DISSERTATION: SOUTH AFRICAN MIDWIVES' KNOWLEDGE OF PLACENTAL TRIAGE.

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SUBMISSION DATE: 17 FEBRUARY 2021

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Declaration

"I, Amori van Rensburg, declare that the dissertation: South African Midwives' knowledge of placental triage, that I herewith submit for the degree Master of Nursing at the University of the Free State, is my independent work and that I have not previously submitted it for a qualification at another institution of higher education."

Amori van Rensburg

31/01/2021

Acknowledgments

Without God, his guidance and love, this study would not have been possible. God, You have guided me through the valleys of fear, doubt, exhaustion, exhilaration and excitement. You carried me when I could no longer walk or even write. Thank you for the gifts You have bestowed upon me and for always blessing me with more than I ever could imagine or deserve.

To each person who has crossed my path and whom I have had the privilege of meeting during this study, a heartfelt thank you. There are a few people whom I would like to mention for their extraordinary contributions to this study:

My partner, best friend and trusted confidant, Chantelle Jordaan. Your support during this study has been unwavering. You have had to forego many social events and pick up more duties around the house when I had one resounding phrase every time: “I have to study”. You ever so patiently made millions of cups of coffee, cooked meals, rubbed shoulders, wiped tears, endured frustration and loved me none the less. I can only thank God for giving me a person who truly knows the meaning of loving a nurse.

My study supervisor, mentor and professional idol, Dr Elgonda Bekker, thank you for your kind words of inspiration and unfailing patience with a student such as myself. You set the bar high for midwives like me who can only dream of being as prominent in the community as you. Your passion is an inspiration. Thank you for pushing, shoving and dragging me to the finish line; I could not have done this without you.

The mother of the placentas in my life, Prof Colleen Wright. If it were not for your passion for the Cinderella story and your persistence to have all placentas go to the ball, this study would not have been born. Just one lecture and I was hooked. Your love for this topic sparked a light inside me and inspired me to pursue this avenue in midwifery. Thank you for your continued contribution to this study, assisting with the study design, the development of the questionnaire and pictures provided, from the beginning right to the final review and editing.

Dr Delene Botha, thank you for igniting in me my initial love for midwifery. Your abundant knowledge and kindness to me as a student have forever remained with me. Thank you also for your inputs into this research and for always being willing to help.

The dedicated librarian, Annemarie du Preez. Thank you for making miracles happen, finding and supplying articles and information when no one else could. Your input and efforts are highly appreciated.

Dedication

I dedicate this degree to my late grandfather, Pieter Potgieter. I started this road when you were still here; I am sorry you could not see me finish it. I remember your proud face and big hug when I told you I am going to further my studies. Your delight that one of your grandchildren will follow in your footsteps is a moment I will never forget.

Thank you for instilling in me the meaning of a good work ethic, perseverance and an absolute love for academia. You always led by example and I could not have asked for a better mentor in my life. You taught me most of what I know in life and always assisted with the crises in my life. You also showed me how to live a God-fearing life.

There were multiple times throughout this study when I wished I could pick your brain about a topic over a cup of tea and cake. Even though you were not here, I could still feel your presence and hear you speak through Ouma. Thank you for watching over us.

Alas, I had given it my all and did everything to the best of my abilities, just as you taught me. I hope it was enough to make you proud.

Abstract

The placenta is an underexplored and underappreciated organ. Examining the placenta is routine after birth. It is given a glance-over, but never a second thought. Placental histology provides a valuable in-depth investigation into placental pathology. Abnormalities can be identified by a macroscopic examination of the placenta. This investigation can be considered as a triage of the placenta to determine if histological investigation is required. One of the biggest contributors to litigation in obstetrics comprises to children with Cerebral Palsy (CP). Factors contributing to the development of CP can be shown to be present in utero, rather than during labour, by sending the placenta for histology. Litigation costs in South Africa in the field of maternal and child health is increasing exponentially. This increased risk for litigation and the high number of unexplained stillbirths are the drivers behind the value of macroscopic placental examination and histology.

This research focussed on answering the research question: *What is the existing knowledge of midwives educated in South Africa regarding placental triage?*

To answer this research question, a quantitative research approach was chosen, and a survey method used. A questionnaire was developed to determine and describe the knowledge of South African midwives. The total number of participants were 157. Of all participants, 64% stated that they always examine placentas. The Department of Health South Africa (DoHSA) require a basic examination of the placenta to always be performed. The regulation relating to the conditions under which registered midwives may carry their profession, R2488, also stipulates that a placenta must be inspected for completeness of the disc and membranes. This finding confirms non-conformity to the guidelines for submission of placentas for histology.

The overall median for the questionnaire was 61.9%. The lowest obtained score was 14.3% and the highest score was 81%. This indicated that the participants had 60% knowledge of the

macroscopic placental examination. Little literature is available regarding investigated placental examination or knowledge within South Africa. The DoHSA admits to constraints in the education system leading to poor competency and limited clinical exposure.

As most participants were employed in the public sector, it was expected that they complied with the procedures described in the in the documentation prescribed by the DoHSA. Yet, through the study findings it became clear that some midwives were not compliant. Only 61% of participants answered that there were placental histology services available in the units they worked in. That left a gap of 40% of institutions that did not have these services available and raises the question of what was being done in these facilities when an abnormal placenta was identified.

In conclusion, forty per cent (40%) of participants did not know what the histology report of the placenta could be used for. This proved that more awareness should be shared on this subject and the benefits it provides, for midwives. A staggering 97% of participants stated that the institution they worked at could benefit from further education regarding placentas and placental histology. It is reassuring that 88% stated that they could benefit from advanced training regarding examination of placentas. It is evident that examination of the placenta is paramount in the prevention of litigation cases and for future treatment of the mother and baby.

Key words: Placenta, pathology, histology, macroscopic examination, midwife, education, competence, knowledge, practice guidelines.

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List of abbreviations used:

BMI	-	Body Mass Index
CP	-	Cerebral Palsy
DoH	-	Department of Health
DoHSA	-	Department of Health South Africa
HIE	-	Hypoxic Ischemic Encephalopathy
IUGR	-	Intra Uterine Growth Retardation
NICU	-	Neonatal Intensive Care Unit
PROM	-	Premature Rupture of Membranes
SANC	-	South African Nursing Council
SOMSA	-	Society of Midwives of South Africa
UFS	-	University of the Free-State
VUE	-	Villitis of unknown aetiology

Clarification of concepts

For the purpose of this study, the following concepts were operationalised as:

Placenta: "A temporary organ that joins the mother and foetus, transferring oxygen and nutrients from the mother to the foetus and permitting the release of carbon dioxide and waste products from the foetus. The placenta is rich in blood vessels. The placenta is expelled with the foetal membranes during the birth process; together, these structures form the afterbirth" (Shiel, 2018:online). For this study, the term placenta included the placenta, membranes and the cord.

Placental triage: Triage is defined as a system of priority classification of patients in any emergency (Churchill Livingstone, 2003:301). In this study, the term placental triage was used to describe the triage or classification of placentas, through macroscopic examination, to be sent for histology or not. Ultimately the benefit of sending a placenta for histology will have to be weighed up against available medical resources and cost. To make this distinction, a midwife will need placental knowledge, which this study aimed to describe.

Placental knowledge: Existing knowledge about the normal and abnormal features of the placenta and its physical structures. In this study, knowledge was evaluated by employing an electronic questionnaire regarding the placenta's normal and abnormal features.

Macroscopic examination of the placenta: The Merriam-Webster's medical dictionary describes macroscopic as "observable by the naked eye" (Merriam-Webster's Medical Dictionary, 2018:online). Thus, the term macroscopic examination of the placenta was used to describe the placenta's physical examination and its physical structures.

Histology: “The anatomical study of microscopic structures of animal tissues” (The American Heritage® Medical Dictionary, 2007:online). In this study, the term histology was used to describe placental histology and microscopic examination by a pathologist.

Midwife: “A midwife is a person who has completed a midwifery education program that is based on the ICM Essential Competencies for Basic Midwifery Practice and the framework of the ICM Global Standards for Midwifery Education and is recognised in the country where it is located; who has acquired the requisite qualifications to be registered and is legally licensed to practice midwifery and use the title ‘midwife’; and who demonstrates competency in the practice of midwifery” (International confederation of Midwives, 2017:1). For this study, the term midwife was operationalised as a person who had completed a midwifery qualification in South Africa, whether they were still practising or not.

Chapter 1

1.1 Introduction and background

A harmonious symbiosis exists between the allies involved in the intricate journey of pregnancy and the result is a beautiful relationship. This symbiotic principle applies to the interdependence between the mother, the foetus and the placenta. If one of the partners of this relationship is malfunctioning, it will be most evident in the outcome of the pregnancy. The unfortunate result will be the death of either party involved.

The placenta is a temporary organ that develops between the mother and foetus to facilitate nutritional needs, hormone production, gas exchange and elimination of waste products (Ziadie, 2017:online). Kulkarni, Palaniappan and Evans (2017:177) quite accurately describe it as the "black box" (as found in an aircraft) of pregnancy, denoting the valuable information from the start of pregnancy until birth (Kulkarni *et al*., 2017:177). As Schoots *et al.* (2018:153) explain, an essential function of the placenta is to exchange nutrients, oxygen and hormones between the mother and her foetus. When this process is impaired, the resulting inadequate placental function results in the manifestation of pregnancy complications (Schoots *et al*., 2018:153).

The placenta is an underexplored and underappreciated organ. There are no set standards for the macroscopic examination of the placenta globally. Examining the placenta is part of our routine after birth. We all glance at it, but never really give it a second thought. That is where the beauty of placenta histology comes in. Histology is the microscopic examination of tissues using imaging techniques such as microscopes to see the changes occurring on a cellular level (BD Editors, 2018:online). Information gained from placental histology can determine foetal disorders, and maternal risk factors that may influence subsequent pregnancies, can be identified. Furthermore, placental histology is a growing practice that helps determine several conditions, some of which are not visible clinically.

Fortunately, some abnormalities can be identified visibly by a macroscopic examination of the placenta. This initial investigation can be considered as a triage of the placenta to determine if further histological investigation is required (Odibo *et al.*, 2016:1).

In addition, the histological examination of a placenta may provide valuable answers to explain an adverse event during pregnancy and birth. From as early as 1989, task forces have been at work compiling practice guidelines for examining the placenta, including indications and methods for placental examination. These guidelines serve to direct the triage of placentas and identify the need for further investigation through placental histology (Langsten *et al.*, 1997:449).

Subsequently, Spencer and Khong (2003:206) did a study to determine compliance with these guidelines. They found that less than a third of placentas were submitted for histological examination from cases that met inspection standards. The authors state that placenta submission for further examination depend on the midwife or healthcare provider recognising the abnormalities that require further investigation. The information yielded by such examinations and analyses of the placenta could be applied to manage adverse events in subsequent pregnancies and prevent litigation (Spencer & Khong, 2003:205).

Another study that surveyed obstetric providers indicated that the lack of conformity to these examination standards and triage guidelines for pathological examination can either be a lack of knowledge on the subject, disagreement with the guidelines or a viewpoint that regards the information yielded as inapplicable to the clinical environment (Odibo *et al.*, 2016:2)

Furthermore, a study done in 2014 on the use of placental pathology and litigation found using placental macroscopic and microscopic examinations to be useful in medico-legal cases to explain undesired birth outcomes and to protect healthcare workers from being wrongfully accused of substandard care. Placental examination and pathology can determine and identify problems with the placenta's functioning and physical structure that could have

attributed to neurological damage in the foetus or even stillbirth. This is discussed in detail in Section 2.2.4. Specific placental changes indicate injury or stress in utero, thus protecting healthcare workers from litigation that claims injury occurred during birth (Chang, 2014:279).

One of the biggest contributors to litigation in obstetrics is infants born with Cerebral Palsy (CP). One can prove that foetal neurological brain damage occurred in utero, rather than intrapartum by sending the placenta for further examination by a pathologist. These findings would drastically improve the outcomes for newborns and mothers, because a proper care and treatment plan can be made according to sound medical facts and evidence. Extensive examination of the placenta can provide pivotal information about foetal or maternal conditions (Hargitai, Marton & Cox, 2004). Using placental histology for CP is further discussed in Section 2.2.2.

The Gauteng province in South Africa's Department of Health (DoH) faced litigation cases amounting to R29 billion in 2019. This amount represents almost 60% of the department's total budget, which could have been used to maintain hospitals or clinics and to acquire urgently needed equipment (Bloom, 2019:online). This increased risk for litigation and unexplained stillbirths are drivers for using placenta examinations, histology and pathology (Chang, 2009:1131).

Interestingly, most sources regarding placental examination and guidelines were published before 2015 and it is recognised that these practises are still not widely implemented in South Africa. The Maternal Care Guidelines for South Africa only requires to state if the placenta had been complete or retained (National Department of Health, 2015:29). Later in the same document, it states that the placenta must be examined for completeness and abnormalities. Still, it fails to mention the type of abnormalities or what to do if abnormalities were found (National Department of Health, 2015:50). It is also stated on page 93 that Intra-Uterine Growth Retardation (IUGR) is linked to placental insufficiency, but again no mention of how to detect placental insufficiency. Throughout the whole document (Maternal care guidelines),

it becomes clear that the only concern regarding the placenta is if it was complete or not, as it focuses on preventing Post-Partum Haemorrhage (PPH).

In addition, the Maternity Case Record issued by the South African government in 2018 has a summary of labour that must be completed by the midwife. This document requires indications if the placenta was normal/abnormal, complete/incomplete, the number of vessels in the cord, the placental weight, if a retro-placental clot was evident and if histology was done (Department of Health of South Africa, 2018:40). This raises the question of why placental triage for histology is omitted despite global evidence of its benefit, especially to curtail litigation cost and improved quality of care.

In addition, IUGR is a common occurrence in South Africa, with a national average of 13% of all babies born. As published in the triennial Saving Babies report in South Africa in 2018 (NAPEMMCO, 2018:10), the primary cause of death in babies was unexplained stillbirths, accounting for 24.4% of all deaths recorded (NAPEMMCO, 2018:11). In 48% of these unexplained stillbirths, the mother had no obstetric complications. The authors of the report recommended that the high volumes of unexplained stillbirths in the third trimester reserves priority of our attention to decrease these incidents (NAPEMMCO, 2018:11). If placental triage can be performed in these events, placentas can be sent for histology, and the results could be used to explain the stillbirths and contribute to preventing its recurrence.

Similarly, IUGR has been associated with stillbirths because of the presence of maternal vascular mal-perfusion and ischemia. Thus, it is presumed that the assessment of stillbirth placentas would show evidence of abnormalities (Silver, 2018:99). Again, this raises the question of why the global practice of placental triage and the histology thereof is not being used in South Africa where the occurrence of stillbirths is a growing national concern.

Another cause for concern is grief-stricken parents, who have no answers to why their baby had died, be it unexplained stillbirth or early neonatal death. These parents will sometimes

be inclined to search for answers, and people would motivate them to pursue malpractice litigation against the hospital or staff. Although litigation will, unfortunately, not change any of the circumstances for these parents, they often view it as a way of justifying what had happened. As midwives work in partnership with parents, they should be inclined to assist parents to find the answers they are seeking (International Confederation of Midwives, 2014:2). This can, in some cases, be provided by a histology examination of the placenta.

Similarly, Domino *et al.* (2014:240) found that, amongst families who pursued malpractice litigation after their child was diagnosed with neonatal brachial plexus palsy, the majority believed that their child sustained an unnecessary birth injury. They did not receive adequate information in the perinatal period and their concerns were either ignored or not adequately addressed by their treating practitioners. Of the participants who pursued litigation, the majority experienced lack of empathy and honesty from their physician. The authors advise a hands-on approach when facing these situations, as better communication between the physician and the family can decrease the risk for litigation (Domino *et al*., 2014:240). The problem with communicating with the family is that the physician does not always have all the answers or information to give. CP has been found to occur during antenatal development rather than intrapartum by means of placental changes seen during pathology (Chang, 2014:280). Thus, this proof obtained from sending the placenta for histological examination could prove that there was no unnecessary birth injury as claimed.

However, limited resources and high volumes of workload may overburden pathologists, causing them to shy away from placental histology. Thus, if a suitable protocol and triage were available for sending placentas for pathology, the workload could be eased (Wright, 2007:5). This deems the need for thorough triage of placentas by midwives and identification of abnormal placentas to be sent for histology. Unfortunately, if the knowledge regarding the normal and abnormal structures of the placenta is not adequate amongst midwives, as the primary examiners of the placenta, the triage will not be done.

The Essential Competencies for Basic Midwifery Practice, published by the International Confederation of Midwives (ICM) in October 2019, describes the minimum knowledge and skills required by a midwifery professional to practice. The competencies state that knowledge about the placenta's physiology and embryology is necessary to determine foetal wellbeing in the antenatal period (International Confederation of Midwives, 2019:14). Also, the midwife is required to be able to assess the placenta after birth for completeness (International Confederation of Midwives, 2019:18). Unfortunately, this is the only reference to placentas in the whole document, and it is not very descriptive about specific anatomical placental knowledge required.

As informed by literature, it becomes clear that the physical and pathological examination of the placenta holds high value in general and in adverse events during labour (Chang, 2014:279), as well as to determine abnormalities not always visible at birth. It can also drastically reduce litigation risks, because there will be sound medical proof of conditions present at birth. The reality is that healthcare workers or hospitals have no means of protecting themselves in these cases, because, in effect, the stillbirth or birth injury was 'unexplained'. There is no evidence supporting the physician or midwife's opinions and actions, but if a placenta histology report can prove the contrary, unnecessary litigation might be minimised.

Placental triage take minutes, is free of additional costs and should not be omitted because it plays such an intricate part in the maternal-foetal symbiosis. For midwives to be able to triage placentas, specific basic knowledge of normal and abnormal placentas are needed. During this study, however, the researcher did not focus on the skills of triage or the physical examination thereof, but rather on the knowledge regarding the examination of the placenta as the first component of placental triage among our South African Midwifery population.

1.2 Problem statement

As discussed during the introduction, placental histology can be beneficial to maternal and newborn care. Unfortunately, each placenta cannot be sent for histology due to financial expenses and lack of capacity within the pathology services to handle the volume. This is where placental triage can play a critical role to ensure only placentas with possible abnormalities are sent for indicated pathological examination.

Triage of placentas by midwives is under-utilised in South Africa, mainly as a method of determining which placentas need to be sent for histology or further investigation. The under-utilisation could be due to ignorance or incompetency regarding the valuable information it can yield or due to midwives being unfamiliar regarding the normal and abnormal physical features of the placenta. If the midwife can triage a placenta after birth to determine if it is normal or if it needs further investigation, it will serve as a primary screening process to send only the clinically relevant placentas for the required pathological examination.

A physical and macroscopic examination of the placenta as first line in detecting abnormalities of the placenta can contribute to a cost-effective strategy to reduce possible future litigation. Once abnormal placentas are identified, they can be sent for histology. The level of competence of the midwife regarding placental triage will determine the efficacy of placental triage.

Thus, if a midwife has adequate knowledge to recognise an abnormal placenta that needs to be sent for histology during the triage, it can significantly improve the information available regarding adverse outcomes. Determining the current knowledge of midwives in South Africa regarding the examination of the placenta, the uses of placental histology and the results it can yield can facilitate appropriate use of placental histology.

1.3 Research question

What is the existing knowledge of midwives educated in South Africa regarding placental triage?

1.4 Aim

The aim of this study was to describe the existing knowledge of placental triage amongst South African educated midwives to identify placentas for further examination.

1.5 Objectives

The objectives of this study were to:

- determine midwives' knowledge regarding the physical structures and macroscopic examination of the placenta, and
- describe current knowledge amongst midwives about placental histology.

1.6 Conceptual framework

A conceptual framework plots out the design and execution of the research and leads to the initial research questions (Mertens, 2010:116). Figure 1.1 maps the conceptual framework for this study as designed by the researcher.

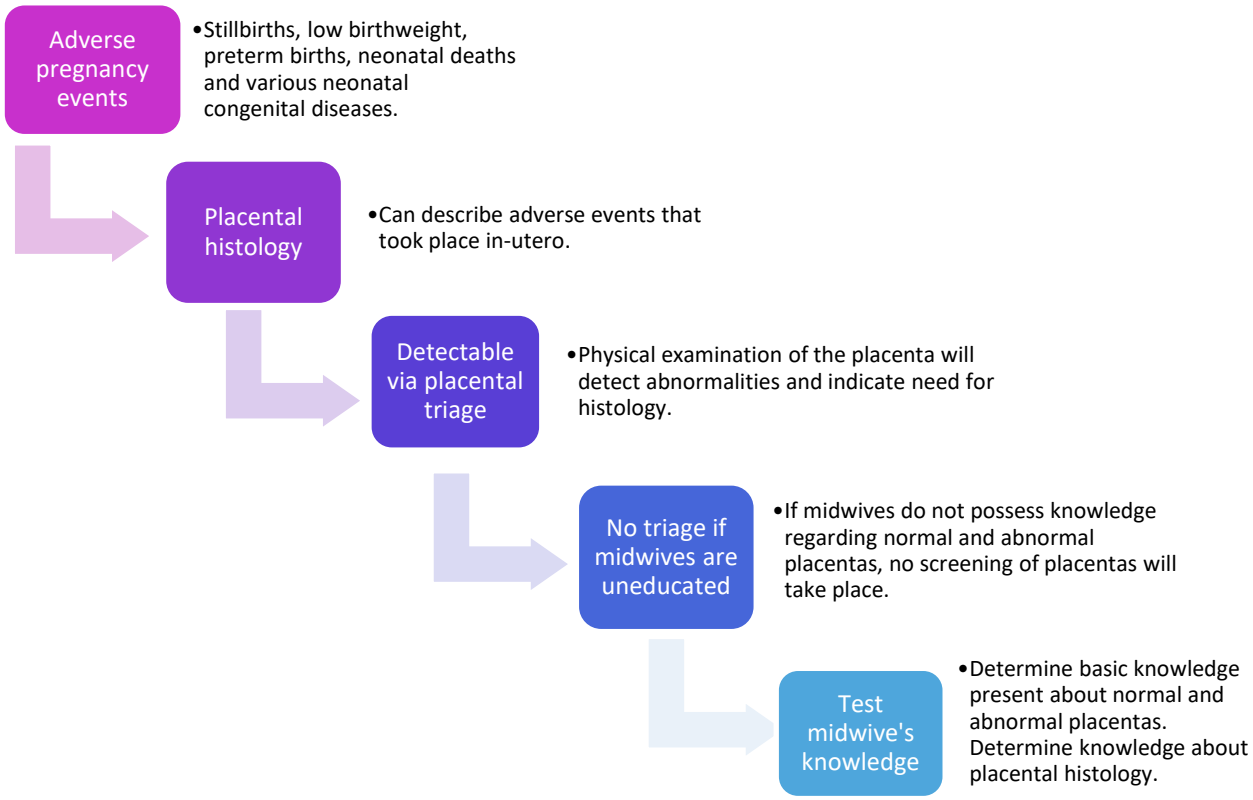

Figure 1.1 Conceptual framework

Figure 1.1 maps the conceptual framework followed in this study and is discussed in Section 3.2. The incidence of adverse pregnancy events, such as stillbirths, preterm births and neonatal congenital diseases, are detectable and explainable via placenta histology. If an in-depth examination is done on each placenta, physical abnormalities thereof will be noted that can serve as a triage system to determine which placentas need to be sent for histological examination. If midwives are not knowledgeable regarding normal and abnormal placentas, no triage can be performed. Therefore, it was necessary to first test midwives' knowledge of normal and abnormal placentas to determine their current knowledge and awareness about histology.

1.7 Research design

The research design is determined by the research problem identified and serves as a guide to address the research problem in a rational and structured way. The research design

comprises the manner in which data will be collected, measured and analysed (University of Southern California, 2020:online). The purpose of the research design is to plan and structure research in order to increase the validity of the results (Mouton & Marais, 1996:33).

There are three types of approaches to apply in research: quantitative, qualitative and a mixed method approach. In this research a quantitative approach was chosen. “Quantitative research is a formal, objective, rigorous, and systematic process for generating numerical information about the world. Quantitative research is conducted to describe new situations, events, or concepts, examine relationships among variables, and determine the effectiveness of interventions on selected health outcomes” (Grove & Gray, 2019:54). The researcher aimed to describe the available placental knowledge amongst midwives that made this approach applicable.

A quantitative research approach was deemed appropriate and used, and a simple descriptive design was chosen by the researcher. A simple descriptive design is described by Botma *et al.* (2010:111) as used to determine characteristics of a single sample. Quantitative research falls into the postpositivist paradigm of research and the significant beliefs associated with it is informed consent, beneficence, justice and respect for privacy (Mertens, 2010:11). The research design is discussed in more detail in Chapter 3.

1.8 Research method

In quantitative research approaches, the aim is to measure certain variables to answer research questions that arose from theory (Creswell & Creswell, 2018:167). The method used to reach that aim in this study was a survey method. Survey methods assist researchers in answering three questions: descriptive questions, the relationship between variables and the relationship between variables over time (Creswell & Creswell, 2018:168). For the purpose of this study, the researcher aimed to answer descriptive questions and determine the relationship between variables as a cross-sectional study. The survey method used in this

study was implemented as a cross-section and data were only collected within a three-month data collection period. The variable in this study, being current knowledge, made it more feasible to measure at one point rather than over a long period as is the case in longitudinal studies (Grove & Gray, 2019:248).

The platform of data collection was an internet-based questionnaire. Using the internet was chosen to reach as many participants as possible in the shortest time possible and because it was deemed to be more convenient for participants to use (Grove & Gray, 2019:356). Using the internet also had minimal financial implications for the researcher and was deemed a more sustainable form of research on the environment. The University of the Free State (UFS) embraces the use of technology and an environmentally friendly approach (University of the Free State, 2018:online). A multi-method approach, as advised by Mertens (2010:203), which uses paper surveys and online surveys, for instance, was not feasible for this study as the researcher stayed in another country at the time of data collection. See Table 1.1 for the advantages and disadvantages of online surveys as identified by the researcher.

Table 1.1 Advantages and disadvantages of online surveys

Advantages	***Disadvantages***
Cost-effective - Low cost to perform the study as no questionnaires are printed or need to be distributed (Maree, 2019:198). Follow-up reminders could be sent electronically with no additional cost.	Sampling bias - Not all participants have email addresses and internet access (Polaris, 2012:3).
Flexibility for researcher and participant- The participants can complete the questionnaire at their own pace and time (Maree, 2019:198).	Compliancy laws - Participants have to consent to participate, and specific laws might prohibit data collection (Polaris, 2012:4).
Fast and accurate - results and data can be processed quicker and without transcribing errors.	Low response rate - Some participants do not respond to email requests (Fricker & Schonlau, 2002:16) and surveys have a lower response rate in general (Grove & Gray, 2019:356).
Larger sample size - Potentially more participants as questionnaire can be shared to reach more people in a shorter time.	Participants need to be literate and have access to the internet (Maree, 2019:198).
No interviewer presence that can influence participant (Maree, 2019:198).	

As seen in Table 1.1, the advantages outweigh the disadvantages regarding using online surveys. The limitations of using an electronic questionnaire had been identified by the researcher and are summarised in Table 1.2, in accordance with actions taken to minimise their effect.

Table 1.2 Limitations of using electronic questionnaires.

Limitations	***Proposed solution***
Access to electronic device and internet service required to complete the questionnaire.	Sample group already assumed to have access to both as the questionnaire will be circulated using social media and internet sources such as email or WhatsApp.
No supervision - participants can use books or the internet to search for answers	Participants will be asked in an information letter not to do so and ensured that no personal information would be obtained to be connected to their answers. In the case that they still use means to get the answers, some knowledge will have been gained on the topic.
Older participants' unwillingness to use electronics	Advise participants to use a computer and no cell phone to complete the questionnaire to ease the difficulty in reading.
Low response rate	Regularly send multiple reminder emails and posts to social media.

Although the researcher was aware of some limitations that accompany the use of an electronic questionnaire, the solutions in Table 1.2 were deployed to try and minimise the effect of those limitations on the outcome of the study.

1.8.1 Questionnaire development

An electronic questionnaire (Annexure A) developed using the Evasys™ program was employed to evaluate the knowledge of midwives. The development of the questionnaire is discussed in Section 3.9. After an extensive search by the researcher and an experienced librarian on various databases, no published questionnaire could be found. Due to the unavailability of a published questionnaire that met the needs of this study, a questionnaire was developed. The guidelines, as published by Hargitai, Marton and Cox (2004:785-792) in the Journal of Clinical Pathology for the examination of a placenta and the relevance of

abnormalities was used in accordance with leading midwifery textbooks, as shown in Table 1.3, to develop the questionnaire content. A placental histology expert was consulted to review the developed questionnaire before submission to the review committee.

Table 1.3 Midwifery textbooks used.

Name of the textbook
A textbook for midwives (Nolte, 1998:308-315)
Anatomy and physiology for midwives (Coad & Dunstall, 2001:159-174)
Seller's midwifery (Sellers, 2018:106-118)
A comprehensive textbook of midwifery (Jacob, 2008:75-83)

The developed questionnaire was reviewed by a team of experts consisting of a midwifery expert, research and family medicine expert, and the study supervisor. It was also approved by the Evaluation Committee of the School of Nursing and Health Sciences Research Ethics Committee of the UFS. After every subsequent round of review and improvement of the questionnaire a placental pathologist was consulted.

1.8.2 Pilot study

A pilot study forms part of the verification process. The aim of the verification processes is to determine data quality by means of adequacy and appropriateness (Denzin & Lincoln, 2018:1397). This contributes to the rigor elements of the study. Rigor is acquired by using a scientific and detailed approach in research (Grove & Gray, 2019:589).

The questionnaire was pre-tested by asking ten midwives to complete the electronic questionnaire. The researcher's former colleagues were chosen to participate in the pilot study for accessibility reasons. This gave the researcher the opportunity to assist participants if they had any questions and to observe if they had any problems. This pilot study familiarised the researcher with the tool's effectiveness and identified any problems in using the instrument. The pilot group was asked to time the completion of the questionnaire so that an

estimated time could be shared with participants. The pilot group was also asked to complete a feedback form to help improve the questionnaire. The questionnaire was updated where deemed necessary and the final version approved by the team of experts as mentioned in Section 1.8.1. The outcome of the pilot study is discussed in detail in Section 3.10.

1.9 Population and sampling

The population of this study was identified as midwives who had completed their midwifery education in South Africa.

According to the latest South African Nursing Council (SANC) statistics, 109 061, people are registered as midwives in South Africa (South African Nursing Council, 2019:4-5). Not all these people practice as midwives after completing a comprehensive nursing degree or diploma with multiple registrations, including midwifery. Of this, 62 975 people have a combined qualification that includes community nursing, psychiatry and midwifery.

Subsequently, it was impossible to determine the population size of practicing midwives in South Africa, and thus a convenient sampling method was chosen. This is more effectively discussed in Section 3.6 in Chapter 3. Convenient sampling is described as using the participants that are conveniently or easily accessible to the researcher (Botma *et al.*, 2010:201). Purposeful sampling that uses the snowball strategy, involving asking each participant to refer to other participants (Mertens, 2010:185), was also used to try and reach more participants. Due to the unavailability of a registry of practicing midwives to determine the accessible population in South Africa (Grove & Gray, 2019:293), the snowball strategy was used to ask midwives to share the questionnaire with their colleagues to recruit more participants for the study.

