A CRITICAL APPRAISAL OF SELECTION CRITERIA AND ACADEMIC PROGRESSION OF FIRST AND SECOND YEAR MEDICAL STUDENTS AT THE UNIVERSITY OF THE FREE STATE

by

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DECLARATION

I hereby declare that the work submitted here is the result of my own independent investigation. Where help was sought it was acknowledged. I further declare that this work is submitted for the first time at this University/Faculty towards a Ph.D. degree in Health Professions Education and that it has never been submitted (in part or as a whole) to any other University/Faculty for purposes of obtaining a degree.

....

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LIST OF ACRONYMS

AACC	American Association of Community Colleges
AAMC	Association of American Medical Colleges
AARP	Alternative Admission Research Project
ACT	American College Testing programme
APS	Admission Point Score
BBC	British Broadcasting Corporation
CASS	Continuous Assessment
CC	Coefficients of Correlation
CHE	Council on Higher Education
CHED	Centre of Higher Education Development
EI	Emotional Intelligence
ENTER	Equivalent National Tertiary Entrance Rank
ELAS	English Language Acculturation Scale
ESL	English Second Language
DA group	Direct access to medical school group
DSM-III	Diagnostic and Statistical Manual of Mental Disorders III
DSM-IV	Diagnostic and Statistical Manual of Mental Disorders IV
GAMSAT	Graduate Australian Medical School Admissions Test
GCE	General Certificate of Education
GMP	Graduate Medical Programmes
GPA	Grade Point Average
HESA	Higher Education South Africa
HG	Higher Grade
HPCSA	Health Professions Council of South Africa
HSPTs	Health Sciences Placement Tests
IMED	Medical Education Directory
IQ	Intelligence Quotient
ISASA	Independent Schools Association of Southern Africa

MACH	Mathematics Achievement Test
MCAT	Medical College Admission Test
MCOM	Mathematics Comprehension Test
MMI	Multiple Mini-Interviews
NACAC	National Association for College Admission Counselling
NBTs	National Benchmark Tests
NSC	National Senior Certificate
OSCE	Objective Structured Clinical Evaluation
PTEEP	Placement Test in English for Educational Purposes
PQA	Personal Qualities Assessment
RS	Randomly Selected group
SADC	Southern African Development Community Countries
SAT	Scholastic Aptitude Test
SES	Socio-Economic Status
SG	Standard Grade
SP	Selection Procedure Group
SRT	Scientific Reasoning Test
SSAP	Study Sample Assessment Procedure
STAL	Screening Test of Adolescent Language
UCAS	Universities and Colleges Admission Services
UCT	University of Cape Town
UMAT	Undergraduate Medical and Health Science Admission Test
UFS	University of the Free State
UMP	Undergraduate Medical Programmes
UK	United Kingdom
UK-CAT	The United Kingdom Clinical Aptitude Test
UNESCO	United Nations Educational, Scientific and Cultural Organisation
USA	United States of America
WFME	World Federation for Medical Education
WHO	World Health Organization

SUMMARY

- **Key terms:** Higher education; progression medical studies; selection medical students; under-graduate medical education.

The changing of the evaluation systems used for Grade 12 scholars in South African schools and the transformation principles of the Department of Education, compelled the University of the Free State (UFS) to start looking into alternative criteria for the selection process of medical students. One of the alternative criteria explored is the Health Science Placement Tests (HSPTs).

The overall aim of this study was to assess the relationship between the HSPTs, school performance and other factors and academic performance during the first two years of study at the UFS. The specific objectives of the study were to conceptualise and contextualise the problem of selection of medical students at the UFS and to identify factors in different regions of the world that play a role in the selection of medical students by means of a thorough literature survey, but also to assess the influence of the current selection criteria and additional criteria on the performance of first and second year medical students at the UFS.

A quantitative research approach was followed. The study population comprised of the first year medical students of 2004 and 2005 and second year medical students during 2005 and 2006 at the UFS. The demographic information of the students, their HSPTs results, school performance and academic performance results during first two years of study were statistically analysed to detect associations.

Data for the study was obtained from the several databases of the University of the Free State and was collated by the researcher. The data management and analysis in this study was conducted by the staff of Statistical Consulting Service, Department of Statistical Sciences, University of Cape Town, using a variety of available statistical techniques.

The correlation between all the numeric and categorical variables and the outcome variable were checked. These results showed the degree to which the variables changed together and allowed the researcher to indicate those with a predictive relationship. Strong to moderate correlations were found to be present between the averages of the first two years of study and English, Mathematics, Science and Biology of the Grade 12 marks, the PTEEP, MACH, MCOM and SRT of the HSPTs and the M-score. A weak negative correlation was found between the age of the student and whether or not they had any tertiary education and both the first and second year averages.

By using the simple linear regression technique of analysis, the researcher evaluated the effect that each of the individual variables had on the first and second year averages. The following variables had a significant influence on the first two year's average marks: English, Mathematics, Science and Biology average mark, School Poverty Quintile Index, M-score and the HSPTs average.

By using a multiple regression analysis, the predictors of dependent variables upon the outcome variable were tested, while the independent variables were held fixed. After following a step-wise regression analysis, the best fit model was the model evaluating the relationship between the first and second year average marks independently and the age of the student, the English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index. This model explained 50% variance of score in the first year and 70% variation of score in the second year as a result of the combination of these variables. Although some of the variables were not statistically significant, they were still of conceptual significance. From this analysis it was clear that the more variables that were included, the more reliable or predictive the model was to determine how a student would perform academically at the end of the first two years of study.

The conclusion of this study was that the application of different statistical approaches presents a case for the complimentarity of data for use in selection models and approaches. Through the exploration of different models of regression and association, a particular model was found acceptable as an indicator for good performance during the first two years of study. This choice was based on the fact that the multiple regression model was able to predict the effect that a variable would have on the outcome and the size of the effect. It was able to explain 50% variance of score in the first year and 70% variation of score in the second year and also took into account the effects of other confounding variables.

This study and similar future studies will identify reliable and valid selection criteria for medical students who will perform well academically within the M.B.,Ch.B. tertiary education programme.

OPSOMMING

- **Sleutelbegrippe:** Hoër onderwys; keuring mediese studente; voorgraadse mediese onderwys; vordering in mediese studies.

Die veranderinge van die evalueringssisteme wat gebruik word vir graad 12-skoliere in Suid-Afrika en die transformasiebeginsels van die Departement van Onderwys, het die Universiteit van die Vrystaat (UV) genoodsaak om te begin kyk na ander kriteria vir die keuring van mediese studente soos die Gesondheidswetenskappe-plasingstoetse ("HSPTs").

Die oorhoofse doel van die studie was om die verband tussen die "HSPTs", skoolprestasie en ander relevante faktore en die akademiese prestasie gedurende die eerste twee jare van studie by die UV te ondersoek.

Die spesifieke doelwitte van die studie was om die probleem aangaande die keuring van mediese student by die UV en verskeie streke in die wêreld te koseptualiseer en te kontekstualiseer deur 'n deeglike literatuurstudie, asook om die invloed van die huidige keuringskriteria en addisionele kriteria van die prestasie van die eerste twee jare van studie te ondersoek.

Die navorsingsontwerp was op 'n kwantitatiewe aanslag geskoei. Die studiepopulasie was die eerstejaar-mediese studente van 2004 en 2005 en die tweedejaarstudente van 2005 en 2006 aan die UV. Die demografiese inligting van die studente, hulle "HSPTs", skoolprestasie en akademieseprestasieresultate van die eerste twee studiejare is statisties geanaliseer om verbande vas te stel.

Data van die studie is verkry vanaf verskeie databasisse van die UV en is deur die navorser geamalgameer. Data-ontleding is hanteer deur die personeel van Statistiese

Konsultasiedienste, Departement Statistiese Wetenskappe van die Universiteit van Kaapstad wat 'n verskeidenheid van analitiese tegnieke gebruik het.

Die korrelasie tussen al die kategoriese en numeriese veranderlikes en die uitkomsveranderlikes is gekontrolleer. Hierdie resultate het die graad waarmee die veranderlikes saam verander het aangedui en het die navorser in staat gestel om 'n voorspellende verhouding vas te stel. Sterk tot matige korrelasies is gevind tussen die gemiddelde van die eerste twee jare van studie en die Engels-, Wiskunde-, Wetenskap- en Biologie-resultate van die graad 12 punte, die PTEEP, MACH, MCOM en SRT van die HSPTs en die M-telling. 'n Swak negatiewe korrelasie is gevind tussen die ouderdom van die student en of hy/sy tersiêre studies voltooi het en die gemiddelde van die eerste- en tweedejaar gemiddelde punte onderskeidelik.

Deur gebruik te maak van die eenvoudige liniêre regressiewe tegniek van analise, het die navorser die effek wat elk van die veranderlikes op die eerste- en tweedejaarpunte gehad het, geëvalueer. Die volgende veranderlikes het 'n betekenisvolle invloed op die eerste twee jare se gemiddelde punte gehad: die Engels-, Wiskunde-, Wetenskap- en Biologie-gemiddelde punt, die Skool Armoede Indekstelling, die M-telling en die gemiddelde HSPTs.

Deur die uitvoering van die veelvuldige regressiewe tegniek van analise, kon die effek van die afhanklike veranderlikes op die uitkomsveranderlike getoets word, terwyl die onafhanlike veranderlikes gefikseer is. Na die uitvoer van 'n stapsgewyse regressie-analise, is gevind dat die beste model die een was wat die verhouding tussen die eerste twee jare se gemiddelde en die ouderdom van die student, die Engels-, Wiskunde-, Wetenskap- en Biologiepunte van graad 12, die PTEEP, MACH, MCOM en SRT toetse van die HSPTs en die Skool Armoede Indeks as model getoets het. Hierdie veranderlikes as deel van 'n model kon 50% van die verandering in die eerstejaarpunte en 70% van die verandering in die tweedejaarpunte verduidelik. Alhoewel sommige van die spesifieke veranderlikes in die model nie statisties betekenisvol was nie, was hulle steeds belangrik as deel van die model en die invloed van die model op die punte. Uit die analise kon afgelei word dat hoe meer veranderlikes in die model ingesluit is, hoe meer betroubaar en voorspellend die model was om te bepaal hoe suksesvol die student sou wees aan die einde van die eerste twee jaar van studie.

Die gevolgtrekking van die studie was bevestig deur verskillende tegnieke van analise. Deur die ondersoek van verskillende modelle van regressie en assosiasie, is ‘n spesifieke model aanvaarbaar gevind as ‘n indikator vir prestasie in die eerste twee jare van studie. Hierdie keuse is gebaseer op die feit dat die veelvuldige regressiemodel in staat was om die effek van die afsonderlike veranderlike op die uitkomste en die grootte van die effek te bepaal. Die model was verder in staat om 50% van verandering in die eerstejaar-gemiddelde punte en 70% in die tweedejaar-gemiddelde punte te voorspel en terselfdetyd die effek van die ander veranderlikes in ag te neem.

Hierdie studie en soortgelyke studies sal keuringskriteria vir mediese studente daar stel in die toekoms wat betroubaar en geldig is vir mediese studente wat akademies goed sal vaar in die M.B.,Ch.B.-tersiêre-onderwysprogram.

A CRITICAL APPRAISAL OF SELECTION CRITERIA AND ACADEMIC PROGRESSION OF FIRST AND SECOND YEAR MEDICAL STUDENTS AT THE UNIVERSITY OF THE FREE STATE

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

According to an investigation into student demographics, student support and curriculum innovation by Lehmann, Andrews and Sanders (2000:10), students applying to study Medicine at any South African medical school have to undergo a stringent selection process. Lehmann *et al.* (2000:10) state that the reasons for this selection process had to do with the high academic demands of the field of study, as well as the fact that there is only a limited number of places available for applicants.

With the changing of the school evaluation system for Grade 12, where the continuous assessment contributes significantly to the final mark and the introduction of transformation principles (as emphasised in the Green paper on Higher Education such as equity, redress and democratisation, RSADoE:1996), the Faculty of Health Sciences at the University of the Free State (UFS) (as well as other Medical Schools at South African universities) recognised the need to introduce additional criteria, apart from academic performance in Grades 11 and 12, in the selection of medical students. The selection criteria for medical students had to be both reliable and valid in order to ensure good academic performance at university level within an M.B.,Ch.B. programme.

Although changes in the selection policies began to take place prior to 1994 and the intake of medical students in South Africa showed progress with regard to changing the demographic profile (which demonstrated an improved representation of the more disadvantaged groups in 1999 as compared to 1994), equitable representation remained a problem that needed to be addressed (Lehmann *et al.*, 2000:37).

Apparently, the UFS (South Africa) was not unique in having experienced challenges with regard to the selection of medical students. According to Ferguson, James and Madeley (2002:952), the selection of medical students in the United Kingdom had also come under intense scrutiny in recent years. The selection criteria in the UK are similar to those used in South Africa. These include academic ability; insight into Medicine (including work experience); extracurricular activities and interests; personality; motivation; and linguistic and communication skills. The problem, however, was that the evidence base for the validity of these criteria often does not exist (McManus, 1998:1111).

McManus, Smithers, Partridge, Keeling and Flemming (2003:140) stated that the results of achievement tests (for example, A-level grades), which were used for the selection of students in the United Kingdom, had long-term predictive validity for undergraduate training and post-graduate careers. By contrast, a test of ability or aptitude (for example, the test of high-grade intelligence – known as the AH5 test – developed by A H Heim) demonstrated little validity for medical careers (McManus *et al.* 2003:141).

Contradictory information regarding the importance of personality and references of applicants was found in the literature. Ferguson, James, O'Hehir and Sanders (2003:429) were of the opinion that a school teacher's reference was of no practical use in predicting the clinical performance of medical students, while careful examination of the student's personal statements proved more useful in aiding the selection process. Personality traits, such as conscientiousness, needed to be considered and integrated into selection procedures. Lumsden, Bore, Millar, Jack and Powis (2005:258) are of the opinion that the use of an assessment tool such as the Personal Qualities Assessment (PQA) had positive implications for widening access and the objective selection of suitable medical students. This resulted in the training of doctors who were more representative of the demographics of the community at large. As part of a study at the Newcastle School of Medicine in Australia, students were entered into medical school by means of different selection processes and the outcome was then evaluated. Powis and Bristow (1997:241) emphasised the importance of the Personal Quality Assessment.

The admission system in the UK, as advocated by Simpson (1972:43), allowed anyone to take an entrance examination for medical school and, if successful, they were automatically allowed to enrol. In the United States of America, medical training is divided into pre-clinical and clinical years and thus admission to study in clinical years depends on the student's performance during the pre-clinical years.

Lehmann *et al.* (2000:10) are of the opinion that the criteria and processes used to select students for the M.B.,Ch.B. programme in South Africa had been subjected to much controversy and debate. In 1998, all medical schools used a combination of academic and non-academic criteria in this process. It seems as if the academic criteria still represented approximately 70-80% of all criteria. The non-academic criteria usually included proof of leadership skills, extracurricular activities and community service.

In South Africa, students were mostly evaluated according to biographical information or by means of personal interviews. Certain schools also awarded bonus points to students from the geographical area feeding into the specific school. The UFS, for example, awarded bonus points to students originating from the Free State, Northern Cape and Eastern Cape regions, as well as two extra points to those students resident in the rural areas (Lehmann *et al.*, 2000:10).

Academic criteria were mostly compiled according to the overall Grade 12 (matric) pass rate and subject choices. Specific requirements varied from university to university (in this thesis "universities" and "faculties" refer to the schools of medicine). Most universities required Mathematics and Physical Sciences, while some medical schools such as at the University of Pretoria, the Transkei (now Walter Sisulu University) and the Free Sate also placed an emphasis on language requirements (Lehmann *et al.*, 2000:10).

De Vries and Reid (2003:11) recommended that the selection criteria of medical schools be reviewed with respect to the rural origin of applicants. Their research showed that South African findings are similar to international findings, namely that graduates of rural origin are more likely to return to practise in rural areas than their urban counterparts. A total of 38,4% of rural graduates are found to be practising in rural areas compared to the 12,4% of those from an urban background. Similar results were found at the University of Calgary, Alberta in Canada in the study of Woloschuk and Tarrant (2004:259).

Another finding that conformed to international experience was that rural origin graduates were more likely to be generalists than specialists when compared to their urban origin counterparts (De Vries & Reid, 2003:10). De Vries and Reid (2003:11) suggested that recruiting larger numbers of rural origin graduates could alleviate shortages of doctors in the rural parts of South Africa as part of a long-term strategy. These conclusions supported the earlier findings of Rabinowitz (1998:485) at the Jefferson Medical College in Philadelphia (USA) and Cooper (1999:737) in South Africa. Likewise, De Vries and Reid (2003:11) concluded that, if more rural students were selected and were to eventually practise in rural areas, it would impact positively on service delivery as the staff in rural hospitals would be able to understand the local language and culture.

Furthermore, there seems to be a relationship between academic selection criteria, personality traits and cognitive style (Ward, Kamien and Lopez, 2004:239). Students with lower university admission scores and who were less outgoing in nature were less likely to complete the course according to Ward *et al.* (2004:239). These authors also found that students were more likely to choose a specialist career if they were male, creative, able to think abstractly, had a father in medicine and were more conscientious and rule-bound (Ward *et al.*, 2004:244).

Another form of selection measurement that was introduced as part of the process of selecting medical school students in South Africa was the Health Sciences Placement Tests (HSPTs). Initially, the Alternative Admission Research Project (AARP) tests were introduced (into seven of the eight Schools of Medicine in South Africa) and adopted from August 2003 as a additional method of gathering information for the selection of future medical students at the UFS. These AARP tests included generic testing of language, mathematical achievement and mathematical comprehension. The Science Reasoning Test was added as a fourth test. The name of the tests was changed to HSPTs. The HSPTs are a collection of tests that were developed by interdisciplinary teams of experts over a time span of several years and constitute the following tests, namely:

- The Placement Test in English for Educational Purposes (PTEEP) that is aimed to assess students' ability to make meaning of texts that they are likely to encounter in their studies and to understand visually presented textual information (Cliff & Hanslo, 2005).
- The Mathematics Achievement (MACH) Test that measures the extent of a candidate's backlog in basic mathematical knowledge and skills according to the level of a Grade 11 Standard Grade Mathematics syllabus (Cliff & Hanslo, 2005).
- The Mathematics Comprehension (MCOM) Test that is designed to provide information concerning the candidate's potential to learn new mathematical knowledge and skills (Cliff & Hanslo, 2005).
- The Scientific Reasoning Test (SRT) that is aimed at assessing the student's capacity to engage in the type of logical thinking typically required of students in Higher Education (Cliff & Hanslo, 2005).

These tests were regarded as a diagnostic benchmark of students' entry-level performance (AARP, 2004).

In the past, very few studies consisted of a wide variety of factors used in combination in the selection of medical students, namely interviews, grade point average, learning styles and personality. Research projects previously undertaken concentrated mainly on measurements of the candidate's previous academic ability as a predictor of undergraduate achievement (Ferguson *et al.*, 2002:952).

After its world summit on medical education held in Edinburgh, the World Federation for Medical Education (WFME) made the following recommendations (WFME, 1993:146):

> "Medical school admission procedures should be based on institutional mission and capacity, and national health workforce targets. The open entry system is obsolete. Selection procedures are essential and endorsed everywhere, but in too many medical schools they are arbitrary and at worst, chaotic."

The WFME (WFME, 1993:146) suggested that the principles of selection have to be clear, equitable and valid and the criteria should be able to address both academic and non-academic criteria. The hopeful outcome would be graduates from medical schools who can respond to national health needs more successfully (WFME, 1993:146). This outcome applies directly to the South African situation.

Lehmann *et al.* (2000:37) strongly expressed two viewpoints. Firstly, although medical schools still had sophisticated and elaborate mechanisms in place to select medical students, definite data on the impact of these selection criteria still did not exist. Secondly, the use of selection criteria based on school achievement still seemed to be a very difficult issue because of secondary schools that failed to equip students for the demands of tertiary education and universities that had yet to address issues such as redress and equity.

The Council on Higher Education (CHE) (2004:8) stipulated: 'Admission and selection of students are commensurate with the programme's academic requirements, within a framework of widened access and equity'.

1.2 STATEMENT OF THE PROBLEM

A problem now facing South African Medical Schools relates to the extent to which academic and non-academic factors are used as selection criteria in the context of diversity and transformation. Current changes in the secondary school system may potentially create problems for the future selection of medical students at universities in South Africa such as:

- With the changes to the National Senior Certificate for school-leavers, Grade 12 marks may become more difficult to interpret as students will be given a rating code, rather than specific marks. The rating code of seven pertains to anything between 80% and 100% achievement. Accordingly, these rating codes obtained in the final year of school may be less meaningful for future selection purposes.
- The importance of certain previously used selection criteria, such as leadership ability and sporting achievements, need to be reassessed. Both the subjective and objective criteria need to be re-evaluated.
- The increased focus on so-called continuous assessment (CASS) at schools raises concern. This has the potential to make the Grade 12 rating code less reliable, since a large amount of the final marks will be obtained from evaluations of assignments and projects where there is no guarantee of the authenticity of students' original work. CASS was introduced into South African schools in 2001 as a way of evaluating Grade 12 learners.
- As an increasing number of students fail during their first year at university, there seems to be a greater need for some parameter to measure the academic preparedness of candidates over and above the Grade 12 symbols (cf. page 35).

- Due to the growing diversity of students applying to medical schools, the need for a valid test(s) has become even greater; tests that also provide reliable information about the readiness of students from educationally disadvantaged backgrounds or about students who did not perform optimally while at school.
- The inequalities of schools in South Africa created a problem for the selection of medical students. By making use of other selection criteria, other than just the Grade 12 school marks, all applicants are put on par when they are selected, in spite of considerably varying standards in different schools.

An underlying challenge is not to discriminate against students in previously disadvantaged communities who remain disadvantaged due to ineffective teachers and a shortage of qualified teachers in certain subjects such as mathematics and a shortage of teaching and learning resources.

Due to the changing assessment systems used to assess Grade 12 learners in South African schools, universities were compelled to consider alternative criteria for the selection process of medical students. The HSPTs (formerly known as the AARP tests) were introduced to the UFS in 2003, with a view to their use as possible additional selection criteria in the future. Although the reliability and validity of these tests had been empirically assessed by the AARP, minimal evidence exists that these tests would indeed ensure good academic performance of medical students enrolled at the UFS (Cliff & Hanslo, 2005). No proof exists that this medical school's ultimate goal will be reached, namely the training of medical students who will be equipped with skills, knowledge and attitudes that will enable them to respond competently and appropriately to the health needs of the community they will serve as doctors. The HSPTs would not necessarily provide this so-called proof as they were designed to produce variation in performance that is sensitive to the educational background of students. This variation can be used to indicate generic levels of students' academic readiness to cope with the academic demands of studying in higher education institutions.

With the progress made in addressing transformation principles (as emphasised in the Green paper on Higher Education such as equity, redress and democratisation, RSADoE:1996), at the UFS, further challenges were encountered, namely that students are not only selected from different backgrounds and high schools, but also have varying ages and qualifications. An important question is whether any of these or other demographic factors could eventually play a role in the achievements of the students during their first two years of study.

The Health Professions Council of South Africa (HPCSA) made certain comments and recommendations after their accreditation visit to the UFS regarding the selection of medical students and transformation, which cannot be ignored (HPCSA, 2005:7. They were concerned about the plan to eventually have 65% Black students in 2007: although 48% of places for selection were offered to Black students in 2005, only 34% eventually enrolled, (HPCSA 2005:7). Not nearly enough Black students fulfilled the criteria to be selected.

Lehmann *et al.* (2000:39) made certain recommendations following their study. One important recommendation was: 'In-depth and longitudinal research studies need to be conducted into reasons for high attrition rates, the relationship between selection criteria and student success...'. These recommendations are in line with recommendations of the WFME (1993:146).

The problem that was addressed in this study was the lack of research regarding the relationship between selection criteria and success, especially in different medical schools, with their unique circumstances.

1.3 OVERALL GOALS OF THE STUDY

The goals and purpose of this study (cf. 3.3.1, page 70) were to contribute to an understanding of the implications of widening the selection criteria for Medical School applicants to the UFS and to assess the validity of at least one additional criterion, namely the HSPTs, and their components.

1.4 AIM OF THE STUDY

The aim of this study was to assess the relationship between the selection criteria for medical students and the marks they obtained at the end of their first and second years of medical study at the UFS (cf. 3.3.2, page 71)

1.5 OBJECTIVES OF THE STUDY

The objectives were the following:

- To conceptualise and contextualise the problem of selection of medical students at the UFS and to identify factors in different parts of the world that play a role in the selection of medical students by means of a thorough literature survey.
- To assess the influence of the present selection criteria and other criteria on the performance of first and second year medical students at the UFS.
- To assess the different components of the HSPTs that play a vital role in the performance of medical students in the first and second year of study by means of an empirical study.
- To make recommendations to the UFS criteria for possible future use for selection of medical students.

1.6 DESIGN OF THE STUDY

A quantitative, analytical, retrospective cohort study was undertaken (see discussion in 3.4.1, page 71).

1.7 THE METHODS OF INVESTIGATION

1.7.1 Study population

The first year medical students of the UFS of 2004 and 2005 and second year medical students during 2005 and 2006 were incorporated into this study.

The following statistics (Tables 1.1, 1.2 and 1.3) for 2000-2005 were obtained from the accreditation report of the HPCSA (2005:22) for the Medical School of the UFS with data for 2006 added on:

Table 1.1: Number of first year students enrolled in the medical undergraduate programme from 2000-2006

Year	Number of first year students
2000	90
2001	134
2002	141
2003	150
2004	145
2005	137
2006	142

Table 1.2: Success rates of first year students from 2000-2005

Year	Success rates of first year students
2000	88%
2001	87%
2002	93%
2003	91%
2004	88%
2005	88%

Table 1.3: Number of first year students enrolled in the medical undergraduate programme from 2001-2006 according to population groups

	2001	2002	2003	2004	2005	2006
Asian	3	5	2	6	2	3
Black	38	46	44	46	53	50
Coloured	10	9	4	8	16	13
White	83	81	100	85	66	76
Total	134	141	150	145	137	142

Not all students who began their studies at the Medical School of the UFS wrote the HSPTs and AARP tests (see 3.4.2, page 74).

1.7.2 Sample selection

No sampling was done as a large amount of data were needed in order to analyse the criteria that might have an influence on performance.

1.7.3 Method of investigation and measurements

A comprehensive literature review was undertaken to provide a background for this study and to confirm the need for the research. This also helped to ensure that the researcher was knowledgeable about the area of study.

Data for the study regarding the students' demographic information, their Grade 12 marks and the available HSPTs were obtained from several databases.

1.7.4 Pilot study

The study was pre-tested by examining the criteria used and performance of twenty of the first year M.B., Ch.B. students of 2006. Discrepancies were addressed and the data programme was updated before the empirical study was undertaken.

1.8 DATA ANALYSIS

According to Last (1988:124), statistics is the science and art of collecting, summarising and analysing data that are subject to random variation.

The data management and analysis was done by the staff of the Department of Statistical Sciences at the University of Cape Town and Dr P. Chikobvu of the Department of Community Health, UFS, who used a variety of statistical techniques available for this analysis.

The data collected were entered by the researcher into the Excel computer programme. Statistical analysis was done using Stata software. Frequency distributions were used to describe students' marks for each year. The main aim of the statistical analysis was to identify the independent factors that predict medical students' marks during the first two years of study. The correlation between all the numeric and categorical variables and the outcome variables were checked. Univariate linear regression was used to assess the relationship between each of the measured factors. Multiple linear regression was used to measure the combined effect of the predictors.

1.9 SCOPE OF THE STUDY

The scope of the study lies in the domain of Health Professions Education.

1.10 VALUE OF THE STUDY

The results of this study will be of great value to medical education in South Africa and, specifically, the Medical School of the UFS in providing guidelines to benefit the appropriate selection of future medical students. The findings of this study may also serve as a platform for universities worldwide in the selection process of future medical students.

1.11 ARRANGEMENT OF THE THESIS

The arrangement of the thesis is as follows:

Chapter 1, entitled "**Orientation to the study**", provides a comprehensive introduction to the study with the applicable background.

Chapter 2, entitled "**Perspective on selection and admission of medical students**", provides a review on the literature, placing the problem in context. Emphasis is placed on:

- the factors regarding policies and legislation,
- the international perspective,
- South African perspective,
- University of the Free State perspective,
- University of the Free State, School of Medicine perspective, and
- specific selection factors and criteria that may possibly play a role in the selection of medical students worldwide.

Chapter 3, entitled "**Research design and methodology**", deals with the research design and methods. This chapter explains the research design and elaborates on the method used in the research. The reliability, validity and possible biasness of the measuring instrument are documented, the ethical and legal considerations are taken into account and the value of the study is emphasised.

Chapter 4, entitled "**Results and data analysis**", deals with the results and findings of the study. The data analysis and results are discussed under the headings of:

- Descriptive analysis,
- Correlation coefficients,
- Simple linear regression, and
- Multiple regression.

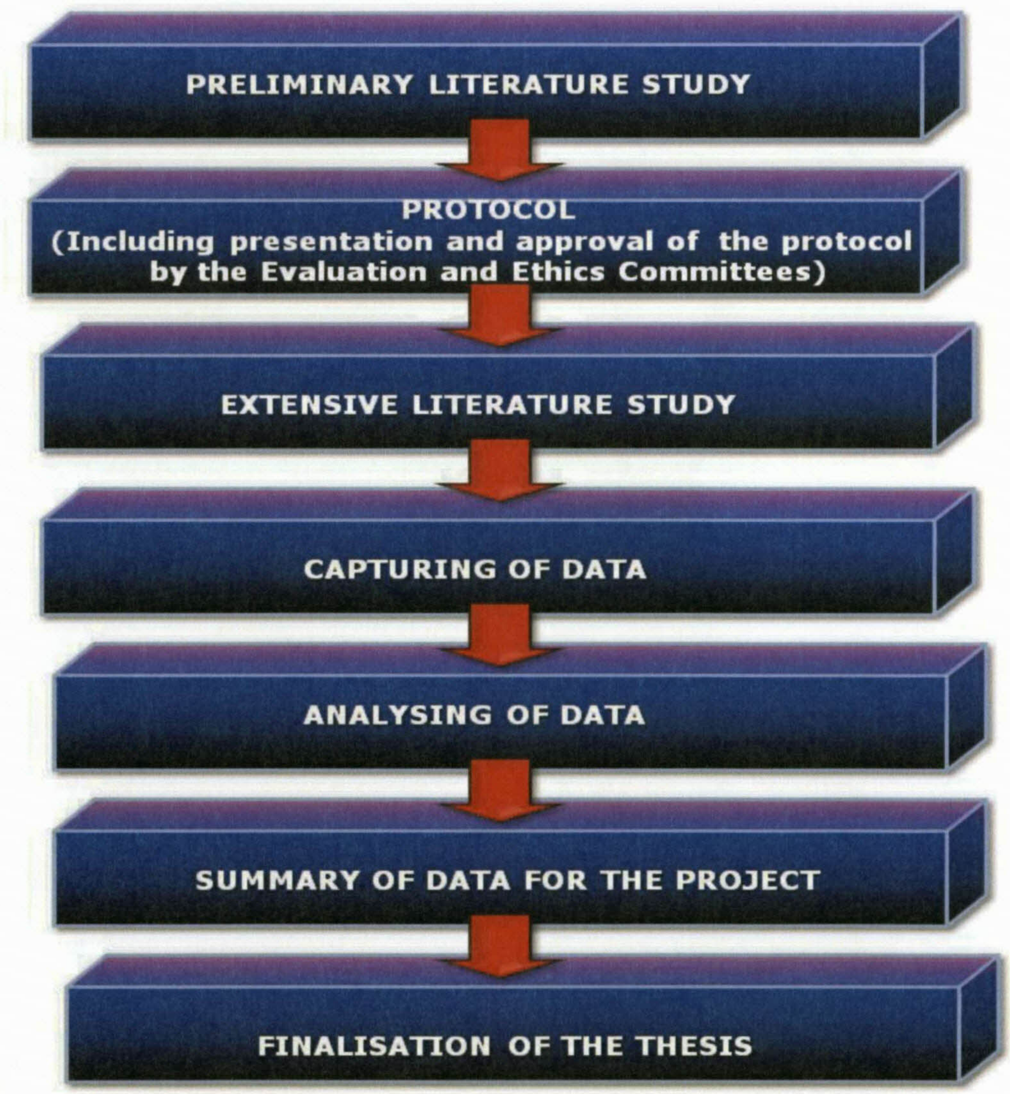
Chapter 5, entitled "**Discussion of the research results**", provides a discussion of the research results in chapter 4 and compares the findings and theories in literature.

Chapter 6, entitled, "**A critical appraisal of selection criteria and academic progression**", provides a critical appraisal of the research findings of the study and critically compares the findings and theories in literature. This chapter also emphasises the strengths and weaknesses of the selection criteria, the challenges in the field, critically appraising the recommendations regarding possible changes in the selection criteria for the UFS.

Chapter 7, entitled "**Recommendations, limitations and conclusion**", deals with the conclusions, the limitations of the study, and recommendations regarding future studies.

The following path will be followed in the completion of the thesis:

Table 1.4: A schematic overview of the study



1.12 CONCLUSION

Chapter 1 provided the background and introduction to the research undertaken regarding the selection criteria and academic progression of first and second year medical students at the UFS.

