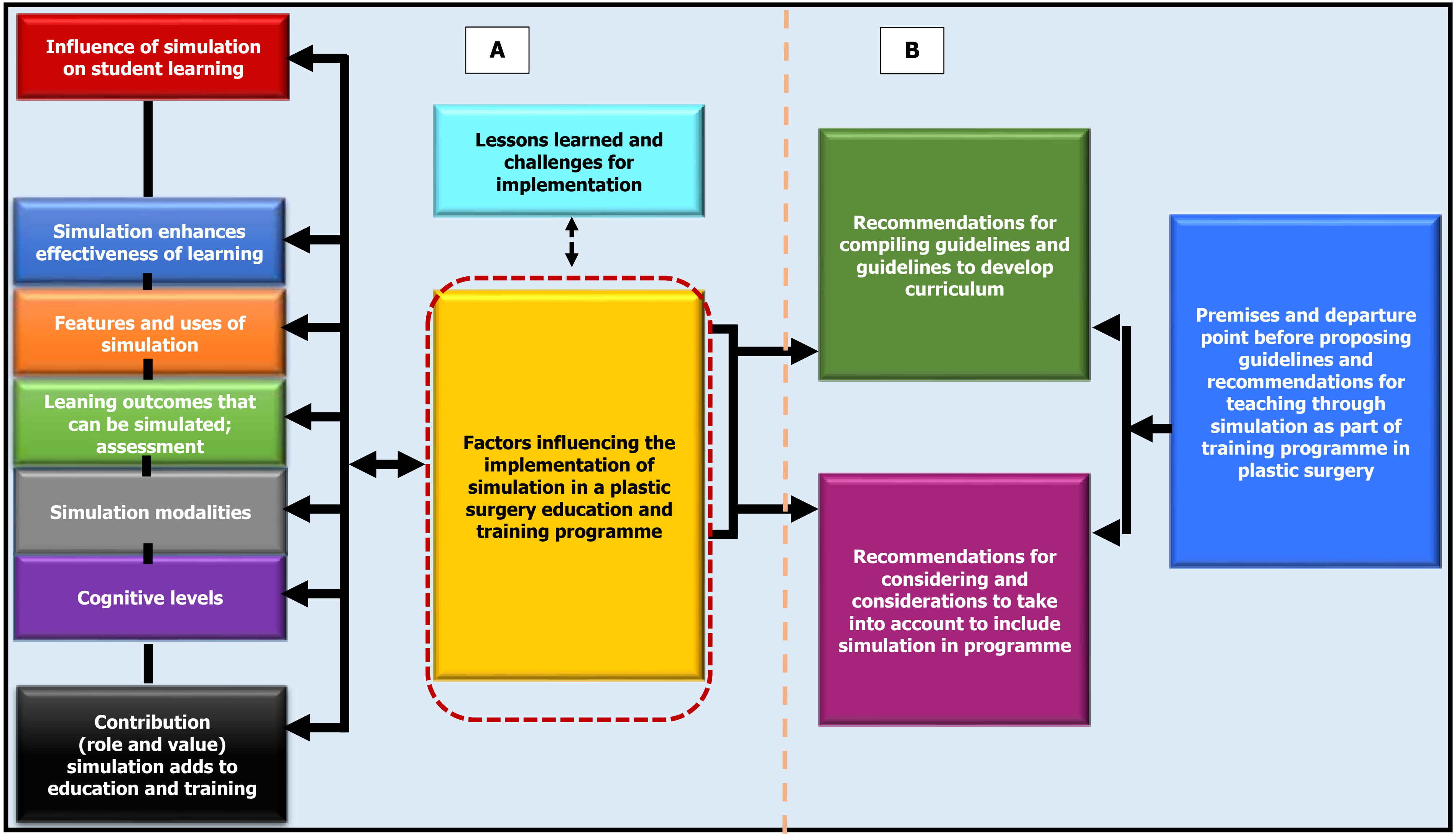

FIG. 1: (A) FACTORS THAT WILL INFLUENCE AND DRIVE THE IMPLEMENTATION OF SIMULATION IN A POSTGRADUATE PROGRAMME AND SERVE AS A DIRECTIVE FOR SUCCESSFUL IMPLEMENTATION; AND (B) ACTIONS BEFORE PROPOSING GUIDELINES

CHAPTER 7

SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING

7.1 INTRODUCTION

The study is based on the recognition and the acknowledgement that a potential gap may exist in the field of study. The cohesion and synergy between medical education, plastic surgery education and training and clinical simulation have not yet received sufficient directional guidance to unlock the potential impact that simulation may have on the outcome of education and training in health care and plastic surgery per se.

The study was undertaken to develop insight and form an understanding of whether there is a need or demand for simulation in postgraduate plastic surgery education and training programmes. The study might serve as a directive for higher education medical institutions due to the fact that not all postgraduate specialist programmes and curricula for the training of plastic surgeons include clinical simulation in their training.

The aim of the study therefore was to do an in-depth study on simulation in postgraduate plastic surgery education and training. It was necessary to conceptualise and contextualise simulation with a view to understanding what forms the backbone of the theoretical grounding for simulation in plastic surgery education and training. The influence of simulation on student learning, the features and uses of simulation that enhance learning, the learning outcomes that may be simulated (including cognitive levels and simulation modalities), as well as the contribution that simulation may make to plastic surgery education and training were identified and discussed. The results and findings were used for developing of a framework structure that may be applied as guidelines for the use of simulation in postgraduate plastic surgery education and training.

The methods used for this research included a literature study, the Delphi technique, and semi-structured interviews.

Chapter 1 dealt with the background to the study and the research problem and research questions. The overall goal, aim and objectives were stated, and the research design and methods that were employed were explained. The scope and demarcated field of study were given, as well as the significance and value of the study. As this thesis is written in the publication format, Chapters 2–6 offer manuscripts/articles that were submitted to scientific journals (or published in proceedings).

In this chapter, Chapter 7, Simulation in postgraduate plastic surgery education and training, objectives five and six of the study will be addressed (cf. 1.4.3). The research findings were integrated to contribute to achieving the aim of the study and were used for the creation of a framework structure to be applied to propose guidelines with recommendations for the implementation of simulation in postgraduate plastic surgery education and training. For simulation to be introduced as a teaching method and a learning opportunity for residents with a view to impacting on plastic surgery education and training, it should include (i) a clear set of recommendations on how simulation can enhance the effectiveness of learning; (ii) a description of the contribution, including the role and value of simulation, based on a scientific research process; (iii) the development of an argument to enhance plastic surgery training by including simulation in education and training programmes; and (iv) the development of a framework structure that can be applied to propose guidelines for teaching through simulation as part of training programmes for evidence-based plastic surgery education and practice.

The theoretical grounding underpinning simulation in plastic surgery education and training is summarised as a diagrammatic overview of the elements that form the theoretical support for simulation (cf. 7.2). The factors that influence and drive the implementation of simulation in a postgraduate programme and that can serve as a directive for successful implementation are touched on (cf. 7.3). A discussion on the development of the framework structure with a view to suggesting guidelines is given (cf. 7.4). This was done based on literature cited and conclusions drawn from the findings of the research, as well as from the discussions in the articles and the formal education and training and the expertise and experience of the researcher as a plastic surgeon and academic.

7.2 THEORETICAL GROUNDING UNDERPINNING SIMULATION IN PLASTIC SURGERY EDUCATION AND TRAINING

The theoretical grounding underpinning simulation in plastic surgery education and training is summarised and illustrated in Figure 7.1.

FIGURE 7.1: A DIAGRAMMATIC OVERVIEW OF THE ELEMENTS THAT FORM THE THEORETICAL GROUNDING FOR SIMULATION IN PLASTIC SURGERY EDUCATION AND TRAINING (COMPILED BY THE RESEARCHER, NEL 2018)

The variation of elements that form the theoretical grounding that underpins and serves as the backbone for the study can be grouped into the following main and overarching categories, namely Medical Education, Clinical Simulation and Plastic Surgery Education and Training.

The elements or vertebrae in these categories are not standing on their own and are not fixed or stagnant; they are supple, flexible and interrelated with one another. They interact with elements from the other categories to play a similar, but stabilising role such as the human spine with vertebrae, ribs, sternum and the rest of the skeleton.

Attention was given in the text of Chapters 1–7 to these elements (shown in Fig. 7.1), their role, function and impact as described by various authors and highlighted by the researcher. In the following paragraphs, the researcher will only endeavour to direct the readers and to refresh their memory on background information. This will be done to focus on what objectives 5 and 6 require us to do, namely to compile a framework structure from which we can suggest a number of guidelines and recommendations to implement simulation as one of the methods that might be useful in the training of a plastic surgeon. It is important to realise once again that simulation is not the alpha and omega of teaching and training - it cannot replace bedside teaching, but it may play an important role. The researcher is of the opinion that to train a plastic surgeon on a real patient in a real-life setting still is invaluable and a privilege. To include simulation in the training of residents, it must be within the approved scope and parameters of the profession according to clear guidelines. The researcher believes that this research is the first step on this path.

The three main categories illustrated in Figure 7.1 are:

i. Medical education, including the changes in the delivery of health care; learning theories, strategies, cognitive levels of learning and adult learning; learning effectiveness at different cognitive levels; postgraduate education and training programme (cf. Chapter 1, page 2–17, Articles 1 & 2).
ii. Clinical simulation, including the driving forces behind medical simulation; benefits of and rationale for medical simulation; features and uses of simulation; the role and value of simulation; strategies, technologies and simulation modalities (cf. Chapter 1, pages 5-9 & Articles 3–5).

iii. Plastic surgery education and training, including models for training in plastic surgery; core competencies, level descriptors, and target for resident performance; learning outcomes (cf. Chapter 1, pages 2–19 & Articles 1–5).

The transfer of knowledge, skills, clinical competence, and professional conduct of the resident in the education and training programme to professional practice as a qualified and independent, competent and excellent specialist forms the final outcome of a training programme.

7.3 FACTORS THAT INFLUENCE AND DRIVE THE IMPLEMENTATION OF SIMULATION IN A POSTGRADUATE PROGRAMME AND SERVE AS A DIRECTIVE FOR IMPLEMENTATION

A number of factors that will act as forces in education and training and that will influence and drive the implementation of simulation in a postgraduate plastic surgery programme were identified from the literature and research findings and will be touched on (cf. Figure 7.2).

7.3.1 The influence of simulation on student learning

Simulation influences student learning in postgraduate education and training and is a specific and holistic learning and education strategy, which is built on adult learning principles. According to Gravett (2005:7), an adult learner is someone who takes responsibility for his/her own life and has other roles than studying full time. In other words, for example, clinical registrars are adult learners who participate in educational activities to obtain a specialist qualification. They are already qualified as professionals and take responsibility for their own learning. The most prominent theories of learning have humanism and constructivism as a foundation (Massyn 2009:125). Humanism emphasises the development of the individual in a learner-centred approach and students learn through interaction and reflection (Massyn 2009:125). "Adult learners should also be directly involved in the learning process; bringing their prior experience to the learning environment and are tasked- and problem-orientated" (Knowles, Holton & Swanson 2005:67). They also engage in transformational learning which have as cornerstones learning experiences, dialogue and critical reflection and that promote effective learning (Merriam & Brockett 2007:144). "Adult learning, self-directed learning and transformational learning focus on developing the potential of the individual; prior experiences, relevant learning of real-life scenarios and reflection" (Merriam & Brockett 2007:145). All these are applicable during debriefing and feedback during simulation. According to the situated cognition approach, educators cannot assume that learning takes place through abstract lectures; neither can it be assumed that learning"will be transferred to different settings; learning needs to be contextualised in complex real-life settings and learners need to understand these settings" (Massyn 2009:136).

Adult learning principles, according to Nel (2007:27), …"form the pillars of adult education and include the following: it should be relevant to the adult learners' life-worlds, and they should know the rationale and benefits for engagement; they need feedback on progress, strengths and weaknesses; they learn best if they feel safe and protected – the facilitator should ensure an environment of cooperation where they feel safe to explore; and assessment should be done on real-life tasks".

Simulation includes self-directed learning (computer-based learning and practice of clinical skills), as well as experiential learning (concrete experiences, reflections during debriefing, formulation of abstract concepts (during debriefing and feedback stages) and testing the implications (active experimentation) (Labuschagne 2012:202–203).

Simulation influences student learning, and if planned strategically correct, it may drive student learning to be more effective. To be effective simulation needs to be an important component in the curriculum – it has to be properly integrated in the curriculum. Simulation can replace other educational strategies, for example, theoretical lectures by bringing simulated case engagement into the normal strategy. Preparation before simulation begins is important because it ensures the theoretical grounding necessary to facilitate learning. The simulation of rare clinical cases or life-threatening scenarios will be motivational while the inclusion of health professionals from different disciplines will foster learning. Repetition to learn skills before practising on patients, and ensuring that a certain level of competence is attained or maintained will have a direct influence on learning and mastering specific skills to become competent and/or proficient (cf. Article 3 in Chapter 4, Nel *et al.* 2019a:1–20; cf. as well as Table 2 in Article 3; cf. Comments of Interviewees, Appendix R – Table 4).

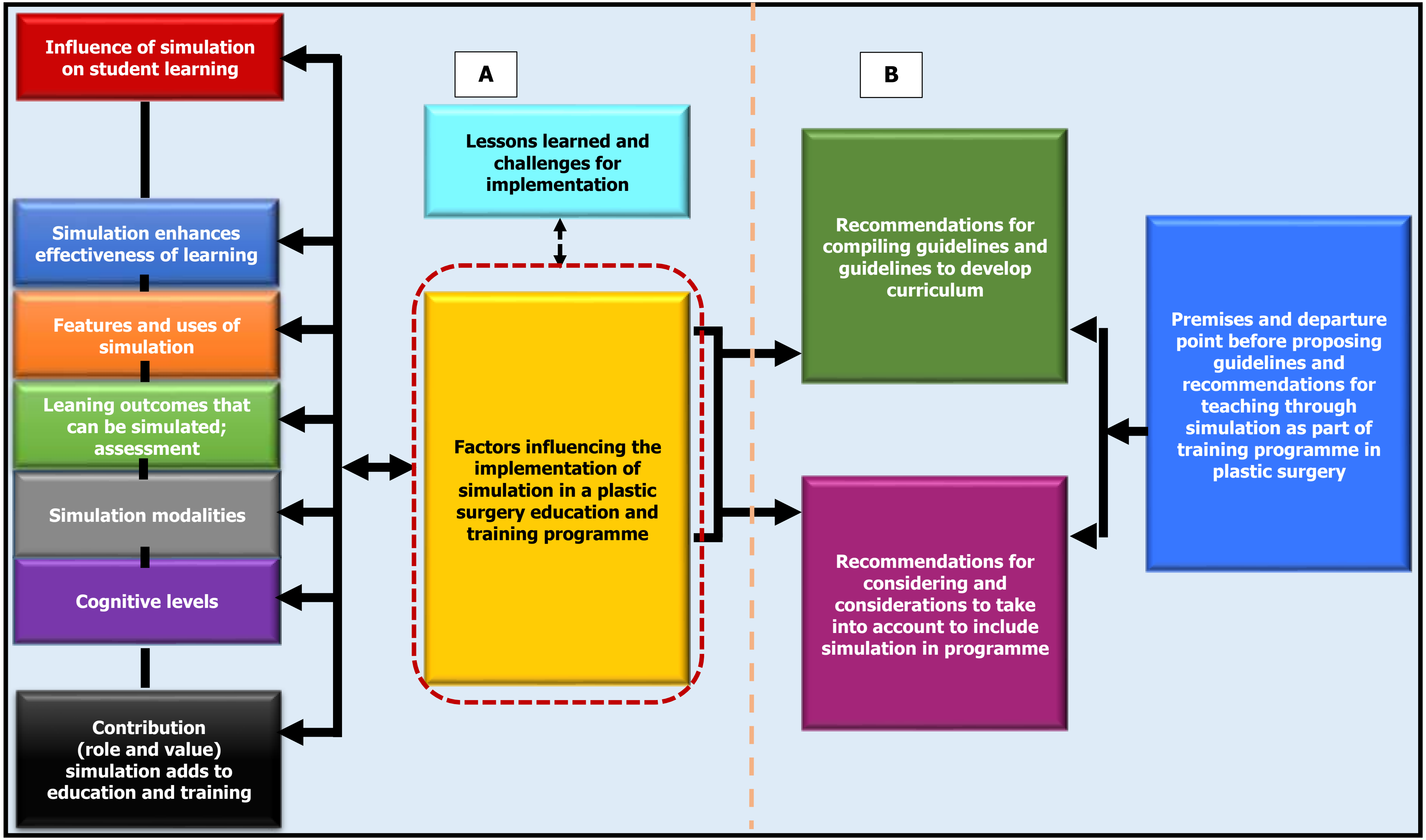

FIGURE 7.2: (A) FACTORS THAT WILL INFLUENCE AND DRIVE THE IMPLEMENTATION OF SIMULATION IN A POSTGRADUATE PROGRAMME AND SERVE AS A DIRECTIVE FOR SUCCESSFUL IMPLEMENTATION; AND (B) ACTIONS BEFORE PROPOSING GUIDELINES
(Compiled by the Researcher, Nel 2018)

7.3.2 Simulation enhances the effectiveness of learning

To understand the concept of learning effectiveness and learning at different cognitive levels or domains of competence, it is necessary to examine learning theories and make it applicable to plastic surgery (cf. Kolb's Learning Cycle, Bloom's Taxonomy & Miller's Pyramid – Chapter 1, 1.2.2; Article 4 in Chapter 5, Nel *et al.* 2019b). The non-threatening environment that simulation provides enhances the effectiveness of learning, causes less stress to registrars, and holds various advantages for clinical teaching, such as patient safety, shorter operation time, fewer complications and lower costs. Through deliberate and repetitive practice, constructive feedback and debriefing, the realism of clinical scenarios and quality assessment procedures the effectiveness of learning can be ensured. For learning to be effective, repetitive practice must take place on a continuous basis for months/years. Simulation can help with the expansion of the training platform and will influence the effectiveness of learning. Assessment enhances learning and plays a role in the evaluation of clinical skills and competencies. The use of simulated and/or standardised patients for clinical examinations will enhance learning and assessment (cf. Article 3 in Chapter 4, Nel *et al*. 2019a: 1–20; as well as Table 3 in Article 3; cf. Comments of Interviewees, Appendix R–Table 3).

7.3.3 Cognitive levels of learning

Learning outcomes should be formulated with Bloom's taxonomy in mind, designating the levels of cognition, namely knowledge, understanding, application, analysis, synthesis and evaluation; or, if preferred, Anderson's adapted version of the taxonomy which uses verbs to describe the six levels of cognition, namely, remember (Level 1), understand, apply, analyse, evaluate and create (Level 6) (cf. Article 4 in Chapter 5, Nel *et al.* 2019b:1–20).

It is important to first identify the level of competence or expertise that is needed from a plastic surgeon (a qualified professional). Secondly, when training the registrar, it is necessary for him/her to master competence and maintain it at the specific level of competence/expertise. Well-defined objectives (outcomes), including competencies, are needed in order to assess the different levels of competence. Simulation provides an opportunity to learn at different cognitive levels, and this may easily be attained by changing the learning outcomes and/or clinical scenarios. It is also essential that registrars be at the same level of competency during simulation training.

Using interprofessional teams in multipurpose, complex scenarios, with real-world experiences, can take the registrar through all the cognitive levels of learning. Simulation at higher cognitive levels is very important – including team-based competence, communication skills and professionalism. Simulation at different cognitive levels is a strong driving force in clinical learning (cf. Article 4 in Chapter 5, Nel *et al.* 2019b; cf. as well as Table 2 in Article 4; cf. Comments of Interviewees, Appendix R – Table 7).

7.3.4 Simulation modalities

For this study simulation modalities were divided into two main families, low-tech and high-tech simulation modalities (cf. Chapter 1, 1.2.1.2), but various other classifications are identified, for example, Chiniara *et al.* (2013:e1380) refer to a simulation modality as the "….description of the simulation experience and includes four modalities (computer-based simulation, simulated patient, simulated clinical immersion, and procedural simulation) in addition to mixed, hybrid simulation". These authors (Chiniara *et al.* 2013:e1380) state that "…. simulation-based education activities rely on experiential learning and must allow participants to affect different degrees, the cause of the educational experience through verbal or physical interaction with the simulated component or patients".

Using simulated patients (SPs) for teaching, or standardised patients during assessment may result in effective learning as they have an important role in a controlled and safe environment, and they also play an important role in the teaching of communication skills. They can make a significant impact on students and influence student learning during feedback sessions. Standardised patients play a key role in assessments.

High-tech simulation plays an important and specific role in effective learning. High-fidelity simulations focus more on integrated types of scenarios and have their place in high performance and critical incidents. To create a holistic experience of simulation, it is necessary to include high-tech and high-fidelity simulators to emphasise integration, group work and the multidisciplinary approach. Training with high-tech simulators ensures effective learning and is a driving force for simulation implementation (cf. Article 4 in Chapter 5, Nel *et al.* 2019b 1–20; cf. as well as Table 1 in Article 4; cf. Comments of Interviewees, Appendix R – Table 6).

7.3.5 Features and uses of simulation

Applying the unique features and uses of simulation in education and training, such as the provision of a controlled, non-threatening environment, integration of simulation into the curriculum, sound clinical teaching and learning practices, as well as constructive feedback will enhance the effectiveness of learning. Technology should be seen as offering endless possibilities to enhance learning for registrars (cf. Article 3 in Chapter 4; Nel *et al*. 2019a 1 – 20; as well as Article 3 – Table 4; cf. Comments of interviewees, Appendix R – Table 5).

Features and uses of simulation, categorised into seventeen themes, and explanations of the applications of simulation in the education and training of registrars are tabled in Appendix R (cf. Table 5). It constitutes 63 suggestions/opinions on how simulation can influence learning and clinical education and training. A substantial number of these were incorporated in the article on features and uses of simulation in Chapter 4 and will demonstrate how these features and uses enhance the effectiveness of learning (cf. 7.5 Guidelines on simulation in a plastic surgery education and training programme to influence the effectiveness of learning).

7.3.6 Set of learning outcomes that can be simulated

Identifying and describing learning outcomes for postgraduate education and training for which simulation might be an important training method, as well as the application of simulation modalities, linked to specific cognitive levels, are important factors that influence simulation and impact on simulation during implementation.

In the Delphi process used for the study, 208 learning outcomes were identified indicating that simulation may be applied as one of the training methods in a plastic surgery postgraduate programme (cf. Article 4 in Chapter 5; cf. Nel *et al.* 2019b: 1–20, as well as Appendix N & Addendum to Appendix M). The identification of learning outcomes for which simulation can be applied/plays a role, will ensure an impact on the implementation process of simulation.

7.3.7 Contribution (role and value) of simulation to education and training

Simulation is not an alternative to bedside teaching, but a valuable way to enhance clinical education. It is a complementary teaching method and makes an important contribution to patient safety. It provides registrars with the opportunity to practise required skills. They can push the limits because they are in a safe environment, with safety aspects in place and when they feel competent with their knowledge, skills, competencies and professional behaviour they can transfer these attributes of training to a real clinical setting and patients. Through training the trainer, as a clinical educator with the specific necessary skills to teach and train, value can be added to simulation as a training method as well as to clinical education. The contribution that simulation can make includes the role and value that simulation adds to education and training.

One of the important roles that simulation plays, is that it provides a non-threatening environment whereby it provides controlled and safe practice opportunities. Simulation facilitates student learning: providing a unique learning situation in whch the registrars can hone their skills and learn in another way.

Simulation enhances the effectiveness of learning at different cognitive levels, for example, while a facilitator is training registrars on a flat screen simulator to master specific skills, the consultants are exposed to making decisions at a higher level, thus, in such a situation two different groups are trained at the same time at different cognitive levels to become competent/proficient, reaching different objectives.

Simulation has an important role in clinical training and offers the opportunity of reasoning at a higher level of complexity, and, for instance, can be applied during interdisciplinary big group simulations using high-fidelity simulators. The opportunity to make use of debriefing after simulation is, in itself, a good learning opportunity.

Simulation plays an important role in deliberate practice and repetitive practice to master skills as well as to keep abreast of clinical challenges. Simulation has the potential to minimise risk to patients and to enhance medical training by using simulated patients and different simulation modalities.

Simulation may be used to address the problem of a lack of opportunity for clinical exposure and practice; the lack of opportunity or not enough exposure can be identified by formative assessment and be addressed. Simulation can be useful to teach registrars patient communication skills.

The value that simulation adds to the education of the registrar is that it provides a valuable complementary alternative learning strategy to bedside teaching. Simulation provides a valuable learning opportunity in a safe environment attending to the individual needs of students.

Simulation improves surgical care, increases patient safety and is a method that offers training in a variety of skills. Registrars can advance along an individual learning curve until they reach the acquired competency level. Simulation allows registrars to identify problem areas and to deliberately practise specific skills until the required level of competence is reached (cf. Article 5 in Chapter 6, Nel *et al*. 2019: 1–7; as well as Article 5 – Tables 2–3; cf. Comments of Interviewees, Appendix R – Tables 8a – 8c).

7.3.8 Lessons learned and challenges for implementation

According to the interviewees, one of the lessons learned is to realise that simulation does not replace real patients. Lessons learned include the importance of re-planning and re-thinking of the curriculum and the learning outcomes; the re-identification of learning content as well as time implications and scheduling of sessions (cf. Article 5 in Chapter 6; cf. Nel *et al.* 2019: 1–17; cf. Comments of Interviewees Appendix R – Table 13A).

A number of *challenges* were identified during the interviews and these include challenges concerning time, student numbers, cost effectiveness, staff resources, curriculum, student attitudes and available space which are matters of concern (cf. Article 5 in Chapter 6; cf. Nel *et al.* 2019: 1–17; cf. Comments of Interviewees Appendix R – Tables 13A –B).

According to Ziv (2009 in Dent & Harden 2009: 221–222) the challenges, as far as the implementation of simulation is concerned, are to overcome resistance to change; to create a safe environment for learning; to carefully plan constructive learning experiences and the recognition of the limitations of simulation-based education; to align the appropriate simulation modality to specific learning outcomes; to develop multi-simulation scenarios with high-fidelity and the integration of simulation into programmes.

7.3.9 Factors influencing the implementation of simulation in a plastic surgery education and training programme

Cognisance must be taken of factors that may influence the implementation of simulation (as specified in 7.3.1–7.3.8) when considering to include simulation as one of the teaching methods in an education and training programme.

During the semi-structured interviews, the interviewees were asked to provide recommendations for compiling guidelines for the development of a curriculum, which includes simulation. They also were asked which considerations they would suggest be taken into account when including simulation into a programme. This will be discussed in the following two sections (cf. Fig. 7.2).

7.3.10 Recommendations for compiling guidelines to develop a curriculum

The interviewees were asked to propose guidelines to direct a team of experts developing a curriculum with simulation as one of the teaching/learning methods. They were asked: "If you have to guide a team of experts tasked to develop a curriculum with simulation as one of the training/learning methods, which important guidelines will you put on paper?" They responded on three key issues, as follow:

Training curricula and outcomes

<u>Identifying the holistic picture</u>

The team of experts/curriculum planners should:

- form a mindset or framework as far as simulation is concerned and how it will fit in into the holistic training picture/process;
- decide what the expectations are at the end of specialisation as far as knowledge, skills, competencies, attitudes, etc. are concerned, and decide what the role of simulation will be – what are the characteristics that need to be in place – then decide how simulation will fit in;
- identify the current curricula available that have the same content as theirs.

Alignment of outcomes

The team of experts/curriculum planners should:

- revisit and develop curriculum outcomes as well as learning outcomes for simulation scenarios that fit their requirements and needs;
- align teaching, learning and assessment.

Content and place

The team of experts/curriculum planners should:

- revisit and develop curriculum outcomes as well as learning outcomes for simulation scenarios that fit their requirements and needs;
- align teaching, learning and assessment.

Scheduled time and overload of the curriculum

The team of experts/curriculum planners should:

- schedule simulation and debriefing sessions into their teaching and training programme, as well as the character/nature of the simulation sessions;
- protect the training time, including time for simulation, for their registrars;
- decide how they are going to get people to progress through the training years;
- take care not to overload the curriculum.

Expertise and staff

The team of experts/curriculum planners should:

- identify content experts and develop new and innovative materials for simulation to overcome a resource constrained environment.
- use all the expertise available.
- develop and offer a course to *train the trainers.*
- identify champions per department who can drive simulation in a department.

Market analysis and research

The team of experts/curriculum planners should:

- do market analysis to identify applicable research, best practices and available simulator modalities.
- use research to test new concepts and identify clinical needs.

It seems that the development of curricula and the alignment of outcomes, as well as building staff expertise are pre-requisites for instituting simulation in a programme. These actions should be based on sound scientific research (cf. Article 5 in Chapter 6; Nel *et al.* 2019: 1–17; Comments of Interviewees, Appendix R - Table 10).

Recommendations that may be used in compiling guidelines on simulation for plastic surgery

The interviewees were asked whether they wished to make recommendations for compiling guidelines on simulation for plastic surgery. "Do you wish to make any recommendations to be used in compiling guidelines for simulation in postgraduate plastic surgery?" They responded as follows:

It was recommended:

- not to attach the wrong value or weight to simulation in the curriculum – it should be seen it as a method of training, not the main aim of clinical education and training;
- that should simulation be included in the programme, it should be a compulsory component of the curriculum and it should be integrated in the curriculum as a required component that must promote aspects that are difficult to train on real patients;
- that there should be synergy in alignment between theory, practice, and assessment;
- that training be standardised and individualised;
- that clarity should be obtained beforehand about which learning objectives would be eliminated from the curriculum and replaced by/reserved for simulation;
- that note should be taken that people do not understand the process from fast training in simulation moving to integrated practice in a clinical environment;

- to take note that staff is not necessarily trained for teaching by means of simulation; and
- to ensure guidelines are clearly formulated.

The suggested guidelines and recommendations will be of value when decisions have to be made concerning the introducing and implementation of simulation in a training programme (cf. Article 5 in Chapter 6; Nel *et al.* 2019: 1–17; Comments of Interviewees, Appendix R - Table 11).

7.3.11 Recommendations and considerations to take into account when including simulation in a programme

The interviewees in the study expressed their views on four aspects that should be taken into account when considering to include simulation in a postgraduate teaching and training programme, namely revisiting the curriculum outcomes of the current postgraduate programme; decisions to be taken on what to simulate; reviewing available simulation facilities, and the role and value of assessment.

The first consideration to deal with is to revisit the curriculum outcomes in the current postgraduate training programme. Simulation has to be integrated into and be part of the outcomes of the curriculum. Decisions should be made about where simulation will fit best in the programme.

These recommendations suggest that curriculum developers should go back to the drawing board and rethink, not only the purpose and outcomes of their education and training programme, but also the knowledge, skills, clinical competencies and professional conduct qualities they want a plastic surgeon to have in order to practise safely and to be proficient / competent / excellent.

The second consideration is to identify and decide what to simulate. To identify the plastic surgeons' role in practice is important. Clinical scenarios must be planned and structured well, and complete scenarios must be developed with clear outcomes. Although a good programme may exist, the environment may change, therefore, it is of utmost importance that the programme should be improved and reformed and adaptions should be made to facilitate effective learning within the aims of education and training for the specific profession. From these perspectives, it is clear that decisions are of utmost importance about what to simulate in a specific training programme and what would meet the needs of that profession.

The third consideration that was mentioned is to review available simulation facilities, not only at the local institution or nationally, but wider too to get a world perspective in order to identify available types of simulation facilities and be able to make informed decisions regarding facilities. It is important to plan in detail how to use available simulators, as high fidelity simulation to a large extent is adaptable.

The fourth consideration to take into account is the opportunities offered by such a new simulation initiative implemented in the programme that may be of value as far as assessment is concerned. Feedback during and after assessment should lead to effective learning experiences. Simulations can form part of different types of examinations, assessments and certification. The role and value of simulation in assessment should be investigated in depth to the benefit of the registrar and profession (cf. Article 5 in Chapter 6; Nel *et al*. 2019: 1–17; Comments of Interviewees, Appendix R - Table 9).

7.3.12 Premises and departure points before proposing guidelines and recommendations for teaching through simulation as part of an education and training programme in plastic surgery

The guidelines proposed and the recommendations that the interviewees made during the semi-structured interviews (listed under 7.3.10–7.3.11), must be read together with the results, findings and perspectives from literature as part of the framework structure and guidelines. Examples of guidelines and recommendations made by the interviewees as stated in 7.3.10–7.3.11 are summarised in Table 7.1. This was done to avoid repetition of formulations of guidelines.

Premises and departure points have to be determined before a framework structure can be compiled and guidelines can be formulated.

7.4 THE DEVELOPMENT OF A FRAMEWORK STRUCTURE WITH A VIEW TO SUGGESTING GUIDELINES

The study aimed to do an in-depth study on simulation in plastic surgery education and training. The results and findings, as well as perspectives from the literature, were used for the development of a framework structure that can be applied to prepare a number of guidelines for teaching through simulation as part of a postgraduate plastic surgery education and training programme.

7.4.1 Premises – The factors underpinning the framework

The rationale and justification for compiling a framework structure, rest on four premises that are not negotiable from the researcher's viewpoint. The first premise entails that the framework structure will be based on valid and scientific research results, obtained from a combination of findings from international and national literature, and feedback from Delphi experts and interviewees with a good standing, who were selected according to specified criteria. These role players (participants in the study) were plastic surgeons, medical specialists, and clinical educators knowledgeable in the field of simulation. Trustworthy data ensured a scientifically sound foundation of intertwining components or a syncytium-like basis from where the framework structure arose.

The second premise was that of relevance – there had to be a need for compiling a framework with guidelines for the implementation of simulation in an education and training programme in plastic surgery. An established need must exist for including simulation to enhance a teaching programme for specialists in plastic surgery with the overarching benefit to health and patient care.

The third premise is based on a flexible approach that should be followed in developing the framework structure. All the aspects and factors influencing simulation should be incorporated. This will allow institutions and programmes to focus on specific areas of need and adapt the structure or select guidelines that are applicable or re-formulate or compile new guidelines that apply to them.

The fourth premise relates to transportability. The absence of a framework and guidelines to implement simulation as part of a plastic surgery programme, highlighted the need that not only in South Africa, but all over the world, the fundamental principles upon which the guidelines and recommendations are based, must be useful and implementable irrespective of the phase in which simulation is employed.

7.4.2 Departure points - the prerequisites and assumptions for implementation of the framework structure

A number of points of departure were identified for compiling and formulating the framework and guidelines.

First, the framework and guidelines should be formulated within the overarching professional and educational policy frameworks – applying discretion to make provision for various and diverse ideologies, beliefs, ethical principles, leadership and managerial initiatives, and other as applicable.

The second point of departure is to keep the framework structure uncomplicated, simple and easy to understand and to use.

The third point of departure is to keep accessibility to simulation facilities and opportunities affordable, and the running of such units cost-effective while at the same time ensuring the enhancement of quality over the full spectrum of education, training, patient care, and more.

The fourth point of departure entails that clinical simulation enhances the postgraduate education and training of specialists and simulation is integrated as a required component of the curriculum, with a clearly defined purpose and final outcome. Simulation has to be implemented in an environment that is safe, and that is conducive to good teaching practices.

7.4.3 Role-players who influence the implementation of simulation

For the framework structure and guidelines to be of value in enhancing plastic surgery education and training by implementing simulation as a teaching method, the role-players involved need to be identified and recognised at different levels and in various functionalities. Such role-players might be representatives from government/state institutions, professional boards/bodies and service delivery agencies; educational institutions, clinical staff and staff from simulation units, professional associations, individual practitioners/specialists, alumni and/or students, industry and the public. Their influence and inputs will be of different importance and will vary from time-to-time.

7.4.4 Different focus areas and aspects addressed in the framework

Figure 7.3 provides a schematic overview of the framework structure and the focus areas and aspects that are addressed.

The following focus areas and aspects are included in the framework structure, namely:

- Foundational aspects focus area
- Management and leadership
- Programme and curriculum development
- Educational factors (teaching and training)
- Factors influencing implementation of simulation
  - Influence of simulation on student learning
  - Simulation enhances effectiveness of learning
  - Features and uses of simulation
  - Learning outcomes to be simulated
  - Simulation modalities
  - Cognitive levels of learning
  - Contribution (role and value) of simulation to education and training
  - Assessment

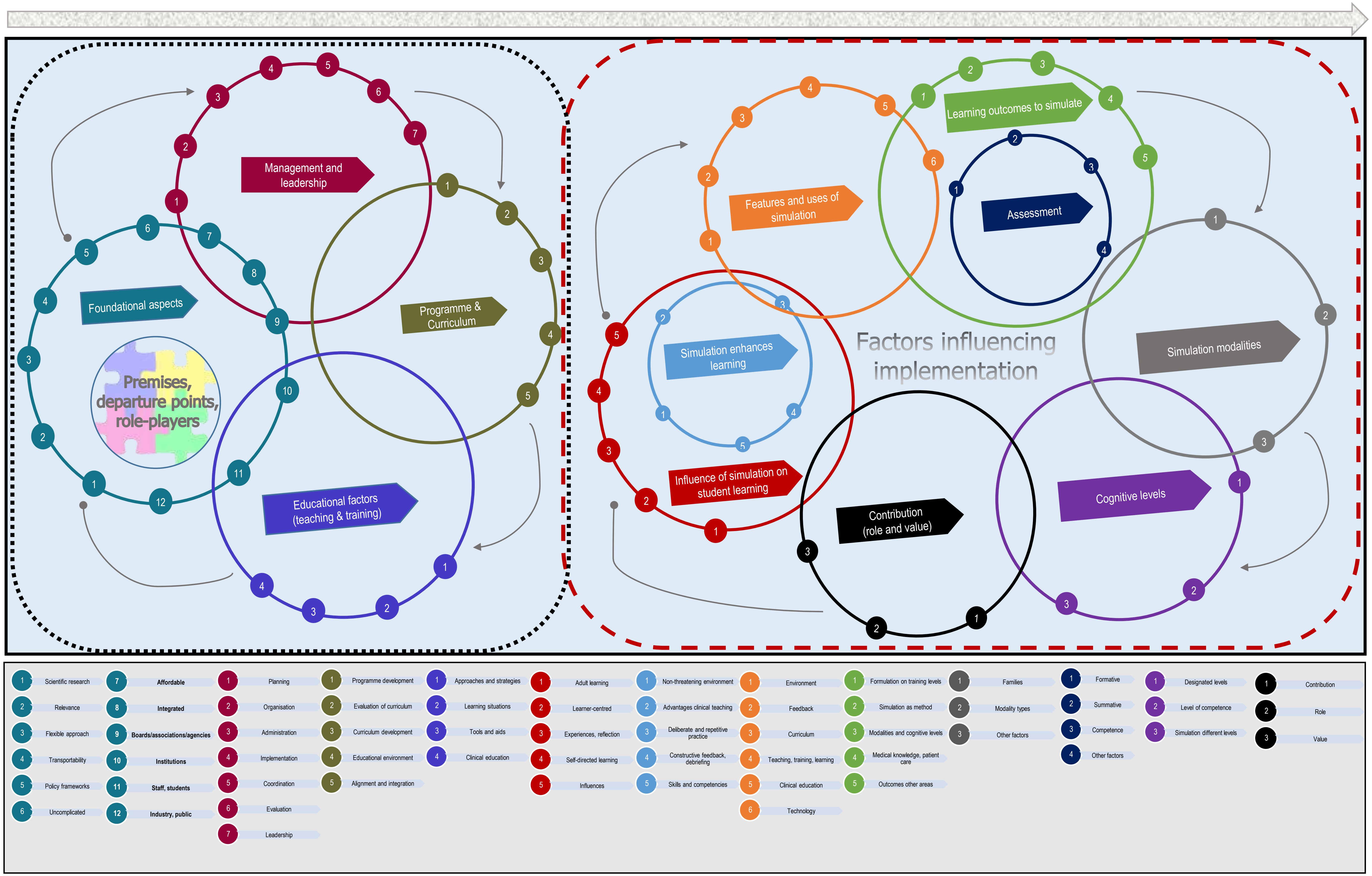

FIGURE 7.3: FOCUS AREAS AND ASPECTS THAT ARE ADDRESSED IN THE FRAMEWORK STRUCTURE
(Compiled by the researcher, Nel 2019)

7.5 GUIDELINES ON SIMULATION IN A PLASTIC SURGERY EDUCATION AND TRAINING PROGRAMME

The overall goal of the study was to enhance postgraduate plastic surgery education and training by means of developing and proposing guidelines for the use of simulation with a view to include medical simulation in training programmes if a need/application, was identified.

A framework structure (cf. Figure 7.3) was developed that can be applied to propose guidelines and recommendations for teaching through simulation as part of the training programme in postgraduate plastic surgery education.

The theory and processes to develop guidelines were explained in Chapter 1, 1.2.3 as well as in Article 5 in Chapter 6.

The framework structure (cf. Figure 7.3) includes focus areas and aspects relevant to proposing the guidelines as formulated in Table 7.3.

It is essential to take into account that the proposed guidelines are not fully inclusive and comprehensive and merely serve as examples drawn from this study. The researcher recommends that further research should be undertaken by role players in the profession and that this study only serves as a directive or seen as a point of departure.

TABLE 7.1: GUIDELINES ON SIMULATION IN A PLASTIC SURGERY EDUCATION AND TRAINING PROGRAMME
(TABLE TO CONTINUE ON THE NEXT PAGES)

A

FOCUS AREA	Foundational aspects
OBJECTIVE(S)	To explain the rationale and justification for developing the framework structure
ASPECT(S)	Premises – factors underpinning the framework
GUIDELINE(S)	
• Framework should be based on valid and scientific results • Should identify a need to compile a framework structure • A flexible approach should be followed in development and application • Principles should be transportable to other training programmes	

RECOMMENDATION(S): It is recommended:	
• That results and findings be reliable, valid and trustworthy • That there should be a framework according to which guidelines can be proposed • That the approach followed be adaptable • That the framework structure be useful and implementable in other programmes	
ACTION(S) / PRINCIPLE(S)/COMMENTS	cf. 7.4.1
Explain research methodology accurately; apply framework in order to propose guidelines; develop flexible structure; use and implement in programmes	

B

FOCUS AREA	Foundational aspects
OBJECTIVE(S)	To identify departure points for implementation of framework structure
ASPECT(S)	Departure points – pre-requisites and assumptions
GUIDELINE(S)	
• Framework structure and guidelines should be formulated within professional and educational policy frameworks • Framework structure should be uncomplicated, simple and easy to understand and use • Accessibility of simulation facilities and opportunities should be affordable • Clinical simulation should enhance education and training of specialists in training	
RECOMMENDATION(S): It is recommended:	
• That knowledge of and information on policy frameworks are available • That framework structure be easy to follow and understand • That implementation of simulation be cost-effective • That simulation be offered according to good educational principles	
ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf.7.4.2
Understand policy frameworks; keep framework structure simple to follow; research financial sustainability; apply good educational principles, etc.	

C

FOCUS AREA	Foundational aspects
OBJECTIVE(S)	To identify role-players who influence implementation of simulation
ASPECT(S)	Role-players influencing implementation of simulation
GUIDELINE(S)	
• Role-players should be identified and recognised on different levels of functionality	
RECOMMENDATION(S): It is recommended:	
• That role-players are representative of different areas and groupings, e.g. boards, associations, agencies; institutions; staff and student sector; industry and public domains	
ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. 7.4.3
Identify role-players and their roles and involvement, etc.	

D

FOCUS AREA	Management and leadership
OBJECTIVE(S)	To recognise managerial and leadership components and initiatives that play a role in simulation
ASPECT(S)	Planning, organisation, administration, implementation, coordination, monitoring, evaluation, leadership
GUIDELINE(S)	
• The inclusion of simulation in a programme should be based on sound and acceptable managerial and leadership principles and practices	
RECOMMENDATION(S): It is recommended:	
• To identify and be knowledgeable about programme management • To keep simulation cost-effective • To get people to buy in and to get an academic driver per department	
ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. Appendix R, Tables 10 & 13
Manage and lead, liaise and coordinate; play role in programme and curriculum development; manage finances; do market analysis, etc.	

E

<table>
<tr><td>FOCUS AREA</td><td colspan="2">Programme and curriculum development</td></tr>
<tr><td>OBJECTIVE(S)</td><td colspan="2">To state the departure points for programme and curriculum development</td></tr>
<tr><td>ASPECT(S)</td><td colspan="2">Programme development, curriculum development, evaluation of curriculum</td></tr>
<tr><td colspan="3">GUIDELINE(S)</td></tr>
<tr><td colspan="3">
A postgraduate programme should have a clearly formulated rationale, justification and purpose explaining the educational and training goals, outcomes and content, including information on the curriculum structure and educational strategies, etc.
Programme and curriculum planners are informed about curriculum models, the aims, objectives, processes such as alignment procedures, content, methods and assessment practices.
Curriculum outcomes as well as learning outcomes for simulation scenarios that fit the requirements and needs should be revisited and developed.
Teaching, learning and assessment should be aligned.
</td></tr>
<tr><td colspan="3">RECOMMENDATION(S): It is recommended:</td></tr>
<tr><td colspan="3">
That clear and transparent educational information (including teaching, learning, training and assessment), formulated in a scientific way, be available in written format.
That the evaluation process of the programme and curriculum be planned simultaneously during the design phase.
That the curriculum be relevant and appropriate at the level and scope of specialist training.
That planning is essential for the development of the clinical training component.
Not to attach the wrong value or weight to simulation in a curriculum – see it as a method for training, not the main aim of clinical education and training.
If it is decided to include simulation in the programme, to make it a compulsory component of the curriculum and it should be integrated into the curriculum as a required component that must promote aspects that are difficult to train on real patients.
</td></tr>
<tr><td colspan="2">ACTION(S)/PRINCIPLE(S)/COMMENT(S)</td><td>cf. 7.3.10, cf. Appendix R (feedback from interviewees)</td></tr>
<tr><td colspan="3">Programme and curriculum development activities as applicable according to a systematic process</td></tr>
</table>

F

<table>
<tr><td>FOCUS AREA</td><td colspan="2">Programme and curriculum development</td></tr>
<tr><td>OBJECTIVE(S)</td><td colspan="2">To recognise importance of alignment</td></tr>
<tr><td>ASPECT(S)</td><td colspan="2">Programme and curriculum development, alignment and integration of simulation</td></tr>
<tr><td colspan="3">GUIDELINE(S)</td></tr>
<tr><td colspan="3">
The education and training environment should be conducive to incorporate simulation as part of clinical training in a specialist programme
During the planning phase of curriculum development emphasis should be placed on the alignment of the content of the curriculum and the assessment as well as needs of students
</td></tr>
<tr><td colspan="3">RECOMMENDATION(S): It is recommended:</td></tr>
<tr><td colspan="3">
That the environment will fulfil the needs of the purpose of the training as well as that the setting will be appropriate for simulation training
That teaching skills, learning material, time tables, students support, the setting of clear learning outcomes as well as clinical experiences will be optimal
</td></tr>
<tr><td colspan="2">ACTION(S)/PRINCIPLE(S)/COMMENT(S)</td><td>cf. 7.3.10 cf. Appendix R</td></tr>
<tr><td colspan="3">The development of opportunities to practise in the simulation unit in a safe environment</td></tr>
</table>

G

<table>
<tr><td>FOCUS AREA</td><td>Educational factors</td></tr>
<tr><td>OBJECTIVE(S)</td><td>To identify and describe educational factors impacting on the learning and training process</td></tr>
<tr><td>ASPECT(S)</td><td>Approaches and strategies, learning strategies, tools and aids</td></tr>
</table>

GUIDELINE(S)	
• Curriculum planners should be knowledgeable on various strategies and approaches but be experts in specific strategies, tools and aids when they plan to include a specific initiative such as to include simulation in a programme as part of the teaching methodology • Simulation and debriefing sessions should be scheduled into the teaching and training programme and the character/nature of the simulation sessions should be elucidated • Training time for registrars should be protected including time for simulation • Decisions must be made to get people to progress through the training years. • Care should be taken not to overload the curriculum • Content experts should be identified to develop new and innovative materials for simulation to overcome a resource constrained environment • All the expertise available should be used • A course to *train the trainers* should be developed and offered • Champions per department should be identified who can drive simulation in a department	
RECOMMENDATION(S): It is recommended:	
• That the clinical teacher should know the features and uses of simulation that may influence the effectiveness of student learning	
ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. 7.3.10 cf. Appendix R
Understand the methodology of simulation teaching and training	

H

FOCUS AREA	Influences of simulation on student learning
OBJECTIVE(S)	To explain influences of simulation on student learning
ASPECT(S)	Adult learning, learner-centred education, experiences and reflections, self-directed learning
GUIDELINE(S)	
• It should be recognised that simulation influences student learning in postgraduate education and training and it is a specific and holistic learning and education strategy which is built on adult learning principles. • It should be recognised that simulation focuses on the development of the individual (skills and competencies of the registrar); and that prior experiences and real-life scenarios with reflection are preferable.	
RECOMMENDATION(S): It is recommended:	
• That registrars as adult learners are directly involved in the learning process (learner-centred approach) • That simulation scenarios be built on experiential learning	
ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. 7.3.1, Appendix R, Table 4
Self-directed learning (including computer-based teaching and practice of clinical skills, etc.	

I

FOCUS AREA	Simulation enhances learning
OBJECTIVE(S)	To identify how simulation enhances learning
ASPECT(S)	Non-threatening environment, clinical teaching, deliberate and repetitive practice, constructive feedback, debriefing, skills and competencies
GUIDELINE(S)	
• To understand learning effectiveness, it is necessary to be knowledgeable on learning theories that form the basis of simulation as a teaching method. • As simulation provides a non-threatening environment, registrars should learn more effectively and experience less stress. • It should be noticed that clinical simulation holds different advantages, for example, patient safety, fewer complications, etc. • Through deliberate and repetitive practices, constructive feedback and debriefing and the real clinical scenarios and quality assessment procedures should be ensured.	

RECOMMENDATION(S): It is recommended:	
• To take note that simulation can help with the expansion of the training platform with more exposure and thus will enhance the effectiveness of learning. • That by using SPs for clinical examinations the effectiveness of learning can be ensured.	
ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. 7.3.2, Appendix R, Table 3
Use of SPs; relevant feedback and debriefing skills to be developed	

J

FOCUS AREA	Features and uses of simulation
OBJECTIVE(S)	To identify features and uses of simulation that can lead to more effective learning
ASPECT(S)	Safe environment, feedback, curriculum, teaching, training and learning, clinical education, technology, etc.
GUIDELINE(S)	
• Educators to be knowledgeable about features and uses of simulation. • Trainers should apply the unique features of simulation to enhance learning during the development of scenarios.	
RECOMMENDATION(S): It is recommended:	
• That simulation be offered in a non-threatening environment to ensure effective learning • That the simulation be integrated in the programme to ensure effective learning • That simulation be applied to influence effectiveness of learning • That feedback be included to influence effectiveness of learning	
ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. 7.3.5, Appendix R, Table 5, cf. Article 3, Chapter 4, Table 4
Development of clinical scenarios where features and applications of simulation are used to the benefit of the registrar	

K

FOCUS AREA	Simulation modalities
OBJECTIVE(S)	To distinguish between the different simulation modalities and applications
ASPECT(S)	Simulation families, modality types

GUIDELINE(S)	
• The clinical educator/trainer should have knowledge of the different types of simulation modalities (low-/high-tech) available and should ensure that they be used appropriately and effectively to train the registrar • That curriculum outcomes, learning outcomes of a scenario and the application of simulation modalities on the specific cognitive level should be aligned	
RECOMMENDATION(S): It is recommended:	
• That SPs should play an important role in the training and assessment of registrars • SPs should play an important role in the training and assessment of students	
ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. 7.3.4 Appendix R, Table 6
Use both low- and high-tech modalities; to experience the holistic scenario use high-fidelity and integration, group work and multidisciplinary approach	

L

FOCUS AREA	Contribution of simulation
OBJECTIVE(S)	To describe the contribution that simulation makes to education and training
ASPECT(S)	Contribution, role, value
GUIDELINE(S)	
• Simulation should be seen as a complementary teaching method and is a effective way to enhance clinical education and training • The contribution that simulation makes includes the role that simulation plays and the value that simulation adds to clinical education • The role that simulation plays should be recognised, namely: provision of a non-threatening environment with controlled and safe practice opportunities; facilitation of student learning – students honing their skills (deliberate and repetitive practice) and	

learning in another way; enhances the effectiveness of learning at different cognitive levels; clinical reasoning on a higher level of competency; minimising risk to patients by using SPs and different simulation modalities • The value that simulation adds to clinical education should be recognised: provision of a complementary alternative learning strategy to bedside teaching; provision of a valuable learning opportunity in a safe environment; attention to individual needs; offering a variation of skills
RECOMMENDATION(S): It is recommended:
• To acknowledge that simulation can play a role in/add to clinical education

ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. 7.3.7, Tables 2 & 3 in Article Chapter 6, Appendix R Tables 8A – 8C
Be aware as educator of role and value that simulation can play to enhance clinical education	

M

FOCUS AREA	Learning outcomes to simulate
OBJECTIVE(S)	To emphasise the importance of identifying learning outcomes
ASPECT(S)	Training levels, simulation as method, modalities and cognitive levels, medical knowledge, patient care and variation of skills and competencies in other areas
GUIDELINE(S)	
• Learning outcomes should be formulated at different training levels in the curriculum • Learning outcomes should be identified where simulation as a teaching method can be useful • Simulation should be tailored to achieve outcomes • The cognitive levels of learning should be identified per learning outcome • Learning outcomes should be formulated on medical knowledge, patient care and skills and competencies in other areas	
RECOMMENDATION(S): It is recommended:	
• That learning outcomes for which simulation is an important training method be identified and described, as well as the simulation modalities linked to specific cognitive levels • That learning outcomes include in their formulation verbs to describe specific actions • To reach a higher level of clinical competence and reasoning the learning outcomes should be formulated at a higher cognitive level for multi-disciplinary simulation and complicated scenarios	
ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. 7.3.6, Appendix R, Table 6
Development of learning outcomes for education and training as well as for scenarios	

N

FOCUS AREA	Cognitive levels
OBJECTIVE(S)	To identify the importance of developing learning outcomes at different cognitive levels
ASPECT(S)	Designating levels of cognition, levels of competence, simulation at different levels
GUIDELINE(S)	
• Learning outcomes should be formulated, based on a theoretical basis, designating the levels of cognition • The registrar should master (and specialists should maintain) competence at the specific level • Simulation should enhance learning at different cognitive levels through changing the level of outcomes and clinical scenarios	
RECOMMENDATION(S): It is recommended:	
• That the level of competence/expertise be identified that is needed from registrars from first year until completion of qualification • That well-defined outcomes are required in order to assess at different levels of competence	

ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. 7.3.3, Appendix R, Table 6
Writing of learning outcomes at cognitive levels (using Bloom's taxonomy and Anderson's adapted version); development of scenarios at different cognitive levels	

O

FOCUS AREA	Assessment
OBJECTIVE(S)	To identify the role of assessment in simulation
ASPECT(S)	Formative and summative assessment, competence
GUIDELINE(S)	
• There should be alignment with assessment between outcomes and scenario outcomes, as well as between theory and practice and assessments • Feedback should be given during and after formative assessment • Assessment should include formative as well as summative assessment based on a scientific and well-researched grounding • Assessment should be reliable, valid and trustworthy	
RECOMMENDATION(S): It is recommended:	
• That the role and value of simulation in assessment should be researched in depth to the benefit of the registrar and the profession	
ACTION(S)/PRINCIPLE(S)/COMMENT(S)	cf. Appendix R Tables 9 & 12
Identify good assessment practices	

7.6 SUMMATIVE DISCUSSION

The overall goal of the research was to contribute to medical education and plastic surgery education and training *per se*. The researcher shares perspectives developed throughout the study from his frame of reference, and his intellectual reasoning (thoughts).

The research findings are linked and spiralled through the five interrelated manuscripts/ articles focusing, (i) on the identification of a research agenda to improve teaching, learning and clinical expertise/professional competence; (ii) on why research is needed on simulation to enhance plastic surgery education and training; (iii) the features and uses of simulation that may lead to effective learning in plastic surgery; (iv) the enhancement of training in plastic surgery by including simulation in education and training programmes, and, (v) the role, value and contribution of simulation in training and giving direction for implementation.

It is clear from the research findings and the outcome of the study (cf. Chapter 8 under accomplishment of research questions and objectives) that the original vision of striving for excellence in learning through simulation might be reachable in future. This research is a small, but significant step towards achieving that.

In this chapter, Chapter 7, a framework structure is presented in which guidelines are proposed for using simulation in a plastic surgery education and training programme. It is worth mentioning here that a number of learning outcomes that may be attained by using simulation as one of the teaching methods were identified and with further development, these may be published.

The study contributed to the academic and professional development of the researcher due to the extent to which his insight was fostered and providing opportunities for experiences that may be useful in clinical practice.

I wish to propose that further research be conducted into the use of simulation as a way to direct registrars in their performance by developing progress tests; simulation employed to teach more reconstructive surgery aspects; the idea that qualified plastic surgeons may be of assistance during simulation scenario development and presentation; as well as the apprenticeship relationship model between registrar and senior colleague in private practice, including the accompaniment of registrars to simulation training facilities that might be available.

7.7 CONCLUSION

Chapter 7 gave an overview of the theoretical grounding underpinning simulation in plastic surgery education and training; a description of the factors that influence and drive implementation of simulation in a postgraduate programme, as well as the development of a framework structure that can be applied to prepare guidelines for teaching through simulation as part of a postgraduate plastic surgery programme. A number of guidelines on simulation and recommendations were described.

In the next **chapter, Chapter 8, Conclusions, Recommendations and Limitations of the study,** a summative discussion, limitations of the study, conclusion and recommendations from the study, will be given.

CHAPTER 8

CONCLUSION, RECOMMENDATIONS AND LIMITATIONS OF THE STUDY

8.1 INTRODUCTION

The researcher endeavoured to find meaning and relevance through investigating philosophical reasoning that could be transformed to scientific argumentation for the inclusion of clinical simulation in a postgraduate plastic surgery education and training programme as an additional teaching method from which specialists in training can benefit. Simultaneously, the existing model of clinical and bedside teaching has been effectuated successfully over the years as the major method of training. It therefore is necessary to state that the purpose of this research and the implementation of the findings have to be seen as a way to enhance, together with the existing clinical teaching, the training of plastic surgeons, and not to replace or substitute it.

This chapter needs to be reflective and provide feedback on the overall goal of the research, the aim of the study, the research questions set and the accomplishment of the objectives formulated. It should also provide the spiral of a thin golden thread running through the whole of the study to draw attention, but not be prescriptive and in the reader's face, how the researcher, respectfully, encompassed and enfolded the views and opinions of highly reckoned and valued professionally qualified specialists, academe, colleagues and friends. The researcher had to distance himself during the process to avoid contamination / influencing of his own professional thoughts. The writing of the publications/publishable manuscripts helped him to do just that, and it directed him clearly to his vision, that is, to make a contribution to medical education as a field of study and to plastic surgery education and training in particular.

The aim of the chapter is to provide an overview of the study, followed by conclusions drawn, a short discussion on the limitations of the study, the contribution to knowledge and the significance of the study. Recommendations and conclusive remarks follow.

8.2 OVERVIEW OF THE STUDY

The problem that was addressed in this study was the lack of clarity about whether, and if so, to what degree, simulation can contribute by playing a role, and will be of value in

postgraduate education and training, and whether it would ensure the effectiveness of learning at various cognitive levels.
The aim of this study was to do an in-depth study on simulation in postgraduate plastic surgery education and training and to identify the contribution that simulation can make to plastic surgery education and training.

The appendices are tabled in the List of Appendices and contain Appendices A – AC. For information on the empirical methods (including the Delphi process and semi-structured interviews used in this study, please refer to the list of Appendices containing letters for approval, invitation to participation, letters to obtain consent, the Delphi questionnaires and interview guide including the results and findings of the study, as well as journal submission guidelines, proof of submission of manuscripts, and verifications of language editing.

The research was carried out and completed based on six research questions. In Chapter 1 (cf. 1.3) an outline of the various research questions was given. The research questions guided the execution of the study. In 8.2.1 – 8.2.6 the research questions are reviewed with reference to the results and findings of the study.

8.2.1 Research question one

The question was stated as:

i. How can simulation be conceptualised and contextualised from a postgraduate plastic surgical training perspective as the theoretical framework of the study?

The following objective was pursued:

i. Conceptualising and contextualising simulation in order to serve as a theoretical framework for the study. This was done by means of a literature study.
This objective addressed research question one.

Research question one was based on a literature review.

This research question aimed to provide the background to the study (cf. 1.2). With this in mind, **Simulation in medical education and plastic surgery**, (cf. 1.2.1) was described. Different views and definitions to explain, **What is simulation?** (cf. 1.2.1.1) were highlighted; and the different families and types of simulation were described under the heading of **Simulation modalities** (cf. 1.2.1.2). The powerful, complementary teaching method that simulation offers was discussed in order to explain the forces whereby simulation is driven in the section, **Driving forces behind medical simulation** (cf. 1.2.1.3), while the new procedure, technology and new solutions to clinical challenges were discussed under **Benefits of and rationale for medical simulation** (cf. 1.2.1.4).

Further, to conceptualise and contextualise simulation as far as education and learning are concerned a full discussion was given on **Learning theories, strategies, cognitive levels of learning and adult learning** (cf. 1.2.2): this included Kolb's experiential learning, Bloom's taxonomy, Anderson's revised taxonomy, Miller's prism of clinical competence, as well as certain aspects of instructional design, and more.

To further conceptualise and contextualise simulation in plastic surgery the researcher (with his promotors as co-authors) presented a paper during a conference at an International Conference on Education in order to report on the process of identifying aspects to be included in a **research agenda with a view to improving teaching, learning and professional competence** in plastic surgery education. The methodology was based on conceptualising and contextualising simulation-based medical education. The researcher was invited to extend the abstract to be published as an article (maximum 3000 words) on, "Simulation in Plastic Surgery: A research agenda to improve teaching, learning and clinical expertise/professional competence". This was published in *The proceedings of the IICE (2016)* (cf. Chapter 2, Article 1). In a further invitation to explore the subject from the conference organisers, the researcher was invited to submit a full length article on the same subject (maximum 4500 words). It was accepted and published in the *International Journal for Cross-Disciplinary Subjects in Education (IJCDSE),* Volume 9, Issue 1, March 2018, pp. 3301-3308. The title is: "Why is research needed on simulation to enhance plastic surgery education and training?" (cf. Chapter 3, Article 2). This article focused on the **purpose of research** on simulation in plastic surgery.

The researcher is of the opinion that the accomplishment of this objective addressed Research question one.

8.2.2 Research question two

The question was stated as:

ii. Which features and uses of simulation in plastic surgery might lead to effective learning?

The following objective was pursued:

ii. Identifying the features and uses of simulation in plastic surgery that lead to effective learning. Data were collected by using semi-structured interviews and a Delphi questionnaire.
This objective addressed research question two.

To address research question two the researcher employed **semi-structured interviews** (cf. 1.7.3.1 – 1.7.3.7; Appendices O - R), as well as the **Delphi process** (cf. 1.7.2.1 – 1.7.2.9; Appendices D – N) that contributed to developing insight in the use of the different applications of simulation. Changes in the delivery of health care led to innovative changes in medical education. Evidence of the contribution that simulation can make in medical education has emphasised the use of simulation in clinical education.

The problem addressed was whether the **features and uses** of simulation would **enhance** postgraduate plastic surgery **education and training** and **ensure more effective learning**. In the Article 3, "Simulation in Plastic Surgery: Features and uses that lead to effective learning", one of the objectives was formulated as: …."to identify and describe the features and uses of simulation that have the potential to enhance learning in plastic surgery" (cf. objective 1(b), Article 3, Chapter 4).

The methodology followed is described in Article 3. The question that was put to the interviewees was: "Which features and applications of simulation in postgraduate/ or plastic surgery education and training will lead to more effective learning?". The results indicated the **effect of simulation** on postgraduate education and training and how learning might be enhanced in the areas of **knowledge, skills, clinical competence and professional conduct** by specific **features, uses and characteristics of simulation** (cf. Appendix R, 4.5, Table 5).

The following feedback on features and uses of simulation that may lead to **effective learning**, is summarised from Appendix R (cf. Appendix R, Table 5, 1 – 17):

- The **integration** of simulation in the postgraduate curriculum is an essential feature of SBE aimed at enhancing the effectiveness of learning.
- **Feedback** is an important feature of SBE and has to focus on a student's knowledge, performance, skills, competence and professional conduct.
- Simulation provides the opportunity for **deliberate** *practice*.
- Students' engagement in repetitive practice is a feature of simulation that leads to effective learning.
- A **controlled environment** provides students with an opportunity to learn more effectively.
- Medical simulations are adaptable to **multiple learning strategies** promoting effective learning.
- Effective learning is enhanced when students practise clinical skills across a wide **range of difficulty levels.**
- **Clinical variations** with a variety of patient problems and conditions will lead to more effective learning.
- The opportunity for students to take part in **experiential learning** where they are active participants leads to effective learning.
- The mastering of **smaller learning components** where students work according to their own pace will lead to more effective learning.
- Simulation offered with clearly defined outcomes will lead to effective learning.
- Simulation **fidelity** influences the effectiveness of learning.
- **Technologies** offer possibilities to influence the effectiveness of learning.
- **Intrinsic motivation** fosters deep learning and the effectiveness thereof.
- Scenarios at different levels of difficulty ensure that learning takes place at **different cognitive levels** and ensure effectiveness of learning.

The researcher further made recommendations to **enhance the effectiveness of learning** in postgraduate plastic surgery education and training by applying the unique features and uses of simulation (cf. Chapter 4, Article 3, Table 4).

The researcher is of the opinion that accomplishment of the objective addressed Research question two.

8.2.3 Research question three

The question was stated as:

iii. ***(a) Does simulation influence student learning in postgraduate education and training?***
(b) Can simulation be used to enhance the effectiveness of student learning?

The following objectives were pursued:

iii. (a) Identifying whether simulation *influences* student learning in postgraduate education and training. This was determined by collecting data by means of semi-structured interviews.
(b) Identifying whether simulation can be used to *enhance the effectiveness* of student learning? This was accomplished by collecting data by means of semi-structured interviews.
These objectives addressed research questions 3a and 3b.

To address Research question three the researcher employed semi-structured interviews (Appendices O – R).

In Article 3, "Simulation in Plastic Surgery: Features and uses that lead to effective learning", one of the objectives was formulated as: "…to identify and describe the influence that simulation may have on student learning and how the effectiveness of learning may be enhanced in postgraduate and/or plastic surgery education and training" (cf. Objective 1(a), Article 3, Chapter 4).

The methodology followed is described in Article 3. The questions that were put to the interviewees were: "Does/can simulation influence student learning in postgraduate education and training? In what regard?" and secondly: "How can effectiveness of learning be enhanced in postgraduate and/or plastic surgery education and training (in the areas of knowledge, skills, clinical competence, professional conduct)?" The results and findings are tabled in Table 3 (cf. Chapter 4, Tables 2 – 3, Article 3).

"Simulation **influences student learning** (cf. Table 2, Article 3, Chapter 4) as it substitutes **other learning strategies**; it supports **adult learning principles** as it requires students to prepare, placing a responsibility on them as adult learners; it provides self-confidence and skills **motivating** students to **confront life-threating** situations, making a difference to a patient's life. Simulation provides the opportunity to learn by **repetition**; to work **individually** or in groups, and it fosters **communication**. Simulation ensures that the student **attains** and sustains a **specific level of competency**" (cf. Article 3, Chapter 4).

"Opinions on how simulation **can enhance the effectiveness of learning** can emphasise the role of simulation as a **non-threatening** learning environment that enhances the effectiveness of learning. Students can practise with **less stress** in a completely safe environment before working with real patients; this highlights the advantages of training using simulation. Simulation also enhances the effectiveness of learning by fostering interpersonal, interprofessional patient communication, health communication and **reasoning skills**. Through **deliberate**, as well as **repetitive** practice, learning is enhanced. The **debriefing** aspect offers another way of learning and allows students to decide on self-improvement. **Authentic scenarios** help the students to learn more effectively than when using paper cases. The **assessment** opportunities provided by simulation enhance student learning" (cf. Table 3, Article 3, Chapter 4).

From the findings (cf. Objectives 2, 3a, 3b) it is clear that **simulation influences student learning**, and can enhance the effectiveness of learning.

The researcher is of the opinion that the accomplishment of the objectives addressed Research question three.

8.2.4 Research question four

The question was stated as:

iv. Can the effectiveness of learning be enhanced through the inclusion of simulation as one of the methods to train a plastic surgeon in postgraduate plastic surgery education and training, and if so, how?

The following objective was pursued:

iv. Identifying whether simulation can be included as one of the training methods in postgraduate plastic surgery education and training. Data were

collected by means of a Delphi questionnaire and during semi-structured interviews.

This objective addressed research question four.

The researcher investigated the possibility of integrating simulation in plastic surgery residency training. The problem addressed was the lack of knowledge about using simulation as an essential or useful method to enhance the training of plastic surgeons. A lack of empirical evidence existed concerning **learning outcomes** that could be mastered by simulation-based education and training and their specific **cognitive levels** on which learning should be pitched. The research is described in Article 4, "Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes" (cf. Chapter 5).

The objective of this research was to identify and describe **learning outcomes** for plastic surgery education and training for which simulation might be an **important (essential and useful)** training method, and to identify and describe **simulation modalities**, linked to specific **cognitive levels**, to establish the influence of simulation on plastic surgery education and training as far as knowledge, skills, clinical competence and professional conduct are concerned.

To address Research Question 4 the researcher employed a **Delphi survey** (cf. 1.7.2.1 – 1.7.2.9; Appendices D - N) and **semi-structured interviews** (cf. 1/7/3/1 – 1.7.3.7; Appendices O – R).

The Delphi survey involved experts who had to indicate the **importance or not of a number of outcomes** that may be addressed by simulation as a training method. The participating experts also had the opportunity to explore the use of simulation in attaining the given outcomes by making suggestions on the applicable **simulation modality**, as well as the **cognitive level** of learning of each outcome. The second data collection method was semi-structured interviews with national and international role players in simulation and postgraduate education to investigate their ideas and opinions on simulation as **teaching and learning method** (cf. Article 4, Chapter 5).

The questions that were put to the interviewees were:

"Can simulation be used to enhance student learning at different cognitive levels? (Will the student only use simulation to remember knowledge / or understand / or apply / or analyse / or evaluate / or create new concepts and ideas? Which types of simulation or simulation modalities might lead to effective learning? And, any recommendation(s) you would like to make when considering including simulation in specialist training?"

The findings of the interviews were tabled in Appendix R, Tables 6–7. The findings of the Delphi outcomes were summarised in Appendices G–N.

A description was given of the **learning outcomes**, **levels of training**, and possible **simulation modalities**, **cognitive levels** and **descriptive verbs and phrases** as these pertain to learning.. Simulation in medical education and its relation to simulation technology, were discussed (cf. Article 4, Chapter 5).

Recommendations for considering the **inclusion of simulation in specialist training** offered by the researcher were:

Aligning the curriculum with the simulation plan according to a scientific and coordinated process and guidelines; Developing a **training course** for the **trainers** before implementing simulation in the plastic surgery programme; Researching the **role of simulation in assessment** carefully before implementation and **assessing/evaluating the workplace environment** on a continuous basis, and carefully considering the **feedback** received from role players (cf. Article 4, Chapter 5).

The researcher is of the opinion that the accomplishment of the objective, addressed Research question four.

8.2.5 Research question five

The question was stated as:

v. Does simulation have a contribution to make and a role to play in postgraduate plastic surgery education and training, and if so, of what value will it be?

The following objective was pursued:

v. **Describing the contribution simulation can make and the role it can play in postgraduate plastic surgery education and training. To this end, the data collected from the literature studied, the Delphi questionnaire and the semi-structured interviews were processed, analysed and interpreted.**
This objective addresses research questions one to five.

An in-depth study was conducted on the role and value of simulation in postgraduate plastic surgery education and training. The question that was asked is whether it was worthwhile to examine the use of simulation in a postgraduate plastic surgery training environment in order to determine if it might be useful in addressing the lack of opportunities for clinical exposure and practice. If simulation has a **contribution** to make; a **role to play** and can be of specific **value** in that it may add to postgraduate plastic surgery education and training, which **points of departure and aspects** must be considered to **compile a framework structure** that can be applied to **propose guidelines and recommendations for teaching through simulation as part of training programmes?** The research is described in Article 5, "Simulation in Plastic Surgery: Role, value and contribution of simulation in education and training – a directive for implementation" (Article 5, Chapter 6).

The objective of this research was to identify and describe (a) the **role and value of and the contribution** that simulation may make, as well as (b) the main **considerations for implementation** of simulation in a training programme.

The questions that were put to the interviewees were:

Does simulation have (a) a contribution to make to, (b) a role to play in, or (c) a specific value to add to postgraduate education? What would your main consideration be if you decided to include simulation in your teaching and training programme? If you have to guide a team of experts tasked to develop a curriculum with simulation as one of the training/learning methods, which important guidelines will you put on paper? Do you wish to make any recommendations that may be used in compiling guidelines on simulation for postgraduate plastic surgery? Will you please share (a) some of the lessons learned regarding the implementation of simulation in a curriculum, as well as

(b) the biggest challenge in implementing simulation in training? (Table 1, Article 5, Chapter 6).

The findings of the semi-structured interviews are summarized in Appendix R, Tables 81-8c, 9-13.

It is clear from the opinions of the interviewees that simulation makes an **important contribution to patient safety**. Registrars can **practise their skills** in a non-threatening, preselected and controlled, **safe environment** preparing them beforehand, and providing them with the opportunity to **learn gradually,** in their **own time** according to their own pace. Once they are competent, the **acquired knowledge, skills, clinical competencies and professional conduct and behaviour** can be transferred to real **clinical settings and patients**. This minimise the risk to patients and ensures a **proficient and competent registrar** delivering an excellent outcome. **Simulation training** also exposes registrars to **higher levels of thinking and complexity**; interdisciplinary and high-fidelity simulation during big group simulations triggers effective learning.

In addition, simulation simultaneously offers an **alternative training** method. While a clinical facilitator or head of department is training registrars on a flat screen simulator to master certain skills, the consultants are responsible for making the decisions, thus, in such a situation, two **different groups** are trained at the **same time at different cognitive levels** to become competent or proficient and pursue different objectives. Through *training the trainer* value can be added to simulation as a training method, as well as to clinical education. The contribution that simulation can make incorporates the role that simulation plays and the value that simulation adds (Article 5, Chapter 6).

It was worthwhile to examine the use of simulation in a postgraduate plastic surgery training environment in order to determine if it **might be useful in addressing the lack of opportunities for clinical exposure and practice**. Simulation has a **specific role** and can definitely **add value** to postgraduate training. **Aspects** were identified that could be applied in compiling a **framework structure** to serve as a point of departure and be applied in proposing guidelines and recommendations for training through simulation as part of the training programme in plastic surgery. These factors will act as **forces in education** and training that will influence and drive the implementation of simulation in a postgraduate programme and will **serve as a directive** in successful implementation.

The contribution that simulation may make in the training of plastic surgeons according to suggested guidelines and recommendations will add value to specialist training. The outcome of the research will serve as a 'roadmap' for postgraduate plastic surgery education and training on how simulation might be used to enhance learning, and how simulation might be used to improve students' knowledge, clinical competence, skills and professional conduct (Article 5, Chapter 6).

The researcher is of the opinion that the accomplishment of the objective addressed Research question five.

