

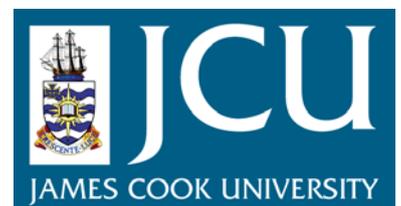
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SELECTING MEDICAL STUDENTS:

Personality as a Potential Predictor

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In August 2005

For the Degree of Doctor of Philosophy

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ABSTRACT

The major aims of this research were to investigate the predictive validity of the selection components used by the JCU School of Medicine (JCUSOM), to explore the potential of personality to predict academic performance, and to investigate the incremental validity of both selection components and personality. The JCUSOM offers an innovative undergraduate program that is vertically and horizontally integrated, and utilises group learning methods of instruction. It had its first intake of students in 2000 and by 2002, a total of 212 students were enrolled in the medical program. Upon entry, participants were between 16 and 21 years of age, and gender and cohort distributions were approximately equal. The overall theoretical relationship between personality and academic performance was based on the PPIK model (intelligence-as-process, personality, interests, intelligence-as-knowledge). Within this framework, the relationship between personality and academic performance was approached from three distinct aspects: 1) personality traits within the framework of the Five-Factor Model of personality, 2) patterns of dysfunctional behaviour with the framework of the DSM-III personality disorders, and 3) motives, values and interests within the framework of the RIASEC typology of personality and environments, and the motivating effects of values. The research undertaken was of a multi-point design with personality data being collected at the same time each year over a three-year period. For statistical purposes, in order to have an equivalent number of students completing each of the first three years of training, grades data were collected for a five-year period. The research project comprised one study that investigated the predictive and incremental validity of the existing selection components (OP ranks, written

application and selection interview) and the three distinct aspects of personality, in relation to academic grades. The selection criteria and grades data were archival data, and I collected the personality data. Personality traits were measured using the Hogan Personality Inventory (HPI), patterns of dysfunctional interpersonal behaviours were measured using the Hogan Development Survey (HDS), and motives, values and vocational interests were measured using the Motives, Values and Preferences Inventory (MVPI). Predictive validity was analysed using Pearson bivariate correlations and incremental validity was analysed using hierarchical regression analyses. The regression analyses also accounted for the confounding variables of age and gender. The results indicated that gender and OP ranks were consistent predictors of academic grades across each year of the medical program, and of average performance. The interview criteria relating to interpersonal, self-reliance and communication also had predictive and incremental validity at various stages of training. Conversely, the written application data were not predictive of grades. In relation to the personality data, motives/values/ and interests had no predictive power, while personality traits had predictive validity but lacked incremental validity. While all patterns of dysfunctional interpersonal behaviour had predictive validity, only the syndromes of Away and Against showed incremental validity. My research has illustrated how an organizational psychology approach can be applied to medical selection, by validating criteria through systematic, theory-driven research. It has highlighted the need for medical schools to pay attention to the incremental validity of their selection components, and has provided valuable information that can be used to improve the cost-effectiveness of the JCU selection process.

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STATEMENT OF SOURCES

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references given.

Signed: _____

Dated: _____

CHAPTER 1

Introduction and Overview

- 1.0 Introduction
- 1.1 Scope of current research
- 1.2 Focus of current research
- 1.3 Significance of current research
- 1.4 Organisation of the thesis

1.0 Introduction

" . . . there was a need in Australia for a different kind of medical graduate; one more versed in the ways of people as psychological and sociological beings and not simply as malfunctioning organisms . . . both the present methods of selecting students for medical school and the nature of the medical course inhibit the production of doctors who have a holistic approach to humans as social beings."

Karmel Report, 1973.

Over thirty years ago, it was recognised that selecting medical students on the basis of academic merit alone was not enough to produce medical practitioners who could effectively serve the community. There were concerns that the curricula of Australian medical schools were non-innovative, too scientific and uninterested in family medical care. Medical practitioners were seen as lacking in their ability to communicate with and counsel patients. In addition, the motivation and commitment necessary for the study and practice of medicine was thought to be missing in a large proportion of medical students (see Doherty, 1988; Karmel, 1973). There were also concerns about the ability of medical students to cope with the demands of medical training. There is an abundance of literature linking depression, suicide and substance abuse to emotional instability in medical students (see for example, Aristeiguieta, 1998; Ashton & Kamali, 1995; Baldwin, Daugherty & Eckenfels, 1991; Baldwin, Hughes, Conrad, Storr & Sheehan, 1991; Lerner, 1995). Emotional instability has also been linked to

the mistreatment of patients (Baldwin, Daugherty, et. al, 1991; Kassenbaum & Cultler, 1998, Lubitz & Nguyen, 1996).

The majority of medical schools in Australia have responded to these concerns by introducing courses in behavioural science and community medicine into their programs. The curriculum has also moved away from a traditional approach to one which is more integrated and responsive to developments in medical knowledge. The debate on the desired characteristics of medical students has resulted in a plethora of both positive and negative personal characteristics. In an endeavour to identify these characteristics, undergraduate medical schools have expanded their selection processes, from the sole criterion of academic merit, to components such as the Undergraduate Medical Admissions Test (UMAT) and the selection interview. There is a paucity of research on the predictive validity of these latest selection components.

There have been numerous research studies on the relationship between personality and academic performance in medical training. However, the earlier, traditional, structure of medical curricula was not conducive to such research. The divide between the basic sciences and clinical practice, curriculum delivery by lectures, and assessment methods that promoted surface type learning strategies, allowed little room for academic performance to reflect the desired personality characteristics during the early years of medical training. With the innovation of the integrated curriculum in

medical training, incorporating both horizontal and vertical integration, personality is more likely to play an important role in academic performance.

To date, several personality inventories have been researched to ascertain their predictive validity in relation to academic performance within medical training (see for example, Ferguson, Sanders, O'Hehir & James, 2000; Lievens, Coetsier, DeFruyt & Maeseneer, 2002; Tutton, 1996, 1997). The results have been conflicting, primarily due to the varying theoretical bases of the inventories and the operationalisations of academic performance. Many of the studies failed to control for known covariates of academic performance, and only one study could be found (Tutton, 1996) which investigated the incremental validity of personality inventories in relation to the selection process.

Another major shortcoming of the existing research on personality and medical selection relates to the focus on personality traits. The literature on medical selection describes many desired personal characteristics that can be better classified as motives, values, vocational interests and/or dysfunctional behaviours. While previous research has identified the relationship between personality traits and academic performance, research on the relationship between motives/values/interests and academic performance in medical training remains virtually non-existent. This is a major limitation as a proper match between an individual's values and vocational choice is a critical concept underlying academic performance, satisfaction and commitment. Similarly, there is a paucity of research on

dysfunctional personality characteristics and their impact upon academic performance. Again, this is an important issue, as an integrated medical curriculum requires students to interact with patients, supervisors and peers from the outset of training, and dysfunctional behaviour in such situations will negatively impact on academic achievement.

It must be emphasized that medical selection is specifically selection for medical school rather than selection for the practice of medicine. After selection, it is the task of medical training to develop students' suitability for the various fields of medicine. Different constellations of personal characteristics are required for the various specializations in medicine.

Therefore, although the medical selection literature is generally framed in terms of identifying desirable characteristics in medical students, in order to ensure an adequate pool of graduates for the range of medical careers, the aim is to retain the greatest possible diversity, deselecting only those applicants with extreme levels of undesirable characteristics. My research aims to contribute to the establishment of an empirical basis for optimizing the selection of medical students.

1.1 Scope of Current Research

My research evaluated the predictive validity of the selection components currently used by the JCU School of Medicine, and explored the potential of personality inventories to predict academic grades. I then extended previous research by investigating the incremental validity of these components. My

research explored three aspects of personality (traits, dysfunctional behaviours, and motives/values/interests).

The theoretical basis for the relationship between personality and academic performance is drawn from PPIK theory (intelligence-as-process, personality, interests, intelligence-as-knowledge), which asserts that ability level and personality dispositions determine the probability of success in a particular task domain, while interests determine the motivation to attempt the task (Ackerman & Heggestad, 1997; Rolfhus & Ackerman, 1999). In my research, “personality dispositions” were operationalised as personality traits and patterns of dysfunctional interpersonal behaviour. There is strong evidence supporting the predictive validity of personality traits in relation to academic performance (see for example, Chamorro-Premuzic & Furnham, 2003; Ferguson, James, O’Hehir & Sanders, 2003; Lievens, et. al., 2002). There is also a proven relationship between personality traits and personality disorders (see for example, Deary, Peter, Austin & Gibson, 1998; Schroeder, Wormworth & Livesley, 1992, 1994). Therefore, it is reasonable to hypothesise that dysfunctional interpersonal behaviours associated with personality disorders will also impact on academic performance. My hypotheses on the relationship between these personality dispositions and academic performance were primarily drawn from the literature on PPIK theory, the Five Factor Model of personality (see Costa & McCrae, 1992), and the DSM-IV taxonomy of personality disorders (American Psychiatric Association, 2000). “Interests” were operationalised as motives, values and vocational preferences, and hypotheses were drawn from the literature on

the RIASEC model (Holland, 1973, 1992) and the motivating effect of values (see for example, Hogan & Blake, 1996; McClelland, 1987; Meglino & Ravlin, 1998).

My research used a sample of medical students from the James Cook University in North Queensland, Australia. The JCU School of Medicine had its first intake of students in 2000. The opening of the school created a unique opportunity to carry out research in an environment where there was no pre-existing culture, or expectations, specific to this school of medicine. There were no existing students selected under a different system. In addition, the medical program was innovative, incorporating horizontal and vertical integration. The delivery of the curriculum was based on group-learning tasks, and this created a learning environment where personality characteristics were predicted to be highly influential to academic outcomes. The JCU School of Medicine is unique, in that it is the first Australian school of medicine to attempt a systematic incorporation of organizational psychology principles to its selection process.

However, a disadvantage of using the JCU Medical School as the field setting site was the resultant small sample size. In addition, the JCU medical school offers an undergraduate program that primarily admits candidates who have just finished secondary education. This resulted in a restricted age range which prohibited any analyses of age differences in relation to personality.

1.2 Focus of Current Research

The major aims of my research are to: 1) investigate the predictive validity of the components of the current selection process for the JCU School of Medicine; 2) investigate the potential of personality to predict academic grades; 3) investigate the incremental validity of the current selection components and personality. From the perspective of medical education, the bulk of the published literature indicates that medical selection is based more on shared opinion, experience and debate, than on theory and research. Within this literature, there appears to be a blurring of boundaries as to what personality characteristics are related to effective medical training versus those related to effective medical practice. Powis (1994, p.446) distinguishes between the two, by describing a good medical student as one who best fits the style, ideology or curriculum of the institution in which they are to study. My research focuses on defining the personality characteristics of a good medical student, not a good medical practitioner, and providing theoretical and empirical evidence for the inclusion of personality in the selection process for medical training.

My research was comprised of one study that investigated the predictive and incremental validity of the components of the current selection process (OP ranks, application criteria and interview criteria) and personality inventories (Hogan Personality Inventory - HPI; Motives, Values and Preferences Inventory - MVPI; and Hogan Development Survey - HDS). This study controlled for known covariates of academic grades (age and gender). It was a multi-point design, with data being collected at the same time each year

over a three-year period. The selection data was supplied by the Chair of the Selection Committee of the JCU School of Medicine, and access to the data on academic grades was authorised by the Dean of the Medical School. Personality data for the first cohort of students was collected in a pilot study, and authority was obtained to use this data. I collected the personality data for the second and third cohorts of students over five testing sessions. Ethics approval to carry out this research is attached as Appendix A.1. Additional grades data for the third year of training for Cohort 2, and the second and third year of training for Cohort 3, was collected in 2005 in order to conduct multivariate regression analyses across the first three years of medical training. Ethics approval to access this additional data is attached as Appendix A.2.

The statistical design incorporated a missing values analysis, independent t-tests for age and gender comparisons on each personality inventory, a correlation analysis of all variables, and twelve sets of hierarchical regression analyses - one set for each dimension of personality (traits – HPI; motives/values/interests – MVPI; and dysfunctional behaviours – HDS) for each level of the dependent variable (Grades 1, 2, 3 and Average Grade).

The first aim of this study was to investigate the predictive validity of the components of the current selection process, in relation to academic performance in the first three years of the medical program. In addition to providing initial concurrent validation data to the JCU School of Medicine, this research served as a check to see if the JCU medical students were

systematically different from the data reported in the literature. I found that gender and OP ranks were strong consistent predictors of academic grades across the first three years of medical training. My findings are discussed in relation to the existing literature on the predictive validity of selection components.