The researcher included midwives from all practice environments in South Africa, to derive a clear picture of the overall knowledge of placentas amongst all midwives, be it practicing

midwives, educators or retired midwives. Midwives were approached on a national level, with the inclusion criteria being that the qualification must have been obtained in South Africa, and included public, private and independent practising midwives.

An electronic questionnaire developed using the Evasys™ program, was distributed by sharing a web link and information about the study on social media platforms and by sending it to people on the member database of the Society of Midwives of South Africa (SOMSA), the professional association for midwives that has voluntary membership. The participants then had the option to follow the link to participate in the study. The SOMSA database was estimated to contain 2 000 members' names and comprised members or midwives that had previously attended activities of the association. In addition, social media pages were employed to share the link to the questionnaire. The social media pages estimated combined total members are shown in Table 1.4, as accessed on 29/01/2019.

Participants were able to share the questionnaire's weblink with friends and colleagues as a strategy to recruit more participants thereby using the snowball sampling approach (Grove & Gray, 2019:579). This method of distribution ensured anonymity during the study as the researcher had no personal details or contact with the participants. It also reduced bias as the researcher did not personally choose participants for the study (Botma *et al*., 2010:85). The information letter provided at the beginning of the questionnaire requested participants not to complete the questionnaire more than once and clearly stated that only South African educated midwives should complete the questionnaire.

Table 1.4 Member totals of social media groups

Midwives of Africa	3043
Empowering midwives in South Africa	4685
Young midwives of South Africa and the world	11787
Private/independent practising midwives In South Africa	55
Society of Midwives of South Africa	639
Midwives on fire – NW	84
Total	**20293**

The researcher was aware that some members may belong to more than one of these groups; thus, the totals in Table 1.4 were an estimation only.

1.10 Data collection

An electronic survey program called Evasys™ was used, because the researcher had access to it via the University of the Free State. Data was collected by means of an electronic questionnaire completed by participants. The landing page of the questionnaire was the informed consent form (Annexure A) and gave participants the option to continue and complete the questionnaire or to exit and not participate. By continuing, participants gave implied consent, but they were still able to leave the questionnaire at any point (Univeristy of California, 2020:online). Reminders were posted to social media to remind participants to complete the questionnaire in order to get a higher response rate. The images and details of these posts are depicted in Section 3.11, where it is discussed in accordance with the data collection process. Data collected is discussed in Section 4.2.

1.11 Data analysis

Descriptive statistics consists of describing data in either numerical or graphical ways. The data collected via the questionnaire were captured electronically and contained multiple variables for each question on the questionnaire (Maree, 2019:226). Subsequently, data were

coded using the program Evasys™ and sent to the UFS's biostatistician who assisted with the analysis of the data. This provided the researcher with data to describe the knowledge of the midwives and formulate a conclusion to answer the research question.

Descriptive statistics, namely means, and standard deviations or medians and percentiles were calculated for continuous data. Frequencies and percentages were calculated for categorical data. The analysis was done in collaboration with the Department of Biostatistics at the UFS.

Quantitative data is expressed by means of pie or bar charts to give an immediate visual representation of the data obtained. Cross-tabulation was also used in accordance with certain questions and the answers received to compare different response patterns to similar variables (Maree, 2019:227-228). Data analysis is described in Section 3.12, and the results of the analysis are discussed and shown in Chapter 4.

1.12 Validity and reliability

In the postpositivist paradigm, there are certain standards for determining the quality of quantitative research, such as validity and reliability (Mertens, 2010:379). Validity in survey research mostly depends on the participant's honesty (Mertens, 2010:173). This made it important for the researcher to ask the participants, in the information sheet, to be as truthful as possible whilst answering the questions.

"Validity in quantitative research—whether you can draw meaningful and useful inferences from scores on the instruments" (Creswell & Creswell, 2018:173). This imply that the instrument, the questionnaire in this study, has to be useful in measuring what it intended to measure. With no existing questionnaire available to use and the researcher having to develop one, as explained in Section 3.9, there were no available validity scores for the instrument. Validity scores are determined by evaluating content validity, predictive validity

and construct validity (Creswell & Creswell, 2018:173) and serve as a guideline to determine the usability of an instrument in future.

The questionnaire's content validity is supported by an in-depth literature review, peer review of the instrument by experts in midwifery and placental pathology, and by performing a pilot study (Botma *et al.*, 2010:175). The experts who reviewed the questionnaire checks the content thereof and if it is applicable to the population of the study (Mertens, 2010:365). This was supported by the pilot study that proved the reliability of the questionnaire. By targeting all midwives in South Africa as participants for the accessible population, evidence produced were maximised and sampling bias reduced, thereby adding to the validity of the study.

The reliability of the instrument is what considers it to be consistent. The more reliable the measurement obtained by the instrument, the higher the accuracy for the researcher to measure the specific traits the instrument was intended to measure. To achieve a high level of accuracy, certain errors need to be minimised. These errors could be systematic or unsystematic (Mertens, 2010:380).

By using an electronic questionnaire, the researcher did not encounter the participants personally, thus reducing observation effects, researcher effects, interviewer bias and the Hawthorne/Rosenthal effect (Grove & Gray, 2019:254). Also, using a questionnaire that is already in electronic format reduced the risk of transcribing error that could influence results. The validity and reliability are further discussed in sections 3.13 and 3.14, respectively.

1.13 Ethical considerations

In the postpositivist paradigm, as used in this research, ethics is still a prominent part of the research that guides the researcher with ethical standards to conduct sound research (Mertens, 2010:12). The Belmont report identifies ethical considerations that should guide researchers on the selection of participants, informing participants about the risks and

benefits of the study and obtaining documented consent to participate (Grove & Gray, 2019:131). Interestingly, Denzin and Lincoln (2018:77) state that the Belmont principle did not protect human rights as it was founded on "value-free experimentation" and "utilitarian concepts of justice" and that it only protected organisations and not the people. In addition, the Singapore statement was considered, and its application is discussed in Section 3.15.

No part of this study caused damage to participants, and participants had the option to withdraw participation at any time. It was also the researcher's opinion that the influx of knowledge on the topic would benefit the participants. Justice was applied to the participants as no one was chosen on personal attributes, but the common characteristics of the study (Botma *et al.*, 2010:3).

This research proposal was submitted to the UFS School of Nursing's evaluation committee for approval; thereafter it was submitted for ethical clearance from the UFS Health Sciences Research Ethics Committee. This ensured that the study was valid and confirmed the risk-benefit ratio as safe, as no risks were identified. Gatekeepers' permission to use the SOMSA database was applied for and written approval obtained before the study commenced.

Implied consent is defined as the participant being informed about a study where participation consists of filling out an anonymous questionnaire. The participant, in turn agrees to participate in the research by completing the questionnaire (University of California, 2020:online). Consent was implied by the participants of this study when the questionnaire was completed and submitted. No personal information was required from participants, thus ensuring anonymity. An information letter (Addendum B) was the first page of the questionnaire. Participants were not chosen for personal factors, but solely because they obtained a midwifery qualification in South Africa. Confidentiality was maintained as participants completed the questionnaire on an anonymous electronic platform that did not obtain any personal information. As mentioned earlier, these steps were used to calculate the

risk-benefit ratio, and all risks were minimised as far as possible to ensure safe participation for participants.

1.14 Study limitations

The researcher had to attend a placenta examination, anatomy, physiology and histology course provided by a placenta expert to ensure that she was well qualified to conduct this study. Unfortunately, due to the 2019 global Coronavirus pandemic, this course was cancelled. The lack of a formal course to educate the researcher on the placenta was seen as a limitation. Still, the researcher tried to educate herself studying textbooks such as Pathology of the Placenta, a practical guide by Khong *et al.* (2019: 1-394).

The researcher was not able to determine the exact population size due to the type of registration at SANC. It only provides the number of people registered as a midwife in South Africa (total population); however that could include a vast number of people who do not consider themselves midwives or who have never practised as such. They had merely obtained the qualification as part of their education. This makes it impossible to determine the accessible population of practising midwives in South Africa.

Access to an electronic device and internet service was required to complete the questionnaire online. This could potentially have limited the number of potential participants who had access and an affinity to electronic resources. According to the latest statistics from SANC, 47% of people registered are over 50 years of age (South African Nursing Council, 2020:1). It is known that this part of the population is not as active on social media or as computer literate as younger people (Yeung, 2019:online). Further limitations of the study are discussed in Section 4.3.

1.15 Study funding

Due to financial limitations, the researcher chose to use the Evasys™ program and electronic questionnaires as a data collection strategy to limit expenses. This study was funded by the researcher for the larger part of the study. Some funding was received in 2020 from the UFS School of Nursing to assist the researcher with costs incurred with the completion of the research.

1.16 Value of the study

This study indicated the level of knowledge amongst South African midwives regarding placental features and its viability for placental triage. This will open areas of improvement needed regarding their knowledge or, if background knowledge is present, it will motivate the use of placental triage. Macroscopic examination of the placenta is a cost-effective, easy and quick way to triage placentas and potentially save healthcare budget allocations in both the public and private sectors by minimising litigation through medical evidence.

This research design increased the study's social value as it was non-invasive and only measured what was set out in the aim of the study: to test the existing knowledge of midwives regarding placentas.

1.17 Conclusion

Through the rest of the research report, it will become evident how the researcher tried to determine the level of knowledge regarding placentas amongst South African midwives and whether additional education is needed to implement placental triage fully. The researcher described the knowledge of midwives, obtained by a questionnaire, to determine the basic knowledge they have regarding the macroscopic examination of the placenta and possible abnormalities.

This chapter provided a brief overview of the study by describing the research topic, defining the research question and objectives, and introducing the research design and methods used. It also outlined the ethical issues faced, study limitations encountered and the value of the study. Chapter 2 aims to summarise the accessed body of knowledge available in the literature to embark on a full literature review of in-depth placental examination and its benefits.

Chapter 3 is dedicated to describing the research methodology, research paradigm, study population, questionnaire development, data collection and data analysis. Thereafter, Chapter 4 focusses on an analysis of the data obtained and discusses its relevance to the research. The researcher's conclusions, limitations, opinions and suggestions for further research are presented in Chapter 5 as the final chapter.

Chapter 2

2.1 Introduction

This chapter aims to review relevant literature in the field of examination of the placenta, either macroscopically or microscopically. It specifically describes how an investigation of the placenta can yield valuable information. The macroscopic examination can offer a diagnostic measure, thereby providing evidence during litigation, and provide solace during foetal or neonatal death. The available evidence, practice guidelines and studies from national and international authors are analysed and current practice shortfalls identified.

This study endeavoured to determine the current knowledge on placental triage amongst South African midwives; the South African guidelines are compared to relevant literature to portray the lack of substantial knowledge required for placental examination, highlighting that midwifery practice and education leave room for improvement. Comprehensive research is available on placental pathology as a diagnostic measure for problems during pregnancy and birth. Placental pathology reports can be used as a protective measure in litigation cases. The chapter concludes by discussing how placental triage can improve midwifery practice in South Africa.

Although many resources were consulted that cast valuable insight into the use of placental pathology, very few touches on the physical examination of the placenta right after birth. A limited body of research exists regarding the midwife's role in examining the placenta or in terms of guidelines on how it can be performed. In the regulation (R2488) that governs midwifery practice in South Africa, it only requests the midwife to mention how the placenta was delivered and if it was complete or not (South African Nursing Council, 1990:online).

In collaboration with an experienced librarian from the Faculty of Health Sciences at the UFS, extensive searches were done on various licensed databases to find relevant literature. The databases used were EBSCOhost, Academic Search, Africa-Wide, Cinahl, Eric and Medline. The search strategy for this study included subject topics and keywords that included, but were

not limited to, placenta, pathology, histology, examination, lesion, abnormalities, nurse, midwife, litigation, cerebral palsy, stillbirth, chorioamnionitis, macroscopic, physical examination, protocol, guideline, South Africa, neonatal death. The search strings were updated continuously during the study to find the most relevant and updated information. Research platforms such as Mendeley notified the researcher of new relevant articles. Figure 2.1 shows the layout of the chapter to follow.

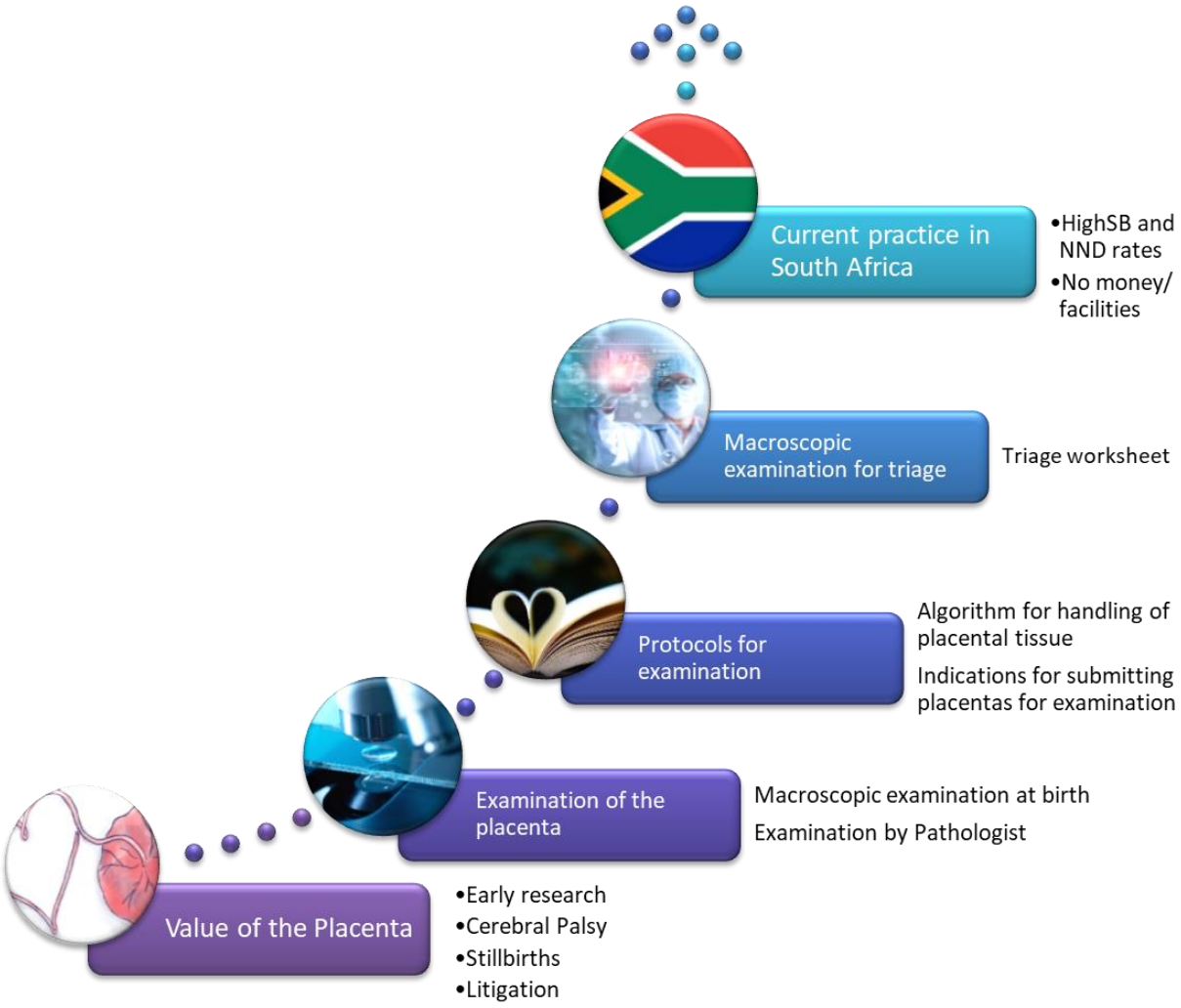

Figure 2.2 Visual representation of the chapter to follow.

Figure 2.1 provides a visual representation of the elements discussed in the review of the literature. It describes each area of knowledge explored by the researcher and provides subcategories of discussions in different sections.

2.2 Value of the placenta

"It is the least understood, and least studied, of all human organs"(National Institutes of Health, 2020:online).

The placenta is a sophisticated organ that develops during pregnancy to support the foetus' growth (Gude *et al.*, 2004:398). For the full duration of the pregnancy, the placenta works incessantly for 24 hours a day to provide essential nutrients and oxygen to the foetus (Wright, 2007:5). Lamentably, it is incinerated after birth without much regard to the valuable information that goes to waste along with it. The placenta is an easily accessible organ that can be examined at a moderate cost, yet it is still an under-examined organ (Hargitai *et al.*, 2004:785). It is deemed normal and even a legal requirement to send tissues removed from a body for pathological examination, yet placentas seem to be an exception to this (Baergen, 2018:544).

Chang (2014:280) perfectly describes the placenta as a "record of pregnancy". This gives us the idea that it can be used as a maternal record with different sections for each stage of the pregnancy. Firstly, it can provide antenatal details, just as a thorough history-taking of the mother would. The placenta can cast a light onto the whole pregnancy. Each stage of development can then be used to identify any adverse events during labour and birth or potential complications expected in the postnatal period or subsequent pregnancies (Baergen, 2018:545). The histology findings give the clinician the needed information to intervene in the mother and baby's current and future conditions. Furthermore, it is possible to determine if an adverse event that affected the foetus was either an acute onset or of chronic origin; intrauterine death timing can also be established (Hargitai *et al.*, 2004:785).

An examination of the placenta can yield information in four ways: Provide relevant information regarding the immediate care of the mother or the newborn, prevent recurrence in future pregnancies, diagnose adverse pregnancy events, and lastly, provide medicolegal evidence during litigation (Lieschke *et al.*, 2020:1). Despite these favourable uses of the placental pathology, a survey done in 2013 among American obstetricians found that only

36% of them were aware that placental pathology guidelines even existed (Odibo *et al.*, 2016). A more recent survey among Australian neonatologists found that the information yielded by the placental examination is valued, but that these professionals were uncertain of the implications of these results. The authors suggest a closer investigation into the knowledge of placental findings in neonatal and obstetric education (Lieschke *et al.*, 2020:6).

During the COVID-19 pandemic faced in 2020, healthcare workers had to make quick changes and decisions, without any evidence that could compromise the outcomes in some situations, all whilst still having to uphold respectful and compassionate care for women and babies (Renfrew *et al.*, 2020:1). To our advantage, placental pathology provided great insight into the effects the virus has on the foetus and the pregnancy. Placental pathology reports were able to identify maternal vascular mal-perfusion, villous oedema and retroplacental hematoma (Shanes *et al.*, 2020:13), indicative of abnormal maternal circulation. This information described the disease's effects on intrauterine life to specialists and assisted them in treating mothers preventatively.

Intrauterine infection such as chorioamnionitis has a spectrum of clinical manifestations, such as premature birth, intra-uterine death or stillbirths, and chronic neonatal respiratory disorders. Neonates with no Respiratory Distress Syndrome (RDS) often have chorioamnionitis positive placentas, which could later present as chronic neonatal respiratory disorders, but which would be unprovable without a pathological examination of the placenta (Nakayama, 2017:1527).

More recently, it has become evident, through placental histopathology, that certain placental morphology is associated with maternal depressive symptoms and toddler psychiatric problems. Clinically, this means that maternal depression directly affects the placental maturation that compromises the maternal-foetal gas exchange, which affects foetal neurodevelopment (Lahti-Pulkkinen *et al.*, 2018:4).

2.2.1 Early research

Although earlier research shows evidence that all placentas should be sent for pathological review, there was always some debate as to the benefits thereof as obstetricians and pathologists alike might not have sufficient information regarding placental histology (Salafia & Vintzileos, 1990:1282). The group most interested in the placenta was largely the cosmetic industry that used it for hormones and proteins. This study by Salafia and Vintzileos (1990:1282-1293) clearly shows discord between obstetricians and pathologists in connecting their knowledge on the subject clinically. The obstetrician had the patient's clinical history and presentation, but did not have the means to connect that to the histological findings. The pathologist, on the other hand, could note the histological changes, but could not link it to the patient's physiological presentation.

Furthermore, obstetricians believed data obtained from the placental histology was retrospective and could not be used during the pregnancy in question. What is even more interesting is that it was the opinion of Salafia and Vintzileos (1990:1282-1293) that all placentas needed to be examined as it can yield the following benefits: acute and chronic intrapartum events can be evaluated, and management of subsequent pregnancies and the long-term outcome of neurodevelopmental incidents could be improved. The authors admitted that the examination of the placenta would require certain technologies and skillsets that are difficult to afford in hospital environments that are cost-focused.

A low- and middle-income country such as South Africa neither has a sufficient number of skilled professionals to do these examinations nor the financial resources required. Fortunately, most pregnancies and births are expected, resulting in normal neonates and placentas. The question arises how to distinguish between a normal and abnormal placenta and when a placenta should be sent for pathology. Throughout this study, the researcher has searched for guidelines and requirements to serve as a benchmark to use.

2.2.2 Cerebral palsy

Oxidative stress is described to result when the balance between oxygen, hydrogen peroxide and antioxidants are disrupted during placental ischemia. This can subsequently lead to the destruction of proteins, lipids and DNA. Oxidative stress comprises the formation of large amounts of reactive oxygen species in cell membranes, endoplasmic reticulum and mitochondria (Schoots *et al.*, 2018:154). Placental examination can be beneficial after a hypoxic event has occurred. Braems (2005:350) describes Hypoxic-Ischemic Encephalopathy (HIE) as foetal brain damage due to neuronal death during intrauterine asphyxia that can subsequently lead to CP.

Hypoxia occurs when there is a reduction in the gas exchange between the mother and foetus and can be the result of interrupted uteroplacental blood flow or umbilical cord occlusion (Braems, 2005:352). The author states that, even though caesarean section rates have increased over the years, the CP rate has remained stable and the indicators for asphyxia leading to CP, such as meconium, foetal heart rate decelerations, tachycardia and low Apgar scores, were found to be falsely positive in 99.8% of cases.

Thus, asphyxia and HIE do not necessarily lead to CP; developmental abnormalities, metabolic abnormalities, autoimmune disorders, coagulation disorders, infections, trauma, hypoxia and IUGR may be rather the cause (Braems, 2005:351). These events can occur during the antenatal, intrapartum or neonatal periods; thus, the timing of injury should be considered before the diagnosis is made.

Chorioamnionitis has also been linked to CP and can be diagnosed via histology (Curtin *et al.*, 2007:41). CP cases will often lead to litigation. As a legal defence mechanism, placental examination findings can protect healthcare workers from malpractice allegations. Regrettably, without placental knowledge and the skill to perform an in-depth placental triage, these placental causes for CP will go undiagnosed.

2.2.3 Stillbirths

" A diseased foetus without its placenta is an imperfect specimen, and a description of a foetal malady, unless accompanied by a notice of the placental condition, is incomplete." (Ballantyne, 1892:62)

A systematic review of placental pathology associated with stillbirth regards placental examination a critical event to determine the causes of stillbirths, as placental abnormalities were primarily associated with stillbirths (Ptacek *et al.*, 2014:560). This statement confirms the findings by Odendaal, Gebhardt and Theron (2013:70).

A post-mortem is not considered ethical in some religions and is a costly intervention that could add to a grieving family's emotional burden. Thus, it is not a viable option to use as the primary means to diagnose stillbirths. Alternatively, the placenta examination can be a precious tool to use in identifying the cause of stillbirths and facilitating treatment options for future pregnancies (Kulkarni *et al.*, 2017:184).

In a review of perinatal deaths at St. Olav's Hospital in Norway between 2004-2008, researchers posed the questions: Does a placenta examination combined with a post-mortem explain foetal/infant death and, could the foetal/infant death be explained using only a placenta examination without a post-mortem? It was found that almost 50% of deaths could be explained solely by analysing the placenta without a post-mortem (Tellefsen & Vogt, 2011:101).

To reduce stillbirths and neonatal deaths, the causes of these events need to be identified and understood. Still, the cause of death remains one of the most considered shortcomings in data (Leisher *et al.*, 2016:2). By doing more placental examinations and sending these placentas for histology, the data shortcoming can be addressed and information to prevent future incidents for the childbearing family could be obtained.

2.2.4 Litigation

As a speciality, obstetrics has become the highest insured medical speciality due to the increased risk and frequency of litigation. Globally there has been a rise in obstetricians being legally pursued when infants present with disabilities such as CP (Chang, 2009:1130). In South Africa, the Gauteng DoH had an estimated R29 billion in claims for medico-legal liability in 2019, most of which were for babies diagnosed with CP. Unfortunately, this comprises nearly 60% of the department's annual budget that could have been spent on healthcare needed (Bloom, 2019:online).

It is commonly assumed that these conditions in infants are due to malpractice by the medical professional during birth. These assumptions and allegations have set the reason for increased use and frequency of foetal monitoring and caesarean sections. Still, they have regrettably not reduced the incidence of CP. As Wright (2007:6) states "The irony is that studies have shown that most children with CP showed no evidence of "foetal distress" before delivery".

Placenta pathology due to intrauterine infection and inflammation affecting foetal and maternal vascular malperfusion, lead to reduced placental perfusion and in excess up to 90% of CP cases could be attributed to antepartum causes. Thus, placental histology is beneficial during possible medicolegal cases as the timing of the incident and implications of adverse outcomes can be determined (Sebire, 2017:122).

Tragically, this means these conditions are not preventable, but it can be diagnosed and documented with formal placental pathology on the original birth documents. These pathological findings can then be used as defence in litigation. The placenta could have a directly impacted the outcome if it were found to be abnormal. The placenta could yield evidence of an adverse intrauterine condition that contributed to the outcome (Chang, 2009:1131). This information could play a key role during legal proceedings.

In conclusion, all the above-mentioned information collected during an examination of the placenta can give closure to parents, improve current practice and serve as defence during litigation. The placenta will continually provide information into maternal and neonatal pathophysiology in the future (Sebire, 2017:125). The value of this information will be substantially financially beneficial in reducing costs claimed during litigation.

2.3 Examination of the placenta

The value of the placental examination is undisputed, therefore the exact procedures for placental examination and evaluation were reviewed. This section describes the macroscopic examination of the placenta at birth and the histological examination by a pathologist. This is followed by an explanation of the different lesions found and their clinical significance.

2.3.1 Macroscopic examination at birth

It has been internationally recommended since the early nineties by authors such as Langsten *et al.* (1997:450) and Salafia and Vintzileos (1990:1282) and more currently by Chang (2009:1123), that placentas should be examined by the healthcare provider present at the birth. It is not necessary to send “normal placentas from normal births” for pathology, but there is no clear definition of what is considered as “normal”. Rather, this decision lies with the professional attending to the birth who may or may not have sufficient knowledge to make such a decision (Baergen, 2018:544).

An American guideline for midwifery practice and skill for the third stage of labour mentions that the midwife should examine the placenta for abnormalities and completeness. If any complications or abnormalities are noted, it should be sent to a pathologist for examination (Hurst, 2017:6). However, it fails to mention the actual abnormalities that should be reported.

This is in line with the South African Department of Health (DoHSA) that recommended the same in the Maternal Care Guideline published in 2015 (National Department of Health, 2015:50). For the healthcare provider to diagnose a normal or abnormal placenta, a knowledge of the anatomy of the placenta would thus be a requirement. In South Africa, midwives are required to do a macroscopic examination of the placenta at birth (South African Nursing Council, 1990:online). Knowledge of the placental anatomy is needed to enable the healthcare provider to act appropriately (Baergen, 2018:544).

Baergen (2018:546) advises using an examination routine to ensure that no part of the macroscopic examination is missed. The instruments needed is a tape measure, a scale, scissors, forceps and a knife. It also advises to do this examination near a sink or in a sluice area to rinse the placenta of blood and facilitate the cleaning process after the examination. The examination flow should start with the cord, then membranes, and lastly the placental disc. As described by Baergen (2018:547), the aspects of the examination are adapted as shown in Table 2.1 and provide guidelines on the macroscopic examination.

Table 2.1 Aspects of macroscopic examination of the placenta.

Placental part	Aspects of identifying and examining
Cord	Check measurements like length and diameter. Next check for arteries and veins in the cord and note the number of each. Then note cord insertion, coiling and knots. Mention if cord coils left or right (Identified as the left of the letter "V" or the right) and if there are hyper-coiling, hypo-coiling or an obstruction. Inspect for discolouration, haemorrhage, cysts, thrombosis, surface nodules or masses and describe with detail. **The cord can then be removed from the insertion site (Not indicated to be done by a midwife).**
Membranes	Check for completeness and if there are enough membranes to cover the foetus. Measure the membrane rupture site (distance from the placental edge to the nearest rupture site). If this is greater than 0 Placenta Previa is ruled out. Note the colour of the membranes. Then note the insertion of membranes as normal at the margin or further inward, indicating circummarginate membrane insertion. **Membranes can then be removed from the disc using sharp scissors (Not indicated to be done by a midwife).**

Placental disc	Identify any nodules, masses, cysts or discolouration on the foetal surface. Inspect for evidence of haemorrhage, thrombosis or disruption. The disc can then be measured in three dimensions and weighed (trimmed weight). Note the disc shape and if it has any adjacent lobes. Check the maternal surface for completeness, blood clots and lesions. Note the colour of the villous tissue as pale, congested or normal. Any lesions should be described in colour, consistency, measurements, location, amount and percentage of tissue involved.

Table 2.1 gives an in-depth account of a macroscopic examination of the placenta and how it should ideally be done in practice.

Wharton's jelly found along the umbilical cord serves as a protection for the cord against compression. The smallest change in the placenta's physical structure such as reduced Wharton's jelly can indicate significant placental pathology. Debebe *et al.* (2020:37) found in their study that the amount of Wharton's jelly correlates to the placenta's functionality. These findings alone should indicate a placenta that needs to be sent for further investigation.

2.3.2 Examination by a pathologist

The pathologist is uniquely equipped to establish placental diseases and conditions related to that of the mother, newborn and placenta per se (Chang, 2009:1131; Yetter, 1998:8). This valuable information can be used by other multidisciplinary team members such as the obstetrician or paediatrician to care for the mother or newborn, either immediately or in later in life (Turowski *et al.*, 2018:638).