8.2.6 Research question six

The question was stated as:

vi. ***How can simulation be used and implemented to be part of a training programme in plastic surgery education and training?***

The following objective was pursued:

vi. **Developing a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes in postgraduate plastic surgery education. This was done based on conclusions drawn from all the findings.**
This objective addresses research question six with a view to a holistic and scientific Ph.D. product.

The study was undertaken to develop insight in and to form an understanding of whether there is a **need for or application to include simulation in postgraduate plastic surgery education and training programmes**. The study could serve as a directive for higher education medical institutions due to the fact that not all postgraduate specialist programmes and curricula for the training of plastic surgeons include clinical simulation training.

The aim of the study was to do an in-depth study on simulation in postgraduate plastic surgery education and training. It was necessary to **conceptualise and contextualise** simulation with a view to understanding what forms the backbone of the theoretical grounding for simulation in plastic surgery education and training. The **influence of simulation** on student learning (Article 3, Chapter 4), the **features and uses** of simulation that enhance learning (Article 3, Chapter 4), The **learning outcomes** that can be **simulated** (including cognitive levels and simulation modalities) (Article 4, Chapter 5), as well as the contribution that simulation might make to plastic surgery education and training were identified and discussed (Article 5, Chapter 6). The results and findings were used to develop a framework structure that might be applied to suggest guidelines for the use of simulation in postgraduate plastic surgery education and training (Chapter 7, cf. 7.5).

Chapter 1 dealt with the background to the study and the research problem and research questions. The overall goal, aim and objectives were stated and the research design and methods that were employed were explained. The scope and demarcated field of study were described, as well as the significance and value of the study. As this thesis is written in the publication format, Chapters 2–6, offer articles that were submitted to scientific journals.

In Chapter 7, **Simulation in postgraduate plastic surgery education and training, objectives five and six** of the study were addressed (cf. 1.4.3). Chapter 7 integrates the research findings and contributes to achieving the aim of the research, and was used to relate the **creation of a framework structure** that might be applied to **propose/suggest guidelines with recommendations** for the implementation of simulation in postgraduate plastic surgery education and training. For simulation to be introduced as a teaching method and a learning opportunity for residents with a view to impact on plastic surgery education and training, it should include (i) a clear set of recommendations on how simulation can enhance the **effectiveness of learning** (Article 3, Chapter 4); (ii) a description of the **contribution** of simulation, including its role and value (Article 5, Chapter 6), based on a scientific research process; (iii) the **development of an argument** to enhance plastic surgery training by **including simulation** in education and training programmes (Article 4, Chapter 5); and (iv) the **development of a framework structure** that might be applied to propose **guidelines** for teaching by means of simulation as part of training programmes for evidence-based plastic surgery education and practice (Chapter 7).

The **theoretical grounding** underpinning simulation in plastic surgery education and training is summarised as a diagrammatic overview of the elements that form the theoretical support for simulation (Figure 7.1, cf. 7.2). The **factors that influence and drive the**

implementation of simulation in a postgraduate programme and which may serve as a directive for successful implementation are touched on (cf. 7.3); and a discussion on the **development** of the **framework structure** with a view to suggesting guidelines is given (cf. 7.4). This was all done based on literature cited, conclusions drawn from the findings of the research, the discussions in the articles, and the formal education and training, as well as the expertise and experience of the researcher as a plastic surgeon and academic. Chapter 7 offered a **framework structure** with **guidelines and recommendations** for teaching through simulation as part of a postgraduate plastic surgeon programme (cf. 7.5).

The researcher is of the opinion that the accomplishment of this objective answered Research question six.

8.3 CONCLUSION

This study was based on the **recognition** and **acknowledgement** that a **gap** existed in the field of study. The study originated from the need to investigate whether clinical simulation could enhance the education and training of specialists in postgraduate plastic surgery. To bridge the perceived gap the researcher aimed to do an in-depth study on **simulation in plastic surgery education and training**. This was done by identifying the **contribution** that simulation could make, including the **role** that simulation could play and the **value** that simulation might add to postgraduate plastic surgery education and training. Of utmost importance was to determine whether and how student learning would be influenced, and more specifically, how the **effectiveness of learning** could be enhanced by the **unique features, characteristics and applications** of simulation. The possibility to include simulation as one of the **teaching methods** in a postgraduate education and training programme in a manner that would add quality to clinical training and health care *per se* was the challenge. Developing a framework structure to which **aspects** and **focus areas** might be added in order to make it more complete, as well as formulating guidelines, which, at this point in time, would serve only as examples of educational guidance for specialists in the field, clinical educators and programme developers, was the overall goal pursued. The proposed guidelines are not a fully comprehensive set of guidelines, and are not by any means exhausted, but will give direction and structure for thought.

A combination of methods was used to generate data and the findings were interpreted to form the basis for the contribution that the research makes. A clear purpose and a set of six explicit **research questions** with aims and objectives were formulated. The scope of the field of study and how the quality of the research was ensured were elucidated by clear a description of the rigor and quality of the research (Chapter 1, and also in the five articles prepared).

This study for the PhD degree in Health Professions Education followed the article option, and met the requirements of three interrelated manuscripts. **Five manuscripts** were prepared and two were **already published**, while **three were submitted** according to the **guidelines of the journals** (cf. Chapters 2 – 6). Two **additional chapters**, namely Chapter 7 that deals with a proposed framework structure and guidelines, and Chapter 8 that includes the conclusion, limitations, contribution and recommendations, were written. The researcher addressed all the objectives of the study.

The **theoretical perspectives**, based on a literature study and linked to the understanding of concepts (conceptualisation) in context (contextualisation) together with the scholarly work of authors in the study field, contribute to the **theoretical grounding** that forms the **conceptual framework** on which the research was based. On the **conceptual level**, to conclude, it became clear that the inclusion of simulation in a postgraduate plastic surgery education and training programme, the contribution that clinical simulation can make and the influence thereof, are of utmost importance. Various challenges were encountered and lessons learned were highlighted during interviews. Applicable information was made available, but could not be elaborated on due to the complexity and extent of the findings/data of the study. The researcher believes this study is a first step in the direction for further research.

The results and findings are described clearly and scientifically in the published article/publishable manuscripts, as well as the scientific processes followed and data gathered in a number of appendices. The researcher feels comfortable to have drawn **factual conclusions** as described in the research manuscripts/articles.

8.4 LIMITTIONS OF THE STUDY

The researcher recognises the following limitations in the study:

The study was planned to be reported in thesis format, and therefore the research questions and objectives were structured in a way that rendered it suitable for a thesis comprising separate chapters, such as an orientation, a literature review, research methodology, results, discussions, and more, but after evaluation committee and ethic committee approval, during the research process and the attending of an international conference, it became clear to the researcher that the need existed to get **scientific knowledge** and **information** in this research field **published** as soon as possible. The article route thus was approved; however, it was difficult to align research questions and research objectives in the manuscripts. It became necessary to link results and findings from the different methodologies, research questions and objectives to be more significant.

Although the study was clearly demarcated, it became a comprehensive study. The Delphi process was extended over a period of months as it included the Delphi questionnaire, but also other questions to place the learning outcomes that might be simulated in modality types as well as identifying the specific suitable cognitive levels. The number of Delphi statements formulated entailed more than seventeen sections at five levels, including medical knowledge and patient care, and were extensive and comprehensive. The panellists indicated that it took them up to three to four hours to complete one round in full.

Although not all the findings from the research were included in this thesis, it was interpreted for the **compilation** of the **framework structure and guidelines**. The research findings are comprehensive in quantity and quality and therefore it was not achievable to discuss them in detail. These aspects will be discussed in follow-up publications.

8.5 CONTRIBUTION AND SIGNIFICANCE OF THE RESEARCH

The overall goal of the research was to make a contribution to knowledge in the field of medical education and clinical plastic surgery education and training. The researcher is of the opinion that the research made a **contribution** to **new knowledge**. With planning and the further publication of articles on the remaining findings on **post-doctoral level**, it might make a **noteworthy contribution** that will impact significantly on clinical training. The profession, as well as academic and other institutions, as opinion formers and providers of formal specialist education and training, should take responsibility and be accountable to **effect change** and make **significant recommendations** in as far as including simulation as a compulsory part of education and training is concerned. The researcher with this study **contributed to filling the identified gap in knowledge**.

8.6 RECOMMENDATIONS

In order for the study to contribute to postgraduate plastic surgery education and training the researcher makes the following recommendations:

- That the **educational needs** of **registrars** in plastic surgery will receive further attention.
- That the information and findings of the study will be used to finalise and implement a compulsory **component of simulation** in plastic surgery education.
- To implement the **framework structure and guidelines** that offer flexible opportunities and are needs-driven.
- To do **further research** in order to inform the further **finalisation** of the **guidelines** on simulation.
- To do **further research** with a view to expanding the **research agenda** in plastic surgery education and training.
- To implement and adapt the **educational recommendations** on simulation for postgraduate registrar training.

8.7 CONCLUSIVE REMARKS

The researcher wishes to emphasise that **steps** must be taken, and **academic leadership** must be shown to extend the research agenda in plastic surgery education and training. The addition of clinical simulation as medium of instruction will enhance postgraduate plastic surgery and enrich student learning.

The outcome of the study will serve as a directive for postgraduate plastic surgery education and training by means of suggested guidelines including recommendations on how simulation may be utilised to improve **students'**, knowledge, skills and professional conduct. This research is seen as the first vital and important step taken in this direction.

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LIST OF APPENDICES

APPENDIX A LETTER TO FACULTY MANAGEMENT TO REQUEST PERMISSION TO EXECUTE THE STUDY

APPENDIX A
LETTER TO FACULTY MANAGEMENT TO REQUEST PERMISSION TO EXECUTE THE STUDY

Unit 14, Palms 10
Palm Lakes Estate, Ballito
4390

27 May 2015

Faculty Management
Faculty of Health Sciences
University of the Free State
Bloemfontein

Dear Faculty Management

APPLICATION FOR PERMISSION TO EXECUTE RESEARCH ON: SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING

I am in the process of executing a study to fulfil the requirements for a PhD degree in Health Professions Education in the Faculty of Health Sciences at the University of the Free State (student number 2000003430). The title of my research is **SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING**.

My promoters are:

Promoter: Prof GJ van Zyl	Co-promoter: Dr MJ Labuschagne
Dean	Head: Clinical Simulation and Skills Unit, School of Medicine
Faculty of Health Sciences	Faculty of Health Sciences
University of the Free State	University of the Free State
Bloemfontein, South Africa	Bloemfontein, South Africa

In this research project, an in-depth study will be done on simulation in postgraduate plastic surgery education and training.

The overall goal of the study is to enhance postgraduate plastic surgery education and training by means of developing guidelines for the use of simulation with a view to include medical simulation in training programmes.

The problem that will be addressed is the lack of clarity about whether, and if so, to what degree, simulation can contribute by playing a role, and will be of value in postgraduate plastic surgery education and training, and whether it would ensure higher effectiveness of learning at the various cognitive levels.

The aim of this study is to do an in-depth study on simulation in postgraduate plastic surgery education and training. This will be done by identifying the contribution (for example by the discussion of the role and value) that simulation can make in postgraduate plastic surgery education and training. An essential aspect that will come into play is determining the different cognitive levels of learning addressed by simulation in plastic surgery education and training, including the types of simulation modalities that may be suitable for use in the various sub-disciplines of plastic surgery, such as reconstructive and aesthetic surgery. The results and findings will be used to develop guidelines for the use of simulation in postgraduate plastic surgery education and training.

In order to address the problem stated, the following **research questions** will be addressed:

1. How can simulation be conceptualised and contextualised from a postgraduate plastic surgical training perspective as the theoretical framework of the study?
2. Which features and uses of simulation in plastic surgery might lead to effective learning?

3a. Does simulation influence student learning in postgraduate education and training?
3b. Can simulation be used to enhance student learning at different cognitive levels?
4. Can the effectiveness of learning be enhanced through simulation in postgraduate plastic surgery education and training, and if so, how?
5. Does simulation have a contribution to make and a role to play in the different sub-disciplines of postgraduate plastic surgery education and training, and if so of what value will it be?
6. How can doctorateness in this study be expressed as a scientific contribution in the fields of postgraduate plastic surgery and health professions education?

The research will be carried out and completed based on these research questions.

The following **objectives** will be pursued in the study:

1. Conceptualising and contextualising simulation in order to compile a theoretical framework for the study. This will be done by means of a literature study.
   This objective addresses research question 1.
2. Identifying the features and uses of simulation in plastic surgery that lead to effective learning. This will be done as part of a Delphi questionnaire.
   This objective addresses research question 3.

3a. Identifying whether simulation influences student learning in postgraduate education and training. This will be determined by collecting data by means of a Delphi questionnaire as well as by a semi-structured interview.
This objective addresses research question 4.

3b. Can simulation be used to enhance student learning at different cognitive levels? This will be done through a Delphi questionnaire as well as by a semi-structured interview.
This objective addresses research question 4.

4. Identifying whether simulation has a role to play and is of value in the different sub-disciplines of postgraduate plastic surgery education and training. This will be done through semi-structured interviews.
   This objective addresses research question 5.
5. Describing the contribution (such as the role and value) simulation might have by making recommendations and compiling guidelines to enhance the effectiveness of learning at the cognitive levels in postgraduate plastic surgery education and training. To this end, the data collected from the literature studied, the Delphi questionnaire and the semi-structured interviews will be processed, analysed and interpreted.
   This objective addresses research questions 1-5.
6. Developing guidelines on simulation in postgraduate plastic surgery. This will be done based on conclusions drawn from literature and the findings.
   This objective addresses research question 6 with a view to a holistic and scientific PhD product.

The **methods** that will be used and which form the basis of the study, comprise a literature study, and, as empirical study, a Delphi-survey and semi-structured interviews. I hereby apply to conduct this research as will be approved by the Evaluation Committee as well as the Ethics Committee, Faculty of Health Sciences on **SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING**. Consent will be sought from Delphi experts and interviewees as applicable for this research project.

Thank you for your time and attention.

Yours faithfully

Dr CPG Nel

Consultant: Department of Plastic Surgery
Inkosi Albert Luthuli Central Hospital, University of Kwa-Zulu Natal
Durban
South Africa, Cell: 082- 924-3847, Cenl.nel@gmail.com

APPENDIX B LETTER TO VICE RECTOR: NOTICE OF RESEARCH AND PERMISSION

APPENDIX B

LETTER TO VICE RECTOR: NOTICE OF RESEARCH AND PERMISSION

Unit 14, Palms 10
Palm Lakes Estate, Ballito
4390

27 May 2015

Prof C Witthuhn
Vice-Rector: Research
University of the Free State
Bloemfontein

Dear Professor Witthuhn

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The overall goal of the study is to enhance postgraduate plastic surgery education and training by means of developing guidelines for the use of simulation with a view to include medical simulation in training programmes.

The problem that will be addressed is the lack of clarity about whether, and if so, to what degree, simulation can contribute by playing a role, and will be of value in postgraduate plastic surgery education and training, and whether it would ensure higher effectiveness of learning at the various cognitive levels.

The aim of this study is to do an in-depth study on simulation in postgraduate plastic surgery education and training. This will be done by identifying the contribution (for example by the discussion of the role and value) that simulation can make in postgraduate plastic surgery education and training. An essential aspect that will come into play is determining the different cognitive levels of learning addressed by simulation in plastic surgery education and training, including the types of simulation modalities that may be suitable for use in the various sub-disciplines of plastic surgery, such as reconstructive and aesthetic surgery. The results and findings will be used to develop guidelines for the use of simulation in postgraduate plastic surgery education and training.

In order to address the problem stated, the following **research questions** will be addressed:

1. How can simulation be conceptualised and contextualised from a postgraduate plastic surgical training perspective as the theoretical framework of the study?
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   This objective addresses research questions 1-5.
6. Developing a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes in postgraduate plastic surgery education.
   This objective addresses research question 6 with a view to a holistic and scientific PhD product.

The **methods** that will be used and which form the basis of the study, comprise a literature study, and, as empirical study, a Delphi-survey and semi-structured interviews. I hereby apply to conduct this research as will be approved by the Evaluation Committee as well as the Ethics Committee, Faculty of Health Sciences on **SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING**. Consent will be sought from Delphi experts and interviewees as applicable for this research project.

Thank you for your time and attention.

Yours faithfully

Dr CPG Nel

Consultant: Department of Plastic Surgery
Inkosi Albert Luthuli Central Hospital, University of Kwa-Zulu Natal
Durban
South Africa
Cell: 082 924 3847, Cenl.nel@gmail.com

APPENDIX C ETHICAL APPROVAL FROM ETHICS COMMITTEE, FACULTY OF HEALTH SCIENCES

APPENDIX C

ETHICAL APPROVAL FROM ETHICS COMMITTEE, FACULTY OF HEALTH SCIENCES

UNIVERSITY OF THE FREE STATE
UNIVERSITEIT VAN DIE VRYSTAAT
YUNIVESITHI YA FREISTATA

UFS·UV
HEALTH SCIENCES
GESONDHEIDSWETENSKAPPE

IRB nr 00006240
REC Reference nr 230408-011
IORG0005187
FWA00012784

12 August 2015

DR CPG NEL
DIVISION HEALTH SCIENCES EDUCATION
UFS

Dear Dr CPG Nel

ECUFS 122/2015
PROJECT TITLE: SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING

1. You are hereby kindly informed that, at the meeting held on 11 August 2015, the Ethics Committee approved the above project after all conditions were met.

2. Any amendment, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

3. A progress report should be submitted within one year of approval of long term studies and a final report at completion of both short term and long term studies.

4. Kindly use the ECUFS NR as reference in correspondence to the Ethics Committee Secretariat.

5. The Ethics Committee functions in compliance with, but not limited to, the following documents and guidelines: The SA National Health Act. No. 61 of 2003; Ethics in Health Research: Principles, Structures and Processes (2015); SA GCP(2006); Declaration of Helsinki; The Belmont Report; The US Office of Human Research Protections 45 CFR 461 (for non-exempt research with human participants conducted or supported by the US Department of Health and Human Services- (HHS), 21 CFR 50, 21 CFR 56; CIOMS; ICH-GCP-E6 Sections 1-4; The International Conference on Harmonization and Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH Tripartite), Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines, Constitution of the Ethics Committee of the Faculty of Health Sciences.

Yours faithfully

....
DR SM LE GRANGE
CHAIR: ETHICS COMMITTEE

Cc: Prof G van Zyl

APPENDIX D LETTER OF INVITATION AND REQUEST TO DELPHI PANELLISTS TO PARTICIPATE IN QUESTIONNAIRE SURVEY

APPENDIX D

LETTER OF INVITATION AND REQUEST TO DELPHI PANELLISTS TO PARTICIPATE IN QUESTIONNAIRE SURVEY

Netcare Mulbarton Hospital
25 True North Road
Mulbarton
Johannesburg
2059

Name and address of expert

Dear Delphi panellist

INVITATION TO PARTICIPATE IN A DELPHI PROCESS

I hereby wish to approach you for support in my study through participation in the data collection process.

I am a qualified Plastic Surgeon, worked as a consultant in the Department of Plastic Surgery at the University of KwaZulu-Natal, Durban, South Africa, and I am currently in private practice since January 2016. I am enrolled at the University of the Free Sate (Bloemfontein, South Africa) for a doctoral study. This study will be executed in the field of Health Professions Education and falls under the domain of clinical simulation education. The study is interdisciplinary as it reaches across and between Health Professions Education and Plastic Surgery.

I am doing a study on postgraduate education and training in Plastic Surgery. The title of my thesis is: **SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING.**

The overall goal of the study is to enhance postgraduate plastic surgery education and training by means of developing guidelines for the use of simulation with a view to include medical simulations in training programmes.

The aim of this study is to do an in-depth study on simulation in postgraduate plastic surgery education and training. This will be done by identifying the contribution that simulation can make in postgraduate plastic surgery education and training. The results and findings will be used to develop guidelines for the use of simulation in postgraduate plastic surgery education and training.

Based on your expertise and experience in the field of Plastic Surgery, Postgraduate Education and/or Simulation as well as your Academic and Scientific national and international standing, I wish to invite you to participate in this study. Your participation will add value to the study and will be appreciated. Your involvement will require you to complete a questionnaire that will be sent to you electronically, or in hard copy format. The questionnaire will focus on the different levels of education and training in Plastic Surgery. Various statements will be listed and you will have to indicate whether simulation of the content can be regarded as an essential or useful method to train a plastic surgeon. If simulation is not an applicable method you will be able to indicate that it can be excluded as a method of training in Plastic Surgery. You will be requested to indicate the type of simulation modality that can be used if applicable. If applicable, you will be invited to indicate the appropriate cognitive level of learning that may occur.

For this part of the research project, in which you are being invited to participate, we will be making use of the Delphi method of research, which involves the use of questionnaires. Members of the expert panel each receive an identical questionnaire, which needs to be answered and returned to the researcher. The answers are then analysed and the original questionnaire may be modified, removing some questions and adding new ones if necessary. The modified questionnaire and an anonymous summary of the experts' opinions from the previous round are then forwarded to the Delphi participants for the follow-up round. Thus, experts are encouraged to revise their earlier responses if they wish to. Further rounds will follow as necessitated by the outcome of each round. The process will be stopped after consensus and/or stability has been reached.

Participation is strictly voluntary and there is no compensation or any known risks for participants. Participation is confidential and all data collected during the research process will be treated confidentially at all times.

Completing the Round One questionnaire should take no more than three to four hours with shorter subsequent rounds as consensus is reached on statements.

Commencement of Round One is planned for 2016/2017 with completion when consensus or stability is reached.

If you would like to contact me, please do not hesitate to mail me at drcnel@gmail.com or phone me at cell no +27 (0)82-924-3847.

My promoters are:

Promoter: Prof GJ van Zyl
Dean
Faculty of Health Sciences
University of the Free State
Bloemfontein, South Africa

Co-promoter: Dr MJ Labuschagne
Head: Clinical Simulation and Skills Unit, School of Medicine
Faculty of Health Sciences
University of the Free State
Bloemfontein, South Africa

If you are willing to participate in the Delphi survey, please complete the accompanying consent form and e-mail it back to me at your earliest convenience. If you are not available, please inform me.

Thank you for considering my request. As you are a highly regarded expert, your participation will be appreciated.

Yours faithfully

Dr Corné PG Nel
MBChB, MHPE, FC Plastic Surgery, MMed (Plastic Surgery)
Student number: 2000003430
Ethics approved number: ECUFS122/2015

APPENDIX E FORM TO OBTAIN CONSENT FROM PANELLISTS TO TAKE PART IN THE DELPHI PROCESS AND QUESTIONNAIRE SURVEY

APPENDIX E

FORM TO OBTAIN CONSENT FROM PANELLISTS TO TAKE PART IN THE DELPHI PROCESS AND QUESTIONNAIRE SURVEY

INFORMED CONSENT FORM: DELPHI SURVEY

I, the undersigned, hereby agree to be a participant in the Delphi process and questionnaire survey being executed as part of the PhD study with the title **SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING** (ECUFS 122/2015).

I have been informed fully about what the process entails, that it will not involve any harm or professional damage, and that participation will be anonymous in that only the researcher in and promoters of the study will be aware of my identity, and that this will not be divulged in any circumstances without my expressed consent.

I understand my participation in the Delphi survey is confidential and that there will be no references to any names. All data collected during the survey will be treated confidentially at all times. I am also of the understanding that I will not be held accountable for any decisions or conclusions emanating from this study. I furthermore acknowledge that the results from this research will be published.

My full particulars are:
Title: ____
Surname: ____
Full names: ____
Contact number: ____
E-mail address: ____

Years associated with postgraduate Plastic Surgery and its sub-disciplines in an education and training capacity: ____

Years of experience in and knowledge of simulation:______________________

Signature: ____ Date: __________________

To ensure validity, reliability and trustworthiness of the study it is important that you do not discuss your participation in this study with any of your colleagues.

Please complete this document and e-mail it to drcnel@gmail.com

THANK YOU FOR AGREEING TO PARTICIPATE IN THIS SURVEY

Dr Corné PG Nel
MBChB, MHPE, FC Plastic Surgery, MMed (Plastic Surgery)
Student number: 2000003430
Ethics approved number: ECUFS122/2015

APPENDIX F INSTRUCTIONS FOR COMPLETION OF THE DELPHI QUESTIONNAIRE ROUND ONE

APPENDIX F

INSTRUCTIONS FOR COMPLETION OF THE DELPHI QUESTIONNAIRE ROUND ONE

SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING

DELPHI SURVEY ROUND ONE

Dear Participant

Thank you for your willingness to participate in this Delphi process and questionnaire survey as an expert participant.

Please save a copy of this document on your computer hard drive and use this saved copy when completing the questionnaire. After completion of the questionnaire please e-mail the document to drcnel@gmail.com. Alternatively, you may print the document and complete the questionnaire by hand. Please call to arrange for courier pick-up if this is the case.

You will need three to four hours to complete the questionnaire. The initial questionnaire should take the longest to complete, with subsequent questionnaires taking less time as questions are eliminated when consensus is reached.

Feedback on each Delphi round will be distributed anonymously to the panel of experts.

If you experience any problems please contact me at drcnel@gmail.com or cell +27(0)82-924-3847. You are reminded not to discuss your participation in the Delphi process with colleagues.

PLEASE RETURN THE COMPLETED QUESTIONNAIRE NOT LATER THAN ONE MONTH AFTER RECEIVING IT.

INFORMATION ON THE DELPHI QUESTIONNAIRE:

The Delphi questionnaire consists of 18 sections (A-R). Each section is divided into two main categories, namely medical knowledge and patient care that have been formulated within five education and training levels with level one the more basic level of training and level five the most advanced training level.

THE DIFFERENT SECTIONS IN THE DELPHI QUESTIONNAIRE ARE AS FOLLOWS:

SECTION A	**SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION B	**WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION C	**TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION D	**CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION E	**HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION F	**MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION G	**FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION H	**NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION I	**BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION J	**RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION K	**UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION L	**NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION M	**COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION N	**LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION O	**SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT**

SECTION P	**PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE AND RESEARCH AND TRAINING**
SECTION Q	**PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY**
SECTION R	**INTERPERSONAL AND COMMUNICATION SKILLS**

Specific instructions are given in each section regarding the completion of questions in that section.

THANK YOU FOR YOUR WILLINGNESS TO COMPLETE THE QUESTIONNAIRE.

Dr Corné PG Nel
MBChB, MHPE, FC Plastic Surgery, MMed (Plastic Surgery)
Student number: 2000003430
Ethics approved number: ECUFS122/2015

APPENDIX G QUESTIONNAIRE FOR DELPHI PANEL: ROUND ONE

APPENDIX G

QUESTIONNAIRE FOR DELPHI PANEL: ROUND ONE

INSTRUCTIONS TO COMPLETE DELPHI QUESTIONNAIRE REGARDING SIMULATION
Please indicate how important each of the following statements is according to the following scale:

1 = Simulation can be regarded as one of the **essential** methods to train a plastic surgeon.
2 = Simulation may be **useful** as one of the methods to train a plastic surgeon.
3 = Simulation is **not** an **applicable** method to train a plastic surgeon and can be excluded as a training method.
Please mark the appropriate box with an X. Mark only one of the three choices (Essential, Useful, Not applicable).

If you indicated 1 or 2 as an option, please also answer to the next two categories (simulation modality and cognitive level). If you indicated 3, go directly to the next Education and Training level.

INSTRUCTIONS TO COMPLETE QUESTIONNAIRE REGARDING MODALITIES AND LEVELS
Please indicate which type of simulation modality is / can be applicable as far as simulation is concerned:
(i) = Low-tech simulation modalities (such as simple three-dimensional organ models; basic plastic manikin and simple skills trainers; animal models; human cadavers; and simulated or standardised patients).
(ii) = High-tech simulation modalities (such as screen-based simulators; realistic, high-fidelity procedural simulators (task trainers); realistic, high-tech interactive patient simulators; and virtual reality).
Please mark the appropriate box(es) with an X. Mark one or two choices (low-tech and/or high-tech).

Please indicate which level of learning is / can be addressed by simulation according to the following scale displaying the various cognitive levels: (*cf.* definitions in accompanying letter to Delphi experts).

A = Remembering (knowledge); B = Understanding (comprehension); C = Applying (application);
D = Analysing (analysis); E = Evaluating (synthesis); F = Creating (evaluation).
Please mark the appropriate box(es) with an X. Mark any number of choices (The six cognitive levels of learning)
OR
Cognitive level of learning: Please give your opinion on the value of simulation as a learning method, for example, will it help the student to remember facts, leading to understand concepts, applying skills, helping to analyse, diagnose or compile a treatment plan/management plan/procedure. Please see end of each section.

	SECTION A **SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Surgical Care – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
1	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modalities**		**Cognitive levels**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of basic medical sciences (e.g., electrolyte and fluid balance, haemostasis, wound healing and sepsis)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the principles utilised to ensure surgical safety (e.g., consent, patient positioning, aseptic techniques, skin	1	2	3	(i)	(ii)	A	B	C	D	E	F

	preparation, universal precautions and the use of appropriate instruments)											
c	*Examines surgical patients while using algorithms like ATLS (advance trauma life support) and ACLS (advanced cardiac life support).*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Manages (with assistance) several uncomplicated patients*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs basic techniques in the management of a surgical patient, independently (e.g. urethral catheterisation and nasogastric [NG] tube placement)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Retrieves and categorises information*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
2	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the effects of ageing on surgical patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the impact of pregnancy on the management of surgical patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes the effects of obesity on the management of surgical patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Explains the role of nutrition in the management of surgical patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	Explains the impact of substance abuse in the management of surgical patients (incl. alcohol, tobacco)	1	2	3	(i)	(ii)	A	B	C	D	E	F
f	*Manages (with assistance) a surgical patient with single system disease*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Conducts (with assistance) surgical consultations*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
h	*Performs routine procedures Independently (e.g., central line placement, biopsies, incision and drainage, chest tube placement, laceration repair and wound closure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
i	*Recognises patterns and prioritises management offering at least one solution*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
3	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the role of medical comorbidities in	1	2	3	(i)	(ii)	A	B	C	D	E	F

	surgical patients (e.g., hepatic, renal, cardiac or pulmonary failure												
b	Demonstrates an understanding of psychological conditions (e.g., body dysmorphic syndrome or depression)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of the impact of treatment (e.g., immunosuppression, radiotherapy or chemotherapy)	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Manages (under supervision) a surgical patient afflicted by multi systemic disorders*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently manages multiple surgical consultations and patients*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Identifies exceptions and offers at least three possible solutions*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
4	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates and understanding of the management of complicated multisystemic surgical pathophysiological processes, ranging from intensive care to organ system support	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Identifies and explains potential reasons not to offer surgical services	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the procedures involved in legally and professionally discharging a patient from a surgical practice	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Manages surgical patients with multiple systemic diseases without supervision or support*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages a surgical firm*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Anticipates potential problems and devises management plans or novel solutions*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
5	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Publishes research in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Teaching and supervision of other learners involved in patient management*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
c	*Develops or implements simulation for the teaching and evaluation of surgical*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	skills												
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).												
	If you so whish, please give an example of a simulation or describe a simulation that you have done or that can be done Section A: Surgical care – Medical Knowledge and Patient Care (specific to this section).												
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING ON SECTION A: SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE.												
	SECTION B **WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**												
	This section deals with the five education and training levels of Wound Care – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.												
6	**EDUCATION AND TRAINING LEVEL 1**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**	
a	Demonstrates an understanding of wound, pressure ulcer, necrotising infection and burns with regards to the pathophysiology	1	2	3	(i)	(ii)	A	B	C	D	E	F	
b	Explains wound management (including burns resuscitation, acute and chronic wounds)	1	2	3	(i)	(ii)	A	B	C	D	E	F	
c	*Examines patients with wounds (such as burns, acute or chronic wounds)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*	
d	*Assists with procedures (e.g., burn resuscitation, negative pressure therapy, wound preparation)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*	
e	*Provides routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*	
7	**EDUCATION AND TRAINING LEVEL 2**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**	
a	Explains the indication for intervening in acute or chronic wounds/burns	1	2	3	(i)	(ii)	A	B	C	D	E	F	
b	Identifies high risk patients for developing chronic wounds (e.g., spinal cord injury)	1	2	3	(i)	(ii)	A	B	C	D	E	F	
c	Understands the diagnostic modalities	1	2	3	(i)	(ii)	A	B	C	D	E	F	

	used in assessing wounds (e.g., biopsies, cultures, imaging)												
d	*Explains procedures for managing wounds (e.g. risks, benefits, consent)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs (with assistance) routine procedures (e.g., burn debridement, skin grafts, local flaps, and regional flaps)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Recognises complications arising from procedures, (e.g., infection) and initiates preventative measures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
8	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the treatment of complex wounds (e.g., necrotising infections, pressure ulcers and radiation wounds)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of surgical procedures (e.g., wound bed preparation, skin substitutes, grafts)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Formulates (with assistance) a management plan for wound preparation and closure*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs (with assistance) complex procedures (e.g., microvascular flaps)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
9	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes the effect and outcomes of different treatment options (e.g., dressing changes *vs.* surgical closures)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the principles of complex procedures (e.g., hyperbaric oxygen, vascularized soft tissue coverage)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a management plan for wound preparation and closure (including patients with comorbidities)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Participates in a wound care team*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures independently (e.g., microvascular flaps)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

f	*Independently manages complications*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
10	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Systematically reviews outcomes leading to publication in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Establishes a cost-effective management plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
c	*Functions as the leader of a wound care team*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Helps co-ordinate a burn center*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Develops a plan for occupational rehabilitation*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING SECTION B – WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE.											
	SECTION C **TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Tissue Transfer – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
11	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the basic science behind grafts, flaps, and microvascular transfers	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgically relevant anatomy of grafts, flaps, and microvascular transfers	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Examines patients with reconstructive problems*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs wound care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	independently (e.g., dressings, negative pressure therapy)											
e	*Provides post-operative care for patients that have undergone loco-regional tissue reconstructions*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

12	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the surgical management of soft tissue defects, and designs basic flap types (e.g., local, axial and perforator flaps)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates knowledge of materials used in soft tissue transfer (e.g. suture materials, surgical devices)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Obtains informed consent for grafts, flaps, and other complex wound care options*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs routine procedures with assistance (e.g., debridement, skin grafts, complex wound closures, local flaps, bone graft harvesting)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs microvascular repairs under simulated conditions*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides post-operative care with assistance for microvascular tissue transfer patients*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

13	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes the indications and anatomy of potential tissue transfer options for various defects	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains principles of treatment options for complex wounds	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of complex tissue transfer procedures (e.g., nerve repair or grafting, and composite microvascular transfers)	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Formulates, with assistance, a treatment plan for complex reconstructive surgery*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	(e.g., nerve repair or gaffing, and microvascular tissue transfers) with assistance											
f	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
14	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Independently decides upon treatment choices for soft tissue defects	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains alternatives following complications	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a management plan for complex reconstructive surgery in complicated patients (e.g., with previous surgeries, comorbidities) with comorbidities and previous*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures independently*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complex complications (e.g., loco-regional tissue and microvascular flap compromises) independently*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
15	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Systematically reviews outcomes of tissue transfers leading to publications in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of tissue engineering principles	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Acts as team leader in complex composite tissue reconstruction*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs prefabricated composite tissue transfer*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs vascularized composite allotransplantation*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											

	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING SECTION C - TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE

	SECTION D **CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Congenital Anomalies – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

16	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the embryology of clefts	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes craniofacial anomalies	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the normal anatomy of the craniofacial system	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Examines patients with craniofacial anomalies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assists with craniofacial procedures (e.g., incisions and skin closures)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides paediatric patients with routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

17	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the management of craniofacial patients (diagnosis, basic surgical treatments, and special needs)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the concepts of staged multi-disciplinary treatment in the care of craniofacial patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Obtains informed consent for routine congenital abnormalities (e.g., vascular anomalies, giant congenital nevi, cleft surgery)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs (with assistance) routine procedures for congenital anomalies (e.g., prominent ear*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	correction)											
e	*Recognises complications arising from procedures (e.g., feeding difficulties, airway compromise)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

18	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the timing and indications for staged management protocols for craniofacial patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical anatomy and principles of simple craniofacial procedures (e.g., the steps involved in a cleft repair)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Formulates, with assistance, a management plan for routine congenital anomalies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures (e.g., cleft lip, palate repair) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages (with assistance) complications (e.g., palatal fistulae, exposed expanders)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

19	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the effects of treatments (e.g., cleft care) on craniofacial patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical anatomy and principles of complex craniofacial procedures (e.g., distraction osteogenesis, cranial vault remodelling, secondary cleft deformities)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Formulates, with assistance, a management plan for craniofacial surgery*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures independently*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

e	*Independently manages complications of congenital anomalies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
20	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of a multidisciplinary craniofacial team's composition and management	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Manages complex craniofacial anomalies (e.g., hemifacial microsomia, craniosynostosis) independently*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION D CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION E **HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Head and Neck – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
21	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains benign and malignant diseases of the head and neck area	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the anatomy of the head and neck (e.g., lymphatic drainage, salivary glands, periorbita)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes the staging of head and	1	2	3	(i)	(ii)	A	B	C	D	E	F

	neck malignancies												
d	*Performs history and physical examination of patients with head and neck malignancies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assists with procedures (e.g., excision of minor skin lesions, biopsies)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

22 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates and understanding of the surgical management for cancers of the head and neck (e.g., parotid, pharynx)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the principles of excision (e.g., margins) and reconstruction for head and neck lesions	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of roll of adjunctive modalities (e.g., feeding tubes, tracheostomy)	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent for extirpative and reconstructive procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs (with assistance) routine excisions and reconstructions (e.g., local flaps, skin grafts)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Recognises complications (e.g., flap compromise, orocutaneous fistula, bleeding)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Prescribes post-operative rehabilitation*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

23 EDUCATION AND TRAINING LEVEL 3

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes the indications for different management options (e.g., surgical, non-surgical, ancillary procedures)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains routine procedures' principles (e.g., local flaps, wedge excisions of the lip)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the effects of previous interventions on reconstructive options (e.g., osteoradionecrosis)	1	2	3	(i)	(ii)	A	B	C	D	E	F

d	Describes the management of metastatic disease (regional and distant)	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	*Formulates, with assistance, a management plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Performs complex procedures (e.g., full thickness nasal defects, repair of complex eyelid defects, myocutaneous flaps) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

24	**EDUCATION AND TRAINING LEVEL 4**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the sequelae of surgical interventions (e.g., long term outcomes, post surgery deformities)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical anatomy and principles of complex procedures (e.g., total nasal reconstruction, microsurgical bone transfer, neck dissection)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains adjunctive reconstructive options (e.g., maxillofacial prosthetics, dental implants)	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Independently formulates a management plan for patients with comorbidities*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently performs complex reconstructions (e.g., microvascular soft tissue or bone transfers)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Independently manages complications (e.g., failed microvascular transfers)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

25	**EDUCATION AND TRAINING LEVEL 5**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Discusses novel modalities (diagnostic and treatment) for head and neck cancer	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Helps lead a multidisciplinary head and neck cancer team*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION E HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE
	SECTION F **MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Maxillofacial Trauma – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

26	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains aetiology of facial fractures and soft tissue injuries	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of head and neck anatomy the anatomy of the head and neck	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes facial fracture patterns	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Describes the risks of associated injuries (e.g., cervical spine injury, airway compromise)	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	*Performs the examination of patients with maxillofacial trauma (incl. workup studies)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Assists with procedures (e.g., early fracture stabilisation, suturing lacerations)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Provides routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

27	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes sequelae of (e.g., malocclusion, enopthalmos)	1	2	3	(i)	(ii)	A	B	C	D	E	F

b	Explains the principles of surgical management (e.g., methods of fixation, open *vs*. closed approaches)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of interventions of associated injuries (e.g., tracheostomy)	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Elicits the specific clinical findings associated with soft tissue injuries and common facial fractures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Interprets imaging studies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Obtains informed consent for maxillofacial trauma cases*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Performs (with assistance) routine procedures (e.g., open reduction internal fixation [ORIF], maxilla mandibular fixation [MMF])*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
h	*Recognises complications (e.g.,, cerebrospinal fluid leak, airway compromise)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
28	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of indications and timing for the different management options for facial trauma	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the surgical principles of routine procedures (e.g., eyelid laceration repair, closed nasal reduction, MMF)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Formulates a treatment plan with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs (with assistance) complex procedures (e.g., panfacial fracture management)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
29	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Identifies the late sequelae of facial trauma (e.g., mucocele, ectropion)	1	2	3	(i)	(ii)	A	B	C	D	E	F

b	Describes the surgical principles of complex procedures (e.g., repair NOE with telecanthus, canalicular repair)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Independently formulates a treatment plan	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Independently performs complex procedures	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	Independently manages complications (e.g., facial nerve injuries, nasal airway obstruction)	1	2	3	(i)	(ii)	A	B	C	D	E	F
30	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Publishes research on maxillofacial trauma in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Manages complex secondary deformities (e.g., malocclusion, enopthalmos)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION F MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION G **FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Facial Aesthetics – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
31	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes the normal anatomy of the face	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding	1	2	3	(i)	(ii)	A	B	C	D	E	F

	of the normal proportions, angles and relationships in facial analysis											
c	*Performs focused history and examination of aesthetic facial surgery patients*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Assists with aesthetic facial procedures (e.g., incisions and skin closures)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
32	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the concepts of facial aging and the management options thereof	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the concept of skin resurfacing (e.g., chemical peels, lasers)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Appreciates the role of psychological factors on outcomes in aesthetic facial surgery	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent for facial aesthetic procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs (with assistance) routine facial aesthetic procedures (e.g., scar revision, upper blepharoplasty, harvesting of cartilage grafts, injection of neuromodulators, fat injections)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Recognises complications (e.g., seroma, haematoma, necrosis, wound dehiscence)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
33	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding for the role of different treatment options for addressing the aging face	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the principles of non-surgical and surgical procedures, (e.g., peels, fillers, neuromodulators, blepharoplasties, facelifts, rhinoplasties)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Formulates a management plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	with assistance											
d	*Performs complex procedures (e.g., tip rhinoplasty, facelifts, neck-lifts) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

34 EDUCATION AND TRAINING LEVEL 4

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes the effects of treatment of non-surgical and surgical options	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles of complex treatments for the aging face, (e.g., secondary rhinoplasties, deep plane facelifts, endoscopic procedures)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Discusses the dynamics of combining various procedures for treatment of the ageing face	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Independently formulates a treatment plan for aesthetic facial surgery patients*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently performs procedures (e.g., lower blepharoplasties, primary rhinoplasties, and facelifts)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Independently manages complications*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

35 EDUCATION AND TRAINING LEVEL 5

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Contributes to research in aesthetic facial surgery leading to publication in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Independently treats complex secondary deformities of previous surgery*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
c	*Leads a multidisciplinary team for the treatment of facial aesthetics*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).

	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION G FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE

SECTION H
NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Non-Cancer Breast Surgery – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

36 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of benign breast conditions (e.g., gynecomastia, hypermastia, ptosis congenital anomalies)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains breast embryology, anatomy, and physiology	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes principles of imaging for benign breast conditions	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Performs examination of patients with a benign breast condition*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Orders imaging studies and diagnostic tests*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Assists with breast procedures (e.g., incisions and skin closures)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Provides routine post-operative care for the breast patient*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

37 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the surgical treatment for benign breast conditions	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains concepts of proportions of the breast, aesthetic ideals, and symmetry	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Shows an understanding of the	1	2	3	(i)	(ii)	A	B	C	D	E	F

		Simulation			Proposed simulation modality		Cognitive level					
	different types of breast implants											
d	*Interprets diagnostic studies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Obtains informed consent for breast procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Performs routine procedures (e.g., mastopexy, gynecomastia, reduction mammoplasty) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Recognises complications (e.g., infection, implant complications, hematoma)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

38 EDUCATION AND TRAINING LEVEL 3

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Recognises indications for treatment options (e.g., skin/ parenchyma reduction, augmentation)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles of routine surgical procedures (e.g., mastopexy, reduction mammoplasty, augmentation mammoplasty)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Formulates (with assistance) a treatment plan for routine breast procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures (e.g., congenital breast deformity, augmentation/ mastopexy) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

39 EDUCATION AND TRAINING LEVEL 4

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the effect of surgery on breast sensation, nipple areolar perfusion, and lactation	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the principles of complex surgical procedures (e.g., tuberous breast deformity, augmentation/ mastopexy)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes evolving technologies such as fat grafting	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently performs complex*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	procedures												
f	*Independently manages complications*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Independently manages secondary deformities*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
h	*Independently manages the dissatisfied patient*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

40 EDUCATION AND TRAINING LEVEL 5

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Systematically reviews patient outcomes	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Publishes in peer-reviewed journals*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).

Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):

ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION H NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE

SECTION I
BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Breast Reconstruction – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

41 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the pathophysiology of malignant breast disease	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the anatomy of the breast and its lymphatic drainage	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Performs history and physical examination of the breast cancer patient*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

d	*Assists with procedures (e.g., incisions and skin closure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Provides routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

42	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains surgical treatment for malignant breast disease	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the principles of implant-based breast reconstruction	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Obtains informed consent for breast reconstruction procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs (with assistance) routine procedures (e.g., tissue expander insertion, flap elevation)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Recognises complications (e.g., implant complications, flap compromise)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

43	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the role of adjuvant treatment	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the impact of primary and adjuvant treatment on breast reconstruction	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the principles of breast reconstruction using pedicled flaps	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Formulates a treatment plan with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures (e.g., treatment of the contralateral breast, microsurgical procedures) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
44	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**			**Proposed simulation modality**		**Cognitive level**					

	***italics*), relate to patient care.**	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the late effects of chemotherapy and radiation on breast reconstruction	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the surgical principles of the various microsurgical breast reconstruction options	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Independently performs complex procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently manages complications*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

45 EDUCATION AND TRAINING LEVEL 5

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Publishes research in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Manages complicated patients with multiple previous treatment failures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
c	*Assists in leading a multidisciplinary team*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Teaches breast reconstructive procedures*	1	2	3	(i)	(ii)	A	B	C	D	E	F

Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).

Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):

ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION I BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE

SECTION J
RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Reconstruction of Trunk and Perineum – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

46 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to	**Simulation**	**Proposed**	**Cognitive level**

	medical knowledge and the second (shaded and *typed in italics*), relate to patient care.				simulation modality							
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of benign, malignant and congenital conditions of the perineum/trunk	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the anatomy of the back, perineum, chest and abdominal wall	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of pressure off-loading, nutrition and respiratory mechanics	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Takes a history and performs an examination of a patient with perineal/truncal defects*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assisting with procedures (e.g., incisions and wound closure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

47	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Explains the concepts of wound management, return of abdominal domain, and chest wall stability	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the indications for the provision of dynamic support, cover of vital structures, and functional restoration	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of the management of major defects in stages	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs, with assistance, routine procedures (e.g., component separation, debridement, musculocutaneous flaps)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Recognises complications (e.g., organ failure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

48	**EDUCATION AND TRAINING LEVEL 3**			
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**	**Proposed simulation modality**	**Cognitive level**

	***italics*), relate to patient care.**	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of surgical management of congenital abnormalities, chest wall defects, hernias, pressure ulcers and irradiated wounds	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the principles of routine surgical procedures (e.g., component separation, hernia repair and pressure ulcer reconstruction)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the uses of synthetic and biologic materials	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Formulates, with assistance, a treatment plan for routine conditions*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures (e.g., urogenital reconstruction, composite chest wall reconstruction) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

49 EDUCATION AND TRAINING LEVEL 4

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the impact of treatment on cardiopulmonary, gastrointestinal, musculoskeletal and genitourinary functioning	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles of complex surgical procedures (e.g., recurrent ventral hernia, perineal reconstruction, composite chest wall defects)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures independently*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently manages*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

50 EDUCATION AND TRAINING LEVEL 5

	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**	**Proposed simulation modality**	**Cognitive level**

	italics), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Publishes research in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Independently manages complex secondary perineal and truncal deformities*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION J RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE											

	SECTION K **UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Upper Extremity Trauma – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.
51	**EDUCATION AND TRAINING LEVEL 1**

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of soft-tissue injuries, dislocations and common fractures.	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the anatomy, basic biomechanics and function of the upper extremity	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the principles of casting/splinting	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Performs examination of patients with upper extremity*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assists with procedures (e.g., applying splints, making incisions, and doing dressings)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

52	**EDUCATION AND TRAINING LEVEL 2**

	The first statements relate to	**Simulation**	**Proposed**	**Cognitive level**

	medical knowledge and the second (shaded and *typed in italics*), relate to patient care.				simulation modality							
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the principles of bony stabilisation and soft tissue coverage	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles of flap cover and bony fixation	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of the management of acute compartment syndrome and vascular injuries	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent for the surgical management of traumatic upper limb injuries*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs, with assistance, routine procedures (e.g., repair of tendon / nerve injuries or simple hand fractures)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Recognises complications (e.g., compartment syndrome, vascular compromise)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
53	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of complicating factors (e.g., vascular compromise, bone loss, exposed critical structures)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles of tendon, nerve, vessel, and bony repairs	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of the principles involved in post-operative regimens for hand therapy	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Formulates, with assistance, a treatment plan for common hand injuries (e.g., fracture/dislocation, tendon injury)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures (e.g., microvascular flap coverage, hand revascularisation, repair of the mangled hand) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
54	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to	**Simulation**			**Proposed**		**Cognitive level**					

	medical knowledge and the second (shaded and *typed in italics*), relate to patient care.				simulation modality							
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Explains tendon transfer biomechanics	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles involved in reconstruction of complex problems (e.g., replantation, secondary tendon reconstruction, nerve grafting)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the role of chronic regional pain syndrome, secondary rehabilitation and prosthetics	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently performs complex procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Independently manages complications*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

55	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the principles involved in tendon and nerve transfers for brachial plexus / combined nerve injuries	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the multidisciplinary management of hand injuries in a dedicated hand unit.	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Publishes research in peer-reviewed journals*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Manages work-related injuries and return-to-work issues*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages chronic regional pain syndrome*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION K UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE											

SECTION L
NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Non-Trauma Hand – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

56 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the pathophysiology of non-traumatic hand conditions (e.g., compression neuropathy, degenerative changes, infection)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the embryology, anatomy and biomechanics of the upper extremity and hand	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Performs history and examination of patients with non-traumatic hand disorders*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Assists with procedures (e.g., injections, abscess drainage, skin incisions and closure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

57 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Explains the treatment options for compression neuropathy, degenerative changes, infection of the upper limb and hand	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the concepts of injections, pharmacologic management, incision, and drainage	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes principles of anaesthesia for the upper extremity (e.g., local and regional)	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent for congenital and non-trauma hand reconstruction procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs, with assistance, routine procedures (e.g., tumor excision, ganglion removal, nerve decompression)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

58	EDUCATION AND TRAINING LEVEL 3											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes management options for contractures and metabolic processes	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains principles of routine surgical procedures (e.g., tumour and ganglion excisions, fusions, nerve releases, and contracture releases)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes the post-operative hand therapy regimens	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Formulates a treatment plan with assistance for routine hand conditions*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures (e.g., syndactyly reconstruction, tendon transfers, arthroplasty, contracture release) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

59	EDUCATION AND TRAINING LEVEL 4											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the management of congenital and autoimmune conditions	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes surgical principles for complex procedures (e.g., syndactyly release, ligament reconstructions, arthroplasties, and tendon transfers)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Independently performs complex procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

60	EDUCATION AND TRAINING LEVEL 5		
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**	**Proposed simulation modality**	**Cognitive level**

	italics), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Explains the surgical anatomy and principles for complex procedures (e.g., thumb reconstructions, congenital hand reconstruction, nerve transfers, rheumatoid hand reconstruction)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Formulates a treatment plan for complex congenital hand and rheumatoid deformities*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
c	*Performs toe-to-hand transfers, pollicisations, implant arthroplasty*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Helps manage a multidisciplinary hand surgery team*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION L NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE											

	SECTION M **COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Cosmetic Trunk and Lower Extremity – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
61	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the pathophysiology of lipodystrophy and obesity	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Discusses the effects of aging	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the effect of massive weight loss	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Describes the anatomy and aesthetic ideals of the lower extremities and trunk	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	Explains the concept of weight	1	2	3	(i)	(ii)	A	B	C	D	E	F

	management (e.g. diet and exercise)												
f	Explains deep venous thrombosis and pulmonary embolism risk factors, workup, and management	1	2	3	(i)	(ii)	A	B	C	D	E	F
g	*Performs physical examination of patients with aesthetic and functional problems of the trunk and lower extremity*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
h	*Assists with procedures (e.g., skin incision and closure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
i	*Provides routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
62	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of bariatric surgery (e.g. indications, different types, their metabolic effects)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Identifies factors influencing patient selection for body contouring surgery	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the physiological effects of liposuction	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Describes the different aesthetic ideals based on a patient's gender	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	Explains the benefit of multidisciplinary bariatric teams	1	2	3	(i)	(ii)	A	B	C	D	E	F
f	*Obtains informed consent for routine cosmetic trunk and lower limb procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Performs routine procedures (e.g., panniculectomy, abdominoplasty)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
h	*Recognises complications (e.g., skin loss, thromboembolism, seroma)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
63	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the management options for massive weight loss patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes surgical principles of	1	2	3	(i)	(ii)	A	B	C	D	E	F

	routine procedures (e.g., brachioplasty, medial thigh lift, liposuction abdominoplasty)											
c	*Formulates a treatment plan with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs, with assistance, complex procedures (e.g., brachioplasty, circumferential body lift)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

64 EDUCATION AND TRAINING LEVEL 4

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Differentiates between aesthetic and functional problems	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the surgical principles of complex procedures	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Independently performs complex procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently manages complications*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

65 EDUCATION AND TRAINING LEVEL 5

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Systematically reviews outcomes and publishes in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Manages patients with multiple prior surgeries / unsatisfactory previous results*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION M COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE

	SECTION N **LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Lower Extremity – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

66 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the pathophysiology of congenital and acquired conditions of the lower extremity (e.g., trauma, cancer, diabetic foot, venous and arterial insufficiency)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the anatomy of the lower extremity	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the classification systems for soft tissue and bone loss of the lower extremity	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Performs history and physical examination of patients with lower extremity concerns*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assists with procedures (e.g., splint application, dressings, skin incision and closure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

67 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the principles of non-operative treatment for lower extremity conditions (e.g., lymphoedema, neuropathic ulcers)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical principles for lower extremity surgery (e.g., timing and staging of procedures)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Obtains informed consent for surgical procedures of the lower extremity*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

		Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
d	*Performs routine procedures (e.g., skin grafts) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Recognises complications (e.g., compartment syndrome, flap compromise)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
68	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the indications for treatment of conditions of the lower extremity (e.g., compartment syndrome, tumor resection, exposed prostheses, arterial insufficiency, and musculoskeletal injury)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical principles of routine procedures (e.g., local flaps, skin grafting, wound debridement)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Formulates a treatment plan with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures (e.g., free tissue transfer) with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
69	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the role of adjunctive modalities (e.g. prosthetics)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical principles of complex procedures (e.g., free tissue transfers, and perforator flaps)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures independently*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently manages complications*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
70	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**			**Proposed simulation modality**		**Cognitive level**					

	***italics*), relate to patient care.**	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the principles of microsurgical treatment of lymphoedema, tendon and nerve transfers of the lower extremity	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Helps lead a multidisciplinary team for limb salvage*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION N: LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE											

	SECTION O **SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT**
	This section deals with the five education and training levels of Systems-based Practice - Patient Safety, Resource allocation and Practice management. The resident should reach the descriptors of performance on the specific level.

71	**EDUCATION AND TRAINING LEVEL 1**	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the differences between sentinel events, near misses, and medical errors	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the roles of team members	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Describes practice variations in resource consumption, such as the utilization of diagnostic tests*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Explains basic health payment systems, including uninsured care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Describes different practice models*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

72	**EDUCATION AND TRAINING LEVEL 2**			
	The first statements relate to patient safety and, the second	**Simulation**	**Proposed simulation**	**Cognitive level**

	(shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Participates in the use of tools (e.g., briefings and checklists) to prevent adverse events	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the common system causes for errors	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Describes the cost implications of using resources*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Describes the principles of evaluation, management, and procedure coding*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Compares and contrasts different practice models*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
73	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Consistently uses tools (e.g., briefings and checklists) to prevent adverse occurrences	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Reports problematic devices, processes and behaviours, including near misses and errors	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Participates in responsible use of health care resources, seeking appropriate assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Codes routine encounters, diagnoses, and surgical procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Recognises basic elements needed to establish practice (e.g., facility accreditation, compliance, staffing, contracts, malpractice insurance, negotiations)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
74	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Formally uses proven analysis methods to evaluate shared team experiences to prevent future	1	2	3	(i)	(ii)	A	B	C	D	E	F

	errors												
b	Leads team by promoting input and situational awareness by all team members	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Improves patient safety by conducting morbidity and mortality meetings	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Practises cost-effective care (e.g., operative efficiency, managing length of stay)	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	*Codes complex and unusual encounters, diagnoses, and procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Establishes timeline and identifies resources for transition to practice*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
75	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Leads curriculum design activities to develop communication skills and teamwork of health care professionals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Assists in leading a multidisciplinary team to address patient safety issues	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Designs measurement tools provide feedback to providers on resource consumption*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Participates in advocacy activities for health policy*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Creates curriculum to teach practice management*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION O: SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT											
	SECTION P **PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE, AND RESEARCH AND TRAINING**											
	This section deals with the five education and training levels of Practice-based Learning and Improvement – Investigate, Evaluate, Assimilate, and Research and Training. The resident should reach the descriptors of performance on the specific level.											
76	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to investigating, evaluating and	**Simulation**			**Proposed simulation**		**Cognitive level**					

	assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
					modality							
a	Shows awareness of one's own level of knowledge and expertise	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Identifies learning resources	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Demonstrates an understanding of the basic concepts in clinical reasoning, biostatistics, clinical epidemiology*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Participates in the education of patients and their families*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

77 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Continually seeks to improve performance by incorporating feedback	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Uses published guidelines and articles in a learning plan	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Ranks study designs and is able to distinguish relevant research outcomes*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Teaches patients and their families*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

78 EDUCATION AND TRAINING LEVEL 3

	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates a balanced and accurate self-assessment of competence	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Selects an appropriate evidence-based information tool to answer specific questions	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Able to critically appraise different research types (e.g., systematic reviews and meta-analyses)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Teaches health professionals and colleagues in both informal and formal settings*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

79	EDUCATION AND TRAINING LEVEL 4											
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates improvement in clinical outcomes based on continual self-assessment	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Performs self-directed learning with minimal external guidance, using evidence-based information tools	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Formulates a researchable question, describes a plan to investigate it, and executes a research project*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Organises educational activities at programme level*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

80	EDUCATION AND TRAINING LEVEL 5											
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Consistently incorporates evidence-based information in common areas of practice	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Independently plans and executes a research programme	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Develops educational curriculum and assessment tools	1	2	3	(i)	(ii)	A	B	C	D	E	F
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION P PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE, AND RESEARCH AND TRAINING											

	SECTION Q **PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY**
	This section deals with the five education and training levels of Professionalism – Ethics and Values, and Personal Accountability. The resident should reach the descriptors of performance on the specific level.

81	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Is able to identify ethical issues in plastic surgery	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates behaviour that conveys honesty, caring and genuine interest in patients and families	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Explains and manages issues related to fatigue and sleep deprivation*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Exhibits professional behaviour (e.g., confidentiality, integrity, diligence, and reliability)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
82	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Is able to analyse, discuss and manage common ethical situation	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates behaviour that shows insight in the impact of one's core values and beliefs regarding patient care	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Demonstrates management of physical, mental, personal and emotional health*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Recognises individual limits in clinical situations and asks for assistance when needed*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
83	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Analyses and manages ethical issues in challenging and complicated situations	1	2	3	(i)	(ii)	A	B	C	D	E	F

b	Demonstrates an understanding of the beliefs, practices and values of diverse and vulnerable patient populations	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Manages situations in which maintaining physical, mental and personal health is challenged*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Acknowledges conflicting interests of self, family, and others, and their effects on the delivery of medical care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
84	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Uses a systemic approach to manage ethical issues, including conflicts of interest, billing and advertising	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Develops a mutually agreeable care plan in the context of conflicting physician and patient values and beliefs	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Recognises signs of physician impairment and demonstrates appropriate steps to address impairment in self and in colleagues*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Prioritises and balances conflicting interests of self, family, and others to optimise medical care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
85	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Helps lead institutional and organisational ethics programmes	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Develops programmes to ensure equality of care in diverse, vulnerable, and underserved populations	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Helps develop institutional and organisational strategies to improve physician wellness*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											

	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY
	SECTION R **INTERPERSONAL AND COMMUNICATION SKILLS**
	This section deals with the five education and training levels of Interpersonal and Communication Skills. The resident should reach the descriptors of performance on the specific level.

86	**EDUCATION AND TRAINING LEVEL 1**												
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Develops a positive relationship with patients and teams, in uncomplicated situations	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the patient's/family's perspective	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Utilises interpreters as needed	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Appreciates effective communication to prevent medical errors	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	Participates in effective transitions of care	1	2	3	(i)	(ii)	A	B	C	D	E	F
f	Uses photographic documentation with safeguards for privacy	1	2	3	(i)	(ii)	A	B	C	D	E	F

87	**EDUCATION AND TRAINING LEVEL 2**												
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Manages conflict (such as with patient, family, and teams)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Ensures that the patient is able to participate in health care decision-making, by incorporating the cultural and social contexts	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Ensures that the medical records, are accurate, and complete	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Demonstrates an understanding of the effects of computer use on information accuracy	1	2	3	(i)	(ii)	A	B	C	D	E	F

e	Demonstrates an understanding of the potential effects of the physician/patient relationship	1	2	3	(i)	(ii)	A	B	C	D	E	F

88 EDUCATION AND TRAINING LEVEL 3

	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Manages complex and challenging situations, including transitions of care	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Conveys emotionally difficult information to patients on a individually applicable basis	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Optimises communication across systems	1	2	3	(i)	(ii)	A	B	C	D	E	F

89 EDUCATION AND TRAINING LEVEL 4

	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Negotiates and manages conflict in complex and challenging situations	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Develops working relationships across specialities	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Organises and facilitates family/health care team conferences	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Uses multiple forms of communication ethically and with respect for patient privacy	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	Demonstrates an understanding of the use of ethical marketing practices	1	2	3	(i)	(ii)	A	B	C	D	E	F

90 EDUCATION AND TRAINING LEVEL 5

	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Develops models/approaches to managing difficult communications	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Coaches others to improve	1	2	3	(i)	(ii)	A	B	C	D	E	F

	communication skills											

	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION R INTERPERSONAL AND COMMUNICATION SKILLS

Thank you for completing the questionnaire!

QUESTIONNAIRE FOR DELPHI PANEL: ROUND ONE

Please take note of the following definitions regarding the cognitive learning levels.

Please note: to be able at each subsequent level, all the previous levels need to be in place.

Different cognitive levels of learning

Students to remember facts, leading to level of understanding facts, leading to understanding concepts, applying skills, helping to analyse, diagnose or compile a treatment plan / procedure.

A: Remembering (knowledge): Knowledge reproduction – memorisation, remembering and recalling – student will remember facts, concepts

B: Understanding (comprehension): Basic level of understanding – student will be able to understand

C: Development and applying (application) of clinical and other skills: To use abstract ideas, principles, or theories in concrete situations in order to solve clinical problems – student will be able to apply skills, solve problems

D: Analysing (analysis): Taking apart a concept into its different elements to expose the relationship between the elements – student will be able to analyse

E: Evaluating (evaluation): Assessing, judging, appraising, forming and opinion – student will be able, or example, to diagnose

F: Creating (synthesis): Putting together parts, combining into a (new) whole – student will be able, for example, to compile a treatment plan / management plan / procedure

APPENDIX H LETTER ON FEEDBACK: DELPHI ROUND ONE

APPENDIX H

LETTER ON FEEDBACK: DELPHI ROUND ONE

Netcare Mulbarton Hospital
25 True North Road
Mulbarton
Johannesburg
2059

Name and address of expert

SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING

Dear Delphi participant

Thank you for having participated in the Delphi Process Round One. Attached please find the results of the first round of the Delphi process. This feedback is sent to you with the sole purpose of providing you with the results and information regarding the first round. YOU NEED NOT DO ANYTHING WITH IT.

In Round One of this Delphi process, out of 453 statements, consensus was reached in 76.6% of these statements. In other words, for Round Two, only the remaining 106 statements are left for your consideration (*this questionnaire will reach you soon*).

Attached please find feedback on Round One. All questions on which consensus have been reached, have been crossed out. Round Two of the Delphi process will reach you soon. That document will not include all the questions on which consensus has been reached. It will therefore be a much shortened questionnaire.

Dr Corné PG Nel
MBChB, MHPE, FC Plastic Surgery, MMed (Plastic Surgery)
Student number: 2000003430
Ethics approved number: ECUFS122/2015

APPENDIX I FEEDBACK: QUESTIONNAIRE FOR DELPHI PANEL: ROUND ONE

APPENDIX I

FEEDBACK: QUESTIONNAIRE FOR DELPHI PANEL: ROUND ONE

INSTRUCTIONS TO COMPLETE DELPHI QUESTIONNAIRE REGARDING SIMULATION
Please indicate how important each of the following statements is according to the following scale:

1 = Simulation can be regarded as one of the **essential** methods to train a plastic surgeon.
2 = Simulation may be **useful** as one of the methods to train a plastic surgeon.
3 = Simulation is **not** an **applicable** method to train a plastic surgeon and can be excluded as a training method.
Please mark the appropriate box with an X. Mark only one of the three choices (Essential, Useful, Not applicable).

If you indicated 1 or 2 as an option, please also answer to the next two categories (simulation modality and cognitive level). If you indicated 3, go directly to the next Education and Training level.

INSTRUCTIONS TO COMPLETE QUESTIONNAIRE REGARDING MODALITIES AND LEVELS
Please indicate which type of simulation modality is / can be applicable as far as simulation is concerned:
(i) = Low-tech simulation modalities (such as simple three-dimensional organ models; basic plastic manikin and simple skills trainers; animal models; human cadavers; and simulated or standardised patients).
(ii) = High-tech simulation modalities (such as screen-based simulators; realistic, high-fidelity procedural simulators (task trainers); realistic, high-tech interactive patient simulators; and virtual reality).
Please mark the appropriate box(es) with an X. Mark one or two choices (low-tech and/or high-tech).

Please indicate which level of learning is / can be addressed by simulation according to the following scale displaying the various cognitive levels: (*cf.* definitions in accompanying letter to Delphi experts).

A = Remembering (knowledge); B = Understanding (comprehension); C = Applying (application);
D = Analysing (analysis); E = Evaluating (synthesis); F = Creating (evaluation).
Please mark the appropriate box(es) with an X. Mark any number of choices (The six cognitive levels of learning)
OR
Cognitive level of learning: Please give your opinion on the value of simulation as a learning method, for example, will it help the student to remember facts, leading to understand concepts, applying skills, helping to analyse, diagnose or compile a treatment plan/management plan/procedure. Please see end of each section.

	SECTION A **SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Surgical Care – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
1	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modalities**		**Cognitive levels**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of basic medical sciences (e.g., electrolyte and fluid balance, haemostasis, wound healing and sepsis)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the principles utilised to ensure surgical safety (e.g., consent, patient positioning, aseptic techniques, skin	1	2	3	(i)	(ii)	A	B	C	D	E	F

	preparation, universal precautions and the use of appropriate instruments)											
c	*Examines surgical patients while using algorithms like ATLS (advance trauma life support) and ACLS (advanced cardiac life support).*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Manages (with assistance) several uncomplicated patients*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs basic techniques in the management of a surgical patient, independently (e.g. urethral catheterisation and nasogastric [NG] tube placement)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Retrieves and categorises information*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
2	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the effects of ageing on surgical patients	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the impact of pregnancy on the management of surgical patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes the effects of obesity on the management of surgical patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Explains the role of nutrition in the management of surgical patients	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
e	Explains the impact of substance abuse in the management of surgical patients (incl. alcohol, tobacco)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
f	*Manages (with assistance) a surgical patient with single system disease*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Conducts (with assistance) surgical consultations*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
h	*Performs routine procedures Independently (e.g., central line placement, biopsies, incision and drainage, chest tube placement, laceration repair and wound closure)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
i	*Recognises patterns and prioritises management offering at least one solution*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
3	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the role of medical comorbidities in surgical patients (e.g., hepatic, renal, cardiac or pulmonary failure	1	2	3	(i)	(ii)	A	B	C	D	E	F

b	Demonstrates an understanding of psychological conditions (e.g., body dysmorphic syndrome or depression)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of the impact of treatment (e.g., immunosuppression, radiotherapy or chemotherapy)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Manages (under supervision) a surgical patient afflicted by multi systemic disorders*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently manages multiple surgical consultations and patients*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Identifies exceptions and offers at least three possible solutions*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
4	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates and understanding of the management of complicated multisystemic surgical pathophysiological processes, ranging from intensive care to organ system support	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Identifies and explains potential reasons not to offer surgical services	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Explains the procedures involved in legally and professionally discharging a patient from a surgical practice	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Manages surgical patients with multiple systemic diseases without supervision or support*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages a surgical firm*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Anticipates potential problems and devises management plans or novel solutions*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
5	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Publishes research in peer-reviewed journals	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	*Teaching and supervision of other learners involved in patient management*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
c	*Develops or implements simulation for the teaching and evaluation of surgical skills*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method											

	(see page 1 of questionnaire as well as last page of this document).
	If you so whish, please give an example of a simulation or describe a simulation that you have done or that can be done Section A: Surgical care – Medical Knowledge and Patient Care (specific to this section).
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING ON SECTION A: SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE.

SECTION B
WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Wound Care – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

6 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of wound, pressure ulcer, necrotising infection and burns with regards to the pathophysiology	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains wound management (including burns resuscitation, acute and chronic wounds)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Examines patients with wounds (such as burns, acute or chronic wounds)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Assists with procedures (e.g., burn resuscitation, negative pressure therapy, wound preparation)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

7 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the indication for intervening in acute or chronic wounds/burns	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Identifies high risk patients for developing chronic wounds (e.g., spinal cord injury)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Understands the diagnostic modalities used in assessing wounds (e.g.,	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F

	biopsies, cultures, imaging)											
d	*Explains procedures for managing wounds (e.g. risks, benefits, consent)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs (with assistance) routine procedures (e.g., burn debridement, skin grafts, local flaps, and regional flaps)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Recognises complications arising from procedures, (e.g., infection) and initiates preventative measures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
8	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the treatment of complex wounds (e.g., necrotising infections, pressure ulcers and radiation wounds)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of surgical procedures (e.g., wound bed preparation, skin substitutes, grafts)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Formulates (with assistance) a management plan for wound preparation and closure*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs (with assistance) complex procedures (e.g., microvascular flaps)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
9	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes the effect and outcomes of different treatment options (e.g., dressing changes *vs.* surgical closures)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the principles of complex procedures (e.g., hyperbaric oxygen, vascularized soft tissue coverage)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a management plan for wound preparation and closure (including patients with comorbidities)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Participates in a wound care team*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures independently (e.g., microvascular*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	flaps)											
f	*Independently manages complications*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

10	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Systematically reviews outcomes leading to publication in peer-reviewed journals	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	*Establishes a cost-effective management plan*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
c	*Functions as the leader of a wound care team*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Helps co-ordinate a burn center*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Develops a plan for occupational rehabilitation*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).

Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):

ANY FURTHER COMMENTS ON EDUCATION AND TRAINING SECTION B – WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE.