The second aim of this study was to investigate the potential of personality to predict academic grades. The Hogan Personality Inventory (HPI) was used to assess the personality traits of medical students. It was hypothesised that Adjustment, Agreeability, Prudence, Intellectance and Scholarship would have a positive relationship with academic grades. Conversely, Sociability and Ambition would have a negative relationship with academic grades. My findings were consistent with previous research and partially supported the above hypotheses, with the exception of Agreeability and Intellectance. The Motives, Values and Preferences Inventory (MVPI) was used to assess the motives, values and vocational interests of medical students. It was hypothesised that Aesthetic, Affiliative, Altruistic and Scientific values would be predictive of academic grades. However, this hypothesis was not supported by my findings. The Hogan Development Survey (HDS) was used to assess dysfunctional interpersonal behaviour in medical students. It was hypothesised that the syndromes of Away and Against would have a negative relationship with academic grades, while the syndrome of Towards would have a positive relationship with grades. My findings supported this hypothesis.

The third aim of this study was to investigate the incremental validity of both existing selection components and personality in relation to academic grades. My findings revealed that gender and OP ranks remained consistent strong predictors of academic grades across the first three years of medical training. The application criteria did not provide any significant increment in variance, and there were only isolated instances where the interview criteria increased variance in the first and second years of training. Neither personality traits (HPI) nor motives/values/interests (MVPI) significantly increased the variance in academic grades over the first three years of the medical program. However, dysfunctional interpersonal behaviour (HDS) remained a significant predictor of grades in the second and third years of training, and in overall performance.

Based on the results of the above analyses, a number of ancillary analyses were carried out in order to 1) compare the incremental validity of the interview criteria with that of personality traits, 2) examine the predictive validity of the application criteria in relation to the interview criteria, and 3) examine the relationship between personality and components of the selection process.

1.3 Significance of Current Research

My research makes a number of significant contributions to the field of medical selection. Firstly, my research has extended the study of personality in medical selection beyond the study of traits, to encompass motives/values/vocational interests, and patterns of dysfunctional interpersonal behaviours.

This approach provides a broad picture of the relationship between personality and academic performance. This has never been done before in the field of medical selection. Secondly, to date, the criteria for selecting medical students have been largely based on shared opinion, experience and debate, rather than on theory and research. My research has demonstrated how to apply theory-based research to evaluate the utility of personality as a selection predictor. My findings provide a sound theoretical and empirical basis for including an assessment of dysfunctional interpersonal behaviours in the selection process for medical training. Thirdly, from a theoretical perspective, investigating the incremental validity of selection processes is rarely carried out in the field of medical selection. My findings have shown that while individual components may have predictive validity they might not necessarily have incremental validity. This is of practical significance because medical selection is a costly process and the selection tools used should “add value” to the prediction of outcome measures. Finally, my research has provided preliminary data evaluating the efficiency of the current selection process, which can be used to refine the JCU selection process in later years.

1.4 Organisation of the Thesis

Chapter 2 provides an overview of medical education in Australia. It outlines the reforms in medical education that have been in progress for the past thirty years, and describes how the structure of medical training has changed in response to these reforms. It looks at the programs offered by Australian medical schools, the changes in curriculum content and design, the diversity

of vocational training, and the importance of continuing medical education.

This chapter introduces the reader to the field of medical education.

Chapter 3 looks at selection processes currently used by medical schools in Australia and reviews the reported levels of validity and reliability of selection components. It describes how the selection process for medical training has changed from one based solely on academic merit, to one that tries to encompass personal characteristics that are now deemed necessary for success in both medical training and medical practice. This chapter also introduces the reader to the field setting of my research, the James Cook University School of Medicine, and describes the current selection process. It introduces the concept of personality as a selection predictor, explores the relationship between personality and academic performance, and outlines the premises of the PPIK model, which suggests that personality dispositions and values can be used to explain variance in academic performance.

Chapter 4 is a review of the literature on personality and academic performance. This chapter is divided into three major sections: Section 1 discusses the relationship between personality traits and academic performance within the framework of the Five Factor Model of personality; Section 2 discusses the relationship between personality disorders and academic performance within the framework of the DSM-IV taxonomy of personality disorders; and Section 3 discusses the relationship between motives/values/interests and academic performance within the framework of the RIASEC model of personality types and academic environments.

Chapter 5 presents the methodology of the research study. It discusses age and gender as covariates of academic performance, and reports on factors that have led to a restricted sample size in relation to the multivariate regression analyses. It details the materials used in the study, the procedure undertaken, and the proposed statistical analyses.

Chapter 6 presents the statistical results of my research.

Chapter 7 is the final chapter in my thesis. This chapter discusses my findings on the predictive and incremental validity of current selection components and personality in relation to academic grades, and discusses the implications for medical selection processes. It looks at the constraints and limitations of my research and provides recommendations for future research activities. Finally, it reviews the contributions of my research to both theory and practice.

CHAPTER 2

Medical Education in Australia

- 2.0 20th Century reforms in medical education
- 2.1 Programs offered by Australian medical schools
- 2.2 Curriculum content and design of Australian medical programs
- 2.3 Vocational training and specialisation
- 2.4 Continuing medical education (CME)
- 2.5 Impact of reforms on medical selection

2.0 Reforms in Medical Education

The last 30 years has been a period of innovation and reform for medical education in Australia. The most significant of these have been a restructuring of the medical school curriculum from a traditional to a more innovative approach, and a greater emphasis on the social and behavioural side of medicine. These changes require medical students to possess certain personal characteristics that facilitate the learning and practice of medicine. They have resulted in the necessity for medical school selection to be based on more than academic merit alone. This chapter aims to guide readers who might not have been closely involved in Australian medical education, by providing an overview of Australian medical education and the reviews that have been at the forefront of this reform.

Undergraduate medical education in Australia was closely modelled on the British prototype. In the past, Australian medical schools obtained formal accreditation from the General Medical Council (GMC) of the United Kingdom and the structure and curriculum of their courses closely followed the GMC's guidelines. It was not until 1985 that the Australian Medical Council (AMC) was established and given the power to make recommendations relating to the accreditation of Australian medical schools, and of courses leading to basic medical qualifications (Doherty, 1988).

As the approval of medical courses still rested with the GMC prior to 1985, the Todd Report (the Report of the Royal Commission on Medical Education in the United Kingdom, 1968) had a considerable impact on medical

education in Australia. This report proposed two major curricular developments. Firstly, courses in behavioural science and community medicine to be introduced in order to emphasise the social and human side of medicine. Secondly, changes in curricula away from the traditional model of one year of basic science, followed by two years of medical science and a further three years of clinical medicine (Sheldrake, Linke, Mensh, Newble & Rosinski, 1978).

Since the Todd Report, there have been several studies into undergraduate medical education in Australia. The Committee on Medical Schools (the Karmel Report, 1973) received many submissions criticising the current curricula of medical schools as being non-innovative, too scientific and not interested in family medical care. This report also discussed a number of curricular changes similar to those proposed in the Todd Report (Sheldrake, et. al, 1978).

In 1977, the Commonwealth Education Research and Development Committee sponsored a study into the future of medical education in Australia. Although this report did not make any specific recommendations, it emphasised the need for a review of student selection procedures, the medical school curriculum and continuing medical education (Sheldrake et. al, 1978).

In 1979, The Medical Board of Queensland set up a committee to investigate the future needs and training for medical practice in Queensland (the

Thompson Report, 1981). Some of the recommendations of this report included an integrated curriculum, early clinical contact and electives.

In 1987, The Committee to Inquire into Medical Education and Medical Workforce was established to investigate major aspects of preparation for medical practice. These included: the effectiveness of the curricula and the structure of current Australian medical undergraduate education to produce graduates with appropriate skills and competencies; the effectiveness of postgraduate training for general practice and medical specialities; and the selection of students to undertake the study of medicine (Doherty, 1988). It was widely acknowledged that selection procedures should include an evaluation of the personal characteristics of the applicant. It was thought that:

. . . although academic merit should remain an important pre-requisite at the tertiary level . . . selection should be broadened by taking account of other factors such as maturity, life experience and, most importantly, personal characteristics considered necessary or desirable for medical practice."

(Doherty, 1988, p. 539)

Proponents for an expansion of the selection criteria argued that those with the best secondary school examination marks did not always make "good" doctors (Doherty, 1988; Lowry, 1992). Secondary school results did not give an accurate picture of personality, ability, maturity and readiness for independent study (Collins & White, 1993; Collins, White & Kennedy, 1995;

Reede, 1999). They did not indicate whether the student was a flexible or rigid thinker, or could tolerate the uncertainties of medicine, or what motivation there was to study medicine (Marley & Carman, 1999; Powis, Neame, Bristow & Murphy, 1988; Rhoads, Gallenmore, Gianturco & Osterhout, 1974; Walton, 1987). It was considered preferable to start with very bright students who exhibited desirable personal characteristics, rather than to try to instill missing personal qualities in the brightest students (Doherty, 1988; Powis, 1994).

The following section will review how medical schools in Australia have adapted to these recommendations of reform and innovation.

2.1 Programs Offered by Australian Medical Schools

In 1978, Sheldrake and his colleagues reported that the adoption of graduate-entry programs was one possible approach for Australian medical schools in the future. They believed that the additional period of study during the first degree, and the maturation that had taken place during that time, may provide a more substantial basis for the selection of suitable medical students. As shown in Table 1, by the year 2002, three medical schools had decided to suspend their undergraduate programs and to introduce entirely new graduate-entry programs.

The University of Queensland converted to a graduate entry course in 1996 with the University of Sydney and Flinders University converting to their graduate entry courses in 1997 (Commonwealth Department of Health and Family Services, 1998; Gordon, 2001). The University of Melbourne now

Table 1

List of Australian Medical Schools - Programs Offered in 2003 and Length of Training

Medical School	Graduate Program or Stream	Undergraduate Program	Undergraduate Program (Years)
Flinders University	Yes	No	n/a
James Cook University	No	Yes	6
Monash University	No	Yes	5
University of Adelaide	No	Yes	6
University of Melbourne	Yes	Yes	6
University of Newcastle	No	Yes	5
University of New South Wales	No	Yes	6
University of Queensland	Yes	No	n/a
University of Sydney	Yes	No	n/a
University of Tasmania	No	Yes	6
University of Western Australia	Yes	Yes	6

offers a graduate-entry program in addition to their undergraduate program (University of Melbourne, 2002), and the University of Western Australia offers a graduate entry option into their medical program (University of Western Australia, 2002).

Another issue raised by Sheldrake and his colleagues (1978) was the length of undergraduate medical training. The Doherty Committee recognised that substantial savings would come from the general adoption of a five-year degree but the relative efficiency and effectiveness of such programs would depend upon appropriate curriculum design (Doherty, 1988). As shown in Table 1, the length of medical programs varies between medical schools, with most undergraduate programs requiring six years of study. The exceptions are the University of Newcastle and Monash University which both have a five-year medical degree. The curriculum in these medical schools is designed as an integrated structure (McPherson, 1997; Monash University, 2002).

The changes in both entry level to the degree and the length of training have given prospective medical students three options: a five year degree, a six year degree, or a four year graduate-entry degree.

2.2 Curriculum Content and Design of Australian Medical Programs

The traditional model of curriculum design in Australian medical schools consisted of two distinct stages. The first, the preclinical stage relating to basic and medical science, ran for two or three years and was mainly conducted in the university. The second, the clinical stage, was conducted mainly outside the university in a teaching hospital or other health facility (Doherty, 1988). Both the Todd Report (1968) and the Karmel Report (1973) proposed that the divide between these stages be eliminated. Such changes have taken place within Australian medical schools with the majority of schools now having an integrated curriculum (see Table 2).

Integration has taken place on both a horizontal and vertical level.

Horizontally integrated curriculum allows students to make connections between the different areas in medicine and the basic sciences in order to apply them to specific medical problems. Vertically integrated curriculum allows students to extend and consolidate their understanding and knowledge between the years of the medical program (McPherson, 1997).

To facilitate an integrated curriculum, many medical schools have moved towards problem-solving, problem-based, and/or patient-orientated learning (refer Table 2).