Submitting a placenta for histology allows an extensive spectrum of aspects to be assessed. A guideline for the less experienced (Kulkarni *et al.*, 2017:177-185) gives a brief guide to less experienced pathologists and obstetricians to assist with deciphering a comprehensive pathology and histology report. Table 2.2 contains the aspects assessed and descriptions of their significance

Table 2.2 Examination of the placenta and clinical significance

Macroscopic examination:	
Macroscopic lesions	An initial examination must be done at birth, recorded and sent to the pathologist, as well as the placenta histology request form. It should include maternal history, BMI, underlying conditions present, gestational age, birth weight, mode of delivery, Apgar scores and complications, e.g., NICU admission. At first glance, the pathologist will give a detailed description of the umbilical cord, membranes, placental disc, and any abnormalities seen before sampling.
Umbilical cord lesions	Cord length, thickness, insertion and coiling are noted. Marginally inserted cords and velamentous insertions are associated with adverse outcomes. Cord thickness can indicate IUGR if thin and maternal diabetes or foetal hydrops if thick. Hyper- and hypo-coiled cords and excessively long or short cords are associated with adverse outcomes. Hyper-coiled cords with sections of extreme narrowing could be associated with stillbirths.
Placental lesions	Placental weight and trimmed weight will be assessed and noted whether it was in fresh or fixed state as this affects results. Amnion nodosum on the foetal surface can indicate a premature rupture of membranes or decreased placental reserve. Ischemia or infarcts can affect the placental function and will be described and evaluated by volume. Circumvallous placental shape is associated with bleeding in early pregnancy and can lead to discolouration of the membranes or hemosiderin-laden macrophages to be present during histology. Including such findings in the macroscopic examination will indicate the use of staining to evaluate the membranes.
Retroplacental haemorrhage	Assess for presence of a crater with depression of the maternal cotyledons and if present, measured and weighed. In the case of crater formation present, staining of membranes will help to assess if there had been previous bleeding episodes. Severe haemorrhage can lead to the death of an infant.
Histological examination of the placental disc:	
Maternalvascular malperfusion	Maternal history is needed to provide insight into underlying conditions that could have led to under perfusion/ ischemia, e.g., placental ischemia secondary to pregnancy-induced hypertension. The infant might present with IUGR and treatment options to consider for infant and subsequent pregnancies.
Foetalvascular malperfusion	Thrombosis, segmental avascular villi and stromal karyorrhexis can be seen. Two forms recognised: Segmental–Thrombotic obstruction causes complete obstruction downstream. Global–Partial obstruction of umbilical vessels leads to intramural fibrin deposition and small avascular or karyorrhectic villi clusters. Could be present secondary to conditions that led to obstruction of foetal blood flow such as cord lesions, hypercoagulability, foetal cardiac dysfunction and hypoxia. Thrombosis is regarded as a premortem process.

Inflammatory lesions	Acute chorioamnionitis is an acute inflammation of the membranes due to microbial infection. Intrauterine infections may also be secondary to hematogenous spread. Histological chorioamnionitis does not always correlate clinically diagnosed chorioamnionitis. There is an association between the inflammatory response noted during histology and neurodevelopmental outcome in infants. Finding infection as a cause of stillbirth is essential and can reassure parents of low risk for recurrence.
Villitis of unknown aetiology (VUE)	A histiocytic lymph lesion of the villi in which infective aetiology is excluded. Can be seen with vascular damage and will then be classified as villitis with stem vessel occlusion. Graded as low grade or high grade and is of clinical importance as high-grade VUE has a relationship to neurodevelopmental delay in infants and has a likelihood of recurrence.
Impaired glucose tolerance	The placenta may appear boggy and plethoric. Histology may show villous immaturity at term with low development of vasculosyncytial membranes and stoma cells. Villous oedema and thickening of the basement membrane may also be seen. Diabetes mellitus is associated with increased morbidity during pregnancy and increased risk for stillbirth. Can be related to BMI > 35.
Chorangiosis	It is associated with villitis, abruptio and umbilical cord anomalies. Chorangioma refers to a nodular lesion composed of small vascular channels. Chorangiomatosis is a less well-defined lesion. Chorangiosis is seen as a marker for hypoxia and is also seen in cases of diabetes or raised BMI, pre-eclampsia, drug ingestion and UTI.
Massive perivillous fibrin deposition	Extensive deposition of fibrin in intervillous space resulting in secondary villous atrophy. Also associated with foetal death, preterm birth and IUGR. Can reoccur in subsequent pregnancies.

Table 2.2 adapted from Kulkarni *et al.* (2017:177-185) gives an in-depth account of abnormalities, as determined by placental histology and the significance thereof on maternal or foetal health.

2.4 Protocols for examination

The current protocols were reviewed to ensure that the valuable information yielded from all the examination modalities for placentas can be optimally used. A guideline published in 1997 by the Placental Pathology Practice Guideline Development Task Force of the College of American Pathologists serves as the basic guideline used in most studies. This guideline gives an algorithm for handling placental tissue with recommendations at each stage. Figure 2.2 is an adaptation of the original algorithm (Langsten *et al.*, 1997:452).

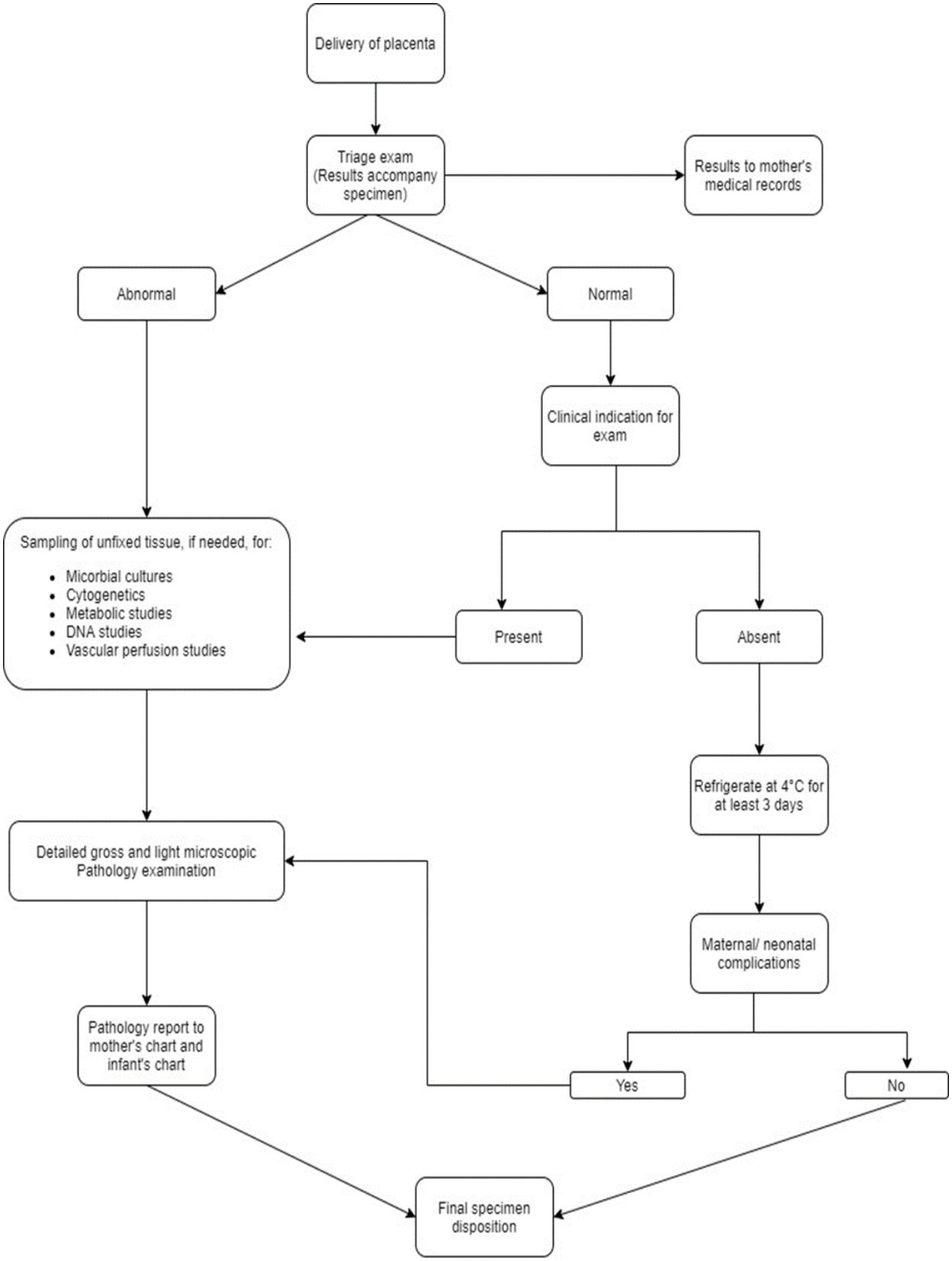

Figure 2.3 Algorithm for the handling of placental tissue

The practice guideline also lists maternal, foetal/neonatal and placental indications for submitting placentas for further examination; these indications are listed in Table 2.3 per category (Langsten *et al.*, 1997:453). If these indications and recommendations to send a placenta for further examination is followed, it is unlikely that significant pathology can be missed (Baergen, 2018:544).

Table 2.3 Maternal, foetal/neonatal and placental indications for submitting placentas for further examination.

Maternal indications	• Systemic disorders or chronic diseases, e.g., diabetes, hypertension, or anaemia, can influence either mother or infant. • Premature delivery < 34 weeks gestation. • Peripartum fever or infection. • Unexplained third trimester bleeding or excessive bleeding. • Clinical concern for infection during pregnancy, e.g., HIV, syphilis, cytomegalovirus, herpes, toxoplasma or rubella. • Severe oligohydramnios. • Unexplained pregnancy complication, e.g., intrauterine growth restriction, stillbirth, spontaneous abortion or premature birth. • Invasive procedures with a suspected placental injury. • Non elective pregnancy termination. • Thick and viscid meconium.
Other maternal indications	• Premature delivery > 34-37 weeks gestation. • Severe unexplained polyhydramnios. • Maternal substance abuse. • Post-dated delivery > 42 weeks. • Severe maternal trauma. • Prolonged rupture of membranes (> 24 hours)
Foetal/neonatal indications	• Admission or transfer to NICU or high care. • Stillbirth or perinatal death. • Compromised clinical condition, e.g., cord blood PH < 7.0, Apgar less than 6/10 at 5 minutes, ventilatory assistance > 10 minutes or severe anaemia. • Hydrops fetalis. • Birthweight < 10^{th} percentile. • Seizures. • Infection or sepsis. • Congenital anomalies, dysmorphic phenotype or abnormal karyotype. • Discordant twin growth > 20% weight difference. • Multiple gestations with same-sex infants and fused placentas.

Other foetal/neonatal indications	• Birthweight > 95th percentile. • Asymmetric growth. • Multiple gestations without other indication. • Vanishing twin beyond the first trimester.
Placental indications	• Physical abnormality, e.g., infarct, mass, vascular thrombosis, retroplacental hematoma, amnion nodosum, abnormal colouration/ opacification or malodour. • Small or large placental size or weight for gestational age. • Umbilical cord lesions, e.g., thrombosis, torsion, true knot, single artery or absence of Wharton's jelly. • Total umbilical cord length < 32cm at term.
Other placental indications	• Abnormal placenta shape. • Long cord > 100cm. • Marginal or velamentous cord insertion. • Placental mass could indicate Chorangioma.

Table 2.3 shows the indications for sending placentas for further investigation (Langsten *et al.*, 1997:453). Similarly, Hargitai *et al.* (2004:786), also provide recommended indications for pathological referral of the placenta, as seen in Table 2.4.

Table 2.4 Recommended indications for pathological referral

Foetal conditions	• IUGR (Birthweight below 2.5kg or 3rd centile) • Prematurity (less than 37 weeks gestation) • Abruption • Foetal hydrops • Foetal abnormality, chromosome aberration • Stillbirth • Severe foetal distress requiring admission to NNU • Rhesus isoimmunisation • Morbidity adherent placenta • Multiple pregnancies (uncomplicated) • Abnormal placenta shape (if clinically relevant, including placental tumours) • Postnatally diagnosed disorders of the placenta (hematoma, too big/small placenta, infarction, discolouration) • Vessel cord • PROM (more than 36 hours)
Diseases of the neonate with possible intrauterine origin	• Infection (Pneumonia, sepsis within 72 hours) • Neurological signs
Maternal illnesses that might have consequences in the neonate	• Maternal pyrexia and maternal group β streptococcus • Pre-eclampsia, hypertension • Severe diabetes, including gestational diabetes, maternal thromboses or other metabolic diseases, autoimmune disease, tumour, storage disease, etc.

Table 2.4 contains key indicators for referring a placenta to a pathologist for expert review that could have clinical relevance to the infant's future management (Hargitai *et al.*, 2004: 786).

Curtin *et al.* (2007:36) advises that placentas be kept refrigerated for three days at 4°C while Chang (2009:1125) advises that it should be kept refrigerated for up to seven days, to be available for instances where the placenta might be sent for histology if the condition of the mother or the baby changes as some neonatal issues only become visible after a few days of life (Baergen, 2018:545).

Sadly, although numerous tools provide indications for sending placentas for further investigation and the valuable information it can yield, it is still not practised with placentas that meet the criteria. It is acknowledged that not all placentas need to be sent for histology. This will create an unnecessary workload for pathologists to examine normal placentas (Hargitai *et al*., 2004:785) and suggest the value of a triage system. If all placentas are examined macroscopically and based on the findings and history selected for further microscopic examination, those with no abnormalities or significant clinical history would only be examined macroscopically (Baergen, 2018:545).

Furthermore, a study was done in Tygerberg hospital in South Africa , reported by Wright, (2007:7), during which an audit was done to correlate placentas sent for histology with clinical evidence. This study found several placentas with confirmed chorioamnionitis that were clinically not suspected. Histopathological diagnoses provided information on the cause for adverse events that had no clinical explanation. The placentas that represented death or suspected intrapartum hypoxia were clinically diagnosed as such, but histopathological findings showed that 70% of these placentas had intrauterine infection. This concludes that the foetus was already compromised when labour started, and should there be any adverse events, the histological report could inform causality.

2.5 Physical examination for triage

Throughout this chapter it has become evident that placental histology and pathological examination are of great value. To advocate that all placentas be sent for pathology is not feasible within the contextual realities of limited available services and resources. The significant volume of placentas would require many skilled professionals to perform the histological examinations, which would be very expensive (Leisher *et al.*, 2016:14). To prevent placentas being sent for pathology unnecessarily, a triage system can be explored.

As mentioned earlier, the taskforce that formulated the algorithm for handling placentas (Langsten et al., 1997:451) propose that the birth attendant must do an initial examination of the placenta at birth. A triage system should be used to determine which placentas need to be sent for further diagnostic investigation.

It is suggested that this triage information be recorded on the maternal and neonatal records (Langsten *et al.*, 1997: 453). A triage worksheet was also attached to the guideline, which had been adapted from page 473 of the guideline, and is inserted as Table 2.5 in this study.

Table 2.5 Triage worksheet

Triage Worksheet				
Triage examination of the placenta (Circle correct response) Patient name: _____ File number: _____				
	Normal		Abnormal	
Cord insertion:	Eccentric	Central	Marginal	Velamentous Other: _____
The number of cord vessels:	3		2	>3
Total cord length:	_____cm		< 32 cm	>100cm
Disc weight for gestational age:	Normal		Small	Large
Dimensions:	__x___x___cm			
Maternal surface:	Intact		Incomplete	Other: _____
Foetal membranes:	Normal		Cloudy	Other: _____
Other placental indications for the exam:		None		Specify: _____
Maternal indications for the exam:		None		Specify: _____
Foetal/ neonatal indications for the exam:		None		Specify: _____

2.6 Current practice in South Africa

The latest Saving Babies report's (NAPEMMCO, 2018:9) data states a decrease in mortality rates over the past three triennia; unexplained intrauterine death remains the leading cause of death of all babies born above 1000g at 24.4% of all deaths, while in 48% of these unexplained intrauterine deaths the mothers had no obstetric complications (NAPEMMCO, 2018:9). Unexplained intrauterine death is the second-highest primary cause of death in all

babies born above 500g, at 22.8% of total deaths, while spontaneous preterm labour is the highest at 22.9% (NAPEMMCO, 2018:23).

These two causes amount to 45.7% of all deaths. If these placentas had been triaged and sent for pathology/histology, it could have identified reasons for death and initiated treatment and prevention measures. Pathologist examination of the placenta can yield information that cannot be identified clinically (Wright, 2007:5) and can explain why the death occurred in mothers who seemed to have no obstetric complications. Using the pathophysiology obtained by placental histology can reduce the overall neonatal deaths by identifying factors that could be prevented and issues that would impact future pregnancies of mothers to prevent recurring events.

2.7 Summary

This chapter aimed to summarise the benefits of placental pathology and triage and considered that midwifery education and guidelines should include the advantages of using placental triage. This discussion also considered other benefits of placental pathology examinations. Curtin *et al.* (2007:41) suggest that policies on placental examination and guidelines for sending placentas for histology be revaluated per institution and on national levels. This will ensure more desirable long-term infant outcomes.

Today's midwives play a frontline role by conducting and assisting with births both in public and private sectors. Discovering new insights into placental triage and the knowledge thereof could play a key role in safeguarding current practice. This study is an opportunity to determine midwives' educational needs to implement placental triage as the standard of care nationally. More research is needed to understand the current knowledge of midwives.

Chapter 3

3.1 Introduction

The purpose of this chapter is to present the research methodology for this quantitative study regarding the knowledge of placental triage amongst South African midwives. The components of the research design are discussed in detail throughout this chapter. As described throughout Chapter 2, there is much insight to gain by evaluating midwives' knowledge on placental triage in South Africa. Placental triage might be underused or executed ineffectively.

This chapter describes the research question and the chosen methodology. Thereafter, the research design and method are explained. The phases of data collection and ethical considerations are also discussed.

The extensive literature review, presented in Chapter 2, led the researcher to the research question:

> **WHAT IS THE EXISTING KNOWLEDGE OF MIDWIVES EDUCATED IN SOUTH AFRICA REGARDING PLACENTAL TRIAGE?**

The aim of the study was, therefore, to describe the existing knowledge of placental triage amongst South African educated midwives in order for them to identify placentas that need to be sent for further investigation.

Placental triage can be an extremely effective way to screen large numbers of placentas to identify those that need to be sent for further evaluation, as described in Section 1.2 as part of the initial problem statement, as well as in Section 2.5.

3.2 Research design

"Research design can be defined as a process of creating an empirical test to support or refute a knowledge claim (Mertens, 2010:122).

The researcher chose a quantitative research approach to address the research question. Quantitative research can be either descriptive or experimental (Creswell & Creswell, 2018:17). With the aim in mind, a simple descriptive approach was decided on as it comprises a single-use questionnaire with the function of describing attributes of a sample at a certain time (Mertens, 2010:177). This approach is also referred to as a survey research strategy by other literature (Creswell & Creswell, 2018:29). The design was implemented as cross-sectional, with data being collected only at one time.

In quantitative research designs, the researcher will identify a sample and population, specify the research question, collect and analyse data, make an interpretation and present the research (Creswell & Creswell, 2018:17). A survey design gives a numeric description of opinions or attitudes of a specific sample of a population; the researcher can then make a claim regarding the whole population (Creswell & Creswell, 2018:137). A survey design was chosen as it helped the researcher to collect the opinions of multiple midwives at one time and because the population was too vast to reach the whole population. The form of data collection was a self-administered electronic questionnaire that is further discussed in Section 3.4.

As shown in the conceptual framework (Figure 3.1), adverse pregnancy events can be diagnosed and treated once a placenta has been sent for histology. As discussed in Section 2.5, not all placentas can be sent for histology, and a triage system can be beneficial. However, a certain level of knowledge regarding the placenta's anatomy would be required, and if this is not present, triage cannot take place effectively.

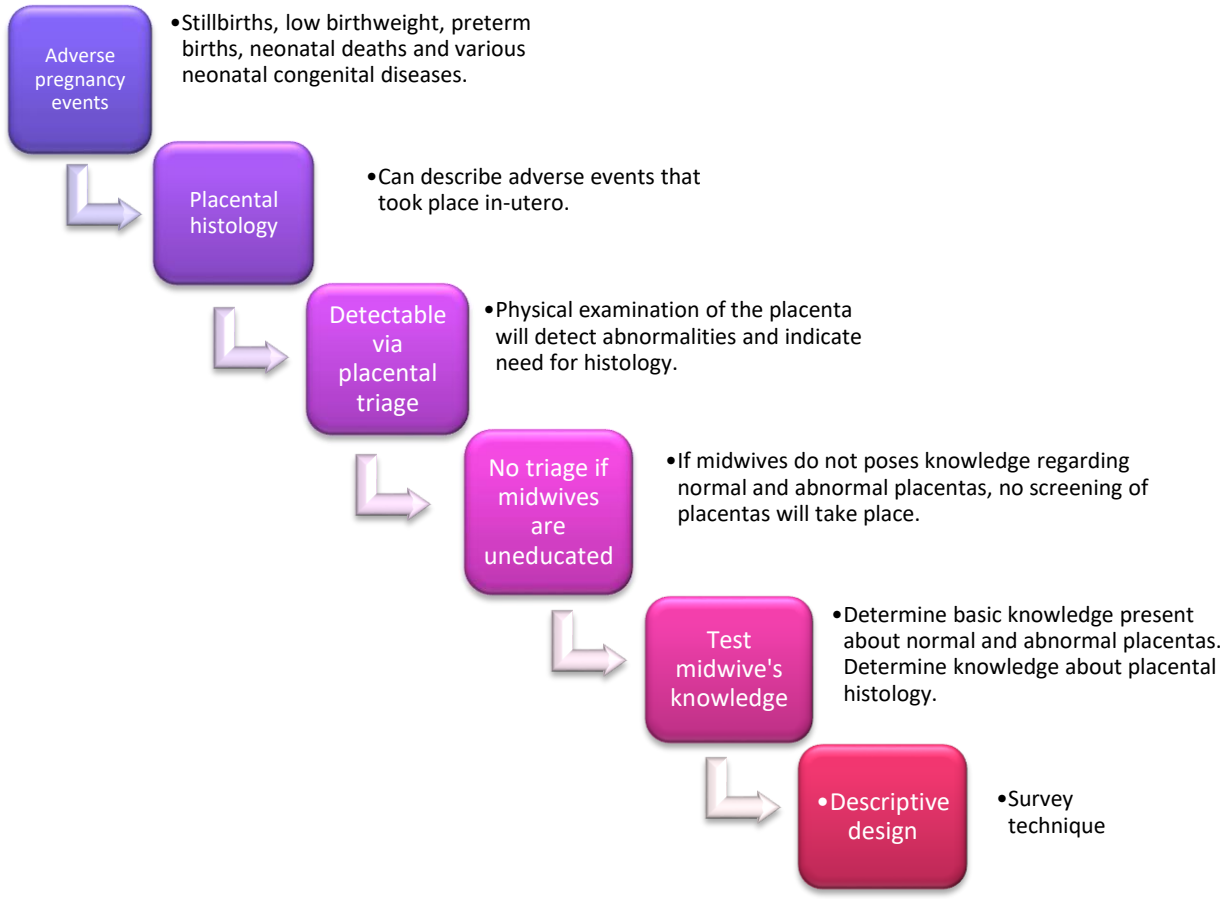

Figure 3.1 Conceptual framework adapted from Chapter 1

Descriptive studies are used to report a specific individual, situation or group comprehensively. An example of this is correlational studies that describe the relationships between different variables. Although there are many types of studies that can be included as descriptive studies, they all share a single trait, namely to explain what exists as precisely as possible (Mouton & Marais, 1996:43-44). This study was descriptive in nature and quantitative methods were used to describe the collected data.

3.3 Paradigm

As mentioned in Section 1.7, the research design chosen for this study falls into the postpositivist paradigm. The postpositivist paradigm comprises two types of knowledge tests.

The first determines if the knowledge claim is true in the specific situation and if it holds internal validity. The second determines if it is true in other situations, thus making it generalisable, and determines if it has external validity (Mertens, 2010:122).

Post-positivism is a philosophy in which the effect or outcome is the result of a specific cause. Thus, each study is started with a particular theory that the researcher has in mind. The data collected through instruments will either contribute to the theory or provide new evidence to reject it. Specifically, survey research gives a numeric value to a population's trends or attitudes by investigating a sample from that population (Creswell & Creswell, 2018:41).

The researcher questions if all midwives have the necessary in-depth knowledge regarding the placenta to triage placentas effectively. The research design related to this view is quantitative and will use an instrument to test midwives' knowledge of the placenta's physical structure and examination. The results obtained by this instrument will then determine the answer to the research question. This type of assumption is described as a postpositivist worldview by Creswell and Creswell (2018:37).

3.4 Research method

This study's primary purpose was to numerically evaluate the knowledge of the placenta structures and physiology amongst a sample of midwives who studied in South Africa. The method chosen to achieve this purpose was identified as using a survey design, specifically an electronic questionnaire.

An electronic questionnaire was chosen because of its advantages. Fast turnaround time for data collection allows for the most significant number of participants to be reached in a relatively short period. This type of questionnaire makes it easy for the researcher to formulate the questionnaire, share it on social media platforms, and export the collected data to the required electronic platform for data analysis (Creswell & Creswell, 2018:140).

An electronic questionnaire is economic and environmentally friendly, no paper is needed for printing, and there is no need to travel to distribute questionnaires. A study done by Heiervang and Goodman (2011:74) states that it was four times more cost-effective than face-to-face interviews. In the same study, the authors highlight low response rates and incomplete surveys as disadvantages. The opinions of these authors are that a low response rate would not necessarily be a problem if the sample size is large enough. The detail of the population is further elaborated on in Section 3.6.

The researcher decided on a simple descriptive study with data collected via an electronic questionnaire for three months. This time frame gave the researcher enough time to distribute the questionnaire electronically to reach as many participants as possible.

A correlation design could not be used because there was no existing relationship between variables to compare (Botma *et al.*, 2010:113). An experimental design could also not be used as there was no hypothesis to be tested, and if this were to be done, it would have had a high degree of assumption bias that would have discredited the study.

3.5 Researcher

The researcher is a midwife with a Bachelor of Social Sciences degree in Nursing, who has experience in midwifery from two different countries in both private and public practice. It is her experience that placentas are under-examined and not given the appropriate attention it deserves. Following an in-practice lecture by Prof. C. Wright on placental histology, the researcher was intrigued by placental histology and decided to advance her knowledge on this subject. As a midwife, she has seen how useful placental histology reports can be for treatment, prevention and litigation. This led her to acknowledge the lack of proper attention given to the placenta upon physical examination. With a struggling economy in South Africa, it would not be possible to send each placenta to a pathologist, but implementing a triage

system could be cost-effective and beneficial. These factors led the researcher to embark on this study in her field and passion.

3.6 Population

The total population of this study was identified as midwives who had obtained their qualification in South Africa. In South Africa, students enrolled for a university degree and some students enrolled for a diploma graduate having studied general nursing, community care, psychiatry and midwifery. Students are then registered with the regulatory body, the South African Nursing Council (SANC), for all four professional registrations.

Thus, although some nurses are not practising as midwives, they are still registered as such at SANC. This makes it impossible to determine the number of practising midwives in South Africa and only the number of registered midwives is known. This made determining the accessible population size problematic.

The total number of registered midwives and accoucheurs in 2019 at SANC was 109 061 (South African Nursing Council, 2019:4-5). This number includes people residing in other countries, but who are still registered in South Africa (number unknown) and 58 individuals who have obtained their qualification in other countries (South African Nursing Council, 2019:8). Of the remaining 109 003 individuals, 62 975 have a combined degree and might not be practising in midwifery (South African Nursing Council, 2019:6).

3.7 Sampling

The total population was identified as 109 003 midwives who had obtained their qualification in South Africa. Purposeful sampling was chosen. As confirmed with the biostatistician, the inability of any structures to provide the actual population of practising midwives

necessitated a sampling method where the participants could contribute by identifying their peers. In this case, the snowball or chain-sampling method was chosen. This meant that the known midwives belonging to social media platforms, or aligned with the midwifery association (as mentioned in Section 1.9 Table 1.3), namely 20 293, could distribute the questionnaire to other known midwives. It was taken into consideration that some midwives could belong to one or more of these platforms and thus the accessible population could not be calculated using this number. The researcher is a member of all mentioned social media groups. For this sampling method, the researcher started with a few known participants who referred other participants to the study (Mertens, 2010:322). This made a snowball sampling method desirable to the researcher as midwives could share the questionnaire. It helped the researcher to reach the highest number of respondents possible due to the vast population size and immeasurability thereof.

Selection criteria for participants were twofold. Participants had to have a midwifery qualification and must have obtained it in South Africa. There were no other geographical or demographical restrictions to participation. The first page of the questionnaire comprised an information letter (Annexure A). It instructed participants to participate only once and served as an agreement of participation by clicking on the 'next' button to complete the questions that followed.

3.8 Approvals obtained

The researcher applied for approval for this research study from the University of the Free State's School of Nursing. Upon approval, ethical clearance was obtained from the Health Sciences Research Ethics Committee on 08 July 2019, with ethical clearance number: UFS-HSD2019/0908/3007 (Annexure C).

The researcher also wrote a formal request to the Society of Midwives of South Africa (SOMSA) to use their member data base to distribute the questionnaire via email (Annexure E). Upon approval of this, the members' email addresses were obtained.

Results were extracted in numerical format only from the Evasys™ program and coded by the researcher using a Microsoft® Excel® spreadsheet. Participants were numbered in results as no distinguishable data were obtained from participants. Results were sent to the University of the Free State's biostatistics department for analysis.

3.9 Questionnaire development technique

With the assistance of an experienced librarian, the researcher could not find a published instrument suitable for this study. This led the researcher to develop a questionnaire. To start developing the questionnaire, the guide described by Mertens (2010:176) was followed. The purpose of the questionnaire was firstly established. This specific questionnaire aimed to establish the current knowledge among midwives regarding the placental anatomical structures and uses of placental pathology.

General directions to developing a survey are shown in Table 3.1, as provided by Mertens (2010:187-189) and these were used as a guide to create the questionnaire and questions.

Table 3.1 General directions to developing a survey.

Steps to follow	Description	Application
Outline topics	Use Delphi technique or something similar, to determine topics to be covered by questions.	Delphi not used; topics determined by group of specialists who assisted in developing the questionnaire.
Explain to yourself why you are asking each question	Be careful not to make questions and questionnaire lengthy.	Questions kept short and concise. Knowledge component questions were developed in accordance to classic test format to increase familiarity with known processes.
Decide on the degree of structure that is most appropriate (e.g., Closed or open-ended questions)	Format choice will determine the type of answers received for each question.	Combined use of open-ended questions with multiple choice questions to comply with normal assessment criteria.
Avoid psychologically sensitive questions	Many participants will react defensively.	Not used.
Clarity is paramount	Make sure all questions mean the same thing to all participants.	Concise terminology used that midwives will be familiar with.
Short items are preferable	Do not make questions too lengthy.	Questions kept short in compliance with normal assessment criteria.
Avoid negative wording	It seems insensitive.	Not used.
Avoid asking about more than one idea	Do not ask about more than one idea per question as it is misleading.	Questions focussed to one topic per question.
Avoid jargon and big words	Keep reading level of respondents in mind.	Terminology used that midwives will be familiar with.
Avoid leading questions	Do not supply the answers you want in the questions asked.	Not used.
Emphasise critical words	Highlight or write in bold to draw attention.	Kept in mind when formulating questions.

Using the Delphi technique has the disadvantage that it takes a long time to execute. The purpose of this research was not to develop a questionnaire, but to test knowledge. Therefore, the researcher consulted with experts in midwifery and placental pathology about what they thought to be essential to include in the questionnaire. The four focus areas that

were followed for developing the questionnaire, as described by Maree (2019:200), were: appearance of the questionnaire, sequence of the questions, the wording of the questions and response categories. This guided the researcher on what the questionnaire's overall layout should be like and in what way the questionnaire could be made easily accessible for participants to complete.

A questionnaire was developed by the researcher and the resources used as a basis for the questions were the midwifery textbooks mentioned in Table 1.1 in Section 1.7. With the input of a placental pathologist, a midwifery expert, a research and family medicine expert and the study supervisor, the questionnaire was peer-reviewed before completion. The instrument was placed onto Evasys™, an electronic survey program.