SECTION C
TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Tissue Transfer – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

11	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the basic science behind grafts, flaps, and microvascular transfers	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgically relevant anatomy of grafts, flaps, and microvascular transfers	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F

c	*Examines patients with reconstructive problems*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs wound care independently (e.g., dressings, negative pressure therapy)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Provides post-operative care for patients that have undergone loco-regional tissue reconstructions*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
12	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the surgical management of soft tissue defects, and designs basic flap types (e.g., local, axial and perforator flaps)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates knowledge of materials used in soft tissue transfer (e.g. suture materials, surgical devices)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Obtains informed consent for grafts, flaps, and other complex wound care options*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs routine procedures with assistance (e.g., debridement, skin grafts, complex wound closures, local flaps, bone graft harvesting)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs microvascular repairs under simulated conditions*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides post-operative care with assistance for microvascular tissue transfer patients*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
13	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes the indications and anatomy of potential tissue transfer options for various defects	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains principles of treatment options for complex wounds	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of complex tissue transfer procedures (e.g., nerve repair or grafting, and composite microvascular transfers)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Formulates, with assistance, a treatment plan for complex reconstructive surgery*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

e	*Performs complex procedures (e.g., nerve repair or gaffing, and microvascular tissue transfers) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
14	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Independently decides upon treatment choices for soft tissue defects	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains alternatives following complications	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a management plan for complex reconstructive surgery in complicated patients (e.g., with previous surgeries, comorbidities) with comorbidities and previous*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures independently*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complex complications (e.g., loco-regional tissue and microvascular flap compromises) independently*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
15	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Systematically reviews outcomes of tissue transfers leading to publications in peer-reviewed journals	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of tissue engineering principles	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Acts as team leader in complex composite tissue reconstruction*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs prefabricated composite tissue transfer*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs vascularized composite allotransplantation*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done											

	(specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING SECTION C - TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE

	SECTION D **CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Congenital Anomalies – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

16	**EDUCATION AND TRAINING LEVEL 1**													
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**							
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**		
a	Demonstrates an understanding of the embryology of clefts	1	2	3	(i)	(ii)	A	B	C	D	E	F		
b	Describes craniofacial anomalies	1	2	3	(i)	(ii)	A	B	C	D	E	F		
c	Explains the normal anatomy of the craniofacial system	1	2	3	(i)	(ii)	A	B	C	D	E	F		
d	*Examines patients with craniofacial anomalies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*		
e	*Assists with craniofacial procedures (e.g., incisions and skin closures)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*		
f	*Provides paediatric patients with routine post-operative care*	~~1~~	~~2~~	~~3~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*		

17	**EDUCATION AND TRAINING LEVEL 2**													
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**							
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**		
a	Demonstrates an understanding of the management of craniofacial patients (diagnosis, basic surgical treatments, and special needs)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F		
b	Demonstrates an understanding of the concepts of staged multi-disciplinary treatment in the care of craniofacial patients	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F		
c	*Obtains informed consent for routine congenital abnormalities (e.g., vascular anomalies, giant congenital nevi, cleft surgery)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*		
d	*Performs (with assistance) routine*	~~1~~	~~2~~	~~3~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*		

	procedures for congenital anomalies (e.g., prominent ear correction)												
e	*Recognises complications arising from procedures (e.g., feeding difficulties, airway compromise)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
18	**EDUCATION AND TRAINING LEVEL 3**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the timing and indications for staged management protocols for craniofacial patients	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical anatomy and principles of simple craniofacial procedures (e.g., the steps involved in a cleft repair)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Formulates, with assistance, a management plan for routine congenital anomalies*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures (e.g., cleft lip, palate repair) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages (with assistance) complications (e.g., palatal fistulae, exposed expanders)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
19	**EDUCATION AND TRAINING LEVEL 4**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the effects of treatments (e.g., cleft care) on craniofacial patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical anatomy and principles of complex craniofacial procedures (e.g., distraction osteogenesis, cranial vault remodelling, secondary cleft deformities)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Formulates, with assistance, a management plan for craniofacial surgery*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures independently*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

e	*Independently manages complications of congenital anomalies*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
20	**EDUCATION AND TRAINING LEVEL 5**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of a multidisciplinary craniofacial team's composition and management	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	*Manages complex craniofacial anomalies (e.g., hemifacial microsomia, craniosynostosis) independently*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).												
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):												
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION D CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE												
	SECTION E **HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE**												
	This section deals with the five education and training levels of Head and Neck – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.												
21	**EDUCATION AND TRAINING LEVEL 1**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains benign and malignant diseases of the head and neck area	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains the anatomy of the head and neck (e.g., lymphatic drainage, salivary glands, periorbita)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Describes the staging of head and neck malignancies	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F

d	*Performs history and physical examination of patients with head and neck malignancies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assists with procedures (e.g., excision of minor skin lesions, biopsies)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
22	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates and understanding of the surgical management for cancers of the head and neck (e.g., parotid, pharynx)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the principles of excision (e.g., margins) and reconstruction for head and neck lesions	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of roll of adjunctive modalities (e.g., feeding tubes, tracheostomy)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent for extirpative and reconstructive procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs (with assistance) routine excisions and reconstructions (e.g., local flaps, skin grafts)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Recognises complications (e.g., flap compromise, orocutaneous fistula, bleeding)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Prescribes post-operative rehabilitation*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
23	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes the indications for different management options (e.g., surgical, non-surgical, ancillary procedures)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains routine procedures' principles (e.g., local flaps, wedge excisions of the lip)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Explains the effects of previous interventions on reconstructive options (e.g., osteoradionecrosis)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	Describes the management of	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F

	metastatic disease (regional and distant)											
e	*Formulates, with assistance, a management plan*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Performs complex procedures (e.g., full thickness nasal defects, repair of complex eyelid defects, myocutaneous flaps) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

24	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the sequelae of surgical interventions (e.g., long term outcomes, post surgery deformities)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical anatomy and principles of complex procedures (e.g., total nasal reconstruction, microsurgical bone transfer, neck dissection)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Explains adjunctive reconstructive options (e.g., maxillofacial prosthetics, dental implants)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Independently formulates a management plan for patients with comorbidities*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently performs complex reconstructions (e.g., microvascular soft tissue or bone transfers)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Independently manages complications (e.g., failed microvascular transfers)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

25	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Discusses novel modalities (diagnostic and treatment) for head and neck cancer	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	*Helps lead a multidisciplinary head and neck cancer team*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method											

	(see page 1 of questionnaire as well as last page of this document).
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION E HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE
	SECTION F **MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Maxillofacial Trauma – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

26 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains aetiology of facial fractures and soft tissue injuries	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of head and neck anatomy the anatomy of the head and neck	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes facial fracture patterns	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Describes the risks of associated injuries (e.g., cervical spine injury, airway compromise)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
e	*Performs the examination of patients with maxillofacial trauma (incl. workup studies)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Assists with procedures (e.g., early fracture stabilisation, suturing lacerations)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

27 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes sequelae of (e.g., malocclusion, enopthalmos)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F

b	Explains the principles of surgical management (e.g., methods of fixation, open *vs*. closed approaches)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of interventions of associated injuries (e.g., tracheostomy)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Elicits the specific clinical findings associated with soft tissue injuries and common facial fractures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Interprets imaging studies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Obtains informed consent for maxillofacial trauma cases*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Performs (with assistance) routine procedures (e.g., open reduction internal fixation [ORIF], maxilla mandibular fixation [MMF])*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
h	*Recognises complications (e.g.,, cerebrospinal fluid leak, airway compromise)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
28	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of indications and timing for the different management options for facial trauma	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains the surgical principles of routine procedures (e.g., eyelid laceration repair, closed nasal reduction, MMF)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Formulates a treatment plan with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs (with assistance) complex procedures (e.g., panfacial fracture management)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
29	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Identifies the late sequelae of facial trauma (e.g., mucocele, ectropion)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical principles	1	2	3	(i)	(ii)	A	B	C	D	E	F

	of complex procedures (e.g., repair NOE with telecanthus, canalicular repair)											
c	Independently formulates a treatment plan	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	Independently performs complex procedures	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
e	Independently manages complications (e.g., facial nerve injuries, nasal airway obstruction)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
30	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Publishes research on maxillofacial trauma in peer-reviewed journals	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	*Manages complex secondary deformities (e.g., malocclusion, enopthalmos)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION F MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION G **FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Facial Aesthetics – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
31	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDI NG**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes the normal anatomy of the face	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the normal proportions, angles	1	2	3	(i)	(ii)	A	B	C	D	E	F

	and relationships in facial analysis											
c	*Performs focused history and examination of aesthetic facial surgery patients*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Assists with aesthetic facial procedures (e.g., incisions and skin closures)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

32 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the concepts of facial aging and the management options thereof	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains the concept of skin resurfacing (e.g., chemical peels, lasers)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Appreciates the role of psychological factors on outcomes in aesthetic facial surgery	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent for facial aesthetic procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs (with assistance) routine facial aesthetic procedures (e.g., scar revision, upper blepharoplasty, harvesting of cartilage grafts, injection of neuromodulators, fat injections)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Recognises complications (e.g., seroma, haematoma, necrosis, wound dehiscence)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

33 EDUCATION AND TRAINING LEVEL 3

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding for the role of different treatment options for addressing the aging face	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the principles of non-surgical and surgical procedures, (e.g., peels, fillers, neuromodulators, blepharoplasties, facelifts, rhinoplasties)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Formulates a management plan with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	(e.g., tip rhinoplasty, facelifts, neck-lifts) with assistance											
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
34	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes the effects of treatment of non-surgical and surgical options	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles of complex treatments for the aging face, (e.g., secondary rhinoplasties, deep plane facelifts, endoscopic procedures)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Discusses the dynamics of combining various procedures for treatment of the ageing face	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Independently formulates a treatment plan for aesthetic facial surgery patients*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently performs procedures (e.g., lower blepharoplasties, primary rhinoplasties, and facelifts)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Independently manages complications*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
35	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Contributes to research in aesthetic facial surgery leading to publication in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Independently treats complex secondary deformities of previous surgery*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
c	*Leads a multidisciplinary team for the treatment of facial aesthetics*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done											

	(specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION G FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE

SECTION H
NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Non-Cancer Breast Surgery – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

36 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of benign breast conditions (e.g., gynecomastia, hypermastia, ptosis congenital anomalies)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains breast embryology, anatomy, and physiology	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Describes principles of imaging for benign breast conditions	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Performs examination of patients with a benign breast condition*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Orders imaging studies and diagnostic tests*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Assists with breast procedures (e.g., incisions and skin closures)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Provides routine post-operative care for the breast patient*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

37 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the surgical treatment for benign breast conditions	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains concepts of proportions of the breast, aesthetic ideals, and symmetry	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Shows an understanding of the different types of breast implants	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F

d	*Interprets diagnostic studies*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Obtains informed consent for breast procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Performs routine procedures (e.g., mastopexy, gynecomastia, reduction mammoplasty) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Recognises complications (e.g., infection, implant complications, hematoma)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

38	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Recognises indications for treatment options (e.g., skin/ parenchyma reduction, augmentation)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles of routine surgical procedures (e.g., mastopexy, reduction mammoplasty, augmentation mammoplasty)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Formulates (with assistance) a treatment plan for routine breast procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures (e.g., congenital breast deformity, augmentation/ mastopexy) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

39	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the effect of surgery on breast sensation, nipple areolar perfusion, and lactation	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the principles of complex surgical procedures (e.g., tuberous breast deformity, augmentation/ mastopexy)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes evolving technologies such as fat grafting	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently performs complex procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

f	*Independently manages complications*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Independently manages secondary deformities*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
h	*Independently manages the dissatisfied patient*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
40	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Systematically reviews patient outcomes	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Publishes in peer-reviewed journals*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION H NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION I **BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Breast Reconstruction – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
41	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the pathophysiology of malignant breast disease	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the anatomy of the breast and its lymphatic drainage	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Performs history and physical examination of the breast cancer*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	patient											
d	*Assists with procedures (e.g., incisions and skin closure)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

42 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains surgical treatment for malignant breast disease	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the principles of implant-based breast reconstruction	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Obtains informed consent for breast reconstruction procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs (with assistance) routine procedures (e.g., tissue expander insertion, flap elevation)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Recognises complications (e.g., implant complications, flap compromise)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

43 EDUCATION AND TRAINING LEVEL 3

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the role of adjuvant treatment	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the impact of primary and adjuvant treatment on breast reconstruction	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Explains the principles of breast reconstruction using pedicled flaps	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Formulates a treatment plan with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures (e.g., treatment of the contralateral breast, microsurgical procedures) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

44 EDUCATION AND TRAINING LEVEL 4

	The first statements relate to medical knowledge and the	**Simulation**	**Proposed simulation**	**Cognitive level**

	second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	modality LOW-TECH SIMULATION MODALITIES	 HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the late effects of chemotherapy and radiation on breast reconstruction	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains the surgical principles of the various microsurgical breast reconstruction options	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Independently performs complex procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently manages complications*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

45 EDUCATION AND TRAINING LEVEL 5

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	 USEFUL	 NOT APPLICABLE	**Proposed simulation modality** LOW-TECH SIMULATION MODALITIES	 HIGH-TECH SIMULATION MODALITIES	**Cognitive level** REMEMBERING	 UNDERSTANDING	 APPLYING	 ANALYSING	 EVALUATING	 CREATING
a	Publishes research in peer-reviewed journals	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	*Manages complicated patients with multiple previous treatment failures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
c	*Assists in leading a multidisciplinary team*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Teaches breast reconstructive procedures*	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION I BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE											

SECTION J
RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Reconstruction of Trunk and Perineum – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

46 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDIN G	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of benign, malignant and congenital conditions of the perineum/trunk	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the anatomy of the back, perineum, chest and abdominal wall	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of pressure off-loading, nutrition and respiratory mechanics	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Takes a history and performs an examination of a patient with perineal/truncal defects*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assisting with procedures (e.g., incisions and wound closure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

47 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Explains the concepts of wound management, return of abdominal domain, and chest wall stability	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the indications for the provision of dynamic support, cover of vital structures, and functional restoration	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of the management of major defects in stages	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs, with assistance, routine procedures (e.g., component separation, debridement, musculocutaneous flaps)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Recognises complications (e.g., organ failure)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

48 EDUCATION AND TRAINING LEVEL 3

	The first statements relate to medical knowledge and the second (shaded and *typed in*	Simulation	Proposed simulation modality	Cognitive level

	***italics*), relate to patient care.**	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of surgical management of congenital abnormalities, chest wall defects, hernias, pressure ulcers and irradiated wounds	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the principles of routine surgical procedures (e.g., component separation, hernia repair and pressure ulcer reconstruction)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Explains the uses of synthetic and biologic materials	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Formulates, with assistance, a treatment plan for routine conditions*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures (e.g., urogenital reconstruction, composite chest wall reconstruction) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

49	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the impact of treatment on cardiopulmonary, gastrointestinal, musculoskeletal and genitourinary functioning	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles of complex surgical procedures (e.g., recurrent ventral hernia, perineal reconstruction, composite chest wall defects)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures independently*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently manages*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

50	**EDUCATION AND TRAINING LEVEL 5**					
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**			**Proposed simulation modality**	**Cognitive level**

	***italics*), relate to patient care.**	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Publishes research in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Independently manages complex secondary perineal and truncal deformities*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION J RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION K **UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Upper Extremity Trauma – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
51	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of soft-tissue injuries, dislocations and common fractures.	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the anatomy, basic biomechanics and function of the upper extremity	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Explains the principles of casting/splinting	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Performs examination of patients with upper extremity*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assists with procedures (e.g., applying splints, making incisions, and doing dressings)*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
52	**EDUCATION AND TRAINING LEVEL 2**											

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the principles of bony stabilisation and soft tissue coverage	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles of flap cover and bony fixation	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of the management of acute compartment syndrome and vascular injuries	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent for the surgical management of traumatic upper limb injuries*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs, with assistance, routine procedures (e.g., repair of tendon / nerve injuries or simple hand fractures)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Recognises complications (e.g., compartment syndrome, vascular compromise)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
53	**EDUCATION AND TRAINING LEVEL 3**											

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of complicating factors (e.g., vascular compromise, bone loss, exposed critical structures)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles of tendon, nerve, vessel, and bony repairs	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Demonstrates an understanding of the principles involved in post-operative regimens for hand therapy	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Formulates, with assistance, a treatment plan for common hand injuries (e.g., fracture/dislocation, tendon injury)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures (e.g., microvascular flap coverage, hand revascularisation, repair of the mangled hand) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
54	**EDUCATION AND TRAINING LEVEL 4**											

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Explains tendon transfer biomechanics	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Explains the principles involved in reconstruction of complex problems (e.g., replantation, secondary tendon reconstruction, nerve grafting)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Explains the role of chronic regional pain syndrome, secondary rehabilitation and prosthetics	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently performs complex procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Independently manages complications*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

55 EDUCATION AND TRAINING LEVEL 5

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the principles involved in tendon and nerve transfers for brachial plexus / combined nerve injuries	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the multidisciplinary management of hand injuries in a dedicated hand unit.	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Publishes research in peer-reviewed journals*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Manages work-related injuries and return-to-work issues*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages chronic regional pain syndrome*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION K UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE											

SECTION L
NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Non-Trauma Hand – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

56	EDUCATION AND TRAINING LEVEL 1											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the pathophysiology of non-traumatic hand conditions (e.g., compression neuropathy, degenerative changes, infection)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the embryology, anatomy and biomechanics of the upper extremity and hand	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Performs history and examination of patients with non-traumatic hand disorders*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Assists with procedures (e.g., injections, abscess drainage, skin incisions and closure)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

57	EDUCATION AND TRAINING LEVEL 2											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the treatment options for compression neuropathy, degenerative changes, infection of the upper limb and hand	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the concepts of injections, pharmacologic management, incision, and drainage	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes principles of anaesthesia for the upper extremity (e.g., local and regional)	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent for congenital and non-trauma hand reconstruction procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs, with assistance, routine procedures (e.g., tumor*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	excision, ganglion removal, nerve decompression)											
58	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes management options for contractures and metabolic processes	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains principles of routine surgical procedures (e.g., tumour and ganglion excisions, fusions, nerve releases, and contracture releases)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Describes the post-operative hand therapy regimens	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Formulates a treatment plan with assistance for routine hand conditions*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Performs complex procedures (e.g., syndactyly reconstruction, tendon transfers, arthroplasty, contracture release) with assistance*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
59	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the management of congenital and autoimmune conditions	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes surgical principles for complex procedures (e.g., syndactyly release, ligament reconstructions, arthroplasties, and tendon transfers)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a treatment plan*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Independently performs complex procedures*	*~~1~~*	*~~2~~*	*~~3~~*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
60	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**			**Proposed simulation modality**		**Cognitive level**					

	***italics*), relate to patient care.**	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Explains the surgical anatomy and principles for complex procedures (e.g., thumb reconstructions, congenital hand reconstruction, nerve transfers, rheumatoid hand reconstruction)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	*Formulates a treatment plan for complex congenital hand and rheumatoid deformities*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
c	*Performs toe-to-hand transfers, pollicisations, implant arthroplasty*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Helps manage a multidisciplinary hand surgery team*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).

Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):

ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION L NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE

SECTION M
COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Cosmetic Trunk and Lower Extremity – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

61 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the pathophysiology of lipodystrophy and obesity	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Discusses the effects of aging	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Explains the effect of massive weight loss	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Describes the anatomy and aesthetic ideals of the lower extremities and trunk	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	Explains the concept of weight	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F

	management (e.g. diet and exercise)											
f	Explains deep venous thrombosis and pulmonary embolism risk factors, workup, and management	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
g	*Performs physical examination of patients with aesthetic and functional problems of the trunk and lower extremity*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
h	*Assists with procedures (e.g., skin incision and closure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
i	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

62	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of bariatric surgery (e.g. indications, different types, their metabolic effects)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Identifies factors influencing patient selection for body contouring surgery	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Explains the physiological effects of liposuction	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	Describes the different aesthetic ideals based on a patient's gender	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
e	Explains the benefit of multidisciplinary bariatric teams	1	2	3	(i)	(ii)	A	B	C	D	E	F
f	*Obtains informed consent for routine cosmetic trunk and lower limb procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
g	*Performs routine procedures (e.g., panniculectomy, abdominoplasty)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
h	*Recognises complications (e.g., skin loss, thromboembolism, seroma)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

63	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the management options for	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F

	massive weight loss patients												
b	Describes surgical principles of routine procedures (e.g., brachioplasty, medial thigh lift, liposuction abdominoplasty)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Formulates a treatment plan with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs, with assistance, complex procedures (e.g., brachioplasty, circumferential body lift)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

64 EDUCATION AND TRAINING LEVEL 4

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDIN G**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Differentiates between aesthetic and functional problems	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the surgical principles of complex procedures	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a treatment plan*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Independently performs complex procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently manages complications*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

65 EDUCATION AND TRAINING LEVEL 5

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Systematically reviews outcomes and publishes in peer-reviewed journals	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	*Manages patients with multiple prior surgeries / unsatisfactory previous results*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).

Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):

ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION M COSMETIC TRUNK

AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE

SECTION N
LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Lower Extremity – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

66 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the pathophysiology of congenital and acquired conditions of the lower extremity (e.g., trauma, cancer, diabetic foot, venous and arterial insufficiency)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the anatomy of the lower extremity	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Explains the classification systems for soft tissue and bone loss of the lower extremity	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	*Performs history and physical examination of patients with lower extremity concerns*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assists with procedures (e.g., splint application, dressings, skin incision and closure)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

67 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Explains the principles of non-operative treatment for lower extremity conditions (e.g., lymphoedema, neuropathic ulcers)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical principles for lower extremity surgery (e.g., timing and staging of procedures)	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Obtains informed consent for surgical procedures of the lower*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

	extremity											
d	*Performs routine procedures (e.g., skin grafts) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Recognises complications (e.g., compartment syndrome, flap compromise)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

68	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the indications for treatment of conditions of the lower extremity (e.g., compartment syndrome, tumor resection, exposed prostheses, arterial insufficiency, and musculoskeletal injury)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical principles of routine procedures (e.g., local flaps, skin grafting, wound debridement)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Formulates a treatment plan with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures (e.g., free tissue transfer) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

69	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the role of adjunctive modalities (e.g. prosthetics)	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes the surgical principles of complex procedures (e.g., free tissue transfers, and perforator flaps)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Independently formulates a treatment plan*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Performs complex procedures independently*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Independently manages complications*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

70	**EDUCATION AND TRAINING LEVEL 5**			
	The first statements relate to medical knowledge and the	**Simulation**	**Proposed simulation**	**Cognitive level**

	second (shaded and *typed in italics*), relate to patient care.				**modality**							
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the principles of microsurgical treatment of lymphoedema, tendon and nerve transfers of the lower extremity	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	*Helps lead a multidisciplinary team for limb salvage*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION N: LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE											

SECTION O
SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT

This section deals with the five education and training levels of Systems-based Practice - Patient Safety, Resource allocation and Practice management. The resident should reach the descriptors of performance on the specific level.

71 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the differences between sentinel events, near misses, and medical errors	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the roles of team members	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Describes practice variations in resource consumption, such as the utilization of diagnostic tests*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Explains basic health payment systems, including uninsured care*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Describes different practice models*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

72	EDUCATION AND TRAINING LEVEL 2											
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Participates in the use of tools (e.g., briefings and checklists) to prevent adverse events	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Describes the common system causes for errors	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Describes the cost implications of using resources*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Describes the principles of evaluation, management, and procedure coding*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Compares and contrasts different practice models*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

73	EDUCATION AND TRAINING LEVEL 3											
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Consistently uses tools (e.g., briefings and checklists) to prevent adverse occurrences	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Reports problematic devices, processes and behaviours, including near misses and errors	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Participates in responsible use of health care resources, seeking appropriate assistance*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Codes routine encounters, diagnoses, and surgical procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Recognises basic elements needed to establish practice (e.g., facility accreditation, compliance, staffing, contracts, malpractice insurance, negotiations)*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

74	EDUCATION AND TRAINING LEVEL 4			
	The first statements relate to patient safety and, the second (shaded and *typed in italics*),	**Simulation**	**Proposed simulation modality**	**Cognitive level**

	relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Formally uses proven analysis methods to evaluate shared team experiences to prevent future errors	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Leads team by promoting input and situational awareness by all team members	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Improves patient safety by conducting morbidity and mortality meetings	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Practises cost-effective care (e.g., operative efficiency, managing length of stay)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
e	*Codes complex and unusual encounters, diagnoses, and procedures*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
f	*Establishes timeline and identifies resources for transition to practice*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

75	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Leads curriculum design activities to develop communication skills and teamwork of health care professionals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Assists in leading a multidisciplinary team to address patient safety issues	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Designs measurement tools provide feedback to providers on resource consumption*	~~1~~	~~2~~	~~3~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Participates in advocacy activities for health policy*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Creates curriculum to teach practice management*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION O: SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT											

	SECTION P **PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE, AND RESEARCH AND TRAINING**
	This section deals with the five education and training levels of Practice-based Learning and Improvement – Investigate, Evaluate, Assimilate, and Research and Training. The resident should reach the descriptors of performance on the specific level.

76	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Shows awareness of one's own level of knowledge and expertise	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Identifies learning resources	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Demonstrates an understanding of the basic concepts in clinical reasoning, biostatistics, clinical epidemiology*	~~1~~	~~2~~	~~3~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Participates in the education of patients and their families*	~~1~~	~~2~~	~~3~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

77	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Continually seeks to improve performance by incorporating feedback	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Uses published guidelines and articles in a learning plan	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Ranks study designs and is able to distinguish relevant research outcomes*	~~1~~	~~2~~	~~3~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Teaches patients and their families*	~~1~~	~~2~~	~~3~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

78	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates a balanced and	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F

	accurate self-assessment of competence											
b	Selects an appropriate evidence-based information tool to answer specific questions	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Able to critically appraise different research types (e.g., systematic reviews and meta-analyses)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Teaches health professionals and colleagues in both informal and formal settings*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
79	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates improvement in clinical outcomes based on continual self-assessment	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Performs self-directed learning with minimal external guidance, using evidence-based information tools	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Formulates a researchable question, describes a plan to investigate it, and executes a research project*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Organises educational activities at programme level*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
80	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Consistently incorporates evidence-based information in common areas of practice	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Independently plans and executes a research programme	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Develops educational curriculum and assessment tools	1	2	3	(i)	(ii)	A	B	C	D	E	F
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											

	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION P PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE, AND RESEARCH AND TRAINING

SECTION Q
PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY

This section deals with the five education and training levels of Professionalism – Ethics and Values, and Personal Accountability. The resident should reach the descriptors of performance on the specific level.

81 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Is able to identify ethical issues in plastic surgery	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates behaviour that conveys honesty, caring and genuine interest in patients and families	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Explains and manages issues related to fatigue and sleep deprivation*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Exhibits professional behaviour (e.g., confidentiality, integrity, diligence, and reliability)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

82 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Is able to analyse, discuss and manage common ethical situation	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates behaviour that shows insight in the impact of one's core values and beliefs regarding patient care	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Demonstrates management of physical, mental, personal and emotional health*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Recognises individual limits in clinical situations and asks for assistance when needed*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

83 EDUCATION AND TRAINING LEVEL 3

	The first statements relate to ethics and values, and the	**Simulation**	**Proposed simulation**	**Cognitive level**

	second (shaded and *typed in italics*), relate to personal accountability.				**modality**							
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Analyses and manages ethical issues in challenging and complicated situations	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the beliefs, practices and values of diverse and vulnerable patient populations	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Manages situations in which maintaining physical, mental and personal health is challenged*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Acknowledges conflicting interests of self, family, and others, and their effects on the delivery of medical care*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

84	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Uses a systemic approach to manage ethical issues, including conflicts of interest, billing and advertising	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Develops a mutually agreeable care plan in the context of conflicting physician and patient values and beliefs	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Recognises signs of physician impairment and demonstrates appropriate steps to address impairment in self and in colleagues*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Prioritises and balances conflicting interests of self, family, and others to optimise medical care*	~~*1*~~	~~*2*~~	~~*3*~~	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

85	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Helps lead institutional and	1	2	3	(i)	(ii)	A	B	C	D	E	F

	organisational ethics programmes											
b	Develops programmes to ensure equality of care in diverse, vulnerable, and underserved populations	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	*Helps develop institutional and organisational strategies to improve physician wellness*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY											
	SECTION R INTERPERSONAL AND COMMUNICATION SKILLS											
	This section deals with the five education and training levels of Interpersonal and Communication Skills. The resident should reach the descriptors of performance on the specific level.											
86	**EDUCATION AND TRAINING LEVEL 1**											
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Develops a positive relationship with patients and teams, in uncomplicated situations	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the patient's/family's perspective	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Utilises interpreters as needed	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	Appreciates effective communication to prevent medical errors	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
e	Participates in effective transitions of care	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
f	Uses photographic documentation with safeguards for privacy	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
87	**EDUCATION AND TRAINING LEVEL 2**											
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					

		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Manages conflict (such as with patient, family, and teams)	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Ensures that the patient is able to participate in health care decision-making, by incorporating the cultural and social contexts	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Ensures that the medical records, are accurate, and complete	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	Demonstrates an understanding of the effects of computer use on information accuracy	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	Demonstrates an understanding of the potential effects of the physician/patient relationship	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
88	**EDUCATION AND TRAINING LEVEL 3**											
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Manages complex and challenging situations, including transitions of care	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Conveys emotionally difficult information to patients on a individually applicable basis	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Optimises communication across systems	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
89	**EDUCATION AND TRAINING LEVEL 4**											
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Negotiates and manages conflict in complex and challenging situations	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Develops working relationships across specialities	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
c	Organises and facilitates family/health care team conferences	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
d	Uses multiple forms of communication ethically and with respect for patient privacy	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F

e	Demonstrates an understanding of the use of ethical marketing practices	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
90	**EDUCATION AND TRAINING LEVEL 5**											
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Develops models/approaches to managing difficult communications	~~1~~	~~2~~	~~3~~	(i)	(ii)	A	B	C	D	E	F
b	Coaches others to improve communication skills	1	2	3	(i)	(ii)	A	B	C	D	E	F
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION R INTERPERSONAL AND COMMUNICATION SKILLS											

Thank you for completing the questionnaire!

APPENDIX J INSTRUCTIONS FOR COMPLETION OF THE DELPHI QUESTIONNAIRE: ROUND TWO

APPENDIX J

LETTER FOR COMPLETION OF THE DELPHI QUESTIONNAIRE: ROUND TWO

Netcare Mulbarton Hospital
25 True North Road
Mulbarton
Johannesburg
2059

Name and address of expert

SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING

DELPHI SURVEY ROUND TWO

Dear Participant

Thank you for your willingness to participate in this Delphi process and questionnaire survey as an expert participant.

Please save a copy of this document on your computer hard drive and use this saved copy when completing the questionnaire. After completion of the questionnaire, please e-mail the document to drcnel@gmail.com. Alternatively, you may print the document and complete the questionnaire by hand. Please call to arrange if this is the case.

You will need less than an hour to complete the questionnaire.

Feedback on each Delphi round will be distributed anonymously to the panel of experts.

If you experience any problems please contact me at drcnel@gmail.com or cell +27(0)82-924-3847. You are reminded not to discuss your participation in the Delphi process with colleagues.

PLEASE RETURN THE COMPLETED QUESTIONNAIRE NOT LATER THAN ONE MONTH AFTER RECEIVING IT.

INFORMATION ON THE DELPHI QUESTIONNAIRE:

The Delphi questionnaire consists of 18 sections (A-R). Each section is divided into two main categories, namely medical knowledge and patient care that have been formulated within five education and training levels with level one the more basic level of training and level five the most advanced training level.

STATEMENTS ON WHICH CONSENSUS WERE REACHED IN ROUND ONE, HAVE BEEN OMITTED.

THE DIFFERENT SECTIONS IN THE DELPHI QUESTIONNAIRE ARE AS FOLLOWS:

SECTION A	**SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION B	**WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION C	**TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION D	**CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION E	**HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION F	**MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION G	**FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION H	**NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION I	**BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE**

SECTION J	**RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION K	**UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION L	**NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION M	**COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION N	**LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**
SECTION O	**SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT**
SECTION P	**PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE AND RESEARCH AND TRAINING**
SECTION Q	**PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY**
SECTION R	**INTERPERSONAL AND COMMUNICATION SKILLS**

Specific instructions are given in each section regarding the completion of questions in that section.

THANK YOU FOR YOUR WILLINGNESS TO COMPLETE THE QUESTIONNAIRE.

Dr Corné PG Nel
MBChB, MHPE, FC Plastic Surgery, MMed (Plastic Surgery)
Student number: 2000003430
Ethics approved number: ECUFS122/2015

APPENDIX K QUESTIONNAIRE FOR DELPHI PANEL: ROUND TWO

APPENDIX K

QUESTIONNAIRE FOR DELPHI PANEL: ROUND TWO

INSTRUCTIONS TO COMPLETE DELPHI QUESTIONNAIRE REGARDING SIMULATION
Please indicate how important each of the following statements is according to the following scale:

1 = Simulation can be regarded as one of the **essential** methods to train a plastic surgeon.
2 = Simulation may be **useful** as one of the methods to train a plastic surgeon.
3 = Simulation is **not** an **applicable** method to train a plastic surgeon and can be excluded as a training method.
Please mark the appropriate box with an X. Mark only one of the three choices (Essential, Useful, Not applicable).

If you indicated 1 or 2 as an option, please also answer to the next two categories (simulation modality and cognitive level). If you indicated 3, go directly to the next Education and Training level.

INSTRUCTIONS TO COMPLETE QUESTIONNAIRE REGARDING MODALITIES AND LEVELS
Please indicate which type of simulation modality is / can be applicable as far as simulation is concerned:
(i) = Low-tech simulation modalities (such as simple three-dimensional organ models; basic plastic manikin and simple skills trainers; animal models; human cadavers; and simulated or standardised patients).
(ii) = High-tech simulation modalities (such as screen-based simulators; realistic, high-fidelity procedural simulators (task trainers); realistic, high-tech interactive patient simulators; and virtual reality).
Please mark the appropriate box(es) with an X. Mark one or two choices (low-tech and/or high-tech).

Please indicate which level of learning is / can be addressed by simulation according to the following scale displaying the various cognitive levels: (*cf.* definitions in accompanying letter to Delphi experts).

A = Remembering (knowledge); B = Understanding (comprehension); C = Applying (application);
D = Analysing (analysis); E = Evaluating (synthesis); F = Creating (evaluation).
Please mark the appropriate box(es) with an X. Mark any number of choices (The six cognitive levels of learning)
OR
Cognitive level of learning: Please give your opinion on the value of simulation as a learning method, for example, will it help the student to remember facts, leading to understand concepts, applying skills, helping to analyse, diagnose or compile a treatment plan/management plan/procedure. Please see end of each section.

	SECTION A **SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Surgical Care – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
1	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modalities**		**Cognitive levels**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
2	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate	**Simulation**			**Proposed simulation modality**		**Cognitive level**					

	to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
b	Describes the impact of pregnancy on the management of surgical patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes the effects of obesity on the management of surgical patients	1	2	3	(i)	(ii)	A	B	C	D	E	F
f	*Manages (with assistance) a surgical patient with single system disease*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
3	**EDUCATION AND TRAINING LEVEL 3**											

		Simulation			Proposed simulation modality		Cognitive level					
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the role of medical comorbidities in surgical patients (e.g., hepatic, renal, cardiac or pulmonary failure	1	2	3	(i)	(ii)	A	B	C	D	E	F
4	**EDUCATION AND TRAINING LEVEL 4**											

		Simulation			Proposed simulation modality		Cognitive level					
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
e	*Manages a surgical firm*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
5	**EDUCATION AND TRAINING LEVEL 5**											
		Simulation			**Proposed simulation modality**		**Cognitive level**					
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	If you so whish, please give an example of a simulation or describe a simulation that you have done or that can be done Section A: Surgical care – Medical Knowledge and Patient Care (specific to this section).											

	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING ON SECTION A: SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE.
	SECTION B **WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Wound Care – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

6	**EDUCATION AND TRAINING LEVEL 1**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**	
a	Demonstrates an understanding of wound, pressure ulcer, necrotising infection and burns with regards to the pathophysiology	1	2	3	(i)	(ii)	A	B	C	D	E	F	
7	**EDUCATION AND TRAINING LEVEL 2**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**	
d	*Explains procedures for managing wounds (e.g. risks, benefits, consent)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*	
8	**EDUCATION AND TRAINING LEVEL 3**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**	
9	**EDUCATION AND TRAINING LEVEL 4**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						

		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
b	Demonstrates an understanding of the principles of complex procedures (e.g., hyperbaric oxygen, vascularized soft tissue coverage)	1	2	3	(i)	(ii)	A	B	C	D	E	F
10	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING SECTION B – WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE.											
	SECTION C **TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Tissue Transfer – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
11	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
d	*Performs wound care independently (e.g., dressings, negative pressure therapy)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
12	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**			**Proposed simulation modality**		**Cognitive level**					

	***italics*), relate to patient care.**	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
b	Demonstrates knowledge of materials used in soft tissue transfer (e.g. suture materials, surgical devices)	1	2	3	(i)	(ii)	A	B	C	D	E	F
13	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
14	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Independently decides upon treatment choices for soft tissue defects	1	2	3	(i)	(ii)	A	B	C	D	E	F
15	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING SECTION C - TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE											

SECTION D
CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE

This section deals with the five education and training levels of Congenital Anomalies – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

16 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the embryology of clefts	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Describes craniofacial anomalies	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the normal anatomy of the craniofacial system	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Examines patients with craniofacial anomalies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assists with craniofacial procedures (e.g., incisions and skin closures)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

17 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
c	*Obtains informed consent for routine congenital abnormalities (e.g., vascular anomalies, giant congenital nevi, cleft surgery)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

18 EDUCATION AND TRAINING LEVEL 3

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	Simulation			Proposed simulation modality		Cognitive level					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING

19 EDUCATION AND TRAINING LEVEL 4

	The first statements relate to medical knowledge and the second (shaded and *typed in*	Simulation	Proposed simulation modality	Cognitive level

	italics), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
b	Describes the surgical anatomy and principles of complex craniofacial procecures (e.g., distraction osteogenesis, cranial vault remodelling, secondary cleft deformities)	1	2	3	(i)	(ii)	A	B	C	D	E	F

20	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION D CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION E **HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Head and Neck – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
21	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
d	*Performs history and physical examination of patients with head and neck malignancies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assists with procedures (e.g., excision of minor skin lesions, biopsies)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
22	**EDUCATION AND TRAINING LEVEL 2**											

		Simulation			Proposed simulation modality		Cognitive level					
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING

23	**EDUCATION AND TRAINING LEVEL 3**											
		Simulation			**Proposed simulation modality**		**Cognitive level**					
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
24	**EDUCATION AND TRAINING LEVEL 4**											
		Simulation			**Proposed simulation modality**		**Cognitive level**					
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Explains the sequelae of surgical interventions (e.g., long term outcomes, post surgery deformities)	1	2	3	(i)	(ii)	A	B	C	D	E	F
f	*Independently manages complications (e.g., failed microvascular transfers)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
25	**EDUCATION AND TRAINING LEVEL 5**											
		Simulation			**Proposed simulation modality**		**Cognitive level**					
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
b	*Helps lead a multidisciplinary head and neck cancer team*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											

	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION E HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE

	SECTION F **MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Maxillofacial Trauma – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

26	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains aetiology of facial fractures and soft tissue injuries	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of head and neck anatomy the anatomy of the head and neck	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes facial fracture patterns	1	2	3	(i)	(ii)	A	B	C	D	E	F

27	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
b	Explains the principles of surgical management (e.g., methods of fixation, open *vs*. closed approaches)	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	*Interprets imaging studies*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

28	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

29	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
b	Describes the surgical principles of complex procedures (e.g., repair NOE with telecanthus, canalicular repair)	1	2	3	(i)	(ii)	A	B	C	D	E	F
30	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
b	*Manages complex secondary deformities (e.g., malocclusion, enopthalmos)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION F MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION G **FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Facial Aesthetics – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
31	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**

a	Describes the normal anatomy of the face	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the normal proportions, angles and relationships in facial analysis	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Performs focused history and examination of aesthetic facial surgery patients*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
32	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
d	*Obtains informed consent for facial aesthetic procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
33	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
34	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
c	Discusses the dynamics of combining various procedures for treatment of the ageing face	1	2	3	(i)	(ii)	A	B	C	D	E	F
f	*Independently manages complications*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
35	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**			**Proposed simulation modality**		**Cognitive level**					

	***italics*), relate to patient care.**	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Contributes to research in aesthetic facial surgery leading to publication in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Leads a multidisciplinary team for the treatment of facial aesthetics*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION G FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION H **NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Non-Cancer Breast Surgery – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
36	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of benign breast conditions (e.g., gynecomastia, hypermastia, ptosis congenital anomalies)	1	2	3	(i)	(ii)	A	B	C	D	E	F
37	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**

b	Explains concepts of proportions of the breast, aesthetic ideals, and symmetry	1	2	3	(i)	(ii)	A	B	C	D	E	F
38	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
c	*Formulates (with assistance) a treatment plan for routine breast procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
39	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
b	Describes the principles of complex surgical procedures (e.g., tuberous breast deformity, augmentation/ mastopexy)	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
40	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Systematically reviews patient outcomes	1	2	3	(i)	(ii)	A	B	C	D	E	F
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION H NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE											

	SECTION I **BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Breast Reconstruction – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

41	EDUCATION AND TRAINING LEVEL 1												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
c	*Performs history and physical examination of the breast cancer patient*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

42	EDUCATION AND TRAINING LEVEL 2												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains surgical treatment for malignant breast disease	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Obtains informed consent for breast reconstruction procedures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

43	EDUCATION AND TRAINING LEVEL 3												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**

44	EDUCATION AND TRAINING LEVEL 4												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**

c	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
45	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
b	*Manages complicated patients with multiple previous treatment failures*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION I BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION J **RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Reconstruction of Trunk and Perineum – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
46	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDIN G**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
c	Demonstrates an understanding of pressure off-loading, nutrition and respiratory mechanics	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Takes a history and performs an examination of a patient with perineal/truncal defects*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
e	*Assisting with procedures (e.g., incisions and wound closure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
47	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**			**Proposed simulation modality**		**Cognitive level**					

	***italics*), relate to patient care.**	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
c	Demonstrates an understanding of the management of major defects in stages	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
48	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of surgical management of congenital abnormalities, chest wall defects, hernias, pressure ulcers and irradiated wounds	1	2	3	(i)	(ii)	A	B	C	D	E	F
f	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
49	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
50	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Publishes research in peer-reviewed journals	1	2	3	(i)	(ii)	A	B	C	D	E	F
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											

	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION J RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE

	SECTION K **UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Upper Extremity Trauma – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

51	**EDUCATION AND TRAINING LEVEL 1**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of soft-tissue injuries, dislocations and common fractures.	1	2	3	(i)	(ii)	A	B	C	D	E	F
f	*Provides routine post-operative care*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
52	**EDUCATION AND TRAINING LEVEL 2**												
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**						
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the principles of bony stabilisation and soft tissue coverage	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	*Obtains informed consent for the surgical management of traumatic upper limb injuries*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
53	**EDUCATION AND TRAINING LEVEL 3**												
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**			**Proposed simulation modality**		**Cognitive level**						

	***italics*), relate to patient care.**	ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
f	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
54	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
d	*Independently formulates a treatment plan*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
55	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
a	Demonstrates an understanding of the principles involved in tendon and nerve transfers for brachial plexus / combined nerve injuries	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Demonstrates an understanding of the multidisciplinary management of hand injuries in a dedicated hand unit.	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Publishes research in peer-reviewed journals*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION K UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION L **NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Non-Trauma Hand – Medical Knowledge											

	and Patient Care. The resident should reach the descriptors of performance on the specific level.
56	**EDUCATION AND TRAINING LEVEL 1**

		Simulation			Proposed simulation modality		Cognitive level					
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**

57	**EDUCATION AND TRAINING LEVEL 2**

		Simulation			Proposed simulation modality		Cognitive level					
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Explains the treatment options for compression neuropathy, degenerative changes, infection of the upper limb and hand	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the concepts of injections, pharmacologic management, incision, and drainage	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Describes principles of anaesthesia for the upper extremity (e.g., local and regional)	1	2	3	(i)	(ii)	A	B	C	D	E	F

58	**EDUCATION AND TRAINING LEVEL 3**

		Simulation			Proposed simulation modality		Cognitive level					
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Describes management options for contractures and metabolic processes	1	2	3	(i)	(ii)	A	B	C	D	E	F

59	**EDUCATION AND TRAINING LEVEL 4**

		Simulation			Proposed simulation modality		Cognitive level					
	The first statements relate to medical knowledge and the second (shaded and *typed in*											

	***italics*), relate to patient care.**	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
60	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
b	*Formulates a treatment plan for complex congenital hand and rheumatoid deformities*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION L NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION M **COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Cosmetic Trunk and Lower Extremity – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
61	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the pathophysiology of lipodystrophy and obesity	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Explains the effect of massive weight loss	1	2	3	(i)	(ii)	A	B	C	D	E	F
d	Describes the anatomy and aesthetic ideals of the lower extremities and trunk	1	2	3	(i)	(ii)	A	B	C	D	E	F

h	*Assists with procedures (e.g., skin incision and closure)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
62	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of bariatric surgery (e.g. indications, different types, their metabolic effects)	1	2	3	(i)	(ii)	A	B	C	D	E	F
e	Explains the benefit of multidisciplinary bariatric teams	1	2	3	(i)	(ii)	A	B	C	D	E	F
h	*Recognises complications (e.g., skin loss, thromboembolism, seroma)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
63	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
64	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDIN G**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Differentiates between aesthetic and functional problems	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Explains the surgical principles of complex procedures	1	2	3	(i)	(ii)	A	B	C	D	E	F
65	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**

b	*Manages patients with multiple prior surgeries / unsatisfactory previous results*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION M COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE											

	SECTION N **LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**											
	This section deals with the five education and training levels of Lower Extremity – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.											
66	**EDUCATION AND TRAINING LEVEL 1**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the pathophysiology of congenital and acquired conditions of the lower extremity (e.g., trauma, cancer, diabetic foot, venous and arterial insufficiency)	1	2	3	(i)	(ii)	A	B	C	D	E	F
67	**EDUCATION AND TRAINING LEVEL 2**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
b	Describes the surgical principles for lower extremity surgery (e.g., timing and staging of procedures)	1	2	3	(i)	(ii)	A	B	C	D	E	F
68	**EDUCATION AND TRAINING LEVEL 3**											
	The first statements relate to medical knowledge and the second (shaded and *typed in*	**Simulation**			**Proposed simulation modality**		**Cognitive level**					

	***italics*), relate to patient care.**	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
e	*Manages complications with assistance*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
69	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the role of adjunctive modalities (e.g. prosthetics)	1	2	3	(i)	(ii)	A	B	C	D	E	F
70	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Demonstrates an understanding of the principles of microsurgical treatment of lymphoedema, tendon and nerve transfers of the lower extremity	1	2	3	(i)	(ii)	A	B	C	D	E	F
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION N: LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE											
	SECTION O SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT											
	This section deals with the five education and training levels of Systems-based Practice - Patient Safety, Resource allocation and Practice management. The resident should reach the descriptors of performance on the specific level.											

71	EDUCATION AND TRAINING LEVEL 1											
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
b	Describes the roles of team members	1	2	3	(i)	(ii)	A	B	C	D	E	F

72	EDUCATION AND TRAINING LEVEL 2											
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**

73	EDUCATION AND TRAINING LEVEL 3											
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**

74	EDUCATION AND TRAINING LEVEL 4											
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Formally uses proven analysis methods to evaluate shared team experiences to prevent future errors	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Leads team by promoting input and situational awareness by all team members	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Improves patient safety by conducting morbidity and mortality meetings	1	2	3	(i)	(ii)	A	B	C	D	E	F

75	EDUCATION AND TRAINING LEVEL 5			
	The first statements relate to	**Simulation**	**Proposed**	**Cognitive level**

	patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.				**simulation modality**								
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Leads curriculum design activities to develop communication skills and teamwork of health care professionals	1	2	3	(i)	(ii)	A	B	C	D	E	F
b	Assists in leading a multidisciplinary team to address patient safety issues	1	2	3	(i)	(ii)	A	B	C	D	E	F
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).												
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):												
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION O: SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT												
	SECTION P **PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE, AND RESEARCH AND TRAINING**												
	This section deals with the five education and training levels of Practice-based Learning and Improvement – Investigate, Evaluate, Assimilate, and Research and Training. The resident should reach the descriptors of performance on the specific level.												
76	**EDUCATION AND TRAINING LEVEL 1**												
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulatio n modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
77	**EDUCATION AND TRAINING LEVEL 2**												
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**

78	EDUCATION AND TRAINING LEVEL 3											
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
c	*Able to critically appraise different research types (e.g., systematic reviews and meta-analyses)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
79	**EDUCATION AND TRAINING LEVEL 4**											
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
b	Performs self-directed learning with minimal external guidance, using evidence-based information tools	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Formulates a researchable question, describes a plan to investigate it, and executes a research project*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
80	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Consistently incorporates evidence-based information in common areas of practice	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	Develops educational curriculum and assessment tools	1	2	3	(i)	(ii)	A	B	C	D	E	F
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION P PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE, AND RESEARCH											

	AND TRAINING

	SECTION Q **PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY**
	This section deals with the five education and training levels of Professionalism – Ethics and Values, and Personal Accountability. The resident should reach the descriptors of performance on the specific level.

81 EDUCATION AND TRAINING LEVEL 1

	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
c	*Explains and manages issues related to fatigue and sleep deprivation*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
d	*Exhibits professional behaviour (e.g., confidentiality, integrity, diligence, and reliability)*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

82 EDUCATION AND TRAINING LEVEL 2

	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**

83 EDUCATION AND TRAINING LEVEL 3

	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
c	*Manages situations in which maintaining physical, mental and personal health is challenged*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*

84 EDUCATION AND TRAINING LEVEL 4

	The first statements relate to ethics and values, and the second (shaded and *typed in*	**Simulation**	**Proposed simulation modality**	**Cognitive level**

	***italics*), relate to personal accountability.**	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
85	**EDUCATION AND TRAINING LEVEL 5**											
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
a	Helps lead institutional and organisational ethics programmes	1	2	3	(i)	(ii)	A	B	C	D	E	F
c	*Helps develop institutional and organisational strategies to improve physician wellness*	*1*	*2*	*3*	*(i)*	*(ii)*	*A*	*B*	*C*	*D*	*E*	*F*
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY											
	SECTION R **INTERPERSONAL AND COMMUNICATION SKILLS**											
	This section deals with the five education and training levels of Interpersonal and Communication Skills. The resident should reach the descriptors of performance on the specific level.											
86	**EDUCATION AND TRAINING LEVEL 1**											
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
87	**EDUCATION AND TRAINING LEVEL 2**											
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					

		ESSENTIAL	USEFUL	NOT APPLICABLE	LOW-TECH SIMULATION MODALITIES	HIGH-TECH SIMULATION MODALITIES	REMEMBERING	UNDERSTANDING	APPLYING	ANALYSING	EVALUATING	CREATING
d	Demonstrates an understanding of the effects of computer use on information accuracy	1	2	3	(i)	(ii)	A	B	C	D	E	F
88	**EDUCATION AND TRAINING LEVEL 3**											
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
89	**EDUCATION AND TRAINING LEVEL 4**											
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
90	**EDUCATION AND TRAINING LEVEL 5**											
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Proposed simulation modality**		**Cognitive level**					
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	**LOW-TECH SIMULATION MODALITIES**	**HIGH-TECH SIMULATION MODALITIES**	**REMEMBERING**	**UNDERSTANDING**	**APPLYING**	**ANALYSING**	**EVALUATING**	**CREATING**
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).											
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):											
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION R INTERPERSONAL AND COMMUNICATION SKILLS											

Thank you for completing the questionnaire!

APPENDIX L LETTER ON FEEDBACK: DELPHI ROUND TWO

APPENDIX L

LETTER ON FEEDBACK: DELPHI ROUND TWO

Netcare Mulbarton Hospital
25 True North Road
Mulbarton
Johannesburg
2059

Name and address of expert

SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING

Dear Delphi Participant

Thank you once again for participating in the Delphi process so far and for completing the second round Delphi questionnaire. Attached please find the results of the second round. This feedback is sent to you with the purpose of providing you with the results and information regarding the second round.

According to Larson and Wissman (2000:45) consensus is reached where 80% of the participants indicate the same value (to a specific item) as their choice. Defining consensus differs from author to author and can vary from 51% to 75% or 80% depending on the type and purpose of the study (Dajani, Sincoff & Talley 1979:83; Diamond, Grant, Feldman, Pencharz *et al*. 2014:404; Keeney, Hasson & McKenna 2006:210). In this study, consensus was defined where **66.7%** of the participants indicated the same value as their choice (decision taken at evaluation committee of Faculty of Health Sciences, UFS, 15/04/2015). In Round Two of this Delphi process, out of 453 statements, consensus was reached in 92.1% of these statements. All questions on which consensus have been reached, have been crossed out.

In the attached questionnaire, an indication is given of the answers that the Delphi panel provided in Round Two. **Please look at all these questions again, and confirm whether you stand by your opinion as you indicated in Round Two, or if you are willing to complete a Third Round.** Your answers on Questions in Round Two are indicated with an X.

A hard copy of this questionnaire is available if needed. Please ask for one if you prefer one.

Stability is described as the natural tendency of opinions of experts to centralise (Linstone & Turoff 1979:277). Stability can be declared when movement of the opinion of the group as a whole has reached stability.

If you wish to change your opinion on your previous answers, please feel free to do so. You can therefore indicate a different level of importance to any of the statements, should you think it appropriate.

Please keep in mind that your response stays anonymous and confidential and will be known only by the researcher.

Thank you again.

Kind regards.

Dr Corné PG Nel
MBChB, MHPE, FC Plastic Surgery, MMed (Plastic Surgery)
Student number: 2000003430
Ethics approved number: ECUFS122/2015

APPENDIX M FEEDBACK: QUESTIONNAIRE FOR DELPHI PANEL: ROUND TWO

FEEDBACK: QUESTIONNAIRE FOR DELPHI PANEL: ROUND TWO

INSTRUCTIONS TO COMPLETE DELPHI QUESTIONNAIRE REGARDING SIMULATION
Please indicate how important each of the following statements is according to the following scale:

1 = Simulation can be regarded as one of the **essential** methods to train a plastic surgeon.
2 = Simulation may be **useful** as one of the methods to train a plastic surgeon.
3 = Simulation is an **applicable** method to train a plastic surgeon and can be excluded as a training method.
Please mark the appropriate box with an X. Mark only one of the three choices (Essential, Useful, applicable).

If you indicated 1 or 2 as an option, please also answer to the next two categories (simulation modality and cognitive level). If you indicated 3, go directly to the next Education and Training level.

INSTRUCTIONS TO COMPLETE QUESTIONNAIRE REGARDING MODALITIES AND LEVELS
Please indicate which type of simulation modality is / can be applicable as far as simulation is concerned:
(i) = Low-tech simulation modalities (such as simple three-dimensional organ models; basic plastic manikin and simple skills trainers; animal models; human cadavers; and simulated or standardised patients).
(ii) = High-tech simulation modalities (such as screen-based simulators; realistic, high-fidelity procedural simulators (task trainers); realistic, high-tech interactive patient simulators; and virtual reality).
Please mark the appropriate box(es) with an X. Mark one or two choices (low-tech and/or high-tech).

Please indicate which level of learning is / can be addressed by simulation according to the following scale displaying the various cognitive levels: (*cf.* definitions in accompanying letter to Delphi experts).

A = Remembering (knowledge); B = Understanding (comprehension); C = Applying (application);
D = Analysing (analysis); E = Evaluating (synthesis); F = Creating (evaluation).
Please mark the appropriate box(es) with an X. Mark any number of choices (The six cognitive levels of learning)
<u>OR</u>
Cognitive level of learning: Please give your opinion on the value of simulation as a learning method, for example, will it help the student to remember facts, leading to understand concepts, applying skills, helping to analyse, diagnose or compile a treatment plan/management plan/procedure. Please see end of each section.

	SECTION A **SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of **Surgical Care – Medical Knowledge and Patient Care.** The resident should reach the descriptors of performance on the specific level. Your opinion indicated in Round Two. Marked with an X. (Sent to a specific expert).				
1	**EDUCATION AND TRAINING LEVEL 1**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of basic medical sciences (e.g., electrolyte and fluid balance, haemostasis, wound healing and sepsis)	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Demonstrates an understanding of the principles utilised to ensure surgical safety (e.g., consent, patient positioning, aseptic techniques, skin preparation, universal precautions and the use of appropriate instruments)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)

c	*Examines surgical patients while using algorithms like ATLS (advance trauma life support) and ACLS (advanced cardiac life support).*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (80.0:20.0)
d	*Manages (with assistance) several uncomplicated patients*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
e	*Performs basic techniques in the management of a surgical patient, independently (e.g. urethral catheterisation and nasogastric [NG] tube placement)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
f	*Retrieves and categorises information*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0.100:0)
2	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the effects of ageing on surgical patients	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0.100:0)
b	Describes the impact of pregnancy on the management of surgical patients	1	2	X	Stability R2 (37.5:62.5)
c	Describes the effects of obesity on the management of surgical patients	1	2	X	Stability R2 (37.5:62.5)
d	Explains the role of nutrition in the management of surgical patients	~~1~~	~~2~~	~~3~~	Consensus R1 (33.3:66.7)
e	Explains the impact of substance abuse in the management of surgical patients (incl. alcohol, tobacco)	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
f	*Manages (with assistance) a surgical patient with single system disease*	*1*	*2*	*X*	Stability R2 (37.5:62.5)
g	*Conducts (with assistance) surgical consultations*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
h	*Performs routine procedures Independently (e.g., central line placement, biopsies, incision and drainage, chest tube placement, laceration repair and wound closure)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
i	*Recognises patterns and prioritises management offering at least one solution*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
3	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the role of medical comorbidities in surgical patients (e.g., hepatic, renal, cardiac or pulmonary failure	1	2	X	Stability R2 (37.5:62.5)
b	Demonstrates an understanding of psychological conditions (e.g., body dysmorphic syndrome or depression)	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
c	Demonstrates an understanding of the impact of treatment (e.g., immunosuppression, radiotherapy or chemotherapy)	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)

d	*Manages (under supervision) a surgical patient afflicted by multi systemic disorders*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
e	*Independently manages multiple surgical consultations and patients*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
f	*Identifies exceptions and offers at least three possible solutions*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
4	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates and understanding of the management of complicated multisystemic surgical pathophysiological processes, ranging from intensive care to organ system support	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
b	Identifies and explains potential reasons to offer surgical services	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
c	Explains the procedures involved in legally and professionally discharging a patient from a surgical practice	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
d	*Manages surgical patients with multiple systemic diseases without supervision or support*	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
e	*Manages a surgical firm*	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
f	*Anticipates potential problems and devises management plans or novel solutions*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
5	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Publishes research in peer-reviewed journals	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	*Teaching and supervision of other learners involved in patient management*	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	*Develops or implements simulation for the teaching and evaluation of surgical skills*	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	If you so whish, please give an example of a simulation or describe a simulation that you have done or that can be done Section A: Surgical care – Medical Knowledge and Patient Care (specific to this section).				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING ON SECTION A: SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE.				

	SECTION B **WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of **Wound Care – Medical Knowledge and Patient Care.** The resident should reach the descriptors of performance on the specific level.				
6	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of wound, pressure ulcer, necrotising infection and burns with regards to the pathophysiology	1	2	X	Stability R2 (37.5:62.5)
b	Explains wound management (including burns resuscitation, acute and chronic wounds)	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	*Examines patients with wounds (such as burns, acute or chronic wounds)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
d	*Assists with procedures (e.g., burn resuscitation, negative pressure therapy, wound preparation)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
e	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0:100.0)
7	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Explains the indication for intervening in acute or chronic wounds/burns	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Identifies high risk patients for developing chronic wounds (e.g., spinal cord injury)	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
c	Understands the diagnostic modalities used in assessing wounds (e.g., biopsies, cultures, imaging)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
d	*Explains procedures for managing wounds (e.g. risks, benefits, consent)*	~~*X*~~	~~*2*~~	~~*3*~~	Consensus R2 (75.0:25.0)
e	*Performs (with assistance) routine procedures (e.g., burn debridement, skin grafts, local flaps, and regional flaps)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
f	*Recognises complications arising from procedures, (e.g., infection) and initiates preventative measures*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
8	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the treatment of complex wounds (e.g., necrotising infections, pressure ulcers and radiation wounds)	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)

b	Demonstrates an understanding of surgical procedures (e.g., wound bed preparation, skin substitutes, grafts)	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
c	*Formulates (with assistance) a management plan for wound preparation and closure*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0:100.0)
d	*Performs (with assistance) complex procedures (e.g., microvascular flaps)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
e	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
9	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Describes the effect and outcomes of different treatment options (e.g., dressing changes *vs.* surgical closures)	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Demonstrates an understanding of the principles of complex procedures (e.g., hyperbaric oxygen, vascularized soft tissue coverage)	1	2	X	Stability R2 (37.5:62.5)
c	*Independently formulates a management plan for wound preparation and closure (including patients with comorbidities)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0:100.0)
d	*Participates in a wound care team*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0:100.0)
e	*Performs complex procedures independently (e.g., microvascular flaps)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
f	*Independently manages complications*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
10	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Systematically reviews outcomes leading to publication in peer-reviewed journals	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	*Establishes a cost-effective management plan*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
c	*Functions as the leader of a wound care team*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
d	*Helps co-ordinate a burn center*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
e	*Develops a plan for occupational rehabilitation*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				

	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING SECTION B – WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE.				
	SECTION C **TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Tissue Transfer – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
11	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the basic science behind grafts, flaps, and microvascular transfers	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	Describes the surgically relevant anatomy of grafts, flaps, and microvascular transfers	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	*Examines patients with reconstructive problems*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
d	*Performs wound care independently (e.g., dressings, negative pressure therapy)*	~~*1*~~	~~*2*~~	~~*X*~~	Consensus R2 (75.0:25.0)
e	*Provides post-operative care for patients that have undergone loco-regional tissue reconstructions*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
12	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**N OT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the surgical management of soft tissue defects, and designs basic flap types (e.g., local, axial and perforator flaps)	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)
b	Demonstrates knowledge of materials used in soft tissue transfer (e.g. suture materials, surgical devices)	~~X~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
c	*Obtains informed consent for grafts, flaps, and other complex wound care options*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
d	*Performs routine procedures with assistance (e.g., debridement, skin grafts, complex wound closures, local flaps, bone graft harvesting)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
e	*Performs microvascular repairs under simulated conditions*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
f	*Provides post-operative care with assistance for microvascular tissue transfer patients*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)

13	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Describes the indications and anatomy of potential tissue transfer options for various defects	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
b	Explains principles of treatment options for complex wounds	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	Demonstrates an understanding of complex tissue transfer procedures (e.g., nerve repair or grafting, and composite microvascular transfers)	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
d	*Formulates, with assistance, a treatment plan for complex reconstructive surgery*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
e	*Performs complex procedures (e.g., nerve repair or gaffing, and microvascular tissue transfers) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
f	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
14	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Independently decides upon treatment choices for soft tissue defects	X	2	3	Stability R2 (50.0:50.0)
b	Explains alternatives following complications	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	*Independently formulates a management plan for complex reconstructive surgery in complicated patients (e.g., with previous surgeries, comorbidities)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
d	*Performs complex procedures independently*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
e	*Manages complex complications (e.g., loco-regional tissue and microvascular flap compromises) independently*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
15	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	

a	Systematically reviews outcomes of tissue transfers leading to publications in peer-reviewed journals	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	Demonstrates an understanding of tissue engineering principles	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
c	*Acts as team leader in complex composite tissue reconstruction*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
d	*Performs prefabricated composite tissue transfer*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
e	*Performs vascularized composite allotransplantation*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING SECTION C - TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION D **CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Congenital Anomalies – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
16	**EDUCATION AND TRAINING LEVEL 1**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the embryology of clefts	~~X~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
b	Describes craniofacial anomalies	~~1~~	~~2~~	~~X~~	Consensus R2 (25.0:75.0)
c	Explains the normal anatomy of the craniofacial system	X	2	3	Stability R2 (50.0:50.0)
d	*Examines patients with craniofacial anomalies*	*1*	*2*	*X*	Stability R2 (37.5:62.5)
e	*Assists with craniofacial procedures (e.g., incisions and skin closures)*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (75.0:25.0)
f	*Provides paediatric patients with routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
17	**EDUCATION AND TRAINING LEVEL 2**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**

a	Demonstrates an understanding of the management of craniofacial patients (diagnosis, basic surgical treatments, and special needs)	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
b	Demonstrates an understanding of the concepts of staged multi-disciplinary treatment in the care of craniofacial patients	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	*Obtains informed consent for routine congenital abnormalities (e.g., vascular anomalies, giant congenital nevi, cleft surgery)*	*1*	*2*	*X*	Stability R2 (37.5:62.5)
d	*Performs (with assistance) routine procedures for congenital anomalies (e.g., prominent ear correction)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
e	*Recognises complications arising from procedures (e.g., feeding difficulties, airway compromise)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
18	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the timing and indications for staged management protocols for craniofacial patients	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	Describes the surgical anatomy and principles of simple craniofacial procedures (e.g., the steps involved in a cleft repair)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	*Formulates, with assistance, a management plan for routine congenital anomalies*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
d	*Performs complex procedures (e.g., cleft lip, palate repair) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
e	*Manages (with assistance) complications (e.g., palatal fistulae, exposed expanders)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
19	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the effects of treatments (e.g., cleft care) on craniofacial patients	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)

b	Describes the surgical anatomy and principles of complex craniofacial procedures (e.g., distraction osteogenesis, cranial vault remodelling, secondary cleft deformities)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	*Formulates, with assistance, a management plan for craniofacial surgery*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0:100.0)
d	*Performs complex procedures independently*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
e	*Independently manages complications of congenital anomalies*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0:100.0)
20	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of a multidisciplinary craniofacial team's composition and management	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	*Manages complex craniofacial anomalies (e.g., hemifacial microsomia, craniosynostosis) independently*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION D CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION E **HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Head and Neck – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
21	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains benign and malignant diseases of the head and neck area	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)
b	Explains the anatomy of the head and neck (e.g., lymphatic drainage, salivary glands, periorbita)	~~1~~	~~2~~	~~3~~	Consensus R1 (88.9:11.1)

c	Describes the staging of head and neck malignancies	~~1~~	~~2~~	~~3~~	Consensus R1 (33.3:66.7)
d	*Performs history and physical examination of patients with head and neck malignancies*	~~*1*~~	~~*2*~~	~~*X*~~	Consensus R2 (66.7:33.3)
e	*Assists with procedures (e.g., excision of minor skin lesions, biopsies)*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (77.8:22.2)
f	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (22.2:77.8)
22	**EDUCATION AND TRAINING LEVEL 2**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates and understanding of the surgical management for cancers of the head and neck (e.g., parotid, pharynx)	~~1~~	~~2~~	~~3~~	Consensus R1 (33.3:66.7)
b	Describes the principles of excision (e.g., margins) and reconstruction for head and neck lesions	~~1~~	~~2~~	~~3~~	Consensus R1 (33.3:66.7)
c	Demonstrates an understanding of roll of adjunctive modalities (e.g., feeding tubes, tracheostomy)	~~1~~	~~2~~	~~3~~	Consensus R1 (33.3:66.7)
d	*Obtains informed consent for extirpative and reconstructive procedures*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (14.1:85.9)
e	*Performs (with assistance) routine excisions and reconstructions (e.g., local flaps, skin grafts)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (88.9:11.1)
f	*Recognises complications (e.g., flap compromise, orocutaneous fistula, bleeding)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (77.8:22.2)
g	*Prescribes post-operative rehabilitation*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0:100.0)
23	**EDUCATION AND TRAINING LEVEL 3**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Describes the indications for different management options (e.g., surgical, non-surgical, ancillary procedures)	~~1~~	~~2~~	~~3~~	Consensus R1 (33.3:66.7)
b	Explains routine procedures' principles (e.g., local flaps, wedge excisions of the lip)	~~1~~	~~2~~	~~3~~	Consensus R1 (88.9:11.1)
c	Explains the effects of previous interventions on reconstructive options (e.g., osteoradionecrosis)	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)

d	Describes the management of metastatic disease (regional and distant)	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)
e	*Formulates, with assistance, a management plan*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (22.2:77.8)
f	*Performs complex procedures (e.g., full thickness nasal defects, repair of complex eyelid defects, myocutaneous flaps) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (88.9:11.1)
g	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (33.3:66.7)
24	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains the sequelae of surgical interventions (e.g., long term outcomes, post surgery deformities)	~~1~~	~~2~~	~~X~~	Consensus R2 (66.7:33.3)
b	Describes the surgical anatomy and principles of complex procedures (e.g., total nasal reconstruction, microsurgical bone transfer, neck dissection)	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)
c	Explains adjunctive reconstructive options (e.g., maxillofacial prosthetics, dental implants)	~~1~~	~~2~~	~~3~~	Consensus R1 (66.7:33.3)
d	*Independently formulates a management plan for patients with comorbidities*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (11.1:88.9)
e	*Independently performs complex reconstructions (e.g., microvascular soft tissue or bone transfers)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
f	*Independently manages complications (e.g., failed microvascular transfers)*	*1*	*2*	*X*	Stability R2 (44.4:55.6)
25	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Discusses novel modalities (diagnostic and treatment) for head and neck cancer	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	*Helps lead a multidisciplinary head and neck cancer team*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				

	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION E HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE

	SECTION F **MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Maxillofacial Trauma – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
26	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains aetiology of facial fractures and soft tissue injuries	~~1~~	~~2~~	~~X~~	Consensus R2 (25.0:75.0)
b	Demonstrates an understanding of head and neck anatomy	~~X~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
c	Describes facial fracture patterns	~~X~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
d	Describes the risks of associated injuries (e.g., cervical spine injury, airway compromise)	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
e	*Performs the examination of patients with maxillofacial trauma (incl. workup studies)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
f	*Assists with procedures (e.g., early fracture stabilisation, suturing lacerations)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
g	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
27	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Describes sequelae of (e.g., malocclusion, enopthalmos)	~~1~~	~~2~~	~~3~~	Consensus R1 (28.6:71.4)
b	Explains the principles of surgical management (e.g., methods of fixation, open *vs.* closed approaches)	1	2	X	Stability R2 (37.5:62.5)
c	Demonstrates an understanding of interventions of associated injuries (e.g., tracheostomy)	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Elicits the specific clinical findings associated with soft tissue injuries and common facial fractures*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
e	*Interprets imaging studies*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (75.0:25.0)

f	*Obtains informed consent for maxillofacial trauma cases*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
g	*Performs (with assistance) routine procedures (e.g., open reduction internal fixation [ORIF], maxilla mandibular fixation [MMF])*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
h	*Recognises complications (e.g.,, cerebrospinal fluid leak, airway compromise)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (85.7:14.3)
28	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of indications and timing for the different management options for facial trauma	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Explains the surgical principles of routine procedures (e.g., eyelid laceration repair, closed nasal reduction, MMF)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	*Formulates a treatment plan with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0:100.0)
d	*Performs (with assistance) complex procedures (e.g., panfacial fracture management)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
e	*Manages complications with assistance*	*1*	*2*	*X*	Stability R2 (37.5:62.5)
29	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Identifies the late sequelae of facial trauma (e.g., mucocele, ectropion)	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Describes the surgical principles of complex procedures (e.g., repair NOE with telecanthus, canalicular repair)	~~X~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
c	*Independently formulates a treatment plan*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (16.7:83.3)
d	*Independently performs complex procedures*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
e	*Independently manages complications (e.g., facial nerve injuries, nasal airway obstruction)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (71.4:28.6)

30	EDUCATION AND TRAINING LEVEL 5				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Publishes research on maxillofacial trauma in peer-reviewed journals	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	*Manages complex secondary deformities (e.g., malocclusion, enopthalmos)*	~~X~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION F MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE				

	SECTION G FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE
	This section deals with the five education and training levels of Facial Aesthetics – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

31	EDUCATION AND TRAINING LEVEL 1				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Describes the normal anatomy of the face	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
b	Demonstrates an understanding of the normal proportions, angles and relationships in facial analysis	~~X~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
c	*Performs focused history and examination of aesthetic facial surgery patients*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (75.0:25.0)
d	*Assists with aesthetic facial procedures (e.g., incisions and skin closures)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)

32	EDUCATION AND TRAINING LEVEL 2				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**

a	Demonstrates an understanding of the concepts of facial aging and the management options thereof	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Explains the concept of skin resurfacing (e.g., chemical peels, lasers)	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	Appreciates the role of psychological factors on outcomes in aesthetic facial surgery	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Obtains informed consent for facial aesthetic procedures*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (75.0:25.0)
e	*Performs (with assistance) routine facial aesthetic procedures (e.g., scar revision, upper blepharoplasty, harvesting of cartilage grafts, injection of neuromodulators, fat injections)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
f	*Recognises complications (e.g., seroma, haematoma, necrosis, wound dehiscence)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
33	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding for the role of different treatment options for addressing the aging face	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Describes the principles of non-surgical and surgical procedures, (e.g., peels, fillers, neuromodulators, blepharoplasties, facelifts, rhinoplasties)	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
c	*Formulates a management plan with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
d	*Performs complex procedures (e.g., tip rhinoplasty, facelifts, neck-lifts) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
e	*Manages complications with assistance*	*1*	*2*	*X*	Stability R2 (37.5:62.5)
34	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Describes the effects of treatment of non-surgical and surgical options	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)

b	Explains the principles of complex treatments for the aging face, (e.g., secondary rhinoplasties, deep plane facelifts, endoscopic procedures)	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
c	Discusses the dynamics of combining various procedures for treatment of the ageing face	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
d	*Independently formulates a treatment plan for aesthetic facial surgery patients*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (16.7:83.3)
e	*Independently performs procedures (e.g., lower blepharoplasties, primary rhinoplasties, and facelifts)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
f	*Independently manages complications*	*1*	*2*	*X*	Stability R2 (37.5:62.5)
35	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Contributes to research in aesthetic facial surgery leading to publication in peer-reviewed journals	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
b	*Independently treats complex secondary deformities of previous surgery*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
c	*Leads a multidisciplinary team for the treatment of facial aesthetics*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION G FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION H **NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Non-Cancer Breast Surgery – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				

36	EDUCATION AND TRAINING LEVEL 1				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of benign breast conditions (e.g., gynecomastia, hypermastia, ptosis congenital anomalies)	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
b	Explains breast embryology, anatomy, and physiology	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	Describes principles of imaging for benign breast conditions	~~1~~	~~2~~	~~3~~	Consensus R1 (28.6:71.4)
d	*Performs examination of patients with a benign breast condition*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
e	*Orders imaging studies and diagnostic tests*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0:100.0)
f	*Assists with breast procedures (e.g., incisions and skin closures)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
g	*Provides routine post-operative care for the breast patient*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)

37	EDUCATION AND TRAINING LEVEL 2				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the surgical treatment for benign breast conditions	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Explains concepts of proportions of the breast, aesthetic ideals, and symmetry	~~X~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
c	Shows an understanding of the different types of breast implants	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
d	*Interprets diagnostic studies*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
e	*Obtains informed consent for breast procedures*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (71.4:28.6)
f	*Performs routine procedures (e.g., mastopexy, gynecomastia, reduction mammoplasty) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
g	*Recognises complications (e.g., infection, implant complications, hematoma)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)

38	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	

a	Recognises indications for treatment options (e.g., skin/ parenchyma reduction, augmentation)	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Explains the principles of routine surgical procedures (e.g., mastopexy, reduction mammoplasty, augmentation mammoplasty)	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
c	*Formulates (with assistance) a treatment plan for routine breast procedures*	*1*	*2*	*X*	Stability R2 (37.5:62.5)
d	*Performs complex procedures (e.g., congenital breast deformity, augmentation/ mastopexy) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
e	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (28.6:71.4)
39	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Explains the effect of surgery on breast sensation, nipple areolar perfusion, and lactation	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Describes the principles of complex surgical procedures (e.g., tuberous breast deformity, augmentation/ mastopexy)	~~X~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
c	Describes evolving technologies such as fat grafting	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Independently formulates a treatment plan*	~~*X*~~	~~*2*~~	~~*3*~~	Consensus R2 (75.0:25.0)
e	*Independently performs complex procedures*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
f	*Independently manages complications*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
g	*Independently manages secondary deformities*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
h	*Independently manages the dissatisfied patient*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)
40	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Systematically reviews patient outcomes	1	2	X	Stability R2 (42.9:57.1)
b	*Publishes in peer-reviewed journals*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (71.4:28.6)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				

	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION H NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION I **BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Breast Reconstruction – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
41	**EDUCATION AND TRAINING LEVEL 1**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the pathophysiology of malignant breast disease	~~1~~	~~2~~	~~3~~	Consensus R1 (28.6:71.4)
b	Describes the anatomy of the breast and its lymphatic drainage	~~1~~	~~2~~	~~3~~	Consensus R1 (28.6:71.4)
c	*Performs history and physical examination of the breast cancer patient*	~~*1*~~	~~*2*~~	~~*X*~~	Consensus R2 (71.4:28.6)
d	*Assists with procedures (e.g., incisions and skin closure)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (14.3:85.7)
e	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (28.6:71.4)
42	**EDUCATION AND TRAINING LEVEL 2**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains surgical treatment for malignant breast disease	1	2	X	Stability R2 (37.5:62.5)
b	Demonstrates an understanding of the principles of implant-based breast reconstruction	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	*Obtains informed consent for breast reconstruction procedures*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (75.0:25.0)
d	*Performs (with assistance) routine procedures (e.g., tissue expander insertion, flap elevation)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
e	*Recognises complications (e.g., implant complications, flap compromise)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)

43	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the role of adjuvant treatment	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Describes the impact of primary and adjuvant treatment on breast reconstruction	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	Explains the principles of breast reconstruction using pedicled flaps	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)
d	*Formulates a treatment plan with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
e	*Performs complex procedures (e.g., treatment of the contralateral breast, microsurgical procedures) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (87.5:12.5)
f	*Manages complications with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)

44	EDUCATION AND TRAINING LEVEL 4				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the late effects of chemotherapy and radiation on breast reconstruction	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Explains the surgical principles of the various microsurgical breast reconstruction options	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	*Independently formulates a treatment plan*	~~*1*~~	~~*2*~~	~~*X*~~	Consensus R2 (75.0:25.0)
d	*Independently performs complex procedures*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
e	*Independently manages complications*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (75.0:25.0)