Table 2

Curriculum Content and Design in Australian Medical Schools

Source: 2002 University Handbooks - Undergraduate Medical Programs

MEDICAL SCHOOL	INTEGRATED CURRICULUM	METHOD OF LEARNING	KEY AREAS OF LEARNING	ELECTIVE STUDIES
James Cook University	Yes	<ul style="list-style-type: none"> • Self-directed learning • Computer assisted learning • Problem-solving learning • Community-orientated learning 	<ul style="list-style-type: none"> • Basic and clinical sciences • Community and population health • Personal and professional development • Rural and remote medicine • Indigenous health • Communication skills 	Yes
Monash University	Yes	<ul style="list-style-type: none"> • Patient-based learning 	<ul style="list-style-type: none"> • Personal and professional development • Population, society, health and illness • Foundations of medicine • Clinical skills 	Yes
University of Adelaide	Yes	<ul style="list-style-type: none"> • Problem based learning • Small groups • Student directed • Community orientated learning 	<ul style="list-style-type: none"> • Clinical skills • Personal and professional development 	Yes
University of Melbourne	Yes	<ul style="list-style-type: none"> • Problem based learning • Working in groups • Computer assisted learning 	<ul style="list-style-type: none"> • The scientific basis of medicine • Population health • Clinical skills • Professional attitudes and development 	Yes

Table 2 (Cont'd)

MEDICAL SCHOOL	INTEGRATED CURRICULUM	METHOD OF LEARNING	KEY AREAS OF LEARNING	ELECTIVE STUDIES
University of Newcastle	Yes	<ul style="list-style-type: none"> • Problem based learning • Student centred learning • Student directed learning • Community-orientated learning 	<ul style="list-style-type: none"> • Professional skills • Critical reasoning • Identification, Prevention and Management of Illnesses • Population medicine • Self-directed learning 	Yes
University of New South Wales	Yes	<ul style="list-style-type: none"> • Student centred learning 	<ul style="list-style-type: none"> • Medical and behavioural sciences • Flexibility of outlook and training • Clinical methods and patient care • Professional and ethical principles 	Yes
University of Tasmania	Yes	<ul style="list-style-type: none"> • Problem based learning 	<ul style="list-style-type: none"> • Foundation of medicine • Clinical skills • Communication skills • Flexibility of outlook and training 	Yes
University of Western Australia	Yes	<ul style="list-style-type: none"> • Problem based learning • Computer assisted learning • Self directed learning • Student centred learning 	<ul style="list-style-type: none"> • Scientific basis of medicine • Doctor and patient • Doctor, health and society • Personal and professional development 	Yes

Problem-based learning requires the development of an educational programme around a set of problems, giving emphasis to the identification and the solution of the problem, and to insights into the process of efficient and effective diagnostic thinking. Problem solving takes place when students acquire the basic and clinical course material and use it to arrive at a solution. Problems are discussed in small group tutorials and form the basis for a student's individual learning (Doherty, 1988; Walton, 1997). In patient-orientated learning, the knowledge, skills and attitudes that form the content of the curriculum are brought to life via formal patient-oriented teaching exercises (Monash, 2002).

Traditionally, the clinical stage of medical training was carried out in teaching hospitals. However, submissions to the Doherty Committee urged the use of various community facilities in addition to teaching hospitals. Community experience was seen as an integral step to "a change of emphasis in medical education towards primary health care, and towards a social as opposed to a medical model of health" (Doherty, 1988, p. 234). Most Australian medical schools currently incorporate community-orientated programs into their curriculum with rural placements, general practitioner attachments, and other placements within the community (refer Table 2). Students benefit from such community-orientated programs as they learn to appreciate the wide spectrum of health, disability and disease in the community, the relative importance of various disorders and disabilities and the extent of community resources available to handle them (Doherty, 1988). Early clinical contact also has the advantages of testing and confirming student commitment to a

medical career while a change of direction is still relatively feasible; of motivating students and providing a medically relevant context for their course material; and inculcating attitudes towards ethical practice, health promotion and disease prevention (Doherty, 1988, p.181).

The Doherty Committee received many expressions of concern at the ability of medical practitioners to communicate with and counsel patients. A common complaint of patients was that their doctors did not talk to them sufficiently and did not explain matters clearly. A lack of interviewing skills resulted in medical practitioners missing significant underlying emotional problems in their patients, and poor doctor-patient communication prejudiced compliance with any given treatment. It was suggested that the behavioural science component of the undergraduate course should be extended and modified to include areas such as effective interviewing, communication and interpersonal skills, counselling and health promotion strategies (Doherty, 1988). Most Australian medical schools have taken the suggestions on board and have included this component as one of their key areas of learning (refer Table 2).

Another curriculum change in almost all of the Australian medical schools is provision of time for elective studies (refer Table 2). The extent of elective programs varies between medical schools with the University of Tasmania limiting electives to year one (University of Tasmania, 2002), while at the University of Adelaide, 25% of the curriculum is devoted to elective studies (University of Adelaide, 2002). Non-medical, elective programs allow

students to broaden their cultural interests and help to reduce the isolation of medical students from the rest of the university population. However, some schools restrict electives to those that are related to medicine, thus allowing the student to pursue a deeper interest in selected aspects of medicine (Doherty, 1988).

2.3 Vocational Training and Specialisation

The objective of all Australian medical schools is to produce medical graduates with a basic knowledge of all areas of medicine, but with a need to complete further training in order to be competent in the area of their chosen specialisation. However, this concept of an "undifferentiated" medical graduate who requires further training for unsupervised practice is relatively new. Traditionally, the objective of undergraduate medical education was to produce a general practitioner who was efficient in the practice of medicine, surgery and midwifery (Doherty, 1988).

Medical school graduates must serve at least 12 months as an intern in an approved hospital before being admitted to full registration as a medical practitioner in Australia (Martin, 2001). After successfully completing the internship and obtaining full registration to practice, graduates have to make a career decision with respect to entering a postgraduate specialty training program (including general practice) offered by a professional college (Paget, 2001). There is a wide range of medical career paths and the options unfold as the student progresses through their undergraduate training. Normally career choices start to be made towards the end of undergraduate training and during the internship year (University of Adelaide, 2002).

Australia has thirteen professional medical colleges, as listed in Table 3. Traditionally, the Royal Australian College of General Practitioners (RACGP) has provided postgraduate training for urban and rural general practice. However, the Australian College of Rural and Remote Medicine (ACRRM) was incorporated in 1997 and it is now the peak professional association for rural medical education and training in Australia (ACRRM, 2002).

Vocational medical training is organised, supervised and examined by the relevant medical college and usually occurs within defined training positions, programs, departments or institutions, approved by the relevant college (Medical Training Review Panel, 1999). The length of vocational training ranges from three years for a General Practitioner to up to seven years for a Surgeon. The entry requirements also vary for each area of specialisation (refer Table 3). Some colleges allow entry to their training programs on the completion of the graduate's internship (PGY1), other colleges require graduates to have an additional postgraduate year (PGY2) in a public hospital-based training position with a generalist orientation before entering the college training program (Martin, 2001).

Australian medical schools also contribute to vocational training and specialisation of medical graduates. Academic research degrees, such as a Doctor of Medicine or Doctor of Philosophy, are seen as desirable qualifications for a career in medical research or academic medicine. In

Table 3

Australian Medical College Training and Continuing Medical Education Requirements

Source: Third Report of the Medical Training Review Panel - 1999; Medical College Websites, 2002.

AUSTRALIAN MEDICAL COLLEGES	LENGTH OF TRAINING (Years)	ENTRY REQUIREMENTS	CONTINUING MEDICAL EDUCATION PROGRAMS
Australian and New Zealand College of Anaesthetists (ANZCA)	5	2 year of general hospital appointments	MOPS - Maintenance of Professional Standards Program - voluntary
Australasian College of Dermatologists (ACD)	4	2 years of acceptable general training in a teaching hospital; pass in the college's Part 1 Dermatological Sciences Examination	
Australasian College for Emergency Medicine (ACEH)	7	Medical degree	MOPS - Maintenance of Professional Standards Program - compulsory
Royal Australian College of General Practitioners (RACGP)	3	Minimum of 7 years of postgraduate experience in general practice. Registered Medical Practitioner	Quality Assurance and Continuing Medical Education Program - compulsory
Royal Australasian College of Medical Administrators (RACMA)	6	Three years of clinical experience. Registered Medical Practitioner	Continuing education program
Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANCOG)	6	Medical degree	Practice Improvement component of Continuing Education Program - compulsory
Royal Australian College of Ophthalmologists (incorporating the Ophthalmological Society of New Zealand) (RANZCO)	4	2 years in approved pre-vocational general medicine and surgical training; examination in basic ophthalmic sciences; gaining an accredited vocational training position in a competitive environment	Continuing Professional Development Program since 1980

Table 3 (Cont'd)

AUSTRALIAN MEDICAL COLLEGES	LENGTH OF TRAINING (Years)	ENTRY REQUIREMENTS	CONTINUING MEDICAL EDUCATION PROGRAMS
Royal College of Pathologists of Australasia (RCPA)	5	Registered medical practitioner	Continuing Professional Development Program since 1996
Royal Australasian College of Physicians (RACP)	6	Medical degree	MOPS - Maintenance of Professional Standards Program since 1994
* <i>Division of Adult Medicine and The Division of Paediatrics</i>	5	Intern year	MOPS - Maintenance of Professional Standards Program
* <i>Australasian Faculty of Occupational Medicine (AFOH)</i>	4	At least 3 years of general clinical experience	MOPS - Maintenance of Professional Standards Program
* <i>Australasian Faculty of Public Health Medicine (AFPHM)</i>	3	Register medical practitioner; minimum of 3 years postgraduate experience and training relevant to public health medicine; completed coursework component of Master of Public Health or equivalent.	MOPS - Maintenance of Professional Standards Program
* <i>Australasian Faculty of Rehabilitation Medicine (AFRM)</i>	6	Registered Medical Practitioner	MOPS - Maintenance of Professional Standards Program
Royal Australian and New Zealand College of Psychiatrists (RANCOG)	5	Registered Medical Practitioner	MOPS - Maintenance of Professional Standards Program
Royal Australian and New Zealand College of Radiologists (RANZCR)	5	Medical degree, intern year and second postgraduate year	Continuing Medical Education Program
Australian College of Rural and Remote Medicine (ACRRM)	4	Registered Medical Practitioner	Professional Development Program
Royal Australasian College of Surgeons (RACS)	6 - 7	Medical degree and intern year	MOPS - Maintenance of Professional Standards Program

addition, medical schools also offer a wide range of postgraduate courses in areas such as medical informatics, general practice, public health, rural health, epidemiology and preventive medicine, forensic medicine, psychological medicine, geriatric medicine, biopharmaceuticals, radiography and medical imaging (University Handbooks, 2002). While these courses are not acceptable qualifications for registration, they may meet some of the requirements of the professional medical colleges (Doherty, 1988; Medical Training Review Panel, 1999).

The Doherty Committee (1988) received a number of submissions covering proposals to develop curriculum streams in the undergraduate course. The general theme of these submissions was that separate programs should be developed according to future career directions. One proposal was:

Consideration should be given to some streaming of medical school curricula towards community and family practice (primary practitioners), or specialist practice (referral practitioners). This could be done on a "core plus options" style of curriculum, or a common base with later streaming. The essential would be that teaching emphasis is on "more of less" rather than the opposite.

(Doherty, 1988, p. 179).

2.4 Continuing Medical Education (CME)

Undergraduate medical education must prepare graduates for a commitment to ongoing continuing education. Undergraduates need to develop a positive

attitude to lifelong learning and the skills that are needed for a lifetime of professional education. This can only be achieved by encouraging active, independent, self-directed learning. To this end, the Doherty Committee recommended that medical schools develop innovative programs, including the development of curricular material, to foster an inquisitive and self-directed approach to learning. In addition, it was recommended that there should be a greater use of computer-aided instruction, and of computers generally, in the day-to-day activities of medical students (Doherty, 1988). As listed in Table 2, a majority of Australian medical schools now utilise computer-assisted learning programs and have a commitment to student-centred and student-directed learning approaches.

By inculcating motivation towards lifelong learning during the undergraduate stage of medical training, future medical practitioners will be equipped with the capacity to seek out, assimilate and adapt to the rapidly changing world of medical knowledge. With a career span of 30-40 years, medical practitioners need to work hard at maintaining currency and competency (Doherty, 1988; Hays & Veitch, 1999).

Practising medical practitioners have a professional obligation to maintain their standards, skills and efficiency by continuously updating their knowledge. In fact, recent legislative changes to the NSW Medical Practices Act require medical practitioners to detail their continuing professional education activities for the preceding year (New South Wales Medical Board, 2002). New Zealand has also legislated similar requirements and it is

expected that other Australian states will follow with mandatory requirements for continuing medical education (Royal Australian College of Ophthalmologists [RANZCO], 2002).

As shown in Table 3, the Australian Medical Colleges offer programs of continuing medical education (CME). In some colleges participation is voluntary, in others participation is compulsory. Where participation is voluntary, the participation rate of medical practitioners varies from college to college (Medical Colleges, 2002). Formal approaches to CME include accreditation programs, peer reviews and clinical audits. Informal approaches include day-to-day professional contact, referral correspondence, participation in hospital case presentations, autopsy discussions, reading medical journals, access to medical libraries and medical databases, materials circulated by the pharmaceutical industry on new drugs and products, and government circulars on health (Doherty, 1988; Hays & Veitch, 1999).

2.5 Impact of Reforms on Medical Selections

In summary, the major reforms to medical education in Australian have been a restructuring of curricula, the adoption of graduate entry medical programs, specialized training after graduation, and on-going professional development. These reforms have resulted in a need for medical students to possess more than academic ability. The new integrated structure of the curricula incorporates problem-based, small-group, training methods which require students to possess the ability to work in teams. They must also possess

good interpersonal behaviours as they are now required to interact with patients, supervisors and peers from the outset of their training. To train to become a medical practitioner takes dedication and commitment. From undergraduate training, to internship, to specialization, takes approximately eleven years. Practitioners are then required to engage in professional development activities for the duration of their practice. This requires a very high level of motivation, compatibility to the pursuit of medicine, and an appreciation of continuous learning. The challenge for medical selection is to be able to identify these desired personal characteristics in medical school candidates.