The methods used were briefly explained, namely a literature study and gathering of data as part of a quantitative, analytical, retrospective cohort study.

The scope of the study and its significance, as well as the value, were also discussed, as was the design of the study. A thorough explanation will follow in Chapter 3 (Research design and methodology). The arrangement of the report was set out and explained.

The next chapter, entitled 'Perspective on selection and admission of medical students' reviews the relevant literature available internationally. It will focus on different aspects of the selection processes, i.e. factors regarding policy and legislation, international perspectives, national perspectives, the perspective of the UFS and other factors that play a role in the prediction of the progress of medical students.

CHAPTER 2

PERSPECTIVE ON SELECTION AND ADMISSION OF MEDICAL STUDENTS

"The first question to ask about selective admissions is why it should be selective at all...Society has mixed feelings about selectivity: On the one hand we think it has unpleasant connotations of elitism, unfairness, snobbishness and uniformity. On the other hand we laud excellence, recognise its scarcity and utility, and endorse admissions on the basis of merit" (Klitgaard, 1985:51).

2.1 INTRODUCTION

Throughout the world, admission to medical school represents an important goal for a great many students and their families and, for many, access to a medical career represents the pinnacle of success (Boelen & Boyer, 2001:20). In the same way, medical schools (including the medical school of the UFS), strive to produce competent and ethical doctors (Bore, Munro, Kerridge & Powis, 2005:267).

Medicine is still one of the courses worldwide where large numbers of students apply to do the course and only a limited number are selected for admission to the course. If students fail to gain admission, in spite of hard work and high marks at school, it may often lead to feelings of resentment on the part of the students, as well as perceptions of the system being unfair or biased (BBC news, 2008).

According to Boelen and Boyer (2001:20), internationally, students are attracted to medicine because of its perceived economic rewards; the intellectual/moral challenge; the scientific excitement; and the opportunity to serve people.

Krumbolz's model of career decision making (Mitchell, Jones & Krumbolz, 1979:19) postulates four sets of factors which influence career decisions. Firstly, genetic and cultural factors, including ability, disability, ethnicity, gender and physical appearance;

secondly, environmental conditions (such as the economic and geographical climates within which we live) and events (for example, the outbreak of war); thirdly, learning experiences, including the myriad of both direct and vicarious events which influence a person's life, such as going to the hospital with a fractured arm. Fourthly, other factors include the impact of positive high quality role-model relationships, which have been shown to benefit students in making career decisions (McHarg, Mattick & Knight, 2007:816).

Task approach skills are derived from the first three factors mentioned above and are skills which help a person to achieve, such as good organisational skills. McHarg *et al.* (2007:815) describe three main aspects relating to reasons for studying medicine, namely:

- Early motivation. Many students have spoken about always having wanted to have studied medicine. Early exposure to the possibility of becoming a doctor may have allowed the idea to flourish within the students' minds and motivated them to achieve high academic goals;
- Inhibitory factors. These include discouragement from applications by teachers on the grounds of not being 'doctor material'; and
- Factors which facilitated access to Medicine. These include the support of family members, particularly mothers and other close friends, as well as having positive role models.

Zwick (2007:3) identifies important questions regarding admission factors, which also seem to be applicable to this study, namely:

- What does a test score tell an admissions officer about a person who has applied to medical school?
- What influence do test scores or selection factors have in predicting whether students will succeed in college (Anderson 1990:159)?
- How much research conducted into the predictive validity of standardised tests is done independently of the agencies that sponsor/develop these tests?

- Do institutions clearly articulate the reasons why standardised tests are included as requirements for admission?
- How do students and parents view standardised tests?
- How would the admission process differ if tests were not available?

Powis (1998:1149) has also provided a set of questions with regard to important admission factors, namely:

- What subject knowledge is required? (biology, physics, chemistry)
- What other cognitive skills are important? (logical reasoning, problem solving, critical reasoning)
- What non-cognitive qualities are required? (empathy, flexibility)
- What excessive behaviours should be recognised? (compulsive behaviour, poor motivation)
- What desirable attributes and behaviours should be recognised? (capacity for self-education)
- What level of verbal and written communication skills is required? (concise, accurate and logical communication)
- Are team skills required? (tolerance, patience and cooperation)
- Are psychomotor skills important? (hand-eye coordination, manual dexterity)

These factors are important especially when students start thinking of possibly following a career in Medicine (cf. 7.2 page 145).

2.2 FACTORS REGARDING POLICY AND LEGISLATION

Policies that influence admission to medical school have a substantial impact on local health service patterns. To a certain degree, these policies reflect the culture of a country and the socio-political orientation of the national health system (Boelen & Boyer, 2001:20).

Boelen and Boyer (2001:20) identify the following factors that may influence policy decisions:

- the number and distribution of medical schools;
- the types of pre-medical education available;
- the nature of courses required by the institutions or professional bodies;
- the number of students admitted per medical school;
- alternative career opportunities;
- the cost of education; and
- the nature of future job expectations.

Boelen and Boyer (2001:23) admit that medical schools' admissions policies mirror a major dilemma. On the one hand, the qualified students must be sufficiently competent to understand the complexity of medical sciences and how to apply new, sophisticated methods of care and treatment; while on the other hand, they must also be able to relate well to the concerns of individuals, families and the community. Admissions policies often result in candidates being selected on the basis of qualities which may not be the most important in later life. The results of this research will might prevent the Medical School of the UFS to fall into this trap.

2.3 INTERNATIONAL PERSPECTIVE

2.3.1 Introduction

Boulet, Bede, McKinley and Norcini (2007:20) indicate that there are over 1 900 operating medical schools in the world. The World Health Organization (WHO) has divided these into six regions (cf. Figure 2.1).

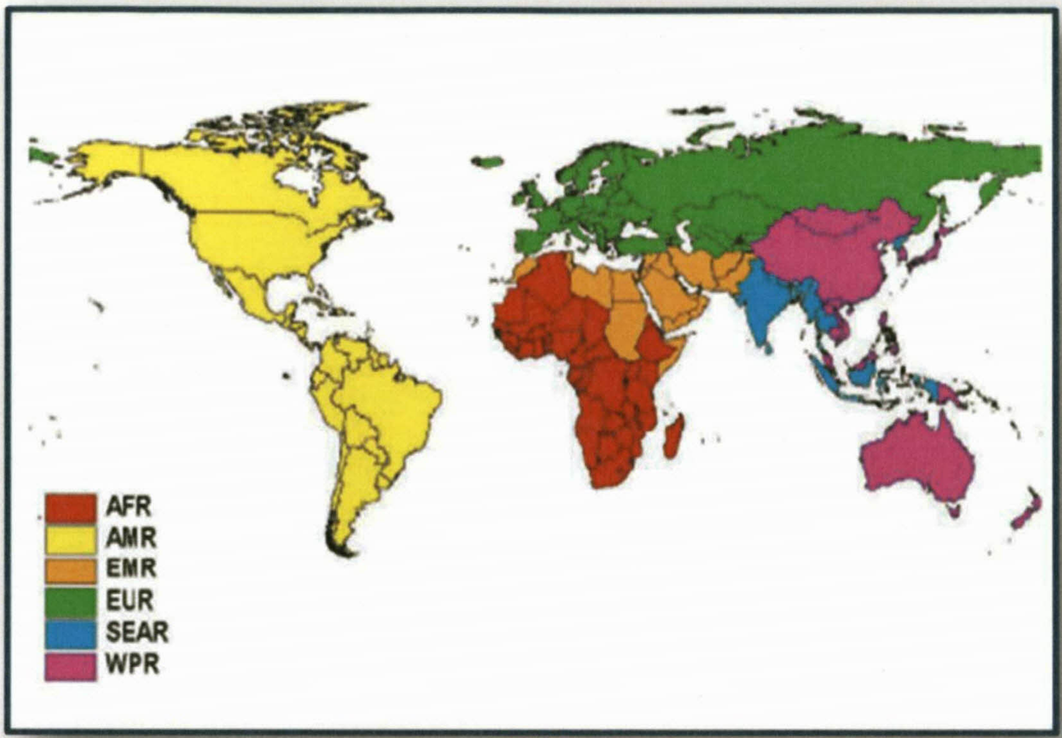


Figure 2.1: World health regions according to the WHO (Boelen & Boyer, 2001:80)

Based on current listings in the International Medical Education Directory (IMED) (Boulet *et al.*, 2007:22), the geographical distribution of medical schools does not mirror the regional population of that specific region (cf. Figure 2.2).

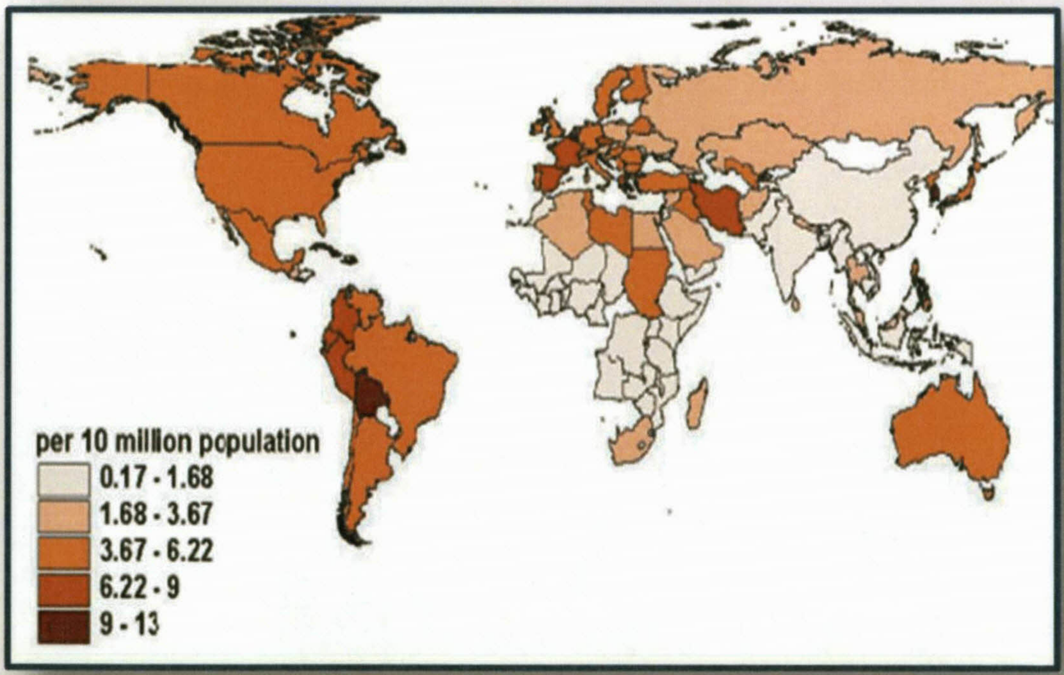


Figure 2.2: Medical schools per country per 10 million population (Boelen & Boyer, 2001:82)

The Caribbean region, with less than 40 million people, has 54 operating medical schools. By contrast, of the 57 African nations, 16 do not have a medical school (Boulet *et al.*, 2007:24). At the UFS, a set number of places are reserved for potential medical students of the Southern African Development Community (SADC) countries.

Certain factors were identified by Boelen and Boyer (2001:20) that determine the nature and number of students, namely pre-admission requirements; duration of medical study; instructional language; entrance examinations; and type and relevance of pre-entrance interviews.

A drive for increased student access to higher education was evidenced in the UNESCO World Conference on Higher Education in 1998, where an emphasis was placed on equality of access (Akoojee & Nkomo, 2007:358). This conference was followed by various debates in South Africa emphasising access as being a key component of successful transformation (Pandor, 2005). Much has been done to ensure that members of previously disadvantaged population groups have a fair chance of being admitted as medical students to the UFS such as the introduction of the quota principle in the Medical School Selection Policy of the UFS (UFS, 2009b).

From an international perspective, Eckhert (2002:606) is of the opinion that there is relatively little data covering medical school enrolment, graduation or even curriculum. Parry, Mathers, Stevens, Parsons, Lilford, Spurgeon and Thomas (2006:1005) emphasise the fact that, worldwide, some commonality exists with regard to the criteria used to select medical students. Powis (2010:432) highlights the importance of also taking non-academic criteria into consideration. Most schools in the world use a combination of one or more of the following areas: academic ability (school, pre-graduate and graduate marks, and/or entrance exams); extracurricular interests; experience with regard to teamwork; leadership skills; and personality, with an emphasis on motivation for studying medicine.

An international perspective involving specific countries will now be presented.

2.3.2 United States of America (USA)

A report by the Association of American Medical Colleges (AAMC) (2009: 1) showed that the requirements for admission to medical schools in the USA vary from school to school and include one or more of the following: minimum academic levels (averages of the undergraduate grade point); performance in the Medical Admission Test (MCAT); and interviews (identifying non-academic characteristics). In 1900, with the founding of the College Entrance Examination Board in the USA, a set of entrance examinations were created for 12 of the north-eastern universities (Hoover, 2007:10).

As observed previously by Lenmann (2004: 5), psychometrists had persuaded the US army to force all recruits to undergo an IQ test during World War I (1914-1918). Subsequently, Carl Brigham adapted the Army Alpha Test for the purpose of selecting students for college admissions. In 1926, the College Board started using Brigham's Scholastic Aptitude Tests (SATs) for the first time (Hoover, 2007:9). At that time, these tests consisted mostly of multiple-choice questions. In essence, the SATs was directly descended from IQ tests. The SATs (the full name has been dispended with) later became the standard for admission to college. At present, over a million students take this test each year.

The SATs changed drastically after 1926 as other components were added to it. In 2007 the SATs provided scores in Mathematics, critical reading and reasoning and verbal scores (Hoover, 2007:11).

In the USA, school segregation was officially ended in 1954 by the ruling of the Supreme Court. America was committed to providing the same opportunities for all children, regardless of background and race, by forcing the pursuit of school desegregation, equity in schools and compulsory education for disadvantaged children (Hoover, 2007:12). In spite of all this effort to eliminate gaps in ethnic score outcomes (test and exam scores, college attendance), the gap only narrowed between 1970 and 1980, but did not disappear. The responsibility of removing this gap was given back to the schools, since race-based college admission preferences were prohibited at most of the universities in the USA.

Colleges and universities in the USA differ in their approach to the selection of students. In the so-called open-door colleges, tests play no role in the admission process. The applicant only needs to show proof of high school graduation, while the other institutions use a more structured approach (AACC, 2010:1).

Breland, Maxey, Gernand, Cumming and Trapani (2002:15) surveyed USA undergraduate admissions policies and procedures in 2000. They reported that 8% of the 957 four-year institutions fell into the open-door category, including the medical schools in the USA. This survey indicated that 80% of the 663 two-year institutions that participated in the study were open-door. The chances of students (who preferred not to attend an open-door institution) getting admitted into a four-year institution were very good as 71% of four-year institutions admitted at least 70% of all applicants (Breland *et al.*, 2002:23).

A survey done by the National Association for College Admission Counselling (NACAC), admission trends at the colleges and universities where selection criteria apply, found that the high school grade-point average (GPA) and the class rank were the most important factors to selection success, followed by the admission test scores. About 70% of institutions reported that admission test scores were routinely used to select students (Zwick, 2007:10).

The World Directory of Medical Schools of the WHO (2007:1) stated, in its final updates of December 2007, that the USA has 141 medical schools, including some of the osteopathic medicine schools.

According to the AAMC (2009:1), representing 130 accredited MD granting US medical schools, there seems to be no requirements that have been fixed for every medical school. Some schools emphasise certain courses and topics as part of the admission process. Most of the medical schools do an initial computer screening of the students to ensure that the correct courses were taken at school and that the GPA and MCAT scores are at the desired level. Thereafter, every school has its own set of criteria or requirements according to which students are selected.

2.3.3 Canada

As in the USA, requirements for admission to any one of the seventeen Canadian medical schools vary, but include minimum academic levels indicated by undergraduate grade point averages (GPAs), performance in the Medical College Admission Test (MCAT), as well as an interview to identify one or more of a range of non-academic characteristics (Parry *et al.*, 2006:1005). However, the study conducted by Siu and Reiter (2009:761) indicate that tools such as academic scores, grade point average, aptitude tests and multiple mini-interviews have shown positive predictive future performance of students, as compared to the use of tools such as personal interviews, letters of reference and emotional intelligence, all of which are not able to predict performance.

Peskun, Detsky and Shandling (2007:57) reviewed the ability of the University of Toronto's academic (undergraduate GPA) and non-academic admission assessments to predict rankings by Internal Medicine and Family Medicine residency programmes (when the candidates proceeded to specialisation). They found that ranking in Internal Medicine correlated significantly with the GPA and the non-cognitive assessment, while ranking in Family Medicine correlated with the admissions interview score.

2.3.4 United Kingdom (UK)

According to the 2007 update of the World Directory of Medical Schools of the WHO (2007:1), a total of 27 medical schools are registered in the UK and Northern Ireland. Lumsden *et al.* (2005:258) are of the opinion that the admission to medical schools in the UK is often 'secretive and varied'.

The United Kingdom Clinical Aptitude Test (UK-CAT) was introduced in 2006 by 23 UK medical and dental schools for possible selection purposes. According to a study done by Fernando, Prescott, Cleveland, Greaves and McKenzie (2009:1018), a comparison was made between the UK-CAT and the traditional admission selection process. The results of this study showed a very weak correlation between the results of the UK-CAT and traditional admission selection tests (Lynch, MacKenzie, Dowell, Cleveland & Prescott, 2009:1206).

Parry *et al.* (2006:1008), as quoted in Table 2.1, compare the different academic criteria used by schools in the UK to identify students who will progress further in the selection process. The most common academic factor used in the selection of students seems to be high A-level grades in two or more science subjects.

Table 2.1: Academic criteria for admission to English medical schools (Parry *et al.*, 2006:1008)

Criteria	Details
A-level grades	Eighteen schools require two A's and one B symbol; two require three A's; and two require one A and two B's. One stated that, depending on circumstances and, in particular, General Certificate of School Education (GCSE) grades, three B symbols might be acceptable.
A-level resits	Seventeen schools did not look favourably upon A-level re-sits, with applicants only being considered (or not considered) in the case of exceptional extenuating circumstances. Five schools were found to accept re-sits if the learner passed at the original grade requested. Two of the five commented that not only would they consider re-sits without prejudice, but also that they viewed the decision to re-sit as evidence of a commitment to read medicine.
A-level subjects	All schools required A levels in Chemistry or Biology, or both, with some schools specifying an A grade in these subjects; some schools advised a third A level to be in a science/math-related subject, while others actively encouraged applicants to consider a non-science subject.
Other qualifications	All schools would consider graduates with good degree results (upper second or higher), with one school indicating that, in exceptional circumstances, a lower second might be acceptable. Twelve schools made explicit reference to 'access to medicine' courses as acceptable means by which academic criteria could be satisfied. All schools recognise alternative equivalent education qualifications, for example, the International Baccalaureate and Scottish Highers.

However, McManus, Woolf and Dacre (2008a:1) mention the fact that almost all medical school applicants are gaining the maximum grade at A level of AAA in England and Wales, resulting in the UK government now piloting the introduction of new additional A* or A** grades.

A similar problem exists at the UFS School of Medicine, where almost all of the applicants for one of the selection groups have A grades for all their school subjects, yet only a specific number of them can be selected).

According to Parry *et al.* (2006:1008), most of the schools (apart from two) in the UK considered one or more of the following non-academic factors: motivation for study; commitment to medicine; teamwork; leadership; acceptance of responsibility; extracurricular activities; and experience of working in health or social care settings.

Most of the schools in the UK utilised complex scoring systems with predefined criteria, using the Universities and Colleges Admission Services (UCAS) forms. Some students are then accepted to study medicine, while others (all borderline applicants) are invited for an interview (Parry *et al.*, 2006:1008).

Admission to a UK medical school occurs after leaving high school or one year later (Peile & George, 2007:1073). The authors argue that potential medical students should complete a degree before applying for medicine, as in other countries such as USA and Australia.

A levels are a major component of selection for the entry of school-leavers into UK universities and medical schools. Intelligence aptitude tests are growing rapidly – they include the Oxford Medicine Admissions Test and the Australian Graduate Medical Schools Admissions Test. Reasons for this include a political climate in which government ministers are advocating alternatives to A levels, as suggested in the Schwartz report on admissions to higher education (McManus, Powis, Wakeford, Ferguson, James & Richards, 2005:555).

Powis, James and Ferguson (2007:242) studied the applicant databases for the 1998-2003 BM BS course at Nottingham University Medical School to determine the factors that predict high tariff point scores on the Universities and Colleges Admission Services (UCAS). In the samples taken, the independent predictors of a high tariff point score were found to be both younger (age) and male (gender). Higher tariff point scores were achieved by those applicants from financially disadvantaged households (Arulampalm, Naylor and Smith, 2004:492).

Hughes (2002b:18) is of the opinion that the greatest single barrier to a more careful selection process in the UK is the resources each school has to invest. She suggests that all medical schools pool their resources to ensure that all applicants have one good assessment. The researcher speculates whether this would apply to the South African school scenario where many high schools' academic performance leave much to be desired. Hughes (2002b:21), however, feels that it is time that UK medical schools came together to collaborate in setting up a first-class selection process that is both fair to society and potential doctors.

Ironically, McManus (2002:787) cautions that, due to the expanding number of medical schools in the UK, the number of applicants may be too few. If this trend continues, universities will find themselves recruiting rather than selecting medical students.

2.3.5 The Netherlands

According to Cohen-Schotanus, Muijtjens, Reinders, Agsteribbe, van Rossum and van der Vleuten (2006:1012), admission to all medical schools in the Netherlands is determined by a national weighted lottery procedure (Parry *et al.*, 2006:1005). The politically motivated rationale behind the use of a lottery system was to provide equal access to medical education for all students meeting the entry criteria, in other words, passing a final examination at the highest level of secondary education (Coebergh, 2003:138). However, Urlings-Strop, Stijnen, Themmen and Splinter (2009:181) as well as and Reibnegger, Caluba, Ithaler, Manhal, Neges and Smolle (2010:212) found that students in Austria who were selected had a much lower drop-out rate compared to students admitted by means of the lottery system.

Because of evidence that cognitive criteria correlate with performance, a compromise was struck between lottery and selection by introducing a weighted lottery. Students are allocated to one of five categories, according to grade point average (GPA). Fixed admission percentages range from 30% for the lowest GPA category to 90% for the highest GPA category. These percentages remain constant, although actual chances of admission vary annually depending on the number of applicants and available places. As far as possible, applicants passing the lottery are placed in the medical school of their choice. This procedure ensures that students across the entire range of GPAs can enrol at a medical school.

2.3.5.1 The approach tested in Utrecht

Oosterveld and Ten Cate (2004:635) suggest the use of their Study Sample Assessment Procedure (SSAP) to select suitable students in Utrecht. This battery of tests focuses on the way in which students are able to assimilate information (related to activities in medical school and patient care), and presents it in a sensible manner. In the SSAP, two applicants (at a time) are interviewed by two parallel selection committees. Following this, both candidates are asked to perform the following activities:

- individually study a three- to five-page text about diagnostic and therapeutic procedures of a particular disease (A) in the space of one hour;
- explain the material they have studied to another candidate and receive reciprocal information from him/her about a different disease (B) which he/she has studied – this exchange lasts for one hour;
- answer questions about disease A in 15 minutes; and
- answer the questions of another standardised patient B in 15 minutes.

A trained selection committee of three people behind a one-way screen observes the first 15-minute interview with a standardised patient and rates it using standardised forms. A second selection committee is involved in rating the candidate's second interview. Each committee consists of a clinical staff member, a student and a student counsellor. A number of twelve candidates are interviewed in a working day.

Based on the findings of three years' work, Oosterveld and Ten Cate (2004:638) found the SSPA to be more reliable than the use of free-response questions concerning reasons and motivation to attend medical school. These were also found to be more reliable than their interview procedure. (The G-coefficients for the SSAP (0,84 to 0,90) were higher than those for the interview and the application form (0,74 to 0,83 and 0,53 to 0,61 respectively). However, the process is very time consuming and probably not practical for use in South African centres where many potential medical students need to be screened.

2.3.5.2 The approach used in Amsterdam

In 2000, the University of Amsterdam introduced the following selection procedures (Boelen & Boyer, 2001:23):

- Students with excellent high school GPAs were allowed direct access to medical school (DA group).
- The remaining placements were randomly selected (RS).
- Of the randomly selected students, 10% were evaluated according to their comprehension of medicine, their social and ethical understanding of health care, as well as communication and interpersonal skills. These students were known as the selection procedure group (SP).

The SP students were significantly more motivated than the rest of the RS students and DA students. Academic achievement was highest among DA students. Selection procedure students were more involved in extracurricular activities, which were often health-care related, and tended to display more studious behaviour. Hulsman, Van

Der End, Oort, Michels, Casteelen and Griffioen (2007:376) have similar findings. All of these qualities are also required for medical doctors in the South African situation as described by Boelen and Boyer (2001:23).

2.3.5.3 The approach used in Groningen

Cohen-Schotanus *et al.* (2006:1012) reported that the association between GPA of school-leaving examinations was related to study success, career development and scientific performance at medical school. They found that GPA scores had no effect on the drop-out rate. High GPA scores were associated with significantly less time to graduation, a higher chance of placement for specialist training and higher scientific placements.

2.3.6 Sri Lanka

A study was undertaken by De Silva, Pathmeswaran, De Silva, Edirisinghe, Kumarasiri, Parameswaran, Seneviratne, Warnasuriya and De Silva (2006:17) to evaluate and predict the success rate of candidates admitted to Sri Lanka's six medical schools. The aggregate marks obtained by students completing their high school education and the General Certificate of Education (GCE) Advanced Level were used for admission to medical studies. The researchers found this to be a poor predictor of success in medical school.

2.3.7 Australia

Within Australasia (and other parts of the world), major changes in the methods of selection into medical courses have occurred over the last ten to fifteen years (Story & Mercer, 2005:647). Admissions policies now attempt to achieve several objectives (not all of which can be reconciled easily), including:

- the selection of medical students with the cognitive skills and other qualities to enable them to cope with the demands of a lengthy and intellectually challenging period of training, both before and after completion of the medical course;

- the selection of applicants, with the potential to become 'good doctors', who possess the personal and professional qualities which enable them to sustain a career in medicine without experiencing undue stress leading to burnout; and
- the development of selection procedures which are equitable, consistent and transparent. This requirement is complicated frequently by the need to exercise a degree of affirmative action in favour of disadvantaged minorities (cf. 6.5.1.4, page 138), or to meet some other perceived community need, for example, to redress the shortage of doctors prepared to work in rural or remote areas.

Using a summary of findings, Elliott and Epstein (2005:174) disclose that many Australian medical schools using Undergraduate Medical Programmes (UMP) and Graduate Medical Programmes (GMP) employ:

- an aptitude test, the Undergraduate Medical and Health Science Admission Test (UMAT) or Graduate Australian Medical School Admissions Test (GAMSAT) to pre-select a student for an interview; and/or
- a measure of academic performance such as Equivalent National Tertiary Entrance Rank (ENTER) or GPA.

Both groups may be used to impose a threshold requirement or may be incorporated into the final ranking.

The fact that UMAT or GAMSAT results have been used to pre-select students for interviews presents medical schools with a challenge in terms of seeking to establish the predictive validity of these instruments as, inevitably, all applicants gaining entry to the course will have scores at the upper end of the distribution. The consequent restriction of the range of scores makes it difficult to investigate the predictive validity of these instruments. UMAT and GAMSAT both assess cognitive and problem-solving ability. UMAT is not curriculum- or content-based, whereas GAMSAT tests content knowledge (especially basic science knowledge), as well as writing ability. Several UMAT training courses have been marketed in Australia (Story & Mercer, 2005:648). The cost and quality of these courses vary considerably and their existence raises equity issues as urban applicants from high socioeconomic backgrounds are more readily able to access them (Tutton & Price, 2002:1170).

The findings of Wilkinson, Zang, Byrne, Luke, Ozolins, Parker and Peterson (2008:349) indicated that GPA is associated most strongly with performance, followed by interview score and GAMSAT score. Because of these findings, the School of Medicine, University of Queensland, Australia, has changed its selection process.

A comprehensive model for the selection of medical students at the University of Newcastle (Australia) has been designed to make fair and defensive selection decisions (Bore , Munro & Powis, 2009:1067), but this model still needs to be tested (Figure 2.3).

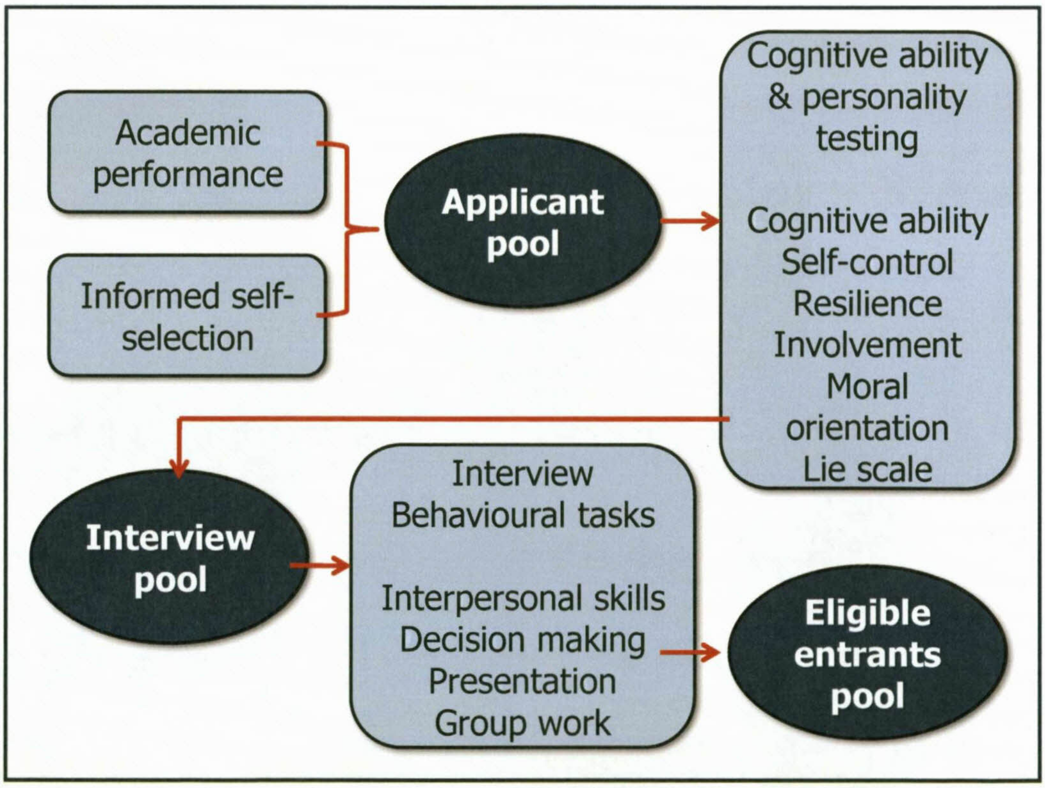


Figure 2.3: A comprehensive model of medical student selection (Bore *et al.*, 2009:1067)

This model of Bore *et al.* consists of different components linking to each other. The first step in the model consists of an informed self-selection component through the provision of timely vocational guidance. The other factors that play a role to be allowed to the applicant pool are the academic achievements of the student indicated by performance at school and/or undergraduate studies. These successful students from the applicant pool are then obliged to undergo psychometric testing to determine their cognitive ability and personality. The successful candidates are then invited for an interview, where their interpersonal skills, decision making and presentation are evaluated. The successful students from the interviews then form part of the eligible entrant pool.

Story and Mercer (2005:648) realise that there is merit in adopting a multifaceted approach to the task of selection. The researcher is also of the opinion that a multifaceted approach might also be regarded as important for the selection of medical students at the Faculty of Health Sciences at the UFS.

2.4 SOUTH AFRICAN NATIONAL PERSPECTIVE

Each one of the eight medical schools in South Africa admits students based on its unique selection criteria, procedures and processes. These selection criteria include academic and non-academic merits. Moolmal, Pick and Edwards-Miller (2008:3) describe non-academic merits as leadership qualities, sporting, cultural interests, community involvement and fluency in languages other than English. They summarised the admission criteria of the medical schools in South Africa and mentioned that scores given to non-academic criteria at South African medical schools are between 20 and 25% of the selection mark.

According to Kent and De Villiers (2007:905), political and social change will have resulted in a new face of the medical student population in South Africa with regard to factors such as diversity of race, gender and previously disadvantaged groups. According to them the brightest and best black students are still not applying for Medicine, in spite of the previous barriers of social segregation being removed.

Despite this problem, the composition of the medical team no more consists of a white male composition, but is rapidly changing to a more demographic representative profession

Concerns about the high failure rates among first year students, in spite of high attrition rates, are not a unique phenomenon of the post-1994 period (Akoojee & Nkomo, 2007:386, Moolmal *et al.*, 1998:3). One of the first studies undertaken to examine the high failure rates of first year students at universities (not only in Medicine) was commissioned in 1936 by J H Hofmeyer, the then Minister of Education (Akoojee & Nkomo, 2007:387). This study indicated that about 47% of all first year students failed at least one subject and 25% more than one subject. The study further indicated that the reason for this finding could be due to the transition from school to university and the university's inadequate teaching system.