45	EDUCATION AND TRAINING LEVEL 5				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Publishes research in peer-reviewed journals	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
b	*Manages complicated patients with multiple previous treatment failures*	*1*	*2*	*X*	Stability R2 (37.5:62.5)

c	*Assists in leading a multidisciplinary team*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
d	*Teaches breast reconstructive procedures*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION I BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION J RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE				
	This section deals with the five education and training levels of Reconstruction of Trunk and Perineum – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
46	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of benign, malignant and congenital conditions of the perineum/trunk	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Demonstrates an understanding of the anatomy of the back, perineum, chest and abdominal wall	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
c	Demonstrates an understanding of pressure off-loading, nutrition and respiratory mechanics	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
d	*Takes a history and performs an examination of a patient with perineal/truncal defects*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (75.0:25.0)
e	*Assisting with procedures (e.g., incisions and wound closure)*	~~*1*~~	~~*2*~~	~~*X*~~	Consensus R2 (75.0:25.0)
f	*Provides routine post-operative care*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (0.0:100.0)
47	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains the concepts of wound management, return of abdominal domain, and chest wall stability	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)

b	Demonstrates an understanding of the indications for the provision of dynamic support, cover of vital structures, and functional restoration	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	Demonstrates an understanding of the management of major defects in stages	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
d	*Obtains informed consent*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (75.0:25.0)
e	*Performs, with assistance, routine procedures (e.g., component separation, debridement, musculocutaneous flaps)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
f	*Recognises complications (e.g., organ failure)*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (28.6:71.4)
48	**EDUCATION AND TRAINING LEVEL 3**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of surgical management of congenital abnormalities, chest wall defects, hernias, pressure ulcers and irradiated wounds	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
b	Describes the principles of routine surgical procedures (e.g., component separation, hernia repair and pressure ulcer reconstruction)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	Explains the uses of synthetic and biologic materials	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
d	*Formulates, with assistance, a treatment plan for routine conditions*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)
e	*Performs complex procedures (e.g., urogenital reconstruction, composite chest wall reconstruction) with assistance*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (100.0:0.0)
f	*Manages complications with assistance*	*X*	*2*	*3*	Stability R2 (60.0:40.0)
49	**EDUCATION AND TRAINING LEVEL 4**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the impact of treatment on cardiopulmonary, gastrointestinal, musculoskeletal and genitourinary functioning	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)

b	Explains the principles of complex surgical procedures (e.g., recurrent ventral hernia, perineal reconstruction, composite chest wall defects)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	*Independently formulates a treatment plan*	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
d	*Performs complex procedures independently*	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)
e	*Independently manages*	~~1~~	~~2~~	~~3~~	Consensus R1 (14.3:85.7)
50	**EDUCATION AND TRAINING LEVEL 5**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Publishes research in peer-reviewed journals	1	2	X	Stability R2 (37.5:62.5)
b	*Independently manages complex secondary perineal and truncal deformities*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION J RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION K **UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Upper Extremity Trauma – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
51	**EDUCATION AND TRAINING LEVEL 1**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of soft-tissue injuries, dislocations and common fractures.	~~1~~	~~2~~	~~X~~	Consensus R2 (75.0:25.0)
b	Describes the anatomy, basic biomechanics and function of the upper extremity	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
c	Explains the principles of casting/splinting	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
d	*Performs examination of patients with upper extremity*	~~1~~	~~2~~	~~3~~	Consensus R1 (85.7:14.3)

e	*Assists with procedures (e.g., applying splints, making incisions, and doing dressings)*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
f	*Provides routine post-operative care*	*1*	*2*	*X*	Stability R2 (37.5:62.5)
52	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the principles of bony stabilisation and soft tissue coverage	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
b	Explains the principles of flap cover and bony fixation	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	Demonstrates an understanding of the management of acute compartment syndrome and vascular injuries	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Obtains informed consent for the surgical management of traumatic upper limb injuries*	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
e	*Performs, with assistance, routine procedures (e.g., repair of tendon / nerve injuries or simple hand fractures)*	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)
f	*Recognises complications (e.g., compartment syndrome, vascular compromise)*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
53	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of complicating factors (e.g., vascular compromise, bone loss, exposed critical structures)	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Explains the principles of tendon, nerve, vessel, and bony repairs	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
c	Demonstrates an understanding of the principles involved in post-operative regimens for hand therapy	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
d	*Formulates, with assistance, a treatment plan for common hand injuries (e.g., fracture/dislocation, tendon injury)*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
e	*Performs complex procedures (e.g., microvascular flap coverage, hand revascularisation, repair of the mangled hand) with assistance*	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)

f	*Manages complications with assistance*	*X*	*2*	*3*	Stability R2 (50.0:50.0)
54	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains tendon transfer biomechanics	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
b	Explains the principles involved in reconstruction of complex problems (e.g., replantation, secondary tendon reconstruction, nerve grafting)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	Explains the role of chronic regional pain syndrome, secondary rehabilitation and prosthetics	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Independently formulates a treatment plan*	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
e	*Independently performs complex procedures*	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
f	*Independently manages complications*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
55	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the principles involved in tendon and nerve transfers for brachial plexus / combined nerve injuries	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
b	Demonstrates an understanding of the multidisciplinary management of hand injuries in a dedicated hand unit.	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
c	*Publishes research in peer-reviewed journals*	*1*	*2*	*X*	Stability R2 (50.0:50.0)
d	*Manages work-related injuries and return-to-work issues*	~~1~~	~~2~~	~~3~~	Consensus R1 (12 5:87.5)
e	*Manages chronic regional pain syndrome*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION K UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE				

	SECTION L **NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Non-Trauma Hand – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
56	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the pathophysiology of non-traumatic hand conditions (e.g., compression neuropathy, degenerative changes, infection)	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	Describes the embryology, anatomy and biomechanics of the upper extremity and hand	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
c	*Performs history and examination of patients with non-traumatic hand disorders*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Assists with procedures (e.g., injections, abscess drainage, skin incisions and closure)*	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
57	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains the treatment options for compression neuropathy, degenerative changes, infection of the upper limb and hand	1	2	X	Stability R2 (50.0:50.0)
b	Explains the concepts of injections, pharmacologic management, incision, and drainage	~~1~~	~~X~~	~~3~~	Consensus R2 (87.5:12.5)
c	Describes principles of anaesthesia for the upper extremity (e.g., local and regional)	~~1~~	~~2~~	~~X~~	Consensus R2 (75.0:25.0)
d	*Obtains informed consent for congenital and non-trauma hand reconstruction procedures*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
e	*Performs, with assistance, routine procedures (e.g., tumor excision, ganglion removal, nerve decompression)*	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)

58	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Describes management options for contractures and metabolic processes	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
b	Explains principles of routine surgical procedures (e.g., tumour and ganglion excisions, fusions, nerve releases, and contracture releases)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	Describes the post-operative hand therapy regimens	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Formulates a treatment plan with assistance for routine hand conditions*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
e	*Performs complex procedures (e.g., syndactyly reconstruction, tendon transfers, arthroplasty, contracture release) with assistance*	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)

59	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Explains the management of congenital and autoimmune conditions	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	Describes surgical principles for complex procedures (e.g., syndactyly release, ligament reconstructions, arthroplasties, and tendon transfers)	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
c	*Independently formulates a treatment plan*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Independently performs complex procedures*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)

60	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Explains the surgical anatomy and principles for complex procedures (e.g., thumb reconstructions, congenital hand reconstruction, nerve transfers, rheumatoid hand reconstruction)	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)

b	*Formulates a treatment plan for complex congenital hand and rheumatoid deformities*	~~1~~	~~2~~	~~X~~	Consensus R2 (75.0:25.0)
c	*Performs toe-to-hand transfers, pollicisations, implant arthroplasty*	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)
d	*Helps manage a multidisciplinary hand surgery team*	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION L NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE				

	SECTION M **COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Cosmetic Trunk and Lower Extremity – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
61	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the pathophysiology of lipodystrophy and obesity	~~1~~	~~2~~	~~X~~	Consensus R2 (25.0:75.0)
b	Discusses the effects of aging	~~1~~	~~2~~	~~X~~	Consensus R1 (12.5:87.5)
c	Explains the effect of massive weight loss	~~1~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
d	Describes the anatomy and aesthetic ideals of the lower extremities and trunk	1	X	3	Stability R2 (50.0:50.0)
e	Explains the concept of weight management (e.g. diet and exercise)	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
f	Explains deep venous thrombosis and pulmonary embolism risk factors, workup, and management	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
g	*Performs physical examination of patients with aesthetic and functional problems of the trunk and lower extremity*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
h	*Assists with procedures (e.g., skin incision and closure)*	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
i	*Provides routine post-operative care*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)

62	EDUCATION AND TRAINING LEVEL 2				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of bariatric surgery (e.g. indications, different types, their metabolic effects)	1	2	3	Stability R2 (37.5:62.5)
b	Identifies factors influencing patient selection for body contouring surgery	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
c	Explains the physiological effects of liposuction	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
d	Describes the different aesthetic ideals based on a patient's gender	~~1~~	~~2~~	~~X~~	Consensus R1 (12.5:87.5)
e	Explains the benefit of multidisciplinary bariatric teams	~~1~~	~~2~~	~~X~~	Consensus R2 (75.0:25.0)
f	*Obtains informed consent for routine cosmetic trunk and lower limb procedures*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
g	*Performs routine procedures (e.g., panniculectomy, abdominoplasty)*	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
h	*Recognises complications (e.g., skin loss, thromboembolism, seroma)*	*X*	*2*	*3*	Stability R2 (37.5:62.5)

63	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the management options for massive weight loss patients	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	Describes surgical principles of routine procedures (e.g., brachioplasty, medial thigh lift, liposuction abdominoplasty)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	*Formulates a treatment plan with assistance*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Performs, with assistance, complex procedures (e.g., brachioplasty, circumferential body lift)*	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)
e	*Manages complications with assistance*	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)

64	EDUCATION AND TRAINING LEVEL 4				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Differentiates between aesthetic and functional problems	1	2	X	Stability R2 (37.5:62.5)
b	Explains the surgical principles of complex procedures	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
c	*Independently formulates a treatment plan*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Independently performs complex procedures*	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
e	*Independently manages complications*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)

65	EDUCATION AND TRAINING LEVEL 5				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Systematically reviews outcomes and publishes in peer-reviewed journals	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
b	*Manages patients with multiple prior surgeries / unsatisfactory previous results*	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION M COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE				

	SECTION N **LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Lower Extremity – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

66	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the pathophysiology of congenital and acquired conditions of the lower extremity (e.g., trauma, cancer, diabetic foot, venous and arterial insufficiency)	1	2	X	Stability R2 (37.5:62.5)
b	Explains the anatomy of the lower extremity	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	Explains the classification systems for soft tissue and bone loss of the lower extremity	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
d	*Performs history and physical examination of patients with lower extremity concerns*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
e	*Assists with procedures (e.g., splint application, dressings, skin incision and closure)*	~~1~~	~~2~~	~~3~~	Consensus R1 (88.9:11.1)
f	*Provides routine post-operative care*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)

67	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Explains the principles of non-operative treatment for lower extremity conditions (e.g., lymphoedema, neuropathic ulcers)	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	Describes the surgical principles for lower extremity surgery (e.g., timing and staging of procedures)	~~1~~	~~X~~	~~3~~	Consensus R2 (85.7:14.3)
c	*Obtains informed consent for surgical procedures of the lower extremity*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Performs routine procedures (e.g., skin grafts) with assistance*	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
e	*Recognises complications (e.g., compartment syndrome, flap compromise)*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)

68	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	

a	Demonstrates an understanding of the indications for treatment of conditions of the lower extremity (e.g., compartment syndrome, tumor resection, exposed prostheses, arterial insufficiency, and musculoskeletal injury)	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	Describes the surgical principles of routine procedures (e.g., local flaps, skin grafting, wound debridement)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	*Formulates a treatment plan with assistance*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Performs complex procedures (e.g., free tissue transfer) with assistance*	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)
e	*Manages complications with assistance*	*X*	*2*	*3*	Stability R2 (62.5:37.5)
69	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the role of adjunctive modalities (e.g. prosthetics)	1	2	X	Stability R2 (50.0:50.0)
b	Describes the surgical principles of complex procedures (e.g., free tissue transfers, and perforator flaps)	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
c	*Independently formulates a treatment plan*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Performs complex procedures independently*	~~1~~	~~2~~	~~3~~	Consensus R1 (100.0:0.0)
e	*Independently manages complications*	~~1~~	~~2~~	~~3~~	Consensus R1 (87.5:12.5)
70	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the principles of microsurgical treatment of lymphoedema, tendon and nerve transfers of the lower extremity	~~1~~	~~2~~	~~X~~	Consensus R2 (75.0:25.0)
b	*Helps lead a multidisciplinary team for limb salvage*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				

	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION N: LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE
	SECTION O **SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT**
	This section deals with the five education and training levels of Systems-based Practice - Patient Safety, Resource allocation and Practice management. The resident should reach the descriptors of performance on the specific level.

71	EDUCATION AND TRAINING LEVEL 1	Simulation			
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains the differences between sentinel events, near misses, and medical errors	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)
b	Describes the roles of team members	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
c	*Describes practice variations in resource consumption, such as the utilization of diagnostic tests*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
d	*Explains basic health payment systems, including uninsured care*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
e	*Describes different practice models*	~~1~~	~~2~~	~~3~~	Consensus R1 (16.7:83.3)

72	EDUCATION AND TRAINING LEVEL 2	Simulation			
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Participates in the use of tools (e.g., briefings and checklists) to prevent adverse events	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
b	Describes the common system causes for errors	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
c	*Describes the cost implications of using resources*	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
d	*Describes the principles of evaluation, management, and procedure coding*	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
e	*Compares and contrasts different practice models*	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)

73	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Consistently uses tools (e.g., briefings and checklists) to prevent adverse occurrences	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	Reports problematic devices, processes and behaviours, including near misses and errors	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
c	*Participates in responsible use of health care resources, seeking appropriate assistance*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
d	*Codes routine encounters, diagnoses, and surgical procedures*	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
e	*Recognises basic elements needed to establish practice (e.g., facility accreditation, compliance, staffing, contracts, malpractice insurance, negotiations)*	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)

74	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Formally uses proven analysis methods to evaluate shared team experiences to prevent future errors	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
b	Leads team by promoting input and situational awareness by all team members	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
c	Improves patient safety by conducting morbidity and mortality meetings	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
d	*Practises cost-effective care (e.g., operative efficiency, managing length of stay)*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
e	*Codes complex and unusual encounters, diagnoses, and procedures*	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
f	*Establishes timeline and identifies resources for transition to practice*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)

75	EDUCATION AND TRAINING LEVEL 5				
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Leads curriculum design activities to develop communication skills and teamwork of health care professionals	~~1~~	~~X~~	~~3~~	Consensus R2 (75.0:25.0)
b	Assists in leading a multidisciplinary team to address patient safety issues	~~1~~	~~X~~	~~3~~	Consensus R2 (85.7:14.3)
c	*Designs measurement tools provide feedback to providers on resource consumption*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
d	*Participates in advocacy activities for health policy*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
e	*Creates curriculum to teach practice management*	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION O: SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT				

	SECTION P **PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE, AND RESEARCH AND TRAINING**
	This section deals with the five education and training levels of Practice-based Learning and Improvement – Investigate, Evaluate, Assimilate, and Research and Training. The resident should reach the descriptors of performance on the specific level.

76	EDUCATION AND TRAINING LEVEL 1				
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Shows awareness of one's own level of knowledge and expertise	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
b	Identifies learning resources	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	*Demonstrates an understanding of the basic concepts in clinical reasoning, biostatistics, clinical epidemiology*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
d	*Participates in the education of patients and their families*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)

77	EDUCATION AND TRAINING LEVEL 2				
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Continually seeks to improve performance by incorporating feedback	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
b	Uses published guidelines and articles in a learning plan	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	*Ranks study designs and is able to distinguish relevant research outcomes*	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
d	*Teaches patients and their families*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)

78	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates a balanced and accurate self-assessment of competence	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
b	Selects an appropriate evidence-based information tool to answer specific questions	~~1~~	~~2~~	~~3~~	Consensus R1 (25.0:75.0)
c	*Able to critically appraise different research types (e.g., systematic reviews and meta-analyses)*	~~1~~	~~2~~	~~X~~	Consensus R2 (25.0:75.0)
d	*Teaches health professionals and colleagues in both informal and formal settings*	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)

79	EDUCATION AND TRAINING LEVEL 4				
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates improvement in clinical outcomes based on continual self-assessment	~~1~~	~~2~~	~~3~~	Consensus R1 (75.0:25.0)
b	Performs self-directed learning with minimal external guidance, using evidence-based information tools	~~X~~	~~2~~	~~3~~	Consensus R2 (75.0:25.0)
c	*Formulates a researchable question, describes a plan to investigate it, and executes a research project*	*X*	*2*	*3*	Stability R2 (50.0:50.0)
d	*Organises educational activities at programme level*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (25.0:75.0)

80	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Consistently incorporates evidence-based information in common areas of practice	1	2	X	Stability R2 (37.5:62.5)
b	*Independently plans and executes a research programme*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
c	*Develops educational curriculum and assessment tools*	~~*X*~~	~~*2*~~	~~*3*~~	Consensus R2 (71.4:28.6)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION P PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE, AND RESEARCH AND TRAINING				

	SECTION Q **PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY**				
	This section deals with the five education and training levels of Professionalism – Ethics and Values, and Personal Accountability. The resident should reach the descriptors of performance on the specific level.				
81	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Is able to identify ethical issues in plastic surgery	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	Demonstrates behaviour that conveys honesty, caring and genuine interest in patients and families	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
c	*Explains and manages issues related to fatigue and sleep deprivation*	*1*	*2*	*X*	Stability R2 (37.5:62.5)
d	*Exhibits professional behaviour (e.g., confidentiality, integrity, diligence, and reliability)*	~~*1*~~	~~*X*~~	~~*3*~~	Consensus R2 (75.0:25.0)

82	EDUCATION AND TRAINING LEVEL 2				
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Is able to analyse, discuss and manage common ethical situation	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
b	Demonstrates behaviour that shows insight in the impact of one's core values and beliefs regarding patient care	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
c	*Demonstrates management of physical, mental, personal and emotional health*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)
d	*Recognises individual limits in clinical situations and asks for assistance when needed*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)

83	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Analyses and manages ethical issues in challenging and complicated situations	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
b	Demonstrates an understanding of the beliefs, practices and values of diverse and vulnerable patient populations	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
c	*Manages situations in which maintaining physical, mental and personal health is challenged*	~~*X*~~	~~*2*~~	~~*3*~~	Consensus R2 (75.0:25.0)
d	*Acknowledges conflicting interests of self, family, and others, and their effects on the delivery of medical care*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)

84	EDUCATION AND TRAINING LEVEL 4				
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Uses a systemic approach to manage ethical issues, including conflicts of interest, billing and advertising	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
b	Develops a mutually agreeable care plan in the context of conflicting physician and patient values and beliefs	~~1~~	~~2~~	~~3~~	Consensus R1 (12.5:87.5)
c	*Recognises signs of physician impairment and demonstrates appropriate steps to address impairment in self and in colleagues*	~~*1*~~	~~*2*~~	~~*3*~~	Consensus R1 (12.5:87.5)

d	*Prioritises and balances conflicting interests of self, family, and others to optimise medical care*	~~1~~	~~2~~	~~3~~	Consensus R1 (0.0:100.0)
85	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Helps lead institutional and organisational ethics programmes	1	2	X	Stability R2 (37.5:62.5)
b	Develops programmes to ensure equality of care in diverse, vulnerable, and underserved populations	~~1~~	~~2~~	~~3~~	Consensus R1 (28.6:71.4)
c	*Helps develop institutional and organisational strategies to improve physician wellness*	~~1~~	~~2~~	~~X~~	Consensus R2 (71.4:28.6)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY				
	SECTION R **INTERPERSONAL AND COMMUNICATION SKILLS**				
	This section deals with the five education and training levels of Interpersonal and Communication Skills. The resident should reach the descriptors of performance on the specific level.				
86	**EDUCATION AND TRAINING LEVEL 1**				
	All the statements relate to interpersonal and communication skills.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Develops a positive relationship with patients and teams, in uncomplicated situations	~~1~~	~~2~~	~~X~~	Consensus R2 (66.7:33.3)
b	Demonstrates an understanding of the patient's/family's perspective	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)
c	Utilises interpreters as needed	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)
d	Appreciates effective communication to prevent medical errors	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)
e	Participates in effective transitions of care	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)
f	Uses photographic documentation with safeguards for privacy	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)

87	EDUCATION AND TRAINING LEVEL 2				
	All the statements relate to interpersonal and communication skills.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Manages conflict (such as with patient, family, and teams)	~~1~~	~~2~~	~~3~~	Consensus R1 (66.7:33.3)
b	Ensures that the patient is able to participate in health care decision-making, by incorporating the cultural and social contexts	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)
c	Ensures that the medical records, are accurate, and complete	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)
d	Demonstrates an understanding of the effects of computer use on information accuracy	1	2	X	Stability R2 (44.4:55.6)
e	Demonstrates an understanding of the potential effects of the physician/patient relationship	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)

88	EDUCATION AND TRAINING LEVEL 3				
	All the statements relate to interpersonal and communication skills.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Manages complex and challenging situations, including transitions of care	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)
b	Conveys emotionally difficult information to patients on a individually applicable basis	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)
c	Optimises communication across systems	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)

89	EDUCATION AND TRAINING LEVEL 4				
	All the statements relate to interpersonal and communication skills.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Negotiates and manages conflict in complex and challenging situations	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)
b	Develops working relationships across specialities	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)
c	Organises and facilitates family/health care team conferences	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)
d	Uses multiple forms of communication ethically and with respect for patient privacy	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)
e	Demonstrates an understanding of the use of ethical marketing practices	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)

90	EDUCATION AND TRAINING LEVEL 5				
		Simulation			
	All the statements relate to interpersonal and communication skills.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the ethods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Develops models/approaches to managing difficult communications	~~1~~	~~2~~	~~3~~	Consensus R1 (22.2:77.8)
b	Coaches others to improve communication skills	~~1~~	~~2~~	~~3~~	Consensus R1 (11.1:88.9)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION R INTERPERSONAL AND COMMUNICATION SKILLS				

Thank you for completing the questionnaire!

CONSENSUS STATEMENTS T1-18

Tables 1-18 show the learning outcomes that the Delphi experts indicated where simulation may play a role of importance and be of value as one of the training methods in the specialist training of plastic surgeons.

Each Table deals with the learning outcomes categorised in five education and training levels indicated from L1-5, followed by the numbered statement in the Delphi questionnaire. The first statements relate to the medical knowledge part while the statements typed in italics related to patient care (c*f.* Table 1-14). For Tables 15-18 the differentiation will be specified within the Table heading.

Table 1. Surgical care – medical knowledge and patient care

L1.1b	Demonstrates an understanding of the principles utilised to ensure surgical safety (e.g., consent, patient positioning, aseptic techniques, skin preparation, universal precautions and the use of appropriate instruments) [L],[A-C]
L1.1c	*Examines surgical patients while using algorithms like ATLS (advanced trauma life support) and ACLS (advanced cardiac life support) [L],[A-C]*
L1.1e	*Performs basic techniques in the management of a surgical patient, independently (e.g. urethral catheterisation and nasogastric [NG] tube placement)* [L],[A-C]
L2.2g	*Conducts (with assistance) surgical consultations* [L],[A-C]
L2.2h	*Performs routine procedures independently (e.g., central line placement, biopsies, incision and drainage, chest tube placement, laceration repair and wound closure)* [L;H],[A-E]
L2.2i	*Recognises patterns and prioritises management offering at least one solution* [L],[A-C]
L3.3d	*Manages (under supervision) a surgical patient afflicted by multi-systemic disorders [L;H], [A-B]*
L3.3e	*Independently manages multiple surgical consultation and patients* [L],[A-C]
L3.3f	*Identifies exceptions and offers at least three possible solutions* [L;H],[A-C]
L4.4a	Demonstrates an understanding of the management of complicated multi-systemic surgical pathophysiological processes, ranging from intensive care to organ system support [L;H],[A-C]
L4.4f	*Anticipates potential problems and devises management plans of novel solutions* [L;H],[A-E]
L4.4e	*Manages a surgical firm* [L;H],[A-D]
L5.5b	*Teachers and supervisors of other learners involved in patient management [L,H][A-F]*
L5.5b	*Teaches and supervises of other earners involved in patient management [L;H], [A-F]*
L5.5c	*Develops or implements simulation for the teaching and e valuation of surgical skills* [L;H],[A-F]

Table 2. Wound care – medical knowledge and patient care

L1.6c	*Examines patients with wounds (such as burns, acute or chronic wounds)*
L1.6d	*Assists with procedures (e.g., burn resuscitation, negative pressure therapy, wound preparation)*
L2.7c	Understands the diagnostic modalities used in assessing wounds (e.g., biopsies, cultures, imaging)
L2.7d	*Explains procedures for managing wounds (e.g., risks, benefits, consent)*
L2.7e	*Performs (with assistance) routine procedures (e.g., burn debridement, skin grafts, local flaps, and regional flaps)*
L3.8a	Demonstrates an understanding of the treatment of complex sounds (e.g., necrotising infections, pressure ulcers and radiation wounds)
L3.8b	Demonstrates an understanding of surgical procedures (e.g., wound bed preparation, skin substitutes, grafts)
L3.8d	*Performs (with assistance) complex procedures (e.g., microvascular flaps)*
L4.9e	*Performs complex procedures independently (e.g., microvascular flaps)*

L4.9f *Independently manages complications*
L5.10b *Establishes a cost-effective management plan*
L5.10c *Functions as the leader of a wound care team*

Table 3. Tissue transfer – medical knowledge and patient care

L1.11b Describes the surgically relevant anatomy of grafts, flaps, and microvascular transfers
L1.11d *Performs wound care independently (e.g., dressings, negative pressure therapy)*
L2.12a Demonstrates an understanding of the surgical management of soft tissue defects, and designs basic flap types (e.g., local, axial and perforator flaps)
L2.12b Demonstrates knowledge of materials used in soft tissue transfer (e.g. suture materials, surgical devices)
L2.12c *Obtains informed consent for grafts, flaps, and other complex wound care options*
L2.12d *Performs routine procedures with assistance (e.g., debridement, skin grafts, complex wound closures, local flaps, bone graft harvesting)*
L2.12e *Performs microvascular repairs under simulated conditions*
L3.13a Describes the indications and anatomy of potential tissue transfer options for various defects
L3.13c Demonstrates an understanding of complex tissue transfer procedures (e.g., nerve repair or grafting, and composite microvascular transfers)
L3.13d *Formulates, with assistance, a treatment plan for complex reconstructive surgery*
L3.13e *Performs complex procedures (e.g., nerve repair or gaffing, and microvascular tissue transfers) with assistance*
L4.14c *Independently formulates a management plan for complex reconstructive surgery in complicated patients (e.g., with previous surgeries, comorbidities)*
L4.14d *Performs complex procedures independently*
L4.14e *Manages complex complications (e.g., loco-regional tissue and microvascular flap compromises) independently*
L5.15c *Acts as team leader in complex composite tissue reconstruction*
L5.15d *Performs prefabricated composite tissue transfer*
L5.15e *Performs vascularised composite allotransplantation*

Table 4. Congenital anomalies – medical knowledge and patient care

L1.16a Demonstrates an understanding of the embryology of clefts
L1.16e *Assists with craniofacial procedures (e.g., incisions and skin closures)*
L2.17d *Performs (with assistance) routine procedures for congenital anomalies (e.g., prominent ear correction)*
L2.17e *Recognises complications arising from procedures (e.g., feeding difficulties, airway compromise)*
L3.18b Describes the surgical anatomy and principles of simple craniofacial procedures (e.g., the steps involved in a cleft repair)
L3.18d *Performs complex procedures (e.g., cleft lip, palate repair) with assistance*
L4.19b Describes the surgical anatomy and principles of complex craniofacial procedures (e.g., distraction osteogenesis, cranial vault remodelling, secondary cleft deformities)
L4.19d *Performs complex procedures independently*
L5.20b *Manages complex craniofacial anomalies (e.g., hemifacial microsomia, craniosynostosis) independently*

Table 5. Head and neck – medical knowledge and patient care

L1.21b Explains the anatomy of the head and neck (e.g., lymphatic drainage, salivary glands, periorbita)
L1.21d *Performs history and physical examination of patients with head and neck malignancies*
L1.21e *Assists with procedures (e.g., excision of minor skin lesions, biopsies)*
L2.22e *Performs (with assistance) routine excisions and reconstructions (e.g., local flaps, skin grafts)*
L2.22f *Recognises complications (e.g., flap compromise, orocutaneous fistula, bleeding)*

L3.23b	Explains routine procedures' principles (e.g., local flaps, wedge excisions of the lip)
L3.23f	*Performs complex procedures (e.g., full thickness nasal defects, repair of complex eyelid defects, myocutaneous flaps) with assistance*
L4.24a	Explains the sequelae of surgical interventions (e.g., long term outcomes, post-surgery deformities)
L4.24b	Describes the surgical anatomy and principles of complex procedures (e.g., total nasal reconstruction, microsurgical bone transfer, neck dissection)
L4.24c	Explains adjunctive reconstructive options (e.g., maxillofacial prosthetics, dental implants)
L4.24e	*Independently performs complex reconstructions (e.g., microvascular soft tissue or bone transfers)*
L5.25b	*Helps lead a multidisciplinary head and neck cancer team*

Table 6. Maxillofacial trauma – medical knowledge and patient care

L1.26b	Demonstrates an understanding of head and neck anatomy
L1.26c	Describes facial fracture patterns
L1.26e	*Performs the examination of patients with maxillofacial trauma (incl. workup studies)*
L1.26f	*Assists with procedures (e.g., early fracture stabilisation, suturing lacerations)*
L2.27e	*Interprets imaging studies*
L2.27g	*Performs (with assistance) routine procedures (e.g., open reduction internal fixation [ORIF], maxilla mandibular fixation [MMF])*
L2.27h	*Recognises complications (e.g. cerebrospinal fluid leak, airway compromise)*
L3.28b	Explains the surgical principles of routine procedures (e.g., eyelid laceration repair, closed nasal reduction, MMF)
L3.28d	*Performs (with assistance) complex procedures (e.g., panfacial fracture management)*
L4.29b	Describes the surgical principles of complex procedures (e.g., repair NOE with telecanthus, canalicular repair)
L4.29d	*Independently performs complex procedures*
L4.29e	*Independently manages complications (e.g., facial nerve injuries, nasal airway obstruction)*
L5.30b	*Manages complex secondary deformities (e.g., malocclusion, enopthalmos)*

Table 7. Facial aesthetics – medical knowledge and patient care

L1.31a	Describes the normal anatomy of the face
L1.31b	Demonstrates an understanding of the normal proportions, angles and relationships in facial analysis
L1.31c	*Performs focused history and examination of aesthetic facial surgery patients*
L1.31d	*Assists with aesthetic facial procedures (e.g., incisions and skin closures)*
L2.32d	*Obtains informed consent for facial aesthetic procedures*
L2.32e	*Performs (with assistance) routine facial aesthetic procedures (e.g., scar revision, upper blepharoplasty, harvesting of cartilage grafts, injection of neuromodulators, fat injections)*
L2.32f	*Recognises complications (e.g., seroma, haematoma, necrosis, wound dehiscence)*
L3.33d	*Performs complex procedures (e.g., tip rhinoplasty, facelifts, neck-lifts) with assistance*
L4.34c	Discusses the dynamics of combining various procedures for treatment of the ageing face
L4.34e	*Independently performs procedures (e.g., lower blepharoplasties, primary rhinoplasties, and facelifts)*
L5.35a	Contributes to research in aesthetic facial surgery leading to publication in peer-reviewed journals
L5.35b	*Independently treats complex secondary deformities of previous surgery*
L5.35c	*Lead a multidisciplinary team for the treatment of facial aesthetics*

Table 8. Non-cancer breast surgery – medical knowledge and patient care

L1.36a	Demonstrates an understanding of benign breast conditions (e.g., gynecomastia, hypermastia, ptosis congenital anomalies)
L2.37b	Explains concepts of proportions of the breast, aesthetic ideals, and symmetry
L2.37c	Shows an understanding of the different types of breast implants

L2.37e *Obtains informed consent for breast procedures*
L2.37f *Performs routine procedures (e.g., mastopexy, gynecomastia, reduction mammoplasty) with assistance*
L2.37g *Recognises complications (e.g., infection, implant complications, hematoma)*
L3.38b Explains the principles of routine surgical procedures (e.g., mastopexy, reduction mammoplasty, augmentation mammoplasty)
L3.38d *Performs complex procedures (e.g., congenital breast deformity, augmentation/ mastopexy) with assistance*
L4.39b Describes the principles of complex surgical procedures (e.g., tuberous breast deformity, augmentation/ mastopexy)
L4.39d *Independently formulates a treatment plan*
L4.39e *Independently performs complex procedures*
L4.39f *Independently manages complications*
L4.39g *Independently manages secondary deformities*
L4.39h *Independently manages the dissatisfied patient*
L5.40b *Publishes in peer-reviewed journals*

Table 9. Breast reconstruction – medical knowledge and patient care

L1.41c *Performs history and physical examination of the breast cancer patient*
L2.42c *Obtains informed consent for breast reconstruction procedures*
L2.42d *Performs (with assistance) routine procedures (e.g., tissue expander insertion, flap elevation)*
L2.42e *Recognises complications (e.g., implant complications, flap compromise)*
L3.43c Explains the principles of breast reconstruction using pedicled flaps
L3.43e *Performs complex procedures (e.g., treatment of the contralateral breast, microsurgical procedures) with assistance*
L3.43f *Manages complications with assistance*
L4.44b Explains the surgical principles of the various microsurgical breast reconstruction options
L4.44c *Independently formulates a treatment plan*
L4.44d *Independently performs complex procedures*
L4.44e *Independently manages complications*
L5.45a Publishes research in peer-reviewed journals
L5.45d *Teaches breast reconstructive procedures*

Table 10. Reconstruction of trunk and perineum – medical knowledge and patient care

L1.46b Demonstrates an understanding of the anatomy of the back, perineum, chest and abdominal wall
L1.46c Demonstrates an understanding of pressure off-loading, nutrition and respiratory mechanics
L1.46d *Takes a history and performs an examination of a patient with perineal/truncal defects*
L1.46e *Assisting with procedures (e.g., incisions and wound closure)*
L2.47c Demonstrates an understanding of the management of major defects in stages
L2.47d *Obtains informed consent*
L2.47e *Performs, with assistance, routine procedures (e.g., component separation, debridement, musculocutaneous flaps)*
L3.48a Demonstrates an understanding of surgical management of congenital abnormalities, chest wall defects, hernias, pressure ulcers and irradiated wounds
L3.48b Describes the principles of routine surgical procedures (e.g., component separation, hernia repair and pressure ulcer reconstruction)
L3.48e *Performs complex procedures (e.g., urogenital reconstruction, composite chest wall reconstruction) with assistance*
L4.49b Explains the principles of complex surgical procedures (e.g., recurrent ventral hernia, perineal reconstruction, composite chest wall defects)
L4.49c *Independently formulates a treatment plan*
L4.49d *Performs complex procedures independently*
L5.50b *Independently manages complex secondary perineal and truncal deformities*

Table 11. Upper extremity trauma – medical knowledge and patient care

L1.51a	Demonstrates an understanding of soft-tissue injuries, dislocations and common fractures.
L1.51b	Describes the anatomy, basic biomechanics and function of the upper extremity
L1.51c	Explains the principles of casting/splinting
L1.51d	*Performs examination of patients with upper extremity*
L1.51e	*Assists with procedures (e.g., applying splints, making incisions, and doing dressings)*
L2.52a	Demonstrates an understanding of the principles of bony stabilisation and soft tissue coverage
L2.52b	Explains the principles of flap cover and bony fixation
L2.52d	*Obtains informed consent for the surgical management of traumatic upper limb injuries*
L2.52e	*Performs, with assistance, routine procedures (e.g., repair of tendon / nerve injuries or simple hand fractures)*
L2.52f	*Recognises complications (e.g., compartment syndrome, vascular compromise)*
L3.53b	Explains the principles of tendon, nerve, vessel, and bony repairs
L3.53c	Demonstrates an understanding of the principles involved in post-operative regimens for hand therapy
L3.53e	*Performs complex procedures (e.g., microvascular flap coverage, hand revascularisation, repair of the mangled hand) with assistance*
L4.54a	Explains tendon transfer biomechanics
L4.54b	Explains the principles involved in reconstruction of complex problems (e.g., replantation, secondary tendon reconstruction, nerve grafting)
L4.54d	*Independently formulates a treatment plan*
L4.54e	*Independently performs complex procedures*
L4.54f	*Independently manages complications*
L5.55a	Demonstrates an understanding of the principles involved in tendon and nerve transfers for brachial plexus / combined nerve injuries
L5.55b	Demonstrates an understanding of the multidisciplinary management of hand injuries in a dedicated hand unit.

Table 12. Non-trauma hand – medical knowledge and patient care

L1.56b	Describes the embryology, anatomy and biomechanics of the upper extremity and hand
L1.56d	*Assists with procedures (e.g., injections, abscess drainage, skin incisions and closure)*
L2.57b	Explains the concepts of injections, pharmacologic management, incision, and drainage
L2.57e	*Performs, with assistance, routine procedures (e.g., tumor excision, ganglion removal, nerve decompression)*
L3.58a	Describes management options for contractures and metabolic processes
L3.58b	Explains principles of routine surgical procedures (e.g., tumour and ganglion excisions, fusions, nerve releases, and contracture releases)
L3.58e	*Performs complex procedures (e.g., syndactyly reconstruction, tendon transfers, arthroplasty, contracture release) with assistance*
L4.59b	Describes surgical principles for complex procedures (e.g., syndactyly release, ligament reconstructions, arthroplasties, and tendon transfers)
L4.59d	*Independently performs complex procedures*
L5.60a	Explains the surgical anatomy and principles for complex procedures (e.g., thumb reconstructions, congenital hand reconstruction, nerve transfers, rheumatoid hand reconstruction)
L5.60b	*Formulates a treatment plan for complex congenital hand and rheumatoid deformities*
L5.60c	*Performs toe-to-hand transfers, pollicisations, implant arthroplasty*

Table 13. Cosmetic trunk and lower extremity – medical knowledge and patient care

L1.61c	Explains the effect of massive weight loss
L1.61d	Describes the anatomy and aesthetic ideals of the lower extremities and trunk
L1.61h	*Assists with procedures (e.g., skin incision and closure)*
L2.62e	Explains the benefit of multidisciplinary bariatric teams
L2.62g	*Performs routine procedures (e.g., panniculectomy, abdominoplasty)*

L3.63b Describes surgical principles of routine procedures (e.g., brachioplasty, medial thigh lift, liposuction abdominoplasty)
L3.63d *Performs, with assistance, complex procedures (e.g., brachioplasty, circumferential body lift)*
L3.63e *Manages complications with assistance*
L4.64b Explains the surgical principles of complex procedures
L4.64d *Independently performs complex procedures*
L4.64e *Independently manages complications*
L5.65b *Manages patients with multiple prior surgeries / unsatisfactory previous results*

Table 14. Lower extremity – medical knowledge and patient care

L1.66b Explains the anatomy of the lower extremity
L1.66c Explains the classification systems for soft tissue and bone loss of the lower extremity
L1.66e *Assists with procedures (e.g., splint application, dressings, skin incision and closure)*
L2.67b Describes the surgical principles for lower extremity surgery (e.g., timing and staging of procedures)
L2.67d *Performs routine procedures (e.g., skin grafts) with assistance*
L2.67e *Recognises complications (e.g., compartment syndrome, flap compromise)*
L3.68b Describes the surgical principles of routine procedures (e.g., local flaps, skin grafting, wound debridement)
L3.68d *Performs complex procedures (e.g., free tissue transfer) with assistance*
L4.69b Describes the surgical principles of complex procedures (e.g., free tissue transfers, and perforator flaps)
L4.69d *Performs complex procedures independently*
L4.69e *Independently manages complications*
L5.70a Demonstrates an understanding of the principles of microsurgical treatment of lymphoedema, tendon and nerve transfers of the lower extremity

Table 15. System-based practice – patient safety (71b, 74a, 74b, 74c, 75a, 75b), resource allocation (no statements) and practice (no statements)

L1.71b *Describes the roles of team members*
L4.74a Formally uses proven analysis methods to evaluate shared team experiences to prevent future errors
L4.74b Leads team by promoting input and situational awareness by all team members
L4.74c Improves patient safety by conducting morbidity and mortality meetings
L5.75a Leads curriculum design activities to develop communication skills and teamwork of health care professionals
L5.75b Assists in leading a multidisciplinary team to address patient safety issues

Table 16. Practice-based learning and improvement – investigate, evaluate, assimilate (76a, 77a, 78a, 79a, 79b) and research and training (76d, 77d, 78d, 80c)

L1.76a Shows awareness of one's own level of knowledge and expertise
L1.76d *Participates in the education of patients and their families*
L2.77a Continually seeks to improve performance by incorporating feedback
L2.77d *Teaches patients and their families*
L3.78a Demonstrates a balanced and accurate self-assessment of competence
L3.78d *Teaches health professionals and colleagues in both informal and formal settings*
L4.79a Demonstrates improvement in clinical outcomes based on continual self-assessment
L4.79b Performs self-directed learning with minimal external guidance, using evidence-based information tools
L5.80c Develops educational curriculum and assessment tools

Table 17. Professionalism – ethics and values (no statements) and personal accountability (81d, 83c, 85c)

L1.81d *Exhibits professional behaviour (e.g., confidentiality, integrity, diligence, and reliability)*
L3.83c *Manages situations in which maintaining physical, mental and personal health is challenged*
L5.85c *Helps develop institutional and organisational strategies to improve physician wellness*

Table 18. Interpersonal and communication skills

L1.86a Develops a positive relationship with patients and teams, in uncomplicated situations
L2.87a Manages conflict (such as with patient, family, and teams)

APPENDIX N FINAL OUTCOME: DELPHI PROCESS

FINAL OUTCOME: DELPHI PROCESS

INSTRUCTIONS TO COMPLETE DELPHI QUESTIONNAIRE REGARDING SIMULATION
Please indicate how important each of the following statements is according to the following scale:

1 = Simulation can be regarded as one of the **essential** methods to train a plastic surgeon.
2 = Simulation may be **useful** as one of the methods to train a plastic surgeon.
3 = Simulation is an **applicable** method to train a plastic surgeon and can be excluded as a training method.
Please mark the appropriate box with an X. Mark only one of the three choices (Essential, Useful, applicable).

If you indicated 1 or 2 as an option, please also answer to the next two categories (simulation modality and cognitive level). If you indicated 3, go directly to the next Education and Training level.

INSTRUCTIONS TO COMPLETE QUESTIONNAIRE REGARDING MODALITIES AND LEVELS
Please indicate which type of simulation modality is / can be applicable as far as simulation is concerned:
(i) = Low-tech simulation modalities (such as simple three-dimensional organ models; basic plastic manikin and simple skills trainers; animal models; human cadavers; and simulated or standardised patients).
(ii) = High-tech simulation modalities (such as screen-based simulators; realistic, high-fidelity procedural simulators (task trainers); realistic, high-tech interactive patient simulators; and virtual reality).
Please mark the appropriate box(es) with an X. Mark one or two choices (low-tech and/or high-tech).

Please indicate which level of learning is / can be addressed by simulation according to the following scale displaying the various cognitive levels: (*cf.* definitions in accompanying letter to Delphi experts).

A = Remembering (knowledge); B = Understanding (comprehension); C = Applying (application);
D = Analysing (analysis); E = Evaluating (synthesis); F = Creating (evaluation).
Please mark the appropriate box(es) with an X. Mark any number of choices (The six cognitive levels of learning)
<u>OR</u>
Cognitive level of learning: Please give your opinion on the value of simulation as a learning method, for example, will it help the student to remember facts, leading to understand concepts, applying skills, helping to analyse, diagnose or compile a treatment plan/management plan/procedure. Please see end of each section.

	SECTION A **SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of **Surgical Care – Medical Knowledge and Patient Care.** The resident should reach the descriptors of performance on the specific level.				
1	**EDUCATION AND TRAINING LEVEL 1**				
		Simulation			**Importance of simulation as one of the methods to train a plastic surgeon.** **Important:1(essential)+2(useful) vs Not important:3(not applicable)** **Opinion percentage Delphi experts:%** **Round:R**
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of basic medical sciences (e.g., electrolyte and fluid balance, haemostasis, wound healing and sepsis)	1	2	3	Consensus R1 (25.0:75.0)
b	Demonstrates an understanding of the principles utilised to ensure surgical safety (e.g., consent, patient positioning, aseptic techniques, skin preparation, universal precautions and the use of appropriate instruments)	1	2	3	Consensus R1 (87.5:12.5)

c	*Examines surgical patients while using algorithms like ATLS (advance trauma life support) and ACLS (advanced cardiac life support).*	*1*	*2*	*3*	Consensus R1 (80.0:20.0)
d	*Manages (with assistance) several uncomplicated patients*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
e	*Performs basic techniques in the management of a surgical patient, independently (e.g. urethral catheterisation and nasogastric [NG] tube placement)*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
f	*Retrieves and categorises information*	*1*	*2*	*3*	Consensus R1 (0.0.100:0)
2	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the effects of ageing on surgical patients	1	2	3	Consensus R1 (0.0.100:0)
b	Describes the impact of pregnancy on the management of surgical patients	1	2	3	Stability R2 (37.5:62.5)
c	Describes the effects of obesity on the management of surgical patients	1	2	3	Stability R2 (37.5:62.5)
d	Explains the role of nutrition in the management of surgical patients	1	2	3	Consensus R1 (33.3:66.7)
e	Explains the impact of substance abuse in the management of surgical patients (incl. alcohol, tobacco)	1	2	3	Consensus R1 (25.0:75.0)
f	*Manages (with assistance) a surgical patient with single system disease*	*1*	*2*	*3*	Stability R2 (37.5:62.5)
g	*Conducts (with assistance) surgical consultations*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
h	*Performs routine procedures Independently (e.g., central line placement, biopsies, incision and drainage, chest tube placement, laceration repair and wound closure)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
i	*Recognises patterns and prioritises management offering at least one solution*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
3	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the role of medical comorbidities in surgical patients (e.g., hepatic, renal, cardiac or pulmonary failure	1	2	3	Stability R2 (37.5:62.5)
b	Demonstrates an understanding of psychological conditions (e.g., body dysmorphic syndrome or depression)	1	2	3	Consensus R1 (0.0:100.0)
c	Demonstrates an understanding of the impact of treatment (e.g., immunosuppression, radiotherapy or chemotherapy)	1	2	3	Consensus R1 (0.0:100.0)

d	*Manages (under supervision) a surgical patient afflicted by multi systemic disorders*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
e	*Independently manages multiple surgical consultations and patients*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
f	*Identifies exceptions and offers at least three possible solutions*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
4	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates and understanding of the management of complicated multisystemic surgical pathophysiological processes, ranging from intensive care to organ system support	1	2	3	Consensus R1 (75.0:25.0)
b	Identifies and explains potential reasons to offer surgical services	1	2	3	Consensus R1 (0.0:100.0)
c	Explains the procedures involved in legally and professionally discharging a patient from a surgical practice	1	2	3	Consensus R1 (12.5:87.5)
d	*Manages surgical patients with multiple systemic diseases without supervision or support*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
e	*Manages a surgical firm*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
f	*Anticipates potential problems and devises management plans or novel solutions*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
5	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Publishes research in peer-reviewed journals	1	2	3	Consensus R1 (12.5:87.5)
b	*Teaching and supervision of other learners involved in patient management*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
c	*Develops or implements simulation for the teaching and evaluation of surgical skills*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	If you so whish, please give an example of a simulation or describe a simulation that you have done or that can be done Section A: Surgical care – Medical Knowledge and Patient Care (specific to this section).				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING ON SECTION A: SURGICAL CARE – MEDICAL KNOWLEDGE AND PATIENT CARE.				

	SECTION B **WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of **Wound Care – Medical Knowledge and Patient Care.** The resident should reach the descriptors of performance on the specific level.
6	**EDUCATION AND TRAINING LEVEL 1**

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of wound, pressure ulcer, necrotising infection and burns with regards to the pathophysiology	1	2	3	Stability R2 (37.5:62.5)
b	Explains wound management (including burns resuscitation, acute and chronic wounds)	1	2	3	Consensus R1 (25.0:75.0)
c	*Examines patients with wounds (such as burns, acute or chronic wounds)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
d	*Assists with procedures (e.g., burn resuscitation, negative pressure therapy, wound preparation)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
e	*Provides routine post-operative care*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)

7	**EDUCATION AND TRAINING LEVEL 2**

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains the indication for intervening in acute or chronic wounds/burns	1	2	3	Consensus R1 (25.0:75.0)
b	Identifies high risk patients for developing chronic wounds (e.g., spinal cord injury)	1	2	3	Consensus R1 (0.0:100.0)
c	Understands the diagnostic modalities used in assessing wounds (e.g., biopsies, cultures, imaging)	1	2	3	Consensus R1 (87.5:12.5)
d	*Explains procedures for managing wounds (e.g. risks, benefits, consent)*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
e	*Performs (with assistance) routine procedures (e.g., burn debridement, skin grafts, local flaps, and regional flaps)*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
f	*Recognises complications arising from procedures, (e.g., infection) and initiates preventative measures*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)

8	**EDUCATION AND TRAINING LEVEL 3**

	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the treatment of complex wounds (e.g., necrotising infections, pressure ulcers and radiation wounds)	1	2	3	Consensus R1 (75.0:25.0)

b	Demonstrates an understanding of surgical procedures (e.g., wound bed preparation, skin substitutes, grafts)	1	2	3	Consensus R1 (75.0:25.0)
c	*Formulates (with assistance) a management plan for wound preparation and closure*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
d	*Performs (with assistance) complex procedures (e.g., microvascular flaps)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Manages complications with assistance*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
9	**EDUCATION AND TRAINING LEVEL 4**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Describes the effect and outcomes of different treatment options (e.g., dressing changes *vs.* surgical closures)	1	2	3	Consensus R1 (25.0:75.0)
b	Demonstrates an understanding of the principles of complex procedures (e.g., hyperbaric oxygen, vascularized soft tissue coverage)	1	2	3	Stability R2 (37.5:62.5)
c	*Independently formulates a management plan for wound preparation and closure (including patients with comorbidities)*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
d	*Participates in a wound care team*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
e	*Performs complex procedures independently (e.g., microvascular flaps)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
f	*Independently manages complications*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
10	**EDUCATION AND TRAINING LEVEL 5**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Systematically reviews outcomes leading to publication in peer-reviewed journals	1	2	3	Consensus R1 (12.5:87.5)
b	*Establishes a cost-effective management plan*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
c	*Functions as the leader of a wound care team*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
d	*Helps co-ordinate a burn center*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
e	*Develops a plan for occupational rehabilitation*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				

	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING SECTION B – WOUND CARE – MEDICAL KNOWLEDGE AND PATIENT CARE.

	SECTION C **TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Tissue Transfer – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
11	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the basic science behind grafts, flaps, and microvascular transfers	1	2	3	Consensus R1 (12.5:87.5)
b	Describes the surgically relevant anatomy of grafts, flaps, and microvascular transfers	1	2	3	Consensus R1 (87.5:12.5)
c	*Examines patients with reconstructive problems*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
d	*Performs wound care independently (e.g., dressings, negative pressure therapy)*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
e	*Provides post-operative care for patients that have undergone loco-regional tissue reconstructions*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
12	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**N OT APPLICABLE**	
a	Demonstrates an understanding of the surgical management of soft tissue defects, and designs basic flap types (e.g., local, axial and perforator flaps)	1	2	3	Consensus R1 (100.0:0.0)
b	Demonstrates knowledge of materials used in soft tissue transfer (e.g. suture materials, surgical devices)	1	2	3	Consensus R2 (75.0:25.0)
c	*Obtains informed consent for grafts, flaps, and other complex wound care options*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
d	*Performs routine procedures with assistance (e.g., debridement, skin grafts, complex wound closures, local flaps, bone graft harvesting)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Performs microvascular repairs under simulated conditions*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
f	*Provides post-operative care with assistance for microvascular tissue transfer patients*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)

13	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Describes the indications and anatomy of potential tissue transfer options for various defects	1	2	3	Consensus R1 (87.5:12.5)
b	Explains principles of treatment options for complex wounds	1	2	3	Consensus R1 (25.0:75.0)
c	Demonstrates an understanding of complex tissue transfer procedures (e.g., nerve repair or grafting, and composite microvascular transfers)	1	2	3	Consensus R1 (75.0:25.0)
d	*Formulates, with assistance, a treatment plan for complex reconstructive surgery*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
e	*Performs complex procedures (e.g., nerve repair or gaffing, and microvascular tissue transfers) with assistance*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
f	*Manages complications with assistance*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
14	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Independently decides upon treatment choices for soft tissue defects	1	2	3	Stability R2 (50.0:50.0)
b	Explains alternatives following complications	1	2	3	Consensus R1 (25.0:75.0)
c	*Independently formulates a management plan for complex reconstructive surgery in complicated patients (e.g., with previous surgeries, comorbidities)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
d	*Performs complex procedures independently*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Manages complex complications (e.g., loco-regional tissue and microvascular flap compromises) independently*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
15	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	

a	Systematically reviews outcomes of tissue transfers leading to publications in peer-reviewed journals	1	2	3	Consensus R1 (12.5:87.5)
b	Demonstrates an understanding of tissue engineering principles	1	2	3	Consensus R1 (12.5:87.5)
c	*Acts as team leader in complex composite tissue reconstruction*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
d	*Performs prefabricated composite tissue transfer*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
e	*Performs vascularized composite allotransplantation*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING SECTION C - TISSUE TRANSFER – MEDICAL KNOWLEDGE AND PATIENT CARE				

	SECTION D **CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Congenital Anomalies – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
16	**EDUCATION AND TRAINING LEVEL 1**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the embryology of clefts	1	2	3	Consensus R2 (75.0:25.0)
b	Describes craniofacial anomalies	1	2	3	Consensus R2 (25.0:75.0)
c	Explains the normal anatomy of the craniofacial system	1	2	3	Stability R2 (50.0:50.0)
d	*Examines patients with craniofacial anomalies*	*1*	*2*	*3*	Stability R2 (37.5:62.5)
e	*Assists with craniofacial procedures (e.g., incisions and skin closures)*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
f	*Provides paediatric patients with routine post-operative care*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
17	**EDUCATION AND TRAINING LEVEL 2**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**

a	Demonstrates an understanding of the management of craniofacial patients (diagnosis, basic surgical treatments, and special needs)	1	2	3	Consensus R1 (0.0:100.0)
b	Demonstrates an understanding of the concepts of staged multi-disciplinary treatment in the care of craniofacial patients	1	2	3	Consensus R1 (25.0:75.0)
c	*Obtains informed consent for routine congenital abnormalities (e.g., vascular anomalies, giant congenital nevi, cleft surgery)*	*1*	*2*	*3*	Stability R2 (37.5:62.5)
d	*Performs (with assistance) routine procedures for congenital anomalies (e.g., prominent ear correction)*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
e	*Recognises complications arising from procedures (e.g., feeding difficulties, airway compromise)*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
18	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the timing and indications for staged management protocols for craniofacial patients	1	2	3	Consensus R1 (12.5:87.5)
b	Describes the surgical anatomy and principles of simple craniofacial procedures (e.g., the steps involved in a cleft repair)	1	2	3	Consensus R1 (87.5:12.5)
c	*Formulates, with assistance, a management plan for routine congenital anomalies*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Performs complex procedures (e.g., cleft lip, palate repair) with assistance*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Manages (with assistance) complications (e.g., palatal fistulae, exposed expanders)*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
19	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the effects of treatments (e.g., cleft care) on craniofacial patients	1	2	3	Consensus R1 (25.0:75.0)

b	Describes the surgical anatomy and principles of complex craniofacial procedures (e.g., distraction osteogenesis, cranial vault remodelling, secondary cleft deformities)	1	2	3	Consensus R1 (87.5:12.5)
c	*Formulates, with assistance, a management plan for craniofacial surgery*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
d	*Performs complex procedures independently*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
e	*Independently manages complications of congenital anomalies*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
20	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of a multidisciplinary craniofacial team's composition and management	1	2	3	Consensus R1 (25.0:75.0)
b	*Manages complex craniofacial anomalies (e.g., hemifacial microsomia, craniosynostosis) independently*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION D CONGENITAL ANOMALIES – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION E **HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Head and Neck – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
21	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains benign and malignant diseases of the head and neck area	1	2	3	Consensus R1 (22.2:77.8)
b	Explains the anatomy of the head and neck (e.g., lymphatic drainage, salivary glands, periorbita)	1	2	3	Consensus R1 (88.9:11.1)

c	Describes the staging of head and neck malignancies	1	2	3	Consensus R1 (33.3:66.7)
d	*Performs history and physical examination of patients with head and neck malignancies*	*1*	*2*	*3*	Consensus R2 (66.7:33.3)
e	*Assists with procedures (e.g., excision of minor skin lesions, biopsies)*	*1*	*2*	*3*	Consensus R2 (77.8:22.2)
f	*Provides routine post-operative care*	*1*	*2*	*3*	Consensus R1 (22.2:77.8)
22	**EDUCATION AND TRAINING LEVEL 2**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates and understanding of the surgical management for cancers of the head and neck (e.g., parotid, pharynx)	1	2	3	Consensus R1 (33.3:66.7)
b	Describes the principles of excision (e.g., margins) and reconstruction for head and neck lesions	1	2	3	Consensus R1 (33.3:66.7)
c	Demonstrates an understanding of roll of adjunctive modalities (e.g., feeding tubes, tracheostomy)	1	2	3	Consensus R1 (33.3:66.7)
d	*Obtains informed consent for extirpative and reconstructive procedures*	*1*	*2*	*3*	Consensus R1 (14.1:85.9)
e	*Performs (with assistance) routine excisions and reconstructions (e.g., local flaps, skin grafts)*	*1*	*2*	*3*	Consensus R1 (88.9:11.1)
f	*Recognises complications (e.g., flap compromise, orocutaneous fistula, bleeding)*	*1*	*2*	*3*	Consensus R1 (77.8:22.2)
g	*Prescribes post-operative rehabilitation*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
23	**EDUCATION AND TRAINING LEVEL 3**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Describes the indications for different management options (e.g., surgical, non-surgical, ancillary procedures)	1	2	3	Consensus R1 (33.3:66.7)
b	Explains routine procedures' principles (e.g., local flaps, wedge excisions of the lip)	1	2	3	Consensus R1 (88.9:11.1)
c	Explains the effects of previous interventions on reconstructive options (e.g., osteoradionecrosis)	1	2	3	Consensus R1 (22.2:77.8)

d	Describes the management of metastatic disease (regional and distant)	1	2	3	Consensus R1 (22.2:77.8)
e	*Formulates, with assistance, a management plan*	*1*	*2*	*3*	Consensus R1 (22.2:77.8)
f	*Performs complex procedures (e.g., full thickness nasal defects, repair of complex eyelid defects, myocutaneous flaps) with assistance*	*1*	*2*	*3*	Consensus R1 (88.9:11.1)
g	*Manages complications with assistance*	*1*	*2*	*3*	Consensus R1 (33.3:66.7)
24	**EDUCATION AND TRAINING LEVEL 4**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains the sequelae of surgical interventions (e.g., long term outcomes, post surgery deformities)	1	2	3	Consensus R2 (66.7:33.3)
b	Describes the surgical anatomy and principles of complex procedures (e.g., total nasal reconstruction, microsurgical bone transfer, neck dissection)	1	2	3	Consensus R1 (100.0:0.0)
c	Explains adjunctive reconstructive options (e.g., maxillofacial prosthetics, dental implants)	1	2	3	Consensus R1 (66.7:33.3)
d	*Independently formulates a management plan for patients with comorbidities*	*1*	*2*	*3*	Consensus R1 (11.1:88.9)
e	*Independently performs complex reconstructions (e.g., microvascular soft tissue or bone transfers)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
f	*Independently manages complications (e.g., failed microvascular transfers)*	*1*	*2*	*3*	Stability R2 (44.4:55.6)
25	**EDUCATION AND TRAINING LEVEL 5**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Discusses novel modalities (diagnostic and treatment) for head and neck cancer	1	2	3	Consensus R1 (25.0:75.0)
b	*Helps lead a multidisciplinary head and neck cancer team*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				

	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION E HEAD AND NECK – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION F **MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Maxillofacial Trauma – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
26	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains aetiology of facial fractures and soft tissue injuries	1	2	3	Consensus R2 (25.0:75.0)
b	Demonstrates an understanding of head and neck anatomy	1	2	3	Consensus R2 (75.0:25.0)
c	Describes facial fracture patterns	1	2	3	Consensus R2 (75.0:25.0)
d	Describes the risks of associated injuries (e.g., cervical spine injury, airway compromise)	1	2	3	Consensus R1 (0.0:100.0)
e	*Performs the examination of patients with maxillofacial trauma (incl. workup studies)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
f	*Assists with procedures (e.g., early fracture stabilisation, suturing lacerations)*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
g	*Provides routine post-operative care*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
27	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Describes sequelae of (e.g., malocclusion, enopthalmos)	1	2	3	Consensus R1 (28.6:71.4)
b	Explains the principles of surgical management (e.g., methods of fixation, open *vs.* closed approaches)	1	2	3	Stability R2 (37.5:62.5)
c	Demonstrates an understanding of interventions of associated injuries (e.g., tracheostomy)	1	2	3	Consensus R1 (25.0:75.0)
d	*Elicits the specific clinical findings associated with soft tissue injuries and common facial fractures*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
e	*Interprets imaging studies*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)

f	*Obtains informed consent for maxillofacial trauma cases*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
g	*Performs (with assistance) routine procedures (e.g., open reduction internal fixation [ORIF], maxilla mandibular fixation [MMF])*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
h	*Recognises complications (e.g.,, cerebrospinal fluid leak, airway compromise)*	*1*	*2*	*3*	Consensus R1 (85.7:14.3)
28	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of indications and timing for the different management options for facial trauma	1	2	3	Consensus R1 (25.0:75.0)
b	Explains the surgical principles of routine procedures (e.g., eyelid laceration repair, closed nasal reduction, MMF)	1	2	3	Consensus R1 (87.5:12.5)
c	*Formulates a treatment plan with assistance*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
d	*Performs (with assistance) complex procedures (e.g., panfacial fracture management)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
e	*Manages complications with assistance*	*1*	*2*	*3*	Stability R2 (37.5:62.5)
29	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Identifies the late sequelae of facial trauma (e.g., mucocele, ectropion)	1	2	3	Consensus R1 (25.0:75.0)
b	Describes the surgical principles of complex procedures (e.g., repair NOE with telecanthus, canalicular repair)	1	2	3	Consensus R2 (75.0:25.0)
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	Consensus R1 (16.7:83.3)
d	*Independently performs complex procedures*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Independently manages complications (e.g., facial nerve injuries, nasal airway obstruction)*	*1*	*2*	*3*	Consensus R1 (71.4:28.6)

30	EDUCATION AND TRAINING LEVEL 5				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Publishes research on maxillofacial trauma in peer-reviewed journals	1	2	3	Consensus R1 (12.5:87.5)
b	*Manages complex secondary deformities (e.g., malocclusion, enopthalmos)*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION F MAXILLOFACIAL TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE				

	SECTION G **FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Facial Aesthetics – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

31	EDUCATION AND TRAINING LEVEL 1				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Describes the normal anatomy of the face	1	2	3	Consensus R2 (75.0:25.0)
b	Demonstrates an understanding of the normal proportions, angles and relationships in facial analysis	1	2	3	Consensus R2 (75.0:25.0)
c	*Performs focused history and examination of aesthetic facial surgery patients*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
d	*Assists with aesthetic facial procedures (e.g., incisions and skin closures)*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)

32	EDUCATION AND TRAINING LEVEL 2				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**

a	Demonstrates an understanding of the concepts of facial aging and the management options thereof	1	2	3	Consensus R1 (25.0:75.0)
b	Explains the concept of skin resurfacing (e.g., chemical peels, lasers)	1	2	3	Consensus R1 (25.0:75.0)
c	Appreciates the role of psychological factors on outcomes in aesthetic facial surgery	1	2	3	Consensus R1 (25.0:75.0)
d	*Obtains informed consent for facial aesthetic procedures*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
e	*Performs (with assistance) routine facial aesthetic procedures (e.g., scar revision, upper blepharoplasty, harvesting of cartilage grafts, injection of neuromodulators, fat injections)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
f	*Recognises complications (e.g., seroma, haematoma, necrosis, wound dehiscence)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
33	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding for the role of different treatment options for addressing the aging face	1	2	3	Consensus R1 (25.0:75.0)
b	Describes the principles of non-surgical and surgical procedures, (e.g., peels, fillers, neuromodulators, blepharoplasties, facelifts, rhinoplasties)	1	2	3	Consensus R1 (0.0:100.0)
c	*Formulates a management plan with assistance*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Performs complex procedures (e.g., tip rhinoplasty, facelifts, neck-lifts) with assistance*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Manages complications with assistance*	*1*	*2*	*3*	Stability R2 (37.5:62.5)
34	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Describes the effects of treatment of non-surgical and surgical options	1	2	3	Consensus R1 (25.0:75.0)

b	Explains the principles of complex treatments for the aging face, (e.g., secondary rhinoplasties, deep plane facelifts, endoscopic procedures)	1	2	3	Consensus R1 (0.0:100.0)
c	Discusses the dynamics of combining various procedures for treatment of the ageing face	1	2	3	Consensus R2 (75.0:25.0)
d	*Independently formulates a treatment plan for aesthetic facial surgery patients*	*1*	*2*	*3*	Consensus R1 (16.7:83.3)
e	*Independently performs procedures (e.g., lower blepharoplasties, primary rhinoplasties, and facelifts)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
f	*Independently manages complications*	*1*	*2*	*3*	Stability R2 (37.5:62.5)
35	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Contributes to research in aesthetic facial surgery leading to publication in peer-reviewed journals	1	2	3	Consensus R2 (75.0:25.0)
b	*Independently treats complex secondary deformities of previous surgery*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
c	*Leads a multidisciplinary team for the treatment of facial aesthetics*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION G FACIAL AESTHETICS – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION H NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE				
	This section deals with the five education and training levels of Non-Cancer Breast Surgery – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				

36	EDUCATION AND TRAINING LEVEL 1				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of benign breast conditions (e.g., gynecomastia, hypermastia, ptosis congenital anomalies)	1	2	3	Consensus R2 (75.0:25.0)
b	Explains breast embryology, anatomy, and physiology	1	2	3	Consensus R1 (25.0:75.0)
c	Describes principles of imaging for benign breast conditions	1	2	3	Consensus R1 (28.6:71.4)
d	*Performs examination of patients with a benign breast condition*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
e	*Orders imaging studies and diagnostic tests*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
f	*Assists with breast procedures (e.g., incisions and skin closures)*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
g	*Provides routine post-operative care for the breast patient*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)

37	EDUCATION AND TRAINING LEVEL 2				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the surgical treatment for benign breast conditions	1	2	3	Consensus R1 (25.0:75.0)
b	Explains concepts of proportions of the breast, aesthetic ideals, and symmetry	1	2	3	Consensus R2 (75.0:25.0)
c	Shows an understanding of the different types of breast implants	1	2	3	Consensus R1 (75.0:25.0)
d	*Interprets diagnostic studies*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
e	*Obtains informed consent for breast procedures*	*1*	*2*	*3*	Consensus R1 (71.4:28.6)
f	*Performs routine procedures (e.g., mastopexy, gynecomastia, reduction mammoplasty) with assistance*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
g	*Recognises complications (e.g., infection, implant complications, hematoma)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)

38	EDUCATION AND TRAINING LEVEL 3				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**

a	Recognises indications for treatment options (e.g., skin/ parenchyma reduction, augmentation)	1	2	3	Consensus R1 (25.0:75.0)
b	Explains the principles of routine surgical procedures (e.g., mastopexy, reduction mammoplasty, augmentation mammoplasty)	1	2	3	Consensus R1 (75.0:25.0)
c	*Formulates (with assistance) a treatment plan for routine breast procedures*	*1*	*2*	*3*	Stability R2 (37.5:62.5)
d	*Performs complex procedures (e.g., congenital breast deformity, augmentation/ mastopexy) with assistance*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Manages complications with assistance*	*1*	*2*	*3*	Consensus R1 (28.6:71.4)
39	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains the effect of surgery on breast sensation, nipple areolar perfusion, and lactation	1	2	3	Consensus R1 (25.0:75.0)
b	Describes the principles of complex surgical procedures (e.g., tuberous breast deformity, augmentation/ mastopexy)	1	2	3	Consensus R2 (75.0:25.0)
c	Describes evolving technologies such as fat grafting	1	2	3	Consensus R1 (25.0:75.0)
d	*Independently formulates a treatment plan*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
e	*Independently performs complex procedures*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
f	*Independently manages complications*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
g	*Independently manages secondary deformities*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
h	*Independently manages the dissatisfied patient*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
40	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Systematically reviews patient outcomes	1	2	3	Stability R2 (42.9:57.1)
b	*Publishes in peer-reviewed journals*	*1*	*2*	*3*	Consensus R1 (71.4:28.6)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				

	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION H NON-CANCER BREAST SURGERY – MEDICAL KNOWLEDGE AND PATIENT CARE

	SECTION I **BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Breast Reconstruction – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
41	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the pathophysiology of malignant breast disease	1	2	3	Consensus R1 (28.6:71.4)
b	Describes the anatomy of the breast and its lymphatic drainage	1	2	3	Consensus R1 (28.6:71.4)
c	*Performs history and physical examination of the breast cancer patient*	*1*	*2*	*3*	Consensus R2 (71.4:28.6)
d	*Assists with procedures (e.g., incisions and skin closure)*	*1*	*2*	*3*	Consensus R1 (14.3:85.7)
e	*Provides routine post-operative care*	*1*	*2*	*3*	Consensus R1 (28.6:71.4)
42	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Explains surgical treatment for malignant breast disease	1	2	3	Stability R2 (37.5:62.5)
b	Demonstrates an understanding of the principles of implant-based breast reconstruction	1	2	3	Consensus R1 (25.0:75.0)
c	*Obtains informed consent for breast reconstruction procedures*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
d	*Performs (with assistance) routine procedures (e.g., tissue expander insertion, flap elevation)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Recognises complications (e.g., implant complications, flap compromise)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)

43	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the role of adjuvant treatment	1	2	3	Consensus R1 (25.0:75.0)
b	Describes the impact of primary and adjuvant treatment on breast reconstruction	1	2	3	Consensus R1 (25.0:75.0)
c	Explains the principles of breast reconstruction using pedicled flaps	1	2	3	Consensus R1 (100.0:0.0)
d	*Formulates a treatment plan with assistance*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
e	*Performs complex procedures (e.g., treatment of the contralateral breast, microsurgical procedures) with assistance*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
f	*Manages complications with assistance*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)

44	EDUCATION AND TRAINING LEVEL 4				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the late effects of chemotherapy and radiation on breast reconstruction	1	2	3	Consensus R1 (25.0:75.0)
b	Explains the surgical principles of the various microsurgical breast reconstruction options	1	2	3	Consensus R1 (87.5:12.5)
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
d	*Independently performs complex procedures*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Independently manages complications*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)

45	EDUCATION AND TRAINING LEVEL 5				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Publishes research in peer-reviewed journals	1	2	3	Consensus R1 (75.0:25.0)
b	*Manages complicated patients with multiple previous treatment failures*	*1*	*2*	*3*	Stability R2 (37.5:62.5)

c	*Assists in leading a multidisciplinary team*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Teaches breast reconstructive procedures*	1	2	3	Consensus R1 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION I BREAST RECONSTRUCTION – MEDICAL KNOWLEDGE AND PATIENT CARE				

	SECTION J **RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Reconstruction of Trunk and Perineum – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
46	**EDUCATION AND TRAINING LEVEL 1**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of benign, malignant and congenital conditions of the perineum/trunk	1	2	3	Consensus R1 (25.0:75.0)
b	Demonstrates an understanding of the anatomy of the back, perineum, chest and abdominal wall	1	2	3	Consensus R1 (75.0:25.0)
c	Demonstrates an understanding of pressure off-loading, nutrition and respiratory mechanics	1	2	3	Consensus R2 (75.0:25.0)
d	*Takes a history and performs an examination of a patient with perineal/truncal defects*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
e	*Assisting with procedures (e.g., incisions and wound closure)*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
f	*Provides routine post-operative care*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
47	**EDUCATION AND TRAINING LEVEL 2**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains the concepts of wound management, return of abdominal domain, and chest wall stability	1	2	3	Consensus R1 (25.0:75.0)

b	Demonstrates an understanding of the indications for the provision of dynamic support, cover of vital structures, and functional restoration	1	2	3	Consensus R1 (25.0:75.0)
c	Demonstrates an understanding of the management of major defects in stages	1	2	3	Consensus R2 (75.0:25.0)
d	*Obtains informed consent*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
e	*Performs, with assistance, routine procedures (e.g., component separation, debridement, musculocutaneous flaps)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
f	*Recognises complications (e.g., organ failure)*	*1*	*2*	*3*	Consensus R1 (28.6:71.4)

48	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of surgical management of congenital abnormalities, chest wall defects, hernias, pressure ulcers and irradiated wounds	1	2	3	Consensus R2 (75.0:25.0)
b	Describes the principles of routine surgical procedures (e.g., component separation, hernia repair and pressure ulcer reconstruction)	1	2	3	Consensus R1 (87.5:12.5)
c	Explains the uses of synthetic and biologic materials	1	2	3	Consensus R1 (0.0:100.0)
d	*Formulates, with assistance, a treatment plan for routine conditions*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
e	*Performs complex procedures (e.g., urogenital reconstruction, composite chest wall reconstruction) with assistance*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
f	*Manages complications with assistance*	*1*	*2*	*3*	Stability R2 (60.0:40.0)

49	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Demonstrates an understanding of the impact of treatment on cardiopulmonary, gastrointestinal, musculoskeletal and genitourinary functioning	1	2	3	Consensus R1 (25.0:75.0)

b	Explains the principles of complex surgical procedures (e.g., recurrent ventral hernia, perineal reconstruction, composite chest wall defects)	1	2	3	Consensus R1 (87.5:12.5)
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
d	*Performs complex procedures independently*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Independently manages*	*1*	*2*	*3*	Consensus R1 (14.3:85.7)
50	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Publishes research in peer-reviewed journals	1	2	3	Stability R2 (37.5:62.5)
b	*Independently manages complex secondary perineal and truncal deformities*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION J RECONSTRUCTION OF TRUNK AND PERINEUM – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION K **UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Upper Extremity Trauma – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
51	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of soft-tissue injuries, dislocations and common fractures.	1	2	3	Consensus R2 (75.0:25.0)
b	Describes the anatomy, basic biomechanics and function of the upper extremity	1	2	3	Consensus R1 (75.0:25.0)
c	Explains the principles of casting/splinting	1	2	3	Consensus R1 (87.5:12.5)
d	*Performs examination of patients with upper extremity*	*1*	*2*	*3*	Consensus R1 (85.7:14.3)

e	*Assists with procedures (e.g., applying splints, making incisions, and doing dressings)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
f	*Provides routine post-operative care*	*1*	*2*	*3*	Stability R2 (37.5:62.5)
52	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the principles of bony stabilisation and soft tissue coverage	1	2	3	Consensus R2 (75.0:25.0)
b	Explains the principles of flap cover and bony fixation	1	2	3	Consensus R1 (87.5:12.5)
c	Demonstrates an understanding of the management of acute compartment syndrome and vascular injuries	1	2	3	Consensus R1 (25.0:75.0)
d	*Obtains informed consent for the surgical management of traumatic upper limb injuries*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
e	*Performs, with assistance, routine procedures (e.g., repair of tendon / nerve injuries or simple hand fractures)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
f	*Recognises complications (e.g., compartment syndrome, vascular compromise)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
53	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of complicating factors (e.g., vascular compromise, bone loss, exposed critical structures)	1	2	3	Consensus R1 (25.0:75.0)
b	Explains the principles of tendon, nerve, vessel, and bony repairs	1	2	3	Consensus R1 (75.0:25.0)
c	Demonstrates an understanding of the principles involved in post-operative regimens for hand therapy	1	2	3	Consensus R1 (75.0:25.0)
d	*Formulates, with assistance, a treatment plan for common hand injuries (e.g., fracture/dislocation, tendon injury)*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
e	*Performs complex procedures (e.g., microvascular flap coverage, hand revascularisation, repair of the mangled hand) with assistance*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)

f	*Manages complications with assistance*	*1*	*2*	*3*	Stability R2 (50.0:50.0)
54	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains tendon transfer biomechanics	1	2	3	Consensus R1 (75.0:25.0)
b	Explains the principles involved in reconstruction of complex problems (e.g., replantation, secondary tendon reconstruction, nerve grafting)	1	2	3	Consensus R1 (87.5:12.5)
c	Explains the role of chronic regional pain syndrome, secondary rehabilitation and prosthetics	1	2	3	Consensus R1 (25.0:75.0)
d	*Independently formulates a treatment plan*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
e	*Independently performs complex procedures*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
f	*Independently manages complications*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)
55	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the principles involved in tendon and nerve transfers for brachial plexus / combined nerve injuries	1	2	3	Consensus R2 (75.0:25.0)
b	Demonstrates an understanding of the multidisciplinary management of hand injuries in a dedicated hand unit.	1	2	3	Consensus R2 (75.0:25.0)
c	*Publishes research in peer-reviewed journals*	*1*	*2*	*3*	Stability R2 (50.0:50.0)
d	*Manages work-related injuries and return-to-work issues*	*1*	*2*	*3*	Consensus R1 (12 5:87.5)
e	*Manages chronic regional pain syndrome*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION K UPPER EXTREMITY TRAUMA – MEDICAL KNOWLEDGE AND PATIENT CARE				

	SECTION L **NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Non-Trauma Hand – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

56	**EDUCATION AND TRAINING LEVEL 1**	**Simulation**			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the pathophysiology of non-traumatic hand conditions (e.g., compression neuropathy, degenerative changes, infection)	1	2	3	Consensus R1 (12.5:87.5)
b	Describes the embryology, anatomy and biomechanics of the upper extremity and hand	1	2	3	Consensus R1 (75.0:25.0)
c	*Performs history and examination of patients with non-traumatic hand disorders*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Assists with procedures (e.g., injections, abscess drainage, skin incisions and closure)*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)

57	**EDUCATION AND TRAINING LEVEL 2**	**Simulation**			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains the treatment options for compression neuropathy, degenerative changes, infection of the upper limb and hand	1	2	3	Stability R2 (50.0:50.0)
b	Explains the concepts of injections, pharmacologic management, incision, and drainage	1	2	3	Consensus R2 (87.5:12.5)
c	Describes principles of anaesthesia for the upper extremity (e.g., local and regional)	1	2	3	Consensus R2 (75.0:25.0)
d	*Obtains informed consent for congenital and non-trauma hand reconstruction procedures*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
e	*Performs, with assistance, routine procedures (e.g., tumor excision, ganglion removal, nerve decompression)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)

58	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Describes management options for contractures and metabolic processes	1	2	3	Consensus R2 (75.0:25.0)
b	Explains principles of routine surgical procedures (e.g., tumour and ganglion excisions, fusions, nerve releases, and contracture releases)	1	2	3	Consensus R1 (87.5:12.5)
c	Describes the post-operative hand therapy regimens	1	2	3	Consensus R1 (25.0:75.0)
d	*Formulates a treatment plan with assistance for routine hand conditions*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
e	*Performs complex procedures (e.g., syndactyly reconstruction, tendon transfers, arthroplasty, contracture release) with assistance*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)

59	EDUCATION AND TRAINING LEVEL 4				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Explains the management of congenital and autoimmune conditions	1	2	3	Consensus R1 (25.0:75.0)
b	Describes surgical principles for complex procedures (e.g., syndactyly release, ligament reconstructions, arthroplasties, and tendon transfers)	1	2	3	Consensus R1 (75.0:25.0)
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Independently performs complex procedures*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)

60	EDUCATION AND TRAINING LEVEL 5				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Explains the surgical anatomy and principles for complex procedures (e.g., thumb reconstructions, congenital hand reconstruction, nerve transfers, rheumatoid hand reconstruction)	1	2	3	Consensus R1 (100.0:0.0)

b	*Formulates a treatment plan for complex congenital hand and rheumatoid deformities*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
c	*Performs toe-to-hand transfers, pollicisations, implant arthroplasty*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
d	*Helps manage a multidisciplinary hand surgery team*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION L NON-TRAUMA HAND – MEDICAL KNOWLEDGE AND PATIENT CARE				

	SECTION M **COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**				
	This section deals with the five education and training levels of Cosmetic Trunk and Lower Extremity – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.				
61	**EDUCATION AND TRAINING LEVEL 1**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the pathophysiology of lipodystrophy and obesity	1	2	3	Consensus R2 (25.0:75.0)
b	Discusses the effects of aging	1	2	3	Consensus R1 (12.5:87.5)
c	Explains the effect of massive weight loss	1	2	3	Consensus R2 (75.0:25.0)
d	Describes the anatomy and aesthetic ideals of the lower extremities and trunk	1	2	3	Stability R2 (50.0:50.0)
e	Explains the concept of weight management (e.g. diet and exercise)	1	2	3	Consensus R1 (12.5:87.5)
f	Explains deep venous thrombosis and pulmonary embolism risk factors, workup, and management	1	2	3	Consensus R1 (12.5:87.5)
g	*Performs physical examination of patients with aesthetic and functional problems of the trunk and lower extremity*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
h	*Assists with procedures (e.g., skin incision and closure)*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
i	*Provides routine post-operative care*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)

62	EDUCATION AND TRAINING LEVEL 2				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of bariatric surgery (e.g. indications, different types, their metabolic effects)	1	2	3	Stability R2 (37.5:62.5)
b	Identifies factors influencing patient selection for body contouring surgery	1	2	3	Consensus R1 (12.5:87.5)
c	Explains the physiological effects of liposuction	1	2	3	Consensus R1 (12.5:87.5)
d	Describes the different aesthetic ideals based on a patient's gender	1	2	3	Consensus R1 (12.5:87.5)
e	Explains the benefit of multidisciplinary bariatric teams	1	2	3	Consensus R2 (75.0:25.0)
f	*Obtains informed consent for routine cosmetic trunk and lower limb procedures*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
g	*Performs routine procedures (e.g., panniculectomy, abdominoplasty)*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
h	*Recognises complications (e.g., skin loss, thromboembolism, seroma)*	*1*	*2*	*3*	Stability R2 (37.5:62.5)

63	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the management options for massive weight loss patients	1	2	3	Consensus R1 (12.5:87.5)
b	Describes surgical principles of routine procedures (e.g., brachioplasty, medial thigh lift, liposuction abdominoplasty)	1	2	3	Consensus R1 (87.5:12.5)
c	*Formulates a treatment plan with assistance*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Performs, with assistance, complex procedures (e.g., brachioplasty, circumferential body lift)*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Manages complications with assistance*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)

64	EDUCATION AND TRAINING LEVEL 4				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Differentiates between aesthetic and functional problems	1	2	3	Stability R2 (37.5:62.5)
b	Explains the surgical principles of complex procedures	1	2	3	Consensus R2 (75.0:25.0)
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Independently performs complex procedures*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
e	*Independently manages complications*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)

65	EDUCATION AND TRAINING LEVEL 5				
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Systematically reviews outcomes and publishes in peer-reviewed journals	1	2	3	Consensus R1 (25.0:75.0)
b	*Manages patients with multiple prior surgeries / unsatisfactory previous results*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION M COSMETIC TRUNK AND LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE				

	SECTION N **LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE**
	This section deals with the five education and training levels of Lower Extremity – Medical Knowledge and Patient Care. The resident should reach the descriptors of performance on the specific level.