The focus of the next chapter is to review the selection procedures currently used by Australian medical schools, and the selection process used by the JCU School of Medicine. It will discuss the personal qualities desired in medical students and the potential of personality testing as a selection predictor. Finally, it will propose a theoretical basis for a relationship between personality and academic performance in medical training.

CHAPTER 3

Selection Procedures Used by Medical Schools in Australia

- 3.0** Overview of selection criteria used by Australian medical schools

- 3.1** Description of current selection components
 - 3.1.1 Academic record
 - 3.1.2 Written applications
 - 3.1.3 Letters of recommendation
 - 3.1.4 Undergraduate Medicine and Health Sciences Admission Test (UMAT)

 - 3.1.5 Interview
 - 3.1.6 Conclusion

- 3.2** The JCU School of Medicine selection process
 - 3.2.1 Academic record
 - 3.2.2 Written application
 - 3.2.3 Interview

- 3.3** Personal qualities desired in medical students
 - 3.3.1 Identification of positive and negative characteristics
 - 3.3.2 Identification of future needs

- 3.4** Personality as a selection predictor
 - 3.4.1 Predictive validity of personality inventories
 - 3.4.2 Link between personality and academic performance

- 3.5** Summary

3.0 Overview of Selection Criteria Used by Australian Medical Schools

Until the mid 1970's, admission into medical schools was based solely upon the marks candidates had achieved in secondary school leaving examinations. "The unspoken justification for adopting and maintaining such a selection criterion was presumably that better marks in an earlier examination would predict better performance in the later examinations taken at medical school and thus ensure a more rapid progress through the medical course" (Powis & Bristow, 1997, p. 236). In 1988, academic merit based on secondary school leaving scores, or Year 12 tertiary entry scores, was still the only criterion for admission of school leavers to five out of 10 medical schools. The Doherty Committee received many submissions arguing that "selection should be broadened by taking account of other factors such as maturity, life experience and, most importantly, personal characteristics considered necessary or desirable for medical practice" (Doherty, 1988, p. 539). The Doherty Committee also received many submissions stating that

the socio-economic background of medical students was too narrow and did not reflect the composition of Australian society adequately. These concerns arose from a perception that medical education attracts private school students from professional families and was inaccessible to the wider population.

(Doherty, 1988, p. 533-534)

This led to a recommendation that encouraged medical schools to investigate and evaluate alternative means of selecting medical students.

The University of Newcastle was the first medical school to go beyond academic criteria, by including an entrance exam (Undergraduate Medical Admissions Test - UMAT) and a structured interview, designed to identify personal characteristics, in their selection process (Gordon, 2001; Powis & Bristow, 1998). Similarly, the three graduate medical schools formed a Consortium and commissioned the Australian Council for Educational Research (ACER) to develop a new entrance exam. Entrance into these graduate medical schools are based on the completion of a prior degree, the Graduate Australian Medical Schools Admission Test (GAMSAT) and a structured interview (Gordon, 2001; Prideaux, Teubner, Sefton, Field, Gordon & Price, 2000).

Today, prospective students initially apply for entry into medical programs through the relevant State Tertiary Admission Centre. As shown in Table 4, three out of eight medical schools in Australia require prospective students to submit a written application, together with letters of recommendation, as part of the selection process. The majority of schools also require prospective students to sit the Undergraduate Medicine and Health Sciences Admissions Test (UMAT), and/or attend an interview, which assesses the most important non-cognitive characteristics deemed necessary for success in their medical program.

Table 4
Selection Criteria used in Australian Medical Schools
Source: 2002 University Handbooks - Undergraduate Medical Programs

MEDICAL SCHOOL	ACADEMIC MERIT	SPECIAL CONSIDERATION	WRITTEN APPLICATION	ADMISSION TEST	PERSONAL INTERVIEW	INTERVIEW CRITERIA
James Cook University	ITI (TER) ≥ 93	<ul style="list-style-type: none"> Rural Students Indigenous Students 	Yes	No	Yes	<ul style="list-style-type: none"> Motivation Independence Communication Interpersonal Style
Monash University	ENTER (TER) ≥ 99	<ul style="list-style-type: none"> Special consideration for educational disadvantage due to rural schooling 	No	UMAT	Yes	<ul style="list-style-type: none"> Motivation Interpersonal Style Communication
University of Adelaide	SACE (TER) ≥ 90	<ul style="list-style-type: none"> Fairway Scheme - rural students 	No	UMAT	Yes	Faculty-structured oral assessment
University of Melbourne	ENTER (TER) ≥ 96	<ul style="list-style-type: none"> Targeted Access Program - Rural students Indigenous Entry Scheme 	No	UMAT	No	N/a
University of Newcastle	UAI (TER) ≥ 90 (Non rural) UAI (TER) ≥ 85 (Rural students)	<ul style="list-style-type: none"> Aboriginal and Torres Strait Islanders 	Yes	UMAT Psychometric Tests <ul style="list-style-type: none"> Problem solving Logical reasoning Morals/ethics Empathy Spatial perception Non-verbal analytical skills 	Yes	<ul style="list-style-type: none"> Compatibility with program Perseverance Tolerance of ambiguity Empathy Motivation Personal effectiveness

Table 4 (Cont'd)

MEDICAL SCHOOL	ACADEMIC MERIT	SPECIAL CONSIDERATION	WRITTEN APPLICATION	ADMISSION TEST	PERSONAL INTERVIEW	INTERVIEW CRITERIA
University of New South Wales	TER Score	<ul style="list-style-type: none"> Indigenous Students ACCESS Scheme - Disadvantaged Rural Student Entry Scheme 	Yes	UMAT	Yes	Information not available in the public domain
University of Tasmania	ITI (TER) ≥ 97.45	n/k	Yes	UMAT	No	N/a
University of Western Australia	TER ≥ 96	<ul style="list-style-type: none"> UWAY Scheme - Disadvantaged Rural students 	No	UMAT	Yes	<ul style="list-style-type: none"> Communication Skills Capacity for analysis Critical reasoning Motivation and commitment Ability to assist/work with others Ability to manage oneself Perseverance

Most medical schools now have a small number of placements allocated to special entry categories, such as, rural and remote students, Aboriginal and Torres Strait Islanders, and international students. The total number of students admitted under these schemes varies between medical schools. Indigenous Australians, Aboriginals and Torres Strait Islanders are significantly under-represented in medical school intakes. While 2% of Australians identify as Aboriginal or Torres Strait Islanders, only 0.6% of students come from these groups (Gordon, 2001; Saunders & Schofield, 2001).

3.1 Description of Current Selection Processes

In Australia, the most common selection components used in medical selection include academic record, the written application, letters of recommendation, the UMAT, and the selection interview. The literature will now be reviewed in terms of the reliability and validity of these components.

3.1.1 Academic Record

Traditionally, Australian medical schools used to select from the top 1-2% students (Australian Council for Educational Research [ACER], 2002; Powis, 1994). However, in an effort to attract rural and indigenous students, and students who are more representative of the social, ethnic, cultural and economic mix of the population at large, most medical schools have lowered their academic entry requirements. Most medical students are now selected from the top 1-10% of school leavers - an exception is the University of

Newcastle who selects rural students from the top 15% (University Handbooks, 2002).

Many international studies have found that previous academic performance, operationalised as MCAT scores, A-Level grades, and/or tertiary grade point average, is predictive of academic performance in medical training (for a review see Collins, et. al., 1995; Hoschl, & Kozeny, 1997; Montague & Odds, 1990; Richardson, Winder, Briggs & Tydeman, 1998; Salvatori, 2001; Weiss, Lotan, Kedar & Ben-Shakher, 1988). In Australia, secondary school exit results have been reported to have a moderate correlation ($r = .49, p < .01$) with overall achievement in medical training (Lipton, Huxham & Hamilton, 1984). In the Monash medical program, they had predictive validity in the fields of cell and tissue studies, systems units, and clinical and communication skills, with correlations ranging from .19 to .35 (Tutton, 1997). In the Newcastle program, students who had scored in the top 1-2% of the New South Wales Higher School Certificate, or equivalent, were 0.6 times less likely to receive an assessment of 'not satisfactory' (Kay-Lambkin, Pearson & Rolfe, 2002). In a meta-analysis of the literature, Ferguson, James and Madeley (2002) reported that 23% of the variance in medical school performance can be explained by previous academic performance. However, the literature also indicates that while previous academic performance may be predictive of academic performance in preclinical training, it has little predictive value in clinical performance (Collins, et. al., 1995; Mitchell, 1990; Montague & Odds, 1990). With the current trend towards the integrated structure of preclinical and clinical years, academic

merit may prove to have less predictive value of success in the early years of medical training.

A comparative analysis of prior studies is extremely difficult due to the different operationalisations of academic performance. However, It is not surprising that studies using a dichotomous scale for academic performance did not find a significant relationship. The secondary school exit scores of medical students fall within a very narrow percentile band, which creates a restricted range problem. This is then compounded by the use of a dichotomous scale for the dependent variable. When a wider scale is used for academic performance (for example, GPA scores with a range of 1-7), studies are more likely to find significant results. A potentially confounding variable that is not addressed in the literature concerns the failure to account for students who may have failed for reasons other than academic capability.

The lowering of the academic threshold has been supported by research that shows students who do not complete the medical degree, due to withdrawal or failure, compared to students who graduate with honours, had no significant difference in their academic scores on entry to the medical program (Powis, et., al. 1988). Furthermore, a study of students initially rejected from medical school but later accepted, compared to students initially accepted, found no meaningful differences between the groups, relating to attrition and preclinical/clinical performance throughout the medical degree and the first year of postgraduate training (DeVaul, Jervey, Chappell, Caver, Short & O'Keefe; 1987).

3.1.2 Written Applications

Components of the written application offer the applicant an opportunity to describe how their personality, motivations, past achievements, skills, education and hobbies make them suitable candidates for medical education (Ferguson, et. al., 2000). The written application can be a useful tool in soliciting in-depth and extensive information about applicants' non-cognitive characteristics and their suitability for the medical profession (Emmett, 1993). Studies have shown that written applications can be reliably judged (McManus & Richards, 1989), with interrater reliabilities between individual raters ranging from .62 to .76 (Brown & Campion, 1994). In addition, raters were found to use the full range of possible judgments and only minor differences were found in the mean and range of their judgments. Thus, similarity of standards can be maintained while using a number of separate assessors (McManus, Maitlis & Richards, 1989).

While research has found written applications are not predictive of preclinical performance in medical school (Ferguson, et. al., 2000), recent studies have shown that they do have predictive validity in clinical performance in medical training (Ferguson, et. al., 2003), and training in the allied health fields (Salvatori, 2001).

3.1.3 Letters of Recommendation

Letters of recommendation, or references, are one of the most commonly used and, unfortunately, the least valid of all selection predictors. They are reported to have an average validity coefficient between .13 (Muchinsky,

2000) and .26 (Schmidt & Hunter, 1998). In the case of medical applicants, they are usually written on behalf of the applicant by principals and teachers and although they may give information about cognitive abilities, attitudes and behaviours, they have been found to be biased, too flattering and not good predictors of performance (Ferguson, et., al, 2003; Muchinsky, 2000; Powis, 1998; Salvatori, 2001; Walton, 1987). For example, the director of one graduate program received two identical letters of recommendation for two different applicants. These letters came from the President of a foreign university where the students were enrolled. Each letter made the student sound incredibly strong academically: the class valedictorian, the only recipient of the native king's fellowship program, the only student who received a special citation from the university, etc. Apparently the foreign university had a form letter for students seeking admission to graduate schools in the United States (Muchinsky, 2000).

3.1.4 Undergraduate Medicine and Health Sciences

Admission Test (UMAT)

The majority of Australian medical schools assess the cognitive ability of applicants through the Undergraduate Medicine and Health Sciences Admissions Test (UMAT), the structure and content of which is shown in Table 5. The UMAT consists of a battery of three tests developed each year by the Australian Council for Educational Research (ACER) on behalf of the UMAT Consortium, which comprises six of Australia's undergraduate medical schools (refer Table 4). It is designed to assess general attributes and skills gained through prior experience and learning. Its aim is to complement the academic record, not to replicate it (ACER, 2002).

Table 5

Structure and Content of the UMAT

Source: Australian Council for Educational Research (ACER), 2002.