Pandor (2005:1) refers to six doors of learning that were difficult to open and for which she has developed plans to open: "The door to early childhood development was out of reach to too many children, school fees barred access to learners, school governing bodies held the keys to the doors of some schools and were selective about who to allow in, the door to higher learning was too often a revolving door, the door to further education was currently a trap door, and the door to adult education was hidden to too many adults". In this document, Pandor mentions that the fourth door seems like a revolving door that trap students because of poor performance and inadequate intellectual challenge.

2.5 UNIVERSITY OF THE FREE STATE (UFS) PERSPECTIVE

In the 'Social Contract'/Institutional Charter (Draft 4) of the UFS, the institution commits itself towards equity in all facets of the university, to eliminate any forms of discrimination and unfair exclusion and to create equitable access for those who have been disadvantaged by factors such as race, gender and language (UFS 2007:5).

The general regulations of the UFS (2008:15) indicated that a student must apply for admission before a specified date. A minimum academic standard (M-count) is required (Table 2.2) in the National Senior Certificate according to a given formula:

Table 2.2: M-count: Calculation according to Grade 12 results (UFS General Regulations, 2008: 15)

	A	B	C	D	E	F
Higher Grade	8	7	6	5	4	3
Standard Grade	6	5	4	3	2	1

The marks of the six best subjects will be added according to the table above and a minimum M-count of 28 is required in order to be considered for admission. Since 2009, this M-count has been replaced by the Admission Point Score (APS) to accommodate the new method of mark allocation in the National Senior Certificate (NSC) (Table 2.3), although, during this study, the M-count was calculated according to Table 2.2 (study population from 2004-2005).

Table 2.3: Admission Point Score: Calculation according to NSC results (UFS general regulations, 2011:14)

90-100%	80-89%	70-79%	60-69%	50-59%	40-49%	30-39%
8	7	6	5	4	3	2

The document with regard to admission requirements for study at the UFS and general regulations A2, A3 and A4 (UFS, 2011:8) summarises the minimum requirements for study in Medicine at the UFS as follows (students who passed Grade 12 prior to 2008):

- C symbol for the language of instruction (Afrikaans or English);
- M-score of 36 and higher;
- an endorsed senior certificate; and
- Mathematics plus one Science subject HG = C symbol or SG = B symbol (excluding physiology).

The minimum requirements (UFS, 2011:7) for selection for an undergraduate degree in Medicine at the UFS (students who passed the NSC in 2008 or later):

- APS = 36;
- Language of Instruction = Achievement level 5 (60%);
- Mathematics = Achievement level 5 (60%);
- Physical Science = Achievement level 5 (60%); and
- Life Sciences = Achievement level 5 (60%).

All of the above are the minimum requirements for application. A selection process is undertaken by the School of Medicine Selection Committee.

2.6 UNIVERSITY OF THE FREE STATE SCHOOL OF MEDICINE PERSPECTIVE

2.6.1 The Selection Policy of the School of Medicine

The principles of the selection policy of the UFS School of Medicine are as follows (UFS Selection Policy, 2011:1):

- "Any candidate can apply for admission to the first year of the M.B.,Ch.B. Programme (i.e. Grade 12 learners, school leavers, graduates and diplomats and people who are already studying for a degree). Candidates from dental faculties or schools will not be considered as long as they are undergraduates. Candidates who are already studying medicine at another university are only selected into the first year of the M.B.,Ch.B. Programme. In exceptional cases only and with the recommendation of the Dean and approval of the School concerned, will a student be admitted to selection in another programme in this Faculty.
- A holistic approach is important in the selection process, which is based on a points system that includes academic achievement, cultural activities, and sport.

- A definite effort is made to accommodate candidates from a disadvantaged academic background who demonstrate the necessary potential and a reasonable ability to attain success in their course.
- It is admitted that students and doctors are national assets, but students from certain areas in South Africa are regarded as the main responsibility of the UFS.
- A maximum target of 140 candidates (including 11 students from SADC countries*) will be selected in four groups based on language of instruction and gender (Eng/Afr, men/women), with an equal number of male and female and Afrikaans and English candidates. Further selection will be considered with the view to registering 140 students. (*Currently Lesotho, Botswana and Namibia)
- Mainly South African students are selected for studies in the medical sciences due to the high costs involved in the training of such students. In respect of the SADC countries*, candidates will be selected in compliance with the policy agreement between the Department of Health and Medical Schools. (*Currently Lesotho, Botswana and Namibia)
- Students are required to produce a medical report completed by a medical practitioner, as well as a completed health questionnaire.
- The medical reports of applicants that have been selected for the M.B.,Ch.B programme will be provided to the Selection Committee in order to ascertain whether there are students with such disabilities that would make them not suitable for medical studies.
- At its own discretion, the Faculty reserves the right to demand immunisation against diseases, from time to time, before admitting students to any further academic year or semester during their studies. As far as the M.B.,Ch.B. Programme is concerned, immunisation against Hepatitis B will occur during training and it is therefore not necessary to be immunised beforehand.
- All students must remember that they should be aware of their HIV status, before taking up the selected places and if positive that they would be exposed to patients with infective diseases, which might affect their wellbeing. In these cases, it will be the students' responsibility to take the necessary precautions

to prevent illness due to their positive status and exposure. All students will be expected to fulfill all the rotation requirements for the programme."

2.6.2 The selection principles and criteria of the School of Medicine

The selection of medical students is conducted by a selection committee appointed by the Faculty Board of Health Sciences. The minimum admission M-score before selection is 36.

The following principles are adhered to:

- "Selection is based on the academic mark obtained in the Grade 11 final examinations, as well as on the academic mark obtained during the March or mid-year examination in Grade 12.
- Approved questionnaires and tests can also be used to identify candidates with the necessary potential. If necessary, a panel from within the Faculty can conduct interviews with students in a further attempt to assess potential and personalities.
- The maximum points to be attained by a student are 122 (if leadership and community involvement are considered that particular year). Of these points, 100 are allocated for academic achievement and a maximum of 12 for extra-curricular activities, a maximum of 8 for region of origin and 2 points for children of University staff, alumni or gold class donors." (UFS Selection policy, 2011:3)

As far as the additional 22 points are concerned, the following holds:

- A maximum of 12 extra-curricular points can be allocated for leadership, community involvement, culture involvement and sport.
- The 8 region of origin points can be allocated if the student originates from the Free State, Northern Cape or the Eastern Cape (UFS Selection policy, 2011:4).

In respect of the language of instruction (Afrikaans or English), a minimum achievement point on achievement level 5 (60%) is required. As far as the science mark is concerned, a minimum of level 5 (60%) in Mathematics, Physical Sciences and Life Sciences must be achieved as a prerequisite for selection (UFS Selection policy, 2011: 3).

A limited number of senior students will be allowed to study Medicine, i.e. students who have completed one or more years of a programme other than the Health Sciences. A candidate will qualify for selection if he/she obtains a minimum average of 75% for the completed year and/or if his/her Grade 12 results would have qualified him/her for admission to M.B.,Ch.B. (UFS Selection policy, 2011:5).

2.7 SPECIFIC SELECTION FACTORS

The use of tests in medical school selection procedures (tests of academic ability, cognitive skills, personality traits or moral orientation), requires that each test reliably measures the trait or ability it purports to (Bore *et al.*, 2005:273). Benbassat and Baumal (2007:509) emphasise that the assessment of cognitive achievements is highly reliable and valid, while the non-cognitive criteria have low validity or are invalid.

Ferguson *et al.* (2002:952-957) reviewed the international literature concerning the factors associated with success in medical school. Traditionally, in the UK, the factors that were deemed important in the selection of medical doctors are academic ability; insight into medicine (including work experience); extracurricular activities and interests; personality; motivation; and linguistic and communication skills.

Boelen and Boyer (2001:23) agree with the above-mentioned factors, but emphasise the importance of intellectual ability and motivation as being the two main indicators in deciding who should be admitted to medical school. They agree that intellectual ability is probably still the most important measure, and the best way to establish this would be through the use of a written, pre-medical testing process. Motivation, however, is far more difficult to measure. They regard the structured interview as a fairly good measure for assessing an applicant's suitability for the profession.

Ferguson *et al.* (2002:952-957) suggest the predictive validity of the following criteria: cognitive factors (previous academic ability); non-cognitive factors (personality, learning styles, interviews, references); personal statements; and demographic factors (gender, ethnicity). However, previous academic performance is a good, but less than perfect predictor of achievements in medical training as it accounts for 23% of the variance in performance in undergraduate medical training and only 6% of that in post-graduate competency (Ferguson *et al.*, 2002:952-957).

Figure 2.4 indicates the percentage of various prerequisites — prior degree, entrance examination and interview — required for admission to medical schools internationally (Boelen & Boyer, 2001:21).

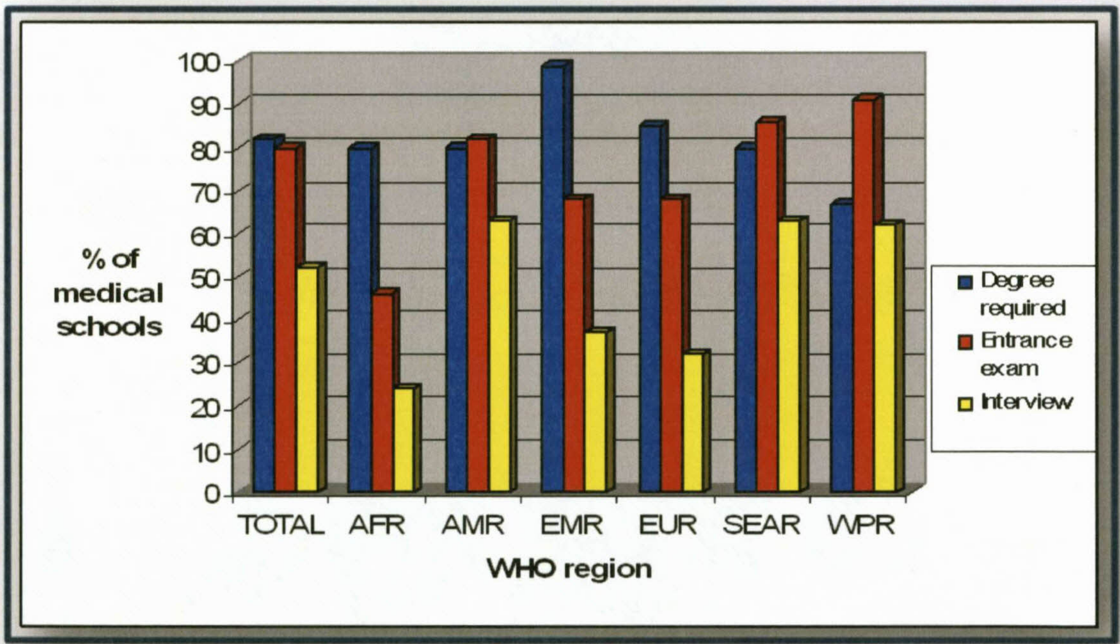


Figure 2.4: Admission requirements to medical schools according to WHO regions (Boelen & Boyer, 2001:21) [AFR = African Region; AMR = American Region; EMR = Eastern Mediterranean Region; EUR = European Region; SEAR = South-East Asian Region; WPR = Western Pacific Region]

According to Figure 2.4, a university degree or certificate is required by 60,2% of universities and an interview in 97,9% of cases as requirements for selection to medical schools in the USA. Overall, the USA has strict standards for admission. On the contrary, China requires an interview in only 16,3% of all admissions. Barely half of the world's medical schools require an interview. A big difference also exists between the Western Pacific Region where entrance examinations are required by 92,9% of schools, compared to the African region where less than half of the schools (47,8%) ask for an admission test (Boelen & Boyer, 2001:21).

With regard to personality, the California Personality Inventory was found to be the most commonly used test for this purpose. The following eight sub-scales consistently emerged as predictors of success in medical training (Ferguson *et al.*, 2002:952-957): dominance; tolerance; sociability; self-acceptance; well-being; responsibility; achievement via conformance; and achievement via independence.

According to the literature, Ferguson *et al.* (2002:953) claim that the use of a strategic learning style (motivated by a desire to be successful, rather than the deep learning style characterised by intrinsic motivation, vocational interest and personal understanding, or the 'surface style' of rote learning); white ethnicity; and the female sex are associated with successful medical training.

For ethical reasons, those charged with the responsibility for assessing and selecting medical school students clearly would need to consider the properties of any measure used (Bore *et al.*, 2005:273).

The approach used by the Medical School Selection Committee of the UFS is in line with the majority of medical schools internationally as far as the use of the final year school mark as part of the selection criteria (cf. 2.6.1, page 37).

2.7.1 Demographic and socio-economic factors

2.7.1.1 Gender

Internationally, there are increasing numbers of women entering medicine (Bedi & Gilthorpe (2000:212); James & Driver, 1999:352; Kilminster, Downes, Gough, McManus, 2002:787; Murdoch-Eaton & Roberts, 2007:39; Seyan, Greenhalgh & Dorling, 2004:1545). Although all countries have different health care systems and social contexts, all still show horizontal segregation (concentration of women in certain areas of work) and vertical segregation (women under-represented at higher levels of the professions).

Kilminster *et al.* (2007:41) indicate that more than 60% of medical students in the UK are women. In the USA, there has been a progressive decrease in male applicants to medicine (and a substantial rise in female applicants). Reasons for this are unclear, but may be attributed to the relative educational under-performance of boys although the finding that males' pre-admission scores were higher, does not substantiate this. Alternatively, men may be more likely to enter more lucrative professions such as business, law and information technology.

The medical school of the UFS has traditionally produced equal numbers of male and female doctors due to the selection policy of the medical school indicating that 50% of the class had to be female and 50% male (UFS Selection policy, 2009:1).

Powis *et al.* (2007:242) state that the independent predictors of a high tariff point score on the structure administered by UCAS were both younger and male (cf. 2.3.4, page 28). Ironically, Ferguson *et al.* (2002:953) claimed that women were more likely to achieve academically in medical school. Cohen-Schotanus *et al.* (2006:1012) argued that, while women tend to graduate earlier, they publish less in scientific journals than men do.

On average, men score higher on the SAT mathematics and verbal sections, the ACT mathematics test, the ACT science test and ACT composite. On the other hand, women achieve a higher score on the ACT English and reading tests (Zwick, 2007:24). When studying the prediction of the college grades, it was also found that the SAT and the ACT scores in women tend to under-predict their college grades.

Gendered expectations shape health care interactions and experiences and, therefore, medical students (and medical doctors) need a greater understanding of how gender (and other issues pertaining to equality and diversity) affect health, health care and their own experience and practice of medicine (Kilminster *et al.*, 2007:44).

2.7.1.2 Social class

In a study conducted by Greenhalgh, Seyan and Boynton (2008:1) in the UK, it was indicated that underachievement by able pupils from poor backgrounds could probably be related to identity, motivation and cultural framing of career choices, rather than to low levels of factual knowledge.

According to Gallagher, Niven, Donaldson and Wilson (2009:433), successful applicants to medical and dentistry schools are more likely to be from higher social classes (taken from data from UCAS) in the UK. Similar results were found by Dhalla, Kwong, Streiner, Baddour, Waddell, and Johnson (2002:1031) at a medical school in Quebec, Canada. Fewer applications are also received from scholars from lower social class backgrounds due to possible reasons such as working-class perceptions of medicine as a profession (Mathers & Parry, 2009:226).

2.7.1.3 Cultural and ethnic background

In the United Kingdom, Powis *et al.* (2007:242) found ethnicity to be a predictor of higher tariff scores, with white, Chinese and those of mixed origin achieving higher tariff point scores than those from other groups (McManus, 1998:1111; McManus, Woolf & Dacre, 2008b:21), indicating that ethnic minority students underperform relative to white students, both in the final school year and during their medical studies.

Ferguson *et al.* (2002:953) claim that Caucasians are associated with higher achievement in medical school, and also cite evidence that, in the USA (Charatan, 2001:1563) and the UK, students (McManus *et al.*, 2008b:2) from ethnic minority groups are more likely to fail an examination. However, non-UK ethnic minority groups in the United Kingdom may perform better than white UK students. Seyan *et al.* (2004:1545) indicated that no black people from the lowest social class were admitted to British medical schools between 1996 and 2000. The authors indicated that "Widening participation" (encouraging pupils from non-traditional groups into higher education) became a political priority in Britain after 2000.

A study by Nettles and Nettles (1999:2) illustrates higher admission test scores on standardised tests for the white and Asian-American participants as compared to the African-American, Hispanic and Native-American participants. Several possible reasons were given for these findings, namely socio-economic, instructional, cultural, linguistic, biological and test bias factors. Last-mentioned participants are also less likely to be promoted once at post-graduate level in medical schools in the United States (Fang, Moy, Colburn & Hurley, 2000:1085).

Bowen and Bok (1998:84) analysed UK medical school admissions from 1996-2000 and were of the opinion that these 'underperformances' of the specific groups could be due to factors outside the academic fields, such as life difficulties, aspects of racism, inadequate financial resources, negative attitudes and anxieties.

Seen from a different perspective, Kilminster *et al.* (2007:41) did a literature review on the changing gender composition, structures and occupational cultures in medicine and concluded that medicine and dentistry were attracting a greater proportion of minority ethnic applicants than their relative size in the general population.

Jolly (1992:765) found that, in the USA, when compared with other applicants within the same ranges of grades and MCAT scores, under-represented minority applicants had a substantially higher rate of acceptance in every stratum. In the Netherlands, social cultural competence is regarded as indispensable for medical doctors.

Taking into consideration that access and quality represent the cornerstones of success in the transformation of higher education, Akoojee and Nkomo (2007:395) stated that, just as there cannot be 'quality without access', access must not only be measured by participation, but also by success.

2.7.1.4 Rural background

According to Basco, Gilbert and Blue (2002:20), applicants from the rural regions of the USA are more likely to become doctors who would be willing to work in rural regions. The Association of American Medical Colleges (AAMC) did surveys in 2003-2004 and indicated that more than 60% of medical schools offered extra consideration at some point in the admission process to candidates more likely to enter primary care, and rural applicants were frequently listed and favoured as one of these groups (Basco *et al.*, 2002:21).

2.7.1.5 Community involvement

In some countries, the community plays a role in determining which candidates enter medical school. Figure 2.5 shows the degree to which the community is involved in the admissions process in the various WHO regions (Boelen & Boyer, 2001:22).

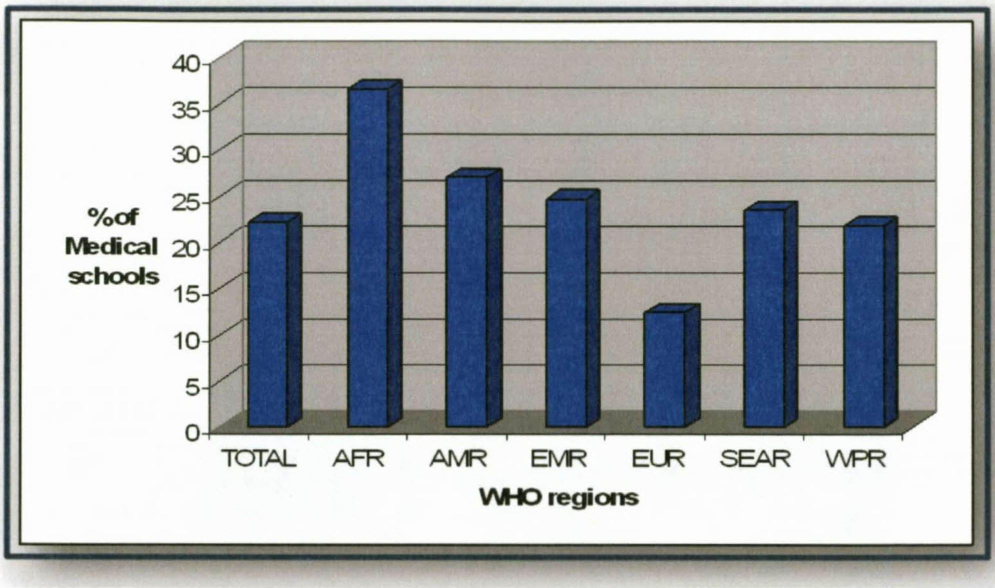


Figure 2.5: Percentage of schools in the WHO regions in which community input plays a role in admissions (Boelen & Boyer, 2001: 22) [AFR = African Region; AMR = American Region; EMR = Eastern Mediterranean Region; EUR = European Region; SEAR = South-East Asian Region; WPR = Western Pacific Region]

The amount of community input into the admissions process is uniformly low (22,2%). The United States indicates that in 48,4% of its schools, the community plays a role in the admissions process (Boelen & Boyer, 2001:22).

2.7.1.6 School Poverty Quintile Index

Studies conducted by Van der Berg (2006:3) as part of the Department of Economics and the Bureau for Economic Research in South Africa, emphasised the fact that educational outcome in schools could be linked to socio-economic status (SES), pupil and teacher characteristics and school resources. According to the author, historically, white and Indian schools outperformed black and coloured schools in matriculation exams, which is still the case (Van der Berg, 2006:3).

Secondary schools are classified by the Department of Education into five groups, so-called Poverty Quintile Index groups. This grouping is done according to the average socioeconomic status (Van der Berg, 2006:7) of the learners in the school. The Group

One schools are the lowest SES schools and Group Five, the highest. Funding from the Department of Education is granted according to these index groups.

A study conducted in 2000 by the South African Consortium on Monitoring Educational Quality (SACMEQ) in Southern and Eastern African schools (Van der Berg, 2006:20), indicated that the socio-economic status of the schools still played a major role in the outcome of Grade 12 results.

2.7.2 Conventional academic achievement factors

2.7.2.1 SAT scores

According to Hoover (2007:6), the SAT, widely used in the USA (as well as in some of South African private schools) as a standardised tool to measure the students' learning and achievements in secondary school – and thus readiness for tertiary education – is not without flaws. It seems as if African-American and Latino students score much lower on the SAT compared to their white peers, resulting in lower admission rates to tertiary institutions in spite of having the same intelligence quotients (IQ) levels (ISASA, 2010:1) (cf. 2.3.2, page 23).

McManus *et al.* (2005:556) report that the 'A' for 'Aptitude' in the SAT has been changed and now refers to 'Assessment' in the UK.

2.7.2.2 High School Grade-Point Average (GPA)

A National Association for College Admission Counselling (NACAC) Admission Trends survey indicated that the GPA and the class rank were the most important indicators for success in tertiary training (Zwick, 2007:10). Ferguson *et al.* (2002:952), confirmed by Lumb and Vail (2004:1002), stated that research conducted in the UK and the USA showed that previous academic performance predicts future academic performance, but that no definite proof seems to exist that previous academic performance correlates with the students' clinical skills.

Undergraduate science GPAs and MCAT scores were considered by Basco, Way, Gilbert and Hudson (2002:13) to be strong predictors of standardised test performances during medical school. McManus (2002:787) argues that, if students with lower high school grades are accepted into medical school, there is a short-term risk of an increased number of students dropping out of medical school, or the longer-term risk of less well-qualified entrants becoming less-competent doctors.

2.7.3 Cognitive factors and generic literacy

2.7.3.1 Language skills

The English language is regarded as a universal scientific language in 45,2% of medical schools worldwide (Boelen & Boyer, 2001:12).

2.7.3.1.1 English language proficiency

Stephen (2003:1) explores the command of the English language or English language proficiency as a likely predictor of how first year students studying Human Resources Management at a University of Technology in KwaZulu-Natal would fare. He compares the abilities of two groups of students, namely Indian (Asian) and black students. In the Indian group, Stephen (2003:1) found that their matric results and matric English marks correlated significantly with their marks which they obtained at the University of Technology. Progressive tests in English language courses for this group (matriculation, first test and final English language marks) showed increasingly high relationships with academic success. By comparison, the matric results and matric English marks for both groups were not significant indicators of academic success. The strongest indicator of success for the black group was the mark they obtained in the English language course at the University of Technology. Therefore, Stephen (2003:1) regards his hypothesis that English language proficiency is associated with academic success to be substantially correct.

A similar approach was also reported by Chur-Hansen (1997:312) and Allen (2002:1) in dealing with potential medical students. In Australia, the Screening Test of Adolescent Language (STAL) was used to assess English language proficiency. Students who were identified as experiencing language difficulties were assessed by means of an interview and were allocated to a faculty-based Language Development Programme for a period of up to two years.

Choi (2005:263) and Phillips and Hartley (1990:1) note the presence of high attrition rates in nursing students where English was not their first language. The English Second Language (ESL) students also suffered higher rates of anxiety, depression and psychosomatic complaints. This leaves the researcher with the possible question whether it is more important to study in your mother tongue or to be proficient in the English language.

2.7.3.1.2 English language proficiency acculturation

In Sydney, Australia, Salamonson, Everett, Koch, Andrew and Davidson (2007:242) explore the relationship between English language acculturation and academic performance. Using the English Language Acculturation Scale (ELAS) in 273 first year nursing students, the researchers noted that the students' ELAS scores correlated well with the nurses' academic grades.

2.7.3.2 Mathematical skills

Eiselen, Strauss and Jonck (2007:38) describe a study conducted at the University of Johannesburg, South Africa, where the importance of performance in Mathematical skills at secondary school level can serve as a predictor of success in the first semester of tertiary studies. This study illustrated that the basic mathematical skills test (measuring mathematics language proficiency, problem solving skills and computational skills) in combination with performance in mathematics at school level significantly contribute towards the prediction of success. (see also 2.7.3.3.2, page 50).

2.7.3.3 Entrance exams and selection tests

Over the past few years, standardised admission tests have become an important factor in undergraduate admissions worldwide. The use of these tests, however, became one of the most debated themes in medical education in recent years (Zwick, 2007:2).

Koch (2007:102) has a negative viewpoint with regard to the tests that were developed by the Centre of Higher Education Development (CHED) at the University of Cape Town (UCT) as part of the initiative of Higher Education South Africa (HESA) that were intended to serve as National Benchmark Tests (NBTs). She argues that, since these tests are done in English only, it will continue to disadvantage learners of disadvantaged educational backgrounds. Koch (2007:103) also mentioned that, by initiating these tests, the higher education authorities might be querying the effectiveness of the educational system to develop the learners in such a way that they are well prepared for tertiary training.

2.7.3.3.1 Medical College Admission Test (MCAT)

In the 1920s, medical schools in the USA had attrition rates ranging from 5-50% (McGaghie, 2002:1085). Since its development in 1928, the MCAT has undergone five revisions. The 1991 test, which is currently being used, has four sections, each with a representative subtest and reported score, namely Verbal Reasoning; Biological Sciences; Physical Sciences; and Writing Sample. McGaghie (2002:1086) reports that the attrition rate for students selected on the basis of MCAT scores for academic reasons in USA medical schools has since dropped to nearly 0%.

Mitchell (1990:149) evaluates the predictive value for the performance in medical school of under-graduate grades; the MCAT; information on the selectivity of the undergraduate institution; and selected transcript data. The performance data examined were basic science grades; clinical science grades; scores on National Board of Medical Examiners examinations, Parts I, II, and III; and information on academic difficulty. Mitchell (1990:149) suggested that selection committees should supplement academic data with non-academic data and interview information.

Kreiter and Kreiter (2007:95) reviewed the literature concerning admissions criteria to medical schools and reported that a validity generalisation perspective of the literature supports the use of MCAT and undergraduate GPA for selection to medical school. Julian (2005:910) state that performance in medical school was best predicted by a combination of MCAT and GPA, but MCAT was a much better predictor of success comparing to GPA. White, Dey and Fantone (2007:7), however, caution that the use of both the MCAT and the undergraduate GPA scores ignore two changes influencing medical school admissions: student diversity and affirmative action. Significant differences between majority and minority students were observed. MCAT scores, for example, did not predict the performance of minority students in the first year of medical school, but did predict the performance of the majority students.

According to the AAMC (1991:9), the Writing Sample section of the MCAT assesses the candidate's skills in organising thoughts and presenting ideas in a cohesive manner, and provides evidence of analytic thinking and writing skills. Hojat, Erdmann, Veloski, Nasca, Callahan, Julian and Peck (2000:25) carefully researched the validity and predictive power of the Writing Sample section of the MCAT using data obtained from 1 776 American medical students. The authors (2000:25) speculated that the ability to organise and express ideas effectively in writing could have relevance to the analytic and problem-solving skills demanded in clinical performance. So, too, they considered that such skills might also be related to a better presentation of one's self and to the effective verbal expression of ideas, both of which are critical in promoting interpersonal relationships.

Thus, the scores of the writing section of the MCAT were proved by Hojat *et al.* (2000:25) to be more accurate as a predictor of clinical competence rather than achievement in basic health sciences (being reflected in academic marks gained in Biological and Physical Sciences during undergraduate studies).

2.7.3.3.2 Health Science Placement Tests (HSPTs)

The HSPTs were introduced to assist with the selection of medical students in South Africa in seven of the eight schools of medicine. From 2003, it was introduced as a possible additional method of selecting medical students in the Free State. Since 2010, these tests were replaced by the NBTs.

The HSPTs are tests that were developed by interdisciplinary teams of experts over a time span of several years (Cliff & Hanslo, 2005) and included generic tests of language, mathematical achievement, mathematical comprehension and a reasoning test. The aims of the different HSPTs are summarised in Table 2.4.

Table 2.4: A summary of the aims of the Health Sciences Placement Tests

HSPT	ABBREVIATION	AIMS
The Placement Test in English for Educational Purposes	PTEEP	To assess the following abilities of students: ▪ to make meaning from texts that they are likely to encounter in their studies; ▪ to understand words in context; to identify and track academic argument; to understand visually presented information such as graphs, tables, and flow-charts; and ▪ to understand basic numerical concepts.
The Mathematics Achievement Test	MACH	The aim of this test is to measure the extent of a candidate's backlog in basic mathematical knowledge and skills. (The areas assessed are covered in the Grade 11 Standard Grade Mathematics syllabus). A great deal of attention is given to problem solving.
The Mathematics Comprehension Test	MCOM	The aim of this test is to provide information on a candidate's potential to learn new mathematical knowledge and skills.
The Scientific Reasoning Test	SRT	The aim of this test is to assess students' capacity to engage with the logical thinking typically required of students in higher education institutions.

2.7.3.3.3 National Benchmark Tests (NBTs)

A pilot study conducted by the Centre for Higher Education (CHED, 2009:1), UCT, where more than 11 500 students from seven universities were asked to participate in the NBTs, showed that at least half of the students needed academic support if they were to finish their studies.

The NBT project was initiated by HESA in 2006. These tests were derived from the Alternative Admission Research Project tests and HSPTs (AARP, 2010:1). The aims of the NBT project are to:

- "Assess entry-level academic literacy, quantitative literacy, and mathematics proficiencies;
- Assist with curriculum development for both regular and foundation-type courses;
- Provide additional information to assist in the placement of students in appropriate curricular routes (e.g. mainstream, extended, bridging programmes, etc.); and
- Assist higher education to interpret the National Senior Certificate results" (UFS, 2009:1).

The following tests are part of the NBTs (HESA, 2009:1):

- The Mathematics test, based on the Curriculum Statement for the NCS subject, Mathematics;
- The Academic Literacy test assesses capacity to engage successfully with the demands of academic study in the medium of instruction; and
- The Quantitative Literacy test assesses ability to manage situations or solve problems of a quantitative nature in real contexts relevant to higher education.

Because of the concern about the pass rate of first year students at the UFS due to the lack in proficiency in numeracy and literacy, the UFS adopted a policy to use the NBTs for all first year students as from 2010 (UFS, 2009:1). All first year students registering at the UFS from 2010, will be required to write the Academic and Quantitative Literacy Test, and students in the Faculties of Health Sciences, Natural and Agricultural Sciences and Economic and Management Sciences will also be required to write the Mathematics Test. Table 2.5 illustrates the achievement levels in each domain (CHED, 2009:1).

Table 2.5: A summary of the different domains of the NBTs (CHED, 2009:1)

Bench-mark	**Assessment of required institutional response**	**Description of benchmark category**		
		Academic literacy	**Quantitative literacy**	**Mathematics**
PROFICIENT	Performance in domain areas suggests that academic performance will not be adversely affected. If admitted, students may be placed into regular programmes of study.	Grade 12 learners at the Proficient level should be able to: Select and use a complex range of vocabulary; understand and interpret non-literal language; understand and critically evaluate the structure and organisation of texts and ideas within these texts; evaluate and use a complex range of different text genres; develop academic arguments; evaluate and interpret the evidence for claims.	Writers at the Proficient level should be able to: Select and use a range of quantitative terms and phrases; apply quantitative procedures in various situations; formulate and apply complex formulae; read and interpret complex tables, graphs, charts and text and integrate information from different sources; do advanced calculations involving multiple steps accurately; identify trends/patterns in various situations; reason logically and competently interpret quantitative information.	Proficient writers should be able to demonstrate insight, and integrate knowledge and skills to solve non-routine problems. They should make competent use of logical skills (conjecture, deduction). Tasks typically require competence in multi-step procedures, represented in the framework outlined below: Modelling, financial contexts, multiple representations of functions (including trigonometric), differential calculus, trigonometric and geometric problems (2-D and 3-D), measurement, representation and interpretation of statistical data; evaluate statistical models.