66	EDUCATION AND TRAINING LEVEL 1				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the pathophysiology of congenital and acquired conditions of the lower extremity (e.g., trauma, cancer, diabetic foot, venous and arterial insufficiency)	1	2	3	Stability R2 (37.5:62.5)
b	Explains the anatomy of the lower extremity	1	2	3	Consensus R1 (87.5:12.5)
c	Explains the classification systems for soft tissue and bone loss of the lower extremity	1	2	3	Consensus R1 (75.0:25.0)
d	*Performs history and physical examination of patients with lower extremity concerns*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
e	*Assists with procedures (e.g., splint application, dressings, skin incision and closure)*	*1*	*2*	*3*	Consensus R1 (88.9:11.1)
f	*Provides routine post-operative care*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)

67	EDUCATION AND TRAINING LEVEL 2				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Explains the principles of non-operative treatment for lower extremity conditions (e.g., lymphoedema, neuropathic ulcers)	1	2	3	Consensus R1 (12.5:87.5)
b	Describes the surgical principles for lower extremity surgery (e.g., timing and staging of procedures)	1	2	3	Consensus R2 (85.7:14.3)
c	*Obtains informed consent for surgical procedures of the lower extremity*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Performs routine procedures (e.g., skin grafts) with assistance*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
e	*Recognises complications (e.g., compartment syndrome, flap compromise)*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)

68	EDUCATION AND TRAINING LEVEL 3				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**

a	Demonstrates an understanding of the indications for treatment of conditions of the lower extremity (e.g., compartment syndrome, tumor resection, exposed prostheses, arterial insufficiency, and musculoskeletal injury)	1	2	3	Consensus R1 (12.5:87.5)
b	Describes the surgical principles of routine procedures (e.g., local flaps, skin grafting, wound debridement)	1	2	3	Consensus R1 (87.5:12.5)
c	*Formulates a treatment plan with assistance*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Performs complex procedures (e.g., free tissue transfer) with assistance*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Manages complications with assistance*	*1*	*2*	*3*	Stability R2 (62.5:37.5)
69	**EDUCATION AND TRAINING LEVEL 4**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the role of adjunctive modalities (e.g. prosthetics)	1	2	3	Stability R2 (50.0:50.0)
b	Describes the surgical principles of complex procedures (e.g., free tissue transfers, and perforator flaps)	1	2	3	Consensus R1 (87.5:12.5)
c	*Independently formulates a treatment plan*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Performs complex procedures independently*	*1*	*2*	*3*	Consensus R1 (100.0:0.0)
e	*Independently manages complications*	*1*	*2*	*3*	Consensus R1 (87.5:12.5)
70	**EDUCATION AND TRAINING LEVEL 5**				
		Simulation			
	The first statements relate to medical knowledge and the second (shaded and *typed in italics*), relate to patient care.	**ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates an understanding of the principles of microsurgical treatment of lymphoedema, tendon and nerve transfers of the lower extremity	1	2	3	Consensus R2 (75.0:25.0)
b	*Helps lead a multidisciplinary team for limb salvage*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				

	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION N: LOWER EXTREMITY – MEDICAL KNOWLEDGE AND PATIENT CARE				
	SECTION O **SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT**				
	This section deals with the five education and training levels of Systems-based Practice - Patient Safety, Resource allocation and Practice management. The resident should reach the descriptors of performance on the specific level.				
71	**EDUCATION AND TRAINING LEVEL 1**				
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Explains the differences between sentinel events, near misses, and medical errors	1	2	3	Consensus R1 (11.1:88.9)
b	Describes the roles of team members	1	2	3	Consensus R2 (75.0:25.0)
c	*Describes practice variations in resource consumption, such as the utilization of diagnostic tests*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
d	*Explains basic health payment systems, including uninsured care*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
e	*Describes different practice models*	*1*	*2*	*3*	Consensus R1 (16.7:83.3)
72	**EDUCATION AND TRAINING LEVEL 2**				
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Participates in the use of tools (e.g., briefings and checklists) to prevent adverse events	1	2	3	Consensus R1 (0.0:100.0)
b	Describes the common system causes for errors	1	2	3	Consensus R1 (12.5:87.5)
c	*Describes the cost implications of using resources*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
d	*Describes the principles of evaluation, management, and procedure coding*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
e	*Compares and contrasts different practice models*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)

73	**EDUCATION AND TRAINING LEVEL 3**				
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Consistently uses tools (e.g., briefings and checklists) to prevent adverse occurrences	1	2	3	Consensus R1 (12.5:87.5)
b	Reports problematic devices, processes and behaviours, including near misses and errors	1	2	3	Consensus R1 (12.5:87.5)
c	*Participates in responsible use of health care resources, seeking appropriate assistance*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
d	*Codes routine encounters, diagnoses, and surgical procedures*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
e	*Recognises basic elements needed to establish practice (e.g., facility accreditation, compliance, staffing, contracts, malpractice insurance, negotiations)*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)

74	**EDUCATION AND TRAINING LEVEL 4**				
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Formally uses proven analysis methods to evaluate shared team experiences to prevent future errors	1	2	3	Consensus R2 (75.0:25.0)
b	Leads team by promoting input and situational awareness by all team members	1	2	3	Consensus R2 (75.0:25.0)
c	Improves patient safety by conducting morbidity and mortality meetings	1	2	3	Consensus R2 (75.0:25.0)
d	*Practises cost-effective care (e.g., operative efficiency, managing length of stay)*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
e	*Codes complex and unusual encounters, diagnoses, and procedures*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
f	*Establishes timeline and identifies resources for transition to practice*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)

75	EDUCATION AND TRAINING LEVEL 5				
	The first statements relate to patient safety and, the second (shaded and *typed in italics*), relate to resource allocation. The third (typed *in italics* and shaded in purple) relate to practice management.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Leads curriculum design activities to develop communication skills and teamwork of health care professionals	1	2	3	Consensus R2 (75.0:25.0)
b	Assists in leading a multidisciplinary team to address patient safety issues	1	2	3	Consensus R2 (85.7:14.3)
c	*Designs measurement tools provide feedback to providers on resource consumption*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
d	*Participates in advocacy activities for health policy*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
e	*Creates curriculum to teach practice management*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION O: SYSTEMS-BASED PRACTICE – PATIENT SAFETY, RESOURCE ALLOCATION AND PRACTICE MANAGEMENT				

	SECTION P **PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE, AND RESEARCH AND TRAINING**
	This section deals with the five education and training levels of Practice-based Learning and Improvement – Investigate, Evaluate, Assimilate, and Research and Training. The resident should reach the descriptors of performance on the specific level.

76	EDUCATION AND TRAINING LEVEL 1				
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Shows awareness of one's own level of knowledge and expertise	1	2	3	Consensus R1 (75.0:25.0)
b	Identifies learning resources	1	2	3	Consensus R1 (25.0:75.0)
c	*Demonstrates an understanding of the basic concepts in clinical reasoning, biostatistics, clinical epidemiology*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
d	*Participates in the education of patients and their families*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)

77	EDUCATION AND TRAINING LEVEL 2				
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Continually seeks to improve performance by incorporating feedback	1	2	3	Consensus R1 (75.0:25.0)
b	Uses published guidelines and articles in a learning plan	1	2	3	Consensus R1 (25.0:75.0)
c	*Ranks study designs and is able to distinguish relevant research outcomes*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
d	*Teaches patients and their families*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)

78	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates a balanced and accurate self-assessment of competence	1	2	3	Consensus R1 (75.0:25.0)
b	Selects an appropriate evidence-based information tool to answer specific questions	1	2	3	Consensus R1 (25.0:75.0)
c	*Able to critically appraise different research types (e.g., systematic reviews and meta-analyses)*	*1*	*2*	*3*	Consensus R2 (25.0:75.0)
d	*Teaches health professionals and colleagues in both informal and formal settings*	*1*	*2*	*3*	Consensus R1 (75.0:25.0)

79	EDUCATION AND TRAINING LEVEL 4				
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Demonstrates improvement in clinical outcomes based on continual self-assessment	1	2	3	Consensus R1 (75.0:25.0)
b	Performs self-directed learning with minimal external guidance, using evidence-based information tools	1	2	3	Consensus R2 (75.0:25.0)
c	*Formulates a researchable question, describes a plan to investigate it, and executes a research project*	*1*	*2*	*3*	Stability R2 (50.0:50.0)
d	*Organises educational activities at programme level*	*1*	*2*	*3*	Consensus R1 (25.0:75.0)

80	EDUCATION AND TRAINING LEVEL 5				
	The first statements relate to investigating, evaluating and assimilating, and, the second (shaded and *typed in italics*) relate to research and training.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Consistently incorporates evidence-based information in common areas of practice	1	2	3	Stability R2 (37.5:62.5)
b	*Independently plans and executes a research programme*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
c	*Develops educational curriculum and assessment tools*	*1*	*2*	*3*	Consensus R2 (71.4:28.6)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION P PRACTICE-BASED LEARNING AND IMPROVEMENT – INVESTIGATE, EVALUATE, ASSIMILATE, AND RESEARCH AND TRAINING				

	SECTION Q PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY
	This section deals with the five education and training levels of Professionalism – Ethics and Values, and Personal Accountability. The resident should reach the descriptors of performance on the specific level.

81	EDUCATION AND TRAINING LEVEL 1				
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation** ESSENTIAL	USEFUL	NOT APPLICABLE	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Is able to identify ethical issues in plastic surgery	1	2	3	Consensus R1 (12.5:87.5)
b	Demonstrates behaviour that conveys honesty, caring and genuine interest in patients and families	1	2	3	Consensus R1 (12.5:87.5)
c	*Explains and manages issues related to fatigue and sleep deprivation*	*1*	*2*	*3*	Stability R2 (37.5:62.5)
d	*Exhibits professional behaviour (e.g., confidentiality, integrity, diligence, and reliability)*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)

82	EDUCATION AND TRAINING LEVEL 2				
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Is able to analyse, discuss and manage common ethical situation	1	2	3	Consensus R1 (0.0:100.0)
b	Demonstrates behaviour that shows insight in the impact of one's core values and beliefs regarding patient care	1	2	3	Consensus R1 (12.5:87.5)
c	*Demonstrates management of physical, mental, personal and emotional health*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
d	*Recognises individual limits in clinical situations and asks for assistance when needed*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)

83	EDUCATION AND TRAINING LEVEL 3				
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Analyses and manages ethical issues in challenging and complicated situations	1	2	3	Consensus R1 (0.0:100.0)
b	Demonstrates an understanding of the beliefs, practices and values of diverse and vulnerable patient populations	1	2	3	Consensus R1 (12.5:87.5)
c	*Manages situations in which maintaining physical, mental and personal health is challenged*	*1*	*2*	*3*	Consensus R2 (75.0:25.0)
d	*Acknowledges conflicting interests of self, family, and others, and their effects on the delivery of medical care*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)

84	EDUCATION AND TRAINING LEVEL 4				
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Uses a systemic approach to manage ethical issues, including conflicts of interest, billing and advertising	1	2	3	Consensus R1 (12.5:87.5)
b	Develops a mutually agreeable care plan in the context of conflicting physician and patient values and beliefs	1	2	3	Consensus R1 (12.5:87.5)

c	*Recognises signs of physician impairment and demonstrates appropriate steps to address impairment in self and in colleagues*	*1*	*2*	*3*	Consensus R1 (12.5:87.5)
d	*Prioritises and balances conflicting interests of self, family, and others to optimise medical care*	*1*	*2*	*3*	Consensus R1 (0.0:100.0)
85	**EDUCATION AND TRAINING LEVEL 5**				
	The first statements relate to ethics and values, and the second (shaded and *typed in italics*), relate to personal accountability.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Helps lead institutional and organisational ethics programmes	1	2	3	Stability R2 (37.5:62.5)
b	Develops programmes to ensure equality of care in diverse, vulnerable, and underserved populations	1	2	3	Consensus R1 (28.6:71.4)
c	*Helps develop institutional and organisational strategies to improve physician wellness*	*1*	*2*	*3*	Consensus R2 (71.4:28.6)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION PROFESSIONALISM – ETHICS AND VALUES, AND PERSONAL ACCOUNTABILITY				
	SECTION R **INTERPERSONAL AND COMMUNICATION SKILLS**				
	This section deals with the five education and training levels of Interpersonal and Communication Skills. The resident should reach the descriptors of performance on the specific level.				

86	**EDUCATION AND TRAINING LEVEL 1**				
	All the statements relate to interpersonal and communication skills.	**Simulation** **ESSENTIAL**	**USEFUL**	**NOT APPLICABLE**	**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
a	Develops a positive relationship with patients and teams, in uncomplicated situations	1	2	3	Consensus R2 (66.7:33.3)
b	Demonstrates an understanding of the patient's/family's perspective	1	2	3	Consensus R1 (22.2:77.8)
c	Utilises interpreters as needed	1	2	3	Consensus R1 (22.2:77.8)
d	Appreciates effective communication to prevent medical errors	1	2	3	Consensus R1 (22.2:77.8)
e	Participates in effective transitions of care	1	2	3	Consensus R1 (11.1:88.9)

f	Uses photographic documentation with safeguards for privacy	1	2	3	Consensus R1 (11.1:88.9)
87	**EDUCATION AND TRAINING LEVEL 2**				
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Manages conflict (such as with patient, family, and teams)	1	2	3	Consensus R1 (66.7:33.3)
b	Ensures that the patient is able to participate in health care decision-making, by incorporating the cultural and social contexts	1	2	3	Consensus R1 (22.2:77.8)
c	Ensures that the medical records, are accurate, and complete	1	2	3	Consensus R1 (22.2:77.8)
d	Demonstrates an understanding of the effects of computer use on information accuracy	1	2	3	Stability R2 (44.4:55.6)
e	Demonstrates an understanding of the potential effects of the physician/patient relationship	1	2	3	Consensus R1 (22.2:77.8)
88	**EDUCATION AND TRAINING LEVEL 3**				
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Manages complex and challenging situations, including transitions of care	1	2	3	Consensus R1 (11.1:88.9)
b	Conveys emotionally difficult information to patients on a individually applicable basis	1	2	3	Consensus R1 (22.2:77.8)
c	Optimises communication across systems	1	2	3	Consensus R1 (11.1:88.9)
89	**EDUCATION AND TRAINING LEVEL 4**				
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Negotiates and manages conflict in complex and challenging situations	1	2	3	Consensus R1 (11.1:88.9)
b	Develops working relationships across specialities	1	2	3	Consensus R1 (11.1:88.9)
c	Organises and facilitates family/health care team conferences	1	2	3	Consensus R1 (11.1:88.9)
d	Uses multiple forms of communication ethically and with respect for patient privacy	1	2	3	Consensus R1 (11.1:88.9)
e	Demonstrates an understanding of the use of ethical marketing practices	1	2	3	Consensus R1 (11.1:88.9)

90	**EDUCATION AND TRAINING LEVEL 5**				
	All the statements relate to interpersonal and communication skills.	**Simulation**			**Importance of simulation as one of the methods to train a plastic surgeon. Important:1(essential)+2(useful) vs Not important:3(not applicable) Opinion percentage Delphi experts:% Round:R**
		ESSENTIAL	**USEFUL**	**NOT APPLICABLE**	
a	Develops models/approaches to managing difficult communications	1	2	3	Consensus R1 (22.2:77.8)
b	Coaches others to improve communication skills	1	2	3	Consensus R1 (11.1:88.9)
	Cognitive level of learning. Please give your opinion on the value of simulation as a learning method (see page 1 of questionnaire as well as last page of this document).				
	Please give an example of a simulation or describe a simulation that you have done or that can be done (specific to this section):				
	ANY FURTHER COMMENTS ON EDUCATION AND TRAINING - SECTION R INTERPERSONAL AND COMMUNICATION SKILLS				

Thank you for completing the questionnaire!

APPENDIX O LETTER OF INVITATION TO PARTICIPATE IN A SEMI-STRUCTURED INTERVIEW

APPENDIX O

LETTER OF INVITATION TO PARTICIPATE IN A SEMI-STRUCTURED INTERVIEW

Netcare Mulbarton Hospital
25 True North Road
Mulbarton
Johannesburg
2059

Name and address of expert

Dear Interviewee

INVITATION TO PARTICIPATE IN A SEMI-STRUCTURED INTERVIEW

I hereby wish to approach you for support in my PhD study through participation in the data collection process during a semi-structured interview.

I am a qualified Plastic Surgeon, worked as a consultant in the Department of Plastic Surgery at the University of KwaZulu-Natal, Durban, South Africa and I am currently in private practice since January 2016. I am enrolled at the University of the Free Sate (Bloemfontein, South Africa) for a doctoral study. This study will be executed in the field of Health Professions Education and falls under the domain of clinical simulation education. This study is interdisciplinary as it reaches across and between Health Professions Education and Plastic Surgery.

For my PhD I am doing a study on postgraduate education and training in Plastic Surgery. The title of my thesis is: **SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING.**

The overall goal of the study is to enhance postgraduate plastic surgery education and training by means of developing guidelines for the use of simulation with a view to include medical simulations in training programmes.

The aim of this study is to do an in-depth study on simulation in postgraduate plastic surgery education and training. This will be done by identifying the contribution that simulation can make in postgraduate plastic surgery education and training.

Semi-structured interviews will be executed with a view to obtaining a more in-depth comprehensive overview of the contribution that simulation can make in postgraduate plastic surgery education and training. The features and uses of simulation that may lead to more effective learning in postgraduate plastic surgery will also be discussed. The lessons learned regarding implementation of simulation in a postgraduate programme as well as the biggest challenge to implementation will be identified. Interviewees will further be asked to make recommendations that may be used in compiling guidelines on simulation in postgraduate plastic surgery.

Because of your expertise and experience in the field of Clinical Education and/or Plastic Surgery and/or Simulation, I wish to invite you to participate in this study. The survey population for the semi-structured interviews will comprise individuals who have agreed to be interviewed and have completed, signed and returned the consent forms.

Participation is strictly voluntary and there is no compensation or any known risks for participants. Participation will be confidential and all data collected during the research process will be treated confidentially at all times.

Participation in the interview will not exceed 90 minutes. A time and place for the interview will be arranged at your convenience. Interviews will be recorded in order to ensure accurate record keeping of data and for the purpose of post-process analysis. The data collected through the research will form the basis of the PhD thesis.

If you would like to contact me please do not hesitate to mail me at drcnel@gmail.com or phone me at Cell no +27 (0)82-924-3847.

My promoters are:

Promoter: Prof GJ van Zyl
Dean
Faculty of Health Sciences
University of the Free State
Bloemfontein, South Africa

Co-promoter: Dr MJ Labuschagne
Head: Clinical Simulation and Skills Unit, School of Biomedical Sciences
Faculty of Health Sciences
University of the Free State
Bloemfontein, South Africa

If you are willing to participate in the semi-structured interview, please complete the accompanying consent form and e-mail it back to me at your earliest convenience. If you are not available, please inform me in writing by sending me an e-mail in this regard.

To ensure the validity, reliability and trustworthiness of the study it is important that you do not discuss your participation in this study with any of your colleagues.

Thank you for considering my request. Your participation will add value to the study, and will be highly appreciated.

Yours faithfully

Dr Corné PG Nel
MBChB, MHPE, FC Plastic Surgery, MMed (Plastic Surgery)
Student number: 2000003430
Ethics approved number: ECUFS122/2015

APPENDIX P FORM TO OBTAIN CONSENT FROM PARTICIPANTS TO TAKE PART IN SEMI-STRUCTURED INDIVIDUAL INTERVIEWS

APPENDIX P

FORM TO OBTAIN CONSENT FROM PARTICIPANTS TO TAKE PART IN SEMI-STRUCTURED INDIVIDUAL INTERVIEWS

CONSENT FORM

I, the undersigned, hereby agree to be a participant in the semi-structured interview being executed as part of the PhD study with the title **SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING** (ECUFS122/2015). I acknowledge that I have been fully informed about the purpose and aims of the research, and also that the interview will be captured by means of recording.

I understand my participation in the semi-structured interview is confidential and that there will be no references to any names. All data collected during the interview will be treated confidentially at all times. I am also of the understanding that I will not be held accountable for any decisions or conclusions emanating from this study. I furthermore acknowledge that the results from this research will be published.

My full particulars are:

Title	
Surname	
Full names	
Contact number	
E-mail address	
Years associated with post-graduate clinical education and/or Plastic Surgery and its sub-disciplines in an education and training capacity	
Years of experience in and knowledge of simulation	
Signature	
Date	

To ensure the validity, reliability and trustworthiness of the study, it is important that you do not discuss your participation in this study with any of your colleagues.

Please complete this document and e-mail it to drcnel@gmail.com

THANK YOU FOR YOUR WILLINGNESS TO GRANT ME THE OPPORTUNITY TO CONDUCT A SEMI-STRUCTURED INTERVIEW WITH YOU.

Yours faithfully

Dr Corné PG Nel
MBChB, MHPE, FC Plastic Surgery, MMed (Plastic Surgery)
Student number: 2000003430
Ethics approved number: ECUFS122/2015

APPENDIX Q INTERVIEW GUIDE FOR SEMI-STRUCTURED INDIVIDUAL INTERVIEWS

APPENDIX Q

INTERVIEW GUIDE FOR SEMI-STRUCTURED INDIVIDUAL INTERVIEWS

SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING

The purpose of the semi-structured interview is to investigate, and to establish clarification on simulation in postgraduate plastic surgery education and training. Semi-structured interviews will be executed with a view to obtaining a more in-depth comprehensive overview of the contribution that simulation can make in postgraduate plastic surgery education and training. The features and uses of simulation that may lead to more effective learning in postgraduate plastic surgery will also be discussed. The lessons learned regarding implementation of simulation in a postgraduate programme as well as the biggest challenge to implementation will be identified. Interviewees will further be asked to make recommendations that may be used in compiling guidelines on simulation in postgraduate plastic surgery.

This will be done by obtaining contributions from professionals that are engaged in simulation education and training. In addition, the purpose is to gain insight into how they feel (attitude, approaches) about important applicable issues and what kind of solutions they foresee.

<u>Semi-structured interview guide</u>

<u>Questions:</u>

1. What experience with/exposure to simulation in the field of health education have you had in general? Briefly describe your experience with/exposure to simulation in terms of the type of simulation, your role, duration of involvement.
2. Are you currently involved in simulation and/or postgraduate education and training? In what context are you involved?
3. Does/can simulation influence student learning in postgraduate education and training? In which regard?
4. How can effectiveness of learning be enhanced in postgraduate and/or plastic surgery education and training (in the areas of knowledge, skills, clinical competence, professional conduct)?
5. Can simulation be used to enhance student learning at different cognitive levels? (Will the student only use simulation to remember knowledge / or understand / or apply / or analyse / or evaluate / or create new concepts and ideas?)
6. Which types of simulation or simulation modalities might lead to effective learning?
7. Which features and applications of simulation in postgraduate/ or plastic surgery education and training will lead to more effective learning?
8. Does simulation have (a) a contribution to make to, (b) a role to play in, or (c) a specific value to add to postgraduate education?
9. What would your main consideration be if you decided to include simulation in your teaching and training programme?
10. If you have to guide a team of experts tasked to develop a curriculum with simulation as one of the training/learning methods, which important guidelines will you put on paper?
11. Do you wish to make any recommendations that may be used in compiling guidelines on simulation for postgraduate plastic surgery?
12. Any recommendation(s) you would like to make when considering including simulation in specialist training?
13. Will you please share (a) some of the lessons learned regarding the implementation of simulation in a curriculum, (b) as well as the biggest challenge in implementing simulation in training?

APPENDIX R SEMI-STRUCTURED INTERVIEWS: ANALYSIS AND RESULTS

APPENDIX R

SEMI-STRUCTURED INTERVIEWS: ANALYSIS AND RESULTS

1. INTRODUCTION

The purpose of this document is to present the results of the semi-structured interviews executed for this study. A number of semi-structured interviews were executed in this study in order to obtain information by investigating and establishing clarification on simulation in postgraduate plastic surgery education and training.

2. THE PROCESS FOLLOWED

(cf. article 3)

3. DATA ANALYSIS OF THE SEMI-STRUCTURED INTERVIEWS

The analysis of the semi-structured interviews was carried out and interpreted by the researcher. The process of data analysis included the following steps: categorise into themes, define categories and show the connections with the interview questions. The data analysis was controlled by an independent researcher, and contributed to the trustworthiness of the research. [cf. quality assurance, trustworthiness/reliability Article 3].

The interviewees have been assigned numbers in the reporting. These numbers were assigned randomly, but they were divided into:

- Clinical specialists [C1-C3]
- Directors/managers of simulation centres [D1-D2]
- Industry/academic [I1]
- Researcher (R1]
- Clinical simulation and skills training specialist [S1]

4. REPORTING OF RESULTS

In order to simplify the analysis process, each question of the semi-structured interview guide will be analysed and discussed.

4.1 Experience/Exposure to simulation

TABLE 1: EXPERIENCE/EXPOSURE OF INTERVIEWEES TO SIMULATION

1.	**Formal qualifications**	Obtaining of formal qualifications in simulation • Obtained a PhD in field of simulation [D1,D2] • Obtained a Master's qualification in field of simulation [I1] • Formal qualifications (clinical) • Holding formal qualifications in specialist clinical field [C1,C2,C3,D1] • Clinical and research qualification [R1] • Formal qualifications (medical and medical education [S1] Supervises postgraduate students in the field of simulation • On PhD level [D1] • On Master's level [D1]
2.	**Development of simulation**	Development of scenarios and simulation for programmes • For registrars in own clinical field [C1,C2,C3,D1] • For undergraduate medical training [C3,D1,S1]] • For other health professionals [D2,I1,S1] • For registrars, together with other clinical fields [C2,D2,R1,S1] Facilitates short learning programmes • Train the trainer programmes [D1,S1] • CPD programmes [C1,C3,D1,I1,S1]
3.	**Practical exposure/ experience**	Attendance of conferences, workshops/courses, etc. • To gain knowledge as far as simulation is concerned [C1,C2,C3,D1,I1,R1] • To gain practical hands-on experience [C1,C2,C3,D1,I1] • To complete a leadership course on simulation with the view to apply simulation in a interprofessional way [D2] • To complete an instructor course with the view to train others and to develop simulation in curriculum [C3,S1]
4.	**Motivation, drive/initiative simulation**	Motivation of colleagues to be involved with • Motivate and assist colleagues to explore simulation [C1,C3,D2,S1] • Motivate other clinicians to develop scenarios in simulation [C1,C3,D2,S1]

		<u>Initiative to introduce a simulator</u> • Initiate and introduce a simulator and a short course on simulation for the first time in a clinical field in S.A. [C1] • Initiate and introduce short courses in simulation and clinical skills in UK [S1] <u>Be part of a team to establish a simulation unit</u> • Identify contacts to visit international simulation units and facilities with a view to establish a simulation unit in own Medical School [C1] • Set up a new simulation lab from start and is responsible for the coordination there-off [D2]
5.	**Experience and exposure in simulation industry**	<u>Playing a role in the field of simulation</u> • By having a broad base of years of experience in education, training, CPD and industry [I1] • By having a broad base of years of experience in research on clinical simulation [R1]

4.2 Involvement in simulation

TABLE 2: CURRENT INVOLVEMENT OF INTERVIEWEES IN SIMULATION AND/OR POSTGRADUATE EDUCATION AND TRAINING AS WELL AS CONTEXT

1.	**Management & Leadership role**	<u>Head of simulation unit and/or department</u> • Coordinate and liaise with School of Nursing and Allied Health Professions [D1] • Functions as Head of Department [C1] • Liaise with departments, divisions, emergency services, trainers, industry [C2,D1,D2,I1,S1] • Building curricula systems assessment; also with simulation [S2]
2.	**Education & Training role**	<u>Education and training in simulation</u> • Academic, education and clinical role in undergraduate and postgraduate education and training [D1,D2,S1] • Development of simulation logbook for simulation training of clinical registrars in specific clinical discipline [C1] • Formal logbook – structured and time allocation to follow – can be used by registrars, consultants, professions for CPD [C1] • Consultants involved and play part of scenarios and debriefing [C1] • Clinical registrars complete scenarios in logbook on an individual time scheduling basis [C1] • Academic, education, CPD in field of emergency care / medicine [D2,I1] • Teaching clinical skills, communication, teamwork, examination skills at under- and postgraduate level [C2,C3,S1] • Experience in work with plastic surgery simulations [C2] • Presenting instructor courses a few times a year (national and international) [C3, D1]

	• Train own registrars/residents in different types of simulation, e.g. skills training, training in advanced scenarios, clinical focussed scenarios, as well as scenarios focussed on teamwork and scenarios that include cognitive and meta-cognitive aspects [C3,S1] • Instructor for ACLS and APLS courses [C3] • Academic, education, CPD in field of trauma and cardiac simulation [S1]

4.3 How can effectiveness of learning be enhanced in postgraduate plastic surgery education and training?

TABLE 3: ENHANCING THE EFFECTIVENESS OF LEARNING IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING BY INTRODUCING SIMULATION

1.	**Non-threatening environment**	Enhancement of learning • Students can practice with less stress [D1,D2] • "You learn in an environment where you are allowed to make mistakes" [D1] • "To get learners to think about their actions, to analyse, taking ownership of own learning, reflective learning" [D2] • "They learn in a complete safe non-threatening environment" [D2] Patient safety • First learn through simulation then real patient [D1] • Steep learning curve before practice on real patient [D1] • "Give them a plan according to which they can work when in a real situation" [D2] • "It allows them to practice more on the simulator so on a real patient there is less medical errors" [D2] Advantage as far as training using simulation • Operation time less; complications fewer; costs lower – big advantage to train postgraduate students/registrars [D1]
2.	**Soft medical skills**	Training of soft skills by simulation • Interpersonal communication, interprofessional communication, patient communication, health communication, etc. to be included in simulation training [D1] • "We give attention to these skills on undergraduate level, but not on postgraduate level – must be enhanced" [D1] • "Some people may think it is not technical skills (as in Afrimed, Canmed does) so it is not assessed" [D1] • "Colleges to include soft skills in evaluation" [D1] • "Students have difficulty to express themselves; and to express themselves (verbally) as far as what went wrong during a simulation – we need to train them these soft skills" [D2] • "Powerful tool to develop clinical reasoning" [S1]

		• "Clinical reasoning will happen in a complex space" [S1] • "Different reasoning in rural situation" [S1]
3.	**Deliberate practice**	Psychomotor skills • Bench models can be used to practice psychomotor skills by repetition and/or deliberate practice of specific procedures until students feel safe [D1] • To make deliberate practice more successful, students can use a tick-sheet to test themselves [C2] • To make deliberate practice more successful the student must be accompanied by consultant/educator [D1] • Student must know what he/she is doing correctly [D1] • There must be scheduled times for practice as well as for feedback [D1] • Registrars are adult learners and can identify skills that need more practice [D1]
4.	**Feedback**	Constructive feedback • Can be according to a debriefing manner: focus first on the positive; then focus on things that students wish he/she should do in another way; then focus on these things without negative critique [D1] • Give feedback direct after simulation/time slot; in writing or on video [D1] • "Feedback to be planned, structured according to a template or can be more personal" [D1] • For non-technical skills use the debriefing method – look at what was good; discuss what can be different [D1] • For technical skills – then use a tick sheet; it will allow for more constructive feedback and certain skills can be revisited [D1] • "Give feedback to students that they can correct themselves" [C2]
		Feedback and assessment with the view to enhance effectiveness of learning • Formative feedback will help students to prepare for assessment and examination: then they will have time to correct their mistakes [D1] • Timely feedback before assessment can help the student to lower stress levels [D1] • Feedback on quality of operations can offer opinion whether registrar is safe: by using easy scenarios evaluate whether the registrar executes the technique in a good/proper way and/or quick enough – this is a good learning opportunity [C1] • Students to be observed on a continuing basis [C2] • "Student can be observed during a skill performance" [C2]
5.	**Debriefing**	The process of debriefing • The process of debriefing gives more insight – "a way to learn"; a good learning situation" [C1] • "Debriefing is another way to learn" [C1] • "It's the debriefing aspect that affects learning" [D2] • "Do not use debriefing as a teaching opportunity – let learner think how they can improve" [D2] • "Learners struggle to verbalise / communicate / to express themselves when something went wrong" [D2] • "Observation of skills, then debriefing after that, improves practical skills [C2]

6.	**Realism or fidelity**	Degree of realism of clinical problems • The degree of realism of the scenario or patient, influences the effectiveness of learning – people see it as an act – difficult to see it is real [C1] • "Gevoel wat in jou brein moet vassteek – as dit gebeur, dan doen ek dit" [C1] *It is a feeling that sticks in your brain – if that happens, then I do this.* • "In the beginning, students do not believe in the simulation scenario; later you can observe the 'overcoming of disbelief' – the suspension of disbelief – they think it is a real patient: that leads to more effective learning than using a paper case" [D2]
7.	**Repetitive practice**	For learning to take place a medical training situation or a practical situation is necessary • You have to practice on a continuous basis – do it repeatedly over the time span of a month/year [C1,D1] • It must become a natural action – you learn by repeating – repeat soon after the first practice; one week; after weeks, month, 3 months [C1]
8.	**Training platform**	Training platforms can become smaller • In certain disciplines not the case; enough opportunities to learn on a continuous basis [C1] • Opportunities/learning situations influence learning [C1] • "Platform varies from rural situation to complex" [S1]
9.	**Assessment**	Evaluation of clinical skills in end/summative assessment of registrars • Own departmental clinical evaluation more reliable [C1] • "Don't concentrate too much on evaluation by means of simulation in final examination" [C1] • "Don't over emphasise the role of simulation for clinical assessment" [C1] • "In the field of specialists, assessment should include well-defined objectives and competencies" [C2] • "Assess levels for competence" [C2] • Assessment to be reliable and statistically sound; can use tick-sheets [C2] • "We use simulated patients for clinical examinations" [S1]

4.4 Influence of simulation on student learning in postgraduate education and training

TABLE 4. THE INFLUENCE OF SIMULATION ON STUDENT LEARNING IN POSTGRADUATE EDUCATION AND TRAINING

THEMES		CATEGORIES
1.	**Replace one education strategy with another**	Replacement of theory/theoretical lectures with simulation scenarios • Trigger more excitement in students [D1] • Students focus and remember more [D1] • Opportunity to learn "hands-on" [C1] • "Bringing a simulated case engagement into the normal learning strategy" [S1]

		• "Cases needs to be a higher level in SA because of the system we are working in" [S1]
2.	**Motivation to make a difference**	<u>By simulating rare clinical cases or life threatening important scenarios can be motivational</u> • Students motivated to make a difference in a patient's life [C1]
3.	**Importance of preparation**	<u>Importance of theoretical grounding and preparation</u> • Students can attend a lecture/e-learning programme, read articles, do a self-test before visiting the simulation lab and ensure that the learning is more meaningful and promotes deep learning and commitment [D1] • Identify own shortcomings, evaluate own level of competence, against own tempo [C1] • "Students must be prepared when they come to simulation lab" [D2]
4.	**Learn by repetition**	<u>Practice non-technical and technical skills</u> • Giving students the opportunity to practice in simulation lab so that they are "more competent" when performing certain procedures on a patient [C1,D1]
5.	**Group simulations**	<u>Simulation scenarios that include different health professionals can foster/enhance learning</u> • Debriefing gives the opportunity to students not only to identify their own shortcomings but also that of the individual group members and group as a whole [C1] • Learn to work in groups and that communication between them is of great importance [C1] • "You have to have small group engagement" [S1]
6.	**Simulation as learning strategy**	<u>Simulation is a very specific education and training strategy</u> • Simulation to be seen as a holistic process to ensure meaningful learning [I1] • "Effectiveness can only be enhanced if there is proper integration" [S1] • "To be effective – it needs to be an important component in the curriculum" [S1] <u>Simulation is based on an adult learning strategy</u> • Simulation is built on adult learning [C3] • "Different people learn in different ways" [C3] • Can be combined with different ways of preparing for learning [C3] • "Simulation is a technique – not a technology [C3]
7.	**Competence**	<u>Attaining a certain competence level</u> • "Attaining some sort of competence level quicker before going to patient" [C2] • "Competent = bare minimum (knows/knows how)" [C2] • "Proficient = level of skill above minimum (shows/does)" [C2] • "As you practice a skill more, you become proficient = on your way to mastery" [C2]
8.	**Sustaining level of competence**	<u>The aim of simulation is to sustain a certain level of competence or expertise</u> • Ensure that the health professional/student maintain that same level of competence after the initial/original mastering of the procedure [I1]

4.5 Features and uses of simulation in postgraduate plastic surgery education and training that leads to effective learning

TABLE 5: THE FEATURES AND USES OF SIMULATION IN POSTGRADUATE PLASTIC SURGERY EDUCATION AND TRAINING THAT MAY LEAD TO EFFECTIVE LEARNING

1. **Environment**	Simulation has the ability to create and/or set the scene for an environment where learning can take place • In a non-threatening way [D1] • Be real mimicking and playing out as a clinical scenario where different education strategies can be part of the learning process [C1] • Including variations from superficial to deep learning [D1] • Over the span of different cognitive levels [D1,D2] • "Good supervision during procedures" [S1] • "Safe environment on their thought process" [S1] • "Simulation is adding for the trainees as well as the trainers" [S1]
	The simulation environment is open to accommodate a multipurpose process • That can change from a uni- to a multi-purpose process where learning can be based on a single objective or on multiple objectives of learning and on different levels of learning [D1] • A simulation scenario can be changed/adapted to a more complex scenario where learning could take place on a total different level of competence and applicability [C1] • Simulation offers the possibility of a cyclic learning dimension/structure, namely a safe purposeful-planned learning environment, including variations of learning strategies and methods and the opportunity to select learning material offering different applicable learning opportunities and ensuring an unique learning experience where the learning that took place could be evaluated by the registrar or feedback/debriefing by a consultant with the outcome of achieving competence or to re-plan and/or deliberate practice certain identified learning units[C1, D1] • "Learning that takes place in an environment where it is acceptable to make mistakes" [D1] • "Safe environment cause less stress for registrars and promote learning" [D1] • Applicable learning objectives in a non-threatening environment on a specific level of experience working towards a more complete objective promote learning [C1] • "A steep learning curve before working on a patient increases learning"[D1] • Simulation offers a controlled environment enabling the detecting of problems and patient care errors without consequences [D1]
2. **Feedback**	Feedback is an important feature and use of simulation • Constructive feedback can slow down decay of skills [D1] • Feedback must be planned and scheduled formally [D1] • Feedback must be an integral part of the programme [C1]

	• Feedback can be built into simulations, or presented at scheduled times, on video or electronic media [C1] • Student can reflect on own time, own pace and be self-assessing [D1] • Constructive feedback can drive decisions as far as preparation for final assessment [C1] • Registrars will approach simulation opportunities in a different way when consultants/educators are with them to give feedback and will see scenarios as a direct learning opportunity and problems can be corrected immediately – they see it as teaching them purposefully and deliberate [D1] • "The simulation environment gives the opportunity to observe students directly" [C2] • "Through direct feedback they can correct themselves" [C2] • During feedback, integration of motor skills, visual input, audio-input is possible [C3] • With integration there is a safety aspect as well – feedback during simulation [C3] • "Psychomotor development feedback on operating skills; feedback of accuracy and timing" [S1] • "Skills training with regards to higher order surgical skills" [S1]
3.	**Curriculum integration**	<u>Simulation to be built into curriculum and normal training schedule</u> • Building into curriculum directed by developing of guidelines to include in training programme [D1] • Be part of how registrar's performance is assessed [C1]
4.	**Deliberate practice**	<u>Engagement in deliberate practice will enhance effectiveness of learning</u> • Deliberate practice must be according to set learning outcomes, real clinical problems [C1]
5.	**Repetitive practice**	<u>Students' engagement in repetitive practice is a feature of simulation that leads to effective learning</u> • Repetitive practice involves intense and repetitive student engagement in a controlled environment [D2,R1] • Repetition of practising skills gives students the opportunity to correct errors, practise performance and make the demonstration of skills effortless and automatic [R1] • The focus is on skill acquisition in shorter time periods, the maintenance of skills as well as skills that can be transferred to patient care settings [R1] • "Done psychomotor component a few times on simulator before going on real patient" [S1]
6.	**Multiple learning strategies**	<u>The adaptability of medical simulations to multiple learning strategies is a feature and use that leads to more effective learning</u> • Learning strategies should be in line with educational goals and learning outcomes and should be adaptable for the learning situation[R1] • "You can simulate physiological problems in a patient and that will help to make decisions" [S1] • "To me it is all about forming brain practice of reasoning and management for a particular issue in a patient" [S1] • "Giving psychomotor feedback to the development of particular skills of operating the patient" [S1]
7.	**Range of difficulty level**	<u>Effective learning is enhanced when students have opportunities to engage in practice of clinical skills across a wide range of difficulty levels</u>: • Performance has to be demonstrated against objective criteria and standards [D2,R1] • Mastery starts at the basic levels and proceeds progressively to higher difficulty levels [D2,R1] • The level of task difficulty that might differ in programmes should be standardised by descriptive learning outcomes [D2,R1]

8.	**Individualising learning**	The opportunity for students to have an individualised educational experience where they are active participants is a feature that leads to effective learning • The learning should be reproducible, standardised and individualised to the student's learning needs [R1]
9.	**Clinical variation**	A wide clinical variation with a variety of patient problems and conditions can lead to more effective learning than a narrow range: • The variety of simulation or simulated patients seen by students should help to standardise the clinical curriculum across training platforms [R1]
10.	**Complex clinical tasks can be broken into their learning units**	The mastery of smaller components at variable rate into their learning units lead to more effective learning • Students should work to their own pace but the mastery in sequence thereof must fall into educational requirements [R1] • Students should take responsibility for their own progress and achievements [R1]
11.	**Clearly defined outcomes**	Simulation offered within clearly defined outcomes can lead to effective learning • Outcomes can be benchmarked in various clinical and educational environments [R1] • Students can master key skills if learning outcomes are clearly defined and appropriate for level of training [R1] • "Formulate outcomes and objectives for each scenario – and it must be met" [D4]
12.	**Degree of realism or fidelity**	Simulation fidelity influence the effectiveness of learning • The degree of realism of clinical problems and the opportunity for hands-on experience should help students to master learning outcomes and to transfer this knowledge, skills and competencies to real patient settings [R1]
13.	**Recording of learning**	Recording of learning • Development of logbooks for registrars with clear objectives [C1] • Recording of learning enhances learning [C1]
14.	**Large group learning**	Large group learning & individualised learning • Simulation offers the opportunity for individualised learning [D1] • Simulation offers the opportunity to develop scenarios for multi-professional large groups where their individual as well as group learning could take place. Opportunity for debriefing and constructive feedback [C1, D1, I1]
15.	**Technology**	New technology offers endless possibilities for learning • By adding/changing scenarios [C1, I1] • Technical skills, non-technical skills as well as the softer skills on different levels can be explored for learning [D1]
		Sharing facilities between institutions can be of benefit • Registrars can see/use whole spectrum of simulations [D1] • Standardisation of outcomes [C1] • Quality learning opportunities and opportunity to learn new skills [I1]
16.	**Motivation**	Intrinsic motivation fosters deep learning • Registrars do it on their own [I1] • Informal in own time [D1]

17.	**Cognitive levels**	<u>Learning can take place on different cognitive levels</u> • Scenarios on different levels of difficulty ensures that learning takes place on different cognitive levels [D1] • You can shift the limits ("jy kan limiete/grense skuif") and observe [C3]

4.6 Types of simulation or simulation modalities that may lead to effective learning

TABLE 6: THE TYPES OF SIMULATION OR SIMULATION MODALITIES THAT MAY LEAD TO EFFECTIVE LEARNING

1.	**Low-tech simulation modalities** *(e.g. organ models; basic plastic manikins & simple skills trainers; animal models; human cadavers; simulated or standardised patients)*	<u>Simulated patients (SP's)</u> • SP's play an important role in a controlled and safe environment [D1] • SP's play an important role in teaching the resident communication skills – they can teach the student how to talk to a patient in a professional way [D1] • SP's teach according a standardised manner (will make use of a script) and make an impact/impression with their feedback to a student – e.g. "you did not look me in the eye/ or did not even greet me" [D1] • SP's feedback very important –"it is a strong, powerful thing" [D1] <u>Task trainers</u> • "Heart of simulators" [I1] • "How do you move from task training skill development" – "you need to figure out what you want to train" [I] • "Task trainers focus is on skills training e.g. psychomotor skills for where you control procedure" [D1] • "We used wet models for basic training" [D1]
2.	**High-tech simulation models** *(e.g. screen-based simulators; realistic, high fidelity procedural simulators (task trainers); realistic high-tech interactive patient simulators; (virtual reality) (c.f. Delphi questionnaire)*	<u>High-tech simulation</u> • Important role not to be underestimated/underrated (laparoscopic skills) [D1] <u>High fidelity</u> • "Used for resuscitation training, intensive care training" [D1] • "High fidelity more focused on integrated type of scenarios" [D1] • "You must get the feeling working the simulator in, for example, your clinical field – it must be high-fidelity" [C1] • Task trainers to learn hand skills – but high fidelity and high performance simulators have their place in high performance and critical incidents [C1] <u>Other basic principles commented on</u> • "All types of simulators have a role to play" [C1] • "You don't need the most expensive – it may do more harm" [I1] • "Outcomes in curriculum must be aligned with what you want to teach, e.g. psychomotor/communication/clinical skills, etc." [D1]

		• "Include high fidelity simulation from year one of training" [D1] • "Use high fidelity, simulations to assess registrar's skills" [C2] • "At conferences we practiced on virtual reality simulation for cataract and retinal surgery" [D1] • "Use bench models to practice psychomotor skills where necessary until they feel competent" [D1] • "Practice soft skills, e.g. interpersonal communication and interprofessional collaboration, etc. with simulation" [D1] • "Used to train registrars on flat screen to have hand skills – registrars practice skills but consultants make decisions" [C1]
3.	**Using low-tech and high-tech**	• "We use both Low Fidelity (LF) and High Fidelity (HF) simulators. Students master the individual task components using the task-trainers (LF)" [D2] • "To train and experience the holistic scenario with all its consequences we use the HF to put emphasis on integration, group work and the multidisciplinary approach" [D2] • "Using both, but a higher fidelity simulator can take you to a higher level" [S1]

4.7 Simulation to enhance learning at different cognitive levels

TABLE 7: THE ENHANCEMENT OF STUDENT LEARNING BY SIMULATION AT DIFFERENT COGNITIVE LEVELS

	THEMES	**CATEGORIES**
1.	**Different cognitive level of learning**	Identify the level of competence or expertise • It is important to first identify the competence or expertise, (in context) what is needed from the qualified professionals [I1] • Then training the registrars it is necessary to master competence and maintaining it on the specific level of competence/expertise in the specific discipline [I1] • Look at cognitive levels but also understand that human development is on emotional experience - having cognitive, motor, social and other skills to take into account [I1] • "The field of specialists should include well defined objectives and competencies – you have to assess the levels for competence" [C2] • "The difference between competence and proficiency should be described clearly" [C2] • Research needed to cover ethics and legal aspects as far as competence is concerned [C2]
	A: Remembering **B: Understanding** **C: Development and applying** **D: Analysing** **E: Evaluating** **F: Creating**	Simulation gives the opportunity to learn on different cognitive levels • The registrars can practice skills until they feel competent [D1] • When the registrars are exposed to a specific situation/scenario they get the opportunity to go back and revisit what went wrong and how they can improve by doing so – thus they learn on different cognitive levels [D1] • Registrars are exposed to critical ill patients, for example in surgery and intensive care disciplines. • It is important that they are trained in a safe environment – especially junior registrars who are not yet experienced [D1] • It is also important that registrars be on the same level of competency (e.g. with resuscitation) – so simulation training on different cognitive levels take place including they have to analyse the situation, interpret facts and act on what they see [D1]

	• It is possible that simulation can also be done on various cognitive levels using task trainers for specific procedures [D1] • "Simulation can enhance student learning at different cognitive levels: remembering of knowledge (during preparation; understanding and applying (using low fidelity simulators); analysing and evaluation (using high fidelity simulators) and developing and formulating new concepts and ideas" [D2] • "During simulation students can go from pure knowledge information to practical knowledge fast" [C2] • Through using interprofessional teams in multipurpose, complex scenarios, with real world experiences, can take you through all the cognitive levels of learning [S1] • Ensures team-based competence [S1] • Better outcomes for patients [S1] • "Using S.P.'s for the development of team-based communication skills and professionalism" [S2] • "Patient management and clinical decision making and skills development in postgraduate medical education: the importance increase because of the seniority of the person going through the system increases – so it takes more and more responsibility in leading teams and decision-making – simulation on higher cognitive levels very important" [S1]

4.8 Role, value and contribution of simulation in postgraduate education

TABLE 8A: ROLE OF SIMULATION IN POSTGRADUATE EDUCATION

1.	**Education and training environment**	<u>Simulation provides a non-threatening environment for teaching and learning</u> • Provides controlled and safe practice opportunities [D2,R1] • Simulation gives students time to hone their skills and competencies in safe, no risk circumstances [D2,R1] • Simulation training takes place in a safe environment where registrars can learn and practice on own time and pace [D1,D2] • Simulation leads to less stress where registrar has the opportunity to practice in a safe environment [D1,D2] • Prepare student before-hand: "what happens here, stays in the sim lab" [C3]
2.	**Facilitation of learning**	<u>Simulation facilitates student learning</u> • Facilitates learner knowledge, clinical competence, skills, professional behavior [R1] • "Simulation is a very good learning situation and gives the opportunity to learn in another way" [C1]
3.	**Learning effectiveness**	<u>Simulation enhances the effectiveness of learning</u> • Feedback during or after simulation plays a role in the effectiveness of learning [D2,R1] • Simulation can enhance learning effectiveness at different cognitive levels [R1] • "Simulation enhances learning – registrar can identify own problems and can correct where and when necessary" [D1] • "Simulation gives the opportunity that registrars can learn gradually and progressing to higher competency and/or cognitive levels" [C1]

		• "While a clinical facilitator/HoD is training registrars on a flat screen simulator to master certain skills the consultants are responsible to make the decisions, thus, in such a situation two different groups are trained at the same time on different cognitive levels to become competent/proficient reaching difficult objectives" [C1]
4.	**Clinical training**	Simulation has an important role in clinical training and has an increased use • Problems with clinical teaching, new technologies for diagnosis and management, assessing professional competence, medical errors, team training [R1] • "Role to play: use from low five to high five simulations" [C3] • Higher levels of thinking and complexity; interdisciplinary; high fidelity simulations; big group simulations [C3] • Shrinking financial resources constrain the educational time that physicians in training receive [R1] • Decreasing training platform and demand for more health care professionals urges investigation of additional options for clinical training and assessment [R1] • "Simulation plays a definite role in holistic and integrated health care training" [D1] • "By making use of SP's during simulation you can teach and train registrars a wide range of material for example history taking, transfer of bad news, and/or medio-legal issues" [C1] • "To practice certain procedures beforehand through simulation makes it easier for registrars when they do it for the first time on a real patient" [C1] • "Simulation gives the opportunity that a registrar in a specific discipline can practice specific skills individually or it can give the opportunity that training can take place in a multi-professional health care group learning various types of skills through a complex scenario" [C1] • "The opportunity to make use of debriefing after simulation is in itself a good learning opportunity" [C1] • "Simulation gives registrars the opportunity to experience clinical cases that they perhaps won't see in certain disciplines as the training platform is becoming smaller" [C1] • "Proficient: competent: excellent outcome" [S1]
5.	**Deliberate practice**	Simulation gives the opportunity for practicing • Plays an important role in deliberate and repetitive practice to master skills [R1] • Helps to keep abreast of skills and topics that frequently appear [R1]
6.	**Patient safety**	Simulation gives the opportunity to practice safely on patients • Learning on simulated patients, simulation modalities [C2,R1] • Trend to utilise simulation for minimizing risk to patients and enhancing medical training [C2,R1] • Utilizing simulation for minimizing risk to patients [C2,R1] • Utilising simulators for/to enhance medical training [C2,R1]
7.	**Opportunity for exposure and practice**	Simulation may be useful in addressing the problem of a lack of opportunity for clinical exposure and practice • More exposure and practice, less medical errors [C2,R1] • Assess students with the view to identify what have been missed or lack of opportunity [C2]
8.	**Problems experienced in**	Simulation offer a solution to problems experienced in postgraduate education & training • "Simulation training according to a specific schedule is a way to protect registrars' training time" [D1]

postgraduate education (specialist training)	• "Simulation meets a need" [D2] • "Simulation will be useful to teach registrars patient communication skills" [C2]

TABLE 8B: THE VALUE OF SIMULATION IN POSTGRADUATE EDUCATION

1.	**Offers alternative training option / learning strategy**	<u>Simulation is an alternative to a real patient learning strategy</u> • "Very similar to situation of real practice – but relaxed and less stressful environment" [I1] • "Simulation is a very specific strategy that you use to learn" [I1] • Not an alternative to good bedside teaching but valuable complementary addition [R1] • "Simulation must be seen as an education and training aid and not as the end goal: Simulation is not the purpose but a way or method to do or learn something" [C1]
2.	**Educational grounding**	<u>Solid educational and social grounding</u> • Medical simulation provides a safe environment where trainees can learn from their errors without the risk of harming a real patient [C2,R1] • Simulation offers a trainee-centred environment that can provide full attention to the student's individual needs, pace, strengths and deficiencies [R1] • Simulation is an experimental learning education modality acknowledged by adult learning theories to be most effective [C2,R1] • Simulation provides unique opportunities for team training [D2,R1] • It provides a reproducible, standardised, objective setting for both formative assessment that includes debriefing and feedback and summative assessment via testing [R1] • "The privileges of simulation are that simulation allows you to provide a safe psychological environment for training/learning" [I1] • Shift from time-based to competency-based training [C2,R1]
3.	**Clinical grounding**	<u>Improve care, increase patient safety</u> • Improve surgical care, reduces errors, increases patient safety, improves surgeon-patient interaction and maximise hospital resources [C2,R1] • Full control of a pre-selected clinical scene [R1] • Simulation can lower risk through precision, improve results by necessitating fewer procedures and decrease operating room time and procedure costs [R1] • Skills transferred to the operating room through surgical simulation [R1] • "Simulation can decrease operation time" [D1] • "Simulation can decrease complications [D1]

		• "Simulation can decrease costs" [D1] • "Simulation valuable method to train variation of skills (technical, non-technical, soft-skills, etc.) [D1] • "Evaluation of skills through simulation can give feedback on competency level of registrar by using rubrics for procedures and may predict whether candidate is ready to sit for final exam" [D1] • "Simulation can be used to evaluate whether a registrar is "safe" to operate on a patient and under pressure before the final examination – using a rubric assessing time and skills for example (as alternative to recommendation of HoD)" [C1] • "Impact on patient care load" [D1] • Offers residents a chance to advance along a learning curve, without subjecting patients to a novice's initial practicing of a skill or procedure [C2,R1]
4.	**Deliberate practice**	<u>Simulation allows deliberate practice</u> • "Feedback during simulation help registrar to identify problems and he/she can deliberately practice certain skills as needed" [D1] • "Constructive feedback and debriefing during simulation add value to the learning process" [D1]
5.	**Individualisation**	<u>Individualisation of education and training</u> • Through simulation accommodation of registrars' learning styles (standardisation of learning style vs individualisation can be achieved) [R1] • Standardizing curriculum, individualisation of education [R1] • Simulation can help with the processing of the information by the learner [R1]

TABLE 8C: THE CONTRIBUTION OF SIMULATION IN POSTGRADUATE EDUCATION

1.	**Patient safety**	<u>Simulation contributes to patient safety</u> • Important contribution to safety of patients [D1,D2] • "Slow is smooth and smooth is fast" [C3] • "Push the limits – there is a safety aspect" [C3]
2.	**Offers alternative training method**	<u>Train the trainer</u> • "Through training the trainer you can add value to simulation as a training method as well as to clinical education" [I1] • You need to teach registrars series of skills to try to do or master other skills [C3] • "What you teach is not necessarily what the student knows" [C3] • "Teach on one level but use the knowledge and skill on another" [C3]

4.9 Main considerations to take into account when simulation is to be included in a postgraduate teaching and training programme

TABLE 9: MAIN CONSIDERATION TO BE TAKEN INTO ACCOUNT WHEN SIMULATION IS TO BE INCLUDED IN A POSTGRADUATE TEACHING AND TRAINING PROGRAMME

1.	**Curriculum outcomes**	<u>Revisit the curriculum outcomes in postgraduate programme</u> • "When you decide to include simulation in your postgraduate programme first look at your curriculum outcomes" [D1] • "Decide where simulation is going to fit into your curriculum" [C1] • "Try to identify the outcomes the registrars find difficult to reach for example specific skills" [D1] • "Develop a basic surgeon across all plastic surgery disciplines" [S1]
2.	**Decision what to simulate**	<u>Identify what to simulate</u> • "You need to know what your starting point is – it's looking what is actually called a zone of simulation – designer simulation" [I1] • "You can't have to simulate everything – what is designer simulation – things are in a high risk and low frequency – that is where your critical area to simulate is" [I1] • Try to identify the scarce clinical conditions that is difficult to see – things you really want the registrars to see and be able to treat – the life threatening conditions/cases that you really do not see regularly [C3,D1] • "Identify discipline unique things to simulate" [C1] • "Identify problem areas that can be simulated" [C1] • "The world doesn't stand still – you may have a good programme – environment changes – improve/reform and make adaptions – don't be too rigid" [C1] • "Set complete scenarios, with clear outcomes" [D2] • "Plan and structure scenarios well" [D2] • "I will first identify the requirements for the role in practice" [S1] • "Push simulation to develop all competencies for basic general plastic surgeon in SA" [S1]
3.	**Facilities available**	<u>Review available simulation facilities</u> • "Take whole world in review – world perspective – try to identify what type of simulation facilities are available" [C1] • "What type of facility do you have" [C1] • "Decide whether and how your facilities can fit in with other facilities" [C1] • "Plan in detail how you can make use of available simulators – high fidelity simulators adaptable" [C1] • "Identify what is already available in your training platform – simulation not better than real patient" [C1] • "Don't invent the wheel again" [C1]
4.	**Assessment**	<u>Formative assessment</u> • Assess the registrar on a continuing bases on preparation, knowledge, skills, oral expertise, professional behaviour, making correct diagnosis, executing proceduring, not harming the patient [C2]

	• "Formative assessment with feedback" [C2] • Assessment should be a learning experience [C2] Other assessment • Maintenance of 'specific field' [C3] • OSCE's as part of examination [C3] • ACLS, PALS, ATLS [C3]

4.10 Important guidelines to guide a team of experts in developing a curriculum with simulation as one of the training/learning methods

TABLE 10: IMPORTANT GUIDELINES FOR GUIDING A TEAM OF EXPERTS IN DEVELOPING A CURRICULUM WITH SIMULATION AS ONE OF THE TRAINING/LEARNING METHODS

1. **Curriculum & outcomes**	Training curricula and outcomes • You should identify the current curricula available that have the same content as yours [D1] • You should form a mind set or framework as far as simulation is concerned and how it will fit in into the holistic bigger training picture/process [I1] • You should decide what the expectations are at the end of specialization as far as knowledge, skills, competency, attitudes, etc. are, and decide what the role will be of simulation – what are the characteristics that need to be in place – decide then how simulation will fit in [I1] • You should decide how you are going to get people to progress through the training years [I1] • You should revisit and develop curriculum outcomes as well as learning outcomes for simulation scenarios that fit your requirements and needs [D1] • Scenarios should be aligned with learning curriculum outcomes [C1] • You should protect the training time for your registrars including time for simulation [D1] • You should make simulation a compulsory part of the curriculum [C1] • You should decide beforehand where simulation fits into the current curriculum [C1] • You should schedule simulation into your training programme and also decide where and when are you going to fit in debriefing sessions as well as the character/nature of the sessions [C1] • You should take care not to overload the curriculum [C1] • You should make simulation compulsory [C1, D1]

2.	**Staff**	Training of staff • You should identify one/two champions per department that can drive simulation in a department [D1] • You should develop and offer a course to train the trainers [C1, D1, I1]
3.	**Expertise**	Expertise of staff • You should identify content experts and develop new innovative materials for simulation to overcome a resource constraint environment [D1] • You should use all the expertise available [D1]
4.	**Research**	Research as foundation • Use research to test new concepts [C3]
5.	**Analysis**	Doing a market analysis • Simulators available [S1] • Available research [S1] • Clinical need for preparation [S1]

4.11 Recommendations that can be used in compiling guidelines on simulation in postgraduate plastic surgery

TABLE 11: RECOMMENDATIONS TO COMPILE GUIDELINES ON SIMULATION IN POSTGRADUATE PLASTIC SURGERY

1.	**The curriculum**	Do not put wrong value on simulation • "You should consider not to give the wrong weight to simulation – don't place the wrong value to it – it is a tool for training not the main aim" [C1]
		Compulsory or optional • Simulation should be compulsory component of curriculum [C1, D1]
		Integration • Integration of simulation into the curriculum should be a required component [D1] • There should be synergy on alignment between theory, practice and assessment [R1] • You should remember that integration of simulation into the curriculum promotes aspects that are difficult to train on real patients e.g. team training and interdisciplinary training [R1] • You should standardise the training curriculum [R1]
2.	**Training and teaching**	Training and teaching • You should individualise the method of acquiring information [R1] • You should objectively evaluate the training process [R1] • You should decide which learning objectives are you going to take out and will be replaced by/reserved for simulation [I1]

3.	**Staff**	Training of staff • You should remember that staff is not necessarily trained for simulation [I1] • You should keep guidelines short and simple but clearly formulated [R1] • "You should remember that people do not understand the process from fast training in simulation moving to integrated practice in clinical environment" [I1]

4.12 Recommendations when considering to include simulation in specialist training

TABLE 12: RECOMMENDATIONS WHEN CONSIDERING TO INCLUDE SIMULATION IN SPECIALIST TRAINING

1.	**Training**	Development of training course • It is recommended to develop and implement a "train the trainer" course [C3, D1, I1] • It is recommended to use a totally integrated education and training system: theoretical lectures, simulation sessions and clinical work on real patients – try to find a balance [D1]
2.	**Curriculum**	Alignment of curriculum • It is recommended that the role of feedback; deliberate practice; the contribution of SP's; integration of simulation into the programme; aligned curriculum outcomes; simulation learning outcomes; and assessment; as well as protected training time, etc. to be highly valued [D1] • It is recommended to sit down and plan in detail: what are you going to take out of curriculum and/or with what are you going to replace it [D1] • It is recommended to reach a point that you plan in detail to have an integrated, structured, compulsory and intrinsic motivated, simulation included, specialized programme [C1] • "The person who has to develop the curriculum, should be knowledgeable about curriculum development; Debriefing must be planned; suitable space; objective idea; way to transfer it effectively; outcomes necessary; support structures and safety must be planned; ventilation and light; bathrooms; medical equipment; staff, etc. [C3] • "Needs to be a coordinated process" [S1]
3.	**Assessment**	End evaluation • It is recommended to try and find a system where you can use simulation in practical examinations (before end-evaluation) to ensure that the registrar is "safe" and "quick" to operate/apply certain skills [C1, D1]
4.	**Quality**	Workplace assessment and feedback • "Remember: the good trainee is always harder on themselves and bad trainee think they don't have problems – so self-evaluation is notoriously weak for weak candidate and notoriously over harsh on good candidates – they never think they are good enough" [S1] • Doing on a regular basis and feedback into your planning [S1]

4.13 Lessons learnt regarding implementation of simulation in a curriculum as well as the challenges to implement it

TABLE 13: (A) LESSONS LEARNT REGARDING IMPLEMENTATION OF SIMULATION IN A CURRICULUM AS WELL AS (B) THE CHALLENGES TO IMPLEMENT IT

1.	**Lessons learnt**	The following lessons learned • To make sure that people realise that simulation doesn't replace real patients [D1] • To schedule/find enough time for compulsory simulation sessions [C1] • "Some courses try to train through what they think the "gap" is – replan and rethink outcomes" [I1] • You have to know what you want to simulate [I1] • "Scheduled sessions before-hand" [D2] • "Observation and feedback improve the learning" [C2]
2.	**Challenges**	The following challenges were identified • Not enough dedicated time for teaching and training registrars (service delivery, under utilisation of simulation [D1] • There must be more protected time for training [C3,D1] • No scheduled time for simulation in postgraduate programmes [D1] • Simulation not integrated in curriculum/programme [D1] • To overcome "pushback action" of older lecturers as far as simulation is concerned [D1] • Make sure that students are not afraid of real patients [C1, D1] • To do group scenarios including different but similar clinical disciplines as well as other health care professionals [C1] • To keep simulation cost effective [C1, C3,I1,S2] • In certain programmes, things such as time constraints, student numbers account for pressure and lower quality – reformulate scenarios and compile smaller groups [I1,S2] • To get persons to buy into simulation [C3,I1] • "To get continuity – there is no longevity" [I1] • "Get an academic driver" [S2] • "Staff resources to run a sim lab" [S2]
		Train trainers • You have to train the trainers [C1,C2,D1,I1,S1] Costs • Cost, financial strains, money [C2,S1] • Grants [C2]

	<u>Space for training</u> • "First get the space and then buy the equipment" [D2] • "Plan storage place from the beginning" [D2] • "Start with simulations and buy equipment with time" [D2] <u>Staff</u> • Challenge to get staff to work in a team [C3] • Different personalities [C3] • Relaxed atmosphere, practice on a continuous basis, practice until skills are obtained [C3]

APPENDIX S JOURNAL SUBMISSION GUIDELINES: ARTICLE 1

PROCEEDINGS OF THE IICE CONFERENCE, IRELAND, UK

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Author names and affiliations are to be centered beneath the title and printed in Times 12-point, non-boldface type. Multiple authors may be shown in a two- or three-column format, with their affiliations italicized and centered below their respective names. Include e-mail addresses if possible. Author information should be followed by two 12-point blank lines.

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[1] A.B. Smith, C.D. Jones, and E.F. Roberts, “Article Title”, *Journal*, Publisher, Location, Date, pp. 1-10.

[2] Jones, C.D., A.B. Smith, and E.F. Roberts, *Book Title*, Publisher, Location, Date.

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APPENDIX T PROOF OF SUBMISSION / REVIEW / PUBLICATION: ARTICLE 1

APPENDIX T

PROOF OF SUBMISSION / REVIEW / PUBLICATION: ARTICLE 1

Ireland International Conference on Education (IICE-2016)

The accepted paper titled: **Simulation in Plastic Surgery: A Research Agenda to Improve Teaching, Learning and Clinical Expertise/Professional Competence**

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Simulation in Plastic Surgery: A Research Agenda to Improve Teaching, Learning and Clinical Expertise/Professional Competence

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Abstract

Changes in health care triggered major shifts in health sciences education, including a move to simulation in education and training. Simulation enhances student learning, provides controlled and safe practice opportunities, and shapes the acquisition of doctors' clinical skills/professional competence. Myriad research opportunities exist in the field of simulation-based medical education (SBME). This research is aimed at presenting a research agenda to improve teaching, learning and professional competence in plastic surgery education. The methodology is based on the conceptualisation and contextualisation of SBME. The research agenda offers recommendations on the role and value of simulation in education; the enhancement of learning; integrating simulation-based education into training curricula; standardising plastic surgery training globally; the revalidation of competency in continuing medical education, and the engagement of teachers and students in educational research. Simulation has potential to play an integral role in developing better and safer health care services for patients worldwide.

1. Introduction

The role of simulation in surgical training is now beyond 'proof of concept' stages. The advantages of simulation in modern health care systems have been well described in numerous reports establishing the validity and transferability of skills learned in simulated clinical setting environments with demonstrable advantages to the system, and patients [1], [2]. Changes in health care triggered major shifts in health sciences education, including a worldwide move to utilising simulators in education and training [3],[4],[5]. According to Issenberg *et al.* [6],"... for instance, in the United States, the pressures of managed care are shaping the form and frequency of hospitalisations, resulting in higher percentages of acutely ill patients and shorter in-patient stays. This results in less opportunity for medical learners to assess patients with a wide variety of diseases and physical findings. Despite increased cost-efficiency, reductions in physician reimbursement and shrinking financial resources constrain the educational time that physicians in training receive. Consequently, at all educational levels, doctors find it increasingly difficult to keep abreast of skills and topics that frequently appear in practice".