SECTION	PURPOSE	NO. OF QUESTIONS	TIME ALLOWED (Minutes)
<u>Section 1:</u> Logical Reasoning And Problem Solving	Assesses the ability to comprehend a passage or piece of information and to draw logical conclusions Tests the ability to reach solutions by identifying relevant facts, evaluating information, pinpointing additional or missing information, and generating and testing plausible hypotheses.	41	50
<u>Section 2:</u> Interaction Skills	Short conversational scenarios and four possible responses	20	30
<u>Section 3:</u> Non-verbal Reasoning	Questions are in the form of patterns or shapes and are designed to assess the ability to extract particular information from within a large amount of irrelevant data - choice of 5 responses.	22	35

The non-academic personal qualities encompassed in the UMAT are considered important to the study and later practice of medicine (ACER, 2002; Powis, 1994). Intellectual ability includes intellectual flexibility, inquisitiveness, critical reasoning, logical thinking, problem solving, and embraces study style and efficiency. Many of these skills appear to be valid prerequisites for clinical practice. Verbal and literacy skills can be linked to increased clinical effectiveness and numeracy skills with research activities. English proficiency and studies in the humanities were found to be the only

factors of statistical relevance in determining progress throughout the medical course, which may be indicative of the importance of communication skills in clinical practice. In addition, previous study of arts/humanities subjects may lead to greater sensitivity, insight and human understanding, which facilitates the relationship between student and patient (Powis, 1994). Research has shown that medical students with a background in both science and humanities had a higher intern performance rating than those students with a background in science alone. Furthermore, those students with a humanities/science background were twice as likely to fulfill the degree requirements (Rolfe, Pearson, Powis & Smith, 1995).

A question mark hangs over the validity of the UMAT across all medical programs as it was designed specifically for the Newcastle medical program which has a different curriculum structure to other medical schools in Australia. Unfortunately, no Australian studies have been published on the predictive validity or reliability of the UMAT. However, numeracy and verbal skills are prominent features of the American equivalent, the Medical College Admissions Test (MCAT), which has been widely researched. The MCAT measures reading, quantitative skills, biology, chemistry, physics, scientific problem-solving, analytic thinking and writing skills (Reede, 1999; Walton, 1987). MCAT scores do not predict grades in non-science courses or performance in clinical subjects (Walton, 1987). Although scores in the preclinical years are predicted by MCAT scores (Mitchell, 1990; Reede, 1999), it provides little if any information regarding extremely important noncognitive abilities such as motivation (Doherty, 1988; Rhoads, et. al,

1974; Walton, 1987) interpersonal skills, personal integrity, and social consciousness (Reede, 1999). One major concern with basing selection decisions solely on prior academic record and MCAT scores is that it may lead to the "cloning" of medical graduates, and to the diminution in creative and original "divergent" personalities (Powis, et. al, 1988). Research has shown that grade point averages and MCAT scores show substantial and significant differences between those applicants who are selected for interview and those who are not. However, at the interview stage, there are essentially no differences between the applicants who are selected and those who are rejected. This is contrary to the new emphasis in medical education to train medical practitioners with diverse and well-rounded interests and backgrounds (VanSusteren, Suter, Romrell, Lanier & Hatch, 1999).

3.1.5 Interview

Six Australian undergraduate medical schools use the interview as part of their selection process (see Table 4). They are also used widely overseas, with 124 of 127 medical schools in the US, and 19 out of 34 schools in Great Britain, using the interview in their admissions process (Collins & White, 1993). As far as can be ascertained, the interview criteria used in Australian medical schools can be grouped into four major domains: motivation, interpersonal skills, independence and communication skills (James Cook University, 2002; Powis, et. al., 1988; Tutton, 1993, 1994).

(1) *Motivation*: Motivation, perseverance and commitment are deemed necessary prerequisites to the study of medicine (Marley & Carman, 1999; Rhoads, et. al., 1974; Walton, 1987). Medical training is a lengthy process

consisting of six years of undergraduate training, one year of internship and up to seven years of specialist training (see Table 3). Prospective students need to have a desire to become a doctor, a good understanding of what a career in medicine entails and a commitment to such an extended period of training.

(2) *Interpersonal Skills:* Good interpersonal skills, together with the ability to work with others, are necessary prerequisites to success in both medical training and medical practice (Powis, et. al., 1988; Tutton, 1994). An integrated curriculum is based on problem-based or problem-solving learning which requires a team approach to specific learning tasks and small group active-learning exercises. Most medical programs include projects and assignments in clinical situations away from the home campus, experiences in rural and remote communities, and hospital-based and general practice exposure. The student-patient relationship requires students to have appropriate consulting and interviewing skills, an ability to empathise with the patient, and an understanding of non-verbal behaviour (Evans, Stanley, Coman & Burrows, 1989).

(3) *Independence:* Independence, personal effectiveness and/or self management, are all necessary attributes for medical students who will experience community placements in rural and remote areas. Students will be away from family and friends and will need to have a capacity for independence, to possess coping skills and the ability to solve problems in novel situations. They will need to have a capacity for self-evaluation and

self-directed learning which will continue throughout their careers as medical practitioners (Edwards, et. al., 1996).

(4) *Communication Skills*: Good communication skills are essential in both the student-patient and doctor-patient relationship (Berg, 1996). Medical students need to possess good listening and feedback skills, and have the ability to formulate, view and communicate them clearly (Tutton, 1994; Powis, et. al., 1988).

Although interviews play an important role in the selection of medical students, they have been criticised because of the many factors that may potentially bias the interviewers' assessment of the applicant. Studies have shown that interviewers' ratings have been biased by gender, with women receiving significantly higher interview ratings than men, regardless of the gender of the interviewer (Shaw, Martz, Lancaster & Sade, 1995). Narrowing the bias down to the level of sex similarity, it was found that female recruiters reported better interview experiences with female applicants than male applicants and, in turn, evaluated them more favourably. On the other hand, sex similarity did not affect male recruiters' perceptions of interview quality or evaluation of applicants (Graves & Powell, 1996). However, in relation to medical school applicants, the reverse has been found - male applicants were rated higher by both male and female interviews (Edwards, et. al., 1996). The candidate's personality has also been found to strongly influence overall outcome decisions (Anderson, 1999), and physical attractiveness (Burnett, 1998; Gilmore, 1986) and body weight (Pingitore,

Dugoni, Tindale & Spring, 1994) have been associated with interviewer bias. The interviewers' subjective assessment of how well the candidate is suited to the job or profession also has a large effect on the overall assessment (Cable, 1997).

The potential for interviewer bias can be reduced through structuring the interview (see Campion, Palmer & Campion, 1997). Structured interviews have been reported to produce mean validity coefficients twice as high as unstructured interviews (McDaniel, Whetzel, Schmidt & Maurer, 1994; Wiesner, 1988). Upper limits of validity have been estimated at .67 for highly structured interviews and .34 for unstructured interviews (Campion, et. al., 1997; Conway, Jako & Goodman, 1995), while interrater reliability scores for selection interviews conducted within medical schools have been reported to range between .86 and .95 (Tutton, 1994).

Research into the predictive validity of interview scores in relation to academic performance within both medical training and training for the allied health fields, has found that interview scores are not predictive of academic success (for a review see Morris, 1999; Salvatori, 2001). Interview scores have been found to be inferior predictors of success in cognitively-orientated course components, such as biochemistry and physiology, in the first three years of medical training (Tutton, 1997). A comparison of academic performance between students admitted on the basis of interview scores and those admitted without an interview, showed that there were no significant differences between the two groups in the first year of training, within the

same medical program (Smith, Vivier & Blain, 1986). Similarly, students who were rejected on the basis of interview scores, but later accepted due to an increase in the number of places available, performed just as well as those students who were initially accepted (DeVaul, et. al., 1987). This later finding is not surprising, as in most large selection processes the next 'several' on the list are not significantly distinguishable from those selected in the first place.

However, interview scores have been found to be significant predictors in relation to clinical performance within training for medicine and the allied health fields (for a review see Morris, 1999; Salvatori, 2001). Interview scores have been found to be a reliable predictor of clinical and communication skills in the first three years of medical training at Monash University (Tutton, 1997). Interview scores have also been predictive of academic failure with students given poor interview scores, compared to students given good scores, being more likely to be excluded from the Newcastle medical program because of persistent failure, or to withdraw from the course before completion (Powis & Rolfe, 1998).

3.1.6 Conclusion

In summary, medical schools in Australia vary in their approach to selecting students for their medical programs. While they all retain the selection criteria of academic merit, they vary in the level of previous academic performance needed for entry into their medical programs. Written applications and letters of recommendation are required by some medical schools but not others. Some schools choose to use the UMAT, others

choose the selection interview, while others use a combination of both. The predictive validity of a single approach is limited (Walton, 1987; Weiss, et. al, 1988). Previous academic record is a proven predictor of academic performance in the preclinical years of medical training, but it has little utility in the prediction of clinical performance. Conversely, interview scores have been found to be predictive of clinical performance but not academic performance. Thus, best practice in selection never relies on a single source of data but rather uses a multi-method approach. The following section looks at the selection components used by the JCU School of Medicine, which is the field setting for my research.

3.2 The JCU School of Medicine Selection Process

In 1998, the percentage of medical practitioners working in rural or remote areas was 15.6% of all medical practitioners. This contrasted with 28.7% of the population living in those areas at that time (Australian Institute of Health and Welfare [AIHW], 2000). Similarly, of the medical students commencing study throughout Australia in 1999, 88.1% came from capital cities or other metropolitan areas, and 11.4% came from rural or remote areas (AIHW, 2000). This trend is attributed, in part, to the educational disadvantage experienced by both rural students and those students who do not attend private secondary schools (Marley & Carman, 1999; Walton, 1987).

In an effort to improve the recruitment and retention of rural doctors, the Commonwealth Government established the JCU School of Medicine in northern Australia (Commonwealth Department of Rural Health, 2002; Hays,

2001). The JCU medical school promotes medical careers to students from rural and regional communities and to indigenous Australians. Research indicates that students who grow up in rural areas have a greater understanding of, and a firmer commitment to, the welfare of rural people and are more likely to return to work in those areas (Australian Medical Workforce Advisory Committee [AMWAC], 1998; Marley & Carman, 1999; Peach & Bath, 2000; Rolfe, Pearson, O'Connell & Dickinson, 1995). There are three components of the JCU selection process: academic record, the written application, and the interview.

3.2.1 Academic Record

In Queensland, Overall Position Ranks (OPs) are used to assess the academic performance of applicants who have recently left school. OPs, provide a statewide rank order of students, on a scale of 1 to 25, with '1' being the superior academic ranking. They are based on students' achievement in Authority subjects studied for the Queensland Senior Certificate, and show how well that student has performed in their senior studies when compared with the performance of all other OP-eligible students in Queensland. Other Australian States use different measures of overall achievement, including Tertiary Entrance Ranks (TERs), University Admissions Index (UAI), and Equivalent National Tertiary Entrance Ranks (ENTERs). These different rankings can be compared using the Australasian Year 12 Conversion Table, which is released on an annual basis by the Queensland Tertiary Admission Centre.

To ensure that rural students have a fair chance of gaining a place in the JCU medical program, the school established a weighting system within the selection process for JCU medical students. This system weights the student's academic performance (OP ranks) according to the geographical location in which such schooling took place - the more remote or rural, the more credit an applicant is given for their academic performance. In addition, there is a separate selection process which is culturally specific to Aboriginal and Torres Strait Islander applicants (McKergow, 2000).

3.2.2 Written Applications

Applicants are required to fill out a written application form which is evaluated to select the candidates who will be invited to attend an interview. Currently, applicants are required to answer four questions which relate to: 1) their motivation for wanting to become a medical practitioner (Rhoads, et. al., 1974); 2) the practical activities they have undertaken to follow-up on their desire to study medicine (Campion, Campion & Hudson, 1994; Motowidlo, Carter, Dunnette, Tippins, Werner, Burnett & Vaughan, 1992); 3) their interest in rural, remote, indigenous and tropical medicine and; 4) any other information that the applicant considers is important to their application. Question 3, regarding an interest in rural and indigenous medicine, was added to the application form following minor revisions after the first intake of students. Question 4, offers the applicant an opportunity to describe how their personality, motivations, past achievements, skills, education and hobbies make them appropriate for selection. Each applicant is also allowed

to submit, if they so wish, three letters of recommendation in support of their application.

For the first cohort, each application was assessed by two raters, who rated each of the four questions, plus the supplementary information, on a scale of 1 – 5. Raters also make an overall assessment of the applicant's suitability for the JCU medical program on a scale of A-D. It should be noted that the operationalisation of the application data is not based on empirical evidence, because relevant empirical norms do not exist in the general field of medical selection and, as a greenfield site, JCU does not yet have local norms. Instead, the criteria are based on the judgment of what is theoretically appropriate and by consultation with subject matter experts who have extensive experience in the selection of students for medical school. The scales are Behaviorally Anchored Rating Scales (BARS) designed to specifically define each dimension. Data from initial cohorts will be analysed and further research sought to more empirically validate and refine the rating process. Interrater reliability has been maximised by having a set rating criteria, and raters undertake training designed to minimize the impact of bias and error. All applications were double-rated in the first intake and, in subsequent years, a random sample was double-rated as a reliability check.

3.2.3 Interview Process

The interview scales are also Behaviorally Anchored Rating Scales that assess the applicant's motivation to study medicine, interpersonal style, level of self-reliance, and communication skills. These broad constructs have

previously been described in Section 3.1.5. Unfortunately, specific details of the operationalisation of the selection criteria cannot be revealed as the selection process is currently in use and confidentiality must be maintained to ensure the future validity and reliability of the process. The retention of such information will not affect the replication of my research, as each medical school formulates their own selection criteria to assess those qualities sought in their medical program. The operationalisation of the JCU selection criteria is of little use to other medical schools, particularly given the JCU rural mandate. Other medical schools replicating my research will do so with their own selection criteria.