INTERMEDIATE	The challenges in domain areas identified are such that it is predicted that academic progress will be affected. If admitted, students' educational needs should be met as deemed appropriate by the institution (e.g. extended or augmented programmes, special skills provision).	Grade 12 learners at the Intermediate level should be able to: Derive word-meanings from context; recognise non-literal language; recognise the fundamental, structural and organisational characteristics of texts; recognise and be able to use a specific range of text genres; understand the difference between academic and everyday arguments; make conclusions on the basis of evidence given for claims.	Writers performing at the Intermediate level should be able to: Select and use many quantitative terms and phrases; apply known quantitative procedures in familiar situations; formulate and apply simple formulae; read and interpret moderately simple tables, graphs, charts and text ; do routine calculations accurately most of the time; identify trends/patterns in familiar situations; reason moderately in simple situations.	Intermediate writers should be able to perform at the Basic level, and be able to integrate knowledge and skills to solve routine problems. Tasks involve multi-step procedures which require some information processing and decision-making skills within the framework outlined below: Estimation, calculation, pattern recognition and comparison (in numerical algebraic and financial contexts); solution of equations; use and interpretation of relevant functions represented algebraically or graphically; geometric properties of 2-D and 3-D objects; geometric and trigonometric problems in two dimensions; calculation and application of statistical measures; representation and interpretation of statistical data.

BASIC	Serious learning challenges identified: it is predicted that students will not cope with degree-level study without extensive and long-term support, perhaps best provided through bridging programmes (i.e. non-credit preparatory courses) or FET provision. Institutions admitting students performing at this level would need to provide such support themselves.	Grade 12 learners at the Basic level should be able to: Cope with a limited range of vocabulary; summarise key ideas related to the organisational structure of texts; recognise that texts have different purposes; understand the fundamental syntactical features of the English language; interpret textually explicit information.	Writers performing at the Basic level should be able to: Select and use some basic quantitative terms and phrases; apply some known quantitative procedures partially correctly in familiar situations; formulate or apply simple formulae; interpret simple tables, graphs, charts and text; sometimes do simple calculations correctly; identify trends/patterns in familiar situations.	Basic level writers should be able to: carry out mathematical computations that require direct application of simple concepts and procedures in familiar situations. Tasks involve single-step problems requiring recall and reproduction of basic knowledge or procedures, within the framework outlined below: The real numbers system; simple algebraic contexts; single representations of relevant functions and recognition of their graphs; identification of 2-D and 3-D objects; geometric and trigonometric calculations; identification and use of some statistical measures; simple representation of statistical information.

At present, the majority of medical schools in South Africa are investigating the possibility of using the NBTs as an additional method to assist in the selection of medical students.

2.7.3.3.4 Admission interviews

Although many medical school admissions departments use interviews to assess applicants' non-cognitive skills and value this information more highly than GPA and MCAT scores, Stansfield and Kreiter (2007:32) and Basco, lanchaster, Gilbert, Carey and Blue (2006:151) state that these interviews have low reliability and validity. However, Eva, Reiter, Trinh, Wasi, Rosenfeld and Norman (2009:767) indicate that some correlation exists between the performance of the Multiple Mini-Interview (MMI) and the number of stations passed on an objective structured clinical exam.

McLellan, Horton, Mullan and Palmer (2008:14) emphasise that, although selection should be based on academic grades, their limitations must be taken into consideration. Examination results only indicate intellectual and scientific abilities and do not allow any measurement to see whether or not the candidate understands fellow human beings. No consideration is given to establish whether or not a person can communicate with people and respond to their needs. Interviews conducted by clinicians are suggested to be an important part of the selection process.

The interview prior to admission to medical school has been identified as among the most subjective and variable aspects of the medical school admissions process. Elam and Johnson (1992:28) and Basco, Lancaster, Gilbert, Carey, and Blue (2006:151) caution that admission interview ratings were only modestly predictive of medical school performance. They felt that, if the interview was expected to be a measure of non-cognitive qualities and abilities, structured interview formats needed to be created.

Parry *et al.* (2006:1008) conducted a survey in the UK where candidates are short-listed by a panel of assessors after which the successful candidates are interviewed (Table 2.6).

Table 2.6: Short-listing candidates for interview at medical school (Parry *et al.*, 2006:1008)

Criteria	Details
Who assesses the UCAS form?	Pool of assessors ranged from one or two to over 30 in each school. All schools have assessors drawn from clinical and academic staff. Three schools have lay assessors, with a fourth having lay people as part of the admissions committee which oversees the selection process.
Training of assessors	Eleven schools offer training. For seven, this involves in-house briefing sessions with the marking of sample forms; two hold informal sessions when assessors discuss processes; one an external two day course; and one has a formal training manual.
No. of assessors per form	Nine schools ask two assessors to score each form independently, with discrepancies resolved by a third; four refer UCAS forms to a second assessor if the first assessor has rejected a candidate. At five schools, forms are single marked, but with either sample of each assessor's forms checked and if discrepancies are found, the entire set of forms is marked for a second time (three schools) or reviewed by an admissions tutor or sub-dean (two schools). At one other school, forms are single marked with range of marks awarded by each of the assessors, 'eyeballed' by a senior admissions tutor to check on the range of marks awarded. One school would not reveal details on the number of assessors.

The interview panels varied from two to six members. Most of the panels consist of at least one senior member of the academic staff. Some schools also included lay people on the panel.

The interviews varied considerably between the different schools in the UK (Parry *et al.*, 2006:8) (see Table 2.7).

Table 2.7: The interview process at various medical schools in the UK (Parry *et al.*, 2006:1008)

Criteria	Details
Do the panellists receive training in the interview process?	Eighteen schools required all interviewers to undergo training either provided in-house (thirteen schools), by the NHS or university (three), or by external agencies (two).
Length of interviews	Eighteen schools interview for 15-20 minutes, with a further three schools interviewing for 25 minutes, 30-45 minutes, and 40 minutes each. Two schools stated that interview length varied and could not be specified.
How is the interview scored?	Fourteen schools score interviews numerically. At six, scoring is non-numeric with candidates categorised as offer/borderline/reject. Two schools were not explicit about their scoring process.

The Michael G DeGroote School of Medicine at the McMaster University introduced a multiple-station assessment process, the Multiple Mini-Interview (MMI) (Lemay, Lockyer, Collin & Brownell, 2007:573). Lemay *et al.* (2007:573) describe how, in the MMI utilisation process, candidates are given short individualised interviews with a number of different interviewers. The interviews are set up in a manner similar to that of an Objective Structured Clinical Evaluation (OSCE), with the applicant moving from station to station. At each station (usually lasting about ten minutes), the applicant will discuss a scenario or respond to questions. The interview assessors use a standardised scoring form to rate candidates. According to Lemay *et al.* (2007:573), the MMI is more reliable than traditional interviews, is better able to predict pre-internship performance and can be designed to reflect the values of the medical school.

The MMI appears to offer an opportunity for all applicants, regardless of gender or background (Lemay *et al.*, 2007:574). Socio-demographic differences were not associated with candidates who were accepted. The MMI was also used successfully in the Australian National University Medical School (Harris & Owen, 2007:234).

The interviews are designed in a way to assess the candidates' performances in several categories. These questions varied from school to school. Some schools had structured, predetermined questions whereas other schools followed a more mixed approach. To date, interviews are not used at the medical school of the UFS, mostly due to lack of resources and the cost involved.

2.7.3.3.5 The Scholastic Aptitude Tests (SATs)

The SAT tests (the full name has been suspended with) are mainly used in the USA by the College Board. The SAT Reasoning Test is claimed to measure developed thinking and reasoning skills needed for success in tertiary training (Zwick, 2007:6). The SATs provides scores relating to mathematics and verbal ability, critical reading and writing and reasoning skills, all of which are thought to be necessary for success in college. In addition to these, the SATs programme also includes the SAT subject tests, which test the student's knowledge in a specific area.

2.7.3.3.6 American College Testing programme (ACT scores)

The American College Testing programme (ACT) started in 1959, at a time when the SAT was well established. The philosophy behind these tests differs from the SATs in that the SATs consists mainly of verbal and mathematical sections, while the ACT is more closely tied to instructional objectives (Zwick, 2007:8).

The modern version of the ACT consists primarily of the analysis of the material taught in Grades 7-12. These questions are mostly multiple-choice questions relating to the four main subject areas: English, Mathematics, Reading and Science Reading (Zwick, 2007:9).

2.7.4 Personality

2.7.4.1 Personality domains

Using Goldberg's bipolar adjectives, Ferguson *et al.* (2003:2) described five main personality domains in potential medical students and the relevant qualities associated with each, namely:

- emotional stability – high scores equate to being relaxed and unemotional;
- surgency – high scores equate to extroversion;
- intellect – high scores equate to being creative, reflective, and imaginative;
- agreeableness – high scores equate to cooperativeness; and
- conscientiousness – high scores equate to being hardworking and organised.

The personality domain of conscientiousness was consistently the best predictor of success across the course, especially for the preclinical years.

The Personal Qualities Assessment (PQA) assesses verbal, numerical and spatial reasoning by its mental agility test, contains a personality inventory, and has an ethical reasoning paper (Nicholson, 2005:560). The Personal Qualities Assessment procedure (PQA) is a portfolio of psychometric tests, commonly used to measure some of the qualities that have been indicated in the literature relating to applicants to medical school (Powis *et al.*, 2006:1156).

Parry *et al.* (2006:1008) stated that these questions are grouped in three parts: measuring of cognitive skills; measuring of personality traits; and measuring of attitudes. These tests have been administered to more than 20 000 applicants to medical schools in Australia since 1997. The reliability of this test has been monitored and documented and the details of its construct validity have been published in several international journals (PQA, 2008:1).

Lumsden *et al.* (2005:158) describe the experimental use of the PQA in all of the applicants to Scottish medical schools. The aim of this study was to gather the scores of prospective students to assist with the forming of predictor variables to be able to compare the later performances of the students.

Powis *et al.* (2006:1156) state that collaborations with medical schools in England, Sweden, Australia and Canada were formed to assist with the long-term prediction of the PQA and they emphasise the importance of the personality testing in ensuring the most suitable candidates (Powis, 2009:1046).

2.7.4.2 Dysfunctional personality tendencies

Knights and Kennedy (2007:362) examined the impact of dysfunctional (personality) tendencies on academic performance. They argue that, by detecting dysfunctional personality characteristics, it is possible to predict academic performance and achievement. It is very costly to enrol and teach students who fail to graduate or becoming inefficient practitioners.

Dysfunctional personality traits are often associated with:

- a negative impact on the learning process, academic motivation, academic grades and course attendance;
- higher levels of anxiety and a negative mood before examinations;
- a lack of self-confidence and fear of failure;
- social skills deficits (including substance abuse, suicide, verbal and/or physical abuse, sexual harassment and unethical behaviour);
- personal and social relationship problems;
- inhibited working relationships and compromised team effectiveness; and
- an increase in mental illness (Knights & Kennedy, 2006:1058; Knights & Kennedy, 2007:362).

According to the American Psychiatric Association's *Diagnostic and Statistical Manual of Mental Disorders III* (DSM-III), there are eleven distinct patterns of dysfunctional behaviour, each associated with a specific personality disorder. The Hogan Development Survey, which is based on the DSM-III taxonomy of personality disorders, was used to assess dysfunctional behaviour (Knights & Kennedy, 2007:363).

Knights and Kennedy (2007:363) claim that there is a negative relationship between academic grades and the DSM-IV categories of schizotypal, paranoid, antisocial, borderline, histrionic, avoidant and passive-aggressive personality disorders. There is a positive relationship between academic grades and both dependent and obsessive-compulsive personalities, but it appears that certain facets of perfectionism have a negative impact on academic grades. Borderline personality characteristics were positively related to academic probation, whereas low course attendance was associated with antisocial, borderline, histrionic, narcissistic, avoidant and passive-aggressive personality traits. There is also an observed co-morbidity between the antisocial, histrionic, dependent and passive-aggressive personalities with substance abuse disorders.

Using the clinical literature, Knights and Kennedy (2007:364) state that there is evidence that the schizotypal, antisocial and borderline personalities are associated with certain cognitive deficits that impact on the learning process.

2.7.4.3 Emotional intelligence (EI)

The applicant scores of the traditional admission criteria (such as GPA and interview assessments) were compared with the scores on the EI instrument by Carrothers, Gregory and Gallagher (2000:456). The 34-item EI instrument consists of five dimensions, namely maturity; compassion; morality; sociability; and calm disposition. Carrothers *et al.* (2000:456) proposed that this instrument demonstrated the ability to measure attributes that indicate desirable and interpersonal skills in medical school applicants.

The study by Carr (2009:1073) indicated that males had a higher EI than females, while Asian students had a higher EI than White students. Due to logistical and financial constraints, the candidates' personalities and personality profiles are not evaluated at the UFS.

2.8 MORAL ORIENTATION

Rather than focusing on the justifications that individuals might give for their decisions, an alternate view is to consider what it is about individuals that determine their opinions, decisions and actions (moral orientation). Bore *et al.* (2005:266) put this in question form: "What psychological variables lead to individual differences in ethical sensitivity (the recognition of an ethical situation)?"

Bore *et al.* (2005:266) suggest three factors are highly relevant in moral decision making:

- an individual's moral orientation;
- personality traits that may influence moral and decision making and the performance of moral behaviour ; and
- an individual's knowledge and experience of moral norms, laws, policies, professional principles and the professional culture in which the person is operating.

An alternative conceptualisation of moral orientation was developed by Bore *et al.* (2005:266) based on insights arising from empirical studies using a questionnaire designed to measure moral orientation prior to the making of a moral decision. This research indicated that the individual differences in moral orientation formed a normally distributed trait-like dimension with, at one extreme, respondents consistently placing greater importance on the needs, rights and well-being of individuals and relatively less importance on the rights, needs, norms and well-being of society and referent groups within society. This was known as the libertarian moral orientation. The researcher is of the opinion that this is in line with contemporary Westernised thinking.

The opposite was apparent at the other extreme of the dimension, with respondents consistently placing greater importance on group/society needs and relatively less importance on the needs of individuals: a communitarian orientation. To the researcher, this approach is more in line with the traditional African concept of 'Ubuntu'. However, elements of both ends of the spectrum should be represented in a large group of students. A majority of respondents occupying the central area of the score distribution appeared to give approximately equal importance to individual needs and group/societal needs, indicating a dual moral orientation.

When confronted by a moral dilemma, libertarians will see and place greater value on the needs of and potential consequences for the individual/s in the context. Communitarians will see and place greater value on the needs of and potential consequences for society and important referent groups within that society, while the dual-oriented will see and approximately easily value the needs of and consequences for both the individual/s and society.

Bore *et al.* (2005:268) developed the Mojac Scale, a questionnaire-based measure of libertarian-communitarian moral orientation. Men were generally found to be more libertarian, while women and older respondents (both sexes) tended towards being more communitarian. Importantly, libertarian-communitarian scores were found to be related to well-validated personality scales in a conceptually coherent patterning. High Mojac scorers (indicating an extreme communitarian moral orientation) showed tendencies (as identified by parallel test instruments) to be authoritarian, conscientious, perfectionistic and self-controlled, while low scorers (indicating an extreme libertarian orientation) tended to be disorderly, narcissistic, abstracted and unrestrained. Thus, when presented with an ethical dilemma in a medical situation, extreme communitarians might tend to be inflexible, reliant on procedures, rules and their perception of the 'authority' of medicine at the expense of the unique needs, rights and autonomy of their patients. Conversely, extreme libertarians might be overly flexible and ignore or bend the usual rules of procedure, while being disproportionately concerned for the rights, well-being and liberty of patients and themselves as doctors.

Bore *et al.* (2005:273) argue that applicants who score extremely high or extremely low on the Mojac Scale – extreme communitarians and extreme libertarians (perhaps defined by cut-points of +2 SD and -2 SD from the mean respectively) – could be considered for exclusion from the applicant pool on the grounds that their moral orientation is likely to be vocationally incongruent with the ethical standards and requirements of the medical context. Bore *et al.* (2005:273) claim that the substantial majority who remain in the applicant pool would approximately equally value the needs, rights and well-being of individual patients and the needs, rights and well-being of others, the profession and society as a whole and so, might be more likely to behave in an ethically appropriate way in the practice of medicine. This questionnaire is not deemed necessary in our country.

2.9 CONCLUSION

Chapter 2 provided an overview of different perspectives on admission and selection of medical students. This literature overview focused on factors regarding policy and legislation; the international perspective; the national perspective; the perspective of the UFS; the perspective of the School of Medicine at the UFS; and specific selection criteria.

The researcher has endeavoured to assimilate information on a variety of factors that are important when selecting medical students. Evaluations of the admission requirements indicate that the process is variable worldwide and is often controlled primarily by the individual medical school itself (Boelen & Boyer, 2001:29; O'Neill, Korsholm, Wallstedt, Erika & Hartvigsen, 2009:61).

Parry *et al.* (2006:1009), having researched the criteria being used worldwide to select medical students, advocated the implementation of a centralised admission system to avoid differences in medical schools in their selection processes. They also stated that, even if this centralised approach is rejected because of medical schools' desire to retain their own system to recruit a distinctive type of student, the need to assess the validity of the school's own selection criteria still needs to be done. This statement mirrors the rationale for the undertaking of this study.

The process of selection varies considerably worldwide, but common factors that are often taken into account in the selection process must be:

- the importance of academic merit,
- the strive towards a holistic judgement of applicants,
- the credibility of selection criteria,
- taking ethical issues into consideration and
- the importance above all, the fairness of the process and the emphasis on basic principles such as equity and justice.

The next chapter, Chapter 3, entitled 'Research Design and Methodology', will deal with the design of the research and the method used to accomplish the research.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

The aim of this study was to assess the relationship between the selection criteria for medical students and the results obtained at the end of the first two years of their medical studies at the UFS.

The literature review in Chapter 2 was used as a support and framework for the design of the study. The research design and methodology featured in this chapter are explained.

Research is defined as the systematic search or inquiry for knowledge. Different scientifically acceptable research methods are used to arrive at valid conclusions. Each discipline has its own types of research tools, which can be used to further knowledge in the field (Katzenellenbogen, Joubert & Abdool Karim, 1997:3). Jack, Hayes, Scharalda, Stetson, Jones-Jack, Vallliere, Kirchain and Le Blanc (2010:162) highlight different facets of research and emphasise that any research must provide the necessary information needed to assess the strengths and weaknesses of that study.

According to Katzenellenbogen *et al.* (1997:4), people may have many reasons for conducting research; however, most people pursue an investigation out of interest in the topic or a perceived need for information in their work situation. They use the results of the research to further scientific knowledge and/or as a rational basis for their work. This may mean that the results can assist when making decisions, as motivation when requesting resources from funders and/or governmental agencies, or monitoring progress and evaluating programmes.

Kaptchuk (2003:1453-1454) warns researchers not to take evidence in research as the ultimate before interpreting for quality and likely error. He adds that any interpretation is never completely independent of a scientist's beliefs, preconceptions, or theoretical commitments. The researcher had to be very aware of these factors in interpreting the results.

3.2 BACKGROUND TO THE STUDY

Seen in the light of an altered high school system and the demands on the changing demographics of first year medical student intake, it was essential to take steps to ensure that the quality of the tertiary education and training students received, was maintained at the same high level as in previous years, while still maintaining an acceptable success rate. One measure taken to ensure a high student success rate, was to ensure that the students who are selected for the programme were capable of achieving academic success.

3.3 PURPOSE AND AIM

3.3.1 Purpose

The purpose of this study was to contribute to the quality of education in the M.B.,Ch.B. programme at the School of Medicine at the UFS (cf. 1.3, page 9).

In order to deliver medical practitioners, who will be equipped with the skills, knowledge and attitudes needed to respond competently and appropriately to the health needs of the people whom they will serve, it is essential that quality students with reasonable potential for success be selected for the Medical Programme at the UFS.

3.3.2 Aim and objectives

The aim of this study was to assess the relationship between the selection criteria for medical students and the results obtained at the end of the first two years of their medical studies at the UFS. The objectives to achieve these aims were discussed in Chapter 1 (cf. 1.5, page 10).

3.4 METHODS AND PROCEDURES

3.4.1 Type of study

A literature study and an empirical investigation were carried out. The purpose of the literature review was to provide a background to, and context for, the research problem, to establish the need for the research, and to gain sufficient knowledge about the area of study (Landman, 1988:75). The literature study was thus conducted to form the basis of the investigation. The study focussed on success in higher education, with special reference to the selection of medical students and the factors in selection criteria that may play a role in the progression of medical students in their first two years of study.

A quantitative, analytical, retrospective cohort study was undertaken. Quantitative research can be defined as a formal, objective and systematic process in which numerical data are used to obtain information (Burns & Grove, 1999:5). McMillan and Schumacher (2001:165) state that designing quantitative research involves choosing subjects and data collection techniques as procedures for gathering and collating the data. These authors summarise this approach by stating that quantitative research presents statistical results which are represented by numbers. The quantitative approach is typically used to answer questions about relationships among variables with the purpose of explaining, predicting and controlling phenomena (Leedy, 1997:104).

Jack *et al.* (2010:163) identified seven key questions to determine the strengths or weaknesses of the quantitative study, namely:

- Is the study design identified and appropriately applied? In this case, the use of a quantitative, analytical, retrospective cohort study will be the most appropriate study due to three reasons:
  - Quantitative: it is measurable and will provide answers to the research question and fulfil the aim of the study.
  - Analytical cohort: the independent and outcome variables of a cohort of medical students from the UFS can be analysed, resulting in recommendations for the School of Medicine at the UFS with regard to the future selection of students.
  - Retrospective: because outcomes and variables from this cohort are already available.
- Is the study sample representative of the group from which it is drawn? (cf. 3.4.3, page 78).
- In research studies using a control group, is this group adequate for the purpose of the study? This statement is not applicable to this study as all the students in the class are included.
- What is the validity of measurements and outcomes identified in the study? (cf. 3.7.1, page 85).
- To what extent is a common source of bias, called blindness, taken into account? This problem is not applicable to this study since data were used and no interaction with students occurred. Sample bias was a problem in this study (cf. 7.3.2, page 147).
- To what extent is the study considered complete with regard to dropouts and missing data? Missing data occurred, especially in the data of the HSPTs, because students were not required to write the HSPTs. The data of these students could not be used in the regression models. Statistical tests were used, however, to establish whether the remaining data of the students are representative of the total study group.

- To what extent are study results influenced by factors that negatively affect their credibility? Consideration of possible confounding factors which might mask actual association, form part of the analysis of the data.

According to Katzenellenbogen *et al.* (1997:69) and Jack *et al.* (2010:163), a cohort is a group whose members share a certain characteristic. In this study, the first year medical students of 2004 and 2005 and second year medical students of 2005 and 2006 of the UFS formed the cohort.

Cohort studies are also known as follow-up studies since individuals with known etiological characteristics are followed up for a period of time during which the outcome is determined (Jack *et al.*, 2010:163; Katzenellenbogen *et al.*, 1997:69).

Hennekens and Buring (1987:154) classify cohort studies in either prospective or retrospective studies, depending on the temporal relationship between the initiation of the study and the occurrence of the outcome. Retrospective cohort studies are sometimes called historical cohort studies (Valanis, 1999:60). This study is an example of a retrospective cohort study.

The cohort study has unique strengths and limitations that must be considered. The following strengths are identified by Hennekens and Buring (1987:173); firstly, it is of particular value when the exposure or attributing factor is rare; and secondly, it can examine multiple effects of a single etiological characteristic.

It can elucidate the temporal relationship between the etiological characteristic and the outcome, which is applicable in this study. In this study, it is the temporal relationship between the selection variables and the outcome, which is the academic performance in the first and second year of study.

With regard to the disadvantages, the researcher must be aware of this study design's limitations. It is inefficient for the evaluation of rare outcomes, unless the attributable-risk percentage is high. Prospective studies can also be extremely expensive and time consuming. If the retrospective approach is used, it requires the availability of adequate records. Furthermore, the validity of the results can be seriously affected by losses to follow-up, such as students who discontinued their medical school education.

The main strengths of the cohort study design for this study was that multiple effects could be examined after a single exposure, as well as the fact that it was able to elucidate the temporal relationship between exposure (in this study, the selection factors) and outcome (in this study, the academic performance in the first and second year of study).

3.4.2 Study population

A target population includes individuals who all possess specific characteristics (De Vos, 1998:14). The first year medical students during 2004 and 2005 and second year medical students during 2005 and 2006 of the UFS, formed the focus of the study. Students were included if an academic score was available after six months of study, with or without any HSPTs results.

The study population consisted of 269 students, divided into two classes, namely the Afrikaans and English classes as described in Table 3.1, Figure 3.1 and Figure 3.3. The students were also divided into the four race groups, i.e. White, Indian, Coloured and African as follows:

- 143 White students (65 male and 78 female);
- Seven Indian students (six male and one female);
- 23 Coloured students (ten male and thirteen female); and
- 96 African students (52 male and 44 female)

Table 3.1: Demographic distribution of the study population

Race	Number	Gender	number	Partially completed diploma	Completed diploma	Degree partially completed	Degree completed	No tertiary education
White	143	male	65	2		5	2	56
		female	78	1	1	7	3	66
Indian	7	male	6					6
		female	1					1
Coloured	23	male	10			1	2	7
		female	13		1			12
African	96	male	52		1	8	5	38
		female	44			6	3	35

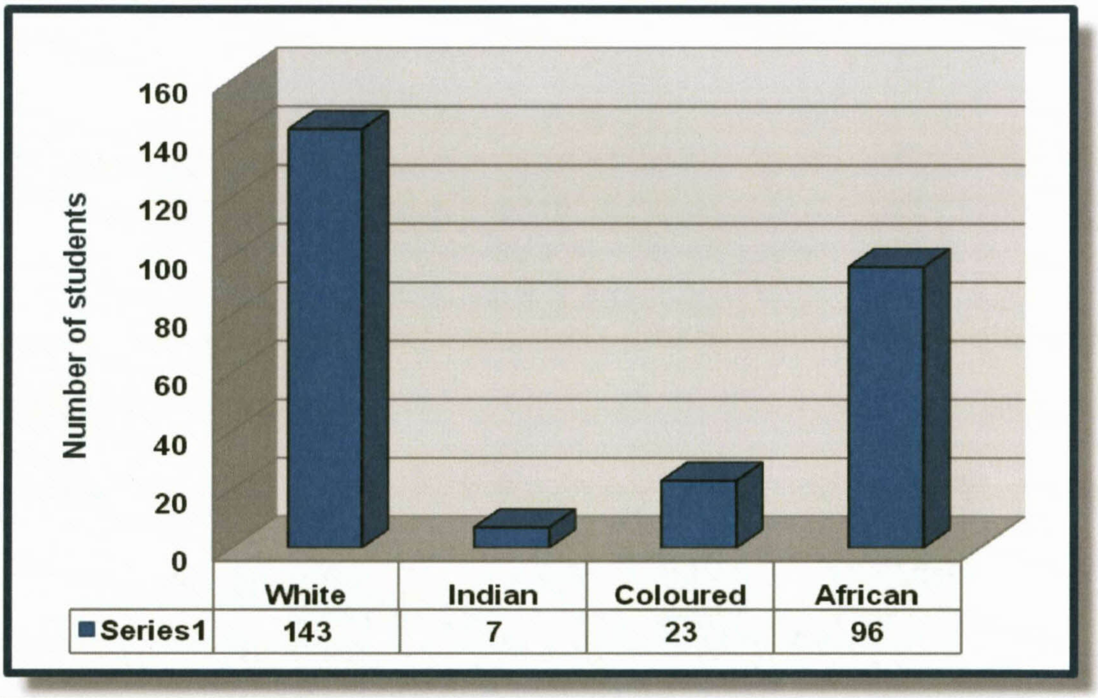


Figure 3.1: Distribution of the study group according to race

The distribution of the study group, according to gender, consisted of 133 males and 136 females (cf. Figure 3.2 and 3.3).

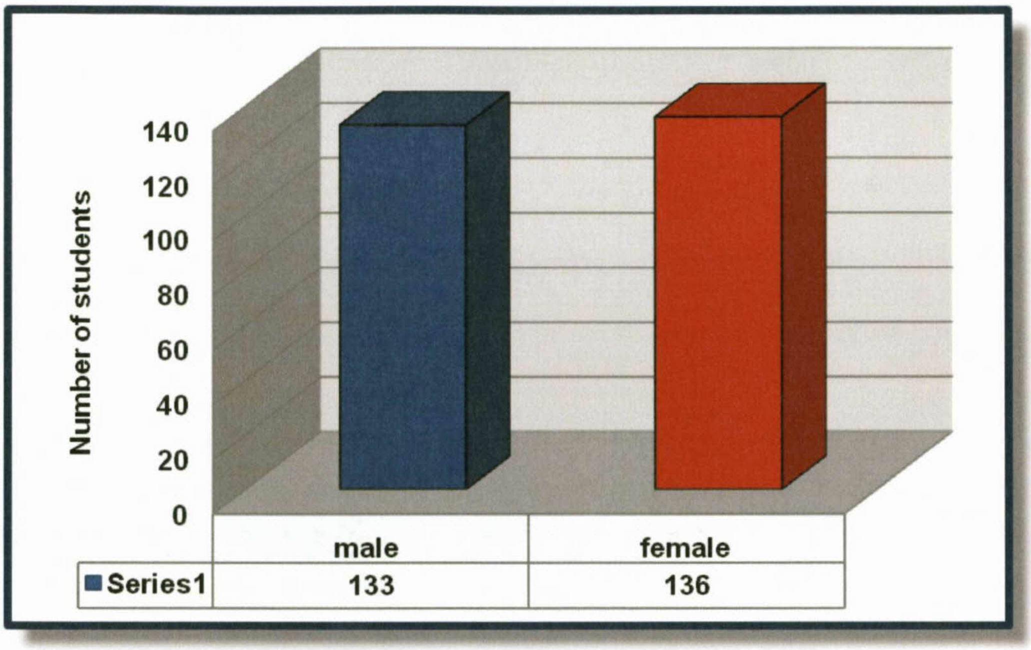


Figure 3.2: Distribution of the study group according to gender

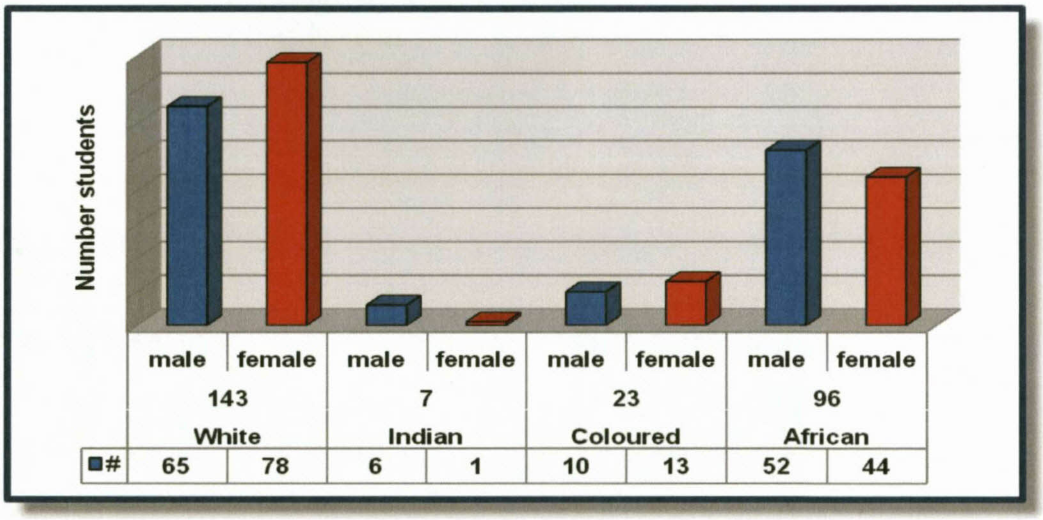


Figure 3.3: Distribution of the study group according to race and gender

At entry, the study group had different levels of tertiary education, namely:

- three students partially completed a diploma;
- three students completed a diploma;
- 27 students partially completed a degree;
- 15 students had completed a degree;
- 221 students had no post-Grade 12 tertiary education (see Table 3.1 and Figure 3.4).