Evidence of the value of simulation in education ensued in increased reliance on simulation technology to facilitate teaching innovation and enhancement of student learning, to provide controlled and safe practice opportunities, and to shape the acquisition of doctors' clinical skills/ professional competence [5]. Students are empowered to make decisions regarding diagnostic and therapeutic procedures, and to experience the full impact of success and mistakes in a safe and authentic educational environment [5], [6]. Simulation-based medical education is an educational method that makes use of simulation to bridge the gap between theory and practice in medical education [7]. Regarding medical simulation, the word simulation means the "imitation of the operation of a real-world process or system over time" [8].

In medicine this may mean any process and system designed and planned to recreate an authentic clinical context and environment, which provide opportunities for a student to assume a role of responsibility. The intention is to facilitate meaningful clinical experiences in a safe environment that the learner can refer to and transfer to authentic clinical contexts [9].

Simulator means a model that encapsulates the key characteristics or behaviours of a selected process or system found in the real world [8]. A medical simulator therefore demonstrates a key clinical

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characteristic or set of clinical responses that mimic real-life conditions and responses. Medical simulators include computer programmes, part-task trainers, human patient simulators (or full-scale mannequins), and standardised patients [10], [11], [12].

The problems caused by the increasing number of students entering medical schools, and the consequence of more students competing for clinical cases, as described by Maran and Glavin [13], as well as the number of conditions primary health care professionals are expected to deal with (case mix) lead to simulation being used to fill the gap in medical training. Patients nowadays are better informed, have greater expectations and may exercise their right not to be involved in student education [14], resulting in an even smaller teaching platform.

Issenberg *et al.* [6] identify five factors contributing to the increase in the use of simulations in medical education, namely problems with clinical teaching; new technologies for diagnosis and management; assessing professional competence; medical errors; patient safety, and team training; and the role of deliberate practice. Due to the pressure caused by these factors, the burden of proof for adoption need not consist of randomized control trials, but rather there is opportunity for a wide range of studies making use of simulation. Thus substantial opportunity exists for investigators to contribute new knowledge in the field of simulation-based medical education, and, more specifically, its use in Plastic Surgery education and training.

Scalese [15] highlights the trend to utilise simulators for teaching, learning and assessment. Ziv, Erez, Munz, Vardi, Barzuk, Levine, Benita, Rubin and Berkenstadt [16] posit that simulation-based medical education (SBME) plays a significant role in minimising risk to patients and enhancing medical training. These authors [16] also mention that medico-legal issues and demands for accountability can be critical driving forces for the incorporation of simulation training in health care education.

2. The problem statement and aim of the study

Training in plastic surgery is not exempted from these drivers. The increased competition for surgical exposure and practice, combined with smaller teaching platforms and shorter training times, might have an impact on the quality and surgical competence of the registrar leaving the training programme. Plastic surgery is falling behind other disciplines in adopting simulation-based medical education, as in many areas and disciplines great strides are made in implementing simulation in formal training programmes, with leaders in the field anaesthesia, emergency medicine and laparoscopic surgery.

A number of articles recently have been published on topics such as the use and potential use, as well as the importance of simulation in plastic surgery [17],[18]; on the integration of surgical simulation in plastic surgery residency training [19]; and skills transferred to the operating room by surgical simulation [20]. In response to these, two seemingly contradictory goals in education have been put forward as priorities. On the one hand, there is a push for further standardization of education. To this end, the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialities (ABMS) have defined six core competencies required of all residents [17]. Standardization aims to increase patient safety by reducing surgical errors and improving the quality of care, while at the same time maximizing hospital resources. On the other hand, the medical education model ought to allow for individualisation to reflect the fact that people learn knowledge and master competencies differently. In this line of reasoning, there should be room for one student's path to differ from another's to best accommodate the student's learning styles [18].

Satava [21] cites three concepts that will be key in revolutionising medical education, which exemplify these dual priorities: an increased efficiency of education by standardising curricula; an individualisation of education, and a shift from time-based training to competency-based training.

Substantial opportunities exist for researchers to contribute to new knowledge in the field of simulation-based medical education (SBME) and, more specifically, plastic surgery education. Medico-legal issues and demands for accountability are critical driving forces for the incorporation of simulation training in health care education.

The research reported here is aimed at identifying aspects to be included in a research agenda with the view to improving teaching, learning and professional competence in plastic surgery education. The methodology is based on the conceptualisation and contextualisation of SBME.

3. Residency programmes and simulation

Worldwide, different models exist for education and training in plastic surgery, including the models of learning through an apprenticeship relationship with senior clinical colleagues, own observation, or self-directed learning – motivated by a candidate's own internal drive. In some cases, registrars receive little guidance in terms of the knowledge, competencies, skills and attitudes that they are expected to acquire during residency. Residency programmes are responsible for producing technically competent surgeons, but not all of the necessary procedural skills are truly mastered during these training periods. "Classroom training" does not translate into effective procedural skills and competence does not always match confidence. Although residency programme directors are asked to attest to the competency of recent graduates, they are unable to evaluate the performance of every procedure by every resident. A further shortcoming is that systematic evaluation using structured objective criteria seldom is used to establish procedural competence, and except for a few procedures, it is not known how many times a specific procedure must be repeated to attain competence. Rosen, Long, McGrath and Greer [22] point out that in contrast to the traditional apprenticeship model, twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, and hospital resources, and minimise errors. The driving forces behind these changes are developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy, simulation can improve results and also lower risk and procedure cost because of fewer procedures and less operating room time [22].

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) identify six core competencies for residents:

"... Patient care, medical knowledge, practice-based learning and improvement, inter-personal and communication skills, professionalism, and systems-based practice" [17].

Training thus is shifting from traditional apprenticeship to more objective, standardized approaches. A shift towards competency-based surgical training comes with two key concepts: objective assessments and simulation laboratory training. The time thus has come for residency programmes to explore and expand their use of simulation.

A joint initiative of the ACGME and the ABMS, *The Plastic Surgery Milestone Project,* compiled descriptors and targets for resident performance, based on the above-mentioned core competencies and can be categorised at five training levels: Moving from Level 1 where the resident demonstrates the mastering of milestones expected of an incoming resident up to Level 5 where the resident has advanced beyond performance targets set for residency and completing graduation [23].

The American College of Surgeons (ACS) has decided to introduce simulation in training and education for general surgery in three phases: Skills training, procedure training, and team training. Mittal *et al.* [17] propose that plastic surgery should follow this simulation initiative with modifications appropriate to the specialty. Phase 1, Skills, is attended to in the resident's general surgery training, but Phase 2, Procedures, focuses on the development of procedures specific to plastic surgery. For Phase 3, Competencies in teamwork, the competencies for plastic surgery resemble those for general surgery and include team-training simulators to improve communication in emergency departments, clinics, operating rooms, and hospital wards.

Arbogast and Rosen [18] in their article: *"Simulation in Plastic Surgery Training: Past, Present and Future"* propose that this three-phase strategy be adapted for plastic surgery residency by modifying it to address challenges specific to the field. They are of the view that a unified commitment by medical educators is required to use simulation "[t]o simultaneously standardize the training curriculum, individualize the method of acquiring information, and objectively evaluate the training process".

4. Aspects of simulation

Simulation is a useful aid in a variety of teaching, training, learning, and assessment situations.

4.1. In which ways can simulation be of help?

Simulation can play a valuable role in improving patient safety, facilitating better surgeon-patient interaction, maximizing hospital resources, lowering risks through increased precision, improving results by necessitating fewer procedures and decreasing operating room time and procedure cost.

Simulation shows great promise to change teaching methods - the traditional model of see one, do one, teach one is an inefficient and risky approach to acquiring technical skills and competencies. This, coupled with public demand for patient safety and an increasing reluctance to be "practised" on, has created ideal opportunities for simulation-based medical education to improve teaching.

Simulation methodologies enable tailored training interventions in a low-threat environment. Limited exposure to patients with low-incidence and high- complexity conditions can be addressed by means of simulation and render competency as outcome. Simulation also can be used to evaluate the outcome of training in a more objective and structured way. Harden [24] used this concept in the development of the objective structured clinical examination (OSCE). An adapted version of the OSCE was created to assess technical skills [25]. This is called the objective structured assessment of technical skills (OSATS).

4.2. Formative versus summative OSATS

Both formative and summative OSATS provide an excellent opportunity for feedback on observed performance. Some argue that the best predictor of the quality of performance is repetitive or deliberative practice - with supervisors providing corrective feedback until skill is mastered. This is an area in which simulation excels.

4.3. In which areas can simulation be implemented?

Simulation-based medical education can target different levels for intervention. It has a role to play at individual level (e.g. supplementing clinical experience, procedural simulation and task training), team and unit level (e.g. behavioural training, multi-disciplinary team interactions, and debriefing), as well as at an organizational level (e.g. on-site simulation to identify vulnerabilities in specific processes as well as broader systems, and disaster management).

4.4. Studying and improving performance

A critical on-going issue is identification and remediation of individuals who are underperforming. The simulation laboratory setting may help determine if an individual's deficits lie in history and examination taking, other data gathering skills, synthesis, decision making or prioritization. In this setting the following may also be determined: Physical ability, lack of practice, effect of fatigue, or other similar areas that may contribute to underperformance. This is an often-underutilised utilisation of simulation with ample opportunity for future research.

4.5. Priorities for simulation-based medical education in plastic surgery and recommendations

Based on the foregoing the following may, as an example, be regarded as priorities for simulation-based medical education in plastic surgery. After each set of priorities a recommendation is provided for the realisation of the priorities:

<u>Integration into training curricula</u>

- The formal integration of simulation into curricula: It does not suffice to use simulation on a voluntary basis without protected simulation time, very few students make use of simulation facilities if simulation is not formally integrated in the programme.
- Simulation should be synchronised with clinical training – there is little benefit if simulation time clashes with clinical teaching.
- Ideally, simulation should be implemented on multiple tiers, namely skills rotations (must be completed to progress to next block/year), independent study/practice opportunities to allow students to progress/become proficient at their own pace, as well as evaluation and assessment of competency.

In order for the above to be achieved, the research question that must be answered is: Can simulation in postgraduate plastic surgery education and training enhance the effectiveness of learning in this discipline?

<u>Standardization of plastic surgery training globally</u>

- SBME should be employed to standardise plastic surgery training, due to the large variation in scope of plastic surgeons worldwide.
- SBME should be employed to counter a lack of clinical exposure opportunities, or (especially in the Third-World setting) programmes overburdened by a specific workload (for example, burns and burn reconstruction), which limits the time and resources available for exposure to other areas of the discipline (for example aesthetic surgery).
- SBME should set a basic standard that might enable educators and researchers to compare and contrast different training programmes worldwide.
- SBME should be available at all training facilities for plastic surgeons to enable the discipline to determine a basic core skills and competency list, which every plastic surgeon should master.

To achieve this, research is required to determine if simulation might be useful in addressing the problem of a lack of opportunities for clinical exposure and practice.

<u>Skill maintenance and validation</u>

- Simulation should play an important role in revalidation of competency on a continuing medical education basis. Currently, in most CME programmes, focus is placed on theoretical knowledge, but there is a large gap in validating and revalidating surgical competency. Simulation could fill this gap.

- Safe thresholds of surgical skill should be identified, validated and may then be used and implemented using simulation as the vehicle to help achieve this goal.
- On-going skills maintenance programmes should be developed where voluntary hours spent on simulators could be used to assist in skill maintenance, and with sufficient logging, could perhaps obviate the need to go for formal revalidation. In order to realize these priorities, further research is needed on the use of simulation to facilitate the transfer of skills to real world practice to assess the validity and reliability of procedural, clinical, and behavioural competency evaluation methods, and to determine the applicability of simulation to achieve these.

5. Challenges in simulation-based medical education and research

Simulation, like other methods in medical education, has some limits and pitfalls that should be kept in mind. These challenges provide ample opportunity for research, and we strongly advocate for research to be undertaken in these areas. The first challenge would be to utilise the wealth of opportunities for research in plastic surgery on procedural competence and to establish the benefit, if any, of deliberate practice in a simulation-based setting. The discipline also lends itself very well to research on defining minimum levels of competency, and the role of simulation in maintaining and validating this. The problem of availability of facilities for simulation poses a challenge in itself, as well as the general misconception that all simulation needs to be hi-fidelity, hi-tech, and expensive to be worthwhile. Given the resource demands of some simulation approaches, we should remain open to all solutions that meet desired educational objectives. Furthermore, simulation cannot completely substitute key clinical experiences and learning from actual surgical practice. This, combined with the possible perception from previously trained professionals, who might feel intimidated and vulnerable ('Are they saying that our training was inferior?') forms a formidable stumbling block, which will have to be addressed in order for simulation-based medical education to be incorporated in training curricula. The challenge to succeed in this regard would be engagement with both trainers and trainees before and after simulation-based medical education is implemented.

6. Future directions

Work needs to be done on developing case libraries of simulation scenarios, which have been peer reviewed. This will facilitate the spread of simulation further by encouraging multi-centre efforts, and providing the opportunity for educational mentoring. Multi-centre simulation research efforts will be required to further develop and share evaluation tools specifically developed for resident and fellowship evaluations, with priority emphasis on research on the transfer of skills into the real world, as well as the assessment of validity and reliability for procedural, clinical and behavioural competency evaluation.

7. Discussion

The research agenda needs to include aspects such as the role and value of simulation in education; the enhancement of student learning at different cognitive levels; the integration of simulation-based education into training curricula; the standardization of plastic surgery training globally; the revalidation of competency in continuing medical education and the engagement of teachers and students in educational research. Medical simulation promises to revolutionize health care education, and specifically education in plastic surgery – but more work is needed. Despite the development of various models and simulation-based learning tools in plastic surgery, the role of simulation in the specialty's training curriculum is less well established. It is necessary for simulation-based training to be fully integrated and funded in formal plastic surgery training programmes. It is also necessary to develop a skilled faculty of educators in well-coordinated simulation facilities. Medical simulation techniques have shown great promise in other specialities - we have outlined here the challenges and opportunities of realizing this promise in plastic surgery.

8. Conclusion

Further research is required to expand the role of simulation in plastic surgery within training, performance evaluation, standardization, certification and revalidation. Simulation has the potential to become an integral part of the development of better and safer plastic surgery services for patients. Simulation in health care education provides ample opportunity for research. Medical simulation promises to revolutionise health care education provided that a skilled cohort of educators be developed in well-coordinated simulation facilities. Simulation has the potential to play an integral role in developing better and safer health care services for patients worldwide. It is clear that a scientific proposal to express the need for research in the field of plastic surgery and simulation, with a clear agenda, proposing research topics in a systematic way is necessary. Aspects discussed in this article can contribute to this.

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APPENDIX U JOURNAL SUBMISSION GUIDELINES: ARTICLE 2

JOURNAL SUBMISSION GUIDELINES: ARTICLE 2

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APPENDIX V PROOF OF SUBMISSION / REVIEW / PUBLICATION: ARTICLE 2

International Journal for Cross-Disciplinary Subjects in Education (IJCDSE), Volume 9, Issue 1, March 2018

Why is Research Needed on Simulation to Enhance Plastic Surgery Education and Training?

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Abstract

Changes in health care triggered major shifts in health sciences education, including a move to simulation in education and training. Simulation enhances student learning, provides controlled and safe practice opportunities, and shapes the acquisition of doctors' clinical skills/professional competence. Myriad research opportunities exist in the field of simulation-based medical education (SBME). The overall goal of this research was to reflect on the purpose and value of research on simulation and was aimed at improving plastic surgery education and training (teaching, learning and professional competence). The methodology is based on the conceptualisation and contextualisation of SBME. This article offers recommendations on the role and value of simulation in education; the enhancement of learning; integrating simulation-based education into training curricula; standardising plastic surgery training globally; the revalidation of competency in continuing medical education, and the engagement of teachers and students in educational research. Simulation has potential to play an integral role in developing better and safer health care services for patients worldwide.

1. Introduction

The role of simulation in surgical training is now beyond 'proof of concept' stages. The advantages of simulation in modern healthcare education and training systems have been well described in reports establishing the validity and transferability of skills learned in simulated clinical setting environments with demonstrable advantages to the system and patients [1]. Changes in health care triggered major shifts in health sciences education, including a worldwide move to utilising simulators in education and training [2]. According to Issenberg *et al.* [3], "... for instance, in the United States, the pressures of managed care are shaping the form and frequency of hospitalisations, resulting in higher percentages of acutely ill patients and shorter in-patient stays". A consequence of this is that medical students may have to forfeit opportunities to assess patients suffering from diverse and sometimes rare diseases and presenting with diverse symptoms. Efforts to increase cost-efficiency can no longer counter the decrease in training staff remuneration and financial resources available for education and training, resulting in less time spent on training at all levels and doctors having to find other ways to stay at the forefront of skills in and new knowledge on cases with which they are confronted.

Evidence of the value of simulation in education resulted in increased reliance on simulation technology to facilitate teaching and training innovation and enhancement of student learning and the mastering of skills, to provide controlled and safe practice opportunities, and to shape the acquisition of doctors' clinical skills/professional competence [2]. Simulation empowers students to make decisions regarding diagnostic and therapeutic procedures, and to experience the full impact of success and mistakes in a safe and authentic educational environment [2],[3].

Simulation-based medical education is an education and training strategy that makes use of simulation to bridge the gap between theory and practice in medical education. In terms of medical simulation, the word simulation means the "imitation of the operation of a real-world process or system over time" [4].

In medicine this may mean any process and/or system designed and planned to recreate an authentic clinical context and environment, providing opportunities for a student to assume a role of responsibility. The intention is to facilitate meaningful clinical experiences in a safe environment that the students can refer to and transfer to authentic clinical contexts [5] that is to educate and train students in a non-threatening, simulated environment, providing opportunities for experimentation and practising in a non-threatening environment. Here students can be brought to the level of application, taking them into the realm of real-word circumstance and helping them to overcome the gap between theory and reality, and to experience a feeling of what it is to be working with real patients in a real-world context. This plays an important role in reflection and the integration of theory with skills. Simulation offers a safe environment and context where students hone their skills and determine for themselves what their strengths and weaknesses are and what they should do about the areas they need to improve in and build out, and they build self-confidence.

Soltanian [6] defines simulation "as the replication of a real-world process or system over time" and makes an appeal to surgeon educators to employ their knowledge and skills in developing and enhancing simulators for training the next generation of plastic surgeons. The required technology has become more readily available lately and surgical simulations have improved significantly in recent years [6]. The most common types of models in surgical simulation include physical models (e.g. to train fundamentals of laparoscopic surgery); mathematic models (e.g. commonly used within a computer simulation); graphical models (e.g. graphical depiction of an object or system), and finite element models (e.g. large and complex systems are divided into smaller and simpler parts with more predictable behaviour with a view to replicating the more complex objects [6].

A simulator is a model that encapsulates the key features or behaviours of an identified process or system found in the real world [4]. A medical simulator, therefore, demonstrates a key clinical characteristic or set of clinical responses or situations that mimic real-life conditions and responses. Medical simulators include computer programmes, part-task trainers, human patient simulators (or full-scale mannequins), and standardised patients [7].

An increasing number of students enter medical schools each year, with the consequence of more students competing for clinical cases and the number of conditions health care professionals are expected to attend to (case mix), as well as the shorter duration of hospitalisation of patients deprive students of opportunities to do clinical work. Simulation is excellently suited to cover this hiatus in medical training. Patients nowadays are better informed, have greater expectations and may exercise their right not to be involved in student education, resulting in an even smaller teaching platform.

Issenberg *et al.* [3] identify five factors contributing to the increase in the use of simulations in medical education, namely a shortage of clinical education opportunities for clinical teaching; innovative technology for diagnosis and management; assessment of professional competence; medical errors; patient safety and team training; and the role of intentional practising. Due to the pressure caused by these factors, the burden of proof for adoption need not rely on randomized control trials, but rather, opportunities exist for a wide range of studies making use of simulation. Thus, investigators using these opportunities can contribute new knowledge in the field of simulation-based medical education, and, more specifically, its use in plastic surgery education and training.

Scalese [8] highlights the trend to utilise simulators for teaching, learning and assessment. It is posited that simulation-based medical education (SBME) plays a significant role in minimising risk to patients and enhancing medical training [9]. These authors [9] also posit that medico-legal issues and demands for accountability may be critical driving forces for the incorporation of simulation training in health care education.

2. Problem statement and aim of the study

Training in plastic surgery is not exempted from the drivers for the use of simulation mentioned. The increased competition for surgical exposure and practice, combined with smaller teaching platforms and shorter training times might have an impact on the quality and surgical competence of the registrar leaving the training programme. Plastic surgery is falling behind other disciplines in adopting simulation-based medical education, as in many areas and disciplines great strides are made in implementing simulation in formal training programmes, with leaders in the field anaesthesia, emergency medicine and laparoscopic surgery.

A number of articles recently have been published on topics such as the use and potential use, as well as the importance of simulation in plastic surgery [10], [11]; the integration of surgical simulation in plastic surgery residency training [12]; and skills transferred to the operating room by surgical simulation [13]. In response two seemingly contradictory goals in education have been put forward as priorities. On the one hand, there is a push for further standardisation of education. To this end, the Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialities (ABMS) have defined six core competencies required of all residents [10]. The standardization of aims will increase patient safety by reducing surgical errors and improving the quality of care, while at the same time maximizing hospital resources. On the other hand, the medical education model ought to allow for individualisation to reflect the fact that people obtain knowledge and master competencies differently. According to this line of reasoning there should be room for one student's path to differ from another's to best accommodate the students' learning styles [11].

Satava [14] cites three concepts that will be key in revolutionising medical education that exemplifies these dual priorities: increased efficiency in education by standardising curricula; individualisation of education, and moving from time-based training to competency-based training.

Substantial opportunities exist for researchers to contribute to new knowledge in the field of simulation-based medical education (SBME) and, more specifically, plastic surgery education. Medico-legal issues and demands for accountability are critical driving forces for the incorporation of simulation training in health care education.

To generate research evidence in education and to establish a research foundation it is necessary to consider/reflect on the purpose of research directives in the specific field of education. Cook, Bordage and Schmidt [15] explored the research performed in Health Professions Education and suggest a framework for classifying the purposes of educational research. According to Cook *et al.* [15], indications are that research in medical education does not necessarily inform educational practice. These authors [15] mention that a best-evidence medical education (BEME) review by Issenberg *et al.* [3] found weak evidence supporting several conditions for effective high-fidelity simulation, but noted that few or no strong studies could be found. However, in the BEME guide *Features and uses of high-fidelity medical simulations that lead to effective learning*, Issenberg *et al.* [16] clearly state that research in this field "needs improvement in terms of rigor and quality. High-fidelity medical simulations are educationally effective and simulation-based education complements medical education in patient care settings". As far as research directives are concerned, Issenberg *et al.* [16] are of the opinion that the "lack of unequivocal evidence for much of the research on simulation-based medical education clearly calls for better research and scholarship in medical education".

Cook *et al.* [15] classify the purposes of research in a useful framework to understand and to give meaning to the research process, as well as to identify potential solutions consisting of three categories, namely description, justification and clarification. *Description* studies focus on the first step in the scientific method, namely observation, and asks: "What was done?"; *Justification* studies focus on the final step in the scientific method comparing educational interventions with each other to address the question: "Did it work?". *Clarification* studies employ each step in the scientific method, starting with observations (building on prior research) and models or theories, making predictions, and testing these predictions. Such studies ask the questions: "How does it work?" and "Why does it work?" [15].

A scientific approach and clear, direction-giving research that will advance the science in the specific field of study, namely plastic surgery and simulation, therefore, are not negotiable. It thus is imperative that any research directive suggested here has to follow this deeper approach when executed during different research initiatives and projects.

Nel, Labuschagne and van Zyl [17] at the IICE conference in 2016 in Ireland emphasised the importance of a scientific proposal with a clear agenda expressing the need for research in the field of plastic surgery and simulation, proposing research topics in a systematic way.

The problem addressed in the research reported here thus was a lack of profound research about the use of simulation in the education and training of plastic surgeons. The study was aimed at identifying aspects to be included as a research directive for studies conducted with a view to improving teaching, learning and professional competence in plastic surgery education and training. The methodology was based on the conceptualisation and contextualisation of SBME.

3. Residency programmes and simulation

Worldwide, different models exist for education and training in plastic surgery, including the models of learning through an apprenticeship relationship with senior clinical colleagues, own observation, or self-directed learning – motivated by a candidate's own internal drive. In some cases, registrars receive little guidance in terms of the knowledge, competencies, skills and attitudes they are expected to acquire during residency. Residency programmes are responsible for producing technically competent surgeons, but not all of the necessary procedural skills are truly mastered during these training periods. "Classroom training" does not translate into effective procedural skills and competence does not always match confidence. Although residency programme directors are required to attest to the competency of recent graduates, they cannot possibly evaluate the performance of every procedure carried out by every resident. A further shortcoming is that systematic evaluation using structured objective criteria seldom is used to establish procedural competence, and except for a few procedures, it cannot be determined and prescribed how many times a specific person should repeat a specific procedure to ensure competence.

Rosen, Long, McGrath and Greer [18] point out that in contrast to the traditional apprenticeship model, twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, and hospital resources, and minimise errors. The driving forces behind these changes are developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy simulation can improve results and also lower risk and procedure cost because of fewer procedures and less operating room time [18].

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) identify six core competencies for residents, namely

> *"Patient care, medical knowledge, practice-based learning and improvement, inter-personal and communication skills, professionalism, and systems-based practice"* [10].

Training thus has evolved from traditional apprenticeship to more objective, standardised approaches. A shift towards competency-based surgical training comes with two key concepts: objective assessments and simulation laboratory training. The time thus has come for residency programmes to explore and expand their use of simulation.

A joint initiative of the ACGME and the ABMS, *The Plastic Surgery Milestone Project,* compiled descriptors and targets for resident performance, based on the above-mentioned core competencies which may be categorised at five training levels, moving from Level 1 where the resident demonstrates the mastering of milestones that new residents have to achieve to Level 5 where the resident has advanced beyond performance targets the residents have to meet during residency and before graduation [19].

The American College of Surgeons (ACS) has decided to introduce simulation in training and education for general surgery in three phases: Skills training, procedure training, and team training. Mittal *et al.* [10] recommend that plastic surgery should follow this simulation initiative with modifications appropriate to the specialty. Phase 1, Skills, is attended to in the resident's general surgery training, but Phase 2, Procedures, focuses on the development of procedures specific to plastic surgery. For Phase 3, Competencies in teamwork, the competencies for plastic surgery resemble those for general surgery and include team-training simulators to improve communication in emergency departments, clinics, operating rooms, and hospital wards.

Arbogast and Rosen [11] in their article, *Simulation in Plastic Surgery Training: Past, Present and Future,* propose that this three-phase strategy be adapted for plastic surgery residency by modifying it to address challenges specific to the field. They are of the view that a unified commitment by medical educators is required to use simulation "[t]o simultaneously standardize the training curriculum, individualize the method of acquiring information, and objectively evaluate the training process".

4. Aspects of simulation

Simulation is a useful aid for honing skills and bridging the gap between theory and practice in a variety of teaching, training, learning, and assessment situations.

4.1. In which ways can simulation be of help?

Simulation can play a valuable role in improving patient safety, facilitating better surgeon-patient interaction, maximizing hospital resources, lowering risks through refining precision, improving results by demanding fewer procedures and decreasing operating room time and procedure cost.

Simulation shows great promise to change teaching methods - the traditional model of see one, do one, teach one is an inefficient and risky approach to acquiring technical skills and competencies. This, coupled with public demand for patient safety and an increasing reluctance to be "practised" on, has created ideal opportunities for simulation-based medical education to improve teaching.

Simulation methodologies enable tailored training interventions in a low-threat environment. Limited exposure to patients with low-incidence and high-complexity conditions may be addressed by means of simulation and render competency as outcome. Simulation also may be used to assess the outcome of training in a more objective and structured way. This concept is used in the development of the objective structured clinical examination (OSCE). An adapted version of the OSCE was created to assess technical skills. This is called the objective structured assessment of technical skills (OSATS).

Neumeister [20] mentions that many plastic surgery programmes find it problematic to balance clinical, hands-on education and training with their didactic programme. Work and duty hour restrictions add another layer of complexity to surgical education. Furthermore, the ultimate step in learning is not the transmission of information from the teacher to the learner but rather the processing of the information by the learner [20]. According to Neumeister [20] the current trends in educational technology "include internet-based instruction, hands-on simulation devices, mobile devices, virtual and augmented reality, point-of-care learning and assessment, and learning analytics". Telemedicine combined with holograms brings distant expertise into the classroom for learners at all levels. Before entering the operating room, interactive mobile applications allow the residents opportunities to practise procedures over and over again to solidify the understanding of each aspect of any given surgery skill [20]. "Educators need to use innovation and technology to make the best use of data and knowledge to train next generations of plastic surgeons. Educational technology offers unique tools to help learners acquire and process the information needed to become masters of their surgical specialty" [20].

4.2. Formative versus summative OSATS

Both formative and summative OSATS provide an excellent opportunity for feedback and reflection on observed performance. Some argue that the best predictor of the quality of performance is repetitive or deliberative practice - with supervisors providing corrective feedback until the skill is mastered. Formative OSATS thus represent an area in which simulation excels.

4.3. In which areas can simulation be implemented?

Simulation-based medical education can target different levels for intervention. It has a role to play at individual level (e.g. supplementing clinical experience, procedural simulation and task training), team and unit level (e.g. behavioural training, multi-disciplinary team interactions, and debriefing), as well as at an organisational level (e.g. on-site simulation to identify vulnerabilities in specific processes as well as broader systems, and disaster management).

4.4. Studying and improving performance

A critical on-going issue is identification and remediation of individuals who are underperforming. The simulation laboratory setting may help determine if an individual's deficits lie in history and examination taking, other data-gathering skills, synthesis, decision making or prioritization. In this setting the following may also be determined: Physical ability, lack of practice, effect of fatigue, or other similar areas that may contribute to underperformance. This is an often-underutilised application of simulation providing ample opportunity for future research.

4.5. Priorities for simulation-based medical education in plastic surgery and recommendations

Based on the foregoing the following, as an example, may be regarded as priorities for simulation-based medical education in plastic surgery. After each set of priorities a recommendation is provided for the realisation of the priorities:

<u>Integration into training curricula</u>

- The formal integration of simulation into curricula: It does not suffice to use simulation on a voluntary basis without protected simulation time. Very few students make use of simulation facilities if simulation is not formally integrated in the programme.
- Simulation should be synchronised with clinical training – there is little benefit if simulation time clashes with clinical teaching times.
- Ideally, simulation should be implemented at multiple tiers, namely skills rotations (must be completed to progress to next block/year), independent study/practice opportunities to allow students to progress/become proficient at their own pace, as well as evaluation and assessment of competency.

In order for the above to be achieved, the research question that must be answered is: Can simulation in postgraduate plastic surgery education and training enhance the effectiveness of learning in this discipline?

<u>Standardisation of plastic surgery training globally</u>

- SBME should be employed to standardise plastic surgery training, due to the large variation in the scope of plastic surgeons worldwide.
- SBME should be employed to counter a lack of clinical exposure opportunities, or (especially in the Third-World setting) programmes over-burdened by a specific workload (for example, burns and burn reconstruction), which limits the time and resources available for exposure to other areas of the discipline (for example aesthetic surgery).
- SBME should set a basic standard that might enable educators and researchers to compare and contrast different training programmes worldwide.
- SBME should be available at all training facilities for plastic surgeons to enable the discipline to determine a list of basic core skills and competencies which every plastic surgeon should master.

To achieve this, research is required to determine whether simulation might be useful in addressing the problem of a lack of opportunities for clinical exposure and practice.

Skill maintenance and validation

- Simulation should play an important role in revalidation of competency on a continuing medical education basis. Currently, in most CME programmes, the focus is on theoretical knowledge, but there is a large gap between theory and validating and revalidating surgical competency. Simulation could fill this gap.
- Safe thresholds of surgical skill should be identified, validated and may then be used and implemented using simulation as the vehicle to help achieve this goal.
- On-going skills maintenance programmes should be developed in which voluntary hours spent on simulators could be used to assist in skill maintenance, and with sufficient logging, could perhaps obviate the need to go for formal revalidation. To realize these priorities, the use of simulation stands in want of further research to facilitate the transfer of skills to real-world practice to assess the validity and reliability of procedural, clinical, and behavioural competency evaluation methods, and to determine the applicability of simulation to achieve these.

5. Challenges in simulation-based medical education and research

Simulation, like other methods in medical education, has some limits and pitfalls that should be kept in mind. These challenges provide ample opportunity for research, and we strongly advocate for research to be undertaken in these areas. The first challenge would be to utilise the wealth of research opportunities in plastic surgery on procedural competence and to establish the benefit, if any, of deliberate practice in a simulation-based setting. The discipline also lends itself very well to research on defining minimum levels of competency, and the role of simulation in maintaining and validating these levels. The problem of availability of facilities for simulation poses a challenge in itself, as well as the general misconception that simulation needs to be hi-fidelity, hi-tech, and expensive to be worthwhile. In the light of the resource demands of some simulation approaches, we should be susceptible to all solutions that comply with educational requirements. Furthermore, simulation cannot replace vital clinical actual observation and practical acquaintance with and learning from actual surgical practice. This, combined with the possible perception from previously trained professionals, who might feel intimidated and vulnerable (‘Are they saying that our training was inferior?’) forms a formidable stumbling block, which will have to be addressed in order for simulation-based medical education to be incorporated in training curricula. The challenge to succeed in this regard is found in meaningful involvement with trainers and trainees alike before embarking on simulation-based education.

6. Future directions

Work needs to be done on developing case libraries of simulation-based scenarios which have been peer reviewed. This will facilitate the promotion of simulation-based training by encouraging multi-centre efforts and providing the opportunity for educational mentoring. Multi-centre simulation research efforts will be required to further develop and share evaluation tools specifically developed for resident and fellowship evaluations, where research on the transfer of skills into the real world takes precedence, as well as studies of valid and reliable assessment of procedural, clinical and behavioural competency evaluation.

7. Discussion

The research on simulation needs to include aspects such as the role and value of simulation in education; the enhancement of student learning at different cognitive levels; the integration of simulation-based education in teaching and training curricula; the standardisation of plastic surgery training globally; the revalidation of competency in continuing medical education, and the engagement of teachers and students in educational research. Medical simulation promises revolutionizing health care education, and specifically education in plastic surgery – but more work is required. Despite the development of various models and simulation-based learning tools used in plastic surgery training, the role of simulation in the specialty’s training curriculum is not yet fully established. It is essential for simulation-based training to be an integral part of formal plastic surgery training programmes and be funded as such. It is also crucial to develop a skilled cadre of trainers and educators in well-managed simulation facilities. Medical simulation techniques have shown great promise in other specialities - we have outlined here the challenges and opportunities of realizing this promise in plastic surgery.

8. Conclusion

The purposes for developing research directives are to compile theoretical and conceptual frameworks for the conception and design of research studies. The ensuing better understanding of the teaching and learning process will positively influence practice, clinical expertise and professional competence.

Further research is required to enhance the role of simulation in plastic surgery training to the benefit of performance evaluation, standardisation, certification and revalidation. Simulation as integral part of plastic surgery training is the preferred way to go to foster a move towards improved and safer plastic surgery services to the benefit of patients. Simulation in health care education provides ample opportunity for research. Medical simulation promises to revolutionise health care education provided that a skilled cohort of educators be developed in well-coordinated simulation facilities. Simulation has the potential to play an integral role in developing better and safer health care services for patients worldwide, avoiding risk and providing real-life opportunities for students to hone their skills and enhance self-confidence. It is clear that a scientific proposal to express the need for research in the field of plastic surgery and simulation, with clear directives proposing research topics in a systematic way urgently needs to be developed and made available to researchers investigating ways in which to ensure validity, reliability and viability in the education, training and assessment of plastic surgeon students. . It is hoped that aspects discussed in this article will contribute to and lay the foundation for such a research framework.

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May include up to 6 illustrations or tables.
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This should be no more than 250 words, with the following recommended headings:
Background: why the study is being done and how it relates to other published work.
Objectives: what the study intends to find out
Methods: must include study design, number of participants, description of the research tools/instruments, any specific analyses that were done on the data.
Results: first sentence must be brief population and sample description; outline the results according to the

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Conclusion: must be supported by the data, include recommendations for further study/actions.
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Book references: Jeffcoate N. Principles of Gynaecology. 4th ed. London: Butterworth, 1975:96-101.
Chapter/section in a book: Weinstein L, Swartz MN. Pathogenic Properties of Invading Microorganisms. In: Sodeman WA, Sodeman WA, eds. Pathologic Physiology: Mechanisms of Disease. Philadelphia: WB Saunders, 1974:457-472.
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Legal references
Government Gazettes:
National Department of Health, South Africa. National Policy for Health Act, 1990 (Act No. 116 of 1990). Free primary health care services. Government Gazette No. 17507:1514. 1996.
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Acts:
South Africa. National Health Act No. 61 of 2003.
Regulations to an Act:
South Africa. National Health Act of 2003. Regulations: Rendering of clinical forensic medicine services. Government Gazette No. 35099, 2012. (Published under Government Notice R176).
Bills:
South Africa. Traditional Health Practitioners Bill, No. B66B-2003, 2006.
Green/white papers:
South Africa. Department of Health Green Paper: National Health Insurance in South Africa. 2011.
Case law:
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Illustrations/figures are high resolution/quality (not compressed) and in an acceptable format (preferably JPEG or PDF). These must be submitted as 'supplementary files' (not in the manuscript).
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From:	Dr Corne Nel <drcnel@gmail.com>
Sent:	Friday, 25 January 2019 10:36 AM
To:	Elmarie Robberts
Subject:	Fwd: Submission Confirmation for Simulation in Plastic Surgery: Features and uses that lead to effective learning

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From: **AJHPE** <em@editorialmanager.com>
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To: Corne Pieter Nel <drcnel@gmail.com>

CC: "Gert J van Zyl" vanzylgj@ufs.ac.za, "Mathys J Labuschagne" labuschagnemj@ufs.ac.za

Dear Dr Nel,

Your submission entitled "Simulation in Plastic Surgery: Features and uses that lead to effective learning" has been received by journal African Journal of Health Professions Education

You will be able to check on the progress of your paper by logging on to Editorial Manager as an author. The URL is https://www.editorialmanager.com/ajhpe/.

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African Journal of Health Professions Education

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Simulation in Plastic Surgery: Features and uses that lead to effective learning

--Manuscript Draft--

Manuscript Number:	
Article Type:	Original Research
Keywords:	Simulation; features and uses; education and training; learning effectiveness; plastic surgery; residency training; registrar training
Corresponding Author:	Corne Pieter Nel, MBChB, M.Med, M.HPE, FC Plast Surg SA Private Practice SOUTH AFRICA
First Author:	Corne Pieter Nel, MBChB, M.Med, M.HPE, FC Plast Surg SA
Order of Authors:	Corne Pieter Nel, MBChB, M.Med, M.HPE, FC Plast Surg SA
	Gert J van Zyl, MBChB, MFamMed, MBA, PHD
	Mathys J Labuschagne, MBChB, MMed Ophth, PHD
Manuscript Region of Origin:	SOUTH AFRICA
Abstract:	Background Increased competition for surgical exposure and practice, smaller teaching platforms, and shorter training times impact the quality of training and competence of plastic surgery registrars. Demands for accountability and minimising patient risks are driving forces for incorporating simulation in health care education. The problem addressed was whether the features and uses of simulation would enhance postgraduate plastic surgery education and training and ensure more effective learning. Objective The objective was to identify and describe (a) the influence that simulation may have on student learning and how the effectiveness of learning may be enhanced in postgraduate and/or plastic surgery education and training, and (b) the features and uses of simulation that have the potential to enhance learning in plastic surgery. Methods Data were collected by means of semi-structured interviews with eight national and international role players in simulation. Results The results indicate the effect of simulation on postgraduate education and training and how learning may be enhanced in the areas of knowledge, skills, clinical competencies and professional conduct by specific features, uses and characteristics of simulation. Recommendations were made to enhance the effectiveness of learning in plastic surgery education and training by including simulation as teaching method and applying its unique features and uses. Conclusion Simulation-based education in postgraduate plastic surgery education and training is not often encountered. This research investigated the use of simulation to enhance plastic surgery education and training and promote safe patient care. Recommendations are made to enhance the effectiveness of learning in postgraduate plastic surgery education and training.

Cover Letter

Dr Corné Nel

MBChB (UFS); FC Plast Surg (SA); MMed Plast Surg

Plastic and Reconstructive Surgeon

MP 0629286 ; PR 036-000-0580880

19 January 2019

The Editor-in-Chief
African Journal of Health Professions Education

Dear Sir or Madam:

Submission of a manuscript titled "Simulation in Plastic Surgery: Features and uses that lead to effective learning."

I am pleased to submit our manuscript titled "Simulation in Plastic Surgery: Features and uses that lead to effective learning" to your journal for publication.

Increased competition for surgical exposure and practice, smaller teaching platforms, and shorter training times impact the quality of training and competence of plastic surgery registrars. Demands for accountability and minimising patient risks are driving forces for incorporating simulation in health care education. Our research looked at whether the features and uses of simulation would enhance postgraduate plastic surgery education and training and ensure more effective learning.

This manuscript reports on the use of simulation to enhance plastic surgery education and training and promote safe patient care. Recommendations are made to enhance the effectiveness of learning in postgraduate plastic surgery education and training. It forms part of a series of articles, which are part of my PHD study in Health Professions Education.

I certify that all authors listed on this manuscript participated substantially in the conception and design, as well as in writing the paper.

We hope that you find this manuscript suitable for publication in your journal.

Sincerely

Corné Nel
FC Plast Surg (SA), MMed Plast Surg, MBChB, M.HPE

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Simulation in Plastic Surgery: Features and uses that lead to effective learning

Abstract:

Background. Increased competition for surgical exposure and practice, smaller teaching platforms, and shorter training times impact the quality of training and competence of plastic surgery registrars. Demands for accountability and minimising patient risks are driving forces for incorporating simulation in health care education. The problem addressed was whether the features and uses of simulation would enhance postgraduate plastic surgery education and training and ensure more effective learning.

Objective. The objective was to identify and describe (a) the influence that simulation may have on student learning and how the effectiveness of learning may be enhanced in postgraduate and/or plastic surgery education and training, and (b) the features and uses of simulation that have the potential to enhance learning in plastic surgery.

Methods. Data were collected by means of semi-structured interviews with eight national and international role players in simulation.

Results. The results indicate the effect of simulation on postgraduate education and training and how learning may be enhanced in the areas of knowledge, skills, clinical competencies and professional conduct by specific features, uses and characteristics of simulation. Recommendations were made to enhance the effectiveness of learning in plastic surgery education and training by including simulation as teaching method and applying its unique features and uses.

Conclusion. Simulation-based education in postgraduate plastic surgery education and training is not often encountered. This research investigated the use of simulation to enhance plastic surgery education and training and promote safe patient care. Recommendations are made to enhance the effectiveness of learning in postgraduate plastic surgery education and training.

Keywords: Simulation, features and uses, education and training, learning effectiveness, plastic surgery, residency training

Introduction

Evidence of the role of simulation in medical education has emphasised the use of simulation technology over the past number of decades in efforts to increase learner knowledge, to provide students with controlled and safe practice opportunities, and to shape the acquisition of doctors' clinical skills.[1,2,3] Simulation is becoming an integral part of medical education at all levels[1,2,3], as medical education, for various reasons, has fast become subject to radical and innovative changes.

Many major shifts in medical education methods are due to changes in the delivery of health care. According to Issenberg *et al.*, in the United States, for example, the pressures of managed care shape the form and frequency of hospitalisation, 'resulting in higher percentages of acutely ill patients and shorter in-patient stays'.[3] Medical students, therefore, have fewer opportunities to assess patients with a wide variety of diseases and physical findings, while reductions in physician remuneration due to shrinking financial resources constrain the educational time that doctors in training receive.[4] Consequently, at all educational levels, doctors find it increasingly difficult to keep abreast of skills and topics they need to practise successfully. [4]

Issenberg *et al*. identify five factors contributing to the increased use of simulations in medical education, namely lack of clinical teaching opportunities, therefore, less patient material due to changes in health care delivery; new technologies for diagnosis and management; assessing professional competence; medical errors, patient safety, team training; and the role of deliberate practice.[4]

Twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, and hospital resources, and minimise errors.[5] The driving forces behind this are developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy, simulation can improve results and also lower risk and procedure costs because of fewer procedures and less operating room time.[5] Simulation in training allows students ample opportunity to hone their skills and competencies in safe, no-risk circumstances. Insufficient and inefficient clinical teaching stressed the need for strategies to improve clinical education, including the use of simulation. [5]

Over the past 30 years new technologies in medicine have revolutionised patient diagnosis and care. Examples are the development of flexible sigmoidoscopy and bronchoscopy, and minimally invasive surgery, including laparoscopy, and robotics for orthopaedics, urology and cardiology. The benefits of these innovations include reduced postoperative pain and suffering, shorter hospitalisation and earlier resumption of normal activities, as well as significant cost savings.[6]

These newer techniques, however, demand psychomotor and perceptual skills that differ from traditional approaches, and these innovative methods may be associated with a higher complication rate than traditional practices.[7] Haluck *et al.* maintain that these 'newer technologies have created an obstacle to traditional teaching that included hands-on experience. For example, endoscopy requires guiding one's manoeuvres in a three-dimensional environment by watching a two-dimensional screen, requiring the operator to compensate for the loss of binocular depth cue with other depth cues'.[8] One of the corollaries to these new techniques was the introduction of simulation technology in the training and assessment of students. Research indicates that training programme directors emphasised that virtual reality and computer-based simulations had become indispensable technological tools in clinical education.[8]

The Accreditation Council for Graduate Medical Education (ACGME) in the USA in an endeavour to ensure and improve the quality of graduate clinical medical education and to attain a higher level of effectiveness listed six domains of clinical medical competence.[6] It is expected of postgraduate programmes to provide educational experiences that would ensure that graduates demonstrate competence in these ACGME project outcomes, namely patient care; medical knowledge; practice-based learning and improvement; interpersonal and communication skills; professionalism, and system-based practice.[9] These are the educational experiences that benefit from simulation most in the light of a lack of patients and clinical exposure.

Miller[10] proposed a framework (Miller's Pyramid) that argues that a medical learner's clinical skills should be assessed at four levels: (a) **knows** (knowledge) – recall of facts, principles and theories; (b) **knows how** (competence) – ability to solve problems and describe procedures; (c) **shows how** (performance) – demonstration of skills in a controlled setting; and (d) **does** (action) – behaviour in real practice.[4] Simulation technology is increasingly being used in each domain of competence to assess the first three of Miller's levels of learning because of its ability to programme and select learning-specific findings, conditions, and scenarios, to provide standardised experiences to all examinees, and to include outcome measures that yield reliable data.[11]

Methods

Elements of grounded theory were used to describe features and uses of simulation, and to relate why simulation lends itself perfectly to be included in educational programmes. Grounded theory was used to develop recommendations to promote learning in postgraduate plastic surgery education and training.

The study focused on the opinions and perspectives of medical and health care professionals regarding the features and uses of simulation, and whether and how simulation as education and training method might influence student learning. The study was aimed at developing a set of recommendations that might enhance the effectiveness of learning in postgraduate plastic surgery education and training by employing simulation as one of the education and training methods used.

Data were collected through semi-structured interviews with eight national and international role players in simulation and postgraduate education.
Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences, UFS (ECUFS 122/2015).

Semi-structured interviews

Semi-structured individual interviews were used to explore key national and international role players' opinions and perceptions on simulation-based medical education. The purpose was to investigate and to establish clarification on simulation in postgraduate education and training. The interviews were conducted to obtain an in-depth, comprehensive overview of the contribution that simulation might make to postgraduate plastic surgery education and training. The features and uses of simulation that might result in more effective education and training in postgraduate plastic surgery thus were determined. An interview guide (Table 1), developed by the author on the basis of a literature review was used. Occasionally, additional questions arose during the semi-structured interview process; the data thus collected were included in the research. Data on Questions 3, 4 and 7 of the interview guide are reported in this article.

Target population

National and international role players in simulation and postgraduate education were requested to participate in the semi-structured interviews. The eight participants were invited to participate in the interviews, and they all accepted the invitation. They were directors of simulation units, clinical heads of clinical medical departments, programme directors of medical and nursing programmes, and education management specialists, researchers and representatives from the simulation industry. Written consent was obtained from all the participants.

Data collection and analysis

Individual interviews based on a single interview guide were conducted with eight participants by the author (CPG). The interviews were audio-recorded, transcribed by the author (CPG) and checked by an independent person who was not part of the study. Field notes taken during the interviews contributed to the data. The data were analysed using the grounded theory approach that requires continuous comparison of data, following the data analysis steps of coding, categorisation and theory generation.[12] Theory building occurred by finding patterns in the data and this continued until saturation of data was reached.[13]

Reliability and trustworthiness

Reliability was ensured by making use of explorative studies, determining strict criteria for sampling, using the carefully constructed interview guide, as well as an interview process that was audio-taped and carefully described [14]. Trustworthiness of the interviewing process was ensured by involving voluntary interviewees with a clear understanding of what the interviewer expected from them, and using open-ended questions, as well as the transcription and verification of data. Scientific record keeping ensured dependability. [14]

Table 1: Interview guide for semi-structured interviews with national and international role players

Question
1. What experience with/exposure to simulation in the field of health education have you had in general? Briefly describe your experience with/exposure to simulation in terms of the type of simulation, your role, duration of involvement.
2. Are you currently involved in simulation and/or postgraduate education and training? In what context are you involved?
3. **Does/can simulation influence student learning in postgraduate education and training? In which regard?**
4. **How can effectiveness of learning be enhanced in postgraduate and/or plastic surgery education and training (in the areas of knowledge, skills, clinical competence, professional conduct)?**
5. Can simulation be used to enhance student learning at different cognitive levels? (Will the student only use simulation to remember knowledge / or understand / or apply / or analyse / or evaluate / or create new concepts and ideas?)
6. Which types of simulation or simulation modalities might lead to effective learning?
7. **Which features and applications of simulation in postgraduate/ or plastic surgery education and training will lead to more effective learning?**
8. Does simulation have (a) a contribution to make to, (b) a role to play in, or (c) a specific value to add to postgraduate education?
9. What would your main consideration be if you decided to include simulation in your teaching and training programme?
10. If you have to guide a team of experts tasked to develop a curriculum with simulation as one of the training/learning methods, which important guidelines will you put on paper?
11. Do you wish to make any recommendations that may be used in compiling guidelines on simulation for postgraduate plastic surgery?
12. Any recommendation(s) you would like to make when considering including simulation in specialist training?
13. Will you please share (a) some of the lessons learned regarding the implementation of simulation in a curriculum, (b) as well as the biggest challenge in implementing simulation in training?

Results

Data collected by means of Questions 3, 4 and 7 of the semi-structured interviews are reported in this article. Data were analysed and findings summarised and qualitative perspectives are shared on *the influence of simulation on student learning* (Table 2) and how *the effectiveness of learning can be enhanced* (Table 3). The features and uses of simulation that may enhance learning in postgraduate education and training served as basis for a number of *recommendations to enhance the effectiveness of learning* in postgraduate plastic surgery education and training (Table 4). Quotes from interviewees' responses are indicated in inverted commas, followed by a code number assigned to each of the participants.

Simulation influences student learning (Table 2) as it substitutes other learning strategies; it supports adult learning principles as it requires students to prepare, placing a responsibility on them as adult learners; it provides self-confidence and skills motivating students to confront life-threating situations, making a difference to a patient's life. Simulation provides the opportunity to learn by repetition; to work individually or in groups, and it fosters communication. Simulation ensures that the student attains and sustains a specific level of competency.

Table 2: The influence of simulation on student learning in postgraduate education and training

<table>
<tr><th>1. Simulation as a learning strategy</th></tr>
<tr><td>Simulation influences student learning in different ways:

Simulation is a very specific learning and education strategy that can be described as a holistic process that ensures meaningful learning

'To be effective it needs to be an important component in the curriculum' [S1]
'Effectiveness can only be enhanced if there is proper integration' [S1]

Simulation is based on an adult learning strategy as it is built on adult learning principles that can be combined in different ways

'Different people learn in different ways' [C3]

Simulation can replace other educational strategies, for example theoretical lectures, by bringing simulated case engagement into the normal learning strategy:

'Simulation will trigger more excitement' [D1]
</td></tr>
</table>

- ‘Students will be more focused and remember more’ [D1]
- ‘It gives students the opportunity to learn hands-on’ [C1]

2. Motivation to make a difference

Simulation of rare clinical cases or life threatening, important scenarios is motivational:

- ‘… students can be motivated to make a difference in a patient’s life’ [C1]

3. Importance of preparation

Theoretical grounding and preparation will influence student learning:

- ‘Students may attend a lecture, e-learning programme, read articles, do a self-test before visiting the simulation lab, which ensures that learning is more meaningful, and promotes deep learning and commitment’ [D1]
- Identify own shortcomings, evaluate own level of competence, against own tempo
    - ‘Students must be prepared when they come to simulation lab’ [D2]

4. Learn by repetition

Practising non-technical and technical skills will influence student learning:

- ‘Giving students the opportunity to practise in the simulation lab so that they are more competent when performing certain procedures on a patient’ [C1, D1]

5. Group simulations

Simulation scenarios that include different health professionals will foster and enhance learning:

- ‘Debriefing provides students the opportunity not only to identify their own shortcomings but also those of the individual group members and group as a whole’ [C1]
- Learn to work in groups and that communication among them is of great importance.
    - ‘You have to have small group engagement’ [S1]

6. Level of competence

The aim of simulation is to attain and sustain a certain level of competence or expertise:

- Ensure that the health professional/student maintains the same level of competence after the initial mastering of the procedure
    - ‘Attaining some sort of competence level quicker before going to the patient’ [C2]
    - ‘Competent = bare minimum (knows/knows how)’ [C2]
    - ‘Proficient = level of skill above minimum (shows/does)’ [C2]

○ 'As you practise a skill more, you become proficient = on your way to mastering' [C2]

Interviewees' opinions on how simulation can enhance the effectiveness of learning are indicated in Table 3 and emphasise the role of simulation as a non-threatening learning environment that enhances the effectiveness of learning. Students can practise with less stress in a completely safe environment before working with real patients; this highlights the advantages of training using simulation. Simulation also enhances the effectiveness of learning by fostering interpersonal, interprofessional patient communication, health communication and reasoning skills. Through deliberate, as well as repetitive practice, learning is enhanced (Table 3). The debriefing aspect offers another way of learning and allows students to decide on self-improvement. Authentic scenarios help the students to learn more effectively than when using paper cases. The assessment opportunities of simulation enhance student learning.

Table 3: Enhancing the effectiveness of learning in postgraduate and/or plastic surgery education and training by introducing simulation

1. Non-threatening environment
A non-threatening environment enhances the effectiveness of learning: • Enhancement of learning ○ 'Students can practise with less stress' [D1, D2] ○ 'You learn in an environment where you are allowed to make mistakes' [D1] ○ 'To get learners to think about their actions, to analyse, taking ownership of own learning, reflective learning' [D2] ○ 'They learn in a completely safe, non-threatening environment' [D2] • Patient safety ○ 'First learn through simulation, then on real patient' [D1] ○ 'Steep learning curve before practice on real patient' [D1] ○ 'Give them a plan according to which they can work when in a real situation' [D2] ○ 'It allows them to practise more on the simulator so there are fewer medical errors when working with real patients' [D2] Advantage of using simulation in training:

• ‘Operation time less; complications fewer; costs lower – big advantage to train postgraduate students/registrars’ [D1]
2. Soft medical skills
Training of soft skills through simulation enhances the effectiveness of learning • Interpersonal communication, interprofessional communication, patient communication, health communication, etc. to be included in simulation training o ‘Some people may think it is not technical skills (as in AFRIMED/CANMED) so it is not assessed’ [D1] o ‘Colleges to include soft skills in evaluation’ [D1] o ‘Powerful tool to develop clinical reasoning’ [S1] o ‘Clinical reasoning will happen in a complex space’ [S1] o ‘Different reasoning in rural situations’ [S1]
3. Deliberate practice
Deliberate practice enhances the effectiveness of learning • Bench models may be used to practise psychomotor skills by repetition or deliberate practice of specific procedures until students feel safe o ‘To make deliberate practice more successful, students may use a tick-sheet to test themselves’ [C2] o ‘To make deliberate practice more successful, the student must be accompanied by consultant/educator’ [D1] o ‘Student must know what he/she is doing correctly’ [D1] o ‘There must be scheduled times for practice as well as for feedback’ [D1] o ‘Registrars are adult learners and identify skills that need more practice’ [D1]
4. Feedback
Feedback enhances the effectiveness of learning • Constructive feedback: o ‘Can be according to a debriefing manner: first focus on the positive; then focus on things which he/she should do in another way; then focus on these things without negative critique’ [D1] o ‘Give feedback directly after simulation/time slot; in writing or on video’ [D1] o ‘Feedback to be planned, structured according to a template or may be more personal’ [D1] o ‘For non-technical skills use the debriefing method – look at what was good; discuss what can be different’ [D1]

○ ‘For technical skills - then use a tick-sheet; it will allow for more constructive feedback and certain skills can be revisited’ [D1] [D1] ○ ‘Give feedback to students so that they can correct themselves’ • Feedback and assessment with a view to enhancing the effectiveness of learning: ○ ‘Formative feedback will help students to prepare for assessment and examination; then they will have time to correct their mistakes’ [D1] ○ ‘Timely feedback before assessment can help the student to lower stress levels’ [D1] ○ ‘Feedback on quality of operations can offer opinion where the registrar is safe; by using easy scenarios evaluate whether the registrar executes the technique in a good/proper way and/or quick enough – this is a good learning opportunity’ [C1] ○ ‘Students to be observed on a continuing basis’ [C2] ○ ‘Student can be observed during a skill performance’ [C2]
5. Debriefing
Debriefing enhances the effectiveness of learning • The process of debriefing gives more insight: ○ ‘Debriefing is another way to learn’ [C1] ○ ‘It is the debriefing aspect that affects learning’ [D2] ○ ‘Do not use debriefing as a teaching opportunity, let learners think how they can improve’ [D2] ○ ‘Observation of skills, then debriefing after that, improves practical skills’ [C2]
6. Realism or fidelity
Realism of fidelity enhances the effectiveness of learning: • The degree of realism of a scenario or patient influences the effectiveness of learning: ○ ‘In the beginning, students do not believe in the simulation scenario; later you can observe the ”overcoming of disbelief” – the suspension of disbelief – they think it is a real patient: that leads to more effective learning than using a paper case’ [D2]
7. Repetitive practice
Repetitive practice enhances the effectiveness of learning • For learning to take place a medical or practical situation is necessary: ○ ‘You have to practise on a continuous basis – do it repeatedly over the time span of a month or year’ [C1, D1]

    - ‘It must become a natural action – you learn by repeating – repeat soon after the first practice; one week; after weeks; months’ [C1]

8. The training platform

The training platform enhances the effectiveness of learning:

- As training platforms may become smaller in certain disciplines, simulation offers opportunities for learning
    - ‘Platform varies from rural situation to complex’ [S1]

9. Assessment

Assessment enhances the effectiveness of learning:

- Evaluation of clinical skills in summative assessment of registrars plays a role in effective learning
    - ‘In the field of specialists, assessment should include well-defined objectives and competencies’ [C2]
    - ‘Assess levels for competence’ [C2]
    - ‘Assessment to be reliable and statistically sound; use tick-sheet’ [C2]
    - ‘Use simulated patients for clinical examinations’ [S2]

Recommendations to enhance the effectiveness of learning in postgraduate plastic surgery education and training are offered in Table 4. To apply the unique features and uses of simulation in a correct manner will influence the effectiveness of learning in a positive way.

Table 4: Recommendations to enhance the effectiveness of learning in postgraduate plastic surgery education and training by applying the unique features and uses of simulation

Environment

The provision of a controlled non-threatening environment to registrars will unlock the opportunity to learn more effectively:

- Simulation has the ability to create a safe environment enabling registrars to detect problems and patient care errors in a non-threatening way of learning, fostering reasoning skills and thought processes; learning takes place where it is acceptable to make mistakes and causes less stress.
- The simulation environment is open to accommodate a process that can change from a uni- to a multi-purpose process where learning can be based on a single objective or on multiple objectives of learning; learning could span different cognitive levels and include variations from superficial to deep learning.

- A simulation scenario may be changed or adapted to a more complex scenario where learning could take place at a totally different level of competence and applicability.

Curriculum

The integration of simulation in the curriculum of a postgraduate plastic surgery training programme will offer registrars the opportunity to learn more effectively:

- Simulation should be integrated in the curriculum and training schedule and be directed by guidelines for teaching through simulation; the role of simulation should be clearly stated in curriculum documents and an explanation of how it will form part of the registrars' performance management.
- Teaching and learning strategies should be aligned with educational goals and learning outcomes and should be adaptable to the learning situation.
- Simulation offers the opportunity for large group training by developing scenarios for multi-professional teams where individual as well as group learning can take place with an opportunity for debriefing and constructive feedback; individualised learning according to the registrars' learning needs set to specific standards should be offered.

Clinical teaching and learning

Simulation should offer to registrars opportunities for clinical learning to be more effective:

- Registrars' engagement in deliberate practice should take place according to set learning outcomes based on real clinical problems in simulated settings; the realism of clinical problems and the hands-on experience should help them to master clinical outcomes and to transfer knowledge, skills, and competencies to real clinical settings.
- Learning outcomes will enhance the effectiveness of learning and processes must be in place to ensure they are met.
- Smaller learning units can give registrars the opportunity to master learning outcomes at own pace; ensuring intrinsic motivation and fostering deep learning.
- Effective learning is enhanced when registrars practise clinical skills across a wide range of difficulty levels; scenarios set on different levels of difficulty ensures that learning takes place at different cognitive levels.
- By offering registrars the opportunity to engage in repetitive practice in a safe environment will give them the challenge to correct and hone their clinical skills and competencies.

Feedback

Registrars should approach simulation opportunities in a different way when consultants are with them to give feedback and will experience scenarios as a direct learning opportunity and problems can be corrected immediately – they should see it as teaching them purposefully and deliberately: • Feedback should be planned, formally scheduled and be an integral part of the training programme. • Feedback should be built into simulations, or presented at scheduled times, on video or electronic media. • Registrars should use the opportunity of feedback to correct themselves by taking notice of feedback on accuracy and timing. • Constructive feedback should drive decisions as far as preparation for final assessment.
Technology
Technology should be seen as offering endless possibilities to enhance learning for registrars: • Technical skills, non-technical skills, as well as the softer skills can be explored for learning at different levels by adding or changing scenarios. • Sharing facilities between institutions will be beneficial as registrars can see or use a whole spectrum of simulations; standardisation of outcomes is possible, as well as offering quality learning opportunities and an opportunity to learn new skills.

Discussion

How simulation influences student learning and how the effectiveness of learning may be enhanced by including simulation as a learning method in postgraduate and/or plastic surgery education and training were addressed by the third and fourth semi-structured interview questions. The opinion was that simulation can enhance the effectiveness of learning as far as the mastery of knowledge, skills, clinical competence and professional conduct are concerned.

The features and uses of simulation in postgraduate and/or plastic surgery education and training were addressed by semi-structured interview question seven.

The data gathered by means of semi-structured interview Questions 3, 4 and 7 were compared with perspectives gained from the literature review with a view to making recommendations. Key outcomes of this research were the identification of the features and uses of simulation, and how simulation might be applied to enhance the effectiveness of learning when including it as a training method in plastic surgery.

As specific features and uses of simulation influence the effectiveness of learning, these should be maximised in simulation-based education and training in plastic surgery education.

According to Issenberg *et al.* [4], 'traditional medical training has focused on individual learning to care for individual patients. Medical education has neglected the importance of teamwork and the need to develop safe systems. The knowledge, skills, and attitudes needed for safe practice are not normally acquired, nor are they required, as part of medical education'.[4] Simulation is an appropriate method for team training - a prerequisite for interprofessional health care required from modern medical education.

Simulation offers the possibility of a cyclic learning dimension structure, namely a safe, purposefully planned learning environment, including variations of learning strategies/methods and the opportunity to select material offering different applicable learning opportunities and ensuring a unique learning experience where the learning can be evaluated by the registrar or feedback/debriefing can be done by a consultant to achieve competence, or to re-plan and/or deliberately practise specific, identified learning units.

Deliberate practice, not just time and experience in clinical settings, is the key to the development of medical clinical competence. [4] Deliberate practice involves '(a) repetitive performance of intended cognitive and psychomotor skills in a focused domain, coupled with (b) rigorous skills assessment, that provides learners with (c) specific, informative feedback, that results in increasingly (d) better skills performance, in a controlled setting.' [4] Simulation is the ideal way to ensure deliberate practice, regardless of whether patient material is available or not. Research emphasises the importance of repetition for clinical skills acquisition and maintenance, [15] and research evidence clearly shows that high-fidelity medical simulations facilitate learning. [4]

Simulation-based education allows students to practise and acquire patient care skills in controlled and safe learning environments. Feedback to students, the opportunity for deliberate and repetitive practice, multiple learning strategies, individualised learning within a controlled environment, and the opportunity for hands-on experiences foster students' self-confidence and plays a cardinal role in mastering educational outcomes.[6]

Simulation can play an important role in postgraduate education; however, it cannot substitute education involving real patients in genuine settings.

Conclusion

From the findings of this research it is clear that for simulation to be introduced as a teaching method and a learning opportunity for residents with a view to improving plastic surgery education and training, it should include (i) a clear set of recommendations on how simulation can enhance the effectiveness of learning, (ii) a description of the role and value of simulation based on a scientific research process, and (iii) the development of an argument to enhance plastic surgery training by including simulation in education and training programmes, and (iv) the development of guidelines for teaching through simulation as part of training programmes for evidence-based plastic surgery education/practice.

Further research is required to enhance the role of simulation in plastic surgery training. [16] ‘Simulation has the potential to play an integral role in developing better and safer health care services for patients worldwide, avoiding risk and providing real-life opportunity for students to hone their skills’ [16] It is foreseen that the features and uses of simulation, discussed in this article, will contribute to and lay the foundation for more effective learning in plastic surgery education and training in the future.

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Simulation in Plastic Surgery: Features and uses that lead to effective learning

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Author contribution.

CPGN designed the study, wrote the protocol, collected data and performed analysis, interpreted data and wrote the manuscript. GJvZ and MJL were supervisors of the study, reviewed the protocol and manuscript and contributed substantially to the conceptualisation, design, analysis and interpretation of data and scientific content. All authors approved the final version of the manuscript submitted.

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Conflicts of interests.

None.

Ethical approval

Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences, UFS (ECUFS 122/2015).

Abstract:

Background. Increased competition for surgical exposure and practice, smaller teaching platforms, and shorter training times impact the quality of training and competence of plastic surgery registrars. Demands for accountability and minimising patient risks are driving forces for incorporating simulation in health care education. The problem addressed was whether the features and uses of simulation would enhance postgraduate plastic surgery education and training and ensure more effective learning.

Objective. The objective was to identify and describe (a) the influence that simulation may have on student learning and how the effectiveness of learning may be enhanced in postgraduate and/or plastic surgery education and training, and (b) the features and uses of simulation that have the potential to enhance learning in plastic surgery.

Methods. Data were collected by means of semi-structured interviews with eight national and international role players in simulation.

Results. The results indicate the effect of simulation on postgraduate education and training and how learning may be enhanced in the areas of knowledge, skills, clinical competencies and professional conduct by specific features, uses and characteristics of simulation. Recommendations were made to enhance the effectiveness of learning in plastic surgery education and training by including simulation as teaching method and applying its unique features and uses.

Conclusion. Simulation-based education in postgraduate plastic surgery education and training is not often encountered. This research investigated the use of simulation to enhance plastic surgery education and training and promote safe patient care. Recommendations are made to enhance the effectiveness of learning in postgraduate plastic surgery education and training.

Keywords: Simulation, features and uses, education and training, learning effectiveness, plastic surgery, residency training

Introduction

Evidence of the role of simulation in medical education has emphasised the use of simulation technology over the past number of decades in efforts to increase learner knowledge, to provide students with controlled and safe practice opportunities, and to shape the acquisition of doctors' clinical skills.[1,2,3] Simulation is becoming an integral part of medical education at all levels[1,2,3], as medical education, for various reasons, has fast become subject to radical and innovative changes.

Many major shifts in medical education methods are due to changes in the delivery of health care. According to Issenberg *et al*., in the United States, for example, the pressures of managed care shape the form and frequency of hospitalisation, 'resulting in higher percentages of acutely ill patients and shorter in-patient stays'.[3] Medical students, therefore, have fewer opportunities to assess patients with a wide variety of diseases and physical findings, while reductions in physician remuneration due to shrinking financial resources constrain the educational time that doctors in training receive.[4] Consequently, at all educational levels, doctors find it increasingly difficult to keep abreast of skills and topics they need to practise successfully. [4]

Issenberg *et al*. identify five factors contributing to the increased use of simulations in medical education, namely lack of clinical teaching opportunities, therefore, less patient material due to changes in health care delivery; new technologies for diagnosis and management; assessing professional competence; medical errors, patient safety, team training; and the role of deliberate practice.[4]

Twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, and hospital resources, and minimise errors.[5] The driving forces behind this are developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy, simulation can improve results and also lower risk and procedure costs because of fewer procedures and less operating room time.[5] Simulation in training allows students ample opportunity to hone their skills and competencies in safe, no-risk circumstances. Insufficient and inefficient clinical teaching stressed the need for strategies to improve clinical education, including the use of simulation. [5]

Over the past 30 years new technologies in medicine have revolutionised patient diagnosis and care. Examples are the development of flexible sigmoidoscopy and bronchoscopy, and minimally invasive surgery, including laparoscopy, and robotics for orthopaedics, urology and cardiology. The benefits of these innovations include reduced postoperative pain and suffering, shorter hospitalisation and earlier resumption of normal activities, as well as significant cost savings.[6]

These newer techniques, however, demand psychomotor and perceptual skills that differ from traditional approaches, and these innovative methods may be associated with a higher complication rate than traditional practices.[7] Haluck *et al*. maintain that these 'newer technologies have created an obstacle to traditional teaching that included hands-on experience. For example, endoscopy requires guiding one's manoeuvres in a three-dimensional environment by watching a two-dimensional screen, requiring the operator to compensate for the loss of binocular depth cue with other depth cues'.[8] One of the corollaries to these new techniques was the introduction of simulation technology in the training and assessment of students. Research indicates that training programme directors emphasised that virtual reality and computer-based simulations had become indispensable technological tools in clinical education.[8]

The Accreditation Council for Graduate Medical Education (ACGME) in the USA in an endeavour to ensure and improve the quality of graduate clinical medical education and to attain a higher level of effectiveness listed six domains of clinical medical competence.[6] It is expected of postgraduate programmes to provide educational experiences that would ensure that graduates demonstrate competence in these ACGME project outcomes, namely patient care; medical knowledge; practice-based learning and improvement; interpersonal and communication skills; professionalism, and system-based practice.[9] These are the educational experiences that benefit from simulation most in the light of a lack of patients and clinical exposure.

Miller[10] proposed a framework (Miller's Pyramid) that argues that a medical learner's clinical skills should be assessed at four levels: (a) **knows** (knowledge) – recall of facts, principles and theories; (b) **knows how** (competence) – ability to solve problems and describe procedures; (c) **shows how** (performance) – demonstration of skills in a controlled setting; and (d) **does** (action) – behaviour in real practice.[4] Simulation technology is increasingly being used in each domain of competence to assess the first three of Miller's levels of learning because of its ability to programme and select learning-specific findings, conditions, and scenarios, to provide standardised experiences to all examinees, and to include outcome measures that yield reliable data.[11]

Methods

Elements of grounded theory were used to describe features and uses of simulation, and to relate why simulation lends itself perfectly to be included in educational programmes. Grounded theory was used to develop recommendations to promote learning in postgraduate plastic surgery education and training.

The study focused on the opinions and perspectives of medical and health care professionals regarding the features and uses of simulation, and whether and how simulation as education and training method might influence student learning. The study was aimed at developing a set of recommendations that might enhance the effectiveness of learning in postgraduate plastic surgery education and training by employing simulation as one of the education and training methods used.

Data were collected through semi-structured interviews with eight national and international role players in simulation and postgraduate education.
Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences, UFS (ECUFS 122/2015).

Semi-structured interviews

Semi-structured individual interviews were used to explore key national and international role players' opinions and perceptions on simulation-based medical education. The purpose was to investigate and to establish clarification on simulation in postgraduate education and training. The interviews were conducted to obtain an in-depth, comprehensive overview of the contribution that simulation might make to postgraduate plastic surgery education and training. The features and uses of simulation that might result in more effective education and training in postgraduate plastic surgery thus were determined. An interview guide (Table 1), developed by the author on the basis of a literature review was used. Occasionally, additional questions arose during the semi-structured interview process; the data thus collected were included in the research. Data on Questions 3, 4 and 7 of the interview guide are reported in this article.

Target population

National and international role players in simulation and postgraduate education were requested to participate in the semi-structured interviews. The eight participants were invited to participate in the interviews, and they all accepted the invitation. They were directors of simulation units, clinical heads of clinical medical departments, programme directors of medical and nursing programmes, and education management specialists, researchers and representatives from the simulation industry. Written consent was obtained from all the participants.

Data collection and analysis

Individual interviews based on a single interview guide were conducted with eight participants by the author (CPG). The interviews were audio-recorded, transcribed by the author (CPG) and checked by an independent person who was not part of the study. Field notes taken during the interviews contributed to the data. The data were analysed using the grounded theory approach that requires continuous comparison of data, following the data analysis steps of coding, categorisation and theory generation.[12] Theory building occurred by finding patterns in the data and this continued until saturation of data was reached.[13]

Reliability and trustworthiness

Reliability was ensured by making use of explorative studies, determining strict criteria for sampling, using the carefully constructed interview guide, as well as an interview process that was audio-taped and carefully described [14]. Trustworthiness of the interviewing process was ensured by involving voluntary interviewees with a clear understanding of what the interviewer expected from them, and using open-ended questions, as well as the transcription and verification of data. Scientific record keeping ensured dependability. [14]

Table 1: Interview guide for semi-structured interviews with national and international role players

Question
1. What experience with/exposure to simulation in the field of health education have you had in general? Briefly describe your experience with/exposure to simulation in terms of the type of simulation, your role, duration of involvement.
2. Are you currently involved in simulation and/or postgraduate education and training? In what context are you involved?
3. **Does/can simulation influence student learning in postgraduate education and training? In which regard?**
4. **How can effectiveness of learning be enhanced in postgraduate and/or plastic surgery education and training (in the areas of knowledge, skills, clinical competence, professional conduct)?**
5. Can simulation be used to enhance student learning at different cognitive levels? (Will the student only use simulation to remember knowledge / or understand / or apply / or analyse / or evaluate / or create new concepts and ideas?)
6. Which types of simulation or simulation modalities might lead to effective learning?
7. **Which features and applications of simulation in postgraduate/ or plastic surgery education and training will lead to more effective learning?**
8. Does simulation have (a) a contribution to make to, (b) a role to play in, or (c) a specific value to add to postgraduate education?
9. What would your main consideration be if you decided to include simulation in your teaching and training programme?
10. If you have to guide a team of experts tasked to develop a curriculum with simulation as one of the training/learning methods, which important guidelines will you put on paper?
11. Do you wish to make any recommendations that may be used in compiling guidelines on simulation for postgraduate plastic surgery?
12. Any recommendation(s) you would like to make when considering including simulation in specialist training?
13. Will you please share (a) some of the lessons learned regarding the implementation of simulation in a curriculum, (b) as well as the biggest challenge in implementing simulation in training?