The JCU interview process has been structured to minimise interviewer bias and to maximise validity and reliability. Firstly, since the JCU School of Medicine is a greenfield site, the questions asked are based on an analysis of personal characteristics which subject-matter-experts deemed necessary for success in the JCU medical program. Secondly, the second highest level of structure is utilised by asking each candidate the same questions, in the same order, but allowing limited follow-up questioning. Thirdly, the JCU interview uses both situational and past-behavioural questions, which are structured and focused. Fourthly, each of the four components of the interview is rated separately on a scale of 1 - 10. The use of anchored scales, where interviewers mark to preset criteria, enhances reliability and validity. Fifthly, each JCU interview panel is comprised of a qualified medical practitioner, a non-medical academic, and a community representative. This reduces the impact of idiosyncratic biases among interviewers and the

aggregation of multiple judgments cancels out random errors. A panel of three also facilitates the recall of information among interviewers. Panels are gender balanced to ensure that there are no single-gender panels. Lastly, during the period of this study, all new JCU interviewers attended a one-day training workshop on the interviewing process, and existing panel members attended a half-day refresher workshop prior to sitting on the selection panel for new intakes. This facilitates the correct implementation of the components of the interview process.

A schematic diagram of the JCU selection process is shown in Figure 1.

Mainstream Process: OP weighted

Indigenous Process: OP weighted or alternative demonstration of academic ability

Parallel Behaviorally Anchored Rating Scales (BARS) adapted for cultural appropriation

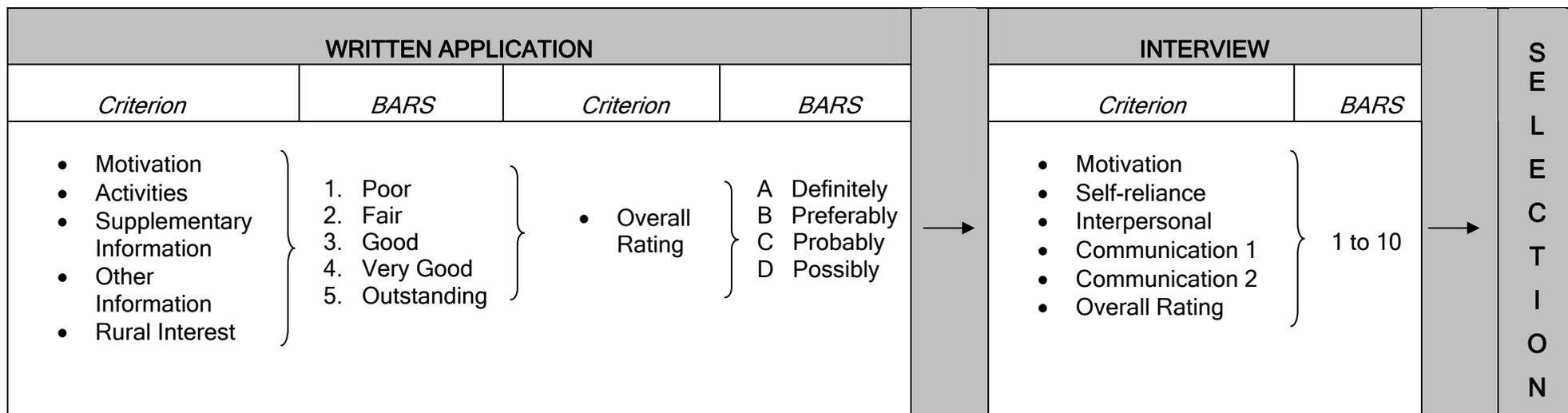


Figure 1

Diagram of the JCU Medical School Selection Process

3.3 Personal Qualities Desired in Medical Students

3.3.1 Identification of Positive and Negative Characteristics

One of the aims of medical education is to produce "good doctors". Overall, a definition of "good doctor" encompasses a person who not only has a high level of clinical competence but who also has personal attributes and attitudes pertinent to good medical practice (Doherty, 1988). However, it is very difficult to precisely define what those attributes and attitudes are. Price, Lewis, Loughmiller, Nelson, Murray & Taylor (1971) produced a list of 87 positive qualities that should be present in a good doctor and 29 negative qualities that should be absent. Meredith, Dunlap & Baker (1982) ranked 87 desirable characteristics and then ranked how easily each characteristic could be taught. The study concluded that there were at least 20 important characteristics that were unteachable, for example, emotional stability, energy, unquestionable integrity, enthusiasm, forthrightness, intellectual honesty, understanding, and a genuine concern for patients. In 1987, representatives of a majority of Australian and New Zealand medical schools met in Newcastle and developed a list of qualities they considered desirable in potential doctors (Table 6). There are inherent problems associated with translating such lists of desirable traits into measurable qualities in medical school applicants.

Firstly, A literature search did not find any information relating to the process undertaken in generating the above list of personality characteristics. Hence, it has been assumed that the list is based on expert opinion, practical experience and debate. From an organizational psychology perspective, the

Table 6

Personal attitudes and attributes desired in an intending doctor

ATTRIBUTES	ATTITUDES
Self-motivation	A positive attitude to self-education and continuing self-education
A caring ethos (compassion, tolerance, patience)	An appropriate view of the role of a doctor:
A sense of social responsibility	- realistic expectations
(a) Ability to work in a team	- ability to subjugate personal beliefs to needs of patients
(b) self-confidence, not arrogance	- tolerance and acceptance of current ethical and moral standards
Astuteness, balance, breadth of vision, a spirit of enquiry, an ability to integrate	
Ability to work systematically	
Curiosity in the context of aspects of medicine	
Intellectual honesty/integrity	
*Admissions Committees should look also for the absence of the above i.e. negative vetting	

SOURCE: Powis, D. A., (1994). Selecting medical students. *Medical Education*, 28, p. 448.

development of a list such as this should be driven by theory and research, to ensure the validity and reliability of the measures proposed. For example, the concept of social responsibility has been defined by an ability to work in a team, and the possession of the traits of self-confidence and a lack of arrogance. However, social responsibility is conceptually related to altruistic behaviour rather than team-working and interpersonal skills (see Baron & Byrne, 1997). A person high on social responsibility believes that they should do their best to help others. Similarly, astuteness, balance, breadth of vision, a spirit of enquiry, and an ability to integrate are very different

psychological constructs, which would make it impossible to measure this grouping as a single concept.

Secondly, there appears to remain a blurring of boundaries as to what personal characteristics are required to make a good “medical student” versus those required in a good “medical practitioner”. Powis defined good medical students as “those who best fit the style, ideology or curriculum of the institution in which they are to study” (1994, p. 446). This means that each individual medical school needs to have a clear view of their curriculum and know what knowledge, skills, abilities and other characteristics (KSAOs) are needed by potential medical students to successfully complete their medical program (Edwards, Johnson & Molidor, 1996; Marley & Carman, 1999; Powis, 1994; Powis & Bristow, 1997; Powis, et. al., 1988; Tutton, 1993). As far as can be ascertained, medical schools in Australia do not carry out a systematic, evidence-based, organizational analysis of the prerequisite personality characteristics required for their medical program.

Thirdly, in addition to devising a list of desirable personal attributes, medical schools must determine if such an attribute needs to be present in the applicant at the outset, or whether the medical curriculum can instill the absent characteristic (see Sade, Stroud, Levine, & Fleming, 1985).

Theoretically, if the attribute can be instilled it is unnecessary to seek the quality and it can be deleted from the list. However, it is easier to shape, nurture and reinforce desirable qualities that are present at the outset, rather than trying to instill absent characteristics (Doherty, 1988; Powis 1994). This

implicitly assumes that medical programs have been designed to transform and/or develop suitable students into successful medical practitioners. However, there is no evidence to support that this is what actually happens.

In making the distinction between desirable characteristics in medical training versus medical practice, Powis (1994) developed a list of non-cognitive personality dimensions that could be used in the evaluation of medical school applicants (see Table 7). As highlighted in that table, the identification of negative characteristics is just as important as the identification of positive qualities in medical school applicants. The possession of negative qualities that have been linked to the exploitation of vulnerable patients, dishonesty, repeated inappropriate behaviour, or failure of treatment for chronic substance misuse, would call into question the applicant's suitability for the training and practice of medicine (Rubin, 2002). The arduous academic requirements of medical training, together with the medical socialization experience, have been found to contribute to stress, anxiety, depression, anger and suicide among vulnerable students (Aristeiguieta, 1998; Ashton & Kamali, 1995; Baldwin, Daugherty, et. al., 1991; Lerner, 1995). It is important that the selection process can identify those students who are potentially at risk. The admission of unsuitable students who prove unable to cope with the rigors of medical training (Hohaus & Berah, 1985; Richman, Flaherty, Rospenda & Christensen, 1992) results in a waste of public resources (i.e. training expense), as well as a personal cost to these students.

Table 7

Groups of related non-cognitive personal qualities that might be sought in applicants by medical school admissions committees.

Positive Qualities:	Empathic Concerned Understanding	Compassionate Caring Responsive	Considerate Sensitive Encouraging
	Optimistic Enthusiastic Persevering	Cheerful Energetic	Well-motivated Persistent
	Flexible Tolerant	Adaptable	Patient
	Responsible Sincere Moral Ethical	Conscientious Honest High integrity	Mature Trustworthy Professional
	Foresight Observant Good judgement Decisive	Anticipation Common sensical Aware of limitations	Alert Thoughtful Self-aware
	Imaginative	Creative	
	Logical Flexible thinker Independent learner	Orderly Lateral thinker Self-teacher	Well-organised Problem solver
	Confident	Inspires confidence	Commands respect
	Good communicator	High verbal skills	Good writing skills
	Negative Qualities:	Neurotic Rigid/intolerant	Psychotic Dishonest
Qualities, the extremes of which are equally undesirable:			
	Introvert	vs	Extrovert
	Compulsive	vs	Sloppy/disorganised
	Obsessional	vs	Poorly motivated
	Manic	vs	Apathetic/lethargic

SOURCE:

Powis, D. A., (1994). Selecting medical students. *Medical Education*, 28, p. 448.

3.3.2 Identification of Future Needs

In addition to fitting the student to the curriculum, consideration must also be given to those future qualities which will become necessary in the face of the changing nature of work itself (Schmitt & Chan, 1998). The speed of technological change and the move towards teamwork will have implications for the selection criteria chosen by medical schools. The speed of technological change is especially relevant to both the study and the practice of medicine, where theoretical and technological knowledge is advancing rapidly. The process of matching applicants to fixed job requirements becomes increasingly irrelevant and there is a need to look at other characteristics, such as the applicant's capacity to seek out, assimilate and adapt to new information (Doherty, 1988; Hays & Veitch, 1999).

Complex technology systems adopted by medical organisations exert demands for effective team functioning. Many complex tasks are assigned to teams because these tasks exceed the capabilities of single individuals. For example, to perform complex surgical procedures, medical teams have to process and act upon specialized information from several expert sources to reach decisions (Schmitt & Chan, 1998). Small group methods in training and assessment are integral parts of medical training (Walton, 1997), and the actual practice of medicine often involves working as part of a multi-disciplinary team. The selection process needs to identify those applicants who have the capacity to work well in teams.

It must be emphasised that not all medical graduates elect to become practitioners, some choose to become, for example, teachers or researchers. Therefore, it is important that the process used in medical selection is broad enough to capture the diversity of personal characteristics associated with the different specialized fields of medicine. The use of personality inventories may have potential in identifying the wide range of personal characteristics that are desired in medical students.

3.4 Personality as a Selection Predictor

There is a paucity of research on the construct validity of interview criteria used in medical selection. Thus, the question of whether the interview criteria used in medical selection are actually assessing those personal qualities desired in medical students, or not, remains unanswered.

Personality testing offers an alternate means of reliably assessing non-cognitive characteristics in medical school applicants. Many of the available personality inventories have been well researched and found to have high levels of internal reliability and construct validity (Gregory, 1996). One of the main advantages of personality testing compared to the medical selection interview is that personality inventories, such as the California Psychological Inventory (CPI) and the Hogan Personality Inventory (HPI), offer both global and specific measures of personality characteristics (Gough, 1987; Hogan & Hogan, 1997). For example, the HPI contains a global scale of 'Adjustment' which is comprised of a number of subscales relating to 'empathy, anxiety, guilt, calmness, temper, somatic complaints, trust and attachment'.

There is some debate in the literature regarding whether global measures are better predictors of job performance and behaviours, compared to specific measures (Ashton, 1998; Ones & Viswesvaran, 1996; Paunonen, Rothstein & Jackson, 1999; Schneider, Hough & Dunnette, 1996; Stewart, 1999). Hogan and Roberts (1996), conclude that the nature of the criterion dictates the choice of predictors. In relation to medical students, if the criterion is to predict academic performance, then broad bandwidth (global) measures are appropriate (e.g. the HPI scale of Adjustment). Alternatively, if the criterion is to select potential students with desired traits, then narrow bandwidth (specific) measures are more appropriate (e.g. the HPI subscales of Adjustment).