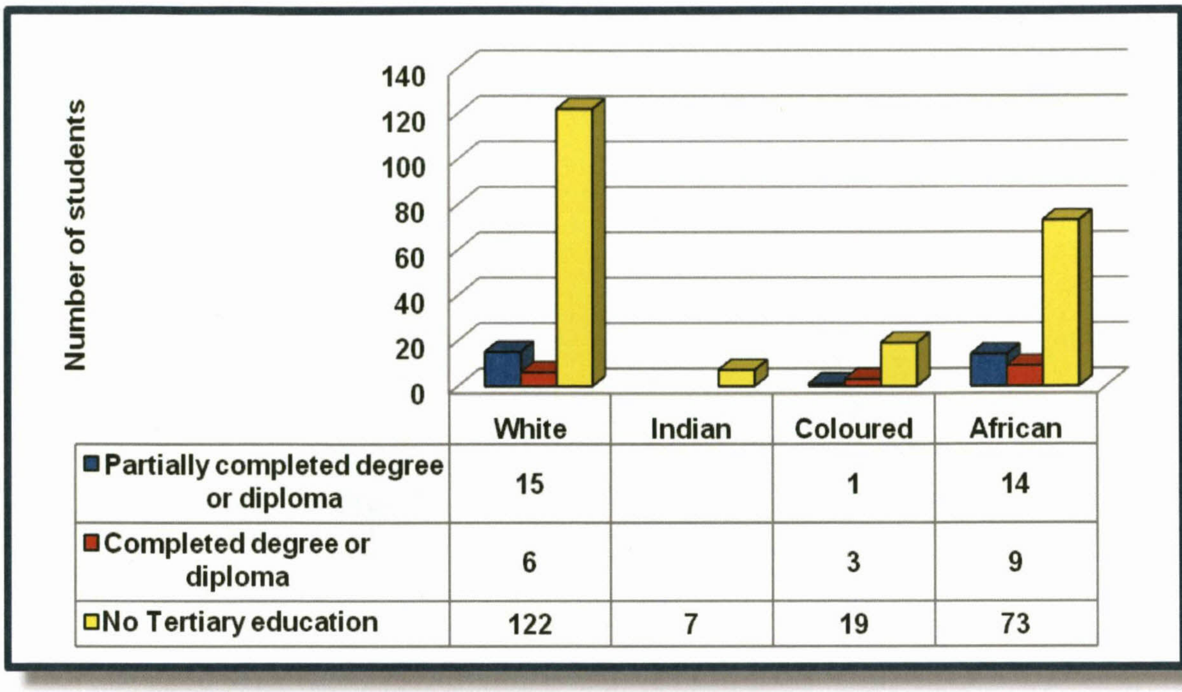


Figure 3.4: Tertiary qualifications obtained by members of the study group prior to medical studies

Not all of the students who started their studies at the Medical School of the UFS had written the HSPTs. Often, students from rural areas and/or students from disadvantaged backgrounds who were unable to pay the fee involved were among those who did not write the tests. This might create some bias and was discussed in chapter 7 (cf. 7.3.2, page 147).

Table 3.2: Number of first year students enrolled in the medical programme from 2000-2006 who completed the HSPTs at the UFS

Year	Number of first year students	Number of first year students who completed the HSPTs
2000	90	0
2001	134	0
2002	141	0
2003	150	0
2004	145	89
2005	137	83
2006	154	56

3.4.3 Sampling

In most studies, it is neither practical nor necessary to study all of the individuals in the study population. Rather, a sample (subset or subgroup) of individuals can be studied closely, ensuring that good quality information is obtained (Katzenellenbogen *et al.*, 1997:74). The study sample must be representative of the group from which it is drawn (Jack *et al.*, 2010:163).

No sampling was done in this study as data collection from the whole study population was feasible and a large amount of data were needed to be able to analyse the determinants of the students' assessments of lecture quality.

3.4.4 Measurements

Data for the study were obtained from the following resources (after obtaining special permission from the Vice Rector, the Dean of the Faculty of Heath Sciences and the Executive Committee of the School of Medicine of the UFS):

- UFS personal data of students. Information gained from several databases of the UFS and the School of Medicine was amalgamated by the researcher.
- Health Sciences Consortium for the HSPT results of the students of the UFS for the years 2003-2004 of students who started their studies 2004-2005. (Students wrote the tests in the year prior to University entrance.)

Each set of data comprised of certain aspects of the study. By amalgamating the data, a more complete set of data could be used for analysis.

The following variables featured in the collection of data from the students and were statistically analysed to detect associations:

- **Demographic information** (name, age, gender, race, nationality, home language, language of Grade 12 education and language of medical education);
- **General school information** (school name, school ATP code, town, home setting in rural/city areas and School Poverty Quintile Index);

- **Grade 12 school results** (individual marks for each subject taken, type of Grade 12 examination, such as National Senior Certificate, Independent Examination Board, etc.). Emphasis was placed on the following subjects: English, Mathematics, Science and Biology, because these subjects are the subjects that most students completed. By looking at these subjects as a group (and also at the average of these 4 rather than the M-score) all students are put on par;
- **Previous tertiary education information** (partially completed diploma, completed diploma/s, partially completed a degree, completed degree or no tertiary education);
- **Marks used in the selection process** (M-score, academic mark, science mark and total selection mark);
- **HSPT results** (including the marks obtained in the four tests, i.e. the PTEEP, MACH, MCOM, RT and the average of these four tests);
- **First year M.B., Ch.B. results** (individual marks for each module, average of the modules of the first year and specifying whether the student passed/failed the year or discontinued his/her studies); and
- **Second year M.B., Ch.B. results** (individual marks for each module, average of the modules of the second year and specifying whether the student passed/failed the year or discontinued his/her studies).

3.4.5 Pilot study

The study was piloted by examining the criteria used and performance of twenty first year M.B., Ch.B. students enrolled in 2006. Initially, the researcher planned to obtain all information from one database but, with the pilot study, it was found that this database was incomplete and information from several databases had to be consolidated. It also became evident that certain information, e.g. school poverty index, was important for this analysis and a list was obtained from Dr Servaas van der Berg from the University of Stellenbosch to assist in updating the demographic data of the students in this regard (Van der Berg, 2006). All of these problems were corrected and the data programme was updated before the empirical study was undertaken.

3.4.6 Exclusion criteria

The HSPT results are vital to the analysis of these data and therefore students who did not write these tests were excluded from the study. Analytical tests were done, however, to confirm that this new population group represented the initial group.

3.5 DATA MANAGEMENT AND STATISTICAL ANALYSIS

Last (1988:124) defines statistics as science and art of collecting, summarising and analysing data that are subject to random variation. The data management and analysis in this study was conducted by the staff of the Department of Statistical Sciences at the University of Cape Town, using a variety of available statistical techniques for this analysis.

The collected data were entered into the Excel computer programme by the researcher. Statistical analysis was undertaken using Stata software. Frequency distributions were used to describe the marks students obtained in each year. The main aim of the statistical analysis was to identify the independent factors that predict medical students' marks during the first two years of study. The correlation between all of the numeric and categorical variables and the outcome variable was checked.

Beaglehole, Bonita, & Kjellström (1993:67) describe correlation as the degree to which two variables change together. It is measured by the correlation coefficient. Several correlation coefficients are often used in epidemiological studies (Rodgers & Nicewander 1988:60).

The Pearson product-moment correlation coefficient (r) measures the degree of linear relationship between two variables. The formula for Pearson product-moment correlation coefficient (r) for variable x and y is (Beaglehole *et al.* 1993:67):

$$r = \frac{\sum_{i=1}^{n}(Xi - \overline{X})(Yi - \overline{Y})}{\sqrt{\sum_{i=1}^{n}(X_i - \overline{X})^2}\sqrt{\sum_{i=1}^{n}(Y_i - \overline{Y})^2}}$$

Several authors have offered guidelines for the interpretation of a correlation coefficient. However, Cohen (1988:88) observed that all such criteria are in some ways arbitrary and should not be observed too strictly. The interpretation of a correlation coefficient depends on the context and purposes. Cohen (1988:88) used table 4.10 as a guideline for the interpretation of values in a social sciences research context.

Table 3.10 Interpretations of correlations (Cohen 1998:88)

Correlation	Negative	Positive
None	−0.09 to 0.0	0.0 to 0.09
Small (weak)	−0.29 to −0.1	0.1 to 0.29
Medium (moderate)	−0.49 to −0.3	0.3 to 0.49
Large (strong)	−1.0 to −0.5	0.5 to 1.0

According to Beaglehole *et al.* (1993:67), regression analysis can be thought of as finding the best mathematical model for predicting one variable from another. The most common form of regression is the simple linear regression where the mathematical model is in a straight line.

The equation for a logistic line can be written as (Beaglehole *et al.* 1993:68):

$y=b_0 + b_1x$

where y = dependant variable

b_0 = intercept value of y for x=0

b_1 = slope of the regression line

x = independant variable

The multiple linear regression method was used to measure the combined effect of the predictors. Any form of analysis that gave optimal clarification of data were also regarded as being of value.

The Shapiro–Wilk test was performed to detect if the sample came from a normally distributed population. In statistics, the Shapiro–Wilk test tests the null hypothesis that a sample x_1, ..., x_n came from a normally distributed population (Shapiro & Wilk 1965:591).

"The test statistic is:

$$W=\frac{(\sum_{i=1}^{n} a_1 x_{(i)})^2}{\sum_{i=1}^{n}(x_i-\overline{x})^2}$$

where

- $x_{(i)}$ (with parentheses enclosing the subscript index i) is the ith, i.e., the ith-smallest number in the sample;
- $x = (x_1 + ... + x_n) / n$ is the sample mean;
- the constants a_i are given by

$$(a_1, \dots, a_n) = \frac{mV^{-1}}{(m^T V^{-1} V^{-1} m)^{1/2}}$$

where

$$m = (m_1, \dots, m_n)^{\mathrm{T}}$$

and m_1, ..., m_n are the expected values of the order statistics of independent and identically-distributed random variables sampled from the standard normal distribution, and V is the covariance matrix of those order statistics", (Shapiro & Wilk 1965:591).

The null hypothesis was rejected if W was too small (Stata Base Reference Manual 2003:171).

3.6 SCOPE OF THE STUDY

The scope of the study lay in the domain of Health Professions Education, and more specifically in the area of selection and progression of medical students.

3.7 RELIABILITY, VALIDITY AND BIAS

A measuring instrument had to be developed in order to collect suitable information and which could be used for quality assurance purposes. This measuring instrument had to adhere to a set of rules before assigning values to objects or events so as to represent quantities, qualities, or categories of attributes (Wilken, Hallam & Dogget, 1992:28).

A measurement error is defined by Higgins and Straub (2006:23) as the difference between an abstract concept or idea, considered the "true" state, and the "observed" measurement provided by an empirical instrument. The validity of the statistical methodology is improved by reducing the systematic error (relationship between the true score and the concept), while the reliability minimises the random error (relationship between the observed score and the variable).

Higgins and Straub (2006:25) designed a concept map (Figure 3.5) to illustrate the relationship between validity and reliability and all their dimensions.

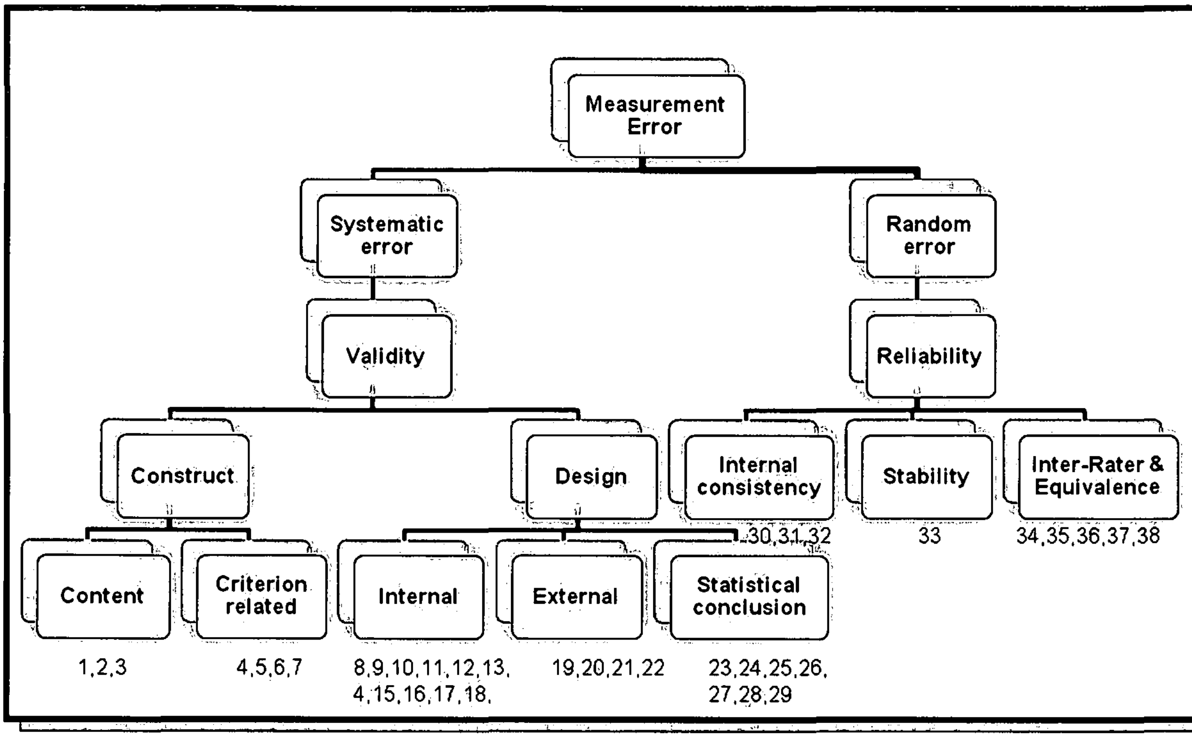


Figure 3.5: Concept map to illustrate validity and reliability and their dimensions (Higgins and Straub, 2006:25)

Explaining the number coding in figure:

Validity		*Reliability*
1. Literature review	*16. Compensatory equalization of treatment*	*30. Chronbach alpha*
2. Personal reflection		*31. Kuder-Richardson formulas*
3. Analytical critique	*17. Compensatory rivalry of subjects*	*32. Coeficient theta*
4. Concurrent validity	*18. Demoralization of control group subjects*	*33. Test-retest*
5. Convergent validity		*34. Alternative form method*
6. Predictive validity	*19. Interaction of subject selection and treatment*	*35. Kendall's coefficient of concordance*
7. Factor analysis		
8. History/concurrent events	*20. Interaction of setting and treatment*	*36. Percent agreement*
		37. Kappa & phi
9. Maturation	*21. Interaction of history and treatment*	*38. Bland-Altman plot*
10. Testing		
11. Regression toward the mean	*22. Interaction of multiple treatments*	
	23. Power	
12. Differential selection of participants	*24. Violations of assumptions of statistical tests*	
13. Differential loss of participants	*25. Confounded significance levels*	
	26. Reliability of measures	
14. Diffusion of treatment	*27. Reliability of treatment implementations*	
15. Ambiguity about direction of causal relationship	*28. Heterogeneity of the environmental setting*	
	29. Heterogeneity of respondents	

According to Jack *et al.* (2010:164), the validity and reliability and excluding factors such as biases, are some of the key factors in establishing the strength and weaknesses of a study. These factors will be discussed below.

3.7.1 Validity

Babbie and Mouton (2001:1190) claim that the term 'validity' refers to the extent to which an empirical measure adequately reflects the real meaning of the concept under consideration and they accurately inquire as to how we can ever say whether a particular measure adequately reflects the meaning of a concept. Higgins and Straub (2006:24) emphasise that an absolute outcome will never be obtained. However, scientists need to make an effort to at least reach a degree of validity.

The validity of an instrument relates to the effects of non-random or systematic error. An instrument is valid to the extent that it measures what it purports to measure. A measure may be valid for the specific purpose for which it was developed, though not necessarily for a related, equivalent purpose (Wilkin *et al.*, 1992:28). Validity as defined by De Vos, Strydom, Fouché and Delport (2002:166), consists of two parts: the instrument being able to measure the concept in question and the concept being measured accurately.

Landman (1988:96) and Santy and Kneale (1998:81), in turn, state that validity is the extent to which an instrument or procedure satisfies the purpose for which it was constructed. In other words, it determines that which it was designed to determine. Jack *et al.* (2010:164) describe it as the extent to which a measurement captures what it claims to measure.

Trochim and Donnelly (2008:7) describe three basic types of validity: content, criterion, and construct validity. Table 3.3 explains the basic definitions in terms of the questions asked (Wilken *et al.*, 1992:30):

Table 3.3: Type of validity and explanation of definitions in terms of the questions asked (Wilken *et al.*, 1992:30)

TYPES OF VALIDITY	QUESTIONS ASKED
Content validity	Is the choice of, and relative importance given to each component of the index, appropriate for the domains they are supposed to measure?
Criterion validity	Does the measure produce results which correspond with those obtained using a superior measure simultaneously (concurrent) or which forecast a future criterion value (predictive)?
Construct validity	Do the results obtained confirm the expected pattern of relationships or hypotheses derived from the theoretical constructs on which the measure is based?

Higgins and Straub (2006:23) describe multiple dimensions of validity (also Figure 3.5). Construct validity answers the question of whether the concept is accurately defined and whether the instrument or tool actually measures the concept that it is supposed to measure. Content validity concentrates on the adequacy of the items of an instrument to assess the concept. This can be done by means of a literature review (cf. Chapter 2), personal reflection and analytical critique (cf. Chapter 6). Criterion-related validity is concerned with the statistical testing of relationships.

Content and criterion validity are often seen as separate types of validity, but Higgins and Straub (2006:23) describe them as dimensions of construct validity. Design validity is related to the design of the study. Three dimensions are described by Higgins and Straub (2006:26). Firstly, internal validity is concerned with the congruence between the theoretical claims and the statistical relationship of two variables. Secondly, external validity is concerned with generalising *to* particular people, settings and times and *across* types of people, settings and times. Thirdly, statistical validity is concerned with both systematic and random error and the correct use of statistics and statistical tests.

Benbassat and Baumal (2007:511) describe the validity of an admission criterion as the degree to which it predicts the applicant's performance during and after his/her undergraduate studies. This fits in with one of the objectives of this study: to assess whether the admission criteria really predict performance during the first two academic years.

The validity of this study rested on an in-depth literature study, the experience of the supervisors, as well as the scientific methods used in the formal study. In order to ensure the quality of an education programme, every effort needs to be made to ensure that the measuring instrument used, satisfies validity criteria.

3.7.2 Reliability

One of the objectives of any measurement should be to reduce both random and non-random errors to a minimum. The more reliable a measure, the lower the element of random error. The reliability of a measure is the extent to which it yields the same results in repeated applications on an unchanged population or phenomenon (Babbie and Mouton 2001:1190; Higgins and Straub, 2006:27; Wilken *et al.*, 1992:28). The reliability of clinical, social and psychosocial instruments is more difficult to establish, but is regarded as having equal or greater importance.

Three types of reliability are generally considered to be important in the assessment of instruments. Firstly, consistency over time is assessed using repeated applications of the instrument (test-retest reliability); in other words, applying the measure to the same population at different points in time under the same conditions. The correlation between the two sets of results is regarded as an estimation of the reliability of the measurement. Secondly, consistency between different users of the instrument may need to be established (inter-rater reliability). This is important for any measure which requires judgements or observations to be made by the person administering the measurement. Thirdly, the internal consistency of items within the instrument can be assessed, i.e., to what extent all the items measure the same dimension. Thus, they provide an estimate of homogeneity (Wilken *et al.*, 1992:28).

Landman (1988:80) infers that reliability refers to the extent to which studies can be replicated, that is, consistency of obtaining the same relative answer when measuring phenomena which have not changed.

Bostwick and Kyte (1981:113) state that reliability has been defined as the accuracy of precision of an instrument; as the degree of consistency or agreement between two independently derived sets of scores; and as the extent to which independent administrators of the same instrument yield the same (or similar) results under comparable conditions.

According to Benbassat and Baumal (2007:511), reliability is defined as the reproducibility of the results obtained when a measurement is repeated on the same study sample. They are of the opinion that cognitive measurements for selection are highly reliable, yet non-cognitive measurements, e.g. interviews and assignments, are not reliable at all. The reliability of these non-cognitive measurements will be strengthened if the coefficients of correlation (CC) are made between two independent observers on different occasions. Benbassat and Baumal (2007:511) are also concerned that these non-cognitive scores are often biased by either the applicants' characteristics, e.g. gender and background, or by the observers' leniency.

In this study, the reliability of the instrument used in this study was established by means of the pilot study. Different uses of the instrument (computer programme) should result in the same answers as this data are fixed as part of the test results and admission papers of students. The same HSPTs have been applied for seven years to a large number of students (i.e. uniform assessments) and the results are the same.

3.7.3 Bias

One form of systematic error commonly found in self-report measures is response bias. There are two recognised forms, namely acquiescent response sets and social response sets (Wilkin *et al.*, 1992:33).

A variety of factors may interfere with the validity and/or reliability of the results of the studies used to determine the influence of the selection criteria for the medical students. Some factors may potentially influence the sample as certain students of the more disadvantaged backgrounds did not write the HSPTs. A potential bias might also be that only the top students are represented in the study as they are selected to enter medical school.

Kaptchuk (2003:1453) documented that doctors should improve their clinical appraisal skills in order to be able to make better use of medical research, but to be careful not to be biased when interpreting the data. Kaptchuk (2003:1453) identified different forms of interpretation biases, which are set out in Table 3.4.

Table 3.4: Different forms of interpretation biases (Kaptchuk, 2003:1453)

Type	Definitions
Confirmation bias	Evaluating evidence that supports one's preconceptions differently from evidence that challenges these convictions.
Rescue bias	Discounting data by finding selective faults in the experiment.
Auxiliary hypothesis bias	Introducing ad hoc modifications to imply that an unanticipated finding would have been different had the experimental conditions been different.
Mechanism bias	Being less sceptical when underlying science furnishes credibility for the data.
'Time will tell' bias	The phenomenon that different scientists need different amounts of confirmatory evidence.
Orientation bias	The possibility that the hypothesis itself introduces prejudices and errors and becomes a determinate of experimental outcomes.

The biases that exist or potentially exist in the study and the way in which it was dealt with will be discussed in Chapter 7.3.2 (page 147).

3.8 IMPLEMENTING THE FINDINGS OF THE STUDY

These findings will be published in appropriate journals; presented at international and national conferences, as well as the academic day of the Faculty of Health Sciences; and recommendations will be submitted to the Selection Committee of the Faculty of Health Sciences at the UFS. These recommendations may be used in the future selection procedures should the Selection Committee choose to do so.

3.9 ETHICAL AND LEGAL CONSIDERATIONS

3.9.1 Confidentiality

The method of information gathering was anonymous. Each student number was given a code by the researcher and only the researcher kept the list with the student numbers and allocated codes. Due to the nature of the study, the student numbers were needed to compile the information. Confidentiality was maintained at all times. The student numbers were used for statistical analysis purposes only and did not appear on any presentations, reports or publications.

3.9.2 Informed consent

There was no need to obtain signed consent from the students. Informed consent was obtained from the Dean of the Faculty of Health Sciences and the Executive Committee of the School of Medicine to enable the researcher to have access to the relevant data of the students (Appendix C). Consent was obtained also from the Vice Rector of the UFS to gain access to the information (Appendix D). All those who wrote the HSPTs signed a declaration allowing their scores to be released to the Consortium for research purposes only; students would not be personally identifiable and their confidentiality would be protected.

3.9.3 Ethics committee approval

As the research project involved first and second year medical students of the UFS, approval was sought. Ethical Committee approval was received for this study (ETOVS no. 117/06) as prescribed by the regulations of the Faculty of Health Sciences of the UFS.

3.10 THE VALUE OF THE STUDY

According to Foxcroft and Stumpf (2005:1), the term 'matric', as it is defined in the Universities Amendment Act, Act 21 of 1993, simply means 'university admission'. By implication, this should mean that a student who passed Grade 12 should have the necessary cognitive, academic and personality abilities to successfully finish his/her higher education qualification. However, publications on the predictive validity of matric results for further academic performances, especially of disadvantaged students, provide conflicting reports (Van der Flier, Thijs & Zaaiman, 2003:399).

Several studies (Braun & Nel, 1995:3; Van der Flier *et al.*, 2003:400; Yeld & Haeck, 1997:5) indicate that the greatest uncertainty about Grade 12 results predicting progression on tertiary level exist in the former DET (Department of Education and Training) schools and, to a large extent, with the ability of Mathematics and Science subjects to predict progress. This statement resulted in many black students with potential not being selected into medical programmes and other science-based programmes (Van der Flier *et al.*, 2003:400). It is clear that another indicator is needed to select disadvantaged students with potential. Such an indicator could be the HSPTs.

The results of this study will be of great value for medical education in South Africa and, especially, for the Medical School of the UFS in providing guidelines that could be used to great advantage in the selection of future medical students (cf. 7.2, page 146).

If these HSPTs prove to be reliable in predicting certain aspects of tertiary study outcomes, they may also be used to identify students with potential learning problems. This will ensure that these students are identified at an early stage for remedial help in certain areas in order to assist them to complete their studies. So, too, early detection of students who will probably not be able to complete their studies, will minimise unnecessary financial burdens.

The findings of this study may also serve as a platform for other local and international universities, assisting them in the selection process of future medical students.

3.11 CONCLUSION

In this chapter, emphasis was placed on the research methodology. An outline of the purpose, aim, methods and procedures was discussed. A discussion of the nature of the study followed. The method of data capturing, management and statistical analysis thereof was also stipulated. Reference was made to reliability, validity and bias and the way in which they were optimised in this study. Finally, the limitations of the methods, the ethical and legal considerations and the value of the study were outlined.

The next chapter, Chapter 4, will deal with the analysis of the data and the findings of the study with a discussion of both entities.

CHAPTER 4

RESULTS AND DATA ANALYSIS

4.1 INTRODUCTION

The aim of this study was to assess associations between the selection criteria for medical students and the results obtained at the end of the first two years of their medical studies at the UFS. To achieve these aims, the study endeavoured to conceptualise and contextualise the problem of selection of medical students at the UFS, identifying universal factors that play a role in this selection by means of a thorough literature survey (see chapter 2). Furthermore, it aimed to assess by way of an empirical study the influence of the present UFS medical school selection criteria and other criteria (e.g. age, previous tertiary education and school poverty index) on the performance of first and second year medical students at the UFS and to assess the different components of the HSPTs that play a possible and vital role in the performance of the first and second year medical students. Chapter 4 will deal with the results and findings of this study.

After the completion of the study, the data were verified and validated by statisticians at the University of Cape Town's Department of Statistical Sciences, using a variety of available statistical techniques for this analysis.

For the interpretation of this study, it was necessary to estimate if the different variables were normally distributed (cf. 3.5, page 82). By confirming this normal distribution, i.e. symmetrically shaped curve, the researcher was able to use this curve to do a large number of statistical tests and to estimate probabilities associated with these variables (Pagano & Gauvreau 2000:117).

The Shapiro–Wilk test was performed to detect if the results of the different variables were normally distributed (table 4.1). The null hypothesis for this test was that the data were normally distributed. The Prob < W value listed in the output was the p-value. If the p-value was less than 0.05, then the null hypothesis that the data were normally distributed was rejected (cf. 7.3.1, page 147). If the p-value was greater than 0.05, then the null hypothesis had not been rejected (Shapiro & Wilk 1965:591).

Table 4.1 Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
First year average	284	0.98	3.9	3.19	0.00070
Second year average	266	0.89	21.71	7.18	0.00000
M-score	262	0.97	4.83	3.67	0.00012
PTEEP	167	0.94	8.05	4.76	0.00000
MACH	167	0.96	4.74	3.55	0.00020
MCOM	167	0.98	2.85	2.39	0.00847
SRT	167	0.99	1.58	1.04	0.14839
Age	284	0.61	79.89	10.26	0.00000
Academic mark	173	0.94	8.19	4.81	0.00000
Science mark	159	0.92	9.86	5.20	0.00000
Total selection mark	184	0.94	8.64	4.94	0.00000

The significances of the majority of the variables were <0.05 and thus the null hypothesis that the data were normally distributed was rejected, meaning that the majority of variables were not normally distributed. However, these findings can be expected, since the population of medical students from the Health Sciences are not part of the normal population as we are dealing with a highly selective population.

4.2 DESCRIPTIVE ANALYSIS

4.2.1 Demographic information

The analysis of the demographic information of the study population will be discussed in this section.

4.2.1.1 Age

Of the 284 students the mean average of their age was 19.4 (inter-quartile range of 18 – 18 and the range 16 - 43) and the scores were positively skewed (Table 4.10).

Table 4.10 Demographic distribution of the age of the study population

Variable	N	Mean	SD	Min	P25	P50	P75	Max	Skewness	Kurtosis
Age	284	19.4	3.9	16	18	18	19	43	3.4	16.2

The majority of medical students start their medical studies immediately after finishing school, resulting in the majority of students being 18 to 19 years old.

4.2.1.2 Gender

The gender of the study group was almost equally distributed with the 141 male (49.6%) and 143 female (50.4%) students (Table 4.11).

Table 4.11 Demographic distribution according to gender

Variable		Frequency	Percentage
Gender	Male	141	49.6
	Female	143	50.4

The equal distribution of male and female students resulted from the stipulation regarding equal selection of males and females in the Selection Policy of the Medical School of the University of the Free State (UFS:2009)

4.2.1.3 Race

According to the race classification, 106 students were Black (37.3%), 24 students were Coloured (8.5%), 7 were Indian (2.5%) and 147 were White (51.7%) (Table 4.12).

The discrepancy regarding the number of students in the different tables are due to students failing, discontinuing their studies or students that did not write the HSPTs.

Table 4.12 Demographic distribution according to race

Variable		Frequency	Percentage
Race	African	106	37.3
	Coloured	24	8.5
	Indian	7	2.5
	White	147	51.7

4.2.1.4 Language

The different variables relating to command of language were combined in a table to illustrate the frequency and percentage of each variable (Table 4.13).

Regarding the language of medical education, 129 students received their education in Afrikaans (45.6%), while 154 students received their education in English (54%). 107 Students (49.5%) received their Grade 12 education in Afrikaans, 101 (46.7%) received their education in English, 6 students (2.8%) received it in Sesotho and 1 student (0.5%) each in Swazi and Tswana (Table 4.13).

Table 4.13 Demographic distribution of the different facets of the languages used of the students

Variable		Frequency	Percentage
Language of medical education	Afrikaans	129	45.6
	English	154	54.4
Language of Grade 12 education	Afrikaans	107	49.5
	English	101	46.7
	Other languages	8	3.8
Home language	Afrikaans	149	52.7
	English	34	12.0
	Sesotho	37	13.1
	Tswana	24	8.5
	Xhosa	17	6.0
	Other languages	19	7.0

The home languages of the study group were represented by 13 languages: Afrikaans 149 (52.7%), Chinese 2 (0.7%), English 24 (12%), Herero 1 (0.35%), Malaysian 1 (0.35%), Mandarin 1 (0.35%), Sepedi 4 (1.41%), Russian 1 (0.35%), Sesotho 27 (13.1%), Tswana 24 (8.5%), Venda 24 (8.5%), Xhosa 17 (6%) and Zulu 8

(2.8%). Smaller groups of home languages were grouped as "other language" (Table 4.13).

4.2.1.5 Grade 12 country of origin

95.1% of students did their school education Grade 12 in South Africa (270 students), while 9 students came from Botswana (3.2%) and 5 students from Lesotho (1.8%) (Table 4.14). The country of origin variable was not further analysed as the students from SADEC countries were selected according to contracts with these countries.

Table 4.14 Country of origin of the Grade 12's

Variable		Frequency	Percentage
Country of Grade 12 school education	South Africa	270	95.1
	Botswana	9	3.2
	Lesotho	5	1.8

4.2.1.6 Tertiary studies prior to medical studies

The majority of the population group (172 and thus 77.1%) came straight from school without any form of tertiary education. Of the study group that had some form of tertiary education, 3 students (1.4%) partially completed a diploma, 3 students (1.4%) completed a diploma, 28 students (12.6%) partially completed a degree and 17 students (7.6%) completed a degree before entering medical school (Table 4.15).

Table 4.15 Demographic distribution of tertiary studies prior to medical studies

Variable		Frequency	Percentage
Tertiary studies completed before medical studies	Partially completed diploma	3	1.4
	Completed diploma	3	1.4
	Partially completed degree	28	12.6
	Completed degree	17	7.6
	No tertiary studies	172	77.1

Because the number of students who had some form of tertiary education was so small, these students were combined for analysis purposes.

4.2.2 Analysis relating to school information

4.2.2.1 School Poverty Quintile Index

Secondary schools are classified by the Department of Education into five groups, so-called Poverty Quintile Index groups. This grouping is done according to the average socio-economic status (SES) of the learners in the school (Van der Berg, 2006:7). The Group One schools are the lowest SES schools and Group Five, the highest (cf. 2.7.1.6, page 47).

The higher socio-economic schools (group 5) are well represented (152 students). Only 28 students came from a group 4 school, 32 students from a group 3 school, 9 students from a group 2 school and 8 students from a group 1 school. The students from private schools could not be categorised, as private schools include schools from all school poverty quintiles index groups. No categorisation of private schools exists. The School Poverty Quintiles Index groups of the schools of 31 of the students were not known (Figure 4.1).