The questions in the questionnaire were divided into five sections:

1. Information letter and informed consent.
2. Demographical information
3. Knowledge about the placenta
4. Anatomy pictures
5. Placenta images

The demographic information asked included only the participant’s qualification and employment, to provide background information to the researcher before the participants answered the subsequent questions.

Knowledge questions about the placenta were linked to the placenta's physiological functions, examination thereof, physical parameters, and if the participants had any knowledge regarding placental pathology. This information was necessary to determine if the participants had experience regarding the placenta and if they were knowledgeable regarding placental pathology. The anatomy pictures and placenta images served as a test of knowledge

and calculated a score to determine if these participants could apply their given knowledge to possibly identify specific aspects of the physical placenta as one would have to during placental triage.

A pilot study was conducted with 10 participants and the final instrument was approved through another peer review. The details of the pilot study are discussed in Section 3.10. The questionnaire was uploaded into the Evasys™ program and the link distributed on social media and via email to participants. The informed consent form, Annexure A, comprised the first page of the questionnaire and gave potential participants instructions about inclusion criteria.

The researcher did not have any contact with individual participants. The questionnaire was sent in bulk via email and to groups on Facebook. Individual WhatsApp™ messages were sent to the researcher's contacts containing the link to the questionnaire. Participants were encouraged to share the link on social media, email and WhatsApp™ with their friends and co-workers who met the participation criteria. The researcher hoped that this would create a snowball effect to increase participation.

No personal information, such as name, address or contact details, were obtained from participants, and there was no way for the researcher to connect results to individual participants. This was intentionally done to reduce researcher bias and to uphold participants' privacy.

3.10 Pilot study

Pilot testing the questionnaire is a vital step in research (Mertens, 2010:455). A pilot study gives insight into the questionnaire's usability and will identify any problems in using it by participants.

The questionnaire was pilot tested with a group of 10 midwives. The original questionnaire was shared with them, and after completion, the second questionnaire was given to all participants for feedback on the original questionnaire. A screenshot of the feedback questionnaire is presented in Figure 3.2.

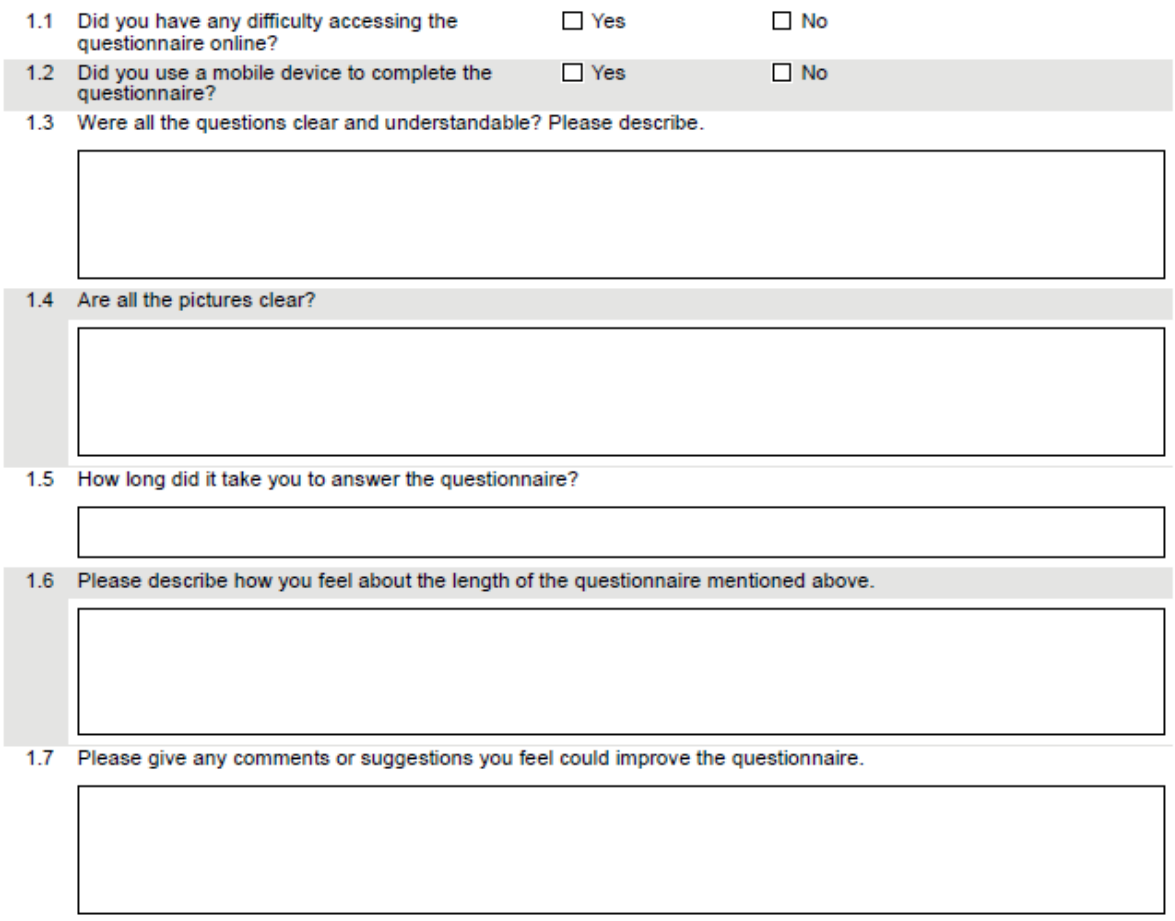

Figure 3.2 Feedback questionnaire.

Feedback from the questionnaire shown in Figure 3.2 was summarised in Table 3.2 with the changes implemented to the questionnaire.

Table 3.2 Pilot study feedback an implementation.

Aspect assessed	Feedback from pilot group	Changes made
Accessibility	No participants answered that they had difficulty with accessing the questionnaire	None
Accessible via mobile applications	85% of pilot group used a mobile device and reported no problems with usability	None
Clarity	One participant mentioned that pictures were not clear	Pictures enlarged and 2 pictures removed that was hard to see clearly.
Time	All participants answered the questionnaire in under 20 minutes, most answered that it took 15 minutes. When asked how they felt about the length of the questionnaire, no concerns were raised.	No questions added to overall length of questionnaire to prevent it from being too lengthy to complete.
Suggestions	Two suggestions from participants were to add a "I don't know" option to questions and an option for people who are unemployed.	Sections added to relevant questions in the questionnaire.

From Table 3.2 it becomes clear that the instrument proved easy to answer, and a few minor changes were made to enhance participant understanding of questions. Some sentences were rewritten and answers such as "I don't know" were added to multiple choice questions. There were no accessibility issues identified as the questionnaire could be accessed via mobile or desktop devices and could be easily shared by participants. Most participants in the pilot study stated that it took them less than 15 minutes to complete. The feedback results from the pilot study are attached as Annexure E. The final questionnaire (Annexure B) was reviewed again by the peer group and approved for use after changes were made.

3.11 Data collection

The researcher used the instrument that was developed using the Evasys™ program to collect data. The means for getting to the largest number of participants in the shortest amount of time was identified as using social media and other technologies to benefit the researcher. The researcher was also not living in South Africa during data collection and found using email, WhatsApp™ and social media beneficial to distribute the questionnaire.

The researcher joined midwifery groups on social media platforms such as Facebook and Instagram. The combined members on the social media groups totalled 20 293 members (Chapter 1, Table 1.2). The link to the questionnaire was shared on social media platforms and groups, via email and messaging. The link was made shareable to entice participants to share it amongst their friends and colleagues to create a snowball effect and reach more participants. In the posts, the participants were invited to share the questionnaire with as many people as possible.

The questionnaire was opened on 01 December 2019 for three months during which time participants could complete the questionnaire online. The period of data collection and procedures for sampling and data collection were confirmed by the review committees and biostatistician. Initially, the response rate was low, so the questionnaire's link was shared again every few weeks. This multiple-phase approach was adapted and used to increase the response rate, as described by Creswell and Creswell (2018:174), as a four-phase administration process. The post containing the link was adjusted each time to relate to current events at the time. Examples of posts on social media can be seen below.

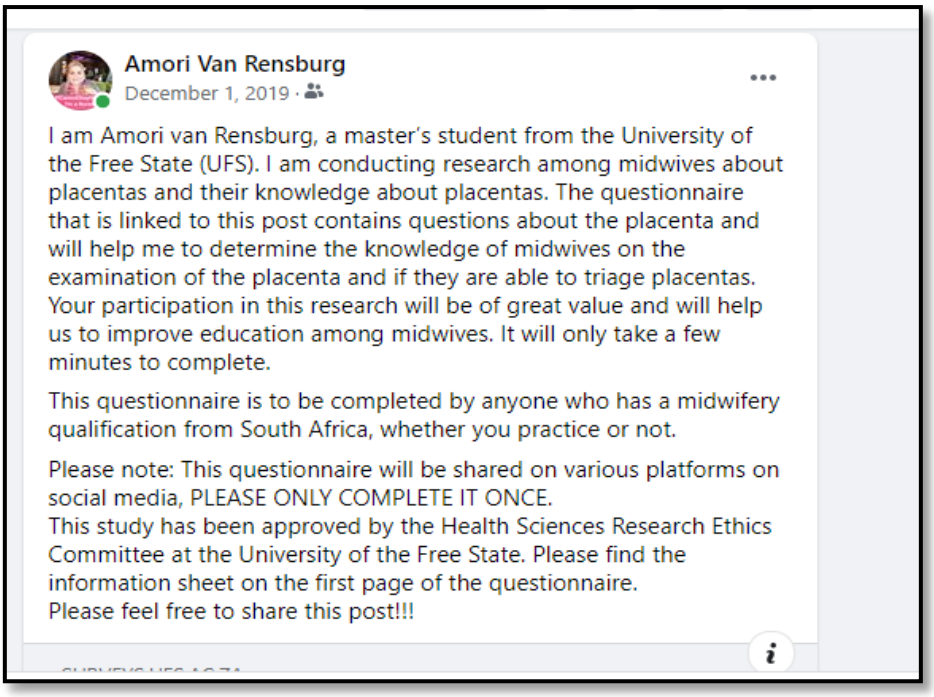

Figure 3.3 Social media post 01 December 2019

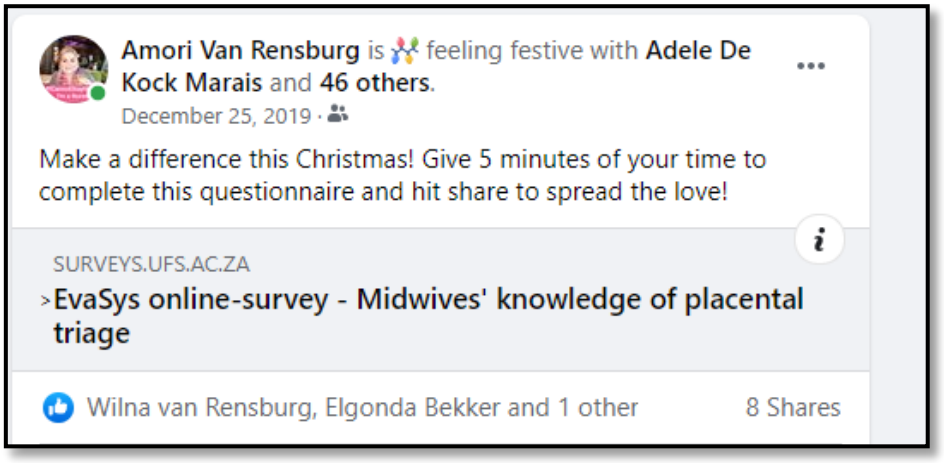

Figure 3.4 Social media post 25 December 2019

Figure 3.5 Social media post 03 January 2020

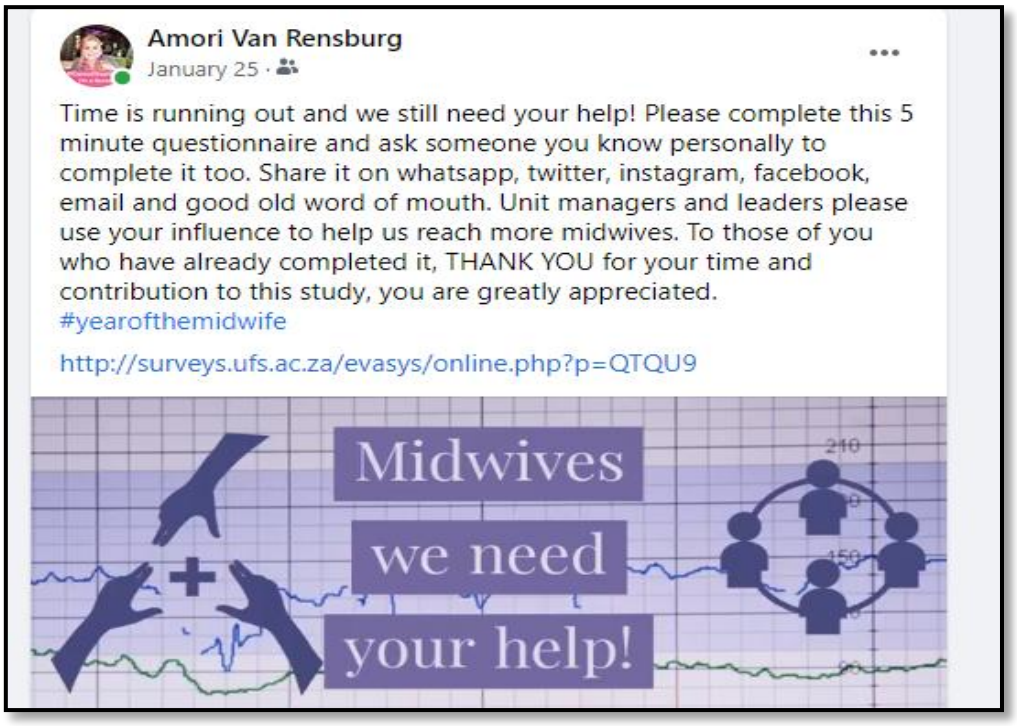

Figure 3.6 Social media post 25 January 2020

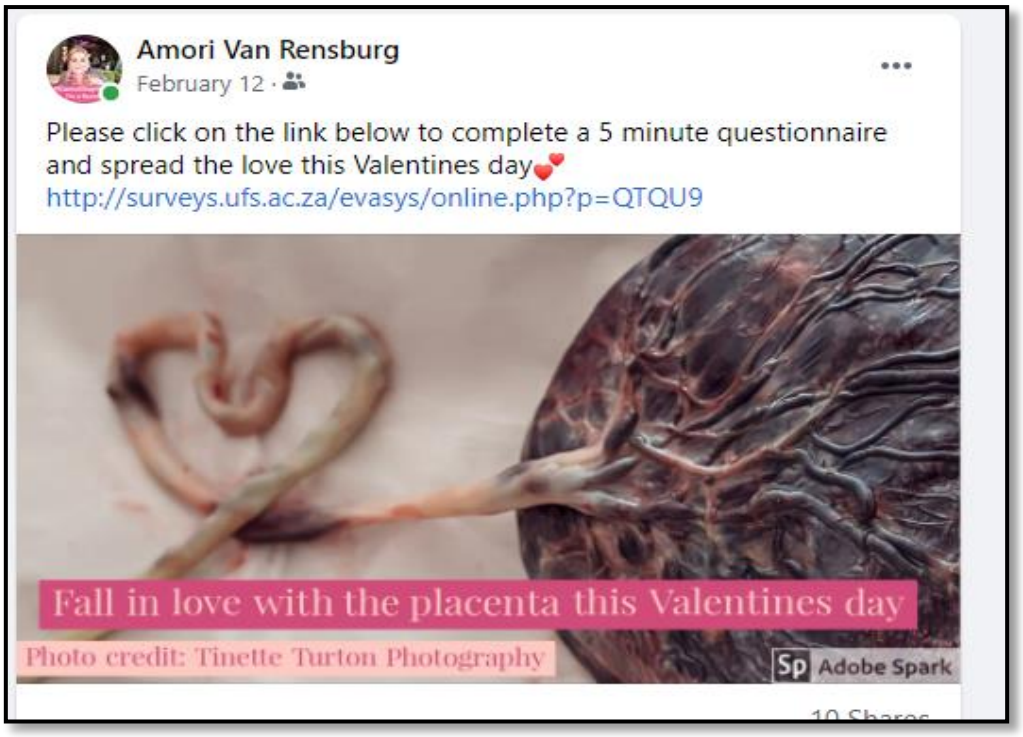

Figure 3.7 Social media post 12 February 2020

Combined, all the social media posts were shared more than 90 times and on more than seven South African midwifery groups. The original list obtained from SOMSA contained an estimated 2 000 members' details; after duplicates were removed and usable email addresses extracted the number came to 83 email addresses. Emails were sent to 83 individuals obtained from SOMSA and reminder emails were sent twice thereafter.

3.12 Data analysis

After the collection of data the data will be analysed by means of descriptive statistics (Maree, 2019:226). Descriptive statistics aims to describe data as a single unit, such as mode, median or mean (Mertens, 2010:405). These types of statistics will be used when explaining the knowledge component of the data and comparisons drawn between different groups of the same variable. The analysed data are discussed and reviewed in Chapter 4.

Raw data was exported from the Evasys™ program and open-ended questions were coded by the researcher. The total number of participants was 157, although the researcher had hoped for a higher response rate. There was minor information loss between programs which meant that certain questions had not been completed by some groups. Missing data were excluded, and the response rate reduced to the number of complete answers for those questions (Maree, 2019:226). The coded results were sent to the Department of Biostatistics at the UFS.

3.13 Validity

The validity of a study comprises the level of accuracy that the results of a study will have. If the validity of a study is high, it will deliver accurate and trustworthy results (Creswell & Creswell, 2018:179). The strengths and threats to a study need to be carefully evaluated and addressed to ensure validity (Mertens, 2010:126). This type of scrutinising of strengths and threats will lead to the critical appraisal of the study. The four focus areas for validity in research are construct validity, internal validity, external validity and statistical conclusion validity (Grove & Gray, 2019:253)..

Mouton and Marais (1996:76) explain a phenomenon known as reactivity that occurs in social sciences research. Reactivity manifests when the participants alter their behaviour due to their awareness of being studied. This can be seen in reluctance to answer questionnaires, incorrect information supplied and adapting behaviour to impress or mislead the researcher. Reactivity is, therefore, a complex variable in data collection that can influence the data obtained during a study. This type of phenomenon is also known as the Hawthorne effect (discussed in Section 1.12) where participants of a study show increased performance due to the researcher paying special attention to them (Mertens, 2010:129).

Table 3.3 presents a summary of different types of validity identified as applicable to this research study and measures taken to address specific threats are discussed.

Table 3.3 Types of validity described and applied.

Concept	Description	Measures in this research
Design validity	Accuracy of results obtained from the study, incorporates the strengths and threats (Grove & Gray, 2019:253).	Critical appraisal through identification of threats to validity.
Construct validity	Match between conceptual and operational definitions of variables and if the instrument measures what it was set out to measure (Grove & Gray, 2019:253) and (Mertens, 2010:384). Mertens (2010:387) includes consequential validity as part of construct validity explains it as the social consequences of a study.	Conceptual definitions operationalised to the specific research. (Page 10) Researcher bias (Rosenthal effect) reduced by use of electronic platform and thus having no personal contact with participants. The aim of this study was not to develop a questionnaire but rather to measure knowledge. Due to no available published instrument the researcher had to develop one and there were no other instruments to compare it to (Mertens, 2010:364). Different types of questions used to determine same aspects of the placenta to increase construct validity (Grove & Gray, 2019:254). Although cultural differences is known to affect performance, participants were not kept from participation in the research on educational or cultural level because to obtain a midwifery qualification through a tertiary institution it is presumed that all participants have the same basic knowledge, such as reading, writing and language (Mertens, 2010:385). Consequential validity gained from this research would be knowledge gained regarding the placenta and examination thereof or a sparked interest to read more about it (Mertens, 2010:387).
Internal validity	Establishes if study findings are correct, includes aspects like participant selection, participant attrition, history and maturation(Grove & Gray, 2019:253) and (Mertens, 2010:311).	Participant selection was not done by the researcher and snowball sampling was applied (Botma *et al.*, 2010:175). No participants withdrew their participation, but they were able to. The researcher has no means of knowing how many participants attempted the questionnaire but did not complete it when they could not answer some questions. As part of history, the only factor that was identified was the questionnaire being opened over the “holiday season”. Although this meant people were less likely to do work-related activities, e.g., read emails, it did give a likelihood of rather spending time on social media, which was beneficial to the researcher. Thus, the data collection took place over this vacation period and a part of the new year to also allow for possible participants to return to work. Follow-up emails and reposts to social media was employed in an effort to increase participation (Mertens, 2010:178). Due to the inability to determine the population size, as discussed in Section 3.6, it is hard

		to determine an actual response rate. No maturation effects were identified (Creswell & Creswell, 2018:197).
External validity	Generalisability of the research beyond the current participants, includes collaboration of: selection and intervention, setting and intervention and history and intervention (Grove & Gray, 2019:253).	There was no threat to selection and intervention identified as participants referred their own contacts and participation was voluntary. No refusal rate could be determined as the researcher did not have contact with the audience that the social media posts reached (Grove & Gray, 2019:255). Generalisability for this research is hard to determine due to low response rate and difficulty in determining the actual population size, as discussed in Section 3.6 (Botma *et al.*, 2010:177). Using a short online questionnaire was thought to be more appealing to attract more participants. The threat to setting and intervention was reduced because participants could access the questionnaire wherever they felt comfortable to complete it. No threat to history and intervention was identified for this research.
Statistical conclusion validity	If conclusions drawn from the research are a true reflection of the rest of the population, considers low statistical power and unreliable measurement methods (Grove & Gray, 2019:253)	Low statistical power could be the effect of a small sample size as in this research (Grove & Gray, 2019:256). There is a definite difference in the intended sample size that the researcher hoped to reach and the actual sample size obtained (Mertens, 2010:311). Measurement methods in this research were used to describe knowledge and makes reliability determination difficult as this variable changes between participants.
Content validity	Assuring that the questionnaire involves the right and applicable content for target population (Botma *et al.*, 2010:175; Mertens, 2010:385).	Content validity of the instrument is determined by examination of three angles: (i) The content of the instrument display the information found in literature, (ii) the experts' evaluation on the content of the instrument and (iii) the participant's responses to the instrument (Grove & Gray, 2019:341). Questionnaire and content discussed and chosen in partnership with the team of experts as mentioned in Section 3.9. Questionnaire was then developed and peer reviewed by the same team of experts. Thereafter a pilot-study was done in order to test and improve the questionnaire (Mertens, 2010:365). This continuous improvement and review of the instrument was aimed at increasing the content validity, but due to the aim of the research not being questionnaire development, multiple pilot-tests were not conducted. Content validity aims at discerning if an instrument measures what it was intended to measure. This is done by contrasting with different participant groups with the same instrument or by convergence, when the new instrument is tested alongside an existing instrument (Grove & Gray, 2019:341-342).

		These methods could be applied as there was no alternative participant group to test it on nor is an existing instrument available. Thus, the researcher had to rely on peer review of the instrument and the results of the pilot-study. As the researcher is a midwife herself, it is expected to improve the face validity (Mertens, 2010:341). This threat will be further reduced by incorporating colleagues in other disciplines in the medical and nursing field, when coming to conclusions in later chapters, such as the study supervisor and a placental pathologist.
Reactivity		A milder form of reactivity was expected, as participants were not necessarily scrutinised for their behaviour on a personal level where the researcher was present. Using the electronic platform Evasys™ guaranteed participants' anonymity and reduced any fear they might have to feel exposed for their knowledge. It was expected that some participants could lie when answering questions that measured if they were doing specific procedures, such as examining a placenta that they know they should be doing. Participants could also alter their answers to make it seem as if they knew about an actual subject when, in fact, they did not. For these reasons, Mouton and Marais (1996:78) describe reactivity as the “largest single threat of research findings”. To control reactivity, the researcher did not have any personal contact with a specific participant to coax them to be truthful in their answers. Questions directed at participants' actions were limited to a minimum and in the informed consent form (Annexure A), participants were asked to be honest in their responses.
Objectivity	The degree to which the measurement of data can be influenced by the researcher (Mertens, 2010:388)	Objectivity was enhanced using multiple choice questions where there is no risk of influence to the answers by the researcher. Open-ended questions were also used in accordance with that to ensure participants were given different opportunities to display their knowledge. Using a multi-dimensional spectrum group of experts from different fields of study ensured that the content of the questionnaire did not only rely on the researcher’s qualifications (Mertens, 2010:388).

As seen in Table 3.3 every effort was made to ensure all threats to the validity of the study were minimised as far as possible and extra measures employed to enhance validity.

3.14 Reliability

Reliability refers to how accurate a measurement method is deemed to be (Grove & Gray, 2019:338). Thus, if the same instrument is applied multiple times, the results should remain the same for all efforts. The types of reliability are: test-retest reliability, equivalent form reliability, split half reliability and internal reliability (Maree, 2019:260).

In addition, reliability of data is affected by four variables: the researcher, the participant, the instrument and research context environment (Mouton & Marais, 1996:79). A visual representation of each variable's characteristics is shown in Figure 3.8, as adapted from Figure 4.1 (Mouton & Marais, 1996:80). These variables are known as effects on research.

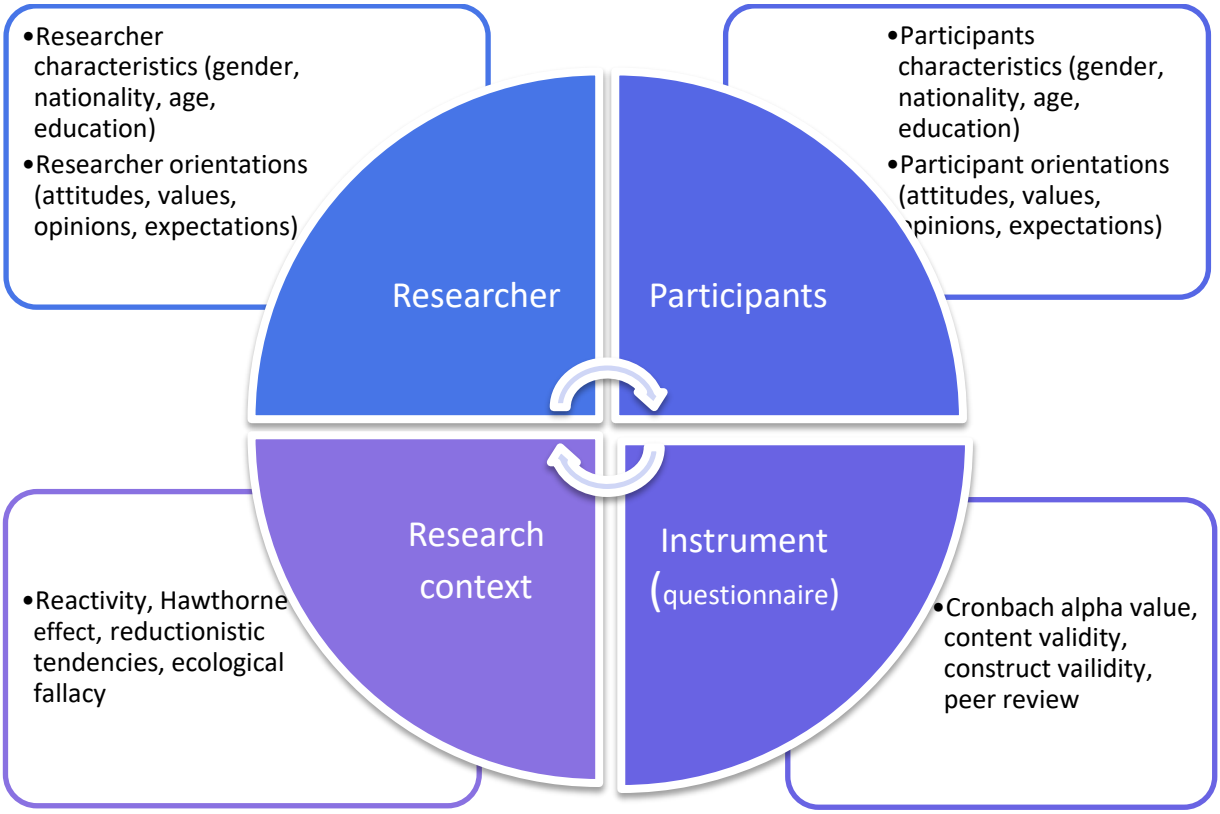

Figure 3.8 Distinction between variables

Though many elements could be more applicable to qualitative research, the researcher found it important to also consider the effects of these qualitative research constructs in this research. The researcher's affiliation and attributes can influence the participants. The questionnaire was published on social media and the participants could scrutinise the researcher's profile, which could have affected them.

Similarly, the researcher's role with participants and the distance between the researcher and participants might also affect the possible relationship between the researcher and participants. As a result, participants could be reluctant to share their knowledge. The researcher's role with regard to participants is usually that of a stranger (Mouton & Marais, 1996:82) and could lead to mistrusting behaviour that could lead to participants giving evasive answers to questions. The researcher's affiliation with a specific university or organisation could positively or negatively impact the participant's reactions. In this study, the researcher is from a reputable university, which might have counted in her favour, but the fact that she

is a midwife could have made some participants feel uneasy. Although the researcher has the benefit of being in the same profession as the participants, she does not know the participants personally, and it is not known if this had had a positive or negative impact on the quality of the data collected.

The participant's effect on the research can be described using the Hawthorne effect. This refers to the participants changing their behaviour to instil a good impression on the researcher (Botma *et al.*, 2010:86). Along with reactivity, this effect can alter data quality and reliability. During this study, it was possible that some participants could have experienced the Hawthorne effect and could have been untruthful in some answers to questions (Mouton & Marais, 1996:86). It was hoped that some of the more technical questions in the questionnaire that contained physical images of placentas would discover the participant's actual knowledge.

3.15 Ethical considerations

"The value and benefits of research are vitally dependent on the integrity of research. While there can be and are national and disciplinary differences in the way research is organized and conducted, there are also principles and professional responsibilities that are fundamental to the integrity of research wherever it is undertaken." (Singapore Statement on Research Integrity, 2010:1)

Following the methods described in this chapter was of the utmost importance to the researcher to uphold the study's validity and reliability. The confidentiality of each participant remains paramount. Due to the inadequacy in the Belmont report, as discussed in Section 1.12, and it not protecting human rights, the principles of the Singapore statement were also applied. The principles that guide the Singapore Statement on Research Integrity (2010:1) is honesty, accountability, good stewardship and professional courtesy and fairness. Each of these principles, as identified by the Singapore statement, has certain responsibilities connected to it. Those that apply to this study and the steps taken to execute each responsibility are shown in Table 3.4.

Table 3.4 Researcher responsibilities and actions taken to execute

Responsibilities	**Application in the research**
Integrity	The researcher took responsibility for the rigour of her research.
Adherence to regulations	The researcher made herself aware of regulations about research within her field of practice.
Research methods	Appropriate research methods were chosen for study and approved by the Evaluation Committee of the School of Nursing.
Research records	Clear and accurate records kept of the research process to allow for replication should it be necessary.
Research findings	Data and findings shared openly and promptly. Findings will be published as soon as possible and sent to various entities, such as SANC and ICM.
Authorship	The researcher took responsibility for her contributions towards the study and any reports that may come from it.
Conflict of interest	The researcher had no financial or other conflicts of interest that could compromise this research study.
Public communication	The researcher will limit herself only to have public discussions regarding her recognised expertise when discussing the research findings' application and importance.
Societal considerations	There was no negative impact on society identified during this research study.