Results

Data collected by means of Questions 3, 4 and 7 of the semi-structured interviews are reported in this article. Data were analysed and findings summarised and qualitative perspectives are shared on *the influence of simulation on student learning* (Table 2) and how *the effectiveness of learning can be enhanced* (Table 3). The features and uses of simulation that may enhance learning in postgraduate education and training served as basis for a number of *recommendations to enhance the effectiveness of learning* in postgraduate plastic surgery education and training (Table 4). Quotes from interviewees' responses are indicated in inverted commas, followed by a code number assigned to each of the participants.

Simulation influences student learning (Table 2) as it substitutes other learning strategies; it supports adult learning principles as it requires students to prepare, placing a responsibility on them as adult learners; it provides self-confidence and skills motivating students to confront life-threating situations, making a difference to a patient's life. Simulation provides the opportunity to learn by repetition; to work individually or in groups, and it fosters communication. Simulation ensures that the student attains and sustains a specific level of competency.

Table 2: The influence of simulation on student learning in postgraduate education and training

1. Simulation as a learning strategy

Simulation influences student learning in different ways:
• Simulation is a very specific learning and education strategy that can be described as a holistic process that ensures meaningful learning
  o 'To be effective it needs to be an important component in the curriculum' [S1]
  o 'Effectiveness can only be enhanced if there is proper integration' [S1]
• Simulation is based on an adult learning strategy as it is built on adult learning principles that can be combined in different ways
  o 'Different people learn in different ways' [C3]
Simulation can replace other educational strategies, for example theoretical lectures, by bringing simulated case engagement into the normal learning strategy:
  o 'Simulation will trigger more excitement' [D1]

- ‘Students will be more focused and remember more’ [D1]
- ‘It gives students the opportunity to learn hands-on’ [C1]

2. Motivation to make a difference

Simulation of rare clinical cases or life threatening, important scenarios is motivational:

- ‘… students can be motivated to make a difference in a patient’s life’ [C1]

3. Importance of preparation

Theoretical grounding and preparation will influence student learning:

- ‘Students may attend a lecture, e-learning programme, read articles, do a self-test before visiting the simulation lab, which ensures that learning is more meaningful, and promotes deep learning and commitment’ [D1]
- Identify own shortcomings, evaluate own level of competence, against own tempo
    - ‘Students must be prepared when they come to simulation lab’ [D2]

4. Learn by repetition

Practising non-technical and technical skills will influence student learning:

- ‘Giving students the opportunity to practise in the simulation lab so that they are more competent when performing certain procedures on a patient’ [C1, D1]

5. Group simulations

Simulation scenarios that include different health professionals will foster and enhance learning:

- ‘Debriefing provides students the opportunity not only to identify their own shortcomings but also those of the individual group members and group as a whole’ [C1]
- Learn to work in groups and that communication among them is of great importance.
    - ‘You have to have small group engagement’ [S1]

6. Level of competence

The aim of simulation is to attain and sustain a certain level of competence or expertise:

- Ensure that the health professional/student maintains the same level of competence after the initial mastering of the procedure
    - ‘Attaining some sort of competence level quicker before going to the patient’ [C2]
    - ‘Competent = bare minimum (knows/knows how)’ [C2]
    - ‘Proficient = level of skill above minimum (shows/does)’ [C2]

○ ‘As you practise a skill more, you become proficient = on your way to mastering’ [C2]

Interviewees’ opinions on how simulation can enhance the effectiveness of learning are indicated in Table 3 and emphasise the role of simulation as a non-threatening learning environment that enhances the effectiveness of learning. Students can practise with less stress in a completely safe environment before working with real patients; this highlights the advantages of training using simulation. Simulation also enhances the effectiveness of learning by fostering interpersonal, interprofessional patient communication, health communication and reasoning skills. Through deliberate, as well as repetitive practice, learning is enhanced (Table 3). The debriefing aspect offers another way of learning and allows students to decide on self-improvement. Authentic scenarios help the students to learn more effectively than when using paper cases. The assessment opportunities of simulation enhance student learning.

Table 3: Enhancing the effectiveness of learning in postgraduate and/or plastic surgery education and training by introducing simulation

1. Non-threatening environment
A non-threatening environment enhances the effectiveness of learning: • Enhancement of learning ○ ‘Students can practise with less stress’ [D1, D2] ○ ‘You learn in an environment where you are allowed to make mistakes’ [D1] ○ ‘To get learners to think about their actions, to analyse, taking ownership of own learning, reflective learning’ [D2] ○ ‘They learn in a completely safe, non-threatening environment’ [D2] • Patient safety ○ ‘First learn through simulation, then on real patient’ [D1] ○ ‘Steep learning curve before practice on real patient’ [D1] ○ ‘Give them a plan according to which they can work when in a real situation’ [D2] ○ ‘It allows them to practise more on the simulator so there are fewer medical errors when working with real patients’ [D2] Advantage of using simulation in training:

• ‘Operation time less; complications fewer; costs lower – big advantage to train postgraduate students/registrars’ [D1]
2. Soft medical skills

Training of soft skills through simulation enhances the effectiveness of learning
• Interpersonal communication, interprofessional communication, patient communication, health communication, etc. to be included in simulation training
  o ‘Some people may think it is not technical skills (as in AFRIMED/CANMED) so it is not assessed’ [D1]
  o ‘Colleges to include soft skills in evaluation’ [D1]
  o ‘Powerful tool to develop clinical reasoning’ [S1]
  o ‘Clinical reasoning will happen in a complex space’ [S1]
  o ‘Different reasoning in rural situations’ [S1]

3. Deliberate practice

Deliberate practice enhances the effectiveness of learning
• Bench models may be used to practise psychomotor skills by repetition or deliberate practice of specific procedures until students feel safe
  o ‘To make deliberate practice more successful, students may use a tick-sheet to test themselves’ [C2]
  o ‘To make deliberate practice more successful, the student must be accompanied by consultant/educator’ [D1]
  o ‘Student must know what he/she is doing correctly’ [D1]
  o ‘There must be scheduled times for practice as well as for feedback’ [D1]
  o ‘Registrars are adult learners and identify skills that need more practice’ [D1]

4. Feedback

Feedback enhances the effectiveness of learning
• Constructive feedback:
  o ‘Can be according to a debriefing manner: first focus on the positive; then focus on things which he/she should do in another way; then focus on these things without negative critique’ [D1]
  o ‘Give feedback directly after simulation/time slot; in writing or on video’ [D1]
  o ‘Feedback to be planned, structured according to a template or may be more personal’ [D1]
  o ‘For non-technical skills use the debriefing method – look at what was good; discuss what can be different’ [D1]

    - ‘For technical skills - then use a tick-sheet; it will allow for more constructive feedback and certain skills can be revisited’ [D1] [D1]
    - ‘Give feedback to students so that they can correct themselves’
- Feedback and assessment with a view to enhancing the effectiveness of learning:
    - ‘Formative feedback will help students to prepare for assessment and examination; then they will have time to correct their mistakes’ [D1]
    - ‘Timely feedback before assessment can help the student to lower stress levels’ [D1]
    - ‘Feedback on quality of operations can offer opinion where the registrar is safe; by using easy scenarios evaluate whether the registrar executes the technique in a good/proper way and/or quick enough – this is a good learning opportunity’ [C1]
    - ‘Students to be observed on a continuing basis’ [C2]
    - ‘Student can be observed during a skill performance’ [C2]

5. Debriefing

Debriefing enhances the effectiveness of learning

- The process of debriefing gives more insight:
    - ‘Debriefing is another way to learn’ [C1]
    - ‘It is the debriefing aspect that affects learning’ [D2]
    - ‘Do not use debriefing as a teaching opportunity, let learners think how they can improve’ [D2]
    - ‘Observation of skills, then debriefing after that, improves practical skills’ [C2]

6. Realism or fidelity

Realism of fidelity enhances the effectiveness of learning:

- The degree of realism of a scenario or patient influences the effectiveness of learning:
    - ‘In the beginning, students do not believe in the simulation scenario; later you can observe the ”overcoming of disbelief” – the suspension of disbelief – they think it is a real patient: that leads to more effective learning than using a paper case’ [D2]

7. Repetitive practice

Repetitive practice enhances the effectiveness of learning

- For learning to take place a medical or practical situation is necessary:
    - ‘You have to practise on a continuous basis – do it repeatedly over the time span of a month or year’ [C1, D1]

o ‘It must become a natural action – you learn by repeating – repeat soon after the first practice; one week; after weeks; months’ [C1]
8. The training platform
The training platform enhances the effectiveness of learning: • As training platforms may become smaller in certain disciplines, simulation offers opportunities for learning o ‘Platform varies from rural situation to complex’ [S1]
9. Assessment
Assessment enhances the effectiveness of learning: • Evaluation of clinical skills in summative assessment of registrars plays a role in effective learning o ‘In the field of specialists, assessment should include well-defined objectives and competencies’ [C2] o ‘Assess levels for competence’ [C2] o ‘Assessment to be reliable and statistically sound; use tick-sheet’ [C2] o ‘Use simulated patients for clinical examinations’ [S2]

Recommendations to enhance the effectiveness of learning in postgraduate plastic surgery education and training are offered in Table 4. To apply the unique features and uses of simulation in a correct manner will influence the effectiveness of learning in a positive way.

Table 4: Recommendations to enhance the effectiveness of learning in postgraduate plastic surgery education and training by applying the unique features and uses of simulation

Environment
The provision of a controlled non-threatening environment to registrars will unlock the opportunity to learn more effectively: • Simulation has the ability to create a safe environment enabling registrars to detect problems and patient care errors in a non-threatening way of learning, fostering reasoning skills and thought processes; learning takes place where it is acceptable to make mistakes and causes less stress. • The simulation environment is open to accommodate a process that can change from a uni- to a multi-purpose process where learning can be based on a single objective or on multiple objectives of learning; learning could span different cognitive levels and include variations from superficial to deep learning.

• A simulation scenario may be changed or adapted to a more complex scenario where learning could take place at a totally different level of competence and applicability.
Curriculum
The integration of simulation in the curriculum of a postgraduate plastic surgery training programme will offer registrars the opportunity to learn more effectively: • Simulation should be integrated in the curriculum and training schedule and be directed by guidelines for teaching through simulation; the role of simulation should be clearly stated in curriculum documents and an explanation of how it will form part of the registrars' performance management. • Teaching and learning strategies should be aligned with educational goals and learning outcomes and should be adaptable to the learning situation. • Simulation offers the opportunity for large group training by developing scenarios for multi-professional teams where individual as well as group learning can take place with an opportunity for debriefing and constructive feedback; individualised learning according to the registrars' learning needs set to specific standards should be offered.
Clinical teaching and learning
Simulation should offer to registrars opportunities for clinical learning to be more effective: • Registrars' engagement in deliberate practice should take place according to set learning outcomes based on real clinical problems in simulated settings; the realism of clinical problems and the hands-on experience should help them to master clinical outcomes and to transfer knowledge, skills, and competencies to real clinical settings. • Learning outcomes will enhance the effectiveness of learning and processes must be in place to ensure they are met. • Smaller learning units can give registrars the opportunity to master learning outcomes at own pace; ensuring intrinsic motivation and fostering deep learning. • Effective learning is enhanced when registrars practise clinical skills across a wide range of difficulty levels; scenarios set on different levels of difficulty ensures that learning takes place at different cognitive levels. • By offering registrars the opportunity to engage in repetitive practice in a safe environment will give them the challenge to correct and hone their clinical skills and competencies.
Feedback

Registrars should approach simulation opportunities in a different way when consultants are with them to give feedback and will experience scenarios as a direct learning opportunity and problems can be corrected immediately – they should see it as teaching them purposefully and deliberately: • Feedback should be planned, formally scheduled and be an integral part of the training programme. • Feedback should be built into simulations, or presented at scheduled times, on video or electronic media. • Registrars should use the opportunity of feedback to correct themselves by taking notice of feedback on accuracy and timing. • Constructive feedback should drive decisions as far as preparation for final assessment.
Technology
Technology should be seen as offering endless possibilities to enhance learning for registrars: • Technical skills, non-technical skills, as well as the softer skills can be explored for learning at different levels by adding or changing scenarios. • Sharing facilities between institutions will be beneficial as registrars can see or use a whole spectrum of simulations; standardisation of outcomes is possible, as well as offering quality learning opportunities and an opportunity to learn new skills.

Discussion

How simulation influences student learning and how the effectiveness of learning may be enhanced by including simulation as a learning method in postgraduate and/or plastic surgery education and training were addressed by the third and fourth semi-structured interview questions. The opinion was that simulation can enhance the effectiveness of learning as far as the mastery of knowledge, skills, clinical competence and professional conduct are concerned.

The features and uses of simulation in postgraduate and/or plastic surgery education and training were addressed by semi-structured interview question seven.

The data gathered by means of semi-structured interview Questions 3, 4 and 7 were compared with perspectives gained from the literature review with a view to making recommendations. Key outcomes of this research were the identification of the features and uses of simulation, and how simulation might be applied to enhance the effectiveness of learning when including it as a training method in plastic surgery.

As specific features and uses of simulation influence the effectiveness of learning, these should be maximised in simulation-based education and training in plastic surgery education.

According to Issenberg *et al.* [4], ‘traditional medical training has focused on individual learning to care for individual patients. Medical education has neglected the importance of teamwork and the need to develop safe systems. The knowledge, skills, and attitudes needed for safe practice are not normally acquired, nor are they required, as part of medical education’.[4] Simulation is an appropriate method for team training - a prerequisite for interprofessional health care required from modern medical education.

Simulation offers the possibility of a cyclic learning dimension structure, namely a safe, purposefully planned learning environment, including variations of learning strategies/methods and the opportunity to select material offering different applicable learning opportunities and ensuring a unique learning experience where the learning can be evaluated by the registrar or feedback/debriefing can be done by a consultant to achieve competence, or to re-plan and/or deliberately practise specific, identified learning units.

Deliberate practice, not just time and experience in clinical settings, is the key to the development of medical clinical competence. [4] Deliberate practice involves ‘(a) repetitive performance of intended cognitive and psychomotor skills in a focused domain, coupled with (b) rigorous skills assessment, that provides learners with (c) specific, informative feedback, that results in increasingly (d) better skills performance, in a controlled setting.’ [4] Simulation is the ideal way to ensure deliberate practice, regardless of whether patient material is available or not. Research emphasises the importance of repetition for clinical skills acquisition and maintenance, [15] and research evidence clearly shows that high-fidelity medical simulations facilitate learning. [4]

Simulation-based education allows students to practise and acquire patient care skills in controlled and safe learning environments. Feedback to students, the opportunity for deliberate and repetitive practice, multiple learning strategies, individualised learning within a controlled environment, and the opportunity for hands-on experiences foster students’ self-confidence and plays a cardinal role in mastering educational outcomes.[6]

Simulation can play an important role in postgraduate education; however, it cannot substitute education involving real patients in genuine settings.

Conclusion

From the findings of this research it is clear that for simulation to be introduced as a teaching method and a learning opportunity for residents with a view to improving plastic surgery education and training, it should include (i) a clear set of recommendations on how simulation can enhance the effectiveness of learning, (ii) a description of the role and value of simulation based on a scientific research process, and (iii) the development of an argument to enhance plastic surgery training by including simulation in education and training programmes, and (iv) the development of guidelines for teaching through simulation as part of training programmes for evidence-based plastic surgery education/practice.

Further research is required to enhance the role of simulation in plastic surgery training. [16] 'Simulation has the potential to play an integral role in developing better and safer health care services for patients worldwide, avoiding risk and providing real-life opportunity for students to hone their skills' [16] It is foreseen that the features and uses of simulation, discussed in this article, will contribute to and lay the foundation for more effective learning in plastic surgery education and training in the future.

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APPENDIX Y JOURNAL SUBMISSION GUIDELINES: ARTICLE 4

APPENDIX Y

JOURNAL SUBMISSION GUIDELINES: ARTICLE 4

cf. Journal submission guidelines: Article 3 (Appendix W)

APPENDIX Z PROOF OF SUBMISSION / REVIEW / PUBLICATION: ARTICLE 4

From: Dr Corne Nel
To: Elmarie Robberts
Subject: Fwd: Submission Confirmation for Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes
Date: Friday, 25 January 2019 10:36:00 AM

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fwd

---------- Forwarded message ---------
From: **AJHPE** <em@editorialmanager.com>
Date: Mon, Jan 21, 2019 at 9:47 PM
Subject: Submission Confirmation for Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes
To: Corne Pieter Nel <drcnel@gmail.com>

CC: "GJ van Zyl" vanzylgj@ufs.ac.za, "Mathys J Labuschagne" labuschagnemj@ufs.ac.za

Dear Dr Nel,

Your submission entitled "Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes" has been received by journal African Journal of Health Professions Education

You will be able to check on the progress of your paper by logging on to Editorial Manager as an author. The URL is https://www.editorialmanager.com/ajhpe/.

Your manuscript will be given a reference number once an Editor has been assigned.

Thank you for submitting your work to African Journal of Health Professions Education.

Kind regards,

African Journal of Health Professions Education

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Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes

--Manuscript Draft--

Manuscript Number:	
Article Type:	Original Research
Keywords:	plastic surgery education and training; simulation; learning outcomes; cognitive levels
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Manuscript Region of Origin:	SOUTH AFRICA
Abstract:	Background This research investigated the possibility of integrating simulation in plastic surgery residency training. The problem addressed was the lack of knowledge about using simulation as an essential or useful method to enhance the training of plastic surgeons. A lack of empirical evidence existed concerning learning outcomes that could be mastered by simulation-based education and training and their specific cognitive levels. Objective The objective of the study was to identify and describe learning outcomes for plastic surgery education and training for which simulation might be an important (essential and useful) training method, and to identify and describe simulation modalities, linked to specific cognitive levels, to establish the influence of simulation on plastic surgery education and training as far as knowledge, skills, clinical competence and professional conduct are concerned. Methods Data were collected by means of a Delphi survey of an expert panel comprising nine plastic surgeons, supplemented by semi-structured interviews conducted with eight national and international role players in simulation and postgraduate education. Results Learning outcomes, levels of training, and possible simulation modalities, cognitive levels and descriptive verbs and phrases were described as these pertain to learning. Simulation in medical education, and its relation to simulation technology, were discussed. Recommendations regarding the inclusion of simulation in specialist training were offered. Conclusion A number of aspects surfaced that should be included in a framework that might serve as a directive for the inclusion of simulation in a training programme in plastic surgery.

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21 January 2019

The Editor-in-Chief
African Journal of Health Professions Education

Dear Sir or Madam:

Submission of a manuscript titled "Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes"

I am pleased to submit our manuscript titled "Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes" to your journal for publication.

This research investigated the possibility of integrating simulation in plastic surgery residency training. This article reports back on identified learning outcomes, levels of training, and possible simulation modalities, cognitive levels and descriptive verbs and phrases as they pertain to learning. Recommendations regarding the inclusion of simulation in specialist training are offered.

The article forms the second in a series of articles emanating from my PHD study.

I certify that all authors listed on this manuscript participated substantially in the conception and design, as well as in writing the paper.

We hope that you find this manuscript suitable for publication in your journal.

Sincerely

Corné Nel
FC Plast Surg (SA), MMed Plast Surg, MBChB, M.HPE

Plastic Surgery
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Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes

Abstract:

Background: This research investigated the possibility of integrating simulation in plastic surgery residency training. The problem addressed was the lack of knowledge about using simulation as an essential or useful method to enhance the training of plastic surgeons. A lack of empirical evidence existed concerning learning outcomes that could be mastered by simulation-based education and training and their specific cognitive levels.

Objective: The objective of the study was to identify and describe learning outcomes for plastic surgery education and training for which simulation might be an important (essential and useful) training method, and to identify and describe simulation modalities, linked to specific cognitive levels, to establish the influence of simulation on plastic surgery education and training as far as knowledge, skills, clinical competence and professional conduct are concerned.

Methods: Data were collected by means of a Delphi survey of an expert panel comprising nine plastic surgeons, supplemented by semi-structured interviews conducted with eight national and international role players in simulation and postgraduate education.

Results: Learning outcomes, levels of training, and possible simulation modalities, cognitive levels and descriptive verbs and phrases were described as these pertain to learning. Simulation in medical education, and its relation to simulation technology, were discussed. Recommendations regarding the inclusion of simulation in specialist training were offered.

Conclusion. A number of aspects surfaced that should be included in a framework that might serve as a directive for the inclusion of simulation in a training programme in plastic surgery.

Keywords: plastic surgery education and training, simulation, learning outcomes, cognitive levels

Introduction

Simulation is now in widespread use for professional health education; however, by itself, it is not a guarantee that adequate learning will occur. Simulation has to be integrated with the outcomes of the curriculum, applicable simulation modalities have to be used, the learning environment must be conducive to education and training, and the features and uses of simulation have to be optimally and correctly incorporated into the training programme.

Satava [1] is of the opinion that three concepts will be essential in revolutionising medical education, namely an increased efficiency of education by standardising the curriculum; an individualisation of education and a shift from time-based training to competency-based training.

Worldwide, different models exist for education and training in plastic surgery, including the model of learning through an apprenticeship relationship with senior clinical colleagues, own observation or self-directed learning – motivated by a candidate's own internal drive. In some cases, registrars receive little guidance in terms of the knowledge, competencies, skills and attitudes that they are expected to acquire during residency.

Rosen, Long, McGrath and Greer [2]point out that in contrast to the traditional apprenticeship model, twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, and hospital resources, and to minimise errors. The driving forces behind this came from developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy, simulation can improve results and also lower risk and procedure cost because of fewer procedures and less operating room time.[2]

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) identify six core competencies for residents: 'Patient care, medical knowledge, practice-based learning and improvement, inter-personal and communication skills, professionalism, and systems-based practice'.[3]

A joint initiative of the ACGME and the ABMS, *The Plastic Surgery Milestone Project,* compiled descriptors and targets for resident performance, based on the above-mentioned core competencies. These descriptors and targets (outcomes) can be categorised at five training levels, starting at Level 1 at which the resident demonstrates the mastering of milestones expected of an incoming resident, moving up to Level 5 where the resident has advanced beyond performance targets set for residency and is ready to graduate. [4]

Simulation represents a safe and standardised postgraduate training method, and also provides a yardstick for gauging residents' practical capabilities regarding procedures, surgery and teamwork in a clinical setting [3]. The American College of Surgeons (ACS) introduces simulation in training and education for general surgery in three phases, namely skills training, procedure training, and team training. Mittal *et al.*[3] propose that plastic surgery should follow this simulation initiative with modifications appropriate to the specialty. Phase 1, Skills, is attended to during the residents' general surgery training, but Phase 2, Procedures, focuses on the development of procedures specific to plastic surgery. For Phase 3, Competencies in teamwork, the competencies for plastic surgery resemble those for general surgery and include team-training simulators to improve communication in emergency departments, clinics, operating rooms, and hospital wards. [3]

Neumeister [5] mentions that many plastic surgery programmes find it problematic to balance clinical, hands-on education and training with their didactic programme. Work and duty hour restrictions add another layer of complexity to surgical education. Furthermore, the rate-limiting step in learning is not the transmission of information from the teacher to the learner, but rather the processing of the information by the learner.[5] Educational technology offers unique tools to help learners acquire and process the information needed to become masters in their surgical specialty.[5] Simulation in medical education and its relation to simulation technology have to be explored.

Many theories exist that explain how adults learn; for example, instrumental learning theories, humanistic theories, transformative learning theory, social theories of learning, as well as motivational and reflective models.[6] To understand the concept of learning effectiveness and learning at different cognitive levels or domains of competence, it is necessary to examine learning theories and for our purpose make these applicable to the discipline of plastic surgery.

According to Kolb's learning cycle, [6] learners must have a concrete experience on which they can reflect. Through their reflection, students are able to formulate abstract concepts, and make appropriate generalisations, after which they solidify their understanding by testing the implications of their knowledge in new situations. This then provides them with an objective experience, and the cycle continues. Learners with different learning preferences will have strengths in different quadrants of Kolb's cycle. [6]

To build knowledge and understanding, learners need to have 'some idea of where things fit, how they fit together, and some idea of how the individual pieces are part of a greater whole, otherwise learners will experience a sense of discomfort when they do not understand the context of an unknown learning situation'.[6] This can be achieved through a process called *instructional scaffolding* during which sufficient support is provided to promote learning when concepts and skills are introduced to students. This support may include resources, tasks, templates and guides, and/or guidance on the development of cognitive, social and practical skills. These *scaffolds* are gradually removed as students develop autonomous learning strategies to promote their own cognitive, affective, and psychomotor skills and knowledge. Most commonly, scaffolding includes providing learners with a list of intended learning outcomes when they enter the programme or a new clinical environment.[6] Learning outcomes should be formulated with Bloom's taxonomy in mind, designating the levels of cognition, namely knowledge, understanding, application, analysis, synthesis and evaluation.[7,8] Anderson's adapted version of this taxonomy uses verbs to describe the six levels of cognition, namely remember (level 1), understand, apply, analyse, evaluate and create (level 6).[8]

Bloom's original work led to several variants of scale to indicate competence. In medical education, the most frequently encountered is Miller's pyramid,[9] building up from knowledge of (knows how) to competence in performance, and independent action (shows how). This pyramid can be used as a guide for planning and assessing student learning, especially the mastery of skills, in a curriculum. [9]

Alinier[10] elucidates the relationship between Miller's pyramid for developing skills and competence, and the type of simulator most appropriate for each level, as well as the degree of simulator fidelity and the nature of skills that can be developed with each type of simulator. [10] Labuschagne [11] draws a comparison between Bloom's taxonomy and Miller's pyramid, and proposes the use of simulation for developing and demonstrating higher-order levels of thinking, which approximate the levels of thinking required in clinical practice. With the development of simulator technology providing greater degrees of fidelity, simulators readily can be employed as precision instruments in the measurement of performance in the clinical setting. Cregan and Watterson [12] claim that simulation makes it possible to assess the development from the ‘knows how’ to the ‘shows how’ category in Miller’s framework. Simulators, therefore, are valid instruments for assessment, on condition that the simulator type has sufficient fidelity to elicit the expected competencies and performance level and students should have had previous exposure to the simulators during training (the first encounter with a simulator should not be during assessment). [10,11]

Methods

The study did not focus on a quantitative approach to learner outcomes or/and the assessment of the outcomes, neither did it include an educational intervention in which simulation was used. The focus was on giving feedback about the opinions and perspectives of medical and health care professionals regarding whether and how simulation as education and training method can be included in training programmes for plastic surgeons.

The study comprised two separate investigations, namely (i) a Delphi survey, which consisted of experts indicating the importance or not of a number of outcomes that may be addressed by simulation as one of the methods of training. They also had the opportunity to explore the use of simulation in attaining the outcomes by making suggestions on the applicable simulation modality, as well as the cognitive level of learning of each outcome. The second data collection method was (ii) semi-structured interviews with national and international role players in simulation and postgraduate education to investigate their ideas and opinions on simulation as teaching and learning method.

Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences (HSREC), UFS (ECUFS 122/2015).

The methods used in this research included a literature study, a Delphi survey and semi-structured interviews. The learning outcomes were developed (adapted) from literature,[4] and categorised in training levels used as point of departure in compiling the Delphi questionnaire. [4]

The Delphi survey

Data collection

The survey questionnaire sent to the Delphi panel consisted of three parts. Part 1 (the Delphi questions regarding the importance of simulation as a method) comprised items in two main categories, namely medical knowledge and patient care, with 18 sections in total, divided into five education and training levels totalling 453 learning outcomes. The panellists had to indicate the importance of simulation as an education and training method for each of the outcomes by indicating whether simulation was an essential method, a useful method, or not applicable/important in training a plastic surgeon as far as that specific outcome was concerned.

In Part 2 of the questionnaire (regarding simulation modalities) for the Delphi process, the members of the panel were asked to give their opinion on each learning outcome and indicate, if they wished to do so, which type of simulation modality (low-tech simulation or high-tech simulation), would be best suited for achieving that learning outcome. In Part 3 of the questionnaire (regarding the cognitive levels) the panellists had to indicate which level of learning should be addressed by simulation to achieve the specific outcome. After two Delphi rounds sufficient consensus (92,05%) was achieved and the process came to an end. On the remaining statements (7,95%) stability was reached after panellists indicated at the end of the second round that they would not be changing their answers in a third round. The results of Parts 1, 2 and 3 of the Delphi survey are reported here.

Target population

A letter of invitation to participate in the Delphi survey was sent to experts in the field of Plastic Surgery, selected according to a set of criteria. Nine experts in plastic surgery and clinical simulation agreed to participate in the Delphi .process . These experts were all qualified plastic surgeons; they were knowledgeable about medical education and served as policy makers, leaders and managers in postgraduate education. They are of high national and international academic and scientific standing.

Data analysis

The analysis of the data collected in the Delphi process was done by the researcher. Responses were entered into a computer spreadsheet for the calculation of consensus or stability. The results were reported separately, listing the experts' comments on simulation as a method to train plastic surgeons, the uses and applicability of simulation modalities, as well as the levels of cognition that might be addressed by simulation.

Reliability and trustworthiness

Reliability was ensured by making use of pilot studies, determining strict criteria in sample selection, and by using a carefully constructed Delphi questionnaire based on a detailed literature study. Trustworthiness was ensured by subjecting the research protocol to the Evaluation and Ethics Committees of the Faculty of Health Sciences; University of the Free State, South Africa; by conducting an in-depth literature study and by providing a thorough description of the whole research project.

Semi-structured interviews

Data collection

Semi-structured interviews were used to explore role-players' opinions and perceptions on simulation-based education. The purpose was to investigate simulation in postgraduate education and training. The interviews were conducted to obtain an in-depth, comprehensive overview of the contribution that simulation might make in postgraduate plastic surgery education and training. An interview guide, developed by the author on the basis of a literature review was used. Data on questions 5, 6 and 12 of the interview guide are reported on in this article to supplement the results and findings of the Delphi questionnaire.

Questions 5, 6 and 12 were formulated as follows in the interview guide:

- Can simulation be used to enhance student learning at different cognitive levels? (Will the student only use simulation to remember knowledge / or understand / or apply / or analyse / or evaluate / or create new concepts and ideas?)
- Which types of simulation or simulation modalities might lead to effective learning?
- Any recommendation(s) you would like to make when considering including simulation in specialist training?

Questions 1-4, 7-11 and 13 are not included here because their data are not directly applicable to the objectives of this article. The findings reported on questions 3, 4 and 7 were dealt with in an article, *Simulation in plastic surgery: features and uses that lead to effective learning* (Author CPG).[13]

Target population

Role players in simulation and postgraduate education were requested to participate in the semi-structured interviews. The eight participants were directors of simulation units, clinical heads of clinical medical departments, programme directors of medical and nursing programmes and education management specialists, researchers and representatives from the simulation industry. Written consent was obtained from the participants.

Data collection and analysis

Individual interviews based on a single interview guide were conducted with eight participants by the author (CPG). All interviews were audio-recorded, transcribed by the author (CPG) and checked by an independent person who was not part of the study. Field notes taken during the interviews contributed to the data. The data were analysed using the grounded theory approach that requires continued comparison of data, following the data analysis steps of coding, categorisation and theory generation.[14] Theory building occurred by finding patterns in the data and this continued until saturation of data was reached.[15]

Reliability and trustworthiness

Reliability was ensured by making use of explorative studies, determining strict criteria for sampling, using the carefully constructed interview guide, as well as an interview process that was audio-taped and carefully described. Trustworthiness of the interviewing process was ensured by involving voluntary interviewees with a clear understanding of what the interviewer expected from them, and using open-ended questions, as well as the transcription of and verifying the accuracy of data. Scientific record keeping ensured dependability.

Results

Data collected through Parts 1–3 of the Delphi questionnaire survey and by means of Questions 5, 6 and 12 of the semi-structured interviews are reported. Data on simulation modalities and cognitive levels are summarised and qualitative perspectives are shared on whether simulation can be used to enhance student learning at different cognitive levels, as well as on the types of simulation modalities that may lead to effective learning. Recommendations that were made by the interviewees are discussed with a view to the possibility of the inclusion of simulation in specialist training.

Questionnaire for Delphi panel (Parts 1–3)

After completing Round 2 of the Delphi process, consensus was reached on 208 of the 453 learning outcomes (descriptors in the form of statements), indicating that simulation as a method of training for plastic surgeons was important (45,92%). Consensus was reached on 209 statements (46,14%), indicating that simulation was not applicable/not important as a method of training. Consensus could not be reached on 36 statements (7,95%), but stability was reached.

The results of the eighteen sections of the Delphi questionnaire were summarised. Each section dealt with the learning outcomes categorised on five education and training levels indicated from L1-5. The first statements related to medical knowledge, while the statements in the second part (in italics) related to patient care.

The Delphi experts indicated where simulation **might play a role of importance and be of value as one of the training methods in the specialist training of plastic surgeons**. The Delphi panel indicated which type of simulation modality, namely low-tech and/or high-tech could be applied, as well as the cognitive level that would be addressed by the simulation. The different descriptive phrases/verbs that were used to formulate these specific learning outcomes at the five education and training levels, as well as the proposed simulation modality and cognitive levels at which learning might take place are described. This is done to serve as an example and to provide an overview of the data that had been gathered during the Delphi process.

The **SECTION ON SURGICAL CARE**, for example, which consisted of the main categories, namely medical knowledge and patient care, resulted in 14 learning outcomes (covering five training levels) being indicated by the Delphi panel as outcomes for which simulation might be used as a training method.

Statements on medical knowledge are in ordinary print and statements on patient care are printed in italics.

The descriptive verbs (action verbs) used in the learning outcomes at **Training Level 1**, for example, were **demonstrates, examines, and performs. The experts indicated, for example,**

that simulation might be important as one of the methods to train the registrars to reach the following outcomes:

Demonstrates an understanding of the principles utilised to ensure surgical safety (e.g. consent, patient positioning, aseptic techniques, skin preparation, universal precautions and the use of appropriate instruments);
Examines surgical patients while using algorithms like ATLS (advanced trauma life support) and ACLS (advanced cardiac life support); and
Performs basic techniques in the management of a surgical patient independently (e.g. urethral catheterisation and nasogastric [NG] tube placement).

It was indicated that low-tech simulation modalities could be used to attain these outcomes, which were indicated as outcomes at the lower cognitive levels, namely **remembering, understanding and applying.**

The descriptive verbs used in the learning outcomes at **Training Level 2**, were **conducts, performs and recognises**. **The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to reach the following outcomes:**
Conducts (with assistance) surgical consultations;
Performs routine procedures independently (e.g., central line placement, biopsies, incision and drainage, chest tube placement, laceration repair and wound closure); and
Recognises patterns and prioritises management offering at least one solution.

It was indicated that low-tech simulation modalities and standardised patients might be used to **conduct** consultations, **recognise** patterns and **prioritise** management-offering solutions; while for **performing** routine procedures low-tech and high-tech modalities might be used and were indicated as outcomes at the cognitive levels of **remembering, understanding, applying and analysing.**

The descriptive verbs in the learning outcomes at **Training Level 3** were **manages, manages independently** and **identifies. The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to attain the following outcomes:**
Manages (under supervision) a surgical patient afflicted by multi-systemic disorders;

Independently manages multiple surgical consultations and patients; and
Identifies exceptions and offers at least three possible solutions.

It was indicated that low- and high-tech simulation modalities could be used to manage a surgical patient at the lower cognitive levels of **remembering** and **understanding.** To independently manage multiple surgical consultations and patients could be used at the level of **remembering, understanding and applying,** while to identify exceptions and offer solutions low- and high-tech simulation modalities were suggested at cognitive levels 1–3.

The descriptive verbs used in the learning outcomes at **Training Level 4,** for example, were **demonstrates, anticipates and manages. The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to reach the following outcomes:**

Demonstrates an understanding of the management of complicated multi-systemic surgical pathophysiological processes, ranging from intensive care to organ system support;
Anticipates potential problems and devises management plans of novel solutions; and
Manages a surgical firm.

It was indicated that low- and high-tech simulation modalities could be used to attain these outcomes, which were at cognitive levels 1–3, but to anticipate potential problems would require the higher cognitive level of **analysing** as well.

The descriptive verbs used in the learning outcomes at **Training Level 5,** for example, were **develops, implements and teaches**. **The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to reach the following outcomes:**

Develops or implements simulation for the teaching and evaluation of surgical skills; and
Teaches and supervises other learners involved in patient management.
Low-tech and high-tech simulation modalities were indicated for use at all six levels from remembering and knowledge up to the highest cognitive level of creating and evaluation.

It is important to understand by changing the action verb in an outcome or to formulate a simulation scenario at a higher difficulty level the learning that can take place will be at a higher cognitive level and will influence the effectiveness of learning.

The discussion on Section 1, namely surgical care, serves as an example. The other sections are wound care, tissue transfer, congenital anomalies, head and neck, maxillofacial trauma, facial aesthetics, non-cancer breast surgery, breast reconstruction, reconstruction of trunk and perineum, upper extremity trauma, non-trauma hand, cosmetic trunk and lower extremity, and lower extremity, lower extremity, system-based practice, practice-based learning and improvement, professionalism and interpersonal- and communication skills. Simulation was indicated as a possible method for training plastic surgeons at each training level, using low- and/or high-tech simulation modalities and simulated patients at different cognitive levels with the learning outcomes formulated for the first years of training at a lower level, while training in the later years would be at a higher cognitive level.

Only 20 learning outcomes were indicated to be trained by simulation in the sections on system-based practice (including patient safety, resource allocation and practice); six of the twenty were in the domain of patient safety. The section on practice-based learning and improvement, including investigate, evaluate, and assimilate, entailed five learning outcomes, while research and training had four learning outcomes.

In the section on professionalism (ethics and values, and personal accountability) the Delphi experts indicated only three learning outcomes that possibly might be reached by simulation, and these were in the domain of personal accountability.

In the final section, namely interpersonal and communication skills, only two learning outcomes were indicated that might be reached by simulation. Although a low applicability of simulation in the domain of the softer skills was indicated by the Delphi panel, it must be emphasised that they were of the opinion that it should be done at the higher cognitive levels, mostly cognitive level six, evaluate and create.

Semi-structured interviews

Table 1 shows the different interviewees' perspectives on the types of simulation modalities that might lead to effective learning.

Table 1: The types of simulation or simulation modalities that may lead to effective learning

1. Low-tech simulation modalities *(e.g. organ models; basic plastic manikins & simple skills trainers; animal models; human cadavers; simulated or standardised patients)*
Using simulated patients (SPs) and/or standardised patients may result in effective learning: • 'SPs play an important role in a controlled and safe environment' (D1) • 'SPs play an important role in teaching the resident communication skills – they can teach the student how to talk to a patient in a professional way' (D1) • 'SPs teach according a standardised manner (will make use of a script) and make an impact/impression with their feedback to a student' – e.g. 'You did not look me in the eye/ or did not even greet me' (D1) • 'SP's feedback is very important' –'It is a strong, powerful thing' (D1) • 'Standardised patients play an important role when used in assessment' (C1) Task trainers play an important role in achieving effective learning: • 'Heart of simulators' (I1) • 'How do you move from task training skill development' – 'you need to figure out what you want to train' (I1) • 'Task trainers' focus is on skills training, e.g. psychomotor skills for where you control procedure' (D1) • 'We used wet models for basic training' (D1)
2. High-tech simulation models *(e.g. screen-based simulators; realistic, high-fidelity procedural simulators (task trainers); realistic high-tech interactive patient simulators; (virtual reality) (cf. Delphi questionnaire)*
High-tech simulation plays an important role in achieving effective learning: • 'Important role not to be underestimated/underrated (laparoscopic skills)' (D1) High fidelity simulation plays an important role in achieving effective learning: • 'Used for resuscitation training, intensive care training' (D1) • 'High fidelity more focused on integrated type of scenarios' (D1) • 'You must get the feeling working the simulator in, for example, your clinical field – it must be high-fidelity' (C1)

- ‘Task trainers to learn hand skills – but high fidelity and high performance simulators have their place in high performance and critical incidents’ [C1]

Other simulation principles that play an important role in attaining effective learning:

- ’All types of simulators have a role to play’ (C1)
- ‘You don’t need the most expensive – it may do more harm’ (I1)
- ‘Outcomes in curriculum must be aligned with what you want to teach, e.g. psychomotor/communication/clinical skills, etc.’ (D1)
- ‘Include high fidelity simulation from year one of training’ (D1)
- ‘Use high fidelity simulations to assess registrar’s skills’ (C2)
- ‘At conferences we practised on virtual reality simulation for cataract and retinal surgery’ (D1)
- ‘Use bench models to practise psychomotor skills where necessary until they feel competent’ (D1)
- ‘Practise soft skills, e.g. interpersonal communication and interprofessional collaboration, etc. with simulation’ (D1)
- ‘Used to train registrars on flat screen to have hand skills – registrars practise skills but consultants make decisions’ (C1)

3. Using low-tech and high-tech simulators

The influence of low- and high-tech simulation modalities:

- ‘We use both Low Fidelity (LF) and High Fidelity (HF) simulators. Students master the individual task components using the task-trainers (LF)’ (D2)
- ‘To train and experience the holistic scenario with all its consequences we use the HF to put emphasis on integration, group work and the multidisciplinary approach’ (D2)
- ‘Using both, but a higher fidelity simulator can take you to a higher level’ (S1)

Where Table 1 focused on the types of simulation or simulation modalities that lead to effective learning, Table 2 shows the effect of simulation on the enhancement of learning at different cognitive levels.

Table 2: The enhancement of student learning through simulation at different cognitive levels

1. Simulation at different cognitive levels may enhance student learning *(A: Remembering / B: Understanding / C: Development and applying / D: Analysing / E: Evaluating / F: Creating)*
<u>Identify the level of competence or expertise</u> • 'It is important to first identify the competence or expertise, (in context) that is needed from the qualified professionals' (I1) • 'Then training the registrars it is necessary to master competence and maintaining it on the specific level of competence/expertise in the specific discipline' (I1) • 'Look at cognitive levels but also understand that human development is on emotional experience - having cognitive, motor, social and other skills to take into account' (I1) • 'The field of specialists should include well defined objectives and competencies – you have to assess the levels for competence' (C2) • 'The difference between competence and proficiency should be described clearly' (C2) • 'Research is needed to cover ethics and legal aspects as far as competence is concerned' (C) <u>Simulation gives the opportunity to learn at different cognitive levels</u> • 'The registrars can practice skills until they feel competent' (D)] • 'When the registrars are exposed to a specific situation/scenario they get the opportunity to go back and revisit what went wrong and how they can improve by doing so – thus they learn on different cognitive levels' (D1) • 'Registrars are exposed to critically ill patients, for example in surgery and intensive care disciplines'(D1) • 'It is important that they are trained in a safe environment – especially junior registrars who are not yet experienced' (D1) • 'It is also important that registrars be on the same level of competency (e.g. with resuscitation) – so simulation training on different cognitive levels takes place including they have to analyse the situation, interpret facts and act on what they see' (D1) • 'It is possible that simulation can also be done on various cognitive levels using task trainers for specific procedures' (D1)

• 'Simulation can enhance student learning at different cognitive levels: remembering of knowledge (during preparation; understanding and applying using low fidelity simulators); analysing and evaluation (using high fidelity simulators) and developing and formulating new concepts and ideas' (D2) • 'During simulation students can go from pure knowledge information to practical knowledge fast' (C2) • 'Through using interprofessional teams in multipurpose, complex scenarios, with real world experiences, can take you through all the cognitive levels of learning' (S1) • 'Ensures team-based competence' (S1) • 'Better outcomes for patients' (S1) • 'Using SP's for the development of team-based communication skills and professionalism' (S2) • 'Patient management and clinical decision making and skills development in postgraduate medical education: the importance increases because the seniority of the person going through the system increases – so it takes more and more responsibility in leading teams and decision-making – simulation on higher cognitive levels very important' (S1)

Recommendations (which were made by the interviewees when considering including simulation in specialist training) focus on curriculum and training initiatives, various aspects that must be in place, suggesting specific planning and supporting efforts with a view to ensuring the quality of training.

Table 3: Recommendations to consider when including simulation in specialist training

1. Training
<u>Development of training course</u> • 'It is recommended to develop and implement a 'train the trainer' course' (C3, D1, I1) • 'It is recommended to use a totally integrated education and training system: theoretical lectures, simulation sessions and clinical work on real patients – try to find a balance' (D1)
2. Curriculum
<u>Alignment of curriculum</u>

- ‘It is recommended that the role of feedback; deliberate practice; the contribution of SPs; integration of simulation into the programme; aligned curriculum outcomes; simulation learning outcomes; and assessment; as well as protected training time, etc. to be highly valued’ (D1)
- ‘It is recommended to sit down and plan in detail: what are you going to take out of curriculum and/or with what are you going to replace it ‘(D1)
- ‘It is recommended to reach a point that you plan in detail to have an integrated, structured, compulsory and intrinsically motivated simulation included, specialized programme’ (C1)
- ‘The person who has to develop the curriculum, should be knowledgeable about curriculum development; debriefing must be planned; suitable space; objective idea; way to transfer it effectively; outcomes necessary; support structures and safety must be planned; ventilation and light; bathrooms; medical equipment; staff, etc.’ (C3)
- ‘Needs to be a coordinated process’ [S1]

3. Assessment

End evaluation

- ‘It is recommended to try and find a system where you can use simulation in practical examinations (before end evaluation) to ensure that the registrar is ’safe’ and ’quick’ to operate/apply certain skills’ (C1, D1)

4. Quality

Workplace assessment and feedback

- ‘Remember: the good trainees are always harder on themselves and bad trainees think they don’t have problems – so self-evaluation is notoriously weak for weak candidates and notoriously over harsh on good candidates – they never think they are good enough’ (S1)
- ‘Doing on a regular basis and feedback into your planning’ (S1)

Perspectives on the use of simulation modalities and how simulation might enhance learning at different cognitive levels were addressed by semi-structured interview questions 5 and 6.

The data gathered by means of the semi-structured interview Questions 5, 6 and 12 were triangulated with the data gathered through Parts 1-3 of the questionnaire survey, and by means of the literature review with a view to identify aspects for compiling a framework to serve as a directive when considering the inclusion of simulation as one of the methods to train a plastic surgeon.

Discussion

A description of the learning outcomes, levels of training, and possible simulation modalities, cognitive levels and descriptive verbs and phrases as these pertain to learning, was given. Simulation in medical education, and its relation to simulation technology, were discussed. Recommendations for considering the inclusion of simulation in specialist training were offered.

It is clear from the feedback of the Delphi survey panel that respondents were positive that almost 46% of the proposed learning outcomes might be reached by including simulation as one of the instructional methods in the postgraduate education and training programme for plastic surgeons. The respondents were of the opinion that simulation might be implemented at all training levels, 1-5, during the training years – albeit less in the earlier years of training. In the earlier years of training students should concentrate more on remembering and understanding knowledge, followed by the mastering and application of skills, with analysing (analysis), evaluating (evaluation) and creating (synthesis) in later years of training.

The Delphi respondents further expressed the opinion that simulation might be important as a method for training students in medical knowledge, skills, competencies and patient care; however, they did not favour simulation as the better training method in the 'softer skills', for example, team training, patient safety, interpersonal and communication skills, professionalism, ethics, values and personal accountability, although literature suggests the opposite. The Delphi respondents, however, emphasised the importance of these skills being trained at higher cognitive levels to reach maximum competencies and proficiency in professional conduct.

As far as the type of simulators used is concerned the participants agreed that the simulation type should be in line with the objectives of the scenarios: Scenarios set at higher cognitive levels would enhance learning using high-tech simulators and simulated patients.

Simulation provides opportunities to learn at different levels. It is important to identify the competence or expertise that is needed at each training level as well as for the qualified professional.

When considering including simulation in specialist training the authors recommend the following:

1. Aligning the curriculum with the simulation plan according to a scientific and coordinated process and guidelines.
2. Developing a training course for the trainers before implementing simulation in the plastic surgery programme.
3. Researching the role of simulation in assessment carefully before implementation.
4. Assessing/evaluating the workplace environment on a continuous basis and carefully considering the feedback received from role players.

From the results of this study, and supported by literature cited [2-5, 12] we developed a clear reasoning process to build an argument favouring the implementation of simulation in postgraduate plastic surgery education and training programmes. It is clear that certain processes must be in place and steps should be taken to ensure that adequate learning will occur, and that simulation outcomes are integrated with the objectives and outcomes of the curriculum within an environment that is conducive to learning.

It is evident from the research that simulation in plastic surgery education and training programmes will enhance effective learning. Further research is needed on simulation to enhance plastic surgery education and training.[16]

Conclusion

Aspects worthy of further investigation with a view to developing a framework that can be applied to serve as a directive for including simulation in plastic surgery are the following: features and uses of simulation, types of simulation modalities, learning at different cognitive levels and the factors enhancing the effectiveness of learning; the role and value of simulation, the contribution that simulation can make, and the quality of training; main considerations and challenges to take into account for implementation, as well as recommendations to compile guidelines for implementation. A framework based on the proposed aspects will definitely make a contribution to postgraduate plastic surgery education and training.

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Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes

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Author contribution.
CPGN designed the study, wrote the protocol, collected data and performed analysis, interpreted data and wrote the manuscript. GJvZ and MJL were supervisors of the study, reviewed the protocol and manuscript and contributed substantially to the conceptualisation, design, analysis and interpretation of data and scientific content. All authors approved the final version of the manuscript submitted.

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Abstract:

Background: This research investigated the possibility of integrating simulation in plastic surgery residency training. The problem addressed was the lack of knowledge about using simulation as an essential or useful method to enhance the training of plastic surgeons. A lack of empirical evidence existed concerning learning outcomes that could be mastered by simulation-based education and training and their specific cognitive levels.

Objective: The objective of the study was to identify and describe learning outcomes for plastic surgery education and training for which simulation might be an important (essential and useful) training method, and to identify and describe simulation modalities, linked to specific cognitive levels, to establish the influence of simulation on plastic surgery education and training as far as knowledge, skills, clinical competence and professional conduct are concerned.

Methods: Data were collected by means of a Delphi survey of an expert panel comprising nine plastic surgeons, supplemented by semi-structured interviews conducted with eight national and international role players in simulation and postgraduate education.

Results: Learning outcomes, levels of training, and possible simulation modalities, cognitive levels and descriptive verbs and phrases were described as these pertain to learning. Simulation in medical education, and its relation to simulation technology, were discussed. Recommendations regarding the inclusion of simulation in specialist training were offered.

Conclusion. A number of aspects surfaced that should be included in a framework that might serve as a directive for the inclusion of simulation in a training programme in plastic surgery.

Keywords: plastic surgery education and training, simulation, learning outcomes, cognitive levels

Introduction

Simulation is now in widespread use for professional health education; however, by itself, it is not a guarantee that adequate learning will occur. Simulation has to be integrated with the outcomes of the curriculum, applicable simulation modalities have to be used, the learning environment must be conducive to education and training, and the features and uses of simulation have to be optimally and correctly incorporated into the training programme.

Satava [1] is of the opinion that three concepts will be essential in revolutionising medical education, namely an increased efficiency of education by standardising the curriculum; an individualisation of education and a shift from time-based training to competency-based training.

Worldwide, different models exist for education and training in plastic surgery, including the model of learning through an apprenticeship relationship with senior clinical colleagues, own observation or self-directed learning – motivated by a candidate's own internal drive. In some cases, registrars receive little guidance in terms of the knowledge, competencies, skills and attitudes that they are expected to acquire during residency.

Rosen, Long, McGrath and Greer [2]point out that in contrast to the traditional apprenticeship model, twenty-first century surgical training is characterised by an increasingly objective, standardised approach using equipment such as simulators to optimise patient safety, surgical care, and hospital resources, and to minimise errors. The driving forces behind this came from developments in medical error statistics, evidence-based medicine, and fewer attending hours. Through increased accuracy, simulation can improve results and also lower risk and procedure cost because of fewer procedures and less operating room time.[2]

The Accreditation Council for Graduate Medical Education (ACGME) and the American Board of Medical Specialties (ABMS) identify six core competencies for residents: 'Patient care, medical knowledge, practice-based learning and improvement, inter-personal and communication skills, professionalism, and systems-based practice'.[3]

A joint initiative of the ACGME and the ABMS, *The Plastic Surgery Milestone Project,* compiled descriptors and targets for resident performance, based on the above-mentioned core competencies. These descriptors and targets (outcomes) can be categorised at five training levels, starting at Level 1 at which the resident demonstrates the mastering of milestones expected of an incoming resident, moving up to Level 5 where the resident has advanced beyond performance targets set for residency and is ready to graduate. [4]

Simulation represents a safe and standardised postgraduate training method, and also provides a yardstick for gauging residents' practical capabilities regarding procedures, surgery and teamwork in a clinical setting [3]. The American College of Surgeons (ACS) introduces simulation in training and education for general surgery in three phases, namely skills training, procedure training, and team training. Mittal *et al.*[3] propose that plastic surgery should follow this simulation initiative with modifications appropriate to the specialty. Phase 1, Skills, is attended to during the residents' general surgery training, but Phase 2, Procedures, focuses on the development of procedures specific to plastic surgery. For Phase 3, Competencies in teamwork, the competencies for plastic surgery resemble those for general surgery and include team-training simulators to improve communication in emergency departments, clinics, operating rooms, and hospital wards. [3]

Neumeister [5] mentions that many plastic surgery programmes find it problematic to balance clinical, hands-on education and training with their didactic programme. Work and duty hour restrictions add another layer of complexity to surgical education. Furthermore, the rate-limiting step in learning is not the transmission of information from the teacher to the learner, but rather the processing of the information by the learner.[5] Educational technology offers unique tools to help learners acquire and process the information needed to become masters in their surgical specialty.[5] Simulation in medical education and its relation to simulation technology have to be explored.

Many theories exist that explain how adults learn; for example, instrumental learning theories, humanistic theories, transformative learning theory, social theories of learning, as well as motivational and reflective models.[6] To understand the concept of learning effectiveness and learning at different cognitive levels or domains of competence, it is necessary to examine learning theories and for our purpose make these applicable to the discipline of plastic surgery.

According to Kolb's learning cycle, [6] learners must have a concrete experience on which they can reflect. Through their reflection, students are able to formulate abstract concepts, and make appropriate generalisations, after which they solidify their understanding by testing the implications of their knowledge in new situations. This then provides them with an objective experience, and the cycle continues. Learners with different learning preferences will have strengths in different quadrants of Kolb's cycle. [6]

To build knowledge and understanding, learners need to have 'some idea of where things fit, how they fit together, and some idea of how the individual pieces are part of a greater whole, otherwise learners will experience a sense of discomfort when they do not understand the context of an unknown learning situation'.[6] This can be achieved through a process called *instructional scaffolding* during which sufficient support is provided to promote learning when concepts and skills are introduced to students. This support may include resources, tasks, templates and guides, and/or guidance on the development of cognitive, social and practical skills. These *scaffolds* are gradually removed as students develop autonomous learning strategies to promote their own cognitive, affective, and psychomotor skills and knowledge. Most commonly, scaffolding includes providing learners with a list of intended learning outcomes when they enter the programme or a new clinical environment.[6] Learning outcomes should be formulated with Bloom's taxonomy in mind, designating the levels of cognition, namely knowledge, understanding, application, analysis, synthesis and evaluation.[7,8] Anderson's adapted version of this taxonomy uses verbs to describe the six levels of cognition, namely remember (level 1), understand, apply, analyse, evaluate and create (level 6).[8]

Bloom's original work led to several variants of scale to indicate competence. In medical education, the most frequently encountered is Miller's pyramid,[9] building up from knowledge of (knows how) to competence in performance, and independent action (shows how). This pyramid can be used as a guide for planning and assessing student learning, especially the mastery of skills, in a curriculum. [9]

Alinier[10] elucidates the relationship between Miller's pyramid for developing skills and competence, and the type of simulator most appropriate for each level, as well as the degree of simulator fidelity and the nature of skills that can be developed with each type of simulator. [10] Labuschagne [11] draws a comparison between Bloom's taxonomy and Miller's pyramid, and proposes the use of simulation for developing and demonstrating higher-order levels of thinking, which approximate the levels of thinking required in clinical practice. With the development of simulator technology providing greater degrees of fidelity, simulators readily can be employed as precision instruments in the measurement of performance in the clinical setting. Cregan and Watterson [12] claim that simulation makes it possible to assess the development from the ‘knows how’ to the ‘shows how’ category in Miller’s framework. Simulators, therefore, are valid instruments for assessment, on condition that the simulator type has sufficient fidelity to elicit the expected competencies and performance level and students should have had previous exposure to the simulators during training (the first encounter with a simulator should not be during assessment). [10,11]

Methods

The study did not focus on a quantitative approach to learner outcomes or/and the assessment of the outcomes, neither did it include an educational intervention in which simulation was used. The focus was on giving feedback about the opinions and perspectives of medical and health care professionals regarding whether and how simulation as education and training method can be included in training programmes for plastic surgeons.

The study comprised two separate investigations, namely (i) a Delphi survey, which consisted of experts indicating the importance or not of a number of outcomes that may be addressed by simulation as one of the methods of training. They also had the opportunity to explore the use of simulation in attaining the outcomes by making suggestions on the applicable simulation modality, as well as the cognitive level of learning of each outcome. The second data collection method was (ii) semi-structured interviews with national and international role players in simulation and postgraduate education to investigate their ideas and opinions on simulation as teaching and learning method.

Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences (HSREC), UFS (ECUFS 122/2015).

The methods used in this research included a literature study, a Delphi survey and semi-structured interviews. The learning outcomes were developed (adapted) from literature,[4] and categorised in training levels used as point of departure in compiling the Delphi questionnaire. [4]

The Delphi survey

Data collection

The survey questionnaire sent to the Delphi panel consisted of three parts. Part 1 (the Delphi questions regarding the importance of simulation as a method) comprised items in two main categories, namely medical knowledge and patient care, with 18 sections in total, divided into five education and training levels totalling 453 learning outcomes. The panellists had to indicate the importance of simulation as an education and training method for each of the outcomes by indicating whether simulation was an essential method, a useful method, or not applicable/important in training a plastic surgeon as far as that specific outcome was concerned.

In Part 2 of the questionnaire (regarding simulation modalities) for the Delphi process, the members of the panel were asked to give their opinion on each learning outcome and indicate, if they wished to do so, which type of simulation modality (low-tech simulation or high-tech simulation), would be best suited for achieving that learning outcome. In Part 3 of the questionnaire (regarding the cognitive levels) the panellists had to indicate which level of learning should be addressed by simulation to achieve the specific outcome. After two Delphi rounds sufficient consensus (92,05%) was achieved and the process came to an end. On the remaining statements (7,95%) stability was reached after panellists indicated at the end of the second round that they would not be changing their answers in a third round. The results of Parts 1, 2 and 3 of the Delphi survey are reported here.

Target population

A letter of invitation to participate in the Delphi survey was sent to experts in the field of Plastic Surgery, selected according to a set of criteria. Nine experts in plastic surgery and clinical simulation agreed to participate in the Delphi .process . These experts were all qualified plastic surgeons; they were knowledgeable about medical education and served as policy makers, leaders and managers in postgraduate education. They are of high national and international academic and scientific standing.

Data analysis

The analysis of the data collected in the Delphi process was done by the researcher. Responses were entered into a computer spreadsheet for the calculation of consensus or stability. The results were reported separately, listing the experts' comments on simulation as a method to train plastic surgeons, the uses and applicability of simulation modalities, as well as the levels of cognition that might be addressed by simulation.

Reliability and trustworthiness

Reliability was ensured by making use of pilot studies, determining strict criteria in sample selection, and by using a carefully constructed Delphi questionnaire based on a detailed literature study. Trustworthiness was ensured by subjecting the research protocol to the Evaluation and Ethics Committees of the Faculty of Health Sciences; University of the Free State, South Africa; by conducting an in-depth literature study and by providing a thorough description of the whole research project.

Semi-structured interviews

Data collection

Semi-structured interviews were used to explore role-players' opinions and perceptions on simulation-based education. The purpose was to investigate simulation in postgraduate education and training. The interviews were conducted to obtain an in-depth, comprehensive overview of the contribution that simulation might make in postgraduate plastic surgery education and training. An interview guide, developed by the author on the basis of a literature review was used. Data on questions 5, 6 and 12 of the interview guide are reported on in this article to supplement the results and findings of the Delphi questionnaire.

Questions 5, 6 and 12 were formulated as follows in the interview guide:

- Can simulation be used to enhance student learning at different cognitive levels? (Will the student only use simulation to remember knowledge / or understand / or apply / or analyse / or evaluate / or create new concepts and ideas?)
- Which types of simulation or simulation modalities might lead to effective learning?
- Any recommendation(s) you would like to make when considering including simulation in specialist training?

Questions 1-4, 7-11 and 13 are not included here because their data are not directly applicable to the objectives of this article. The findings reported on questions 3, 4 and 7 were dealt with in an article, *Simulation in plastic surgery: features and uses that lead to effective learning* (Author CPG).[13]

Target population

Role players in simulation and postgraduate education were requested to participate in the semi-structured interviews. The eight participants were directors of simulation units, clinical heads of clinical medical departments, programme directors of medical and nursing programmes and education management specialists, researchers and representatives from the simulation industry. Written consent was obtained from the participants.

Data collection and analysis

Individual interviews based on a single interview guide were conducted with eight participants by the author (CPG). All interviews were audio-recorded, transcribed by the author (CPG) and checked by an independent person who was not part of the study. Field notes taken during the interviews contributed to the data. The data were analysed using the grounded theory approach that requires continued comparison of data, following the data analysis steps of coding, categorisation and theory generation.[14] Theory building occurred by finding patterns in the data and this continued until saturation of data was reached.[15]

Reliability and trustworthiness

Reliability was ensured by making use of explorative studies, determining strict criteria for sampling, using the carefully constructed interview guide, as well as an interview process that was audio-taped and carefully described. Trustworthiness of the interviewing process was ensured by involving voluntary interviewees with a clear understanding of what the interviewer expected from them, and using open-ended questions, as well as the transcription of and verifying the accuracy of data. Scientific record keeping ensured dependability.

Results

Data collected through Parts 1–3 of the Delphi questionnaire survey and by means of Questions 5, 6 and 12 of the semi-structured interviews are reported. Data on simulation modalities and cognitive levels are summarised and qualitative perspectives are shared on whether simulation can be used to enhance student learning at different cognitive levels, as well as on the types of simulation modalities that may lead to effective learning. Recommendations that were made by the interviewees are discussed with a view to the possibility of the inclusion of simulation in specialist training.

Questionnaire for Delphi panel (Parts 1–3)

After completing Round 2 of the Delphi process, consensus was reached on 208 of the 453 learning outcomes (descriptors in the form of statements), indicating that simulation as a method of training for plastic surgeons was important (45,92%). Consensus was reached on 209 statements (46,14%), indicating that simulation was not applicable/not important as a method of training. Consensus could not be reached on 36 statements (7,95%), but stability was reached.

The results of the eighteen sections of the Delphi questionnaire were summarised. Each section dealt with the learning outcomes categorised on five education and training levels indicated from L1-5. The first statements related to medical knowledge, while the statements in the second part (in italics) related to patient care.

The Delphi experts indicated where simulation **might play a role of importance and be of value as one of the training methods in the specialist training of plastic surgeons**. The Delphi panel indicated which type of simulation modality, namely low-tech and/or high-tech could be applied, as well as the cognitive level that would be addressed by the simulation. The different descriptive phrases/verbs that were used to formulate these specific learning outcomes at the five education and training levels, as well as the proposed simulation modality and cognitive levels at which learning might take place are described. This is done to serve as an example and to provide an overview of the data that had been gathered during the Delphi process.

The **SECTION ON SURGICAL CARE**, for example, which consisted of the main categories, namely medical knowledge and patient care, resulted in 14 learning outcomes (covering five training levels) being indicated by the Delphi panel as outcomes for which simulation might be used as a training method.

Statements on medical knowledge are in ordinary print and statements on patient care are printed in italics.

The descriptive verbs (action verbs) used in the learning outcomes at **Training Level 1**, for example, were **demonstrates, examines, and performs. The experts indicated, for example,**

that simulation might be important as one of the methods to train the registrars to reach the following outcomes:

Demonstrates an understanding of the principles utilised to ensure surgical safety (e.g. consent, patient positioning, aseptic techniques, skin preparation, universal precautions and the use of appropriate instruments);

Examines surgical patients while using algorithms like ATLS (advanced trauma life support) and ACLS (advanced cardiac life support); and

Performs basic techniques in the management of a surgical patient independently (e.g. urethral catheterisation and nasogastric [NG] tube placement).

It was indicated that low-tech simulation modalities could be used to attain these outcomes, which were indicated as outcomes at the lower cognitive levels, namely **remembering, understanding and applying.**

The descriptive verbs used in the learning outcomes at **Training Level 2**, were **conducts, performs and recognises**. **The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to reach the following outcomes:**

Conducts (with assistance) surgical consultations;

Performs routine procedures independently (e.g., central line placement, biopsies, incision and drainage, chest tube placement, laceration repair and wound closure); and

Recognises patterns and prioritises management offering at least one solution.

It was indicated that low-tech simulation modalities and standardised patients might be used to **conduct** consultations, **recognise** patterns and **prioritise** management-offering solutions; while for **performing** routine procedures low-tech and high-tech modalities might be used and were indicated as outcomes at the cognitive levels of **remembering, understanding, applying and analysing.**

The descriptive verbs in the learning outcomes at **Training Level 3** were **manages, manages independently** and **identifies. The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to attain the following outcomes:**

Manages (under supervision) a surgical patient afflicted by multi-systemic disorders;

Independently manages multiple surgical consultations and patients; and
Identifies exceptions and offers at least three possible solutions.

It was indicated that low- and high-tech simulation modalities could be used to manage a surgical patient at the lower cognitive levels of **remembering** and **understanding.** To independently manage multiple surgical consultations and patients could be used at the level of **remembering, understanding and applying,** while to identify exceptions and offer solutions low- and high-tech simulation modalities were suggested at cognitive levels 1–3.

The descriptive verbs used in the learning outcomes at **Training Level 4,** for example, were **demonstrates, anticipates and manages. The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to reach the following outcomes:**

Demonstrates an understanding of the management of complicated multi-systemic surgical pathophysiological processes, ranging from intensive care to organ system support;
Anticipates potential problems and devises management plans of novel solutions; and
Manages a surgical firm.

It was indicated that low- and high-tech simulation modalities could be used to attain these outcomes, which were at cognitive levels 1–3, but to anticipate potential problems would require the higher cognitive level of **analysing** as well.

The descriptive verbs used in the learning outcomes at **Training Level 5,** for example, were **develops, implements and teaches**. **The experts indicated, for example, that simulation might be important as one of the methods to train the registrars to reach the following outcomes:**

Develops or implements simulation for the teaching and evaluation of surgical skills; and
Teaches and supervises other learners involved in patient management.
Low-tech and high-tech simulation modalities were indicated for use at all six levels from remembering and knowledge up to the highest cognitive level of creating and evaluation.

It is important to understand by changing the action verb in an outcome or to formulate a simulation scenario at a higher difficulty level the learning that can take place will be at a higher cognitive level and will influence the effectiveness of learning.

The discussion on Section 1, namely surgical care, serves as an example. The other sections are wound care, tissue transfer, congenital anomalies, head and neck, maxillofacial trauma, facial aesthetics, non-cancer breast surgery, breast reconstruction, reconstruction of trunk and perineum, upper extremity trauma, non-trauma hand, cosmetic trunk and lower extremity, and lower extremity, lower extremity, system-based practice, practice-based learning and improvement, professionalism and interpersonal- and communication skills. Simulation was indicated as a possible method for training plastic surgeons at each training level, using low- and/or high-tech simulation modalities and simulated patients at different cognitive levels with the learning outcomes formulated for the first years of training at a lower level, while training in the later years would be at a higher cognitive level.

Only 20 learning outcomes were indicated to be trained by simulation in the sections on system-based practice (including patient safety, resource allocation and practice); six of the twenty were in the domain of patient safety. The section on practice-based learning and improvement, including investigate, evaluate, and assimilate, entailed five learning outcomes, while research and training had four learning outcomes.

In the section on professionalism (ethics and values, and personal accountability) the Delphi experts indicated only three learning outcomes that possibly might be reached by simulation, and these were in the domain of personal accountability.

In the final section, namely interpersonal and communication skills, only two learning outcomes were indicated that might be reached by simulation. Although a low applicability of simulation in the domain of the softer skills was indicated by the Delphi panel, it must be emphasised that they were of the opinion that it should be done at the higher cognitive levels, mostly cognitive level six, evaluate and create.

Semi-structured interviews

Table 1 shows the different interviewees' perspectives on the types of simulation modalities that might lead to effective learning.

Table 1: The types of simulation or simulation modalities that may lead to effective learning

1. Low-tech simulation modalities *(e.g. organ models; basic plastic manikins & simple skills trainers; animal models; human cadavers; simulated or standardised patients)*
Using simulated patients (SPs) and/or standardised patients may result in effective learning: • 'SPs play an important role in a controlled and safe environment' (D1) • 'SPs play an important role in teaching the resident communication skills – they can teach the student how to talk to a patient in a professional way' (D1) • 'SPs teach according a standardised manner (will make use of a script) and make an impact/impression with their feedback to a student' – e.g. 'You did not look me in the eye/ or did not even greet me' (D1) • 'SP's feedback is very important' –'It is a strong, powerful thing' (D1) • 'Standardised patients play an important role when used in assessment' (C1) Task trainers play an important role in achieving effective learning: • 'Heart of simulators' (I1) • 'How do you move from task training skill development' – 'you need to figure out what you want to train' (I1) • 'Task trainers' focus is on skills training, e.g. psychomotor skills for where you control procedure' (D1) • 'We used wet models for basic training' (D1)
2. High-tech simulation models *(e.g. screen-based simulators; realistic, high-fidelity procedural simulators (task trainers); realistic high-tech interactive patient simulators; (virtual reality) (cf. Delphi questionnaire)*
High-tech simulation plays an important role in achieving effective learning: • 'Important role not to be underestimated/underrated (laparoscopic skills)' (D1) High fidelity simulation plays an important role in achieving effective learning: • 'Used for resuscitation training, intensive care training' (D1) • 'High fidelity more focused on integrated type of scenarios' (D1) • 'You must get the feeling working the simulator in, for example, your clinical field – it must be high-fidelity' (C1)

• ‘Task trainers to learn hand skills – but high fidelity and high performance simulators have their place in high performance and critical incidents’ [C1] Other simulation principles that play an important role in attaining effective learning: • ’All types of simulators have a role to play’ (C1) • ‘You don’t need the most expensive – it may do more harm’ (I1) • ‘Outcomes in curriculum must be aligned with what you want to teach, e.g. psychomotor/communication/clinical skills, etc.’ (D1) • ‘Include high fidelity simulation from year one of training’ (D1) • ‘Use high fidelity simulations to assess registrar’s skills’ (C2) • ‘At conferences we practised on virtual reality simulation for cataract and retinal surgery’ (D1) • ‘Use bench models to practise psychomotor skills where necessary until they feel competent’ (D1) • ‘Practise soft skills, e.g. interpersonal communication and interprofessional collaboration, etc. with simulation’ (D1) • ‘Used to train registrars on flat screen to have hand skills – registrars practise skills but consultants make decisions’ (C1)
3. Using low-tech and high-tech simulators
The influence of low- and high-tech simulation modalities: • ‘We use both Low Fidelity (LF) and High Fidelity (HF) simulators. Students master the individual task components using the task-trainers (LF)’ (D2) • ‘To train and experience the holistic scenario with all its consequences we use the HF to put emphasis on integration, group work and the multidisciplinary approach’ (D2) • ‘Using both, but a higher fidelity simulator can take you to a higher level’ (S1)

Where Table 1 focused on the types of simulation or simulation modalities that lead to effective learning, Table 2 shows the effect of simulation on the enhancement of learning at different cognitive levels.

Table 2: The enhancement of student learning through simulation at different cognitive levels

1. Simulation at different cognitive levels may enhance student learning *(A: Remembering / B: Understanding / C: Development and applying / D: Analysing / E: Evaluating / F: Creating)*
Identify the level of competence or expertise • 'It is important to first identify the competence or expertise, (in context) that is needed from the qualified professionals' (I1) • 'Then training the registrars it is necessary to master competence and maintaining it on the specific level of competence/expertise in the specific discipline' (I1) • 'Look at cognitive levels but also understand that human development is on emotional experience - having cognitive, motor, social and other skills to take into account' (I1) • 'The field of specialists should include well defined objectives and competencies – you have to assess the levels for competence' (C2) • 'The difference between competence and proficiency should be described clearly' (C2) • 'Research is needed to cover ethics and legal aspects as far as competence is concerned' (C) Simulation gives the opportunity to learn at different cognitive levels • 'The registrars can practice skills until they feel competent' (D)] • 'When the registrars are exposed to a specific situation/scenario they get the opportunity to go back and revisit what went wrong and how they can improve by doing so – thus they learn on different cognitive levels' (D1) • 'Registrars are exposed to critically ill patients, for example in surgery and intensive care disciplines'(D1) • 'It is important that they are trained in a safe environment – especially junior registrars who are not yet experienced' (D1) • 'It is also important that registrars be on the same level of competency (e.g. with resuscitation) – so simulation training on different cognitive levels takes place including they have to analyse the situation, interpret facts and act on what they see' (D1) • 'It is possible that simulation can also be done on various cognitive levels using task trainers for specific procedures' (D1)

• ‘Simulation can enhance student learning at different cognitive levels: remembering of knowledge (during preparation; understanding and applying using low fidelity simulators); analysing and evaluation (using high fidelity simulators) and developing and formulating new concepts and ideas’ (D2) • ‘During simulation students can go from pure knowledge information to practical knowledge fast’ (C2) • ‘Through using interprofessional teams in multipurpose, complex scenarios, with real world experiences, can take you through all the cognitive levels of learning’ (S1) • ‘Ensures team-based competence’ (S1) • ‘Better outcomes for patients’ (S1) • ‘Using SP’s for the development of team-based communication skills and professionalism’ (S2) • ‘Patient management and clinical decision making and skills development in postgraduate medical education: the importance increases because the seniority of the person going through the system increases – so it takes more and more responsibility in leading teams and decision-making – simulation on higher cognitive levels very important’ (S1)

Recommendations (which were made by the interviewees when considering including simulation in specialist training) focus on curriculum and training initiatives, various aspects that must be in place, suggesting specific planning and supporting efforts with a view to ensuring the quality of training.

Table 3: Recommendations to consider when including simulation in specialist training

1. Training
Development of training course • ‘It is recommended to develop and implement a ‘train the trainer’ course’ (C3, D1, I1) • ‘It is recommended to use a totally integrated education and training system: theoretical lectures, simulation sessions and clinical work on real patients – try to find a balance’ (D1)
2. Curriculum
Alignment of curriculum

• 'It is recommended that the role of feedback; deliberate practice; the contribution of SPs; integration of simulation into the programme; aligned curriculum outcomes; simulation learning outcomes; and assessment; as well as protected training time, etc. to be highly valued' (D1) • 'It is recommended to sit down and plan in detail: what are you going to take out of curriculum and/or with what are you going to replace it '(D1) • 'It is recommended to reach a point that you plan in detail to have an integrated, structured, compulsory and intrinsically motivated simulation included, specialized programme' (C1) • 'The person who has to develop the curriculum, should be knowledgeable about curriculum development; debriefing must be planned; suitable space; objective idea; way to transfer it effectively; outcomes necessary; support structures and safety must be planned; ventilation and light; bathrooms; medical equipment; staff, etc.' (C3) • 'Needs to be a coordinated process' [S1]
3. Assessment
<u>End evaluation</u> • 'It is recommended to try and find a system where you can use simulation in practical examinations (before end evaluation) to ensure that the registrar is 'safe' and 'quick' to operate/apply certain skills' (C1, D1)
4. Quality
<u>Workplace assessment and feedback</u> • 'Remember: the good trainees are always harder on themselves and bad trainees think they don't have problems – so self-evaluation is notoriously weak for weak candidates and notoriously over harsh on good candidates – they never think they are good enough' (S1) • 'Doing on a regular basis and feedback into your planning' (S1)

Perspectives on the use of simulation modalities and how simulation might enhance learning at different cognitive levels were addressed by semi-structured interview questions 5 and 6.