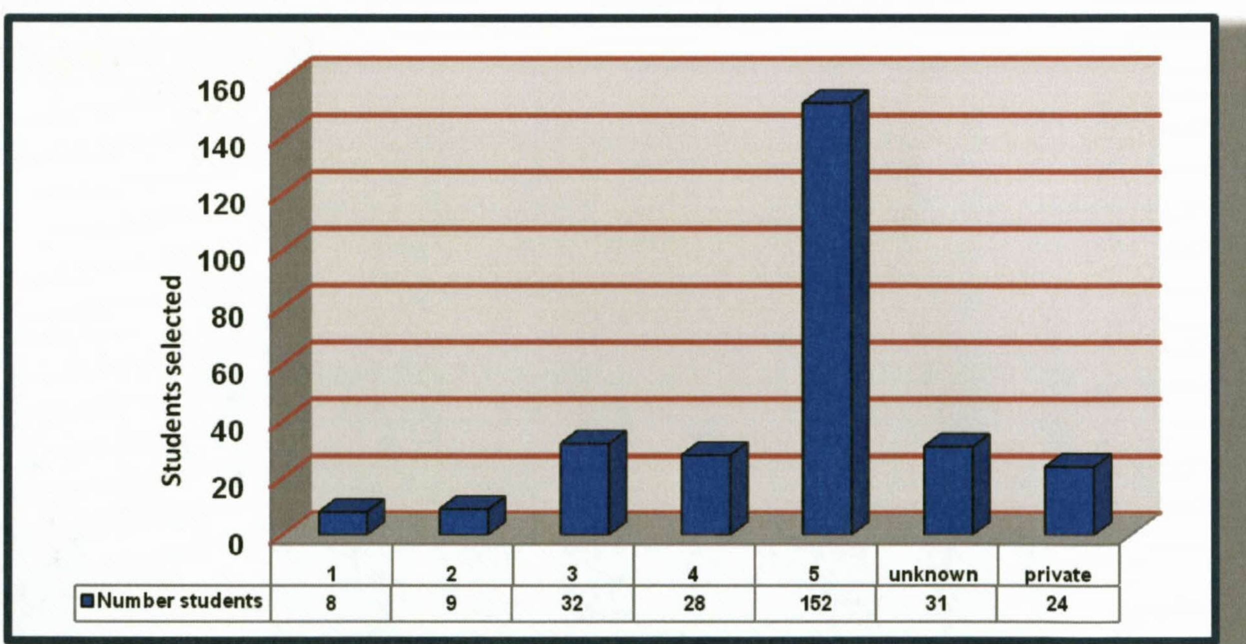


Figure 4.1 Distribution of the study group according to the School Poverty Quintile Index of their schools of origin

4.2.2.2 School marks

Of the 262 students with an available M-score, the mean value was 46.4 (inter-quartile range 41 – 50 and the range 21 – 78).

The data of the individual school marks were only available as symbols. Numbers were allocated to each symbol for the sake of the analysis. For an A symbol, an 8 was allocated, 7 for a B, 6 for a C, etc. The mean for the English was 7.1 (inter-quartile range of 6 – 8 and range 3 - 8), for the Mathematics it was 6.8 (inter-quartile range of 6 – 8 and range 1 - 8), for the Science it was 6.7 (inter-quartile range of 6 – 8 and range 1 - 8) and for the Biology it was 7.2 (inter-quartile range of 7 – 8 and range 2 - 8). The M-score was slightly positively skewed, while the four school subjects were negatively skewed (Table 4.16). These four school subjects are the subjects regarded as cognate to the study of Medicine. It will be called from now on as the 'preferred' subjects.

The M-score was calculated by the UFS using the marks of all the school subjects. Because not all students took the same subjects at school, the average of the four subjects regarded as cognate to the study of Medicine was taken as one of the variables.

Table 4.16 Distribution of the school marks of the study group during Grade 12 year

Variable	N	Mean	SD	Min	P25	P50	P75	Max	Skewness	Kurtosis
M-score	262	46.4	9.6	21	41	47	50	78	.23	3.9
English	265	7.1	1.1	3	6	7	8	8	-1.2	3.9
Mathematics	263	6.8	1.5	1	6	7	8	8	-1.4	5.2
Science	258	6.7	1.6	1	6	7	8	8	-1.4	4.5
Biology	251	7.2	1.2	2	7	8	8	8	-1.6	5.4
Average of preferred subjects	241	6.9	1.3	1.7	6	7.3	8	8	-1.3	4.4
Average Science subjects	239	7.0	1.1	2.5	6.3	7.5	8	8	-1.19	3.9

4.2.3 Health Sciences Placement Tests

Because the HSPTs were not compulsory, only 167 of the 284 students wrote these tests. The mean value for the PTEEP was 58.2% (inter-quartile range of 51.6% - 68.2% and range 15.6% - 85.5%); for the MACH it was 66.7% (inter-quartile range of 49.1% - 83.9% and range 6.5% - 100%); for the MCOM it was 59.9% (inter-quartile range of 46.9% - 74% and range 16.1% - 97.8%); and for the SRT it was 53.7% (inter-quartile range of 43.5% - 66.1% and range 18.4% - 88.7%). The data of the different tests were all slightly negatively skewed (Table 4.17).

Table 4.17 Distribution of the Health Sciences Placement Tests

Variable	N	Mean	SD	Min	P25	P50	P75	Max	Skewness	Kurtosis
PTEEP	167	58.2	14.3	15.6	51.6	61.5	68.2	85.5	-.8	2.9
MACH	167	66.7	20.0	6.5	49.1	70.9	83.9	100	-.59	2.7
MCOM	167	59.9	17.6	16.1	46.9	61.7	74.0	97.8	-.33	2.4
SRT	167	53.7	14.5	18.4	43.5	53.2	66.1	88.7	-.21	2.5

The writing of the HSPTs was not compulsory as a requirement for selection, resulting in missing data of these tests. A new sample group thus only consisted of students who wrote the HSPTs (cf. 7.3.2, page 147), however, these data can still be extrapolated to the general student pool.

4.2.4 Outcome variables

Of the 284 students that formed the sample for the study during their first year, only 266 students progressed to the second year of study without failing.

The first year average and second year average were used as dependent variables. The researcher assumed that the first and second year averages were good indications of the student's ability to pass the first and second year, after looking at combinations of variables that could influence academic performance. It was valuable to use a score that would give a close indication of pass or fail. The first and second year averages were chosen as the variables to indicate success.

During the first year, the mean of the outcome of the first year average results was 68.2% (inter-quartile range of 62.6 - 74.7% and range 37.7 – 85.8%) and during the second year the mean of the outcome of the second year average results was 64.5% (inter-quartile range of 58.8% - 72.4% and range 4.2% - 87.8%). (First and second year average refers to the simple average of all the modules during that year.) Scores on both the first year and second years were negatively skewed (Table 4.18).

Table 4.18 Distribution of the outcome variables of the study

Variable	N	Mean	SD	Min	p25	p50	p75	Max	Skewness
First Year Average	284	68.2	8.7	37.7	62.6	69.3	74.7	85.8	-.48
Second Year Average	266	64.5	13	4.2	58.8	66.1	72.4	87.8	-1.5

4.3 CORRELATION COEFFICIENTS

Different types of analyses were done in this study (correlations, simple linear regression and multiple regression), because each type of analysis had certain strengths and weaknesses and resulted in different conclusions that could be made (cf. 4.4, page 106 and 4.5, page 109).

In this study, the correlation coefficient (Pearson) was calculated to determine the degree to which different variables changed together (Beaglehole *et al.* 1993:67) or in other words to allow the researcher to make a prediction about one variable, based on what we know about another variable. This kind of analysis was very useful since it was able to indicate a predictive relationship that could be exploited further.

The disadvantage about this type of analysis was that correlations indicated that two variables were related, but it could not measure whether the one caused the other (Beaglehole *et al.* 1993:67). It could also not predict the influence on the coefficient of the other variable and did not incorporate the influence of other confounding variables. Correlations were done between most of the variables.

4.3.1 Correlation coefficient between the first and second year average, M-score and school subjects and School Poverty Quintile index

As one would have expected, a strong correlation (0.76) between the first and second year average existed, because students that did academically well during the first year would automatically also be successful during the second year (Table 4.19).

Table 4.19 Correlation coefficient between the first and second year average, M-score and school subjects (English, Mathematics, Science and Biology).

	1st year average	2nd year average	M-score	English	Mathe-matics	Science	Biology
1st year average	1.0 **284**						
2nd year average	0.76 **266**	1.0 **266**					
M-score	0.44 **262**	0.35 **247**	1.0 **262**				
English	0.35 **265**	0.28 **250**	0.67 **259**	1.0 **265**			
Mathematics	0.39 **263**	0.33 **249**	0.65 **256**	0.55 **261**	1.0 **263**		
Science	0.46 **258**	0.43 **243**	0.69 **252**	0.61 **256**	0.81 **256**	1.0 **258**	
Biology	0.45 **251**	0.39 **237**	0.69 **244**	0.71 **249**	0.67 **247**	0.76 **243**	1.0 **251**
School poverty Quintile index	0.22 **260**	0.28 **245**					

Often students who did extremely well in one subject, would also be successful in his other school subjects. The school subjects regarded as cognate to the study of Medicine, Science (0.46) and Biology (0.45) seemed to be the strongest predictors for success in the first year, and Science (0.43) for success in the second year (Table 4.19).

4.3.2 Correlation coefficient between the first and second year average, Health Science Placement Tests and age

Of the HSPTs, the MCOM seemed to have the strongest association with first year average (0.44), followed by the PTEEP (0.41) and MACH (0.40). The second year average correlated strongest with the SRT (0.35), followed by the correlation of 0.33 of the PTEEP and MCOM (Table 4.20).

Table 4.20 Correlation coefficient between the first and second year average, HSPTs and age

	1st year average	**2nd year average**	**PTEEP%**	**MACH%**	**MCOM%**	**SRT%**	**Age**
1st year average	1.0 **284**						
2nd year average	0.77 **266**	1.0 **266**					
PTEEP%	0.41 **167**	0.33 **157**	1.0 **167**				
MACH%	0.40 **167**	0.27 **157**	0.40 **167**	1.0 **167**			
MCOM%	0.44 **167**	0.33 **157**	0.53 **167**	0.71 **167**	1.0 **157**		
SRT%	0.38 **167**	0.35 **157**	0.34 **167**	0.37 **167**	0.64 **167**	1.0 **167**	
Age	-0.006 **284**	-0.1 **266**	-0.26 **167**	-0.29 **167**	-0.26 **167**	-0.18 **167**	1.0 **284**

4.3.3 Correlation coefficients between the M-score, school marks and the Health Science Placement Tests (HSPTs)

The English school mark correlated strongest with the Biology mark (0.71) of the school marks and with the PTEEP test (0.51) of the HSPTs. The Mathematics school mark correlated strongest with the Science school mark (0.82) and with MACH (0.66) and MCOM (0.61). Biology school mark correlated strongest with the MCOM (0.54) (Table 4.21).

Table 4.21 Correlation coefficient between the school subjects, HSPTs and M-score

	M-score	English	Mathematics	Science	Biology	PTEEP%	MACH%	MCOM%	SRT%
M-score	1.0 **262**								
English	0.67 **259**	1.0 **265**							
Mathematics	0.65 **256**	0.55 **261**	1.0 **263**						
Science	0.69 **252**	0.61 **256**	0.82 **258**	1.0 258					
Biology	0.69 **244**	0.71 **249**	0.67 **247**	0.76 **243**	1.0 **251**				
PTEEP%	0.53 **162**	0.51 **160**	0.37 **159**	0.51 **156**	0.41 **150**	1.0 **167**			
MACH%	0.48 **162**	0.36 **160**	0.66 **159**	0.57 **156**	0.48 **150**	0.39 **167**	1.0 **167**		
MCOM%	0.41 **162**	0.47 **160**	0.61 **159**	0.60 **156**	0.54 **150**	0.52 **167**	0.71 **167**	1.0 **167**	
SRT%	0.05 **162**	0.39 **160**	0.35 **159**	0.39 **156**	0.45 **150**	0.34 **167**	0.37 **167**	0.64 **167**	1.0 **167**

4.3.4 Correlation coefficients between the M-score, calculated average of Health Science Placement Tests (HSPTs), first year average and second year average, the average of the 4 preferred subjects and average of Science-related school subjects

The calculated average of the HSPTs gave a strong correlation with the first year average (0.51) and a moderate correlation with the second year average (0.39). The M-score correlated slightly less with the first year average (0.42) and second year average (0.37) when compared with the HSPTs calculated average (Table 4.22).

Both the average of the Science-related school subjects (Mathematics, Science and Biology) and the average of the 4 preferred subjects (English, Mathematics, Science and Biology) showed a slightly stronger correlation with the outcome of the first and second year, compared to the individual school marks. The correlation between the Science-related school subjects and first year outcome was 0.53 and the second year outcome 0.40. The correlation between the average of the 4 preferred school subjects and first year outcome was 0.53 and the second year outcome 0.41 (Table 4.22).

Table 4.22 Correlation coefficients between the M-score, calculated average of Health Science Placement Tests (HSPTs), first year average and second year average and the average of the 4 preferred subjects and average of Science-related school subjects

	M-score	**HSPTs average**	**First year average**	**Second year average**	**Preferred subjects school average**	**Science-related school subjects average**
M-score	1.0000					
HSPTs average	0.4658	1.0000				
First year average	0.4294	0.5139	1.0000			
Second year average	0.3750	0.3946	0.8049	1.0000		
Preferred subjects school average	0.6598	0.6768	0.5293	0.4085	1.000	
Science–related school subjects average	0.6474	0.6654	0.5288	0.4006	0.9860	1.000

4.4 SIMPLE LINEAR REGRESSIONS

According to Beaglehole *et al.* (1993:67), regression analysis can be thought of as finding the best mathematical model for predicting one variable with another. The most common form of regression is the simple linear regression where the mathematical model is in a straight line. Univariate linear regression was used to assess the relationship between each of the measured factors.

In this study, the linear regression analysis was done to explore the nature of the relationship between different variables. But in addition to the correlation analysis, the linear regression also enabled the researcher to investigate the change in one variable (response) which corresponded to a given change in the explanatory variable (Pagano & Gauvreau 2000:415). With this analysis, the researcher was able to predict the value of the response that was associated with a fixed value of the explanatory variable.

4.4.1 First year average

For every one year increase in age, the first year average decreased by 0.15%. But age was not significant in predicting first year average (p=0.911). R^2=0.00, explaining 0% of variation in the first year average mark (Table 4.23).

Females had a first year average of 3.12% more, compared to males. (P-value= 0.003 = statistically significant). The R^2 (0.0319) indicated that only ±3% of variation in the first year average mark could be explained by the variable gender.

For every mark increase in the calculated HSPTs average, the first year average increased by 0.331%. HSPTs calculated average was significant in predicting first year average (p=0.000). The R^2=0.263, indicated that 26.3% of variation in the first year average mark could be explained by the variable HSPT average (Table 4.23).

For every mark increase in the M-score, the first year average increased by 0.389%. M-score was significant in predicting first year average (p=0.000). The R^2=0.182, indicated that 18.2% of variation in the first year average mark could be explained by the variable M-score (Table 4.23).

For every category increase in the School Poverty Quintile Index score (cf. 2.7.1.6, page 47), the first year average increased by 2.759%. The School Poverty Quintile Index was significant in predicting first year average (p=0.000). The R^2=0.123 indicated that 12.3% of variation in the first year average mark could be explained by the variable School Poverty Quintile Index score (Table 4.23).

Table 4.23 Simple linear regression of first year average according to other independent variables

Variable	Coefficient	Standard error	t-value	p-value	95% Conf interval		R^2 - value
Age	-.015	.132	-0.11	0.911	-.275	.245	0.000
Female (1) comparing to Males (0)	3.12	1.022	3.05	0.003	1.106	5.133	0.032
White comparing to Black students	-0.76	.974	-8.99	0.000	-10.7	-6.83	0.244
HSPTs average	.331	.043	7.67	0.000	.246	.417	0.263
M-score	.389	.051	7.61	0.000	.289	.491	0.182
School Poverty Index	2.759	.489	5.64	0.000	1.795	3.723	0.123
Science-related school subjects	3.460	.400	8.65	0.000	2.673	4.250	0.238
Preferred 4 school subjects average	4.162	.449	9.26	0.000	3.276	5.047	0.265

For every mark increase in the Science-related subjects average, the first year average increased by 3.46%. The Science-related subjects average was significant in predicting first year average (p=0.000). The R^2=0.2384, indicated that 23.8% of variation in the first year average mark could be explained by the variable Science-related subjects (Table 4.23).

For every mark increase in the 4 preferred subjects average, the first year average increased by 4.16%. The 4 preferred school subjects average was significant in predicting first year average (p=0.000). The R^2=0.2656 indicated that 26.6% of variation in the first year average mark could be explained by the variable 4 preferred subjects (Table 4.23).

4.4.2 Second year average

For every one year increase in age, the second year average decreased by 0.328%. But age was not significant in predicting second year average (p=0.1). The R^2 (0.01) also indicated that only 1% of variation in the second year average mark could be explained by the variable age (Table 4.24).

For every mark increase in the calculated HSPTs average, the second year average increased by 0.422%. HSPTs calculated average was significant in predicting second year average (p=0.000). The R^2=0.157 indicated that 15.7% of variation in the second year average mark could be explained by the calculated HSPTs average (Table 4.24). The difference in test results (HSPTs) are because not all students passed the first year.

For every mark increase in the M-score, the second year average increased by 0.476%. M-score was significant in predicting second year average (p=0.000). The R^2= 0.122 indicated that 12.2% of variation in the second year average mark could be explained by the variable M-score (Table 4.24).

For every mark increase in the School Poverty Quintile Index score, the second year average increased by 3.946%. The School Poverty Quintile Index was significant in predicting second year average (p=0.000). The R^2=0.113, indicated that 11.3% of variation in the second year average mark could be explained by the variable School Poverty Quintile Index (Table 4.24).

For every mark increase in the Science-related subjects average, the second year average increased by 4.09%. The Science-related subjects average was significant in predicting second year average (p=0.000). The R^2=0.1671 indicated that 16.7% of variation in the second year average mark could be explained by the variable Science –related subjects (Table 4.24).

For every mark increase in the 4 preferred school subjects average, the second year average increased by 4.85%. The 4 preferred school subjects average was significant in predicting second year average (p=0.000). The R^2= 0.1785 indicated that 17.9% of variation in the second year average mark could be explained by the variable 4 preferred subjects average (Table 4.24).

Table 4.24 Simple linear regression of second year average according to other independent variables

Variable	Coefficient	Standard error	t-value	p-value	95% Confidence interval		R^2 - value
Age	-.328	.199	-1.65	0.100	-.721	.063	0.01
HSPTs average	.422	.079	5.36	0.000	.267	.578	0.157
M-score	.476	.081	5.84	0.000	.315	.636	0.122
School poverty index	3.946	.759	5.20	0.000	2.449	5.442	0.113
Science-related school subjects	4.086	.668	6.72	0.000	2.887	5.285	0.167
Preferred 4 school subjects average	4.851	0.697	6.96	0.000	3.477	6.225	0.178

4.5 MULTIPLE REGRESSION ANALYSIS

According to Katzenellenbogen *et al.* (1997:120), multiple regression analysis consists of a range of statistical techniques which, on the basis of mathematical models, can evaluate the inter-relationship of more than two variables. In this way influence of a variable can be determined if adjusted for the other variables.

The results of the linear regression analysis (cf. 4.4, page 106) were used to explore the nature of the relationship between two continuous variables. However, to be able to investigate the more complicated variables and the confounding effect of some of these variables, it was necessary to complete the study by using analysis known as multiple regression (Pagano & Gauvreau 2000:449).

After following a stepwise approach in analysis, the following 4 models seemed to be the strongest models according to the R^2 of the model. The models that were able to explain the highest variation in the first and second year average mark were selected.

4.5.1 Model 1: The relationship between the first year average mark and second year average mark independently and the M-score, PTEEP, MACH, MCOM and SRT test and the School Poverty Quintile Index

The M-score significantly (p= 0.00) predicted first year average mark adjusting for the MACH, MCOM and SRT tests as well as the School Poverty Quintile Index (estimating how the dependent variable, the M-score, changed while the independent variables, the MACH, MCOM and SRT, were held fixed). The first year average mark increased by 0.344 for a unit increase in M-score adjusting for the other variables in the model. The SRT test was significantly (p=0.001) associated with first year average mark adjusting for the other variables in the model. The first year average mark increased by 0.426 for every unit increase in School Poverty Quintile Index adjusting for the other variables in the model (Table 4.25).

Table 4.25 The relationship between the first year average mark, M-score, PTEEP, MACH, MCOM and SRT test and the School Poverty Quintile Index

Variable	Coefficient	Standard error	t-value	p-value	95% Confidence interval	
M-score	.344	.082	4.19	0.000	.182	.506
PTEEP	.051	.052	0.97	0.333	-.053	.155
MACH	.030	.043	0.72	0.475	-.054	.115

MCOM	.006	.058	0.10	0.924	-.109	.120
SRT	.175	.052	3.35	0.001	.072	.278
School Poverty Quintile Index	.426	.519	0.82	0.414	-.601	1.453
R^2	**0.3499**					

The R^2 for this model was 0.3499, meaning that these findings explained 34.99% of variation in the first year average mark.

A similar model, applying to the influences of the second year average marks had a high R^2 (0.6473), yet none of the individual variables had a significant statistical prediction of the second year average mark if adjusted for the other variables in the model (Table 4.26).

Table 4.26 The relationship between the second year average mark, M-score, PTEEP, MACH, MCOM and SRT test and the School Poverty Quintile Index

Variable	Coefficient	Standard error	t-value	p-value	95% Conf interval	
M-score	.141	.104	1.35	0.178	-.065	.346
PTEEP	.001	.065	0.01	0.995	-.128	.128
MACH	-.026	.052	-0.50	0.620	-.129	.077
MCOM	-.080	.072	-1.12	0.266	-.222	.062
SRT	.1	.066	1.51	0.133	-.031	.231
School Poverty Quintile Index	-1.017	.641	-1.59	0.115	-2.283	.249
R^2	**0. 6473**					

4.5.2 Model 2: The relationship between the first year average mark and second year average mark independently and the English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index

The Mathematics mark at high school significantly (p= 0.044) predicted first year average mark adjusting for the English score, Mathematics score, Science score, Biology score at high school, the MACH, MCOM and SRT tests as well as the School Poverty Quintile Index.

The first year average mark decreased by 2.07 for a unit increase in Mathematics score adjusting for the other variables in the model. The Science school mark was significantly ($p=0.001$) associated with first year average mark adjusting for the other variables in the model. The first year average mark increased by 3.422 for every unit increase in the Science school mark adjusting for the other variables in the model (Table 4.27).

The R^2 for this model was 0.4016, meaning that these findings explained 40.16% of variation in the first year average mark.

Table 4.27 The relationship between the first year average mark, English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index

Variable	**Coefficient**	**Standard error**	**t-value**	**p-value**	**95% Confidence interval**	
English	0.630	1.042	0.60	0.546	-1.430	2.691
Mathematics	-2.070	1.017	-2.04	0.044	-4.081	-.059
Science	3.422	.993	3.45	0.001	1.459	5.386
Biology	1.458	1.100	1.32	0.187	-.718	3.633
PTEEP	.036	.055	0.66	0.514	-.072	.145
MACH	.081	.046	1.76	0.081	-.010	.173
MCOM	-.029	.063	-0.45	0.650	-.153	.096
SRT	.061	.055	1.13	0.262	-.046	.169
School Poverty Quintile Index	.359	.538	0.67	0.506	-.704	1.421
R^2	**0.4016**					

4.5.3 Model 3: The relationship between the second year average and first year average mark, the English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index

The first year average mark significantly ($p < 0.001$) predicted second year average mark adjusting for English score, Mathematics score, Science score, Biology score at high school and the School Poverty Quintile Index as well as MACH, MCOM and SRT tests. The second year average mark increased by 1.429 for a unit increase in first year average mark adjusting for the other variables in the model. The School Poverty Quintile Index was significantly ($p=0.03$) associated with second year average mark adjusting for the other variables in the model. The second year average mark decreased by 1.377 for every unit increase in School Poverty Quintile Index adjusting for the other variables in the model (Table 4.28). The R^2 for this model is 0.6996, meaning that these findings explained 69.96% of variation in the second year average mark (cf. 5.4.2, page 130)

Table 4.28 The relationship between the second year average mark and the first year average mark, English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index

Variable	**Coefficient**	**Standard error**	**t-value**	**p-value**	**95% Confidence interval**	
First year average mark	1.429	.106	13.47	0.000	1.219	1.639
English	.866	1.205	0.72	0.474	-1.519	3.252
Mathematics	-1.889	1.216	-1.55	0.123	-4.296	.518
Science	1.766	1.203	1.47	0.144	-.614	4.147
Biology	-.839	1.264	-0.66	0.508	-3.342	1.663
PTEEP	.015	.063	0.24	0.813	-.11	.14
MACH	.0146	.053	0.27	0.784	-.09	.12
MCOM	-.099	.073	-1.36	0.175	-.244	.045
SRT	.078	.063	1.23	0.22	-.047	.203
School Poverty Quintile Index	-1.376	.626	-2.2	0.03	-2.617	-.136
R^2	**0.6996**					

4.5.4 Model 4: The relationship between the first and second year average independently and the age of the student, the English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index

The age of the student significantly (p=0.000) predicted first year average mark adjusting for English score, Mathematics score, Science score, Biology score at high school and the School Poverty Quintile Index as well as MACH, MCOM and SRT tests. First year average mark increased by 1.656 for a unit increase in age adjusting for the other variables in the model. The school Science mark was significantly (p=0.000) associated with first year average mark adjusting for the other variables in the model. The second year average mark increased by 3.826 for every unit increase in school Science mark adjusting for the other variables in the model (Table 4.29). The R^2 for this model was 0.5031, meaning that these findings explain 50.31% of variation in the first year average mark (cf. 5.4.2, page 130).

Table 4.29 The relationship between the first year average mark, the age of the student, the English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index

Variable	Coefficient	Standard error	t-value	p-value	95% Confidence interval	
Age	1.656	.316	5.23	0.000	1.03	2.283
English	1.61	.971	1.66	0.1	-.31	3.53
Mathematics	-.748	.963	-0.78	0.439	-2.654	1.157
Science	3.826	.911	4.20	0.000	2.023	5.629
Biology	.96	1.01	0.95	0.344	-1.038	2.959
PTEEP	.036	.05	0.73	0.466	-.062	.136
MACH	.068	.042	1.60	0.112	-.016	.152
MCOM	-.050	.057	-0.88	0.382	-.164	.063
SRT	.062	.049	1.26	0.211	-.035	.161
School Poverty Quintile Index	.18	.492	0.37	0.714	-.794	1.155
R^2	**0.5031**					

The first year average mark significantly ($p < 0.000$) predicted second year average mark adjusting for age, English score, Mathematics score, Science score, Biology score at high school and the School Poverty Quintile Index as well as MACH, MCOM and SRT tests. Second year average mark increased by 1.425 for a unit increase in first year average mark adjusting for the other variables in the model. The School Poverty Quintile Index was significantly ($p=0.03$) associated with second year average mark adjusting for the other variables in the model. The second year average mark decreased by 1.379 for every unit increase in School Poverty Quintile Index adjusting for the other variables in the model (Table 4.30). This finding might be associated with the fact that school performance had a lesser effect on medical school performance as the student progressed in their studies.

The R^2 for this model is 0.6996, meaning that these findings explained 69.96% of variation in the first year average mark.

Table 4.30 The relationship between the second year average mark and the first year average mark, age, English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index

Variable	Coefficient	Standard error	t-value	p-value	95% Confidence interval	
First year average mark	1.425	.115	12.32	0.000	1.196	1.654
Age	.038	.433	0.09	0.93	-.82	.896
English	.891	1.243	0.72	0.475	-1.57	3.353
Mathematics	-1.86	1.263	-1.47	0.143	-4.361	.64
Science	1.78	1.229	1.45	0.149	-.645	4.219
Biology	-.846	1.272	-0.67	0.507	-3.364	1.671
PTEEP	.015	.063	0.24	0.814	-.11	.14
MACH	.014	.053	0.28	0.783	-.091	.12
MCOM	-.1	.073	-1.36	0.177	-.246	.045
SRT	.078	.063	1.23	0.221	-.047	.204
School Poverty Quintile Index	-1.379	.629	-2.19	0.03	-2.625	-.132
R^2	**0.6996**					

4.5.5 Model 5: The relationship between the first year average and the calculated HSPTs average, The Science-related school subjects average and previous tertiary education

The calculated average of the HSPTs significantly (p=0.014) predicted first year average mark adjusting for Science-related school subjects average and previous education. The first year average mark increased by 0.131 for every unit increase in the HSPTs' average adjusting for the other variables in the model. The Science-related school subjects average mark was significantly (p=0.000) associated with first year average mark adjusting for the other variables in the model. The first year average mark increased by 2.925 for every unit increase in Science-related school subjects average adjusting for the other variables in the model. Previous tertiary education significantly (p=0.042) predicted first year average adjusting for the other variables in the model. The first year average decreased by 2.269 marks (adjusting for other variables in the model), if the student completed some form of previous tertiary education in the past (Table 4.31).

The R^2 for this model is 0.3577, meaning that these findings explained 35.77% of variation in the first year average mark.

Table 4.31 The relationship between the first year average mark, the calculated average of HSPTs, the Science-related school subjects average, age and previous tertiary education

Variable	**Coefficient**	**Standard error**	**t-value**	**p-value**	**95% Confidence interval**	
Calculated HSPTs average	.131	.052	2.50	0.014	.027	.235
Science-related school subjects average	2.925	.667	4.38	0.000	1.603	4.246
Age	1.106	.384	2.88	0.005	.345	1.867
Previous tertiary education	-2.629	1.279	-2.06	0.042	-5.162	-.096
R^2	**0.3577**					

A discussion of the models will follow in 5.4.2 (page 130).

4.6 CONCLUSION

In this chapter the results of the study were summarised under the headings of descriptive analysis, correlation coefficients, simple linear regressions and multiple regressions. These different approaches to analysis of data were crucial in evaluating the different influences of the variables and the conclusions that could be drawn from it. It sometimes led to what seemed to be conflicting results, but looking at the overall picture and evaluating the results according to the type of analysis and ensuring the actual meaning of the result in the background of the type of analysis done, some very valuable results were shown (see discussions in chapter 5, page 118).

The next chapter, Chapter 5, entitled "Discussion of research results", provides a discussion of the research results in chapter 4, and compares the findings and theories in literature.

CHAPTER 5

DISCUSSION OF THE RESEARCH RESULTS

5.1 INTRODUCTION

The aim of this study was to assess the relationship between the selection criteria for medical students and the marks they obtained at the end of their first and second years of medical study at the UFS.

The researcher has endeavoured to assimilate a comprehensive literature survey on a variety of factors that are important when selecting medical students (cf. chapter 2, page 17). With the discussion of the research findings in this chapter the researcher linked some of the research findings to the applicable literature.

5.2 DISCUSSION OF INDIVIDUAL FACTORS

5.2.1 Demographic and socio-economic factors

5.2.1.1 Gender

Ferguson *et al.* (2002: 953) and Cohen-Schotanus *et al.* (2006: 1012) claimed that female students were more likely to achieve academically in medical school. This argument was strengthened by the findings of Haist, Wilson, Elam, Blue and Fosson (2000:203) and Yates, Smith, James and Ferguson (2009:5).

Similar results were found in this study. Female students had a significant first year average of 3.12% more marks (P-value = 0.003) than their male counterparts. (R^2 was 0.0319). This only explained ±3% of variation in the first year average mark. The R^2 was very small and future bigger studies might result in bigger R^2–values and more reliable results.

In spite of this significant finding regarding gender, this variable was not incorporated into any of the multiple regression models because of the recommendations in the Selection Policy of the Medical School of the University of the Free State (cf. 4.2.1.2, page 95) regarding equal selection of males and females (UFS: 2009) (cf. 6.5.1.1, page 137).

5.2.1.2 Age

The majority of students were from the younger age groups (the mean average of their age was 19.4 with inter-quartile range of 18 – 18 and the range 16 - 43).

Increased age correlated negatively toward first year average (-0.006), second year average (-0.1), PTEEP test (-0.26), MACH test (-0.29), MCOM test (-0.26) and the SRT test (-0.18). Yates *et al.* (2009:5) and Parker (1993:747) demonstrated similar findings in their studies where superior performance over the medical course was predicted by younger age. One should however take into consideration that the correlation analysis indicated that age and first year performance were related (cf. 4.3), but it could not measure whether the increased age caused poorer performance during first and second year (Beaglehole, Bonita, & Kjellström 1993:67). One should also take into consideration that there were very few older students, which made the results less reliable. None of the confounding factors were taken into consideration.

Age was not significant in predicting the final first year average mark (p=0.911) or second year average mark (p=0.1) using a simple linear regression model in this study, yet in the study by Haist *et al.* (2000:179) it was shown that the combination of age and female gender, showed a significant prediction of higher score in the Wilson Academic Performance test, both in theory and in clinical work. (The Wilson academic performance scale score was developed to assess both excellent and poor performance in medical school. This scale included first-, second-, and third-year medical school grade-point-averages and components of the United States Medical Licensing examination.)

In one of the multiple regression models (model 4) – where the relationship between the first and second year average independently and the age of the student, the individual school subjects, the HSPTs and the School Poverty Quintile Index were compared - the age of the student significantly (p=0.000) predicted first year average mark adjusting for English score, Mathematics score, Science score, Biology score at high school and the School Poverty Quintile Index as well as MACH, MCOM and SRT tests (cf. 4.5.4, page 114). The first year average mark increased by 1.656% for every unit increase in age adjusting for the other variables in the model.

A similar model, relating to second year marks, showed that age did not significantly predict (p=0.93) the second year average mark, if adjusted for the other variables in the model. This finding might be due to the fact that the variables that were related to success during the first year of study, might not have an influence (or reduced influence) in the following years. One would expect that as the student progressed with his/her studies, the factors that initially influenced success in the first year, would phase out because of other factors that become important in success.

Using a multiple regression model, adjusted for the calculated HSPTs average, the Science-related school subjects average and previous tertiary education, the first year average mark increased by 1.106 for every year increase in age (p=0.005), explaining 35.77% of variation in the first year average mark (R^2=0.3577). Taking into consideration that the majority of students were between 18 and 19 years old (cf. 4.2.1.1, page 95), it would be wise to do a bigger study over many years in future with a larger component of older students.