Table 3.4 shows the valuable actions and steps the researcher had taken to ensure the integrity of her research.

The principles described by the Belmont Report (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979:4-7) still have value to add to this research. The report describes the ethical principles involved in research and guides the researcher on how to approach study participants (Grove & Gray, 2019:564). The Belmont report's three principles that are relevant to research with human participants are: respect for persons, beneficence, and justice (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979:4-7). Respect for people requires

respect for their autonomy, and in this study, it was upheld by not retrieving the participants' personal information. Beneficence implies that the actions should be beneficial to the participant and cause no harm.

Some questions in the questionnaire could have led to the assumption that participants display deviant behaviour to the norm. Emphasis was placed on participants' anonymity with the intent of setting participants at ease in answering difficult questions (Mouton & Marais, 1996:92). Alongside this attempt, a definite distance was placed between the researcher and the participants to not make them feel intimidated. The downside of these actions was that building effective rapport with the participants was difficult and could have influenced the lower response rate.

Informed consent acceptance of each participant is a requirement in health sciences research. It ensures that each participant participates in the study of their own free-will, and they can withdraw at any given time (Univeristy of California, 2020:online). The information in this letter also explained the study to the participants for them to decide if they wanted to participate or not.

There was no risk to human subjects in this study. Participants were all over 18 years of age and sound of mind, determined by their qualification of being a qualified midwife. Also, the participants had to have obtained their qualification in South Africa, and they were asked to complete the questionnaire only once. Meeting all the criteria qualified them as participants for the study.

3.16 Summary

This chapter aimed to describe the chosen research method used to answer the research question. The study participants' discussion, procedures followed, and data collection

explained how the study was conducted. Measures to enhance rigor of the research were discussed and compliance with ethical principles and guidelines elaborated on. The following chapter displays the data analysis and shows how the methodology and design, explained in this chapter, was used.

Chapter 4

4.1 Introduction

The purpose of this chapter is to describe the data collected from the study. In the modern science philosophy, it is understood that no finding can be conclusive when based on empirical research data (Mouton & Marais, 1996:192). Quantitative research uses numerical data systematically and objectively from a specific group of participants of a population, to generalise the findings towards the whole population (Maree, 2019:184). This researcher thus drew conclusions based on what the data revealed in terms of midwives' knowledge regarding placental triage and the physical structures of the placenta. Data are displayed in graphs, tables and charts.

In quantitative research data is analysed by evaluating numerical data and producing results after statistical analysis of the data. The procedures used to reduce numerical data gathered is known as statistical analyses. Descriptive statistics is conclusive in nature and assists the researcher to gain insight and meaning from the data; during this the sample and study variables are calculated (Grove & Gray, 2019:378).

After the data collection had been completed, it was exported from the Evasys™ program into a Microsoft® Excel® spreadsheet where the data was cleaned and coded by the researcher (Maree, 2019:226). A copy of the coding key is attached as Annexure F. According to the protocol of the UFS, the coded results were sent to the biostatistician to assist in analysing the statistical data. Percentages and descriptive statistics were then determined.

4.2 Findings

The findings of this study are presented in the following categories: demographic information, general knowledge and applied knowledge.

4.2.1 Demographic information

The data collected indicated that most participants completed a four-year combined diploma qualification. Of all the participants, 35.7% had an Advanced Midwifery Diploma, as seen in Figure 4.1. An advanced midwife or midwifery specialist is a person who holds an additional qualification in midwifery and is registered with SANC as such (South African Nursing Council, 2014:1). As these practitioners are specialists in the field, it is expected that their knowledge pertaining to the study subject will be notable. This is discussed further in Section 4.2.3.

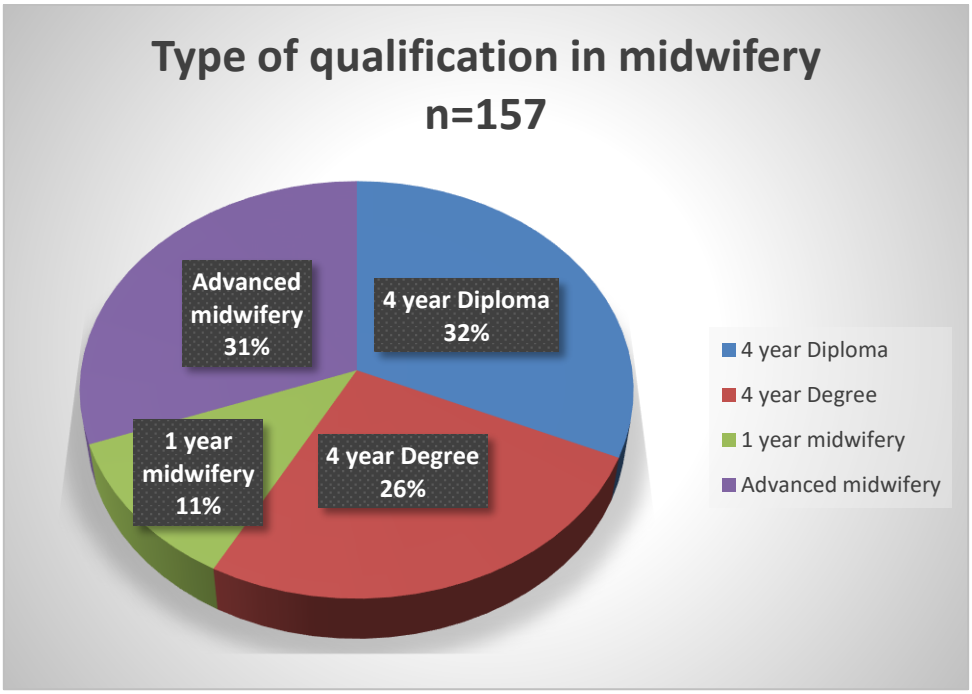

Figure 4.1 Type of midwifery qualification

The group that represented the years after which most of the participants received their qualification (Figure 4.2), was 2015-2019, which is very recent and could indicate that knowledge on the placenta, triage and use of placenta histology might be present as this is a newer emerging field in midwifery. Only one representative had the oldest qualification, having qualified during 1975-1979 and the most recently qualified person obtained a qualification in 2020. Participants who qualified before 2000 comprised 27.3% of the population. The latest available statistics from SANC for 2019 shows that 47% of registered

nurses and midwives were older than 50 years of age (South African Nursing Council, 2020:1). This could explain why almost a third of this study population were older and might be the reason for the low response rate to the questionnaire in general, as older people are more reluctant to use social media or sometimes have difficulty using it (Yeung, 2019:online). This is discussed in more detail in Section 5.2 as a limitation to the study.

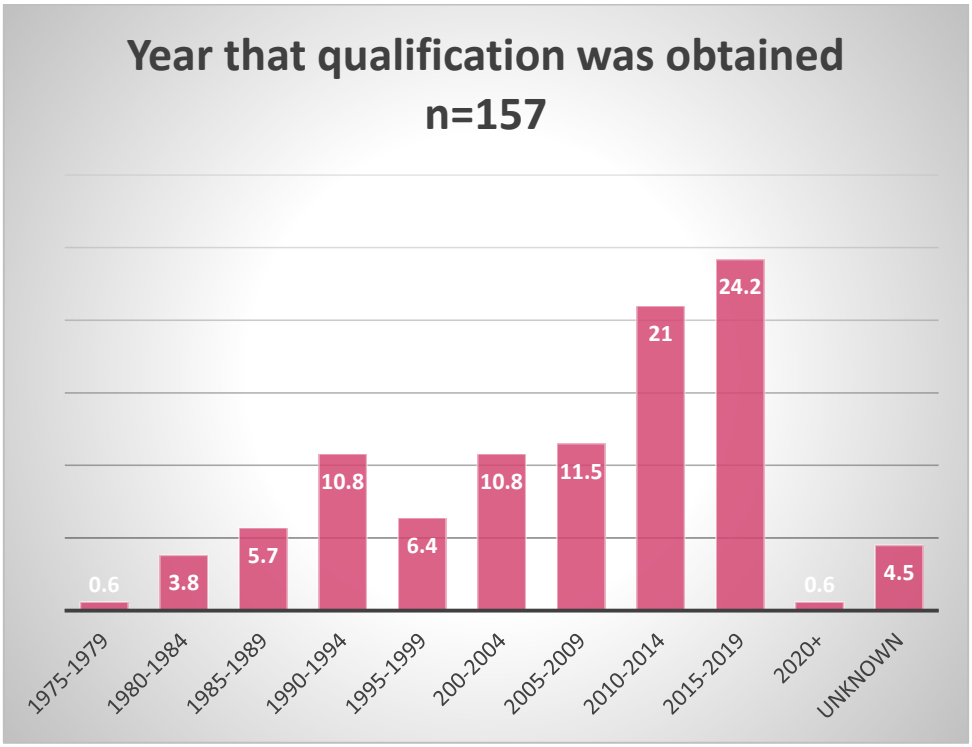

Figure 4.2 Year that qualification was obtained

Figures 4.1 and 4.2 show the distribution of different qualifications and graduation years. Furthermore, Figure 4.3 shows the provinces where participants graduated with the top three provinces being the Free-State, Gauteng and North-West.

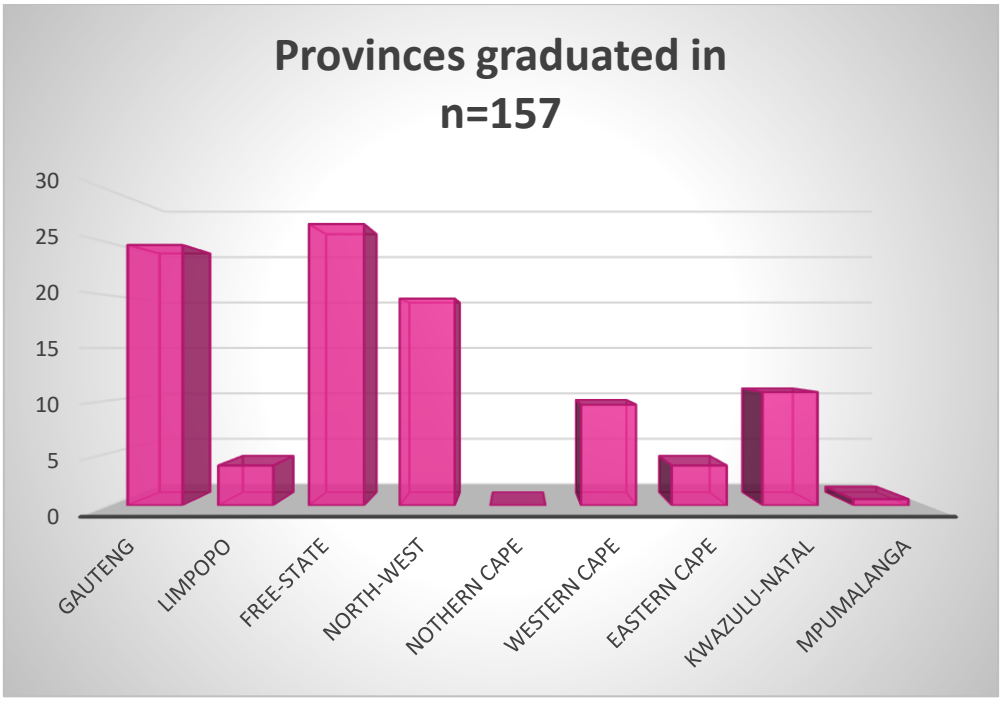

Figure 4.3 Province where graduated

As seen from Figure 4.3 most participants graduated in the Free-state and Gauteng provinces and combined these provinces represent 51.6% of all participants. This gives a general idea of where education was received and could be useful to institutions to evaluate their education in this field or to determine what might be lacking. The link to the questionnaire was shared with colleagues of the researcher via WhatsApp™, therefore most of these people had studied in the Free-State or North-West provinces. The researcher had studied in the Free-State and worked in the North-West province for an extended period. Participants were also asked to share the link with their friends and colleagues, and it is presumed that these were the reasons why more participants were from these provinces. Regardless, a comparison is drawn between the provinces and overall participant knowledge in Section 4.2.3.

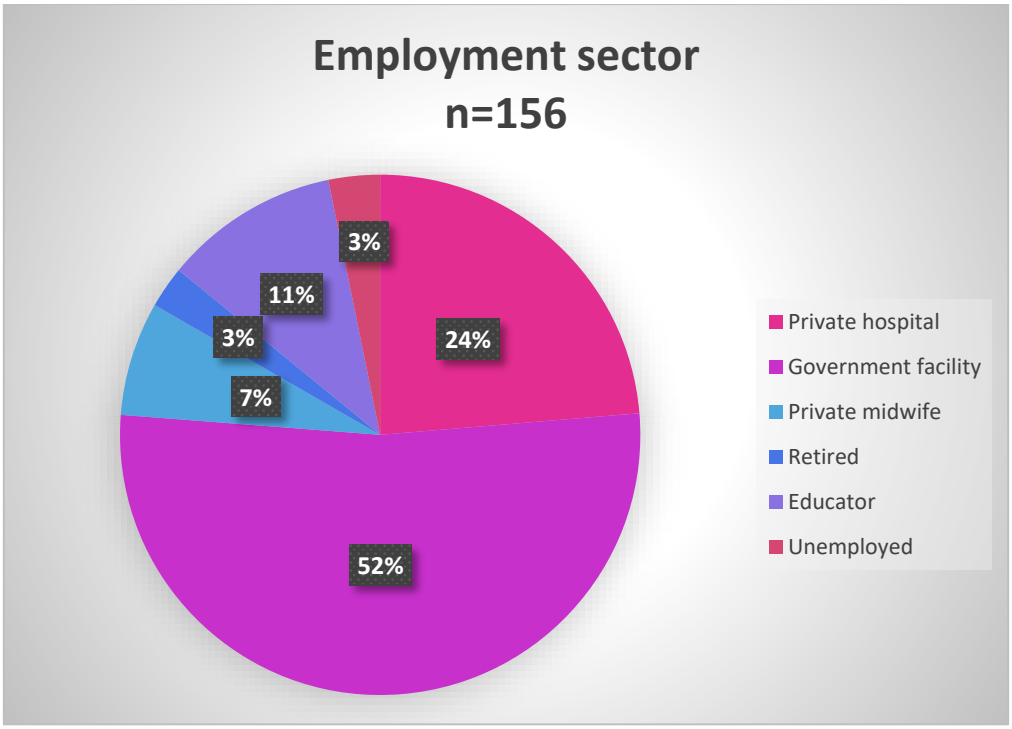

Figure 4.4 employment sector

As seen in Figure 4.4, 52.6% of participants are currently working in the public sector versus 23.7% in the private sector, while 5.8% of the participants were unemployed or had retired. A correlation between knowledge of participants from these different sectors are drawn and discussed in Section 4.2.3. Participants were asked in what level of care they were currently or had previously worked in and most participants had worked either at a tertiary or a private hospital, as seen in Figure 4.5.

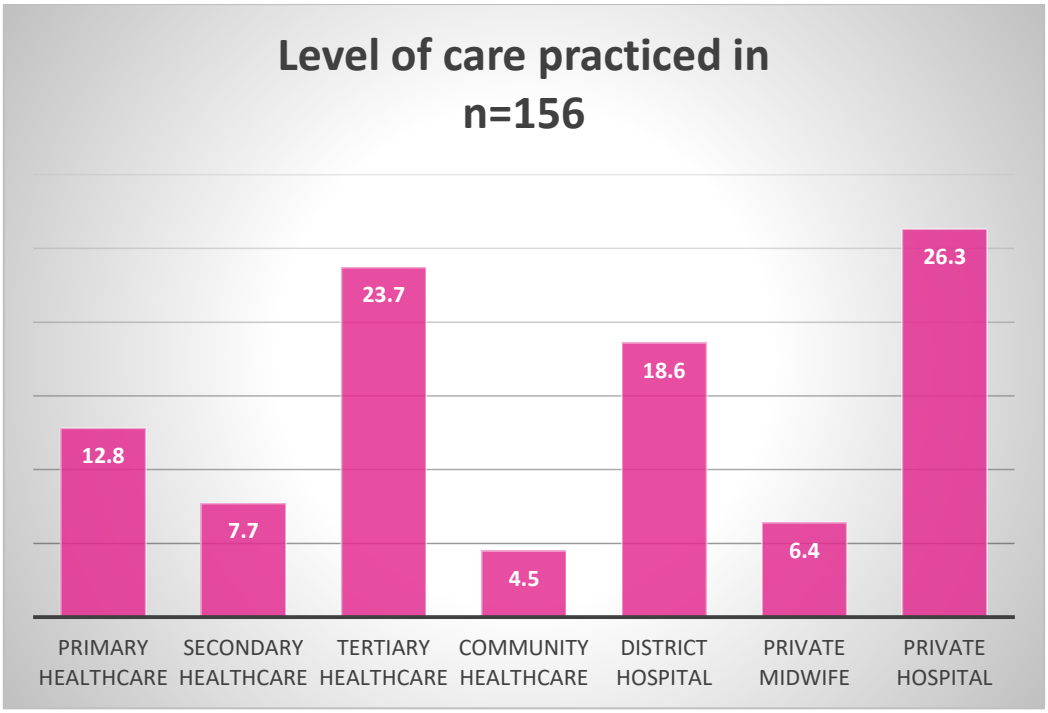

Figure 4.5 Level of care practiced in

Figure 4.5 indicates that almost 24% of participants who work in the public sector, work at a tertiary hospital. These types of institutions are more advanced when compared to a primary healthcare clinic and one would expect these levels of care to have histology services available and thus that the midwives will have a certain level of knowledge regarding this study topic. It is also expected that private hospitals and private midwives should have access to histology services, although it is still to be determined if it is common practice to send placentas for histology in these environments.

4.2.2 General knowledge

Questions 3.1-3.22, as seen in Annexure B, investigated how participants examine placentas and their knowledge about the physical structures of the placenta. The pivotal question asked to participants was if they do or did examine placentas in practice. Surprisingly enough only 64% of participants answered that they always examine placentas. This leads to the assumption that these participants, who answered that they always examine placentas, should have adequate knowledge regarding placentas.

As seen in Figure 4.6, 31% of participants answered that they only examine placentas sometimes, which was further explored by the following questions.

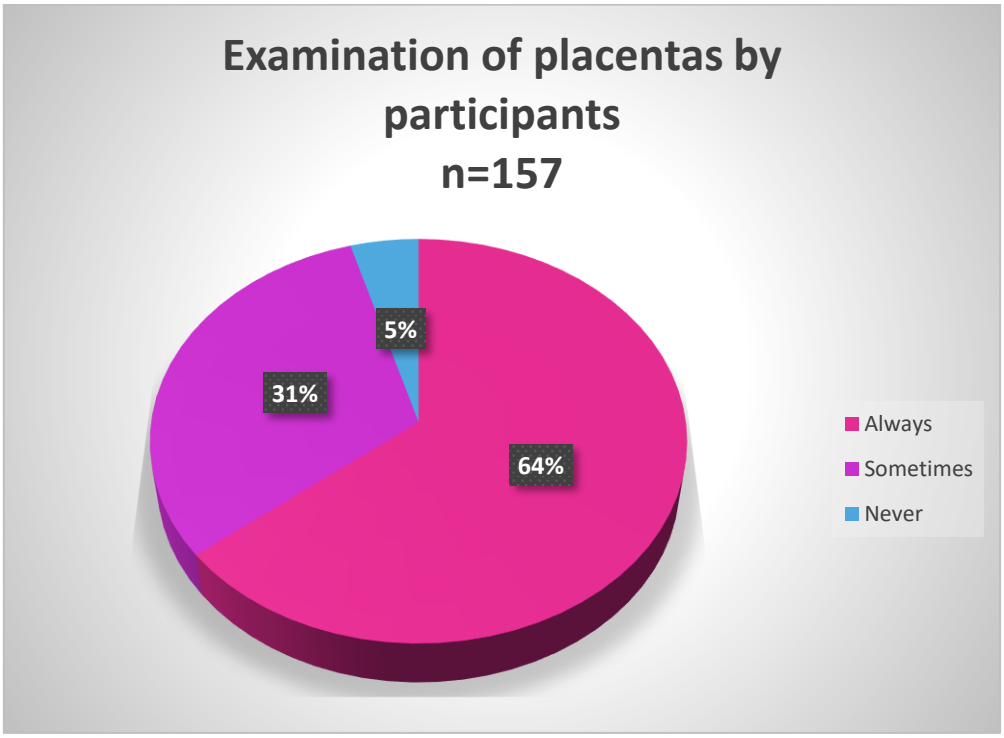

Figure 4.6 Are placentas examined

Unfortunately, the researcher cannot be sure if participants answered that they always examined placentas because they knew it was the ethical response or if they were truthful on the subject. It is, however, of some concern that not all participants answered that they always examine a placenta, as even a basic examination is required by the DoHSA, as stated in its documentation, and as discussed in Section 2.6. The finding on the data confirms non-conformity to the guidelines for submission of placentas as found in a study done by Spencer and Khong (2003:206) and that, in-fact, there has been no improvement in this regard over the passing years.

Figure 4.6 shows that, disappointingly, only 64% of midwives stated that they always examine placentas. Participants were then asked to explain why they answered always, sometimes or never. The answers to this open-ended question were coded into groups with similar answers,

as presented in Table 4.1. The pink highlighted answers are answers that were identified as suboptimal by the researcher and are discussed after the table.

Table 4.1 Explained answers as to why participants do or do not examine placentas.

Answers	**Frequency (n=157)**	**Percentage**
Only after normal births and not after caesarean sections.	6	3.8%
After each birth, quick exam like weight and assessment.	59	37.6%
Only if PPH present to evaluate completeness.	2	1.3%
I do not always have time to examine the placenta.	12	7.6%
Only if there is a concern during pregnancy or birth.	7	4.5%
Only if placenta is retained or incomplete/abnormal.	3	1.9%
I do not work with placentas.	9	5.7%
Doctors must do the examination.	2	1.3%
After each birth, in-depth examination (Participants deemed it important).	38	24.2%
It is not common practice to examine placentas.	2	1.3%
Only did it during education or for educational purposes.	8	5.1%
Unknown.	9	5.7%
Total	157	100%

The optimal answer would be that an in-depth examination is done after each birth and that participants deemed it an important part of the birth-routine (Tellefsen & Vogt, 2011:99). From Table 4.1 can be deduced that only 38 of the 157 participants shared that view, amounting to 24.2%. Some participants did not answer the question, namely those who do not work with placentas or whom only examined placentas for educational purposes. Combined these comprised 26 participants (16.5%).

It is alarming that such a small group within this sample deemed it necessary to examine a placenta. Although it is recognised that time and resource constraints can place strain on the already laden system. It is seen that 7.6% of participants stated they do not have time to do an examination. This finding concurs with Spencer and Khong (2003:206), who note non-conformity to the guidelines for placental submission for further examination, with less than

a third of placentas submitted for examination meeting the criteria. This raises the question whether midwives are, in fact, skilled regarding this practice in South Africa. Very little literature was available that investigated placental examination, triage or knowledge thereof within South Africa. Nevertheless, the DoHSA shares a similar opinion with regard to nursing education in the country and admits to constraints in the education system leading to poor competency and limited clinical exposure (Department of Health of South Africa, 2019:76).

In addition, ICM published the Global Standards for Midwifery Education, a document that guides midwifery education worldwide. This document emphasises competency-based education instead of academic degrees. The values needed to achieve this type of education standards include, among others, lifelong learning (International Confederation of Midwives, 2013:1-2). South African midwifery education does not comply with these global standards with regards to time- and competency-based requirements, which can explain this finding.

The remainder of the answers were divided into two groups: one group's answers were suboptimal but still better than no examination (37.6%) and the group whose reasoning is a cause for concern (38.2%). The group of participants that answered that they do a quick examination and/or assessment after each birth amounted to 37.6%. This is the single largest group to answer this question. It is seen as suboptimal by the researcher because, although they are doing some sort of examination of the placenta, a quick glance is not sufficient to effectively triage placentas as normal or abnormal (Odibo *et al.*, 2016:1).

The remainder of the answers highlighted in Table 4.1 are a cause for concern in midwifery practice. Some participants believed that it is the physician's responsibility to examine the placenta or that it is not common practice to examine the placenta. These opinions contradict what a midwife is expected to provide in the maternity case record as supplied by the DoHSA (Departement of Health of South Africa, 2018:40) and as discussed in Section 2.3.1, which is in any case too vague and inadequate to be regarded as a full examination of the placenta. As most participants are employed in the public sector, it is expected that they will have to

comply with the documentation prescribed by the DoHSA. Yet, through these findings it becomes clear that some midwives are not even complying with the minimum requirements set by the DoHSA.

Furthermore, 7.6% of participants noted that they do not always have time to examine the placenta. This raises the question if staffing models provided for enough staff when compared to patient numbers or if it were rather a question of time management of the individual midwife (Butler *et al.*, 2019:16).

Other answers included that the placenta was only examined if there was cause for concern after the birth, e.g., PPH or a retained placenta, in which case they would then inspect the placenta to see if it was complete or not. This follows the lead from the maternity case record (Department of Health of South Africa, 2018:40) that does not require an in-depth examination of the placenta, as mentioned in Section 2.3.1., but rather inquires if the placenta is complete or not as it seems the focus is on PPH prevention.

PPH prevention was identified as a major focus point after the 2009 maternal mortality rate was at its peak of 188 per 100 000 live births and the task force investigating those deaths found that 60% were preventable (NCCEMD, 2017:iii). This focus on preventing and reducing obstetric haemorrhage brought about a 22% reduction of the maternal deaths related to haemorrhage (NCCEMD, 2016:2). The researcher is then tempted to suggest that the shift in perspective and priorities should come from the DoHSA that should compel an in-depth examination of the placenta and to educate midwives accordingly to reduce litigation and subsequent pregnancy problems.

The data was further split into participants who stated that they always examine the placentas and compared to those who answered that they only sometimes examine placentas. Of the group that answered that they always examined placentas (64%), 52.5% only did a quick examination after birth and only 37.7% did an in-depth examination after each birth. That

concludes that, although midwives might always do an examination of the placenta, less than 40% of these participants performed an in-depth examination.

Figure 4.8 shows the answers from participants when asked what they deem abnormal when examining a placenta. Answers were grouped into the number of aspects mentioned by participants. A screenshot of the question is inserted as Figure 4.7 as taken from Addendum B.

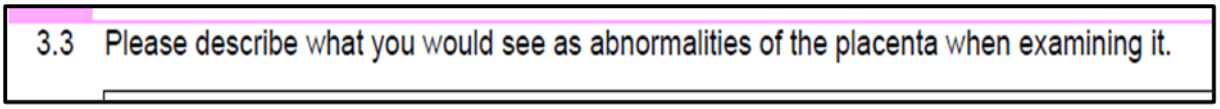

Figure 4.7 Screenshot of question from questionnaire

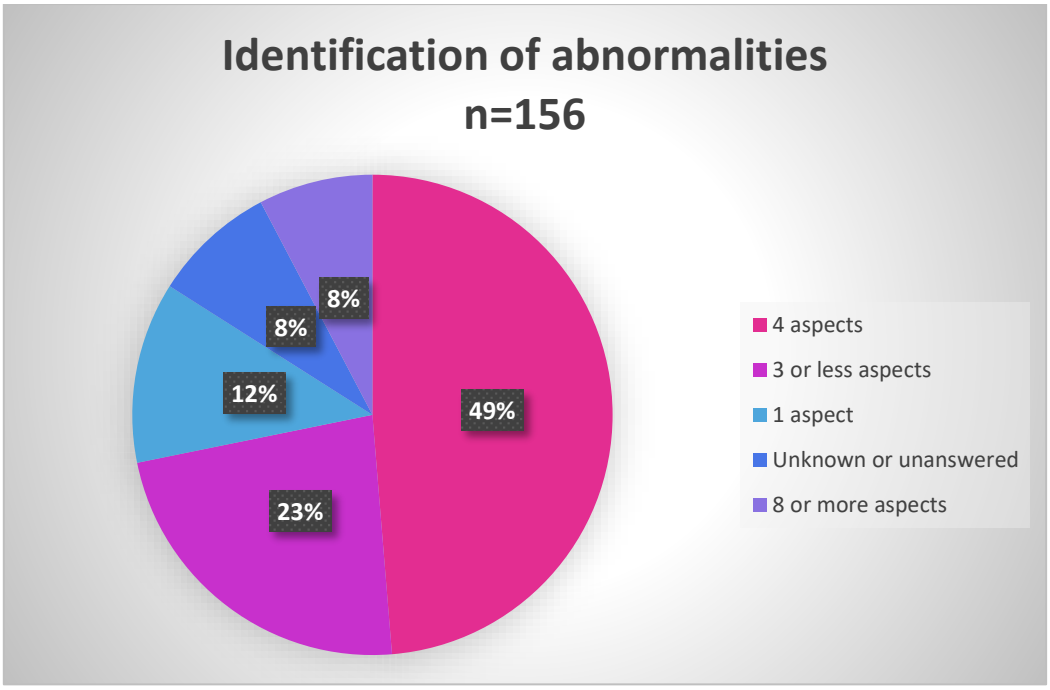

Figure 4.8 Abnormalities to look for in a placenta

Figure 4.8 shows that 49% of participants could name four or more aspects of the placenta that they would examine and check for abnormalities. Only 8% were able to name eight or more aspects they would examine for abnormalities. A combined 20% could only name one aspect or did not know any abnormalities. It now becomes clear that there is some knowledge

deficiency among these participants to assess a placenta and all its components fully as would be expected from a skilled birth attendant (World Health Organization, 2018:1).

Thereafter, participants were asked what they would do in case any of these abnormalities were found, as seen in Figure 4.9, and 22.9% of the participants answered that they would either report or refer it to the physician. Only 11.5% mentioned that they would record it in the file, report it to the physician and send it to the laboratory for histology, which would be the ideal course of action.