The data gathered by means of the semi-structured interview Questions 5, 6 and 12 were triangulated with the data gathered through Parts 1-3 of the questionnaire survey, and by means of the literature review with a view to identify aspects for compiling a framework to serve as a directive when considering the inclusion of simulation as one of the methods to train a plastic surgeon.

Discussion

A description of the learning outcomes, levels of training, and possible simulation modalities, cognitive levels and descriptive verbs and phrases as these pertain to learning, was given. Simulation in medical education, and its relation to simulation technology, were discussed. Recommendations for considering the inclusion of simulation in specialist training were offered.

It is clear from the feedback of the Delphi survey panel that respondents were positive that almost 46% of the proposed learning outcomes might be reached by including simulation as one of the instructional methods in the postgraduate education and training programme for plastic surgeons. The respondents were of the opinion that simulation might be implemented at all training levels, 1-5, during the training years – albeit less in the earlier years of training. In the earlier years of training students should concentrate more on remembering and understanding knowledge, followed by the mastering and application of skills, with analysing (analysis), evaluating (evaluation) and creating (synthesis) in later years of training.

The Delphi respondents further expressed the opinion that simulation might be important as a method for training students in medical knowledge, skills, competencies and patient care; however, they did not favour simulation as the better training method in the ’softer skills’, for example, team training, patient safety, interpersonal and communication skills, professionalism, ethics, values and personal accountability, although literature suggests the opposite. The Delphi respondents, however, emphasised the importance of these skills being trained at higher cognitive levels to reach maximum competencies and proficiency in professional conduct.

As far as the type of simulators used is concerned the participants agreed that the simulation type should be in line with the objectives of the scenarios: Scenarios set at higher cognitive levels would enhance learning using high-tech simulators and simulated patients.

Simulation provides opportunities to learn at different levels. It is important to identify the competence or expertise that is needed at each training level as well as for the qualified professional.

When considering including simulation in specialist training the authors recommend the following:

1. Aligning the curriculum with the simulation plan according to a scientific and coordinated process and guidelines.
2. Developing a training course for the trainers before implementing simulation in the plastic surgery programme.
3. Researching the role of simulation in assessment carefully before implementation.
4. Assessing/evaluating the workplace environment on a continuous basis and carefully considering the feedback received from role players.

From the results of this study, and supported by literature cited [2-5, 12] we developed a clear reasoning process to build an argument favouring the implementation of simulation in postgraduate plastic surgery education and training programmes. It is clear that certain processes must be in place and steps should be taken to ensure that adequate learning will occur, and that simulation outcomes are integrated with the objectives and outcomes of the curriculum within an environment that is conducive to learning.

It is evident from the research that simulation in plastic surgery education and training programmes will enhance effective learning. Further research is needed on simulation to enhance plastic surgery education and training.[16]

Conclusion

Aspects worthy of further investigation with a view to developing a framework that can be applied to serve as a directive for including simulation in plastic surgery are the following: features and uses of simulation, types of simulation modalities, learning at different cognitive levels and the factors enhancing the effectiveness of learning; the role and value of simulation, the contribution that simulation can make, and the quality of training; main considerations and challenges to take into account for implementation, as well as recommendations to compile guidelines for implementation. A framework based on the proposed aspects will definitely make a contribution to postgraduate plastic surgery education and training.

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APPENDIX AA JOURNAL SUBMISSION GUIDELINES: ARTICLE 5

APPENDIX AA

JOURNAL SUBMISSION GUIDELINES: ARTICLE 5

Submissions
» Online Submissions
» Author Guidelines
» Copyright Notice
» Privacy Statement

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Abbreviations should be spelt out when first used and thereafter used consistently, e.g. 'intravenous (IV)' or 'Department of Health (DoH)'.
Include sections on Acknowledgements, Conflict of Interest, Author Contributions and Funding sources. If none is applicable, please state 'none'.
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Numbers should be written as grouped per thousand-units, i.e. 4 000, 22 160.
Quotes should be placed in single quotation marks: i.e. The respondent stated: '...'
Round brackets (parentheses) should be used, as opposed to square brackets, which are reserved for denoting concentrations or insertions in direct quotes.
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Bennet et al. Standardized human pedigree nomenclature: Update and assessment of the recommendations of the National Society of Genetic Counselors. J Genet Counsel 2008;17:424-433: standard human pedigree nomenclature.

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Objectives: what the study intends to find out

Methods: must include study design, number of participants, description of the intervention, primary and secondary outcomes, any specific analyses that were done on the data.

Results: first sentence must be brief population and sample description; outline the results according to the methods described. Primary outcomes must be described first, even if they are not the most significant findings of the study.

Conclusion: must be supported by the data, include recommendations for further study/actions.

Please ensure that the structured abstract is complete, accurate and clear and has been approved by all authors.

Do not include any references in the abstracts.

Here is an example of a good abstract.

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All articles are to include the following main sections: Introduction/Background, Methods, Results, Discussion, Conclusions.

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Interventions (within Methods): what, how, when and for how long. Typically for randomised controlled trials, crossover trials, and before and after studies.

Main outcome measures (within Methods): those as planned in the protocol, and those ultimately measured. Explain differences, if any.

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Start with description of the population and sample. Include key characteristics of comparison groups.

Main results with (for quantitative studies) 95% confidence intervals and, where appropriate, the exact level of statistical significance and the number need to treat/harm. Whenever possible, state absolute rather than relative risks.

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E.g.: The mean (SD) birth weight was 2 500 (1 210) g. Do not use the ± symbol for mean (SD).

Leave interpretation to the Discussion section. The Results section should just report the findings as per the Methods section.

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Please ensure that the discussion is concise and follows this overall structure – sub-headings are not needed:

Statement of principal findings
Strengths and weaknesses of the study
Contribution to the body of knowledge
Strengths and weaknesses in relation to other studies
The meaning of the study – e.g. what this study means to clinicians and policymakers
Unanswered questions and recommendations for future research

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This may be the only section readers look at, therefore write it carefully. Include primary conclusions and their implications, suggesting areas for further research if appropriate. Do not go beyond the data in the article.

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Short abstract: does not need to be structured, but should capture the essential features of the article
Introduction: the reason for the article and the issue being addressed
Recent research, discussion, local policy around the issue – include your own research where appropriate
All statements should be referenced and, if opinion only, this should be stated
Discussion: how this article adds to the discussion around a particular topic
If a clinical practice or policy point is at issue, this needs to be emphasised, using a box with highlights if appropriate.

Essentially In practice is an opportunity for a more discursive approach to topics of clinical, economic or political importance in southern African health systems. It is not an opportunity to put forward unsubstantiated opinions!

Case reports

The *SAMJ* has recently started to accept case reports. The cases must come from Africa, preferably southern Africa unless the condition is common to all African countries, and must be either a completely new description of a clinical condition or result (use Google!) or a case that highlights important practice or management issues.

Please use the following format for case reports:

Title of case: do not include the words 'a case report' in the title
Summary/abstract: up to 150 words summarising the case presentation and outcome
Background: why is this case important and why did you write it up?
Case presentation: presenting features, medical, social, family history as appropriate
Case management: should be according to best practice, and if not, please explain why
Investigations, if relevant: save space by simply saying 'normal' if, for example, renal function was completely normal, rather than listing normal results, highlight the abnormal – or indeed the normal if this is clinically significant
Differential diagnosis, if relevant
Treatment, if relevant
Outcome and follow-up
Discussion – a VERY BRIEF review of similar published cases
Teaching points: 3 - 5 bullet points
References: as per the *SAMJ* house style
Tables and figures: keep to a minimum. Use clinical images where relevant – we need hi-res versions for print, and identifiable persons must have a consent form
Patient consent: please include a statement about patient consent to a written case report. This should be uploaded as a supplementary file.

Clinical trials
Guideline word limit: 4000 words

As per the recommendations published by the International Committee of Medical Journal Editors (ICMJE), clinical trial research is any research that assigns individuals to an intervention, with or without a concurrent comparison/control group to study the cause-and-effect relationship between the intervention and health outcomes. All clinical trials should be registered with the appropriate national clinical trial registry (or any international primary register, if relevant), and the trial registration number should be cited at the end of the abstract. Since 1st December 2005, all clinical trials conducted in South Africa have been required to be registered in the South African National Clinical Trials Register. The *SAMJ* therefore requires that clinical trials be registered in the relevant public trials registry at or before the time of first patient enrollment as a condition for publication. The trial registry name and registration number must be included in the manuscript.
Please refer to the general guidelines for all papers at the top of this article for additional requirements with respect to ethics approval, funding, author contributions, etc. The format of original research articles should be followed for reporting of clinical trial results.

Review articles
Guideline word limit: 4 000 words

These are welcome, but should be either commissioned or discussed with the Editor before submission. A review article should provide a clear, up-to-date account of the topic and be aimed at non-specialist hospital doctors and general practitioners.

Please ensure that your article includes:
Abstract: unstructured, of about 100-150 words, explaining the review and why it is important
Methods: Outline the sources and selection methods, including search strategy and keywords used for identifying references from online bibliographic databases. Discuss the quality of evidence.
When writing: clarify the evidence you used for key statements and the strength of the evidence. Do not present statements or opinions without such evidence, or if you have to, say that there is little or no evidence and that this is opinion. Avoid specialist jargon and abbreviations, and provide advice specific to southern Africa.
Personal details: Please supply your qualifications, position and affiliations and MP number (used for CPD points); address, telephone number and fax number, and your e-mail address; and a short personal profile (50 words) and a few words about your current fields of interest.

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Guideline word limit: 500 words

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May include only one illustration or table
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Because of the intensive review process required to ensure Guidelines are independent, evidence-based and free from commercial bias, they are usually published as a supplement to the *SAMJ*, the costs of which must be covered by sponsorship, advertising or payment by the guideline authors/association. We will provide a quote based on the expected length of the guideline and whether it is to appear online only, or in print, which must be accepted by the body putting the guidelines together before submitting the work to the SAMJ.

The Editor reserves the right to determine the scheduling of supplements. Understandably, a delay in publication must be anticipated dependent upon editorial workflow.
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All guidelines should be structured according to Agree II.
Please access this website before putting the guidelines together, download the Agree 11 instrument and use this to put the guidelines together.
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A structured abstract not exceeding 400 words (recommended sub-headings: *Background, Recommendations, Conclusion*) is required. Sections and sub-sections must be numbered consecutively (e.g. 1. Introduction; 1.1 Definitions; 2.etc.) and summarised in a Table of Contents.

Illustrations/photos/scans
If illustrations submitted have been published elsewhere, the author(s) should provide consent to republication obtained from the copyright holder.
Figures must be numbered in Arabic numerals and referred to in the text e.g. '(Fig. 1)'.
Each figure must have a caption/legend: Fig. 1. Description (any abbreviations in full).
All images must be of high enough resolution/quality for print.
All illustrations (graphs, diagrams, charts, etc.) must be in PDF or jpeg form.
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Tables
Tables should be constructed carefully and simply for intelligible data representation. Unnecessarily complicated tables are strongly discouraged.
Large tables will generally not be accepted for publication in their entirety. Please consider shortening and using the text to highlight specific important sections, or offer a large table as an addendum to the publication, but available in full on request from the author
Embed/include each table in the manuscript Word file - do not provide separately as supplementary files.
Number each table in Arabic numerals (Table 1, Table 2, etc.) and refer to consecutively in the text.
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Footnotes must be indicated with consecutive use of the following symbols: * † ‡ § ¶ || then ** †† ‡‡ etc.

Do not: Use [Enter] within a row to make 'new rows':

Rather:
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Combine into one column, *n* (%):

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References
NB: *Only complete, correctly formatted reference lists in Vancouver style will be accepted. Reference lists must be generated manually and not with the use of reference manager software. Endnotes must **not** be used.*
Authors must verify references from original sources.
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regulations are endorsed by the World Health Organization,[2] and others.[3,4-6]
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Approved abbreviations of journal titles must be used; see the List of Journals in Index Medicus.
Names and initials of all authors should be given; if there are more than six authors, the first three names should be given followed by et al.
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Journal references: Price NC, Jacobs NN, Roberts DA, et al. Importance of asking about glaucoma. Stat Med 1998;289(1):350-355.
http://dx.doi.org/10.1000/hgjr.182
Book references: Jeffcoate N. Principles of Gynaecology. 4th ed. London: Butterworth, 1975:96-101.
Chapter/section in a book: Weinstein L, Swartz MN. Pathogenic Properties of Invading Microorganisms. In: Sodeman WA, Sodeman WA, eds. Pathologic Physiology: Mechanisms of Disease. Philadelphia: WB Saunders, 1974:457-472.
Internet references: World Health Organization. The World Health Report 2002 - Reducing Risks, Promoting Healthy Life. Geneva: WHO, 2002. http://www.who.int/whr/2002 (accessed 16 January 2010).
Legal references

- Government Gazettes:

National Department of Health, South Africa. National Policy for Health Act, 1990 (Act No. 116 of 1990). Free primary health care services. Government Gazette No. 17507:1514. 1996.
In this example, 17507 is the Gazette Number. This is followed by :1514 - this is the notice number in this Gazette.

- Provincial Gazettes:

Gauteng Province, South Africa; Department of Agriculture, Conservation, Environment and Land Affairs. Publication of the Gauteng health care waste management draft regulations. Gauteng Provincial Gazette No. 373:3003, 2003.

- Acts:

South Africa. National Health Act No. 61 of 2003.

- Regulations to an Act:

South Africa. National Health Act of 2003. Regulations: Rendering of clinical forensic medicine services. Government Gazette No. 35099, 2012. (Published under Government Notice R176).

- Bills:

South Africa. Traditional Health Practitioners Bill, No. B66B-2003, 2006.

- Green/white papers:

South Africa. Department of Health Green Paper: National Health Insurance in South Africa. 2011.

- Case law:

Rex v Jopp and Another 1949 (4) SA 11 (N)
Rex v Jopp and Another: Name of the parties concerned
1949: Date of decision (or when the case was heard)
(4): Volume number
SA: SA Law Reports
11: Page or section number
(N): In this case Natal - where the case was heard. Similarly, (C) woud indicate Cape, (G) Gauteng, and so on.
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From submission to acceptance

Submission and peer-review

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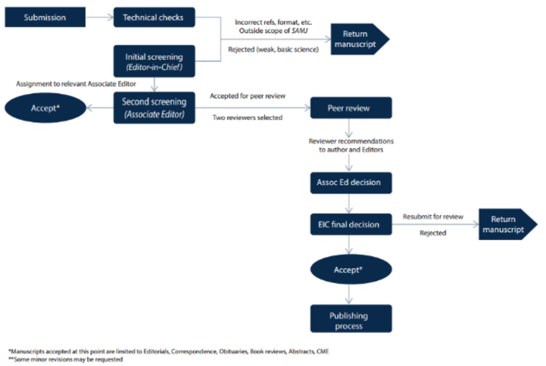
Peer-review process



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If the CE has an author queries, he/she will contact the corresponding author and send them the copyedited Word doc, asking them to solve the queries by means of track changes or comment boxes.

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The CE will finalise the article and then it will be typeset.

Once typeset, the CE will send a PDF of the file to the authors to complete their final check, while simultaneously sending to the 2nd-eye proofreader.

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The CE implements the authors' and proofreader's mark-ups, finalises the file, and prepares it for the upcoming issue.

Changing contact details or authorship

Please notify the Editorial Department of any contact detail changes, including email, to facilitate communication.

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The *SAMJ* is an online journal. The online version of the journal is the one that has the widest circulation, is indexed by bibliographic databases including PubMed and SciELO, and is accessible in academic libraries. A printed edition , containing material selected by the Editor is also published each month and distributed to the membership of the South African Medical Association.

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The full text of all accepted articles is published in full online, open access.

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You may want to make use of the advantages of online publication e.g. specify web links to other sources, images, data or even a short video.

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Research articles will appear *in abstract form only*, if selected for a print edition.

Errata and retractions

Errata

Should you become aware of an error or inaccuracy in yours or someone else's contribution after it has been published, please inform us as soon as possible via an email to publishing@hmpg.co.za,including the following details:

Journal, volume and issue in which published

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Description of error and details of where it appears in the published article

Full detail of proposed correction and rationale

We will investigate the issue and provide feedback. If appropriate, we will correct the web version immediately, and will publish anerratum in the next issue. The correction will be indexed, as PubMed has a function for linking errata back to the original article. All investigations will be conducted in accordance with guidelines provided by the Committee on Publication Ethics (COPE).

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When a retraction is published, it will be linked to the original article.

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Contact claudian@hmpg.co.za for information on submitting ad hoc/commissioned supplements, including guidelines, conference/congress abstracts, Festschrifts, etc.

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As part of the submission process, authors are required to check off their submission's compliance with all of the following items, and submissions may be returned to authors that do not adhere to these guidelines.
Named authors consent to publication and meet the requirements of authorship as set out by the journal.
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The text complies with the stylistic and bibliographic requirements in **Author Guidelines**.
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The text is single-spaced, in 12-point Times New Roman font, and contains no unnecessary formatting.
Illustrations/figures are high resolution/quality (not compressed) and in an acceptable format (PDF or jpeg). These must be submitted individually as 'supplementary files' (not solely embedded in the manuscript).
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Where possible, references are accompanied by a digital object identifier (DOI).
An abstract has been included where applicable.
The research was approved by a Research Ethics Committee (if applicable)
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APPENDIX AB PROOF OF SUBMISSION / REVIEW / PUBLICATION: ARTICLE 5

From:	Dr Corne Nel
To:	Elmarie Robberts; Pieter Nel
Subject:	Fwd: A manuscript number has been assigned to Simulation in Plastic Surgery: Role, value and contribution of simulation in education and training – a directive for implementation
Date:	Tuesday, 29 January 2019 9:16:14 PM

Manuscript number
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From: **SAMJ** <em@editorialmanager.com>
Date: Tue, Jan 29, 2019 at 9:13 PM
Subject: A manuscript number has been assigned to Simulation in Plastic Surgery: Role, value and contribution of simulation in education and training – a directive for implementation
To: Corne Pieter Nel <drcnel@gmail.com>

CC: "Gert J van Zyl" vanzylgj@ufs.ac.za, "Mathys J Labuschagne" labuschagnemj@ufs.ac.za

Dear Dr Nel,

Your submission entitled "Simulation in Plastic Surgery: Role, value and contribution of simulation in education and training – a directive for implementation" has been been assigned the following manuscript number: SAMJ13943.

You will be able to check on the progress of your paper by logging on to Editorial Manager as an author.
The URL is https://www.editorialmanager.com/samj/.

Thank you for submitting your work to South African Medical Journal.

Kind regards,

South African Medical Journal

South African Medical Journal

Simulation in Plastic Surgery: Role, value and contribution of simulation in education and training – a directive for implementation

--Manuscript Draft--

Manuscript Number:	
Article Type:	Original Research
Keywords:	Role, value and contribution of simulation; postgraduate plastic surgery education and training; directives for implementation; Simulation; Medical Education
Corresponding Author:	Corne Pieter Nel, MBChB, FC Plast Surg (SA), M.Med, M.HPE Netcare Mulbarton Hospital SOUTH AFRICA
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	Gert J van Zyl, MBChB, MFamMed, PHD, MBA
	Mathys J Labuschagne, MB ChB, MMed (Ophth), PhD
Manuscript Region of Origin:	SOUTH AFRICA
Abstract:	Background In this research, an in-depth study was done on the role and value of simulation in postgraduate plastic surgery education and training. The question that was asked is whether it was worthwhile examining the use of simulation in a postgraduate plastic surgery training environment in order to determine if it might be useful in addressing the lack of opportunities for clinical exposure and practice. If simulation has a contribution to make; a role to play and be of specific value that it can add to postgraduate plastic surgery education and training, which points of departure and aspects must be considered to compile a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes? Objective The objective of the research was to identify and describe (a) the contribution that simulation can make, including the role, as well as (b) the main considerations for implementation of simulation in a training programme. Methods Data were collected by means of semi-structured interviews conducted with national and international role players in simulation. Results A description of the role that simulation can play, the value that simulation can add and the contribution that simulation can make, are given. The main considerations to take into account for the identification of aspects that might be considered in order to compile a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes are described. Conclusion The contribution that simulation can make in the training of plastic surgeons according to suggested guidelines and recommendations can add value to specialist training. The outcome of the research, it is foreseen, will serve as a directive for postgraduate plastic surgery education and training on how simulation might be used to enhance learning, and how simulation might be used to improve students' knowledge, clinical

	competence, skills and professional conduct.

Dr Corné Nel
MBChB (UFS); FC Plast Surg (SA); MMed Plast Surg
Plastic and Reconstructive Surgeon
MP 0629286 ; PR 036-000-0580880

29 January 2019

The Editor-in-Chief
South African Medical Journal

Dear Sir or Madam:

Submission of a manuscript titled "Simulation in Plastic Surgery: Role, value and contribution of simulation in education and training – a directive for implementation."

I am pleased to submit our manuscript titled "Simulation in Plastic Surgery: Role, value and contribution of simulation in education and training – a directive for implementation" to your journal for publication.

Increased competition for surgical exposure and practice, smaller teaching platforms, and shorter training times impact the quality of training and competence of plastic surgery registrars. Demands for accountability and minimising patient risks are driving forces for incorporating simulation in health care education. Our research looked at whether the features and uses of simulation would enhance postgraduate plastic surgery education and training and ensure more effective learning.

This manuscript reports on the contribution that simulation can make, including the role, as well as the main considerations for implementation of simulation in a training programme. It forms part of a series of articles, which are part of my PHD study in Health Professions Education.

I certify that all authors listed on this manuscript participated substantially in the conception and design, as well as in writing the paper.

We hope that you find this manuscript suitable for publication in your journal.

Sincerely

Corné Nel
FC Plast Surg (SA), MMed Plast Surg, MBChB, M.HPE

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Simulation in Plastic Surgery: Role, value and contribution of simulation in education and training – a directive for implementation

Abstract:

Background. In this research, an in-depth study was done on the role and value of simulation in postgraduate plastic surgery education and training. The question that was asked is whether it was worthwhile examining the use of simulation in a postgraduate plastic surgery training environment in order to determine if it might be useful in addressing the lack of opportunities for clinical exposure and practice. If simulation has a contribution to make; a role to play and be of specific value that it can add to postgraduate plastic surgery education and training, which points of departure and aspects must be considered to compile a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes?
Objective. The objective of the research was to identify and describe (a) the contribution that simulation can make, including the role, as well as (b) the main considerations for implementation of simulation in a training programme.
Methods. Data were collected by means of semi-structured interviews conducted with national and international role players in simulation.
Results. A description of the role that simulation can play, the value that simulation can add and the contribution that simulation can make, are given. The main considerations to take into account for the identification of aspects that might be considered in order to compile a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes are described.
Conclusion. The contribution that simulation can make in the training of plastic surgeons according to suggested guidelines and recommendations can add value to specialist training. The outcome of the research, it is foreseen, will serve as a directive for postgraduate plastic surgery education and training on how simulation might be used to enhance learning, and how simulation might be used to improve students' knowledge, clinical competence, skills and professional conduct.

Keywords: Role, value and contribution of simulation, postgraduate plastic surgery education and training, directives for implementation.

Introduction

Clinical simulation plays an important and valuable role in the development of clinical skills and professional attributes, and in creating a safe, non-threatening training environment. Simulation can play an important role in building a safer health care system and may have the potential to address a number of challenges facing postgraduate plastic surgery education. The ability to perform clinical procedures is a key skill and requires a combination of various skills and competencies – some of which may be obtained by introducing simulation into registrars' training. Over the past number of years, the evidence of simulation as an integral part of medical education has placed increased emphasis on simulation technology to improve education and training opportunities. [1-4]

Scalese (2009: 65) points to the trend to utilise simulation for teaching, learning and assessment. [5] Simulation-based education plays a significant role in minimising risk to patients and enhancing medical training. [6] The question that is asked, is: Can the use of simulation be valuable in addressing the problem of a lack of opportunity for clinical exposure and practise?

The American College of Surgeons (ACS) has decided to introduce simulation in teaching and education for general surgery. [7,8] Mittal *et al*. (2012) have proposed that plastic surgery should follow the simulation initiative with modifications appropriate to the speciality of plastic surgery. [7,8] Arbogast and Rosen (2012: 235 – 252) proposed in their article, *Simulation in Plastic Surgery Training: Past, Present and Future,* that these modifications may address the challenges specified to the field of plastic surgery. [9] They are of the view that a unified commitment by medical educators to use simulation '…to simultaneously standardize the training curriculum, individualize the method of acquiring information, and objectively evaluate the training process' is necessary. [9]

Arbogast and Rosen (2012: 241 - 244) have listed 20 skills required of postgraduate residents in general surgery and plastic surgery respectively that can be simulated in year one and two, as well as procedures required of residents in plastic surgery in years three, four and five that can be simulated. [9] In this research project, the researcher (CPG) identified a number of learning outcomes on, for example, medical knowledge and patient care, distributed over five training levels, where simulation may have a role and be of value as an important method to be included in the training programme of plastic surgeons. [10]

'Simulation needs not to be restricted to residency: simulation has a role to play in medical education from undergraduate level to senior physician's maintenance of certification. The incorporation of innovative technology into today's curriculum will be an essential step in not only preparing for the future, but shaping it as well'. [9] This research article will, hopefully, facilitate the identification of aspects with the view to establishing a framework structure that can serve as a directive, in future, to propose a system of guidelines and recommendations to be used for the implementation of simulation in plastic surgery education and training programmes.

Methods

The research was designed as a descriptive study that includes a literature overview, a Delphi process and semi-structured interviews. The results and findings of five questions put to the interviewees during the interviews are described in this article.

Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences, UFS (ECUFS 122/2015).

Semi-structured interviews

Semi-structured interviews were used to explore key national and international role players' opinions and perceptions on simulation-based medical education. The purpose was to investigate and to establish clarification on simulation in postgraduate education and training. The interviews were conducted to obtain an in-depth, comprehensive overview of the contribution that simulation might make to postgraduate plastic surgery education and training. An interview guide developed by the author on the basis of a literature review was used. Occasionally, additional questions arose during the semi-structured interview process; the data thus collected were included in the research. Data on Questions 8, 9, 10, 11 and 13 of the interview guide are reported in this article. The questions are selected from the interview guide and presented in Table 1.

Table 1. Questions for semi-structured interviews with role players

Does simulation have (a) a contribution to make to, (b) a role to play in, or (c) a specific value to add to postgraduate education?
What would your main consideration be if you decided to include simulation in your teaching and training programme?
If you have to guide a team of experts tasked to develop a curriculum with simulation as one of the training/learning methods, which important guidelines will you put on paper?
Do you wish to make any recommendations that may be used in compiling guidelines on simulation for postgraduate plastic surgery?
Will you please share (a) some of the lessons learned regarding the implementation of simulation in a curriculum, (b) as well as the biggest challenge in implementing simulation in training?

Target population

National and international role players in simulation and postgraduate education were requested to participate in the semi-structured interviews. The participants were directors of simulation units, clinical heads of clinical medical departments, programme directors of medical and nursing programmes, and education management specialists, researchers and representatives from the simulation industry. Written consent was obtained from the participants.

Data collection and analysis

Individual interviews (based on a single interview guide) were conducted by the author (CPG) with eight participants. All interviews were audio-recorded, transcribed by the author (CPG) and checked by an independent person who was not part of the study. Field notes taken during the interviews contributed to the data. The data were analysed using the grounded theory approach that requires continuous comparison of data, following the data analysis steps of coding, categorisation and theory generation. [11] Theory building occurred by finding patterns in the data and this continued until saturation of data was reached. [12]

Reliability and trustworthiness

Reliability was ensured by making use of explorative studies, determining strict criteria for sampling, using the carefully constructed interview guide, as well as an interview process that was audio-taped and carefully described. Trustworthiness of the interviewing process was ensured by involving voluntary interviewees with a clear understanding of what the interviewer expected from them, and using open-ended questions, as well as the transcription and verifying of the accuracy of data. Scientific record-keeping ensured dependability.

Results

The contribution, role and value as well as the main considerations for implementation of simulation in a teaching/training programme are given. It is followed by suggestions from the interviewees on a number of key issues in the form of proposed guidelines to direct a team of experts developing a curriculum with simulation as one of the teaching/learning methods. They also make recommendations that may be used to compile these guidelines. The lessons learned and challenges to implement simulation as part of a training programme are offered.

The contribution of simulation in postgraduate plastic surgery education and training

It is clear from the opinions of the interviewees that simulation makes an important contribution to patient safety. Registrars/specialists in training can practise their skills in a non-threatening, pre-selected and controlled, safe environment that prepares them beforehand and provides them with the opportunity to learn gradually, in their own time and according to their own pace. Once they are competent, the acquired knowledge, skills, clinical competencies and professional conduct and behaviour can be transferred to real clinical settings and patients. This minimises the risk to patients and ensures a proficient and competent registrar, while delivering an excellent outcome. Simulation training also exposes registrars to higher levels of critical thinking and complexity; interdisciplinarity; and high-fidelity simulation during large group simulations - triggering effective learning.

In addition, simulation simultaneously offers an alternative training method. While a clinical facilitator or head of department is training registrars on a flat screen simulator to master certain skills, the consultants are responsible for making the decisions; thus, in such a situation, two different groups are trained at the same time at different cognitive levels to become competent or proficient - reaching difficult objectives. Through *training the trainer* you can add value to simulation as a training method as well as to clinical education. The contribution that simulation can make incorporates the role that simulation plays and the value that simulation adds.

The role and value of simulation

The findings on the role that simulation can play and the value that simulation can make to postgraduate education are tabulated in Tables 2 and 3.

Table 2 sets out the opinions expressed by interviewees on the role that simulation may play in postgraduate education. Responses of the interviewees were organised into themes (in Table 2), followed by the themes together with quotes based on their verbatim responses.

Table 2. The role of simulation in postgraduate education

Simulation provides a non-threatening environment for teaching and learning
Simulation facilitates student learning
Simulation enhances the effectiveness of learning
Simulation plays a role in clinical training and has an increased application
Simulation gives the opportunity for deliberate practise
Simulation gives the opportunity to practise safely on patients
Simulation offers a solution to problems experienced in postgraduate education and training

Simulation provides a non-threatening environment for teaching and learning

Interviewees expressed the opinion that simulation provides controlled and safe practise opportunities by giving registrars time to hone their skills and competencies in safe, no-risk circumstances. Registrars also have the opportunity to practise in an environment where they feel safe and relaxed:

Quote 1: ‘Simulation leads to less stress where registrar has the opportunity to practice in a safe environment’

Quote 2: ‘What happens here, stays in the simulation lab.’

Simulation facilitates student learning

Simulation facilitates student learning, knowledge, clinical competence, skills and professional behaviour:

Quote 1: ‘Simulation is a very good learning situation and provides the opportunity to learn in another way’.

Simulation enhances the effectiveness of learning

Simulation can enhance learning effectiveness at different cognitive levels. Feedback during or after simulation influences the effectiveness of learning:

Quote 1: ‘Simulation enhances learning – registrar can identify own problems and rectify where and when necessary ‘

Quote 2: ‘Simulation provides the opportunity for registrars to learn gradually and progress to higher competency and/or cognitive levels.’

Simulation plays a role in clinical training and has an increased application

Simulation has an important role in clinical training and plays a definite role in holistic and integrated health care training. Simulation provides the registrar in a specific discipline the opportunity to practise specific (certain) skills individually or it can provide the opportunity that training can take place in a multi-professional health care group, where learning various types of skills through complex scenarios takes place. A decreasing number of training platforms that become smaller in certain disciplines, shrinking financial resources, as well as a demand for more health care professionals require that additional options for clinical training and assessment be investigated: these constrain the education time that registrars in training receive - but at the same time, however, simulation gives registrars the opportunity to experience clinical cases that they would perhaps not see in certain disciplines:

Quote 1: 'By making use of simulated patients during simulation you can teach and train a wide range of material for example history taking, transfer of bad news, and/or medio-legal issues'

Quote 2: 'To practice certain procedures beforehand through simulation makes it easier for registrars when they do it for the first time on real patients'

Quote 3: 'Simulation gives registrars the opportunity to experience clinical cases that they perhaps won't see in their discipline'.

Simulation gives the opportunity for deliberate practise

Simulation gives the opportunity for deliberate practise, which together with repetitive practise plays an important role to master skills:

Quote 1: 'Helps to keep abreast of skills and topics'

Quote 2: 'Proficient: competent: excellent outcome'.

Simulation gives the opportunity to practise safely on patients

Simulation gives the opportunity to practise safely on patients:

Quote 1: 'Learning on simulated patients minimises the risk on real patients'

Quote 2: 'Simulation enhances medical training'.

Simulation offers a solution to problems experienced in postgraduate education and training

Simulation addresses the problem of a lack of opportunity for clinical exposure and practise as more exposure leads to fewer medical errors:

Quote 1: 'Assess students with the view to identify what have been missed or lack of opportunity'

Quote 2: 'Simulation training according to a specific schedule is a way to protect registrars' training time'

Quote 3: 'Simulation is useful to teach registrars patient communication skills'

Quote 4: 'Simulation definitely meets a need'.

Table 3 sets out the opinions expressed by interviewees on the value that simulation may add to postgraduate education. Responses of the interviewees were organised into themes (listed in Table 3), followed by the themes together with quotes based on their verbatim responses.

Table 3. The value of simulation in postgraduate education

Simulation is an alternative to a real patient strategy
Simulation is a solid educational and social grounding strategy
Simulation improves clinical grounding: care and increased patient safety
Simulation allows individualisation of education and training

Simulation is an alternative to a real patient strategy

Simulation offers an alternative training option and learning strategy in a more relaxed and less stressful environment:

Quote 1: 'Very specific strategy that can be used to learn'

Quote 2: ‘Simulation must be seen as an education and training aid and not the end goal: simulation is not the purpose but a way or method to do or learn something’

Quote 3: ‘Valuable additional alternative to bedside teaching’.

Simulation is a solid educational and social grounding strategy

Simulation is a solid educational and social grounding strategy that provides a safe environment where registrars can learn from their errors without the risk of harming a patient:

Quote 1: ‘The privileges of simulation is that simulation provides you a safe psychological environment for training/learning’

Quote 2: ‘Simulation provides a training environment where registrars’ individual needs, strengths and deficiencies can be attended to’

Quote 3: ‘Simulation provides an opportunity for both formative assessment (debriefing, feedback) as well as summative assessment

Quote 4: ‘Competency-based training environment’.

Simulation improves clinical grounding: care and increased patient safety

Simulation improves clinical grounding such as patient care and patient safety. Simulation is a valuable method to train a variation of skills in a controlled clinical environment:

Quote 1: ‘Through surgical simulation skills can be transferred to the operating theatre, decreasing operation time, complications and costs’

Quote 2: ‘Evaluation of skills through simulation can give feedback on competency level of registrar by using rubrics for procedures and may predict whether the candidate is ready to sit for final exam’

Quote 3: ‘Simulation can be used to evaluate whether a registrar is “safe” to operate on a patient and under pressure before the final examination’

Quote 4: ‘Offers registrars to advance along a learning curve’.

Simulation allows individualisation of education and training

Simulation allows individualisation of education and training; for example, through the standardisation of the curriculum, accommodating the learning styles of registrars as well as the opportunity for deliberate practise:

Quote 1: ‘Feedback during simulation helps registrar to identify problems and he/she can deliberately practice certain skills as needed’

Quote 2: ‘Constructive feedback and debriefing during simulation add value to the learning process’.

It is clear that simulation has a role to play and can add value to postgraduate education and training.

<u>The main considerations for implementation of simulation in a teaching/training programme</u>

The interviewees in his research project expressed their views on four aspects that should be taken into account when considering the inclusion of simulation in a postgraduate teaching and training programme, namely: revisiting the curriculum outcomes of the current postgraduate programme with integration on simulation; decisions to be taken on what to simulate; reviewing of available simulation facilities and equipment; as well as the role and value of assessment.

The first consideration to deal with is to revisit the curriculum outcomes in the current postgraduate training programme. Two points were emphasised, namely that simulation has to be integrated into and be part of the outcomes of the curriculum and that decisions should be reached as to where simulation is going to fit into the programme. The interviewees suggested:

Quote 1: 'Try to identify the outcomes that the registrars find difficult to reach, for example specific skills'

Quote 2: 'Develop a basic surgeon across all plastic surgery disciplines'.

These recommendations entail that curriculum developers need to go back to the drawing board and rethink, not only the purpose and outcomes of their education and training programme, but also the knowledge, skills, clinical competencies and professional conduct qualities they want a plastic surgeon to have in order to practice safely and to be proficient / competent / excellent.

The second consideration is to identify and decide what to simulate. The following four points were emphasised: To identify the plastic surgeons' role in practice is important. Plan and structure clinical scenarios well, develop complete scenarios with clear outcomes. Although you might have a good programme, the environment may change: improve, reform and make adaptions to facilitate effective learning within the aims of education and training for the specific profession. The interviewees suggested:

Quote 1: 'You need to know what your starting point is – it's looking what is actually called zone of simulation – designer simulation'

Quote 2; 'You can't have to simulate everything – what is designer simulation – things are in a high risk and low frequency – that is where your critical area to simulate is'

Quote 3: 'Try to identify the scars clinical conditions that is difficult to see – things you really want the registrars to see and be able to treat – the life-threatening conditions/cases that you really do not see regularly'

Quote 4: 'Identify discipline unique things to simulate'

Quote 5: 'Identify problem areas that can be simulated'

Quote 6: 'Push simulation to develop all competencies for basic general plastic surgeons in SA'.

From these perspectives, it is clear that decisions on what to simulate in a specific training programme and what meets the needs of that profession are of utmost importance.

The third consideration that was mentioned is to review available simulation facilities and equipment, not only in your institution or nationally, but also to get a world perspective in order to identify what type of simulation facilities are available and decide whether and how your facilities can fit in with other facilities. The interviewees suggested:

Quote 1: 'Identify what is already available in your training platform – simulation not better than real patient'

Quote 2: 'Don't invent the wheel again'.

It is important to plan in detail how you can use available simulators, as high fidelity simulation is adaptable to a large extent.

The fourth consideration to take into account is the opportunities offered by such a new simulation initiative implemented in the programme that can be of value as far as assessment is concerned. Two points were emphasized, namely that feedback during and after assessment should lead to effective learning experiences; and that simulation can be used to be part of different forms of examinations and certification. The interviewees suggested the following:

Quote 1: 'Assess the registrar on a continuing basis on preparation, knowledge, skills, oral expertise, professional behaviour, making a correct diagnosis, executing procedures, and not harming patients.'

Quote 2: 'Maintenance of a specific field'.

The role and value of simulation in assessment should be investigated in depth to the benefit of the registrar and profession.

Guiding a team of experts in developing a curriculum with simulation as one of the training/learning methods

The interviewees were asked to propose guidelines to direct a team of experts developing a curriculum with simulation as one of the teaching/learning methods. They responded on three key issues, as follows and in their own words:

Training curricula and outcomes

Identifying the holistic bigger picture

- You should form a mind set or framework as far as simulation is concerned and how it will fit in into the holistic bigger training picture/process
- You should decide what the expectation are at the end of specialisation as far as knowledge, skills, competencies, attitudes, etc. are and decide what the role will be of simulation – what are the characteristics that need to be in place – decide then how simulation will fit in
- You should identify the current curricula available that has the same content as yours.

Alignment of outcomes

- You should revisit and develop curriculum outcomes as well as learning outcomes for simulation scenarios that fit your requirements and needs
- You should align teaching, learning and assessment.

Content and place

- You should make simulation a compulsory part of the curriculum
- You should decide beforehand where simulation fits into the curriculum.

Scheduled time and overload of the curriculum

- You should schedule simulation and debriefing sessions into your teaching and training programme as well as the character/nature of the simulation sessions
- You should protect the training time for your registrars including time for simulation
- You should decide how you are going to get people to progress through the training years.
- You should take care not to overload the curriculum.

Expertise and staff

- You should identify content experts and develop new and innovative materials for simulation to overcome a resource constraint environment
- You should use all the expertise available

- You should develop and offer a course to *train the trainers*
- You should identify champions per department who can drive simulation in a department.

Market analysis and research

- You should do market analysis to identify applicable research, best practices and available simulator modalities
- You should use research to test new concepts and identify clinical needs.

It seems that the development of curricula and the alignment of outcomes are pre-requisites, as well as building staff expertise – these actions should be based on sound scientific research.

Recommendations that may be used in compiling guidelines on simulation for plastic surgery

The interviewees were asked whether they wish to make recommendations for compiling guidelines on simulation for plastic surgery and responded as follows:

- It is recommended not to attach the wrong value or weight on simulation in your curriculum – see it as a method for training, not the main aim of clinical education and training
- It is recommended, if it is decided to include simulation in the programme, to make it a compulsory component of the curriculum and it should be integrated into the curriculum as a required component and that it must promote aspects that are difficult to train on real patients
- It is recommended that there should be synergy on alignment between theory, practice and assessment
- It is recommended that training is standardise and individualised
- It is recommended that you decide beforehand which learning objectives are you going to eliminate from the curriculum and will be replaced/reserved for simulation
- It is recommended to take note that registrars/specialists in training, do not understand the process from fast training in simulation moving to integrated practice (skills transference) in a clinical environment
- It is recommended to take note that staff are not necessarily trained for teaching by means of simulation
- It is recommended to keep guidelines clearly formulated.

The suggested guidelines and recommendations will be of value and noteworthy when decisions need to be reached as far as introducing and implementing simulation into a training programme.

Lessons learned regarding implementation of simulation into a curriculum

The interviewees shared the perspective that it is necessary that people realise that simulation does not replace real patients. It is important to replan and rethink curriculum and learning outcomes and to schedule enough time for compulsory simulation sessions. You have to identify beforehand what you want to simulate. Remember that observation and feedback improve the effectiveness of learning.

<u>Challenges in implementing simulation as part of a training programme</u>

The interviewees identified a number of challenges, namely:

Time challenges and student numbers

- Not enough dedicated schedule time for teaching and training registrars (service delivery, underutilisation of simulation)
- Time constraints, student numbers account for pressure and lower quality – reformulate objectives and compile smaller groups.

Cost-effectiveness challenges

- To keep cost effective is one of the biggest challenges
- Financial strains and the availability/non-availability to cover expenditure.

Staff resource challenges

- To get staff to work in a team in integrated scenarios as staff members have different personalities
- Staff resources and the willingness to run a simulation lab
- Staff have to be trained – time and cost of the challenge
- To overcome the *pushback action* of older lecturers as far as simulation is concerned
- To get staff to buy in and to identify and appoint an academic leader (driver).

Curriculum challenges

- Identify what you want to simulate
- Simulation that is not integrated into the curriculum
- To do group scenarios including different but similar clinical disciplines as well as other health care professionals
- To get continuity in simulation as part of the curriculum.

Student challenges

- The biggest challenge is to ensure that students are not afraid of real patients.

Space for training challenges

- The challenge is to provide a relaxed atmosphere, practice on a continuous basis, and practice skills until competency is obtained
- First get the space and then by the equipment
- Plan storage space in advance
- Start with simulators and buy equipment over time.

It is important to take note of the lessons learned and the challenges faced by simulation when it is introduced or implemented in a postgraduate training programme.

Discussion

Factors influencing simulation and the impact of simulation on postgraduate plastic surgery education and training need attention (Figure 1).

<u>Influence of simulation on student learning</u>

Simulation influences student learning in postgraduate education and training as it is a very specific and holistic learning and education strategy that is built on adult learning principles and ensures meaningful learning. The importance of preparation before simulation begins ensures the theoretical grounding necessary to facilitate learning. The simulation of rare clinical cases or life-threatening scenarios will be motivational, while the inclusion of health professionals from different disciplines will foster collaboration. Repetition to learn skills before practising on patients, and ensuring the attainment or maintenance of a certain level of competence will have a direct influence on learning. [13]

Simulation enhances the effectiveness of learning in postgraduate education and training (including aspects such as cognitive levels of learning, simulation types, application of features and uses of simulation)

The non-threatening environment that simulation provides enhances the effectiveness of learning; causes less stress to registrars; and holds various advantages for clinical teaching - such as patient safety, shorter operation time, fewer complications and lower costs. Through deliberate and repetitive practising, constructive feedback and debriefing, realism of clinical scenarios and quality assessment procedures, the effectiveness of learning can be ensured. Applying the unique features and uses of simulation in education and training - such as the provision of a controlled, non-threatening environment, integration of simulation into the curriculum, sound clinical teaching and learning practices as well as constructive feedback - will enhance the effectiveness of learning. Simulation can enhance learning at different cognitive levels by changing the learning outcomes and clinical scenarios. [10]

Identifying and describing learning outcomes

Identifying and describing learning outcomes for postgraduate education and training for which simulation might be an important training method, as well as the application of simulation modalities linked to specific cognitive levels are important factors that influence simulation and impact on simulation during implementation. [10]

Contribution that simulation can make; considerations to take into account; lessons learned; challenges posed by simulation; guidelines and recommendations

Other factors influencing the implementation of simulation in a programme are, for example, the contribution - including role and value - that simulation can make and add to training; considerations to take into account when compiling guidelines; taking note of lessons learned and challenges as far as simulation is concerned and as described in this article.

In order to compile guidelines for implementation of simulation into a programme, the factors/forces influencing simulation and the implementation of simulation on postgraduate education and training should be taken into account.

The final outcome of the research project will be to develop a framework structure that can be used to propose guidelines for teaching through simulation as part of the training of plastic surgeons. These inclusive and comprehensive guidelines will be reported and discussed in a forthcoming article based on the challenges, recommendations and suggestions in this article.

Guidelines can be defined as ‘rules or instructions that are given by an official organization telling you how to do something, especially something difficult’. [14] A recommendation differs

from the closely related word ‘advice’ in that ‘recommend’ is often used with positive advise to tell someone about potential benefits and ‘advice’ with more negative connotations to warn a person about potential dangers. [14] In clinical practice guidelines are considered to be ‘statements that include recommendations intended to optimize patient care’. [15]
A principle can be defined as a ‘moral rule of strong belief that influences your actions’. [14] For Shekelle *et al.* (1999) three principles are fundamental to the development of valid and useable guidelines namely:

i. *The development of guidelines requires sufficient resources, experts, finances and research skills;*
ii. *A systematic review of the evidence is essential to every guideline; and*
iii. *A multidisciplinary group should translate the evidence into a guideline.* [16]

The abovementioned three principles should be applied during the drawing up of guidelines for implementation of simulation in plastic surgery in future research.

Conclusion

It was worthwhile examining the use of simulation in a postgraduate plastic surgery training environment in order to determine if it might be useful in addressing the lack of opportunities for clinical exposure and practise. Simulation has a specific role and can definitely add value to postgraduate training. Aspects were identified to compile a framework structure that can serve as a point of departure and can be applied to propose guidelines and recommendations for training through simulation as part of the training programme in plastic surgery. These factors will act as forces in education and training that will influence and drive the implementation of simulation in a postgraduate programme and will serve as a directive in successful implementation.

The contribution that simulation can make in the training of plastic surgeons according to suggested guidelines and recommendations so far can add value to specialist training. The outcome of the research will serve as a ‘roadmap’ for postgraduate plastic surgery education and training on how simulation might be used to enhance learning, and how simulation might be used to improve students’ knowledge, clinical competence, skills and professional conduct.

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Simulation in Plastic Surgery: Role, value and contribution of simulation in education and training – a directive for implementation

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Author contribution.
CPGN designed the study, wrote the protocol, collected data and performed analysis, interpreted data and wrote the manuscript. GJvZ and MJL were supervisors of the study, reviewed the protocol and manuscript and contributed substantially to the conceptualisation, design, analysis and interpretation of data and scientific content. All authors approved the final version of the manuscript submitted.

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Abstract:

Background. In this research, an in-depth study was done on the role and value of simulation in postgraduate plastic surgery education and training. The question that was asked is whether it was worthwhile examining the use of simulation in a postgraduate plastic surgery training environment in order to determine if it might be useful in addressing the lack of opportunities for clinical exposure and practice. If simulation has a contribution to make; a role to play and be of specific value that it can add to postgraduate plastic surgery education and training, which points of departure and aspects must be considered to compile a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes?
Objective. The objective of the research was to identify and describe (a) the contribution that simulation can make, including the role, as well as (b) the main considerations for implementation of simulation in a training programme.
Methods. Data were collected by means of semi-structured interviews conducted with national and international role players in simulation.
Results. A description of the role that simulation can play, the value that simulation can add and the contribution that simulation can make, are given. The main considerations to take into account for the identification of aspects that might be considered in order to compile a framework structure that can be applied to propose guidelines and recommendations for teaching through simulation as part of training programmes are described.
Conclusion. The contribution that simulation can make in the training of plastic surgeons according to suggested guidelines and recommendations can add value to specialist training. The outcome of the research, it is foreseen, will serve as a directive for postgraduate plastic surgery education and training on how simulation might be used to enhance learning, and how simulation might be used to improve students' knowledge, clinical competence, skills and professional conduct.

Keywords: Role, value and contribution of simulation, postgraduate plastic surgery education and training, directives for implementation.

Introduction

Clinical simulation plays an important and valuable role in the development of clinical skills and professional attributes, and in creating a safe, non-threatening training environment. Simulation can play an important role in building a safer health care system and may have the potential to address a number of challenges facing postgraduate plastic surgery education. The ability to perform clinical procedures is a key skill and requires a combination of various skills and competencies – some of which may be obtained by introducing simulation into registrars' training. Over the past number of years, the evidence of simulation as an integral part of medical education has placed increased emphasis on simulation technology to improve education and training opportunities. [1-4]

Scalese (2009: 65) points to the trend to utilise simulation for teaching, learning and assessment. [5] Simulation-based education plays a significant role in minimising risk to patients and enhancing medical training. [6] The question that is asked, is: Can the use of simulation be valuable in addressing the problem of a lack of opportunity for clinical exposure and practise?

The American College of Surgeons (ACS) has decided to introduce simulation in teaching and education for general surgery. [7,8] Mittal *et al*. (2012) have proposed that plastic surgery should follow the simulation initiative with modifications appropriate to the speciality of plastic surgery. [7,8] Arbogast and Rosen (2012: 235 – 252) proposed in their article, *Simulation in Plastic Surgery Training: Past, Present and Future,* that these modifications may address the challenges specified to the field of plastic surgery. [9] They are of the view that a unified commitment by medical educators to use simulation '…to simultaneously standardize the training curriculum, individualize the method of acquiring information, and objectively evaluate the training process' is necessary. [9]

Arbogast and Rosen (2012: 241 - 244) have listed 20 skills required of postgraduate residents in general surgery and plastic surgery respectively that can be simulated in year one and two, as well as procedures required of residents in plastic surgery in years three, four and five that can be simulated. [9] In this research project, the researcher (CPG) identified a number of learning outcomes on, for example, medical knowledge and patient care, distributed over five training levels, where simulation may have a role and be of value as an important method to be included in the training programme of plastic surgeons. [10]

'Simulation needs not to be restricted to residency: simulation has a role to play in medical education from undergraduate level to senior physician's maintenance of certification. The incorporation of innovative technology into today's curriculum will be an essential step in not only preparing for the future, but shaping it as well'. [9] This research article will, hopefully, facilitate the identification of aspects with the view to establishing a framework structure that can serve as a directive, in future, to propose a system of guidelines and recommendations to be used for the implementation of simulation in plastic surgery education and training programmes.

Methods

The research was designed as a descriptive study that includes a literature overview, a Delphi process and semi-structured interviews. The results and findings of five questions put to the interviewees during the interviews are described in this article.

Approval to conduct the research was obtained from the Ethics Committee of the Faculty of Health Sciences, UFS (ECUFS 122/2015).

Semi-structured interviews

Semi-structured interviews were used to explore key national and international role players' opinions and perceptions on simulation-based medical education. The purpose was to investigate and to establish clarification on simulation in postgraduate education and training. The interviews were conducted to obtain an in-depth, comprehensive overview of the contribution that simulation might make to postgraduate plastic surgery education and training. An interview guide developed by the author on the basis of a literature review was used. Occasionally, additional questions arose during the semi-structured interview process; the data thus collected were included in the research. Data on Questions 8, 9, 10, 11 and 13 of the interview guide are reported in this article. The questions are selected from the interview guide and presented in Table 1.

Table 1. Questions for semi-structured interviews with role players
Does simulation have (a) a contribution to make to, (b) a role to play in, or (c) a specific value to add to postgraduate education?
What would your main consideration be if you decided to include simulation in your teaching and training programme?
If you have to guide a team of experts tasked to develop a curriculum with simulation as one of the training/learning methods, which important guidelines will you put on paper?
Do you wish to make any recommendations that may be used in compiling guidelines on simulation for postgraduate plastic surgery?
Will you please share (a) some of the lessons learned regarding the implementation of simulation in a curriculum, (b) as well as the biggest challenge in implementing simulation in training?

Target population

National and international role players in simulation and postgraduate education were requested to participate in the semi-structured interviews. The participants were directors of simulation units, clinical heads of clinical medical departments, programme directors of medical and nursing programmes, and education management specialists, researchers and representatives from the simulation industry. Written consent was obtained from the participants.

Data collection and analysis

Individual interviews (based on a single interview guide) were conducted by the author (CPG) with eight participants. All interviews were audio-recorded, transcribed by the author (CPG) and checked by an independent person who was not part of the study. Field notes taken during the interviews contributed to the data. The data were analysed using the grounded theory approach that requires continuous comparison of data, following the data analysis steps of coding, categorisation and theory generation. [11] Theory building occurred by finding patterns in the data and this continued until saturation of data was reached. [12]

Reliability and trustworthiness

Reliability was ensured by making use of explorative studies, determining strict criteria for sampling, using the carefully constructed interview guide, as well as an interview process that was audio-taped and carefully described. Trustworthiness of the interviewing process was ensured by involving voluntary interviewees with a clear understanding of what the interviewer expected from them, and using open-ended questions, as well as the transcription and verifying of the accuracy of data. Scientific record-keeping ensured dependability.

Results

The contribution, role and value as well as the main considerations for implementation of simulation in a teaching/training programme are given. It is followed by suggestions from the interviewees on a number of key issues in the form of proposed guidelines to direct a team of experts developing a curriculum with simulation as one of the teaching/learning methods. They also make recommendations that may be used to compile these guidelines. The lessons learned and challenges to implement simulation as part of a training programme are offered.

The contribution of simulation in postgraduate plastic surgery education and training

It is clear from the opinions of the interviewees that simulation makes an important contribution to patient safety. Registrars/specialists in training can practise their skills in a non-threatening, pre-selected and controlled, safe environment that prepares them beforehand and provides them with the opportunity to learn gradually, in their own time and according to their own pace. Once they are competent, the acquired knowledge, skills, clinical competencies and professional conduct and behaviour can be transferred to real clinical settings and patients. This minimises the risk to patients and ensures a proficient and competent registrar, while delivering an excellent outcome. Simulation training also exposes registrars to higher levels of critical thinking and complexity; interdisciplinarity; and high-fidelity simulation during large group simulations - triggering effective learning.

In addition, simulation simultaneously offers an alternative training method. While a clinical facilitator or head of department is training registrars on a flat screen simulator to master certain skills, the consultants are responsible for making the decisions; thus, in such a situation, two different groups are trained at the same time at different cognitive levels to become competent or proficient - reaching difficult objectives. Through *training the trainer* you can add value to simulation as a training method as well as to clinical education. The contribution that simulation can make incorporates the role that simulation plays and the value that simulation adds.

The role and value of simulation

The findings on the role that simulation can play and the value that simulation can make to postgraduate education are tabulated in Tables 2 and 3.

Table 2 sets out the opinions expressed by interviewees on the role that simulation may play in postgraduate education. Responses of the interviewees were organised into themes (in Table 2), followed by the themes together with quotes based on their verbatim responses.

Table 2. The role of simulation in postgraduate education

Simulation provides a non-threatening environment for teaching and learning
Simulation facilitates student learning
Simulation enhances the effectiveness of learning
Simulation plays a role in clinical training and has an increased application
Simulation gives the opportunity for deliberate practise
Simulation gives the opportunity to practise safely on patients
Simulation offers a solution to problems experienced in postgraduate education and training

Simulation provides a non-threatening environment for teaching and learning

Interviewees expressed the opinion that simulation provides controlled and safe practise opportunities by giving registrars time to hone their skills and competencies in safe, no-risk circumstances. Registrars also have the opportunity to practise in an environment where they feel safe and relaxed:

> Quote 1: 'Simulation leads to less stress where registrar has the opportunity to practice in a safe environment'
>
> Quote 2: 'What happens here, stays in the simulation lab.'

Simulation facilitates student learning

Simulation facilitates student learning, knowledge, clinical competence, skills and professional behaviour:

> Quote 1: 'Simulation is a very good learning situation and provides the opportunity to learn in another way'.

Simulation enhances the effectiveness of learning

Simulation can enhance learning effectiveness at different cognitive levels. Feedback during or after simulation influences the effectiveness of learning:

> Quote 1: 'Simulation enhances learning – registrar can identify own problems and rectify where and when necessary '
>
> Quote 2: 'Simulation provides the opportunity for registrars to learn gradually and progress to higher competency and/or cognitive levels.'

Simulation plays a role in clinical training and has an increased application

Simulation has an important role in clinical training and plays a definite role in holistic and integrated health care training. Simulation provides the registrar in a specific discipline the opportunity to practise specific (certain) skills individually or it can provide the opportunity that training can take place in a multi-professional health care group, where learning various types of skills through complex scenarios takes place. A decreasing number of training platforms that become smaller in certain disciplines, shrinking financial resources, as well as a demand for more health care professionals require that additional options for clinical training and assessment be investigated: these constrain the education time that registrars in training receive - but at the same time, however, simulation gives registrars the opportunity to experience clinical cases that they would perhaps not see in certain disciplines:

Quote 1: 'By making use of simulated patients during simulation you can teach and train a wide range of material for example history taking, transfer of bad news, and/or medio-legal issues'

Quote 2: 'To practice certain procedures beforehand through simulation makes it easier for registrars when they do it for the first time on real patients'

Quote 3: 'Simulation gives registrars the opportunity to experience clinical cases that they perhaps won't see in their discipline'.

Simulation gives the opportunity for deliberate practise

Simulation gives the opportunity for deliberate practise, which together with repetitive practise plays an important role to master skills:

Quote 1: 'Helps to keep abreast of skills and topics'

Quote 2: 'Proficient: competent: excellent outcome'.

Simulation gives the opportunity to practise safely on patients

Simulation gives the opportunity to practise safely on patients:

Quote 1: 'Learning on simulated patients minimises the risk on real patients'

Quote 2: 'Simulation enhances medical training'.

Simulation offers a solution to problems experienced in postgraduate education and training

Simulation addresses the problem of a lack of opportunity for clinical exposure and practise as more exposure leads to fewer medical errors:

Quote 1: 'Assess students with the view to identify what have been missed or lack of opportunity'

Quote 2: 'Simulation training according to a specific schedule is a way to protect registrars' training time'

Quote 3: 'Simulation is useful to teach registrars patient communication skills'

Quote 4: 'Simulation definitely meets a need'.

Table 3 sets out the opinions expressed by interviewees on the value that simulation may add to postgraduate education. Responses of the interviewees were organised into themes (listed in Table 3), followed by the themes together with quotes based on their verbatim responses.

Table 3. The value of simulation in postgraduate education
Simulation is an alternative to a real patient strategy
Simulation is a solid educational and social grounding strategy
Simulation improves clinical grounding: care and increased patient safety
Simulation allows individualisation of education and training

Simulation is an alternative to a real patient strategy

Simulation offers an alternative training option and learning strategy in a more relaxed and less stressful environment:

Quote 1: 'Very specific strategy that can be used to learn'

Quote 2: ‘Simulation must be seen as an education and training aid and not the end goal: simulation is not the purpose but a way or method to do or learn something’
Quote 3: ‘Valuable additional alternative to bedside teaching’.

Simulation is a solid educational and social grounding strategy
Simulation is a solid educational and social grounding strategy that provides a safe environment where registrars can learn from their errors without the risk of harming a patient:
Quote 1: ‘The privileges of simulation is that simulation provides you a safe psychological environment for training/learning’
Quote 2: ‘Simulation provides a training environment where registrars’ individual needs, strengths and deficiencies can be attended to’
Quote 3: ‘Simulation provides an opportunity for both formative assessment (debriefing, feedback) as well as summative assessment
Quote 4: ‘Competency-based training environment’.

Simulation improves clinical grounding: care and increased patient safety
Simulation improves clinical grounding such as patient care and patient safety. Simulation is a valuable method to train a variation of skills in a controlled clinical environment:
Quote 1: ‘Through surgical simulation skills can be transferred to the operating theatre, decreasing operation time, complications and costs’
Quote 2: ‘Evaluation of skills through simulation can give feedback on competency level of registrar by using rubrics for procedures and may predict whether the candidate is ready to sit for final exam’
Quote 3: ‘Simulation can be used to evaluate whether a registrar is “safe” to operate on a patient and under pressure before the final examination’
Quote 4: ‘Offers registrars to advance along a learning curve’.

Simulation allows individualisation of education and training
Simulation allows individualisation of education and training; for example, through the standardisation of the curriculum, accommodating the learning styles of registrars as well as the opportunity for deliberate practise:
Quote 1: ‘Feedback during simulation helps registrar to identify problems and he/she can deliberately practice certain skills as needed’
Quote 2: ‘Constructive feedback and debriefing during simulation add value to the learning process’.

It is clear that simulation has a role to play and can add value to postgraduate education and training.

<u>The main considerations for implementation of simulation in a teaching/training programme</u>
The interviewees in his research project expressed their views on four aspects that should be taken into account when considering the inclusion of simulation in a postgraduate teaching and training programme, namely: revisiting the curriculum outcomes of the current postgraduate programme with integration on simulation; decisions to be taken on what to simulate; reviewing of available simulation facilities and equipment; as well as the role and value of assessment.

The first consideration to deal with is to revisit the curriculum outcomes in the current postgraduate training programme. Two points were emphasised, namely that simulation has to be integrated into and be part of the outcomes of the curriculum and that decisions should be reached as to where simulation is going to fit into the programme. The interviewees suggested:

Quote 1: 'Try to identify the outcomes that the registrars find difficult to reach, for example specific skills'

Quote 2: 'Develop a basic surgeon across all plastic surgery disciplines'.

These recommendations entail that curriculum developers need to go back to the drawing board and rethink, not only the purpose and outcomes of their education and training programme, but also the knowledge, skills, clinical competencies and professional conduct qualities they want a plastic surgeon to have in order to practice safely and to be proficient / competent / excellent.

The second consideration is to identify and decide what to simulate. The following four points were emphasised: To identify the plastic surgeons' role in practice is important. Plan and structure clinical scenarios well, develop complete scenarios with clear outcomes. Although you might have a good programme, the environment may change: improve, reform and make adaptions to facilitate effective learning within the aims of education and training for the specific profession. The interviewees suggested:

Quote 1: 'You need to know what your starting point is – it's looking what is actually called zone of simulation – designer simulation'

Quote 2; 'You can't have to simulate everything – what is designer simulation – things are in a high risk and low frequency – that is where your critical area to simulate is'

Quote 3: 'Try to identify the scars clinical conditions that is difficult to see – things you really want the registrars to see and be able to treat – the life-threatening conditions/cases that you really do not see regularly'

Quote 4: 'Identify discipline unique things to simulate'

Quote 5: 'Identify problem areas that can be simulated'

Quote 6: 'Push simulation to develop all competencies for basic general plastic surgeons in SA'.

From these perspectives, it is clear that decisions on what to simulate in a specific training programme and what meets the needs of that profession are of utmost importance.

The third consideration that was mentioned is to review available simulation facilities and equipment, not only in your institution or nationally, but also to get a world perspective in order to identify what type of simulation facilities are available and decide whether and how your facilities can fit in with other facilities. The interviewees suggested:

Quote 1: 'Identify what is already available in your training platform – simulation not better than real patient'

Quote 2: 'Don't invent the wheel again'.

It is important to plan in detail how you can use available simulators, as high fidelity simulation is adaptable to a large extent.

The fourth consideration to take into account is the opportunities offered by such a new simulation initiative implemented in the programme that can be of value as far as assessment is concerned. Two points were emphasized, namely that feedback during and after assessment should lead to effective learning experiences; and that simulation can be used to be part of different forms of examinations and certification. The interviewees suggested the following:

> Quote 1: 'Assess the registrar on a continuing basis on preparation, knowledge, skills, oral expertise, professional behaviour, making a correct diagnosis, executing procedures, and not harming patients.'
>
> Quote 2: 'Maintenance of a specific field'.

The role and value of simulation in assessment should be investigated in depth to the benefit of the registrar and profession.

Guiding a team of experts in developing a curriculum with simulation as one of the training/learning methods

The interviewees were asked to propose guidelines to direct a team of experts developing a curriculum with simulation as one of the teaching/learning methods. They responded on three key issues, as follows and in their own words:

Training curricula and outcomes

Identifying the holistic bigger picture

- You should form a mind set or framework as far as simulation is concerned and how it will fit in into the holistic bigger training picture/process
- You should decide what the expectation are at the end of specialisation as far as knowledge, skills, competencies, attitudes, etc. are and decide what the role will be of simulation – what are the characteristics that need to be in place – decide then how simulation will fit in
- You should identify the current curricula available that has the same content as yours.

Alignment of outcomes

- You should revisit and develop curriculum outcomes as well as learning outcomes for simulation scenarios that fit your requirements and needs
- You should align teaching, learning and assessment.

Content and place

- You should make simulation a compulsory part of the curriculum
- You should decide beforehand where simulation fits into the curriculum.

Scheduled time and overload of the curriculum

- You should schedule simulation and debriefing sessions into your teaching and training programme as well as the character/nature of the simulation sessions
- You should protect the training time for your registrars including time for simulation
- You should decide how you are going to get people to progress through the training years.
- You should take care not to overload the curriculum.

Expertise and staff

- You should identify content experts and develop new and innovative materials for simulation to overcome a resource constraint environment
- You should use all the expertise available

- You should develop and offer a course to *train the trainers*
- You should identify champions per department who can drive simulation in a department.

Market analysis and research
- You should do market analysis to identify applicable research, best practices and available simulator modalities
- You should use research to test new concepts and identify clinical needs.

It seems that the development of curricula and the alignment of outcomes are pre-requisites, as well as building staff expertise – these actions should be based on sound scientific research.

Recommendations that may be used in compiling guidelines on simulation for plastic surgery

The interviewees were asked whether they wish to make recommendations for compiling guidelines on simulation for plastic surgery and responded as follows:

- It is recommended not to attach the wrong value or weight on simulation in your curriculum – see it as a method for training, not the main aim of clinical education and training
- It is recommended, if it is decided to include simulation in the programme, to make it a compulsory component of the curriculum and it should be integrated into the curriculum as a required component and that it must promote aspects that are difficult to train on real patients
- It is recommended that there should be synergy on alignment between theory, practice and assessment
- It is recommended that training is standardise and individualised
- It is recommended that you decide beforehand which learning objectives are you going to eliminate from the curriculum and will be replaced/reserved for simulation
- It is recommended to take note that registrars/specialists in training, do not understand the process from fast training in simulation moving to integrated practice (skills transference) in a clinical environment
- It is recommended to take note that staff are not necessarily trained for teaching by means of simulation
- It is recommended to keep guidelines clearly formulated.

The suggested guidelines and recommendations will be of value and noteworthy when decisions need to be reached as far as introducing and implementing simulation into a training programme.

Lessons learned regarding implementation of simulation into a curriculum

The interviewees shared the perspective that it is necessary that people realise that simulation does not replace real patients. It is important to replan and rethink curriculum and learning outcomes and to schedule enough time for compulsory simulation sessions. You have to identify beforehand what you want to simulate. Remember that observation and feedback improve the effectiveness of learning.

Challenges in implementing simulation as part of a training programme

The interviewees identified a number of challenges, namely:

Time challenges and student numbers

- Not enough dedicated schedule time for teaching and training registrars (service delivery, underutilisation of simulation)
- Time constraints, student numbers account for pressure and lower quality – reformulate objectives and compile smaller groups.

Cost-effectiveness challenges

- To keep cost effective is one of the biggest challenges
- Financial strains and the availability/non-availability to cover expenditure.

Staff resource challenges

- To get staff to work in a team in integrated scenarios as staff members have different personalities
- Staff resources and the willingness to run a simulation lab
- Staff have to be trained – time and cost of the challenge
- To overcome the *pushback action* of older lecturers as far as simulation is concerned
- To get staff to buy in and to identify and appoint an academic leader (driver).

Curriculum challenges

- Identify what you want to simulate
- Simulation that is not integrated into the curriculum
- To do group scenarios including different but similar clinical disciplines as well as other health care professionals
- To get continuity in simulation as part of the curriculum.

Student challenges

- The biggest challenge is to ensure that students are not afraid of real patients.

Space for training challenges

- The challenge is to provide a relaxed atmosphere, practice on a continuous basis, and practice skills until competency is obtained
- First get the space and then by the equipment
- Plan storage space in advance
- Start with simulators and buy equipment over time.

It is important to take note of the lessons learned and the challenges faced by simulation when it is introduced or implemented in a postgraduate training programme.

Discussion

Factors influencing simulation and the impact of simulation on postgraduate plastic surgery education and training need attention (Figure 1).

Influence of simulation on student learning

Simulation influences student learning in postgraduate education and training as it is a very specific and holistic learning and education strategy that is built on adult learning principles and ensures meaningful learning. The importance of preparation before simulation begins ensures the theoretical grounding necessary to facilitate learning. The simulation of rare clinical cases or life-threatening scenarios will be motivational, while the inclusion of health professionals from different disciplines will foster collaboration. Repetition to learn skills before practising on patients, and ensuring the attainment or maintenance of a certain level of competence will have a direct influence on learning. [13]

Simulation enhances the effectiveness of learning in postgraduate education and training (including aspects such as cognitive levels of learning, simulation types, application of features and uses of simulation)

The non-threatening environment that simulation provides enhances the effectiveness of learning; causes less stress to registrars; and holds various advantages for clinical teaching - such as patient safety, shorter operation time, fewer complications and lower costs. Through deliberate and repetitive practising, constructive feedback and debriefing, realism of clinical scenarios and quality assessment procedures, the effectiveness of learning can be ensured. Applying the unique features and uses of simulation in education and training - such as the provision of a controlled, non-threatening environment, integration of simulation into the curriculum, sound clinical teaching and learning practices as well as constructive feedback - will enhance the effectiveness of learning. Simulation can enhance learning at different cognitive levels by changing the learning outcomes and clinical scenarios. [10]

Identifying and describing learning outcomes

Identifying and describing learning outcomes for postgraduate education and training for which simulation might be an important training method, as well as the application of simulation modalities linked to specific cognitive levels are important factors that influence simulation and impact on simulation during implementation. [10]

Contribution that simulation can make; considerations to take into account; lessons learned; challenges posed by simulation; guidelines and recommendations

Other factors influencing the implementation of simulation in a programme are, for example, the contribution - including role and value - that simulation can make and add to training; considerations to take into account when compiling guidelines; taking note of lessons learned and challenges as far as simulation is concerned and as described in this article.

In order to compile guidelines for implementation of simulation into a programme, the factors/forces influencing simulation and the implementation of simulation on postgraduate education and training should be taken into account.

The final outcome of the research project will be to develop a framework structure that can be used to propose guidelines for teaching through simulation as part of the training of plastic surgeons. These inclusive and comprehensive guidelines will be reported and discussed in a forthcoming article based on the challenges, recommendations and suggestions in this article.

Guidelines can be defined as 'rules or instructions that are given by an official organization telling you how to do something, especially something difficult'. [14] A recommendation differs

from the closely related word ‘advice’ in that ‘recommend’ is often used with positive advise to tell someone about potential benefits and ‘advice’ with more negative connotations to warn a person about potential dangers. [14] In clinical practice guidelines are considered to be ‘statements that include recommendations intended to optimize patient care’. [15]
A principle can be defined as a ‘moral rule of strong belief that influences your actions’. [14] For Shekelle *et al.* (1999) three principles are fundamental to the development of valid and useable guidelines namely:

i. The development of guidelines requires sufficient resources, experts, finances and research skills;
ii. A systematic review of the evidence is essential to every guideline; and
iii. A multidisciplinary group should translate the evidence into a guideline. [16]

The abovementioned three principles should be applied during the drawing up of guidelines for implementation of simulation in plastic surgery in future research.

Conclusion

It was worthwhile examining the use of simulation in a postgraduate plastic surgery training environment in order to determine if it might be useful in addressing the lack of opportunities for clinical exposure and practise. Simulation has a specific role and can definitely add value to postgraduate training. Aspects were identified to compile a framework structure that can serve as a point of departure and can be applied to propose guidelines and recommendations for training through simulation as part of the training programme in plastic surgery. These factors will act as forces in education and training that will influence and drive the implementation of simulation in a postgraduate programme and will serve as a directive in successful implementation.

The contribution that simulation can make in the training of plastic surgeons according to suggested guidelines and recommendations so far can add value to specialist training. The outcome of the research will serve as a ‘roadmap’ for postgraduate plastic surgery education and training on how simulation might be used to enhance learning, and how simulation might be used to improve students’ knowledge, clinical competence, skills and professional conduct.

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Author contribution. CPGN designed the study, wrote the protocol, collected data, and performed analysis and interpreted the findings and wrote the manuscript. GJvZ and MJL reviewed the protocol and manuscript. All authors approved the final version of the manuscript submitted.

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Conflicts of interest. None.

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APPENDIX AC VERIFICATION OF LANGUAGE EDITING AND EDITING OF REFERENCES

APPENDIX AC

VERIFICATION OF LANGUAGE EDITING AND EDITING OF REFERENCES

DECLARATION

8 December 2018

TO WHOM IT MAY CONCERN

I herewith declare that I did the language editing of the manuscript of an article on ***Simulation in Plastic Surgery: Features and uses that lead to effective learning***, authored by **CPG Nel**, **GJ van Zyl** and **MJ Labuschagne**. The track changes function was used and the authors were responsible for accepting/rejecting the changes and recommendations, and for finalising the document.

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DECLARATION

20 January 2019

TO WHOM IT MAY CONCERN

I herewith declare that I did the language editing of the manuscript of an article on **Enhancement of Plastic Surgery Training by Including Simulation in Education and Training Programmes, by CPG Nel**, **GJ van Zyl** and **MJ Labuschagne**.

The track changes function was used and the authors were responsible for accepting/ rejecting the changes and recommendations, and for finalising the document.

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DECLARATION

29 January 2019

TO WHOM IT MAY CONCERN

I herewith declare that I did the language editing of Chapters 7 and 8 of the thesis on *Simulation in postgraduate plastic surgery education and training* by Corné Nel, student number 2000 003430.

The track changes function was used and the student was responsible for accepting/ rejecting the changes and recommendations, and for finalising the documents.

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29 January 2019

To whom it may concern

This is to certify that I language-edited Corne Nel's PhD thesis partly manually and partly electronically via track changes and comments. The author effected the changes. In this way, both linguistic excellence and the author's ownership of his text were ensured.

Sincerely
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I hereby confirm that I did the editing of the references of the thesis: "Simulation in Postgraduate Plastic Surgery Education and Training" by Corné Pieter Gustav Nel. (Thesis submitted in fulfilment of the requirements for the degree Philosophiae Doctor in Health Professions Education (PhD HPE) in the Division Health Sciences Education, Faculty of Health Sciences, University of the Free State).

Michele de Klerk