Because the confounding effect of some of these variables (age of the student, the individual school subjects, the individual HSPTs and the School Poverty Quintile Index in the first mentioned multiple regression model and calculated HSPTs average, the Science-related school subjects average and previous tertiary education in the second example) were adjusted (were fixed in the multiple regression models), the outcome of the multiple regression analysis (cf. 4.5, page 109) gave the impression of being the opposite finding of the correlation analysis.

5.2.1.3 Previous tertiary education

De Clercq, Pearson and Rolfe (2001:417) performed a study at the Newcastle university in Australia and found that certain students with previous successfully completed tertiary study e.g. students with a nursing and arts background, were significantly more likely to receive a "not satisfactory" assessment at the end of their studies. Contrary to the findings of the study of De Clerq *et al.* (2001:417), the findings of Rolfe, Ringland and Pearson (2004:778) indicated that there was no clear advantage, at least on the outcomes measured in their study, to limiting medical school entry to either those candidates from secondary school or those with tertiary backgrounds.

The findings of this study indicated that the majority of the population group (172 and thus 77.1%) entered medical school without any form of tertiary education (cf. table 3.1, page 75). Of the study group that had partially or completed tertiary education qualifications, three students (1.4%) had partially completed a diploma, three students (1.4%) had obtained a diploma, 28 students (12.6%) had partially completed a degree, and 17 students (7.6%) had completed a degree before entering medical school. As the sample sizes of the students who had either partially completed or completed a prior diploma or a degree were so small, they were combined into one group. The study group were then divided by those with prior exposure to tertiary education and those who had entered medical school without any exposure to tertiary studies.

The findings of this study revealed a weak negative correlation between acquisition of previous tertiary studies and the first year average mark (-0.03) as well as the second year average mark (-0.13).

This finding was complemented by one of the multiple regression models of this study where the relationship between the first year average and the calculated HSPTs average, the Science-related school subjects' average and previous tertiary education was investigated. It was found that previous tertiary education significantly (p=0.042) predicted first year average (if adjusted for the other variables in the model). The first year average will decrease by 2.269 marks if the student was exposed to some form of previous tertiary education in the past (R^2 for this model is 0.3577, meaning that these findings explain 35.77% of variation in the first year average mark).

5.2.1.4 Race

Ferguson *et al.* (2002:953) claimed that White students are associated with higher achievement in medical school, and also cited evidence that, in the USA (Charatan, 2001:1563) and the UK (McManus *et al.*, 2008b:2), Black students were more likely to fail an examination. Nettles and Nettles (1999:2) added that they found higher admission test scores on standardised tests for the White and Asian participants as compared to the Black participants.

In this study with a simple linear regression, looking at the relationship between the first year average mark and the race of the student, it was found that the Black students had an average of 8.76% less than White students (P-value=0.0) and Coloured students had an average of 8.51% less than White students (P-value=0.0). The R-square value of 0.2441 of the finding indicated that ±24.4% of variation in the first year average mark could be explained by the variable of race (cf. Table 4.23, page 107).

Similar findings were found in this study when a multiple regression model was adjusted for tertiary education and gender: Black students achieved an average of 6.78% less than Whites (P-value=0.0) and Coloured students had a first year average mark of 6.53% less than Whites (P-value=0.0). A R-squared value of 0.2707 means that these findings explain ±27% of variation in the first year average mark.

All the different approaches to analysis showed similar findings regarding the influence of race, but each one had to be seen in the light of what that specific approach meant (cf. 4.3 page 101, 4.4 page 106 and 4.5 page 109).

5.2.1.5 School Poverty Quintile Index

Studies conducted by Van der Berg (2006:3) for the Department of Economics (University of Stellenbosch) and the Bureau for Economic Research in South Africa, found that educational outcome in schools was linked to socio-economic status (SES), pupil and teacher characteristics and school resources (cf. 2.7.1.6, page 47). These findings were confirmed in this study with the simple linear regression analysis where it was found that for every mark increase in the School Poverty Quintile Index score, the first year average increased by 2.759%. The School Poverty Quintile Index was significant in predicting the first year average mark (p=0.000). The R^2 of 0.123 explained 12.3% of variation in the first year average mark, which might not be that significant because of the contribution it makes to variation, but still is of conceptual significance and important as a contributor to success in the first year.

The correlation model (Table 4.19, page 102) showed a very weak positive correlation between the School Poverty Quintile Index and both the first (0.22) and the second year average (0.28). In contrast to this a multiple regression model adjusting for the first year average mark, the English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs indicated that the School Poverty Quintile Index was significantly (p=0.03) associated with second year average mark. However, in this study the second year average mark decreased by 1.377 for every unit increase in School Poverty Quintile Index (adjusting for the other variables in the model). The R^2 for this model was 0.6996, meaning that these findings explained 69.96% of variation in the second year average mark. Again this might be due to the fact that factors that strongly influenced the first year average has less effects on the following senior years. One would expect that the student had by the end of the first year overcome the backlogs due to poor schooling systems.

5.2.2 School marks vs. selection tests

An Admission Trends Survey conducted by the National Association for College Admission Counselling (NACAC), indicated that the GPA and the class rank were the most important indicators for predicting success in tertiary training (Zwick, 2007:10). Over the past few years the use of standardised admission tests have become an important factor in undergraduate admissions internationally and also one of the most debated themes in medical education in recent years (Zwick, 2007:2).

In this study the average of the HSPTs correlated stronger with the first year and second year average than the M-score, traditionally used as part of the selection criteria UFS (2011(a):7). However, the average of the 4 preferred subjects (Mathematics, Science, Biology and English) correlated even better with the outcome of the first and second year than the average of the HSPTs (table 5.1 and figure 5.1). The M-score was calculated from all the subjects that a student wrote during their Grade 12 year at school. Because the students did not all take the same subjects the M-score could not be used as a universal indictor of success. Using the average of 4 subjects (Mathematics, Science, Biology and English) was more reliable as all students are placed on par (cf. 4.2.2.2, page 99) during evaluation. These four subjects were also regarded as cognate to the study of Medicine. This average mark also correlated much better with the progress of the first and second year compared than the use of the M-score (Table 5.1 and Figure 5.1).

Comparing the components of the HSPTs and the individual subjects of Grade 12, there seemed to be a stronger correlation of the individual components of the HSPTs compared with the matching school subject to the success of the first and second year: The PTEEP correlated better with the first and second year average compared to the English Grade 12 mark and the MACH and the MCOM test correlated better with the first and second year average compared to the mathematics mark. (Although these HSPTs are not the equivalence to the mentioned school subjects, the MACH and MCOM consist of components of Mathematics and the PTEEP test evaluates aspects of language proficiency.)

Table 5.1 The correlation of the Grade 12 marks and the HSPTs with first and second year average marks

	Grade 12 school marks							HSPTs				
	M-score	**Four preferred subjects**	**Science-related subjects**	**English**	**Mathematics**	**Science**	**Biology**	**Average HSPTs**	**PTEEP**	**MACH**	**MCOM**	**SRT**
First year average	0.44	0.53	0.41	0.35	0.39	0.46	0.45	0.51	0.41	0.4	0.44	4.38
Second year average	0.35	0.53	0.4	0.28	0.33	0.43	0.39	0.39	0.33	0.27	0.33	0.35

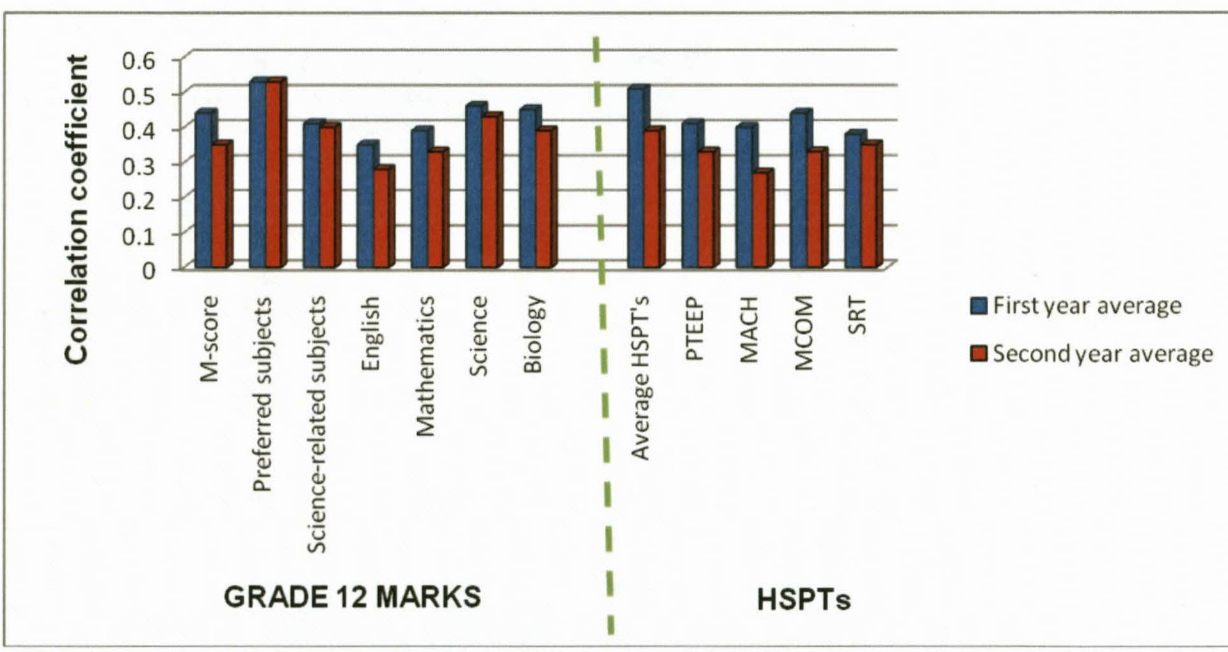


Figure 5.1 Comparing the Grade 12 marks' and the HSPTs' correlation to the first and second year average marks

Eiselen *et al.* (2007:38) described a study conducted at the University of Johannesburg, South Africa, where the importance of performance in Mathematical skills at secondary school level can serve as a predictor of success in the first semester of tertiary studies. However, in a multiple regression model in this study where the relationship between the first year average mark, English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index were investigated, it was found that, for every unit increase in Mathematics, the first year average would decrease by 2.07 marks (p=0.044) and, for every unit increase in the Science mark, the first year mark would increase by 3.42 marks (p=0.001), if adjusted for the other variables in this model. This finding was difficult to explain as one would expect that Mathematics and Science would strongly correlate and that both would have a positive influence on academic performance during the first two years.

5.3 CORRELATION MODEL

When evaluating the results of the correlation analysis, one must take into consideration that it only showed the degree to which the variables changed together and allowed a person to indicate a predictive relationship.

The average mark of the HSPTs and the average mark of the Grade 12 preferred subjects (English, Mathematics, Science and Biology) and the Science–related subjects were the three variables with the highest (strongly positive) correlation with the first year average mark, while the average of the 4 preferred subjects of Grade 12 was correlated best with the second year average mark (Figure 5.2).

The first year average mark correlated moderately with the PTEEP, MACH and MCOM of the HSPTs, the M-score, the Science-related subjects' average and the Science subject of Grade 12. Second year average mark correlated moderately with the Science-related subjects' average and the Science mark of Grade 12 (Figure 5.2).

The relationship between the PTEEP and success during the first two years of study as found in this study is in line with the findings of Stephen (2003:1) who stated that English language proficiency was a predictor of how first year students studying Human Resources Management at a university of technology in KwaZulu-Natal would fare.

A weak negative correlation was found between the age of the student and whether they had any tertiary education and both the first and second year average (Figure 5.2).

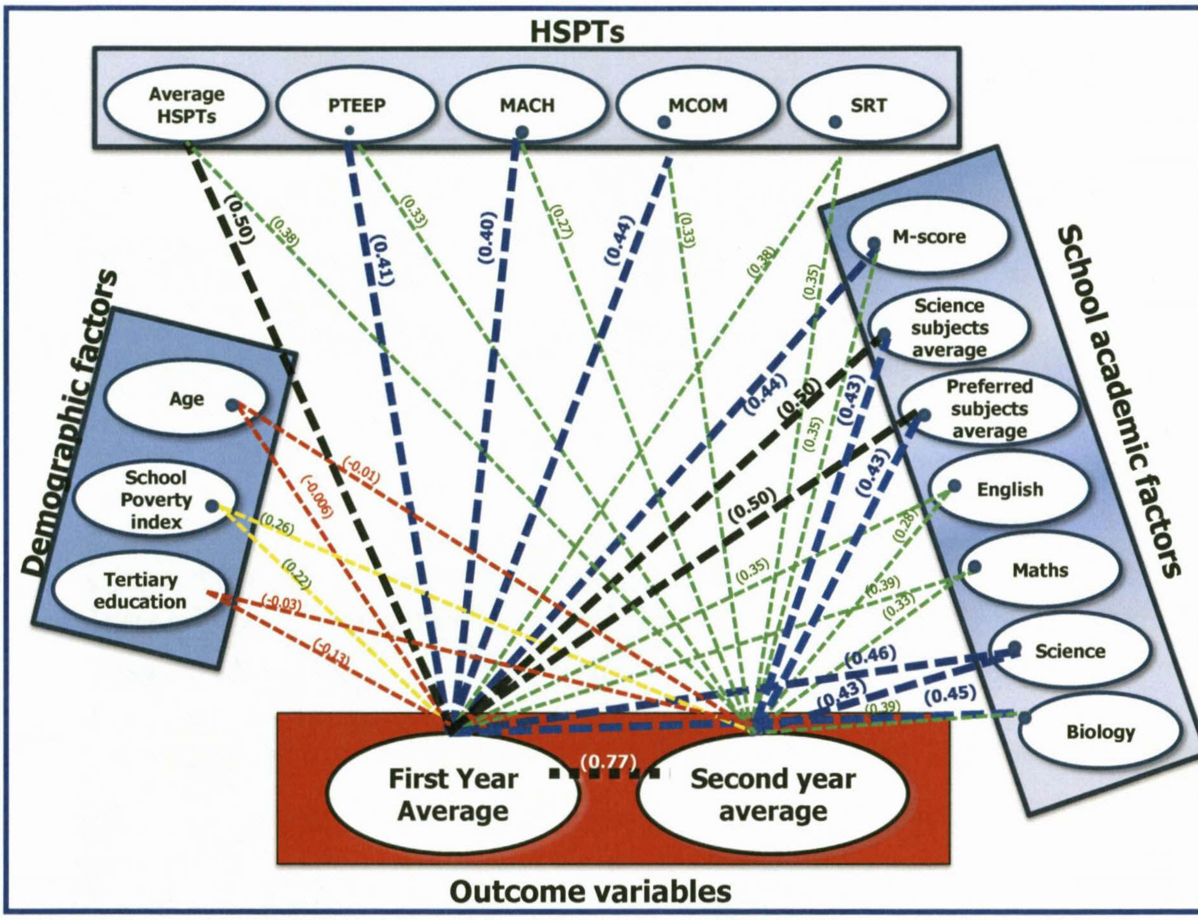


Figure 5.2 A model to summarise factors correlating to first and second year average marks. (This model was developed by the researcher, De Klerk, 2011 as part of the PhD research project.)

Colour coding:
- - - - - *Strong positive correlation (0.5-1);*
- - - - - *Moderate positive correlation (0.4-0.49)*
- - - - - *Moderate positive correlation (0.3-0.39)*
- - - - - *Poor positive correlation (0-0.29)*
- - - - - *Negative very poor correlation (- 0.29-0)*

The researcher created a table (Table 5.2) to be able to evaluate these correlations and to rank them from most influential to least influential in affecting the first and second year marks.

Table 5.2 Ranking the correlations of different variables with the final first and second year average marks

Strength of correlation	Variables influencing first year average mark	Variables influencing second year average mark
Strong positive correlation (0.5-1)	• HSPTs average • Grade 12 average mark for English, Mathematics, Science and Biology • Grade 12 average mark for Mathematics, Science and Biology	• First year average mark • Grade 12 average mark for English, Mathematics, Science and Biology
Moderate positive correlation (0.4-0.49)	• PTEEP • MACH • MCOM • M-score • Science (Grade 12) • Biology (Grade 12)	• Grade 12 average mark for Mathematics, Science and Biology • Science (Grade 12)
Moderate positive correlation (0.3 - 0.39)	• SRT • Mathematics (Grade 12) • English (Grade 12)	• HSPTs average • PTEEP • MACH • MCOM • SRT • M-score • English (Grade 12) • Mathematics (Grade 12) • Biology (Grade 12)
Poor positive correlation (0.0 - 0.29)	• School Poverty Quintile Index	• School Poverty Quintile Index
Very poor negative correlation (-0.29 - 0.00)	• Increased age • Previous tertiary education	• Increased age • Previous tertiary education

5.4 REGRESSION MODELS

5.4.1 Simple linear regressions

When ordered from highest to the lowest influence, the simple linear regressions for first year average mark indicated the influence of the following variables (Figure 5.3):

- Preferred 4 school subjects (English, Mathematics, Science and Biology) average mark (coefficient of 4.162, p-value 0.000 and R^2=0.265)
- Science-relating school subjects (Mathematics, Science and Biology) mark (coefficient of 3.460, p-value 0.000 and R^2=0.238)
- School Poverty Index (coefficient of 2.759, p-value 0.000 and R^2=0.123)

- M-score (coefficient of 0.389, p-value 0.000 and R^2=0.182)
- HSPTs average (coefficient of 0.331, p-value 0.000 and R^2=0.263)

The order from the highest to the lowest of the variables influencing the second year average using simple linear regressions was exactly the same as for the first year (Figure 5.3):

- Preferred 4 school subjects average (coefficient of 4.851, p-value 0.000 and R^2=0.178)
- Science-relating school subjects (coefficient of 4.086, p-value 0.000 and R^2=0.167)
- School Poverty Index (coefficient of 3.946, p-value 0.000 and R^2=0.113)
- M-score (coefficient of 0.476, p-value 0.000 and R^2=0.122)
- HSPTs average (coefficient of 0.422, p-value 0.000 and R^2=0.157)

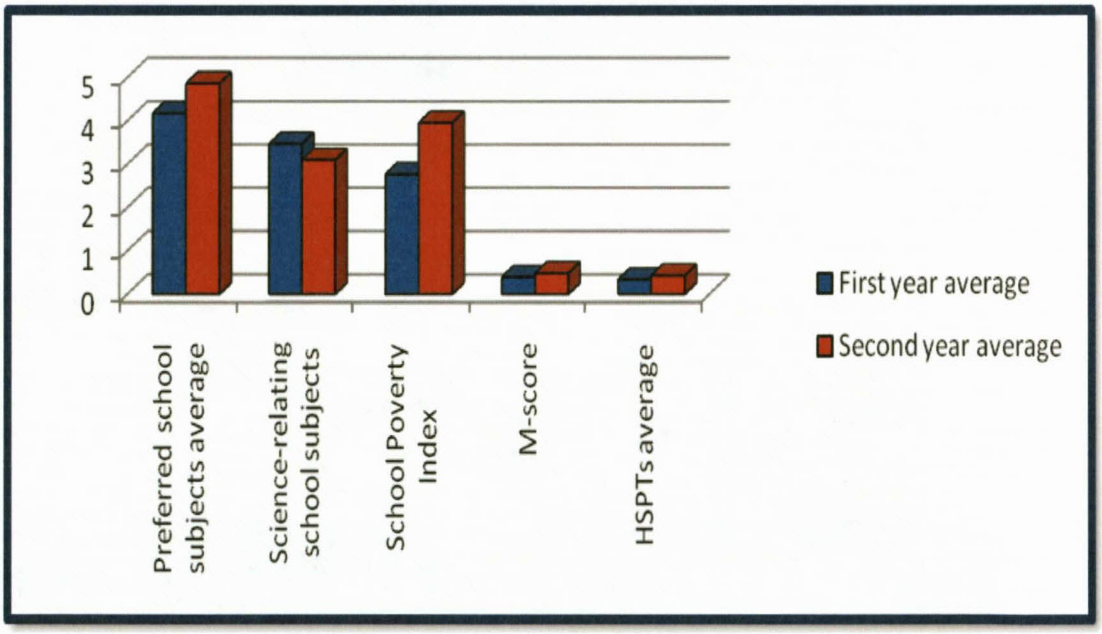


Figure 5.3 Comparison of the coefficients of the different variables influencing the first and second year average marks using simple linear regression

By merely looking at the simple linear regression (Figure 5.3), one can evaluate the effect that each of the individual variables have on the first and second year average. These results seemed to imply that the averages of the 4 school subjects, the

Science-related subjects and the School Poverty Quintile Index had the largest effect on the first and second year averages, whereas no confounding variables were taken into consideration.

5.4.2 Multiple regression models

By doing the multiple regression analysis, the predictors of dependent variables upon the outcome variable were tested, while the independent variables were held fixed. With the multiple regression models, there were certain individual variables that statistically significantly predicted first and second year average marks. These were discussed under the individual variables in this chapter (cf. 5.2, page 118).

The strongest models where the R^2 were the highest and thus explained the most variation of the first and second year average marks were models 3 and 4:

- Model 3 (cf. 4.5.3, page 113) evaluated the second year average and adjusting for first year average mark, the English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index (R^2=0.6996). Results of this model showed that only the School Poverty Quintile Index is significantly (p=0.03) associated with second year average mark.

  By including the first year average into this model, the R^2 were inflated but not reliable, because a student that did well in the first year would most probably also perform in the second year. Although this model explained a high variance of the second year average, it was not that significant and the first and second year average should rather be used in separate models.

- Model 4 (cf. 4.5.4, page 114) evaluated the relationship between the first and second year average marks independently and the age of the student, the English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty

Quintile Index. The R^2 for the first year average (adjusting for all the other variables in model) was 0.5031 and for the second year average 0.6996. The age and the Science school mark significantly predicted the first year in this model (adjusting for the other variables) and the School Poverty Quintile Index predicted the second year average (cf. 5.2.1, page 118).

Some of the P-values of individual variables were statistically not significant in this model, but still of conceptual significance. Part of the reason that they are not statistically significant was that approaches to regression search for dominant statistical effects – hence some statistical significant associations became reduced in importance. This model explained 50% variance of score in the first year and 70% variation of score in the second year as a result of a combination of these variables. Although some of the variables are not statistically significant, they were still influential as part of the model.

This model seemed to be the best fit model. In this study the researcher took a combination of factors that contributed to academic performance and from the analysis it was clear that the more variables were included, the more reliable or predictive the model was to determine how the student will do at the end of the first two years of study.

5.5 CONCLUSION

Different types of analysis were done to be able to make different conclusions. The application of different statistical approaches presents a case for the complementarity of data for use in selection models and approaches. After looking at the different types of analysis and evaluating what each of these findings meant, the researcher found the multiple regression models (and more specific model 4) to be the best to be used as an indicator for good performance during the first two years of study. This choice was based on the fact that the multiple regression models were able to predict the effect that the variable will have on the outcome, the size of the effect and then also will take into account the effects of other confounding variables.

In this chapter the results of the study were discussed. The next chapter, Chapter 6, will deal with "A critical appraisal of selection criteria and academic progression".

CHAPTER 6

A CRITICAL APPRAISAL OF SELECTION CRITERIA AND ACADEMIC PROGRESSION

"A fair admissions system should enable institutions to select students who are able to complete the course as judged by their achievements and their potential."
(Admissions to Higher Education Review group, 2004:7)

6.1 INTRODUCTION

Currently one of the biggest challenges for medical schools worldwide is to be able to select medical students with potential, using fair, valid and reliable criteria utilising good research practice as foundation (cf. 7.4, page 149). The results of this study should assist medical schools in achieving this goal.

6.2 A CRITICAL APPRAISAL OF THE INTERNATIONAL TRENDS OF SELECTION OF MEDICAL STUDENTS

Most medical schools in the world use a combination of one or more of the following areas: academic ability (school, under-graduate and graduate marks, and/or entrance exams), extracurricular interests, experience with regard to teamwork, leadership skills, and personality, with the emphasis on motivation for studying medicine (cf. 2.3.1, page 20).

Although the requirements for admission to medical schools in the USA and Canada vary from school to school, most of them include one or more of the following: minimum academic levels, performance in the MCAT or SATs, and interviews. Some schools use an 'open-door' policy (cf. 2.3.2, page 23). The factor common to all schools in the USA is the requirement for students to first complete a degree as part of their qualification, before applying to a medical school. This may be a good proposition should the University of the Free State consider following this model where the M.B., Ch. B.-degree is divided into a Basic Medical Science degree and a Clinical Medicine-degree. Another advantage of this model will be that students who drop-out during their senior years at least will be in possession of an initial degree. All the years they spent at University will not be wasted as the modules they have previously completed would be acknowledged.

Admission to UK medical schools occurs after having finished high school (cf. 2.3.4, page 25). The A-level is a major component of selection for the entry of school-leavers into UK medical schools. Most schools require at least 2 A's (or sometimes three) and one B. The researcher speculates whether this could apply to the South African school scenario where many high schools scholars' academic performance leaves much to be desired and not all SA schools seem to be on the same standard. Another big difference between the UK and the UFS School of Medicine exists where almost all of the applicants for one of the ethnic groups require A-grades for all their school subjects in order to be allowed into Medicine, yet in other selection groups a C-symbol would suffice. In the UK certain students are accepted to study medicine because of their good school results, while all borderline applicants are invited for an interview (cf. 2.3.4, page 25). Due to the limited resources at the University of the Free State it may be a good proposal to adapt this principle in future and select the students with full A's directly into the programme, but all the students with lower marks, especially in certain selection groups, be invited for interviews.

Admission to all medical schools in the Netherlands is determined by a national weighted lottery procedure (cf. 2.3.5, page 28). The politically motivated rationale behind the use of a lottery system was to provide equal access to medical education for all students meeting the given entry criteria, in other words, passing a final examination at the highest level of secondary education. Certain researchers found that students in Austria who were selected according to strict criteria had a much lower drop-out rate compared to students admitted by means of the lottery system (cf. 2.3.5, page 28). The researcher is of the opinion that at the UFS Medical School this kind of a selection system should not be adopted as the standards of high schools differ. Additionally if scholars' high grades results are thrown into the selection pool, the important issues such as fairness, equity, redress and democratisation will have to be ignored.

6.3 A CRITICAL APPRAISAL OF THE SOUTH AFRICAN TRENDS OF SELECTION

The eight South African medical schools each have their own unique way of selecting medical students. These criteria relate to academic and non-academic components (cf. 2.4, page 34).

Several South African authors expressed their concern about first year students' high failure rates (cf. 2.4, page 34). The results of this research project will assist medical schools in South Africa to select students who are more likely to complete their first two years of study.

The challenge facing South African medical schools is the selection of medical students in line with political and social changes of the country regarding the diversity of race and gender while including previously disadvantaged groups (cf. 2.4, page 34). This study (and other studies to follow in South Africa) will ensure students with the potential to be successful with their studies will be selected, enabling them to become competent doctors in time.

6.4 A CRITICAL APPRAISAL OF THE SELECTION OF THE MEDICAL STUDENTS AT THE UFS

The Selection Policy of the School of Medicine of the UFS states "A definite effort is made to accommodate candidates from disadvantaged backgrounds who have the necessary potential and reasonable ability to attain success in their course" (cf. 2.6.1, page 37). In contrast, according to the results of the initial years, it is mostly students from disadvantaged backgrounds who fail during the first two years of study each year. The researcher is of the opinion that this challenge can be overcome by selecting students on criteria according to the finding of this study and then even adding extra criteria (e.g. English language comprehension tests and interviews) for applicants with lower Grade 12 marks (cf. 6.2, page 134).

At present the medical school of the UFS is one of the very few medical schools who discriminate against students on the basis of gender. In the various selection groups, female candidates need to have achieved higher marks for entry into the UFS Medical School than their male counterparts (cf. 2.6.1, page 37 and 4.2.1.2, page 95 and 6.5.1.1, page 137). The majority of medical schools in South Africa select the best candidates, in spite of their gender (cf. discussion 6.5.1.1, page 137).

The Selection Policy of the School of Medicine of the UFS adheres to a principle where 12 selection points can be awarded for various aspects of leadership (cf. 2.6.2, page 37). This principle is unfair as leaders who attended a small rural school consisting of only 5 Grade 12 pupils will be compared to a large urban school with 300 pupils in Grade 12. No studies have been undertaken in South Africa to prove that leadership in school will guarantee success later on in medical school.

The researcher proposes that multiple factors should be taken into account in the selection of medical students, having the emphasis on the English, Mathematics, Physical Sciences and Life Sciences of the Grade 11 and 12 examination marks as well as the HSPTs scores (PTEEP, MACH, MCOM and SRT) (cf. 7.2, page 142). These HSPTs can be replaced by the NBT in future as the NBTs were developed from the HSPTs.

6.5 A CRITICAL APPRAISAL OF INDIVIDUAL FACTORS REGARDING THE SELECTION OF MEDICAL STUDENTS

6.5.1 Demographic and socio-economic factors

6.5.1.1 Gender

This study shows female students performed significantly better than their male counterparts during the first year of study (cf. 5.2.1.1, page 118). These findings were in line with the findings of several authors found in the pertinent literature (cf. 2.7.1.1, page 43 and 5.2.1.1, page 118).

Internationally there seems to be a trend for increasing numbers of women applying for Medicine, while the amount of male applicants is decreasing (cf. 2.7.1.1, page 43), resulting in female medical students in the majority worldwide. In spite of these findings, there still seems to be a horizontal segregation (concentration of women working in certain areas of hospitals) and a vertical segregation (women under-represented at higher levels of clinical or non-clinical management) of gender (cf. 2.7.1.1, page 43). At the University of the Free State, the Selection Policy of the Medical School of the University of the Free State (cf. 2.6.1, page 37 and 4.2.1.2, page 95) still prescribe an equal selection of males and females.

Taking into consideration the international trends of the increasing number of women in the medical profession and the results of this study and other studies, it may be the right time to reconsider the prescriptions of the Selection Policy of the Medical School of the UFS regarding gender. The best students applying for Medicine should be admitted regardless of their gender.

6.5.1.2 Age

The majority of students in this research were from the younger age groups. Although the study group was small, it became clear that increased age of students correlated negatively to their performance in the first and second year (cf. 5.2.1.2, page 119). Because the correlation is so small in this study and almost =0, it should not be taken into account when selecting medical students. According to the literature, findings indicated that superior performance was predicted by younger age group (cf. 5.2.1.2, page 119).

Paradoxically, evaluation using a multiple regression model (cf. 4.5.4, page 114), which was adjusted for other variables (including potential confounding variables), it was confirmed that the first year average mark increased with increasing age. If the confounding effect of some of these variables such as the age of the student, the individual school subjects, the individual HSPTs and the School Poverty Quintile Index in the first mentioned multiple regression model and calculated HSPTs average, the Science-related school subjects average and previous tertiary education in the second example were adjusted, the outcome of the multiple regression analysis gave the false impression of being the opposite finding of the correlation analysis.

6.5.1.3 Previous tertiary education

Sometimes senior students who had performed poorly at school later tried to enter medical school by acquiring alternative tertiary education qualifications. It was clear from the different analytical investigations (cf. 5.2.1.3, page 121) and from literature that students with previous tertiary education were less likely to achieve success. Therefore post-graduates should not be given the benefit of studying medicine above those not having any tertiary education. However, in this study consideration must be given to the small sample size of the students who completed tertiary training; this should be followed up by bigger studies.

6.5.1.4 Race

Race seemed to be a very strong predictor of performance according to the literature (cf. 2.7.1.2, page 44 and 5.2.1.4, page 122), but should not be used as a motivation for the changing of criteria for the selection process as it clashes with the principles in the Green paper on Higher Education such as equity, redress and democratisation; that are all important parts of the transformation process (RSADoE:1996).

The drive for greater access of students from disadvantaged backgrounds to higher education was evidenced in the UNESCO World Conference on Higher Education in 1998, where an emphasis was placed on equality of access (cf. 2.3.1, page 20). However, Akoojee and Nkomo (2007:358) agreed with the challenge facing the Medical School of the Free State by accentuating the fact that access is not only measured by participation, but also by success!

6.5.1.5 School Poverty Quintile Index

In line with the findings of this research, the School Poverty Quintile Index (SPQI) was significant in predicting the first year average mark (cf. 5.2.1.5, page 123). Studies completed in Stellenbosch, South Africa confirmed that the educational outcome in schools was linked to socio-economic status (SES), pupil and teacher characteristics and school resources (cf. 2.7.1.6, page 47). Because the School Poverty Quintile Index is strongly associated with school performance, this factor continues to have a confounding effect as the final year school marks which are used as selection criteria in the Medical School of the Free State.

It is important that the prescriptions in the Green paper on Higher Education (RSADoE:1996) regarding equity, redress and democratisation also be taken into account thus allowing students with potential from low scores in School Poverty Quintile Index into medical schools.

The number of students applying from low socio-economic schools, especially SPQI group 1 and 2, is small. The reason students from these schools are not applying, could either be that students are not motivated from an early age in their lives to study Medicine, teachers dissuading them by telling them they are not 'doctor material, no support from parents or no positive role models (cf. 2.1, page 18). The latter is most probably one of the important motivators to study Medicine.

Sometimes students make inappropriate choices of medicine subjects for Grade 11 and 12 and then will not meet the criteria for entrance into medical school. Sometimes schools simply do not have trained teachers to be able to assist students to study certain subjects (cf. 2.1, page 17).