3.4.1 Predictive Validity of Personality Inventories

The predictive validity of personality inventories in relation to performance has been questionable in the past, primarily due to the use of inappropriate personality measures such as the Rorschach and the MMPI (Minnesota Multiphasic Personality Inventory) for personnel selection. These particular inventories were developed to make clinical diagnoses and to differentiate between normal and abnormal personalities - they were not refined enough to make accurate predictions about performance. In addition, they were used indiscriminately to assess personality, even where there was no established relationship between test scores and performance. Subsequently, personality tests lost favour as valid selection tools (Gregory, 1996; Lowman, 1996; Muchinsky, 2000).

It is now widely recognised that personality tests must possess a demonstrated link to performance before they are used in personnel selection. Accordingly, organisational psychologists have developed new personality inventories designed exclusively for use with working populations (Gregory, 1996; Muchinsky, 2000). For example, the California Psychological Inventory which was designed to measure managerial potential (Gough, 1984), the Inwald Personality Inventory which was designed as a pre-employment test for law enforcement (Inwald, 1988), and the Hogan Personality Inventory (HPI) which is a well validated predictor of performance in military, hospital, and corporate settings (Gregory, 1996).

Previous research into the relationship between personality and academic performance of medical students has been conflicting, largely due to the different personality inventories used and the operationalisation of academic success. In the late 1970's and early 1980's, the University of Queensland found that seven of the eleven scales of the Sixteen Personality Factor Questionnaire (16PF) were predictive of achievement at medical school (Huxham, Lipton & Hamilton, 1980; Lipton, Huxham & Hamilton, 1984, Huxham, Lipton, Hamilton & Chant, 1989). In addition, personality factors were better predictors of biological, paraclinical and clinical science than secondary school exit scores (Lipton, et. al., 1984). While the predictive validity of the 16PF has been supported in a recent international study of preclinical medical students in Malaysia (Peng, Khaw & Edariah, 1995), it has not been supported in studies involving medical students from Wales (Green, Peters & Webster, 1991, 1993). However, this latter research did

operationalise academic performance as a dichotomous variable of 'no problems' and 'problems', which may have accounted for the non-significant findings.

In the 1990's, Monash University found that scales of the California Psychological Inventory (CPI) were predictive of academic performance in medical training (Tutton, 1996, 1997). During this period, international researchers have also investigated the Comrey Personality Scales and the Tridimensional Personality Questionnaire, with positive findings in relation to both academic performance (Hoschl & Kozeny, 1997) and clinical performance (Shen & Comrey, 1997).

In the 2000's, research has moved on to an exploration of the five-factor taxonomy of personality traits using the NEO Personality Inventory - Revised (NEO-PI-R) and Goldberg's Bipolar Adjectives. The 'conscientiousness' scale of NEO-PI-R was found to have good predictive validity in relation to the academic performance of British medical students (Ferguson, et. al, 2000) and Flemish pre-clinical medical students (Lievens, et. al, 2002). Similar results were obtained with Goldberg's Bipolar Adjectives, with 'conscientiousness' being a consistent predictor of performance across the course (Ferguson, et. al, 2003).

3.4.2 Link between Personality and Academic Performance

Recent research has suggested that individual differences such as personality, intelligence, and vocational interests can be used to explain both the variance in academic performance, and the processes by which

personality traits influence examination outcomes. Ackerman's PPIK theory (intelligence-as-process, personality, interests, intelligence-as-knowledge) posits that personality traits play an important role in the development of knowledge, by directing an individual's choice and level of persistence to engage in intellectually stimulating activities and settings (Chamorro-Premuzic & Furnham, 2003). Briefly, PPIK theory extends the distinction between fluid intelligence (Gf) and crystallized intelligence (Gc) by defining two constructs: intelligence-as-process and intelligence-as-knowledge. Process is exemplified by abstract reasoning and working-memory tasks, and knowledge is exemplified by the recall or recognition of declarative facts and the demonstration of procedural skills. Knowledge is accumulated by the application of process to learning experiences. When Gf-type abilities are applied over time to learning experiences, they result in knowledge and skills. In addition, Gc-type abilities interact with particular personality traits and interests (Rolfhus & Ackerman, 1999).

Ackerman and Heggestad (1997) propose that "abilities, interests and personality develop in tandem, such that ability level and personality dispositions determine the probability of success in a particular task domain, and interests determine the motivation to attempt the task" (p.239). In a meta-analysis of personality-intellectual ability traits, they found facets of personality associated with Neuroticism and Psychoticism tended to have a negative relationship with intellectual abilities. Psychoticism was negatively correlated with crystallized intelligence (Gc), ideational fluency, learning and memory, processing speed, fluid intelligence (Gf) and math-numerical ability.

Facets associated with Extraversion and Openness to Experience tended to result in positive correlations. Extraversion was positively correlated with Gc, Gf, ideational fluency, processing speed, visual perception and mathematical ability. Openness to Experience was most highly correlated with general intelligence, crystallized intelligence, and knowledge and achievement. The pattern of correlations for Conscientiousness was unclear. In relation to Holland's taxonomy of vocational interests, Ackerman and Heggestad found mechanical ability was most highly correlated with Realistic interests, math and spatial abilities were associated with Realistic and Investigative interests, perceptual speed and computational math abilities were associated with Conventional interests. Verbal abilities were most highly correlated with Artistic and Investigative interests, there were negative correlations between ability measures and Enterprising interests, and a very few correlations (negative) between ability measures and Social interests. An indepth discussion of the PPIK model is beyond the scope of my thesis, and the reader is referred to Ackerman and Heggestad (1997), Goff and Ackerman (1992), and Rolfhus and Ackerman (1996, 1999) for further information.

3.5 Summary

This chapter has reviewed the literature in relation to the reliability and validity of selection components used in medical selection in Australia, and detailed the selection process currently used by the JCU School of Medicine. The list of personal qualities deemed desirable in medical students is vast. Many of these qualities are not personality traits per se but are better

categorized as dysfunctional behaviours or motives/values/interests. This categorisation is compatible with PPIK theory, which proposes that personality dispositions and interests are associated with academic performance. Current medical selection procedures, such as the written application and interview, attempt to capture desired attributes by using global measures such as 'motivation' or 'interpersonal skills'. Given the lack of evidence for the construct validity of interview criteria, and the limited number of criteria assessed in the interview (usually three to seven – see Table 4), it was suggested that personality testing may offer an alternate means of reliably assessing desirable personality characteristics.

The focus of the following chapter is to explore the evidence for the predictive validity of personality traits, dysfunctional interpersonal behaviours, and motives/values/interests in relation to academic performance. Based on that review, hypotheses will be generated to test the relationship between personality and academic performance, and between interests and academic performance. The outcome will be a body of research that supports the validity of including personality assessment as part of the selection process for medical training.

CHAPTER 4

Personality and Academic Performance

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4.4 Summary

4.0 Introduction

The primary purpose of a medical selection process is to select those students who will do well in the medical program. Selection criteria must be based on theoretical and empirical evidence and validated by measuring its predictive validity in relation to performance outcomes. The selection interview conducted in most medical schools attempts to assess a range of personal characteristics deemed desirable in medical students (refer Chapter 3, Tables 6 & 7). However, there is no theoretical or empirical evidence for the inclusion of these variables in the selection process. The focus of this chapter of my thesis is to provide this much needed theoretical evidence and develop hypotheses on the predictive validity of specific personality variables. This review is presented in three major sections: the first section explores the relationship between personality traits and academic performance within the framework of the Five-Factor Model of personality; the second section looks at dysfunctional patterns of interpersonal behaviour from the perspective of the DSM-IV personality disorders and explores their impact on cognitive and social functioning and the learning process; and the third section looks at the relationship between motives/values/interests and academic performance within the framework of the RIASEC model of personality types and academic environments.

4.1 Personality Traits

Personality traits can be defined as internal dispositions that are relatively stable over time and across situations (McAdams, 1994). There are literally hundreds of traits that might explain or predict human behaviour, and various

researchers have attempted to group these traits into broad personality dimensions. Three of the most notable taxonomies emerging from the organizational and educational literature that have been used to predict academic performance are the 16 Personality Factor (Cattell, 1949), Eysenck's three-factor model (psychoticism, extraversion and neuroticism; 1970), and Costa and McCrae's five-factor model (extraversion, neuroticism, agreeableness, conscientiousness, and openness; 1992). The five-factor model has been used extensively in research on the relationship between personality and workplace performance, and is now being used by a number of researchers to investigate the relationship between personality and academic performance. To date, the personality traits sought in medical candidates have been based upon expert opinion, practical experience and debate. By investigating the relationship between personality traits and academic performance, I hope to provide theoretical and empirical evidence for the inclusion of such traits in the selection process for medical training. The following review will describe the five-factor model, discuss the stability of personality traits, review the literature on the relationship between personality and performance in both the workplace and education, and review the literature on gender differences in relation to the five-factor model.

4.1.1 The Five-Factor Model (FFM)

It is now widely acknowledged that personality traits can be grouped into five main domains (see Table 8). The first domain is Neuroticism, which taps into chronic anxiety, depression, emotionality, moodiness, hostility and hypochondriasis. The second is Extraversion, which taps into sociability,

Table 8

The Big Five Trait Factors and Associated Characteristics

Characteristics of High Scorers	TRAIT DIMENSION	Characteristics of Low Scorers
Worrying, nervous, emotional, insecure, inadequate, hypochondriacal	<i>Neuroticism (N)</i> Assesses adjustment vs. emotional instability. Identifies individuals prone to psychological distress, unrealistic ideas, excessive cravings or urges, and maladaptive coping responses.	Calm, relaxed, unemotional, hardy, secure, self-satisfied
Sociable, active, talkative, person-oriented, optimistic, fun-loving, affectionate	<i>Extraversion (E)</i> Assesses quantity and intensity of interpersonal interaction; activity level; need for stimulation; and capacity for joy.	Reserved, sober, unexuberant, aloof, task-oriented, retiring, quiet
Curious, broad interests, creative, original, imaginative, untraditional	<i>Openness (O)</i> Assesses proactive seeking and appreciation of experience for its own sake; toleration for and exploration of the unfamiliar	Conventional, down-to-earth, narrow interests, unartistic, unanalytical
Soft-hearted, good-natured, trusting, helpful, forgiving, gullible, straightforward	<i>Agreeableness (A)</i> Assesses the quality of one's interpersonal orientation along a continuum from compassion to antagonism in thoughts, feelings and actions.	Cynical, rude, suspicious, uncooperative, vengeful, ruthless, irritable, manipulative
Organized, reliable, hard-working, self-disciplined, punctual, scrupulous, neat, ambitious, persevering	<i>Conscientiousness (C)</i> Assesses the individual's degree of organization, persistence, and motivation in goal-directed behavior. Contrasts dependable, fastidious people with those who are lackadaisical and sloppy	Aimless, unreliable, lazy, careless, lax, negligent, weak-willed, hedonistic

activity, optimism and fun. High levels of extraversion are associated with positive affect, while high levels of neuroticism are associated with negative affect. Eysenck argues that extraversion and neuroticism are rooted in human biology (see McAdams, 1994). The third domain, Openness to Experience, relates to reflection, imagination, artistry and refinement. The fourth domain, Agreeableness, incorporates expressive qualities such as love, empathy, friendliness and cooperation. While the fifth, Conscientiousness, pertains to personal dispositions relating to work, achievement and accomplishment. Eysenck's scale of 'psychoticism' is reportedly associated with the agreeableness and conscientiousness factors

of the five-factor model (Digman, 1990). The reader is referred to McAdams (1994), Digman (1990), and Wiggins (1996), for further discussion on the five-factor model.

4.1.2 Long-term Stability of Personality

The issue of the stability of personality over the adult life span needs to be clarified in relation to my research. It is now generally accepted that personality does not take its final, fully developed form until somewhere between the ages of 21 and 30, (Costa & McCrae, 1994; McCrae, et. al., 1999; 2000). Thus, a question mark may hang over the utility of using personality as a selection predictor when the majority of individuals admitted to the JCU medical program are aged between 17 and 21. It is emphasized that the focus of my research is to investigate the utility of personality as a predictor of academic performance in medical training, not medical practice. The length of undergraduate medical programs in Australia ranges from five to six years (see Table 1, Chapter 1). As discussed below, it is unlikely that any significant changes in personality traits, within the individual, will occur within a six year timeframe.

Existing research indicates that over the adult life span there are declines in Neuroticism, Extraversion and Openness, and increases in Agreeableness and Conscientiousness. These changes occur more rapidly between the ages of 18 to 30, with the rate of change decreasing after age 30 (Costa & McCrae, 1994; McCrae, et. al., 1999; 2000). These findings have also been supported using different personality measures. For example, in a 10-year

study conducted by McGue, Bacon and Lykken (1993), 127 pairs of twins (averaging 19.8 years at the initial testing) completed the Multidimensional Personality Questionnaire. McGue and colleagues found declines in Stress Reaction (related to Neuroticism), Absorption (related to Openness), and Aggression (inversely related to Agreeableness). They also found increases in Achievement and Control (related to Conscientiousness).