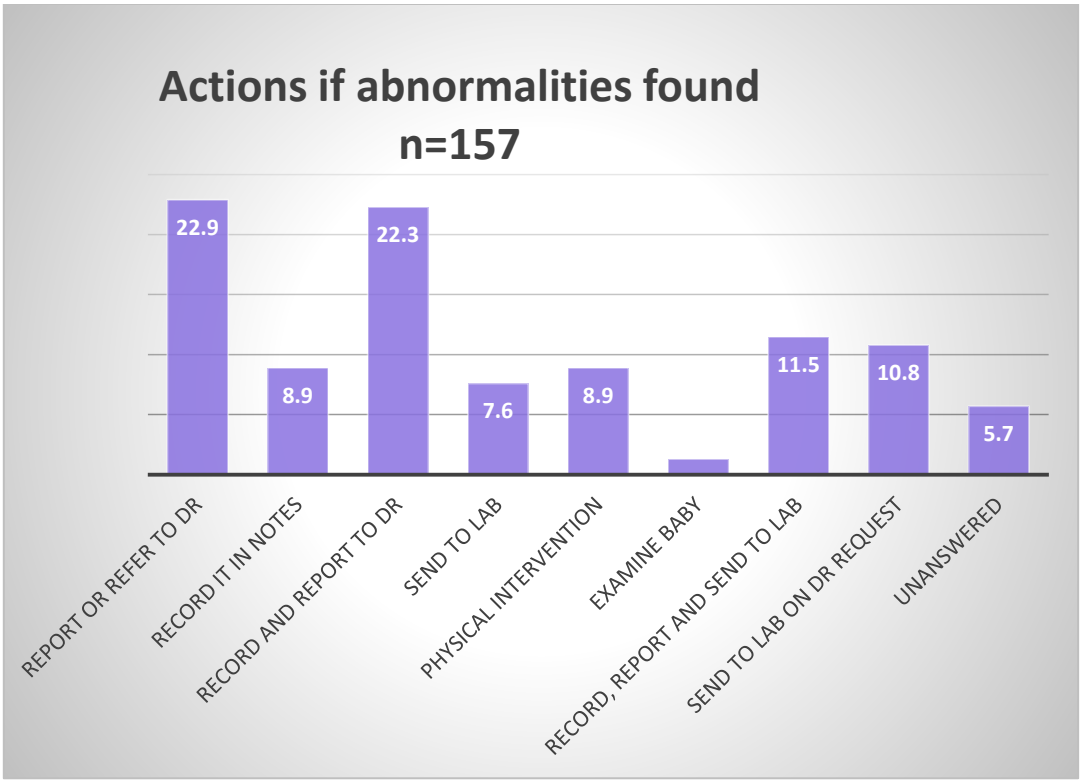

Figure 4.9 What is done when abnormalities are found.

Regrettably, it is clear from Figure 4.9 that only 7.6% of participants would send an abnormal placenta to the laboratory for further investigation and 10.8% of participants would only send it on the physician's request. When working in the public sector, most midwives work without a physician present and the physician or specialist is only called to assist during an emergency or difficult birth, compared to the private sector where midwives always practice alongside

the specialist during a birth. Thus, when examining the answers from these participants, who mostly work in the public sector, it is of some concern that midwives do not feel they can or will send a placenta for further investigation because, when litigation cases arise, the midwife will have to explain her actions as an independent provider. It is encouraged that midwives take ownership of their actions and make independent decisions when they are in a clinical situation without a specialist or if they might disagree with the specialist on evidence-based practice (World Health Organization, 2018:3).

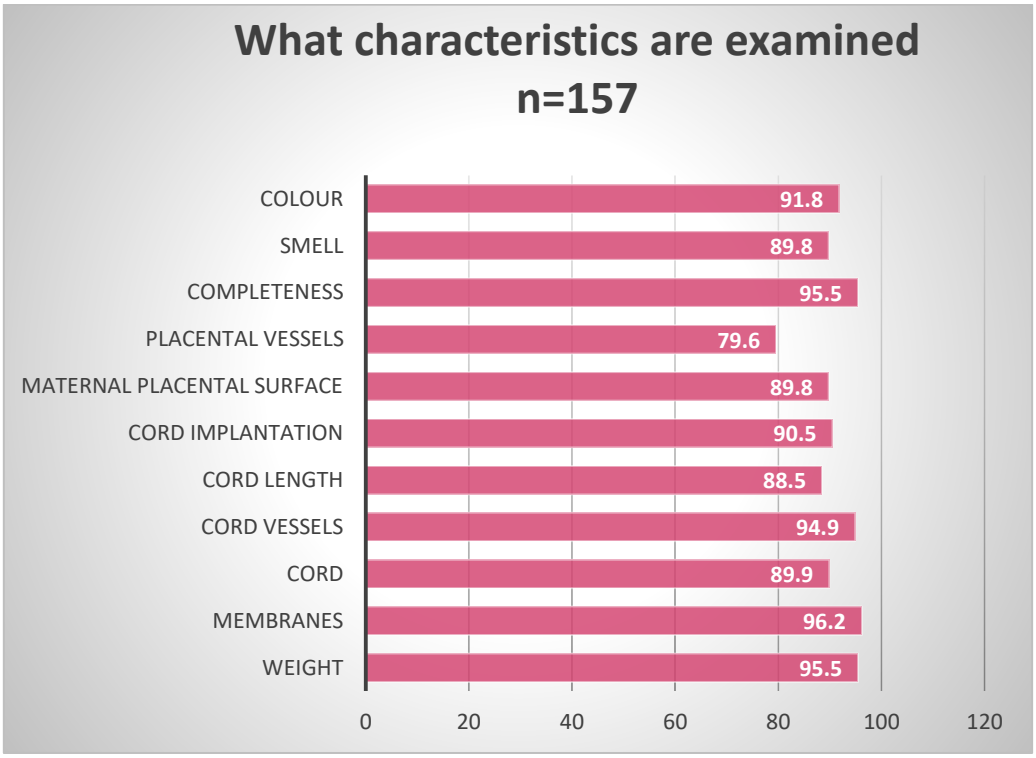

Figure 4.10 Which characteristics are examined

When participants were asked in a multiple-choice question about the characteristics of placentas they would examine, the characteristics most examined were: membranes, weight, cord vessels and general completeness. Characteristics that are equally important, such as placental vessels and cord length (Khong, 2001:175) were least examined, as seen in Figure 4.10.

Again, this is in accordance with the "obstetric haemorrhage focus" that has been discussed, where midwives only examine the placenta as a means to an end to prevent or stop severe bleeding, instead of seeing it as the gem of information it can be and how much could be learnt from it regarding the pregnancy and the newborn (Badawi *et al.*, 2000:343).

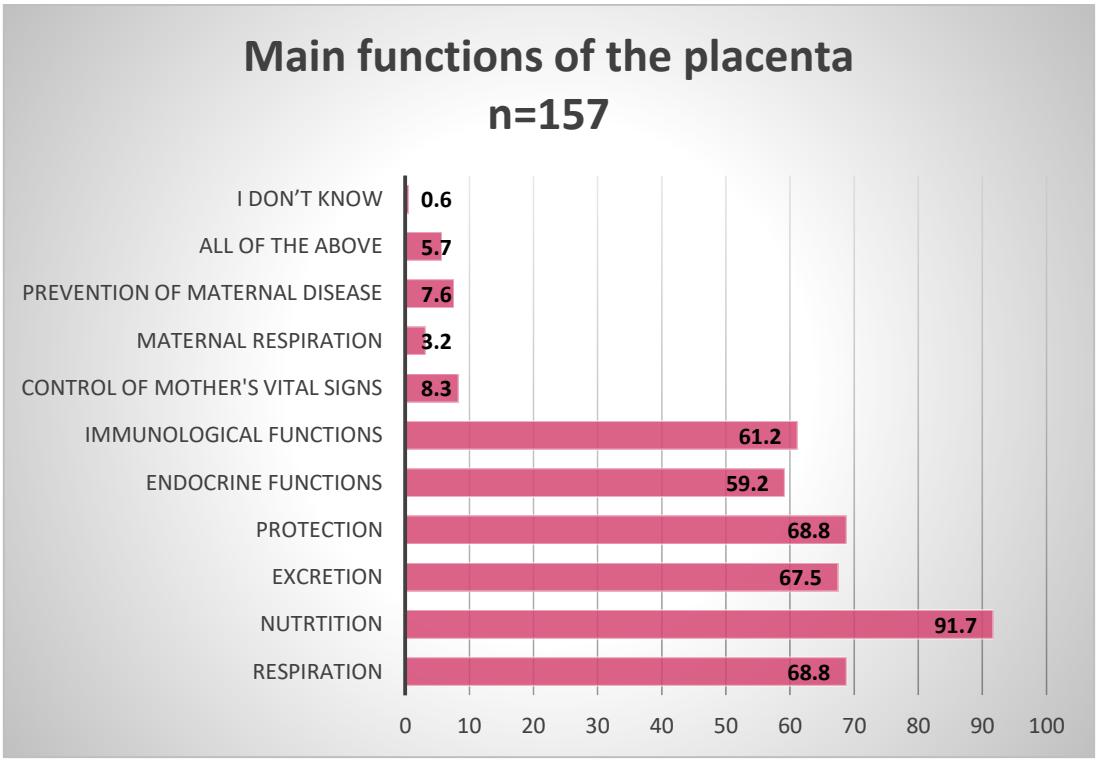

Figure 4.11 Main functions of the placenta.

According to participants the main functions of the placenta is nutrition, as asked in a multiple-choice question (Figure 4.11). There were some wrong answers placed into the optional answers and those wrong answers amounted to 25.4% of participant's answers.

The questions to follow focussed more on specific knowledge of specific parts of the placenta and served as a confirmatory question to determine participant's true knowledge. These knowledge-related questions were extracted and marked as a test to determine knowledge. Although the researcher did not mark questions negatively and deducted points, the marking

was done with a rigorous template in order to discern true knowledge and not guessed answers. The knowledge test results are further discussed in Section 4.2.3.

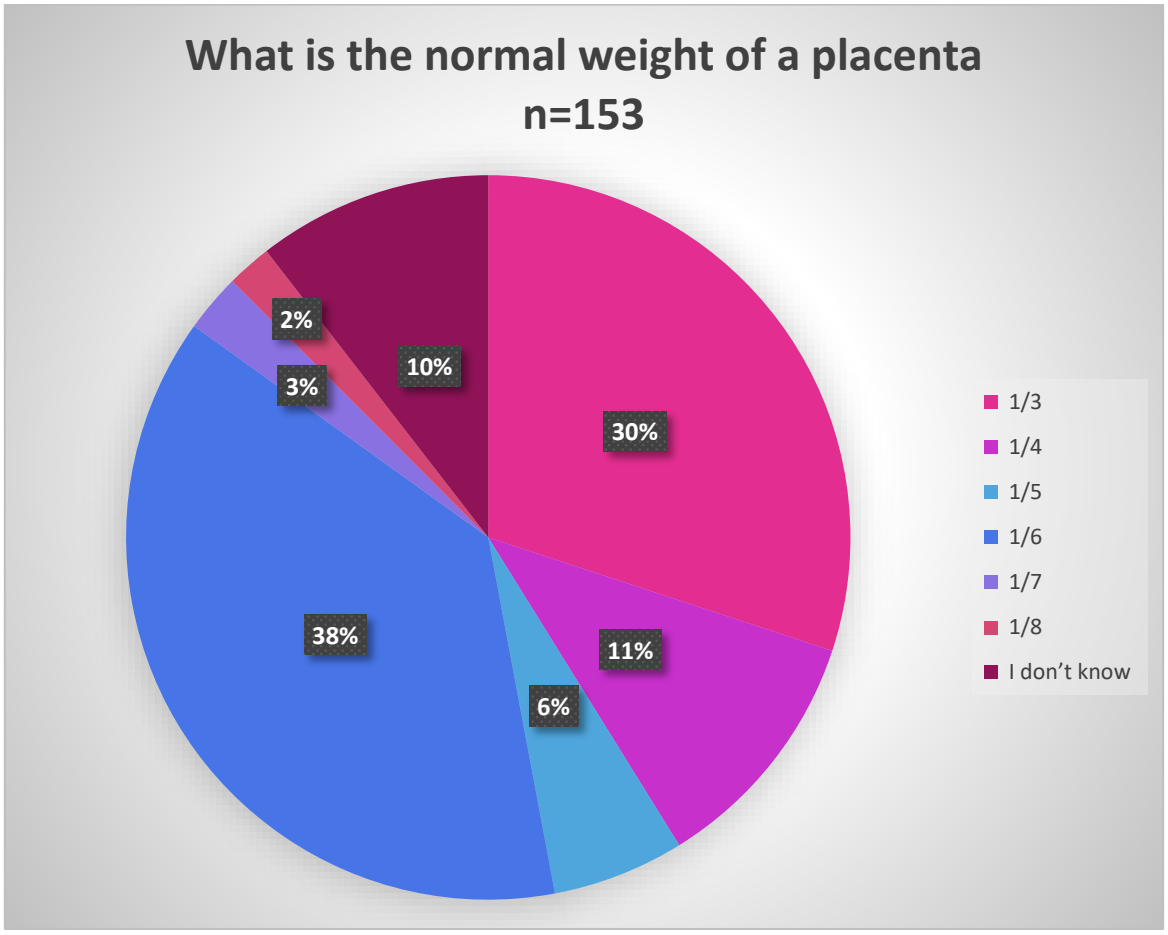

Figure 4.12 Normal placenta weight

As seen before in Figure 4.10, 95.5% of participants answered that they do examine placental weight, yet, as seen in Figure 4.12, it becomes clear that only 38% were able to answer the questions about placental weight correctly as a fraction of the baby's weight. When asked what a low placental weight can indicate, the correct answers are IUGR, PET or trisomy (Hargitai *et al.*, 2004:789).

As seen in Figure 4.13, 91.1% of participants answered IUGR correctly, while only 65% answered PET and 12.1% answered trisomy.

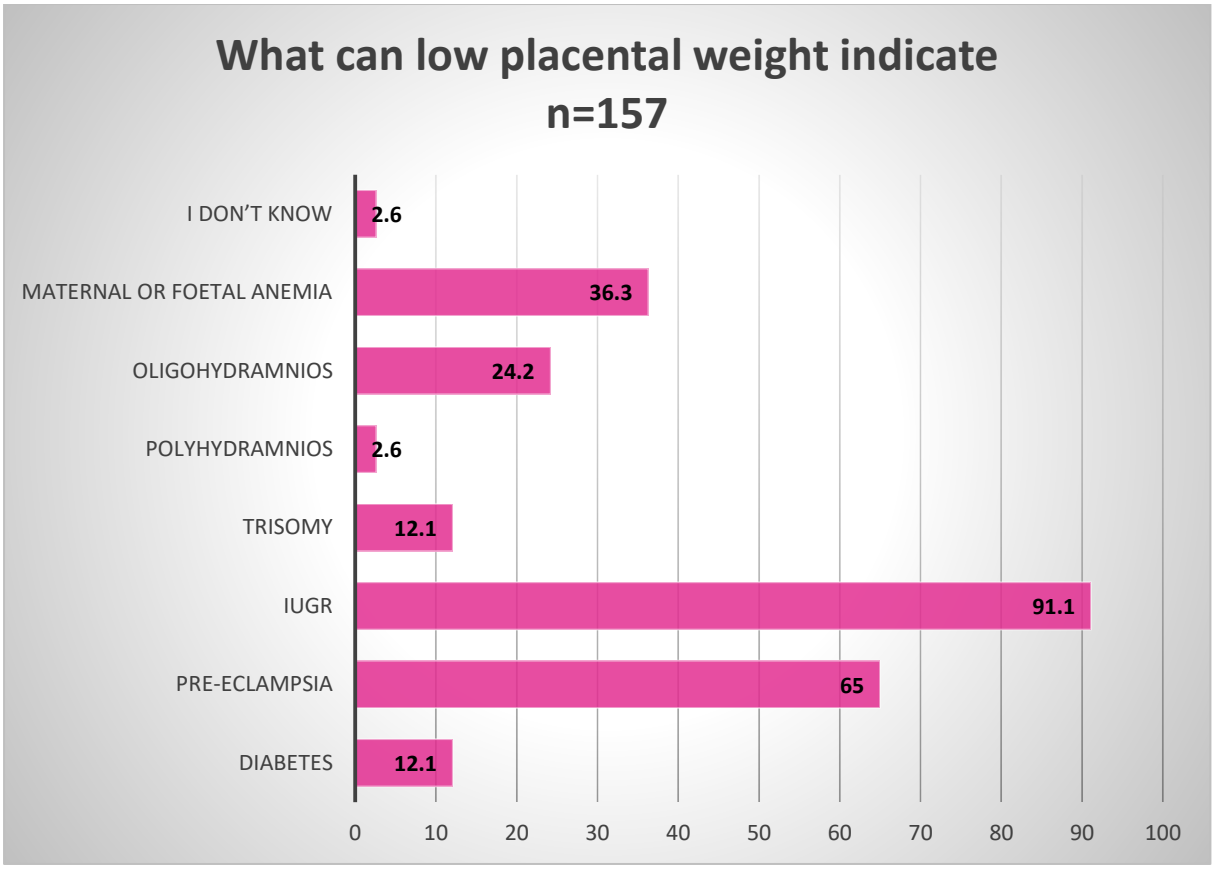

Figure 4.13 Low placental weight indication

From Figure 4.13 it is seen that wrong answers such as anaemia, still received 36.3% of participants' answers. Due to the importance of low placental weight and what it can indicate, it is expected that those placentas should be sent for further examination (Hayward *et al.*, 2016:2). Yet, if midwives do not weigh placentas and know the implications of a low placental weight, they will not necessarily send these placentas for histology.

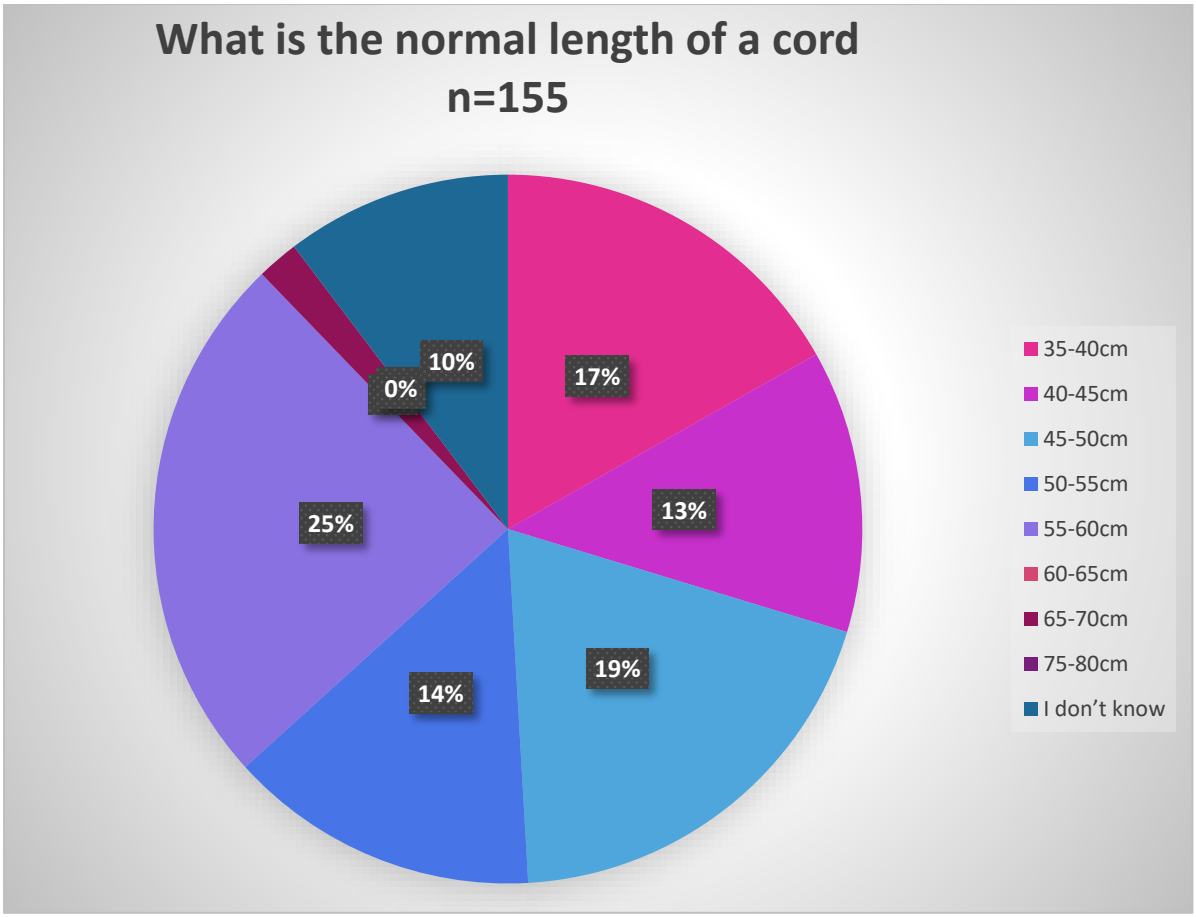

Figure 4.14 Normal cord length

Resources differ when referring to the normal length of a cord and anything between 40- 60 cm is deemed within the normal range. Below 40 cm is seen as short and above 60 cm as excessively long (Fraser, Cooper & Nolte, 2012:123). For this question, all answers within the 40-60 cm range were accepted, which constituted 71% of all answers, as seen in Figure 4.14. Of all the participants only 10.3% answered that they do not know the normal length of a cord. When asked what a short umbilical cord can be indicative of, as seen in Figure 4.15, only 24.5% of participants answered neurological abnormality, correctly.

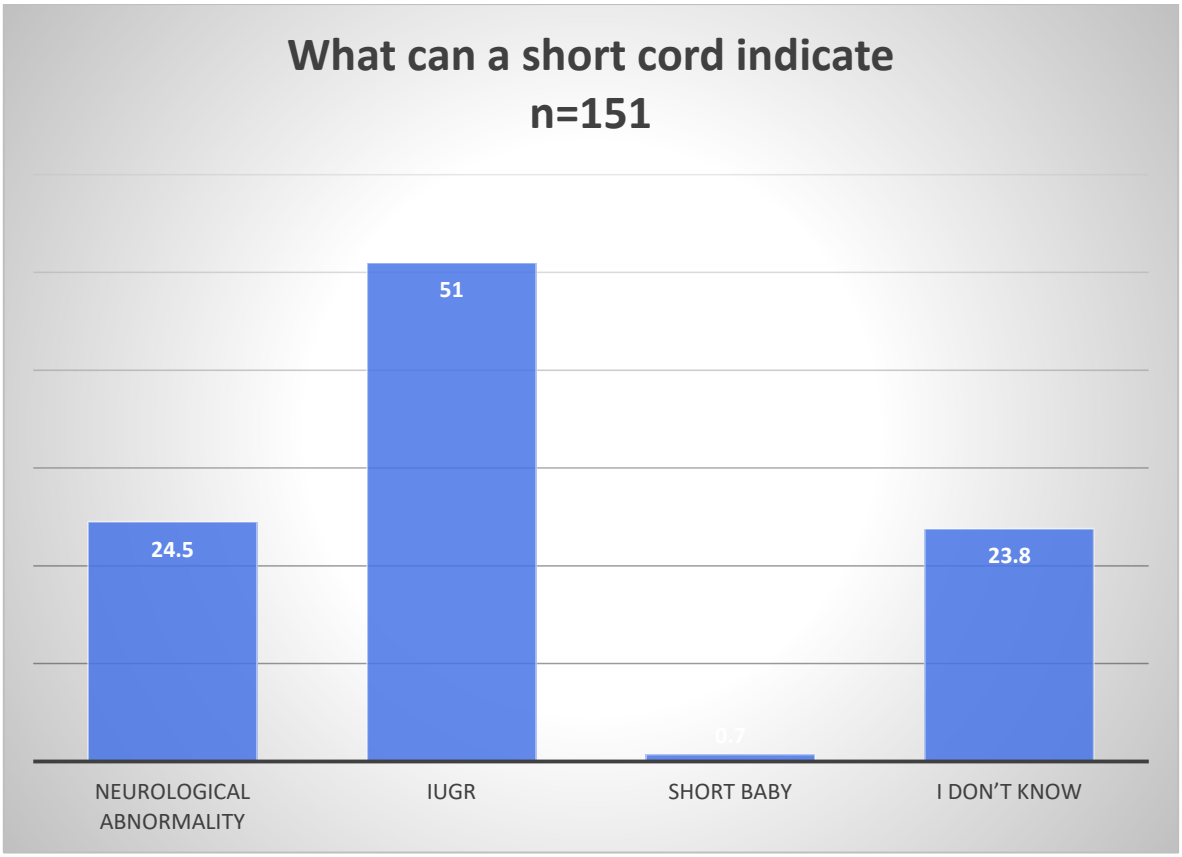

Figure 4.15 Short cord indication

As can be seen in Figure 4.15, almost 76% of participants did not know the relevance of a short umbilical cord. In Figure 4.16, 83% of participants answered correctly that there is two arteries and one vein in an umbilical cord and 16% of them were able to indicate what an abnormal number of arteries could indicate.

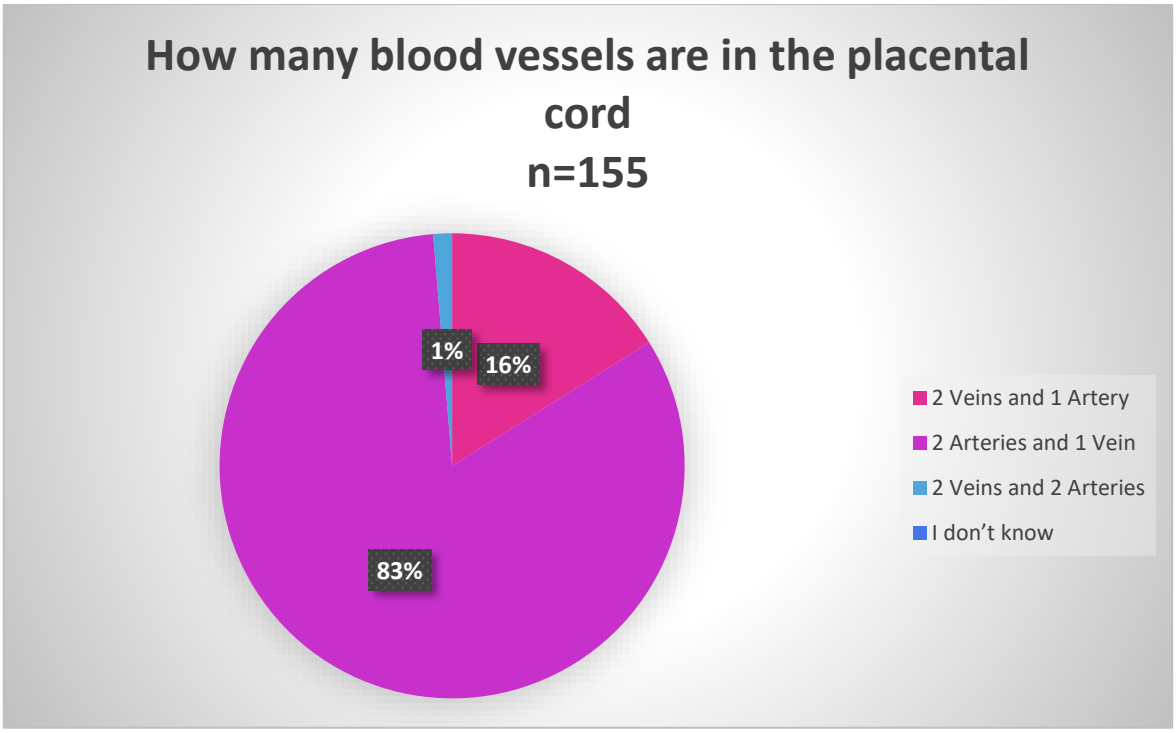

Figure 4.16 Normal cord vessels

From Figures 4.16 to 4.18 it is seen that participants were mostly able to distinguish the normal placental shape and colour.

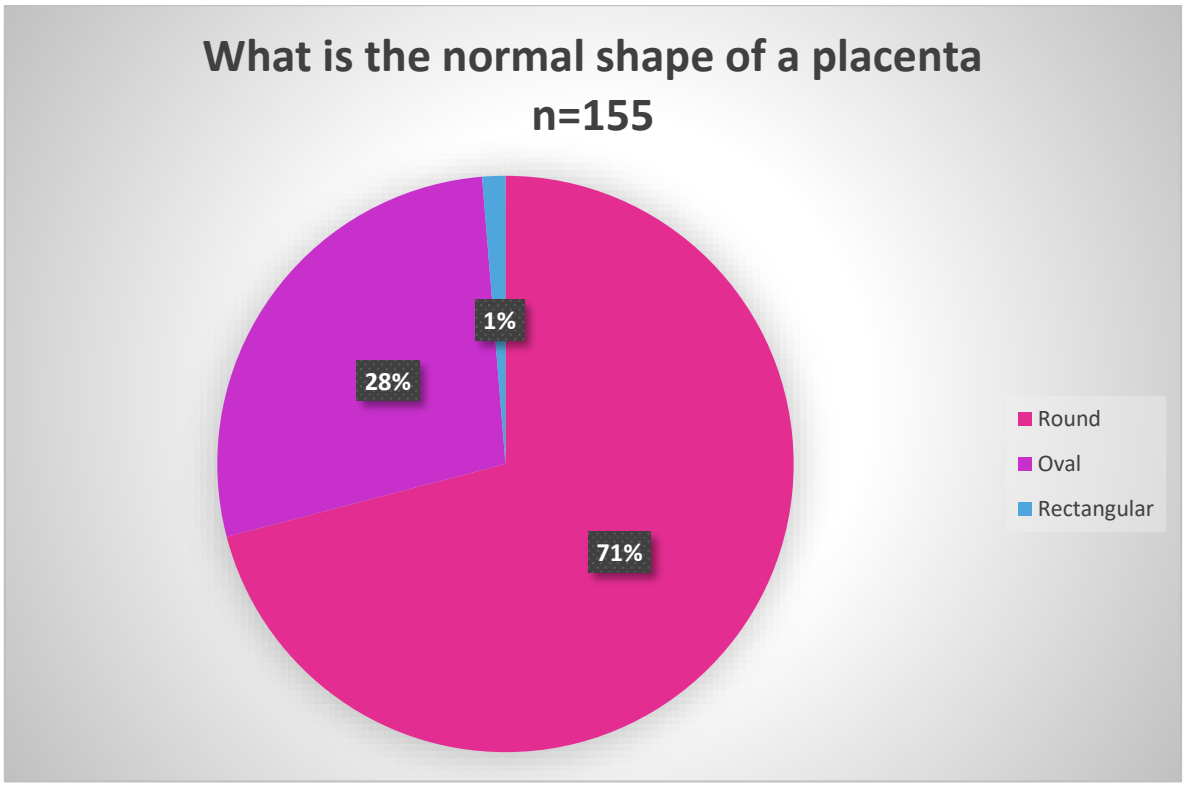

Figure 4.17 Normal placental shape

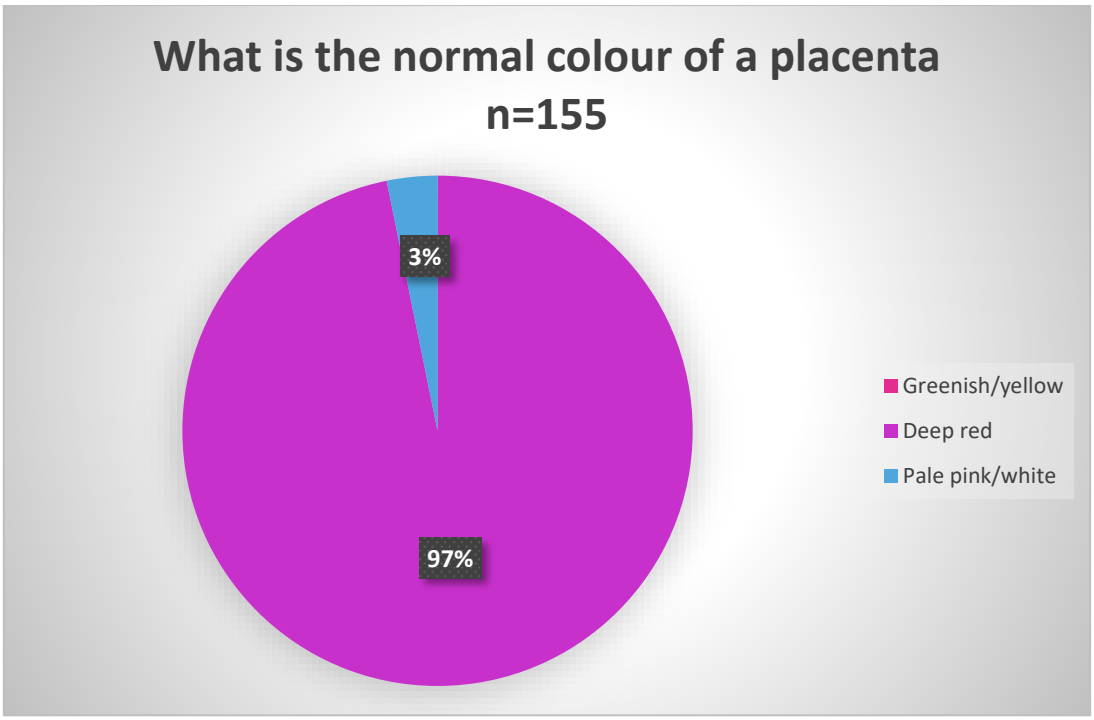

Figure 4.18 Normal placental colour

The guidelines for these questions and answers were used from Table 2.1 as discussed in Section 2.3.1. This indicates that these midwives had in fact worked with placentas and were aware of what was regarded as normal when looking at the placenta. This basic knowledge was needed for the midwives to answer the questions in the last part of the questionnaire, which contained actual pictures of normal and abnormal placentas.