Research focussing on students from lower socio-economic schools needs to be undertaken in order to obtain more reliable results in order to identify students with potential from schools with low School Poverty Quintile Indeces and to identify reasons for the students from these schools not applying for Medicine.

6.5.2 School marks versus selection tests

Most of the literature from the UK and USA still emphasises the value of the Grade Point Average as the most important indicator for predicting success in tertiary training (cf. 2.7.2.2, page 48). During the last few decades, however, the standardised admission tests have also become an important factor (and much debated issue) in the selection of undergraduate students worldwide (cf. 2.7.3.3, page 51).

In this study the average of the HSPTs correlated stronger with the first year and second year average than the M-score, traditionally used as part of the selection criteria UFS (cf. 5.3, page 126). The average of the 4 subjects regarded as cognate to the study of Medicine (Mathematics, Science, Biology and English), however, correlated even better with the outcome of the first and second year than the average scores of the HSPTs (cf. table 5.1 and figure 5.1).

There seemed to be a stronger correlation of the individual components of the HSPTs compared to the Grade 12 school subjects and the success of the first and second year average. The MACH and the MCOM test (consisting of components of

Mathematics) correlated better with the first and second year average compared to the Grade 12 Mathematics mark alone.

The literature illustrates that Mathematical skills contributed significantly towards success in tertiary studies (cf. 2.7.3.2, page 50). Yet using a multiple regression model in this study where the relationship between the first year average mark, English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index were investigated, it was found that where the Mathematics mark increased, the first year average would decrease but where the Science mark increased, the first year mark would also increase (if adjusted for the other variables in this model). This finding was difficult to explain as one would expect that Mathematics and Science marks would correlate strongly and that both would have a positive influence on academic performance during the first two years at medical school.

The grade 12 Mathematics mark is still important in the selection of medical students (it correlated well with the success during the first two years), but not as important as it used to be considered in the past if one consider the multiple regression results.

In spite of fact that the HSPTs were replaced by the NBTs, the same principles are still applicable for selection of students since the NBTs developed from the HSPTs.

6.6 CONCLUSION

The researcher endeavoured to add to the knowledge regarding selection of medical students by critically appraising the relevant literature and comparing it to the findings of the research.

In this chapter the selection criteria and academic progression were critically appraised. The next chapter, Chapter 7, will deal with recommendations resulting from the research findings and also discuss the limitations of the study.

CHAPTER 7

RECOMMENDATIONS, LIMITATIONS AND CONCLUSION

7.1 INTRODUCTION

The Admissions to Higher Education Review Group (2004:2) stated that the admission of students is the responsibility of universities and colleges themselves. In setting their own criteria, and choosing their own guidelines and policies to select medical students, it is also important that interested parties in Higher Education should have confidence in the integrity of the admissions process of an institution. By allowing each medical school to set their own criteria for selection, it allows each medical school to recruit a distinctive type of student; however, the need to assess the validity of the school's own selection criteria still needs to be done. This statement mirrors the rationale for the undertaking of this study. The aim of this study was to assess the relationship between the selection criteria for medical students and the results obtained at the end of the first two years of their medical studies at the UFS. The aims and objectives were achieved as discussed in Chapters 6 and 7.

In this chapter recommendations are made in line with the study results with the aim to add to the integrity and confidence in the selection process of the Medical School at the UFS. The limitations of the study and the main conclusion are also highlighted.

7.2 RECOMMENDATIONS

By looking at the correlations of the different variables and relationship with the first and second year final average mark, the researcher was able to form a picture of the variables that strongly correlated with success in the first and second year and these therefore were included in the multiple regression models and could possibly be included as part of the selection criteria for entry into medical school at the UFS (cf. Table 5.2).

Factors that are very strongly correlated with the first year average mark often tend to be slightly less correlated with the second year average mark. The researcher would expect that factors will correlate less as the students progress with their studies as these factors that initially influenced progress during the first year became less important during the following years.

The following recommendation is made, based on the correlation analysis of the study:

- It is recommended that the variables that strongly correlate with the progress of the first years could be used as part of the selection process (cf. Table 5.2). The variables that are most influential are:
  - The HSPTs average mark and
  - The Grade 12 average mark for English, Mathematics, Science and Biology
  - The individual HSPTs (PTEEP, MACH, MCOM an SRT)
  - The individual school subjects (English, Mathematics, Science and Biology)

Certain variables such as age, previous tertiary education and School Poverty Quintile Index played little or no role, or even correlated negatively with progress during the first two years and should not be taken into consideration when selecting medical students. However, these finding cannot be used as an exclusion criteria for selection as these correlations are very poor negative correlations. (At the moment some of these factors do influence the choices in selecting students at the UFS.)

Although the study indicated that race factors (Black and Coloured students perform much worse than White students) strongly influence the success of students in the first two years, these factors could not be taken into consideration for recommendations because of the transformation principles that are strongly addressed in the Green Paper on Educational Transformation (RSADoE:1996):

"The inherited system of higher education is characterised by injustices, inequalities and imbalances, and opportunities and privileges are currently skewed as a result of racial and gender-biased policies, structures and practices. Applying the principle of equity implies, on the one hand, a critical identification of existing inequalities, and on the other a programme of transformation with a view to redress. Such transformation includes not only abolishing all existing forms of unjust differentiation, but also measures of empowerment to bring about equal opportunity for individuals and institutions."

The challenge however with these principles would be to select students from disadvantaged communities with the most potential to succeed in their medical studies. This study should assist the selection committees to achieve this goal.

Of all the different types of analyses done, the multiple regression results were the most useful because the relative contributions of each of the variables were taken into consideration.

The best fit model for selection purposes would be the multiple regression model 4. This model (cf. 4.5.4, page 114) evaluated the relationship between the first and second year average marks independently and the age of the student, the English, Mathematics, Science and Biology scores of Grade 12 and the PTEEP, MACH, MCOM and SRT tests of the HSPTs and the School Poverty Quintile Index. This model explained 50% variance of score in the first year and 70% variation of score in the second year as a result of a combination of these variables. Although some of the variables are not statistically significant, they were still influential as part of the model. Looking at all the models in the stepwise regression, it seemed that the more variables were included, the more reliable or predictive the model was to determine how the student would perform at the end of the first two years of study.

A proposed model for the selection of medical students is illustrated in figure 7.1.

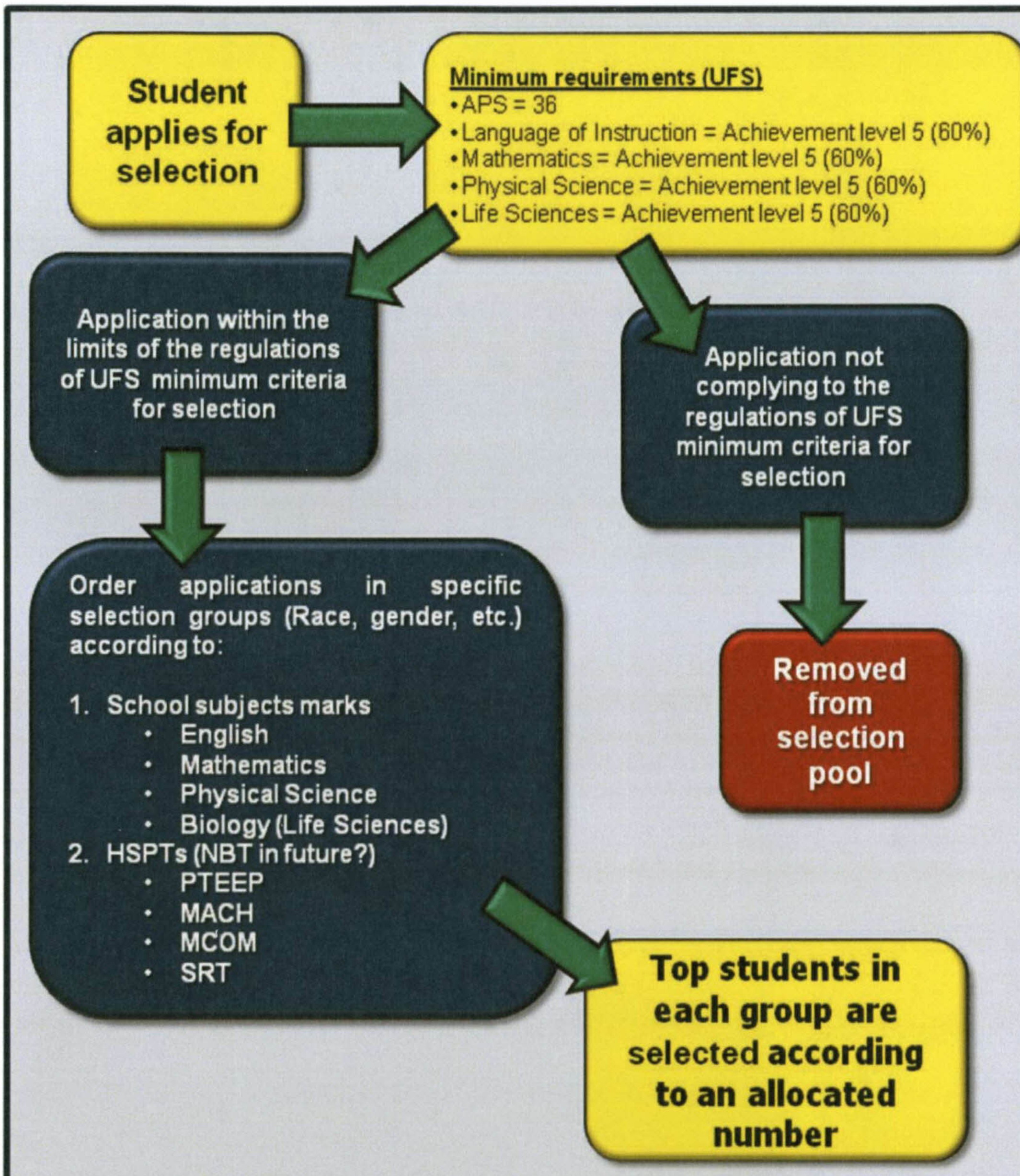


Figure 7.1 A proposed model for the selection of medical students at the UFS

The researcher suggests (as illustrated in Figure 7.1) that students apply at random for selection at the Medical School of the UFS. Only the students who comply to the minimum requirements of the UFS, based on the Grade 11 and 12 results (APS of 36; achievement level 5 in the language of instruction, Mathematics, Physical Science and Life Sciences), are then ordered in specific selection groups (race and gender). The ordering will be according to the English, Mathematics, Physical Sciences and Life Sciences of the Grade 11 and

12 exams as well as the HSPTs results (PTEEP, MACH, MCOM and SRT). These HSPTs can be replaced by the NBT in future as the NBTs developed from the HSPTs. The top students are then chosen from each group according to a number determined by the Medical School Selection Committee.

7.3 LIMITATIONS OF THE STUDY

The researcher recognises the following limitations in the study:

7.3.1 Data of different variables not all normally distributed

The Shapiro–Wilk test was performed to detect if the results of the different variables were normally distributed (cf. 4.1, page 93). The significances of the majority of the variables were <0.05 and thus the null hypothesis that the data were normally distributed was rejected, meaning that the majority of variables were not normally distributed. However, these findings can be expected, since the population of medical students from the Health Sciences is not part of the normal population as we are dealing with a highly selective population and would expect the data to be skewed.

7.3.2 Sample bias

At the time of the study, the writing of the HSPTs was not compulsory as a requirement for the selection of medical students, resulting in missing data of these tests for the analysis. The Variance Ratio test and the Two-sample t-test were performed to establish if the new sample of only the 167 students who wrote the HSPTs were representative of the total class.

With the gender, School Poverty Quintile Index and the rural and city variables there seemed to be no significant differences between the whole sample and the group that wrote the HSPTs. With certain variables, e.g. race and previous completed tertiary education, there were significant differences between the two groups.

It was clear that the students that wrote the HSPTs were more from the higher socio-economic schools and therefore resulted in findings mentioned in the previous paragraph. Although the population group who wrote the HSPTs were not entirely representative of the whole population group, the findings and tests are useful in the selection process of the total applicant pool.

7.3.3 Use of symbols for school subjects

Students applying to medical school (especially in certain selection groups) typically score very high symbols in school and there is often very little variation in their school-subject data. The school-subject problem is furthermore amplified by the use of symbols resulting in estimated marks allocated to each symbol, e.g. a B-symbol could be anything between 70 and 79% resulting in a mark of 7 being given to this variance on the database. This could have resulted in small differences in the results if the real marks would have been available, but the total outcome of the results should not be different because the same adaption was made to all the students marks.

7.3.4 Collinearity amongst all the variables

There is some evidence of collinearity amongst all the variables, i.e. they interact with one another in contributing to variation. Statistically, this is somewhat problematic but conceptually, understandable: The researcher is of the opinion that it would not be possible to separate out completely the effects of different variables as contributors to academic performance.

7.3.5 Outcome of only the first two years

This study concentrated on the outcome of the first two years of study. It was important to concentrate in this study on the first part of the course where students often fail due to school-related factors. It would be useful if further studies could also be performed to measure progressing results up to the final year of the M.B.,Ch.B.

programme, but one would expect that other factors would be important in the progress of senior students.

7.3.6 Only cognitive ability evaluated

During this research study, all emphasis was placed on cognitive abilities of the students, while alternative more holistic indicators of success as found in literature, such as personality evaluations, interviews, statements, questionnaires, character references and moral orientations, could not be evaluated due to the financial and resource constraints of the study.

Further studies in these domains should be undertaken in the future to give a more comprehensive picture of this area of research.

7.4 CONCLUSION

The researcher took the liberty to make the following additional comments adding to the value of the study:

- ***Implementation:*** The research findings and recommendations of the study should be taken into consideration in the reviewing of the selection policy of medical students at the UFS.

- ***Publications:*** The researcher plans to use the data and results of the findings described in this thesis to publish several articles in scientific journals accredited by the UFS.

- ***Research:*** Additional research studies need to be undertaken to determine other additional indicators that may have an influence on the progress relating to first and second year medical students. Additional larger research studies need to flow from this study such as studies on specific groups of students, e.g.

students who completed tertiary training, students from group 1 and 2 School Poverty Quintile Index groups and students from rural areas. The application of this research also needs to be tested with the National Benchmark Tests. The researcher plans to be involved in further post-doctoral studies in these areas.

The Admissions to Higher Education Review group (2004:5) believes that a fair admissions system is one that provides equal opportunity for all individuals, regardless of background, to gain admission to a course suited to their ability and aspirations. This study would be helpful to address important factors such as reliability, consistency and fairness in the selection process.

This study would also add to the value of basic principles in the selection of students as documented by some of the principles by the Admissions to Higher Education Review group (2004:7), such as:

- *"A fair admissions system should be transparent."* Through a good selection policy which is founded on scientific data such as this one to establish selection criteria that play a role in success is of vital importance to be transparent.
- *"A fair admissions system should enable institutions to select students who are able to complete the course as judged by their achievements and their potential."* As shown in this study, other factors such as the HSPTs are important in assessing the applicants' merit and potential and not only their academic achievement in Grade 12 in school which is dependent on the resources and financial constraints of a school.
- *"A fair admissions system should strive to use assessment methods that are reliable and valid."* By applying the findings of this study into the selection criteria of policy of the UFS, the selection process will be more reliable and valid and founded on good research practice.

With reference to the study the researcher wishes to accentuate the following:

- ***Overall goal, aim and objectives.*** The researcher believes the overall goal, aim and objectives of the study were addressed. The aim of this study was to assess the relationship between the selection criteria for medical students and the results obtained at the end of the first two years of their medical studies at the UFS. The following steps were followed with this study to achieve these aims:
  - Conceptualising and contextualising the problem of selection of medical students at the UFS, identifying factors that play a role in this selection by means of a thorough literature survey (Chapter 2);
  - Assessment of the influence of the present selection criteria and other criteria on the performance of first and second year medical students at the UFS;
  - Assessment of the different components of the HSPTs that play a possible and vital role in the performance of the first and second year medical students; and
  - Recommendations to the UFS for possible future use as selection criteria for medical students.

- ***The link between literature and research findings.*** The process can be linked to a literature survey and research findings and the researcher's own practical knowledge of factors determining success in the first two years in a medical school.

- ***Policies and guidelines.*** The recommendations of the researcher are in line with the selection policies and guidelines of the University of the Free State.

7.5 CONCLUDING REMARK

This study was unique, because the approach of using different statistical techniques resulted in very profound results. The technique of using the multiple regression analysis, where different variables were tested as part of a model, led to the best model for selection.

The researcher wishes to accentuate that she believes that a study such as this one and studies that might flow from this will assist this University (and other universities in South Africa) to overcome the challenges of the changing of the school evaluation system for Grade 12 and the introduction of transformation principles. This study and similar studies will ensure selection criteria for medical students that are reliable and valid, leading to admission of students with potential for good academic performance at university level within an M.B.,Ch.B. programme.

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APPENDIX A:	Letter of request to School of Medicine, Faculty of Health Sciences to access data

THE UNIVERSITY OF THE FREE STATE

Department of Community Health - Faculty of Health Sciences
Dr. Brenda de Klerk | Box 339 (G52) | **Tel:** (051) 4053137
Email: gngmbdk.md@mail.uovs.ac.za | BLOEMFONTEIN 9300 | **Fax:** (051) 4489278

25/2/2009

Executive committee
School of Medicine
Faculty of Health Sciences
University of the Free State
Box 339
BLOEMFONTEIN
9300

Dear Professor van Zyl

PERMISSION TO HAVE ACCESS TO DATA OF FIRST AND SECOND YEAR MEDICAL STUDENTS

I am a qualified medical doctor, working in the Department of Community Health, University of the Free State. I have completed my Master's degree in Health Professions Education in 2004 and have been enrolled as a Doctorate degree student in Health Professions Education in the Faculty of Health Sciences at the University of the Free State since 2005. In order to obtain the Doctorate degree, I have to complete a research project. The title of my thesis will be "Factors associated with the selection and academic progression of first and second year medical students at the University of the Free State."

I would therefore like to kindly request your permission to have access to the personal and academic data of the first and second year medical students from 2004-2006.

Permission to obtain data was already obtained from Prof Magda Fourie when she was still the Vice Rector of the University and from Prof Moja, our dean. I have however not considered the fact that with Prof Moja as one of my study leaders, it might have created conflict of interest, and therefore it would be more appropriate to also ask permission from the Executive Committee of the School of Medicine to obtain such information.

Confidentiality will be kept at all times and no student number or name will ever appear on any report, presentation or publication.

Since this study concentrates on the selection and HSPTs factors that play a role in the performance of first and second year medical students, I am sure that it can probably contribute immensely to the selection of medical students in future.

I would like to sincerely thank you in advance for your kind attention and consideration of my request.

Yours faithfully

....

Brenda de Klerk

(RESEARCHER) (STUDENT NUMBER: 1994366779)

CO-ORDINATOR HEALTH PROFESSIONS

EDUCATION PROGRAMME: PROF. DR DR M.M. NEL

HEAD: EDUCATION DEVELOPMENT

FACULTY OF HEALTH SCIENCES

UNIVERSITY OF THE FREE STATE
BLOEMFONTEIN

SUPERVISOR: PROF. DR DR P.P.C. NEL
PROGRAMME ORGANISER
DIVISION FOR PROGRAMME MANAGEMENT AND CPD
SCHOOL OF MEDICINE
FACULTY OF HEALTH SCIENCES
UNIVERSITY OF THE FREE STATE
BLOEMFONTEIN

CO-SUPERVISORS:

(1) PROF. DR(MED.) L.M. MOJA
DEAN
FACULTY OF HEALTH SCIENCES
UNIVERSITY OF THE FREE STATE
BLOEMFONTEIN

(2) DR A. CLIFF
CENTRE FOR HIGHER EDUCATION DEVELOPMENT
ALTERNATIVE ADMISSION RESEARCH PROJECT
OLD CHEMICAL ENGINEERING BUILDING
NORTH LANE
UPPER CAMPUS
PRIVATE BAG
7701 RONDEBOSCH

THE UNIVERSITY OF THE FREE STATE
Department of Community Health - Faculty of Health Sciences
Dr. Brenda de Klerk | Box 339 (G52) | **Tel:** (051) 4053137
Email: gngmbdk.md@mail.uovs.ac.za | BLOEMFONTEIN 9300 | **Fax:** (051) 4489278

27/3/2006

Prof. L.M. Moja

Dean

Faculty of Health Sciences

University of the Free State

Box 339

BLOEMFONTEIN

9300

Dear Professor Moja

PERMISSION TO HAVE ACCESS TO DATA OF FIRST AND SECOND YEAR MEDICAL STUDENTS

I am a qualified medical doctor, working in the Department of Community Health, University of the Free State. I have completed my Master's degree in Health Professions Education in 2004 and have been enrolled as a Doctorate degree student in Health Professions Education in the Faculty of Health Sciences at the University of the Free State since 2005. In order to obtain the Doctorate degree, I have to complete a research project. The title of my thesis will be "Factors associated with the selection and academic progression of first and second year medical students at the University of the Free State."

I would therefore like to kindly request your permission to have access to the personal and academic data of the first and second year medical students from 2004-2006. The nature of information needed is attached as an appendix called "Data information sheet".

Should I obtain your kind permission, I will contact the necessary persons to help with the access of the data (Dr Jeanette Buys, Me Erna Rossouw and me Marlene Viljoen). They will assist me in the gathering of the information and compiling of a spread sheet through a computer programme. Confidentiality will be kept at all times and no student number or name will ever appear on any report, presentation or publication.

Since this study concentrates on the selection and HSPTs factors that play a role in the performance of first and second year medical students, I am sure that it can probably contribute immensely to the selection of medical students in future.

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SCHOOL OF MEDICINE
FACULTY OF HEALTH SCIENCES
UNIVERSITY OF THE FREE STATE

BLOEMFONTEIN

CO-SUPERVISORS:

(1) PROF. DR(MED.) L.M. MOJA	(2) DR A. CLIFF
DEAN	CENTRE FOR HIGHER EDUCATION DEVELOPMENT
FACULTY OF HEALTH SCIENCES	ALTERNATIVE ADMISSION RESEARCH PROJECT
UNIVERSITY OF THE FREE STATE	OLD CHEMICAL ENGINEERING BUILDING
BLOEMFONTEIN	NORTH LANE
	UPPER CAMPUS
	PRIVATE BAG
	7701 RONDEBOSCH

APPENDIX B: Letter of request to Vice-rector, University of Free State to access data

THE UNIVERSITY OF THE FREE STATE

Department of Community Health - Faculty of Health Sciences
Dr. Brenda de Klerk Box 339 (G52) **Tel:** (051) 4053137
Email: gngmbdk.md@mail.uovs.ac.za BLOEMFONTEIN 9300 **Fax:** (051) 4489278

13/3/2007

Prof. M Fourie

Vice-rector

University of the Free State

Box 339

BLOEMFONTEIN

9300

Dear Professor Fourie

PERMISSION TO HAVE ACCESS TO DATA OF FIRST AND SECOND YEAR MEDICAL STUDENTS

I am a qualified medical doctor, working in the Department of Community Health, University of the Free State. I have completed my Master's degree in Health Professions Education in 2004 and have been enrolled as a Doctorate degree student in Health Professions Education in the Faculty of Health Sciences at the University of the Free State since 2005. In order to obtain the Doctorate degree, I have to complete a research project. The title of my thesis will be "Factors associated with the selection and academic progression of first and second year medical students at the University of the Free State."

I would therefore like to kindly request your permission to have access to the personal and academic data of the first and second year medical students from 2004-

2006. The nature of information needed is attached as an appendix called "Data information sheet".

Should I obtain your kind permission, I will contact the necessary persons to help with the access of the data (Dr Jeanette Buys, Me Erna Rossouw and me Marlene Viljoen). They will assist me in the gathering of the information and compiling of a spread sheet through a computer programme. Confidentiality will be kept at all times and no student number or name will ever appear on any report, presentation or publication.

Since this study concentrates on the selection and HSPTs factors that play a role in the performance of first and second year medical students, I am sure that it can probably contribute immensely to the selection of medical students in future.

I would like to sincerely thank you in advance for your kind attention and consideration of my request.

Yours faithfully

....

Brenda de Klerk

(RESEARCHER) (STUDENT NUMBER: 1994366779)

CO-ORDINATOR HEALTH PROFESSIONS
EDUCATION PROGRAMME: PROF. DR DR M.M. NEL
HEAD: EDUCATION DEVELOPMENT
FACULTY OF HEALTH SCIENCES
UNIVERSITY OF THE FREE STATE
BLOEMFONTEIN

SUPERVISOR: PROF. DR DR P.P.C. NEL
PROGRAMME ORGANISER

DIVISION FOR PROGRAMME MANAGEMENT AND CPD
SCHOOL OF MEDICINE
FACULTY OF HEALTH SCIENCES
UNIVERSITY OF THE FREE STATE
BLOEMFONTEIN

CO-SUPERVISORS:

(1) PROF. DR(MED.) L.M. MOJA
DEAN
FACULTY OF HEALTH SCIENCES
UNIVERSITY OF THE FREE STATE
BLOEMFONTEIN

(2) DR A. CLIFF
CENTRE FOR HIGHER EDUCATION DEVELOPMENT
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OLD CHEMICAL ENGINEERING BUILDING
NORTH LANE
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PRIVATE BAG
7701 RONDEBOSCH

APPENDIX C: Permission from School of Medicine, Faculty of Health Sciences to access data

From: Gertraud Groenewald
To: de Klerk , Brenda
Date: 19/05/2006 16:28:51
Subject: VERSOEK: TOEGANG TOT DATA VAN MEDIESE STUDENTE

Beste Dr De Klerk

Na aanleiding van u versoek om toegang te verkry tot data van mediese studente vir doeleindes van u Ph.D-studies, word die besluit wat die Dagbestuur op 25 April 2006 geneem het vir u hieronder aangehaal:

DECISION:
Permission was granted to Dr. B de Klerk to gain access to the personal and academic data of first-and second-year M.B.,Ch.B. students for the purpose of her research project entitled "Factors associated with the selection and academic progression of first-and second-year medical students at the University of the Free State", subject to approval of her Ph.D. and the Ethics Committee accepting her protocol. She must also obtain permission from the Vice-Rector, Prof. M Fourie.

Vriendelike groete
Gertraud Groenewald

Gertraud Groenewald
Afdeling Vergaderingsadministrasie
Fakulteit Gesondheidswetenskappe
UNIVERSITEIT VAN DIE VRYSTAAT
Tel. (051) 405 2814

APPENDIX D: Permission from Vice-rector, University of Free State to access data

From: Bronwyn Taljaard
To: de Klerk , Brenda
Date: 2009/03/25 02:08 PM
Subject: Extract from Executive Management Comittee meeting

Dear Dr de Klerk

The following extract from the minutes of the Executive Management Committee meeting held on 24 March 2009 has reference:

13.1 PERMISSION TO HAVE ACCESS TO DATA OF FIRST AND SECOND YEAR MEDICAL STUDENTS

Dr B de Klerk has requested access to the personal and academic data of the first and second year medical students from 2004 to 2006 for the purpose of a research study titled "Factors associated with the selection and academic progression of first and second year medical students at the University of Free State". All confidentiality protocols would be adhered to.

DECISION:
The request from Dr B de Klerk to access the data of the first and second year medical students for the purpose of conducting a research study titled "Factors associated with the selection and academic progression of first and second year medical students at the University of Free State" was APPROVED on condition that she also obtains approval from Prof D Hay.
DR B DE KLERK

Kind regards,

Bronwyn Taljaard (Ms)
Committee Administration
Faculty of Health Sciences
Francois Retief Building

Tel. 051 405 2821

"If A equals success, then the formula is A equals X plus Y and Z, with X being work, Y play, and Z keeping your mouth shut."
Albert Einstein

APPENDIX E: Selection criteria of the School of Medicine UFS 2011

Updated 12 January 2010
FACULTY OF HEALTH SCIENCES
SELECTION POLICY: SCHOOL OF MEDICINE 2011
M.B.,Ch.B.

1. PREMISES
PLEASE NOTE: ADMISSION IS SUBJECT TO SELECTION
The present selection policy can be summarised as follows:
(a) Any candidate can apply for admission to the first year of the M.B.,Ch.B. Programme (i. e. Grade 12 Learners,
school leavers, graduates and diplomats, and people who are already studying for a degree). Candidates from
dental faculties will not be considered as long as they are undergraduates. Candidates who are already studying
medicine at another university are only selected into the first year of the M.B.,Ch.B. Programme. In exceptional
cases only and with the recommendation of the Dean and approval of the School concerned, will a student be
admitted to selection in another programme in this Faculty.
(b) A holistic approach is important in the selection process, which is based on a points system that includes academic
achievement, cultural activities, and sport.
(c) A definite effort is made to accommodate candidates from a disadvantaged academic background who has the
necessary potential and a reasonable ability to attain success in their course.
(d) It is admitted that students and doctors are national assets, but students from certain areas in South Africa are
regarded as the main responsibility of the UFS for possible selection.
(e) A maximum of 140 candidates as target (including 11 students from SADC countries1) will be selected in four
groups (Eng/Afr, men/women), with an equal number of male and female and Afrikaans and English candidates.
Further selection will be considered with the view to registering 140 students.
(f) Mainly South African students are selected for studies in the medical sciences due to the high costs involved in the
training of such students. In respect of the SADC countries*, candidates will be selected in compliance with the
policy agreement between the Department of Health and Medical Schools. (*Currently Lesotho and Botswana.)
(g) Students are required to produce a medical report completed by a medical practitioner, as well as a completed
health questionnaire.
(h) At its own discretion, the Faculty reserves the right to demand immunization against diseases, from time to time,
before admitting students to any further academic year or semester during their studies. As far as the M.B.,Ch.B.
Programme is concerned, immunization against Hepatitis B will occur during training and it is therefore not
necessary to be immunized beforehand.
(i) All students must remember that if their status is HIV positive, they should be aware, before taking up the selected
places, that they would be exposed to patients with infective diseases, which might affect their illness. In these

cases, it will be the students' responsibility to take the necessary precautions to prevent illness due to their positive
status and exposure. All students will be expected to fulfil all the rotation requirements for the programme.
(j) The medical reports of applicants that have been selected for the M.B.,Ch.B Programme will be provided to the
Selection Committee in order to ascertain whether there are students with such disabilities that would make them
unfit for medical studies.

2. SELECTION PROCESS

2.1 Selection of Grade 12 Learners (Admission point = 36)

(a) Selection is based on the academic mark obtained in the Grade 11 final examinations, as well as on the academic
mark obtained during the June examination in Grade 12 (where the June mark is used).
(b) Approved questionnaires and tests can also be used to identify candidates with the necessary potential. If
necessary, a panel from within the Faculty can conduct interviews with students in a further attempt to assess
potential and personalities.
HSPT tests are compulsory for school leavers.
(c) The maximum points to be attained by a student are 122 (if leadership and community involvement are considered
that particular year). Of these points, 100 are allocated for academic achievement and a maximum of 12 for extracurricular
activities, a maximum of 8 for region of origin and 2 points for children of University staff, - alumni or gold
class donors.
As far as the additional 22 points are concerned,
the following holds:
(i) A point is allocated for non-academic achievements, (maximum allocation of twelve (12) points (if leadership and community involvement are used in a particular year).
This point is based on achievements in the following categories:
leadership and community involvement (1-4, to be considered annually);
culture (1-4) (differentiated between participation at school, provincial and national level);
sport (1-4) (differentiated between partici-pation at school, provincial and national level).
(ii) An additional point allocation in respect of regions is as follows (maximum allocation of 8 points):
Free State, Northern Cape: an additional 6
points
Eastern Cape: an additional 3 points
Rest: no additional points
Applicants from rural schools earn an additional 2 points.
(iii) An additional point allocation of 2 points for children of University staff or University alumni or gold class
donors.
(d) In respect of the language of instruction (Afrikaans or English) a minimum achievement point on achievement level
5 (60%) is required.
(e) The following applies to all applicants regarding the science mark. A minimum average mark on achievement level
5 (60%) is required for each of the following :
Mathematics achievement level 5 (60%) and
Physical Sciences achievement level 5 (60%) and
Life Sciences achievement level 5 (60%)

2.2 Selection of post-Grade 12 learners and graduates

The post-school achievements at higher education institutions attained by students, who have already passed

Grade 12, will be taken into account in addition to their Grade 12 marks. Limited positions will be available for
selection in this category.

2.2.1 University students

(a) Degree not yet obtained

For the selection of candidates that have completed one or more years of a programme that does not fall within the
Health Sciences (programmes that are excluded as part of the selection criteria) the following applies:

(i) A candidate will qualify for selection if s/he obtains a minimum average of 75% for the completed year.

(ii) A candidate must have the minimum credits required to pass a year of any degree.

(iii) Preference will be given to students with applicable modules.

(b) Degree already obtained

Selection of students that have already obtained a degree will be as follows:

(i) Preference will be given to students with applicable subjects with a minimum average of 75%.

(ii) The programme must have been completed in no longer than the allowed minimum period plus one year.

2.2.2 Technological universities and other institutions

(a) Degree/Diploma not yet obtained

Selection of students from Technological Universities will be done as follows:

(i) A minimum average of 80% is required for completed modules.

(ii) Preference will be given to students with applicable modules.

(b) Degree/Diploma already obtained

(i) For Candidates with a B.Tech. Degree, a minimum average of 80% is required. A minimum average of
80% is required for other applicable diplomas.

(ii) Preference will be given to students with applicable modules.