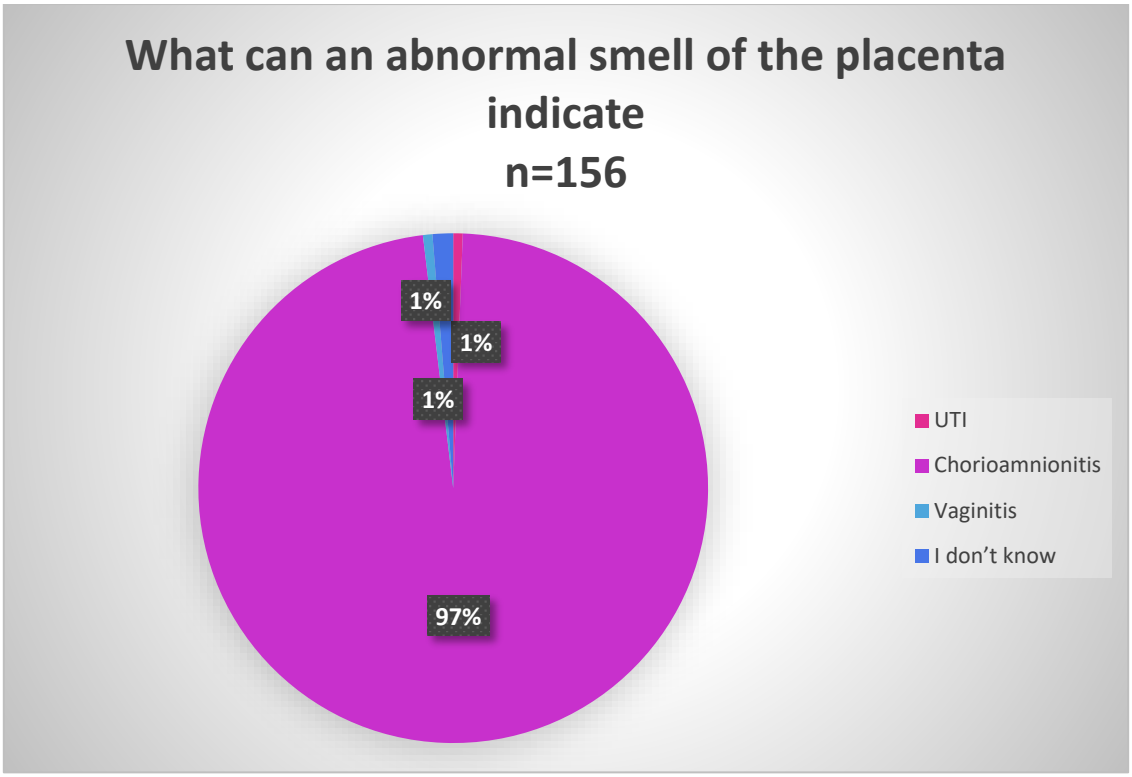

Figure 4.19 Abnormal placental smell indication

An abnormal smell of the placenta is an indication of infection and as seen in Figure 4.19, most of these midwives were able to determine the right answer as chorioamnionitis. This is of great importance because, if a placenta can be identified and sent for histology to confirm chorioamnionitis, those records can be consulted to determine the child's brain development and motor skills at 2 years the age (Van Vliet *et al.*, 2012:1).

Although this data was collected before the start of the global COVID-19 pandemic, the effects of the pandemic is notable in practice with midwives having to wear more Personal Protective Equipment (PPE) than they usually would. Using an N95 mask prohibits sensory clarity through means of smell and could impede the midwives' ability to identify an abnormal smell of the placenta. Furthermore, one of the detrimental side-effects of the virus is loss of taste and smell that could last months (Dawson *et al.*, 2020:1) and should a midwife be affected by the virus, her clinical ability to perform this function will be compromised. The researcher would suggest further research on this topic and the effects of the pandemic on clinical practice.

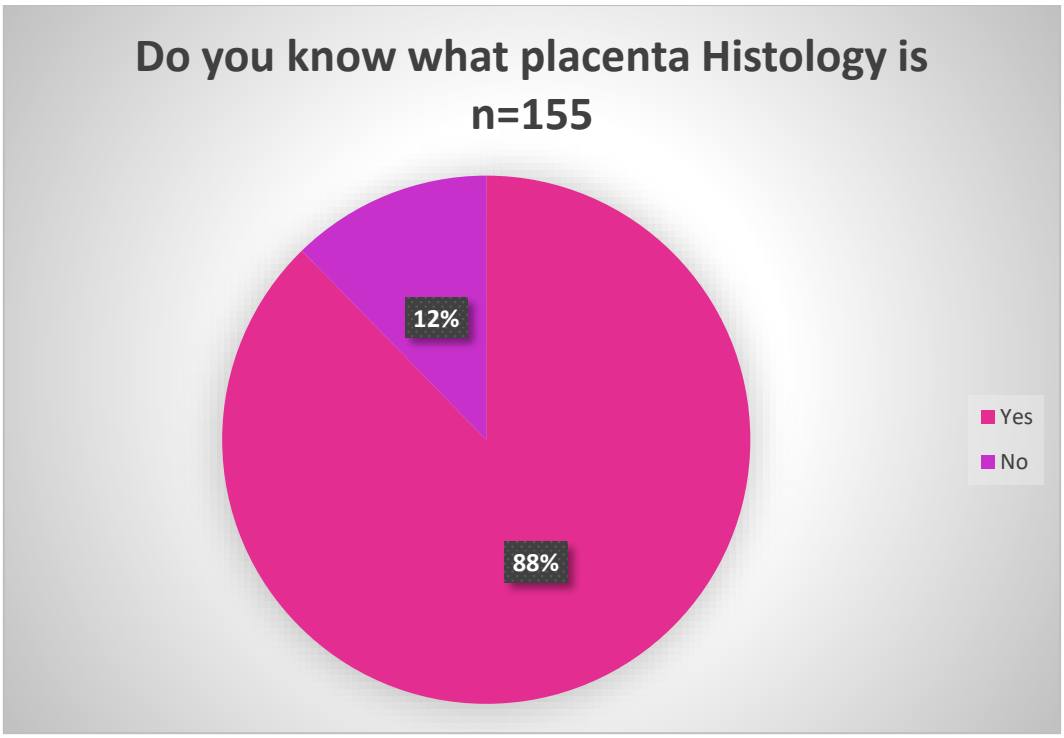

Figure 4.20 Do you know what histology is

As seen in Figure 4.20, when participants were asked if they knew what placental histology is, 88% answered yes. Unfortunately, when asked if they knew what abnormalities for either mother or baby can be diagnosed with histology, as shown in Figure 4.21, only 53% could answer yes and name them correctly.

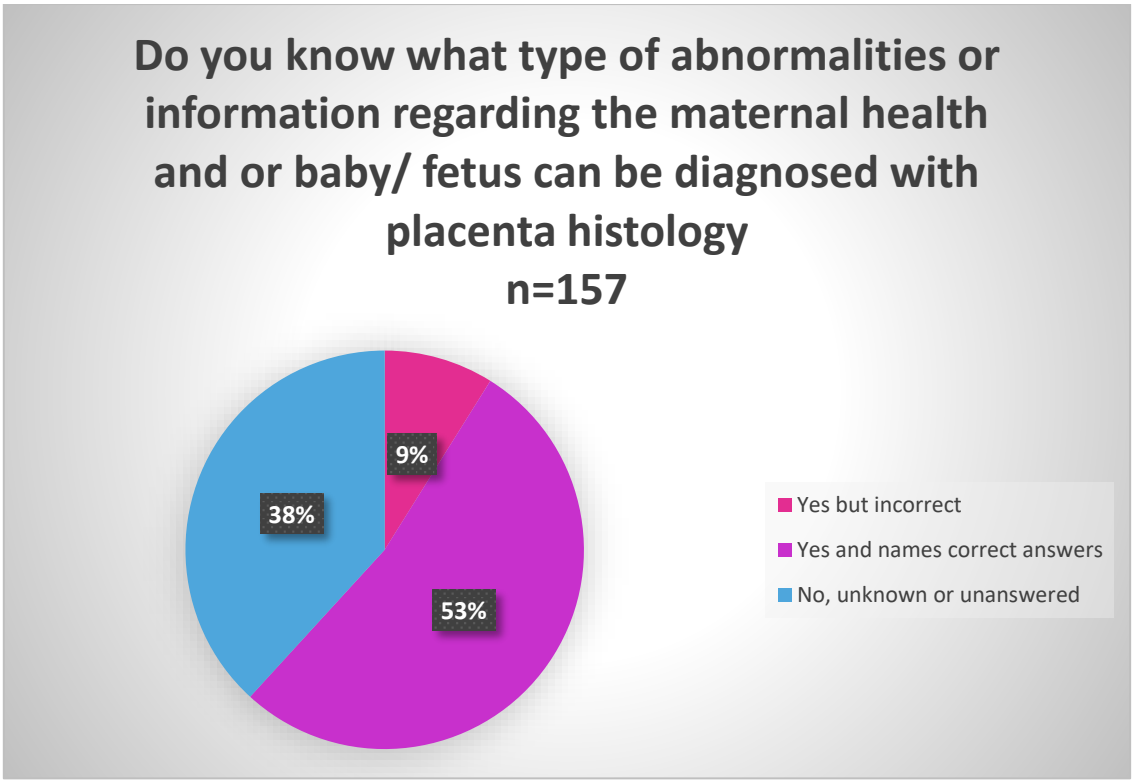

Figure 4.21 Name what type of information can be yielded from placenta histology

Participants were asked if they knew what information could be gained from the placenta. A striking 38% of participants answered no or did not answer the question. Another 9% of participants thought they knew, but gave incorrect answers. The remaining 53% of participants were able to answer correctly. Table 4.2 contains all the correct answers as can be found in the coding key attached as Annexure F, in accordance with the percentages of participants that accounted for each answer.

Table 4.2 Information obtainable from placentas according to participants

Answer	**Percentage**
Litigation	9.6%
Diagnostics	30.6%
Future pregnancies	12.7%
Treatment planning	5.7%
Unknown, unanswered	40.1%
Research	1.3%

As seen in Table 4.2, some participants were aware of the advantages and information obtainable from placenta histology, yet it leaves the researcher questioning why it was then not common practice to send placentas for histology.

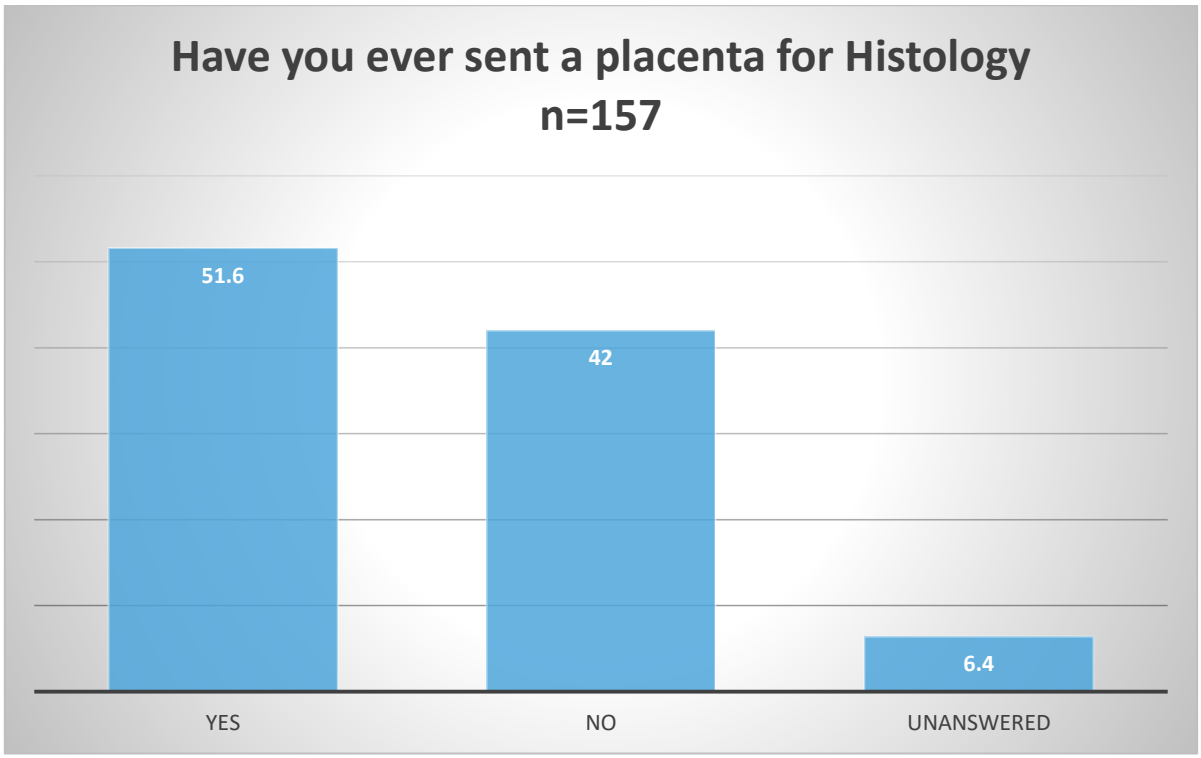

Figure 4.22 Have you sent a placenta for histology

From all participants, just over 50% confirmed that they had ever sent a placenta for histology, as illustrated in Figure 4.22. This is significant when considering that 50% of participants worked/works in either tertiary or private healthcare. It might be that only these specific participants send placentas for histology.

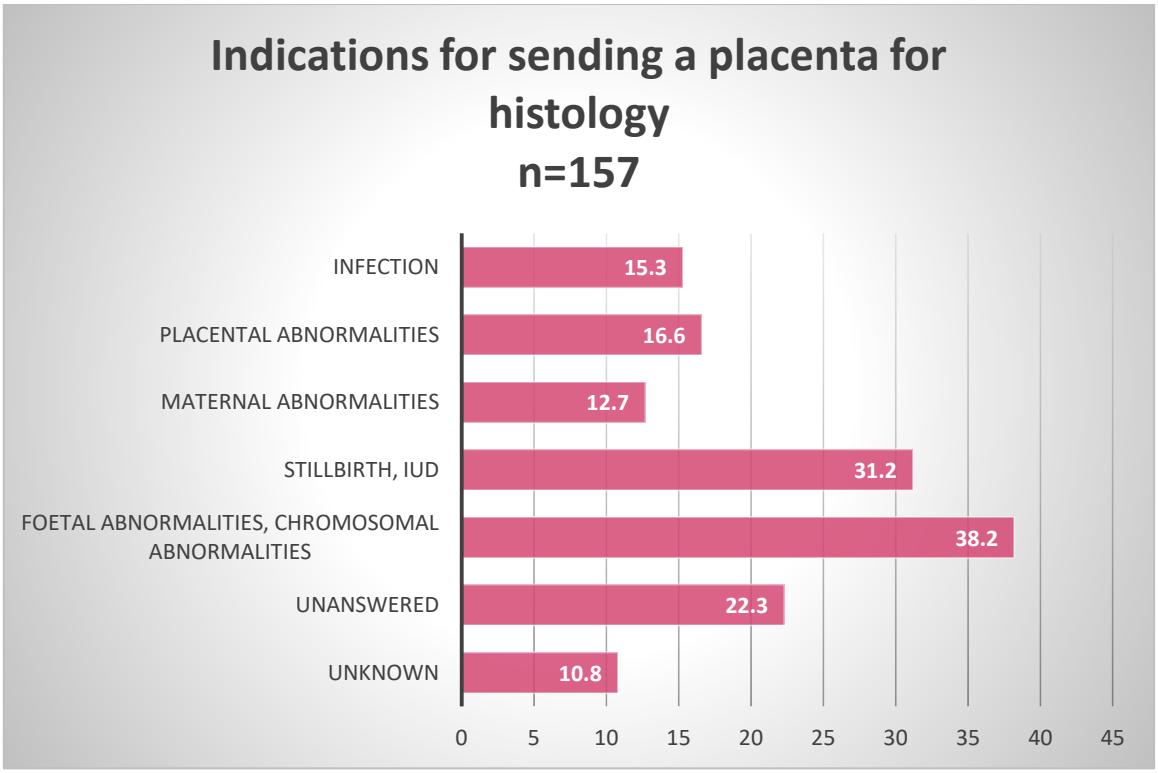

Figure 4.23 List indications for sending a placenta for histology

Furthermore, Figure 4.23 indicates the answers of participants when asked to identify indications for sending a placenta for further investigation. Most participants knew the indications for sending a placenta for histology and only 33.1% did not know or did not answer this question. The indication most listed was foetal or chromosomal abnormalities. This gives the perception that most participants know what histology is, what results it can yield, why placentas should be sent for histology and whom have access to histology services. Yet, more than 40% of participants stated that they do not know what a placental histology report can be used for (Figure 4.25).

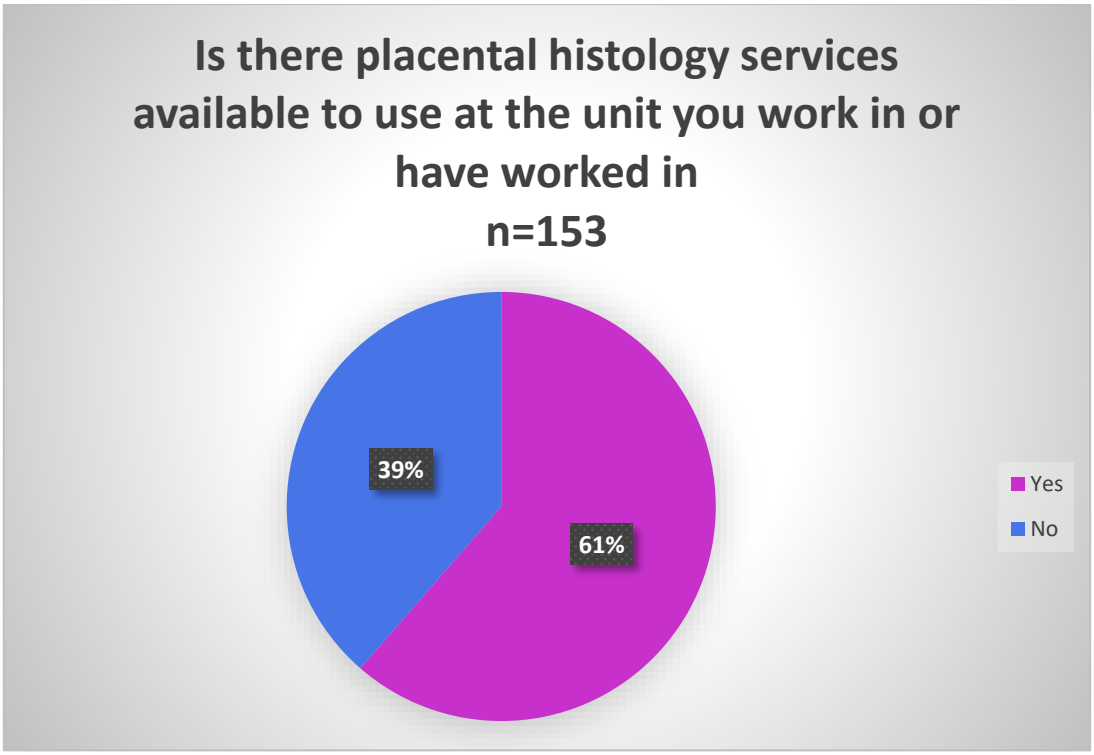

Figure 4.24 Availability of histology services

Regrettably, as seen in Figure 4.24, only 61% of participants said that there were placental histology services available in the units they work/worked in. That leaves a gap of almost 40% that do not have these services available and raises the question of what is being done in these facilities when an abnormal placenta is identified.

Figure 4.25 indicates if participants knew what a histology report of the placenta could be used for. A staggering 40% of participants did not know. Only 9.6% of participants knew it could be used during litigation. This proves that more awareness should be raised among midwives on this subject and its benefits. Increased awareness about the placenta and it's uses, as discussed in this study, could immeasurably benefit improved midwifery care in South Africa.

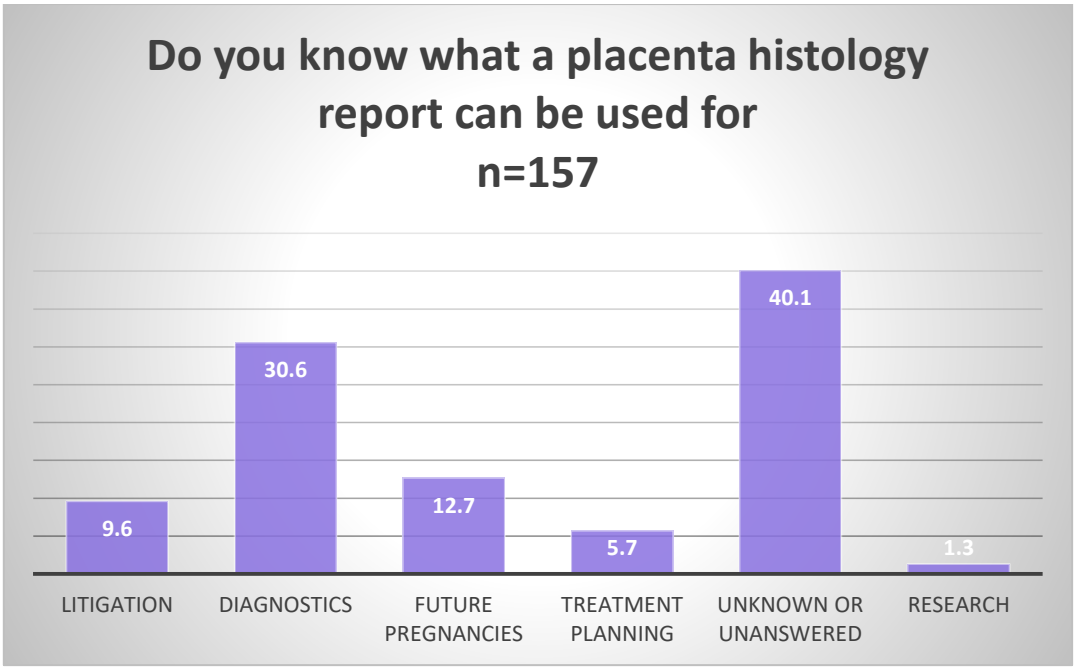

Figure 4.25 List what a placenta histology report can be used for

In the last part of the questionnaire the participants were asked if they thought the midwives at their institution could use training regarding placental histology. As seen in Figure 4.26, 97% answered yes. When the question was turned to the participants personally (Figure 4.27), 88% stated that they could use advanced training on examining placentas.

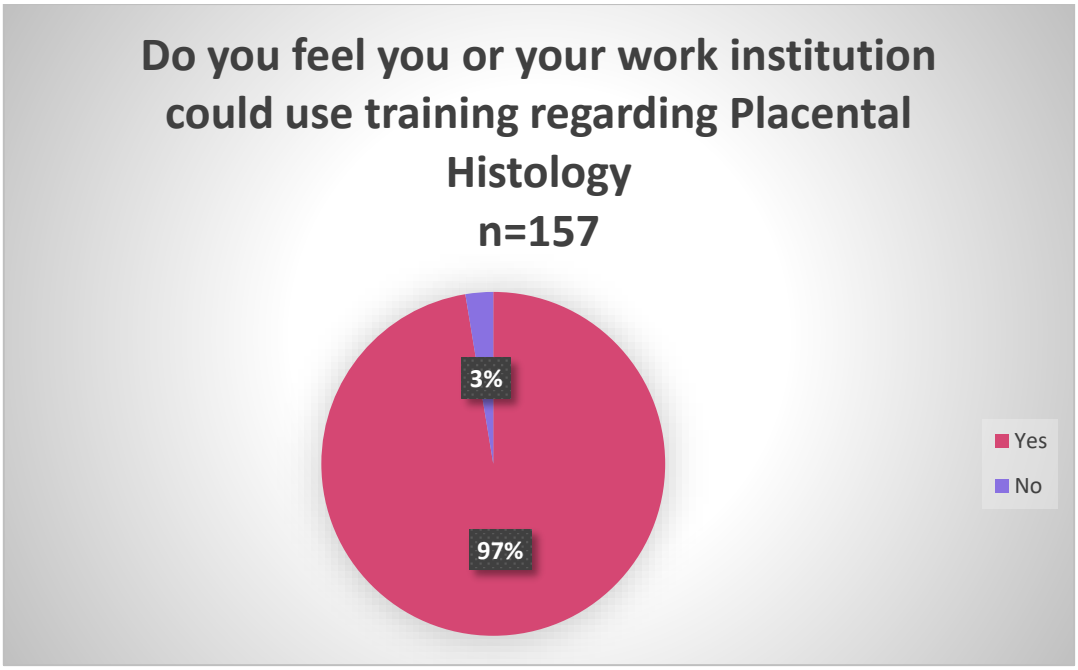

Figure 4.26 In work training required on placental histology

The confirmation of educational needs is a significant result for the researcher; if not for anything else, awareness about placental examination and histology was raised and midwives were interested to learn more, which in turn will have a positive effect in the field of midwifery in South Africa.

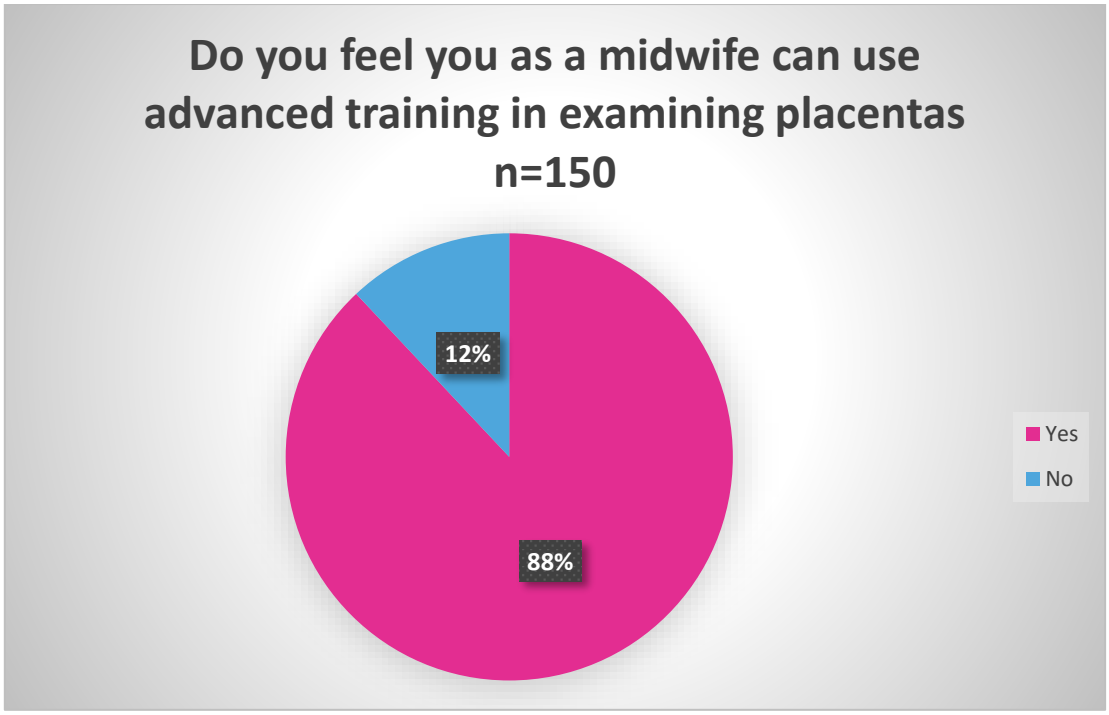

Figure 4.27 Advanced training in placentas required for midwives

A series of questions from the questionnaire were marked as a test to determine the knowledge of participants. Participants were asked to identify parts of the placenta on anatomical images and to identify normal and abnormal placentas on real images. These are discussed in the following section.

4.2.3 Applied knowledge

Specific other questions were combined with these to formulate the knowledge part of the questionnaire. These were questions 3.6 - 3.15, 4.1 - 4.4 and 5.1 – 5.6. These questions were extracted from the data and the correct answers used to allocate marks for each question. Results were tallied to give a total percentage for participants' overall knowledge. Some examples of the anatomical and real-life pictures used are shown as screen shots from the questionnaire. These are displayed as Figures 4.28 and 4.29.

4.1 For each of the following questions, please choose one option that best describes the anatomy seen in the picture.

☐ Maternal surface ☐ Fetal surface

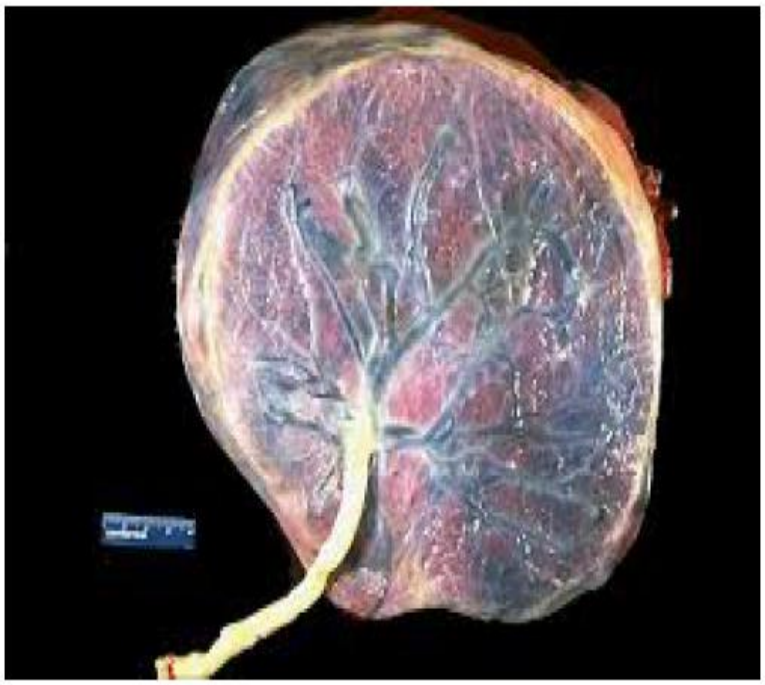

Photo credit: Pathology outlines

Figure 4.28 Question 4.1

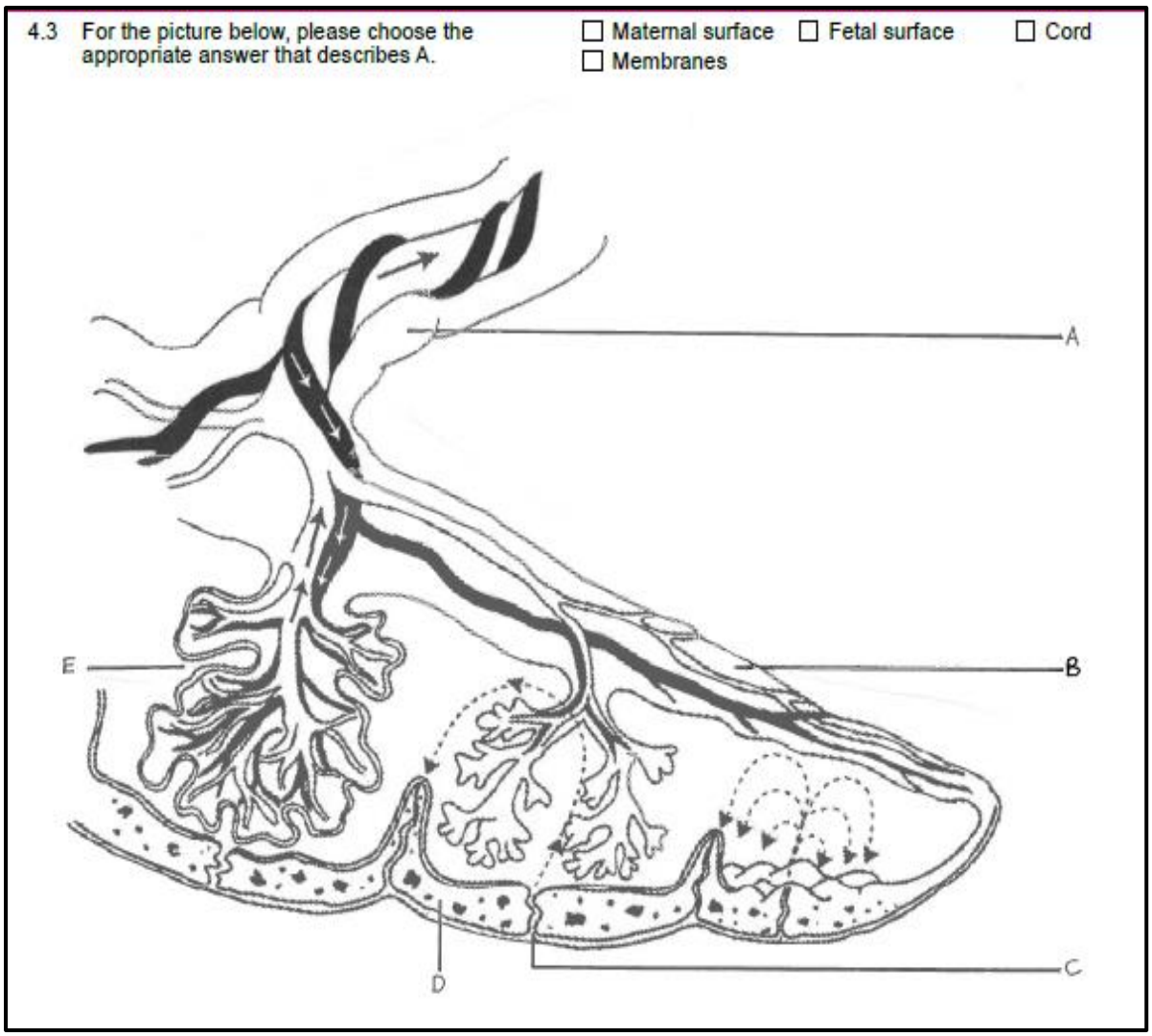

Figure 4.29 Question 4.3

Figures 4.28 and 4.29 display the type of questions in the questionnaire for participants to answer. Their answers to these open-ended questions were coded by the researcher and then marked in accordance with the correct answer for each question. A total score for the entire questionnaire was derived and comparisons drawn between different groups within the sample.

The overall median for the group was 61.9%. The lowest score was 14.3% and the highest score was 81%. This indicates that, on average, the participants had about 60% knowledge of the placenta, its functions and features.

The philosophy and model of care, as described in the core document, published by the International Confederation of Midwives (2014:1-4), is one of partnership with the women we attend to as midwives, with skills and practice that are founded on evidence-based care and continuous learning and development. The document states that midwives are individually and jointly responsible for the growth of midwifery practice and education for themselves and those that come after them. Having been published in 2014, which is more than six years ago, the researcher would expect South Africa to have already conformed to this type of philosophy and model of care, as set out by the International Confederation of Midwives (2014:1-4).

Unfortunately, Regulations for the Course for the Diploma in Midwifery for Registration as a Midwife, as published by SANC, were initially drafted in 1975 and the latest update was in 1997. This regulation outlines the curriculum and clinical practica needed by a student in order to obtain a midwifery qualification (South African Nursing Council, 1997:online). These regulations have not been updated to conform to current global standards of competency-based education and lifelong learning.

The test component of this research was further divided and different variables, such as province studied in, type of education, year of qualification and areas worked in, were correlated. This is graphically depicted in figures 4.30 to 4.31.

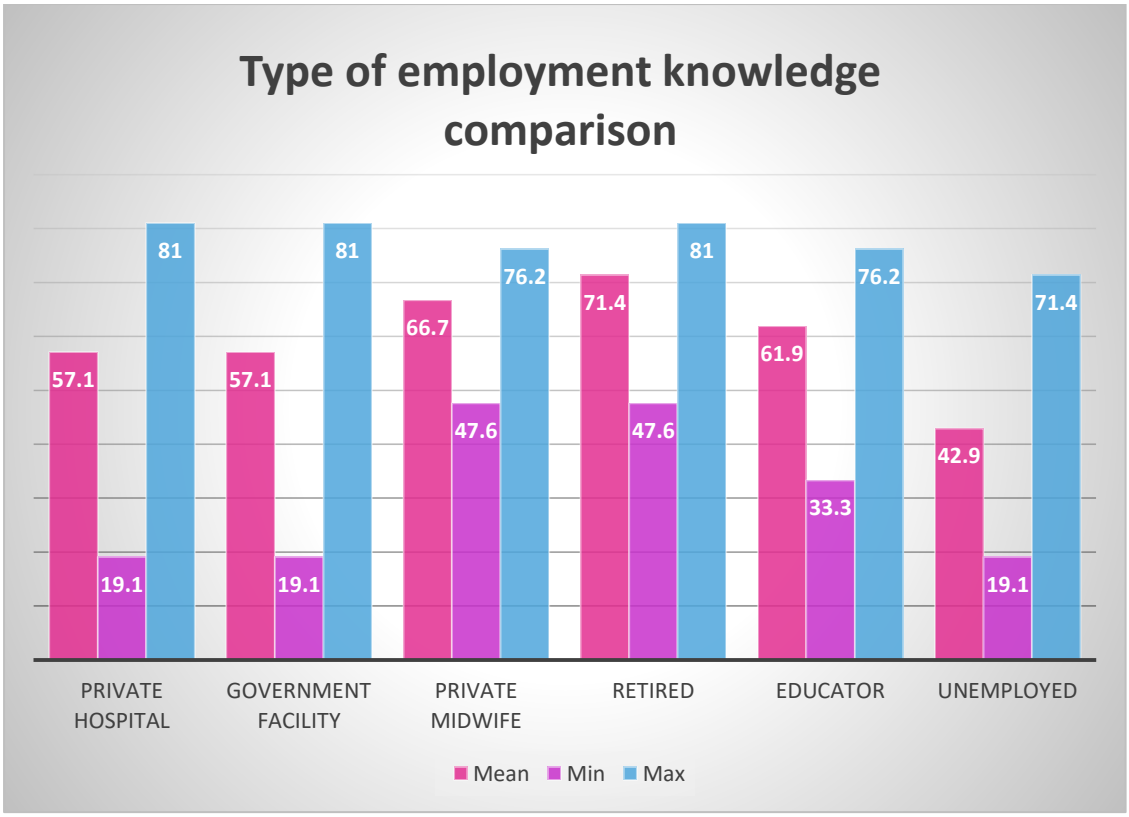

Figure 4.30 Type of employment knowledge comparison

Figure 4.30 shows the mean, minimum and maximum percentages obtained for each employment sector in the knowledge section of the questionnaire. It shows that retired midwives had the best average score at over 70%. This leads the researcher to wonder whether this knowledge was acquired over many years of experience or if their foundational knowledge was better laid out when they initially studied, as the ICM global standards are not currently being met in South African education. Private and publicly employed midwives had the same average score of 57.1%, indicating no statistical difference in knowledge obtained working within either environment.

As discussed by Fullerton, Thompson and Johnson (2013:37) global analyses indicate that if midwives were educated on international standards and competencies, as set out by regulatory bodies, such as the ICM and WHO, they could render almost all of the essential services needed by women and their newborns. However, the authors found that governments founded action plans on short-term solutions to problems rather than focusing on the competence of midwives. This calls to question the educational problems faced by

low- and middle-income countries such as South Africa, with educators not having access to further learning and development opportunities to enhance their knowledge in their field of teaching, while students lack decent hands-on experience opportunities (Fullerton *et al.*, 2016:36-41). When compared to the average score of educators of 61.9% in Figure 4.28, it is seen that even our South African educators are not more knowledgeable on the placenta and that further education on this topic is needed by this population as well.

New Zealand has a proactive approach to education and continuous learning. Their Midwifery Council has certain recertification requirements for a midwife to be registered annually (Gilkison *et al.*, 2016:33). If South Africa could incorporate continuous professional development (CPD) as part of the minimum required efforts for reregistration annually, it will ensure that midwives' skills and knowledge are kept current. This will also ensure that both private and publicly employed midwives reach the same standards of competence.

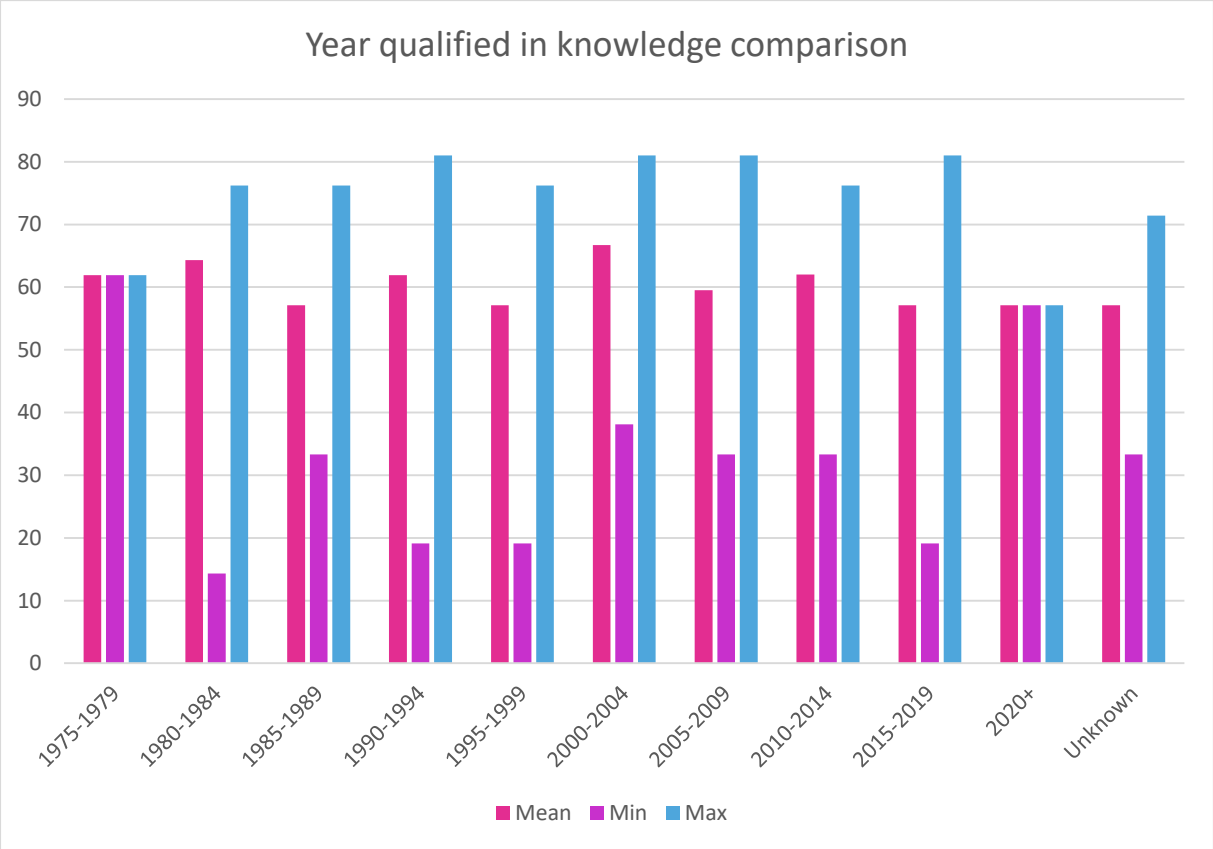

Figure 4.31 Year qualified knowledge comparison

As seen in Figure 4.31 the year group with the best average knowledge was 2000-2004. A close second was 1980-1984; these two groups are far apart in the data set. The researcher divided the year groups into two big groups: 1975-1999 and 2000-2020 and calculated the mean average for each group. Surprisingly both groups amounted to the exact same average of 60.5%. Thus, it is not possible to determine which group was more knowledgeable.

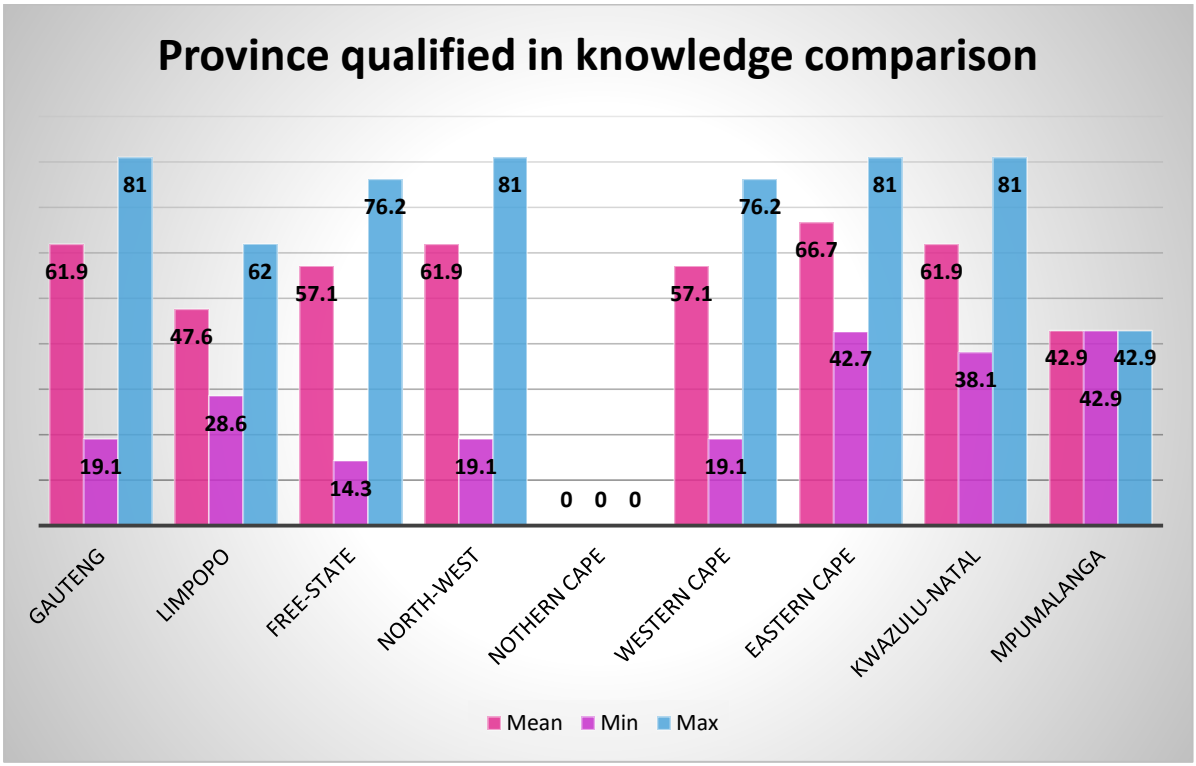

Figure 4.32 Province qualified knowledge comparison

Figure 4.32 illustrates the provinces in which participants obtained their qualification and their average knowledge comparison. The province with the best average score was the Eastern Cape with 66.7%, yet it only attributed to 3.8% of the total number of participants. The provinces that accounted for the largest number of participants were Gauteng, Free-State and North-West, respectively. These provinces scored as follows: Gauteng 61.9%, Free-State 57.1% and North-West 61.9%. However, it was not possible to determine if this knowledge was obtained whilst studying or acquired during work experience, albeit in other provinces.

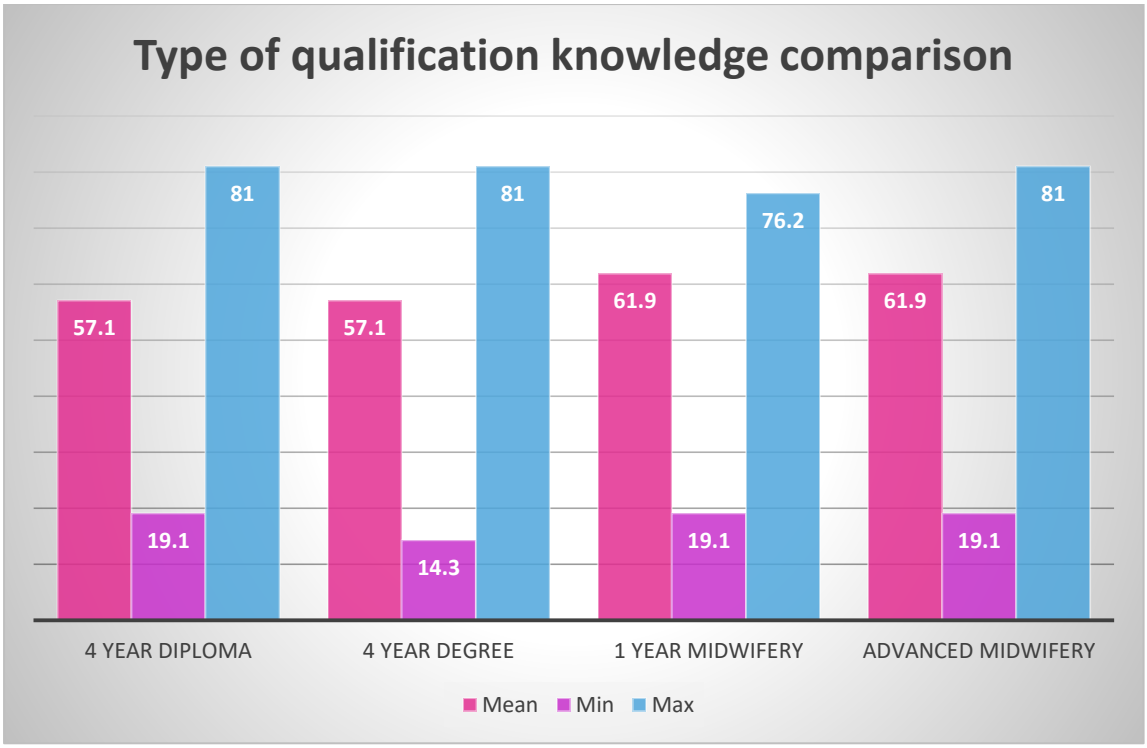

Figure 4.33 Type of qualification knowledge comparison

To illustrate the knowledge comparison between different types of qualifications, Figure 4.33 shows the mean, minimum and maximum results for each group. On average, the advanced midwifery and one-year midwifery groups both scored 61.9% on average. The 4-year programmes also scored the same at 57.1%. The participant with the lowest score obtained 14.3%. This shifts the attention to how these midwives have obtained these qualifications if they knew so little about a pivotal part of pregnancy and birth, namely the placenta.

Fullerton *et al.* (2013:1129) mention the use of a Skilled Birth Attendant (SBA) and the standardisation of competency-based education. Although these authors warn that an assumption must not be made that all midwives share a common definition and identity, it becomes clear that the regulatory body in South Africa, SANC, is not improving education standards for midwifery to conform to a more structured and regulated educational approach that includes global competencies and thus we cannot expect to deliver SBAs.

4.3 Conclusion

Throughout this chapter, the collected data was scrutinised. It is easily detectable that the average knowledge among midwives regarding the placenta is rather low and shows definite room for improvement. If midwives merely possess, on average, 60% of knowledge regarding the placenta, it becomes clear why placental triage is not commonly practiced and even more evident that it is not common practice.

It was deduced that there is not much statistical difference in the knowledge between different qualifications or work environments, but rather that this population lack in-depth knowledge regarding the placenta and its features. It is the researcher's opinion that midwives in South Africa can benefit from mandatory CPD courses, specifically on the placenta, as a prerequisite to annual registration with SANC.

If the basic knowledge and competence of midwives in South Africa are improved by means of CPD or other courses, midwives will be better educated about placentas, how to macroscopically examine placentas and triage placentas, which will lead to more abnormal placentas being identified to be sent for histology. This will provide proof in litigation cases or clinically relevant information for either the mother or baby for their future treatment.

Chapter 5

This chapter is the final chapter of this study and aims to discuss the findings laid out in the previous chapter in correlation to the research question. Suggestions for future study and for clinical practice are also discussed.

From the first chapter it is seen how beneficial the macroscopic examination of the placenta can be clinically in midwifery practice and what information can be retrieved from it. This revelation was what initially ignited the interest of the researcher. Working in the clinical environment herself, the researcher immediately recognised the gap in knowledge of the placental examination in her own experience as a midwife. Seeing the benefits of placental histology first-hand in practice, the researcher felt obliged to create awareness on this topic and that is when the idea for this research was born.

To first ascertain the current knowledge among South African midwives, the research question was determined.

> *What is the existing knowledge of midwives educated in South Africa regarding placental triage?*

The aim of this study was to describe the existing knowledge of placental triage amongst South African educated midwives to identify placentas for further examination. The objectives identified were to:

- determine midwives' knowledge regarding the physical structures and macroscopic examination of the placenta, and
- describe current knowledge amongst midwives about placental histology.

In Chapter 2 the accessible body of knowledge on placental triage and histology was evaluated. The researcher compared global guidelines for placental examination to the South African practice guidelines and discerned some discrepancies in the guidelines available.

As discussed in Chapter 3, the researcher thought it best to determine existing knowledge using a questionnaire. Because no instrument was readily available for the researcher to use for this purpose, a questionnaire was developed for this research. It was hoped that an electronic and shareable questionnaire would make it easier to reach a larger sample size, but regrettably only 157 participants responded. Critical appraisal was done by identifying threats to validity and taking steps to minimise these effects on the research in order to increase the rigour thereof. Ethical considerations were adhered to by maintaining to uphold the integrity of the research and paying attention to participants' rights and confidentiality.

Chapter 4 displayed the data that was analysed and described. The knowledge about the placenta and use of placental triage among midwives in South Africa was discussed. Shortfalls that emanated from the data were identified and highlighted. The researcher continuously consulted ICM and WHO sources that set the standard for global practice in midwifery. Triangulation with relevant research literature was incorporated to make sense of the data.

In summary of the research findings obtained from the data acquired, the researcher has come to the following conclusions: There is a definite focus in the midwifery community on the management and prevention of PPH that draws the main attention regarding the placenta to that purpose. There is a definite lack in knowledge regarding the placenta and its macroscopic examination among midwives that should be urgently addressed. Midwifery education, regulation and documentation need to be updated to conform to global standards and include a focus on competence and evidence-based practice.

To improve midwifery practice in South Africa and the world, the researcher shares key implications of this research for midwifery practice, education and regulation. The limitations of the study are next discussed and recommendations for further study are presented.

5.1 Implications for midwifery

After consideration of the data findings the researcher concluded the following suggestions for midwifery.

5.1.1 Implications for midwifery practice

Acceptance of standard guidelines for submission of the placenta for further examination by a pathologist on national level. The handling of placental tissue should follow the algorithm as set out in Figure 2.2 in Section 2.4. This practice will serve as a guideline for placentas to be submitted for further examination during triage. If national standards include triage of the placenta by midwives, this type of tool will be most helpful. If the DoHSA can publish standard guidelines for the submission of placental tissue in addendum to the Maternal Care Guidelines, all birthing facilities in the country will have to comply and as a nation we can practice according to the same guidelines. This will mean that all health practitioners, including midwives and obstetricians alike, will be bound to these guidelines and will have to perform a placental triage on all placentas. This will lead to the identification of abnormal placentas to be submitted for histology. It is the researcher's opinion that should national guidelines be published, and placental triage be compelled by the DoHSA, it will greatly improve maternal and newborn care in South Africa as a whole.

Adaptation of national requirements to include placental triage documents into birth records. If the Maternal Record, as issued by the DoHSA, includes a triage worksheet like the one set out in Figure 2.5 of Section 2.4 of this study, it will conform all levels of care to the same practice standards. This triage worksheet will be kept in the maternal record and can serve as proof of the placental triage during further investigation. Using the same document across all service levels will ensure consistency with triage performed and lead to the overall skills improvement of healthcare providers affected.

Use of ultrasound to diagnose abnormal placentas during pregnancy. With education and practical workshops, the use of ultrasound devices by midwives can have many benefits like reduction in perinatal mortality rates and early identification of adverse events like low birth weight infants (Sharma et al., 2016:70). The use of devices such as Umbiflow™, which is a low-cost Doppler ultrasound, in primary healthcare settings was proven effective in South Africa after this device was trailed in multiple cities across the country between 2017-2019 (Hlongwane et al., 2020: online). National implementation of these devices will assist South Africa on the road to improving antenatal care for the nation.

5.1.2 Implications for midwifery education

Introduction of placentology as part of basic midwifery education at all educational facilities. Through the researcher's own experience at a prominent university in the country, it was evident that not much regard is given to the placenta and its examination during undergraduate studies. The midwifery handbook that was prescribed during the researcher's midwifery studies contains merely eight pages of information regarding the placenta and its development (Fraser *et al.*, 2012:119-126). The macroscopic examination of the placenta is not a requirement for registration as a midwife by SANC, as seen in Regulation 254, which contains the requirements for the course leading to registration as a midwife. The researcher recalls learning this examination in practice from other midwives. It is the researcher's finding that an in-depth focus should be placed on the placenta and its examination during education before a person can register as a midwife. Conforming to competence-based outcomes, as suggested by ICM, should be incorporated during this process. This will ensure the delivery of Skilled Birth Attendants who can identify and triage abnormal placentas, and ensure that midwives are vigilant regarding placentas and the information contained therein.

The roll-out of an integrated education programme on national level to educate midwives on macroscopic placental examination, placental triage and histology. Although the approach to future learning and development of midwives has been discussed, there remains a vast population of qualified midwives in the country. Thus, it is the researcher's recommendation that an education programme be rolled out, likely in the form of a CPD

course or as part of the Essential Steps to Managing Obstetric Emergencies (ESMOE) programme, which can be used to upskill midwives' knowledge and expertise to triage placentas effectively. This type of education can follow the lead of the ESMOE programme, which was developed in 2008 and aimed to upskill midwives in obstetric emergencies. This was executed in both private and public sectors and included midwives, paediatricians and obstetricians (Pretorius, 2021:online).

5.1.3 Implications for midwifery regulation

The implementation of recertification requirements by SANC. If the attendance of CPD courses is made mandatory for midwives, it will ensure the continuous professional growth and production of Skilled Birth Attendants in South Africa. Midwives will be kept up-to-date in an ever-growing profession and this will ensure that they are continuously providing evidence-based practice.

Revision of SANC regulations pertaining to the registration and education requirements for midwives. The midwifery profession in South Africa can simply not be governed by regulations, some of which were last updated in 1997. The South African regulations should be conformed to global standards as set out by the ICM in their Core Document and Standards for Midwifery Education. Emphasis should be placed on the production of Skilled Birth Attendants in South Africa that are educated for the appropriate length of time and with ample practical experience. This will safeguard the patients and improve the birth outcomes of a nation.

5.2 Limitations

The sample size obtained was smaller than the researcher had hoped for and reduced the generalisability of the study findings, even though the researcher employed different approaches to obtain a larger sample size, such as sharing the questionnaire multiple times, reminding participants to complete the questionnaire and collecting data over a three-month

period. It is admitted that a physical approach to data collection, e.g., visiting different hospitals, could have been beneficial to obtain a larger sample size, but regrettably the researcher was not in South Africa at the time of data collection. It is also considered that nearly a third of the sample was older and when compared to statistics from SANC it is noted that nearly 50% of the midwifery population is in fact over 50 years of age. This could indicate that an electronic and social media approach was maybe not best suited.

Although the findings in this research is not generalisable to the entire population, enough evidence was found in the data to deem intervention in placental education necessary, as it was evident that some participants could merely score 14% on the standard knowledge questions pertaining to the placenta in this questionnaire.

5.3 Recommendations for further study

Many future study opportunities arose from this research, but the following were identified as research priorities:

1. This study could be replicated on a larger scale to include more midwives in South Africa as a larger population will yield more accurate results to make findings more generalisable.

2. Further study on the implications of PPE usage during the global COVID-19 pandemic and how it impacts sensory actions required by midwives.

3. Education material development for education facilities to improve education of undergraduate students regarding the placenta and triage thereof.

4. CPD programme development that focusses on educating current practicing midwives in the role of triage of the placenta in conjunction with national conformity to guidelines for submission of the placenta for further examination.

5.4 Suggestions for dissemination of research

The researcher intends to publish the findings of this research as soon as possible in association with the study supervisor in local and international journals.

The research and findings will be sent to prominent midwifery stakeholders, such as SANC, ICM and SOMSA, as these entities have the authority to make lasting change to the midwifery educational standards in South Africa.

The researcher will submit feedback of the research and findings to the DoH via the NCCEMD, which investigates issues into maternal and child health for the DoHSA. This attempt will aim to expose current issues in the education of midwives and to draw attention to the dire need of an education programme regarding placental examination.

The researcher will present the findings of her research at various congresses and conferences relating to midwifery to raise awareness regarding placental examination and the importance thereof.

5.5 Conclusion

In conclusion to this research, it has become evident that much further research is needed in the field of the placental examination and education of midwives in this regard in South Africa. It is seen that although a small sample was drawn, the results found were enormous. Competence in midwifery cannot be viewed as optional, but as paramount to the delivery of Skilled Birth Attendants.

Throughout this study it has been revealed that the symbiotic relationship between the mother, the foetus and the placenta remains a crucial factor to consider in the management of pregnancy. Similarly, in midwifery there are key components to our relationship with the placenta: the midwife and the placenta, competence, regulations and most importantly, passion. If a midwife has a burning passion and an unextinguishable fire inside her for her profession, it will lead her to never cease the will to acquire the utmost form of competence throughout her career.

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