However, there are two specific studies which support my proposition that personality will remain stable over the life of a six-year medical program. The first is a longitudinal study of self-reports and spouse ratings on the NEO Personality Inventory (Costa & McCrae, 1988). Participants included men and women aged between 21 and 96 years of age. An earlier version of the NEO was used to provide the basis for a 6-year longitudinal study of the domains of Neuroticism, Extraversion and Openness. Two additional scales to measure Agreeableness and Conscientiousness were developed and used in 3-year longitudinal studies of those domains. They found all five of the domains showed stability in self-reports across the adult age range. The second study, was a 7-year longitudinal study of the traits of Positive Affect (which is highly correlated with Extraversion) and Negative Affect (which is highly correlated with Neuroticism) carried out by Watson and Walker (1996). The sample was comprised of college students who completed the PANAS early in their undergraduate life and had graduated at some point during the retest interval. Thus, students had experienced major life transitions in, firstly, adjusting to the challenges of college life and, secondly, adjusting to significant life changes after graduation. All participants were still in their

mid-20s at the final assessment. Watson and Walker found that the trait measures of Positive Affect and Negative Affect showed substantial stability across the 7-year retest interval.

Additional support for my proposition comes from cross-sectional studies using the NEO-PI-R. McCrae and colleagues (1999), found significant differences between the age groups 18-21 and 30+, and between the age groups 30-40 and 50+. In each case, the older group was lower in Extraversion and Openness, and higher in Agreeableness and Conscientiousness than the younger group. There was a trend for younger individuals to score higher on Neuroticism. However, there were no significant differences between the age groups of 18-21 and 22-29, or between the age groups 22-29 and 30-49. Although the 22-29 age group scored intermediate between the late adolescent and midlife groups.

In summary, the above research suggests that there is a decline in Neuroticism, Extraversion and Openness, and an increase in Agreeableness and Conscientiousness, over the adult life span. These changes occur more rapidly between the ages of 18 to 30, with the rate of change decreasing after age 30 (Costa & McCrae, 1994; McCrae, et. al., 1999; 2000; McGue et. al., 1993). However, short-term longitudinal and cross-sectional studies suggest that five-factor personality dimensions have temporal stability over a shorter timeframe (3 - 7 years) (Costa & McCrae, 1988; McCrae, et. al., 1999; Watson & Walker, 1996). There is evidence of significant differences in

personality between the age groups of 18-21 and 30+, and between the age groups 30-40 and 50+ (Costa & McCrae, 1994; McCrae, et. al., 1999).

4.1.3 Personality and Work Performance

A review of the organizational psychology literature shows that Conscientiousness, Extraversion and Neuroticism are cited as the characteristics most frequently associated with job performance (Barrick & Mount, 1991; Behling, 1998; Salgado, 1997; Tokar, Fiscer and Subich, 1998). However, the pattern of personality variables appears to be dependent upon the occupation itself (Fritzsche, McIntire & Yost, 2001; Hogan & Blake, 1999; Holland, 1992; Muchinsky, 1999). For example, in a review of the literature, Tokar and colleagues (1998) report that Conscientiousness is positively related to job effectiveness in automobile plastic-part injection mold machine operators. Extraversion is positively related to job performance in police academy grades, but inversely related to job effectiveness in automobile plastic-part injection mold machine operators. Neuroticism is inversely related to pilot performance, while being positively related to job performance in insurance sales consultants. Openness is inversely related to job performance in automobile plastic-part injection mold machine operators and police. However, in a changing task context, a pattern of high Openness and low Conscientiousness is predictive of better decision making (LePine, Colquitt & Erez, 2000). Openness and Extraversion are also valid predictors of organizational training proficiency for all occupational groups (Barrick & Mount, 1991).

In relation to teamwork, which has specific relevance to medical education, personality characteristics of group members impact on group processes and team outcomes. Individuals who score low in extraversion are less likely to be active participants in group discussions, exhibit leader behaviours, or command high levels of intragroup popularity (Barry & Stewart, 1997). Teams possessing lower aggregate mean levels of extraversion and higher levels of neuroticism are less likely to experience positive intragroup interactions and thus become less socially cohesive, which reduces team viability (Barrick, Stewart, Neubert & Mount, 1998).

Agreeableness, Emotional Stability, and Conscientiousness are also positively related to success in jobs involving considerable interpersonal interaction and teamwork (Mount, Barrick & Stewart, 1998). Teams lower in conscientiousness, agreeableness, extraversion, and higher in neuroticism, reportedly received lower ratings for team performance; while low levels of conscientiousness and agreeableness were both found to lower performance and heighten levels of conflict (Barrick, et. al., 1998). Individuals with low levels of conscientiousness were not inclined to strive for successful task accomplishment, regardless of their roles or responsibilities within the group (Barry and Stewart, 1997). Individuals with high levels of Agreeableness reportedly experience more subjective distress when they encounter interpersonal conflict (Suls, Martin & James, 1998), and those with high levels of negative affect (Neuroticism) tend to use competitive behaviour to manage conflict (Rhoades, Arnold & Jay, 2001). Conversely, individuals who are high on positive affect (Extraversion) tend to encourage collaboration and

problem-solving during the resolution of organisational conflict (Rhoades, et. al., 2001).

4.1.4 Personality and Academic Performance

The organizational literature clearly illustrates that the personality variables associated with effective performance are dependent upon the occupation and the task. Therefore, my literature search was narrowed to focus more on examining evidence for the relationship between personality and performance in an academic environment. Previous research into the relationship between personality and academic success of medical students has been conflicting, largely due to the different personality inventories used and the operationalisation of academic success, thus, the following review divides the discussion under three headings: Cattell's 16PF, the California Psychological Inventory, and the Five-Factor Model.

4.1.4.1 Cattell's 16PF

In the late 1970's and early 1980's, the University of Queensland found that several scales of the Sixteen Personality Factor Questionnaire (16PF) were predictive of achievement at medical school. The scale of 'independence' contributed to clinical science, 'subjectivity' made an indirect contribution to clinical science via English language skills, and 'stability' was associated with high chemistry scores (Huxham, Lipton & Hamilton, 1980; Huxham, Lipton, Hamilton & Chant, 1989; Lipton, et. al., 1984). A more recent study of Malaysian medical students (Peng, et. al., 1995) found the personality variables of being enthusiastic, venturesome, self-opinionated, imaginative,

experimenting, resourceful and driven to be positively correlated with examination results, while being self-assured was negatively correlated with performance. The predictive validity of the 16PF has not been supported in studies involving medical students from Wales (Green, et. al., 1991, 1993). As mentioned previously (Section 3.1.1) the contradictory findings may be explained by problems associated with restricted range and operationalisation of academic performance.

4.1.4.2 California Psychological Inventory (CPI)

Ferguson and colleagues (2002), in a review of the literature, found eight scales of the California Personality Inventory (CPI) to emerge as consistent predictors of success in medical training. These were dominance, tolerance, sociability, self acceptance, well-being, responsibility, achievement via conformance, and achievement via independence. A study carried out at Monash University in Australia found numerous scales of the CPI to be predictive of academic performance in medical training (Tutton, 1996, 1997). Tutton found positive correlations between academic performance and 'socialisation', 'self-control', and 'work-orientation', 'intellectual efficiency' and 'management potential'. Unexpectedly, there were also negative correlations between academic performance and 'sociability', 'responsibility' and 'achievement via independence'. Tutton (1996) suggests that the content and style of teaching, and the methods of examination, may be relevant to the contrary findings.

4.1.4.3 The Five-Factor Model

Conscientiousness: The trait of Conscientiousness is a central psychological resource in learning and education. It covers the drive to accomplish something, and it contains the characteristics necessary in such a pursuit: being organized, systematic, efficient, practical, and steady (De Raad & Schouwenburg, 1996). Conscientiousness has been found to be the most consistent personality predictor of academic performance in university students. In medical training, Conscientiousness has been found to have a positive relationship with grades in the first year (Ferguson, et. al., 2000), across the first three years (Lievens, et. al., 2002) and five years of medical training (Ferguson, et. al., 2003). Conscientiousness has also been found to be a strong predictor of grades in other academic disciplines (Chamorro-Premuzic & Furnham, 2003; De Fruyt & Mervielde, 1996; Gray & Watson, 2002; Musgrave-Marquart & Bromely, 1997). At the subscale level, the sub-traits of Dutifulness (Chamorro-Premuzic & Furnham, 2003), Achievement Striving (Chamorro-Premuzic & Furnham, 2003; Gray & Watson, 2002; Lievens, et. al., 2002), and Self-discipline (Gray & Watson, 2002; Lievens, et. al., 2002), were consistent predictors of positive performance, while Disinhibition, Carefree Orientation and Antisocial Behaviour were predictors of negative performance (Gray & Watson, 2002).

Extraversion: Extraversion has been found to correlate negatively with academic performance in the first year of university (Chamorro-Premuzic & Furnham, 2003; Lievens, et. al., 2002) and with clinical performance in the fourth and fifth years of medical training (Ferguson, et. al., 2003). A plausible

explanation attributed to Eysenck (1992, p.137) is that the 'extravert socializes, instead of concentrating on his work, seeks non-academic outlets (sports, sex) for his energies, and has difficulty in concentrating' (De Raad & Schouwenburg, 1996). This is supported by McCown and Johnson (1991) who found that Extraversion was associated with interference in examination studying due to pre-planned social activities, and impulsive and unplanned study distractions. Further support comes from Chamorro-Premuzic and Furnham (2003) who found the primary traits of Gregariousness and Activity to be negatively related to academic performance.

Neuroticism: A number of studies have found no significant relationship between Neuroticism and academic performance in medical training (Ferguson, et. al, 2000; Ferguson, et. al, 2003; Lievens, et. al., 2002). However, a negative relationship between Neuroticism and academic performance has been found in other academic majors (Chamorro-Premuzic & Furnham, 2003; McCown & Johnson, 1991; Musgrave-Marquart & Bromely, 1997). McCown and Johnson attribute this negative relationship to anxiety, suggesting that anxiety provides little motivation towards additional studying, and that studying cues increased anxiety in neurotic students who then avoid studying to reduce anxiety. The attribution to anxiety is also supported by Chamorro-Premuzic and Furnham (2003) who found the primary traits of Anxiety and Impulsiveness were negatively correlated with examination results in the first three years of university training. They suggest that the moody, irritable, and excitable nature of impulsive individuals may be counter-productive for a student's study habits - neurotic

students may be less able to control certain impulses, or resist desires, that may be detrimentally associated with learning discipline.

Agreeableness: The findings in the literature of the predictive validity of Agreeableness are conflicting. Research indicates that Agreeableness is unrelated to intellectual performance (Ackerman & Heggestad, 1997; Rolfhus & Ackerman, 1996). This is supported by a number of studies that have found no significant relationship between Agreeableness and academic performance (Chamorro-Premuzic & Furnham, 2003; De Fruyt & Mervielde, 1996; Ferguson, et. al., 2003; Gray & Watson, 2002; Lievens, et. al., 2002). In contrast, other studies have found Agreeableness to be positively related of behavioural and social science examinations in the first year of medical training (Ferguson, et. al., 2000) and university GPA (Musgrave-Marquart & Bromely, 1997).

Openness to Experience: Although Ackerman and Heggestad (1997) found a positive association between Openness to Experience and intellectual abilities, a number of studies have failed to find a significant relationship between Openness and academic performance (Busato, Prins, Elshout & Hamaker, 2000; Chamorro-Premuzic & Furnham, 2003; Ferguson, et. al., 2000; Ferguson, et. al., 2003). Chamorro-Premuzic and Furnham (2003) suggests that Openness may have a positive effect in academic performance when artistic, imaginative, and creative intervention of students is highly regarded, but not in other degrees in which systematic organized, and dutiful performance is required. This hypothesis is supported by the study of

Rolfhus and Ackerman (1996) that found Openness to be significantly correlated with knowledge in art, literature, poetry, philosophy, and theatre, but not significantly correlated with knowledge in biology, technology, science or economics. A later study (1999) found more consistent correlations between Openness and the sciences, however, correlations were still higher for the humanities. In support of the Openness-academic performance relationship, Musgrave-Marquart and Bromely (1997) found a positive relationship between Openness and GPA in university students, while Lievens and colleagues (2002) found a positive relationship between Openness and the third year of medical training (preclinical).

4.1.5 Gender Differences in Personality

There have been only a few studies carried out on gender differences in the field of personality and organizational psychology. The results of a large-scale meta-analysis of the literature on gender differences on the Five Factor Model of personality (Feingold, 1994), found males scored higher than females on the facet of openness to ideas, while females scored higher than males on the facets of anxiety and impulsiveness (related to Neuroticism), conscientiousness, trust and tender-mindedness (both related to Agreeableness). Different patterns of gender differences occurred on the three facets of Extraversion, with males scoring higher on 'assertiveness', females scoring higher of 'gregariousness', and no gender difference on 'activity'.

The findings of Feingold (1994) offer partial support for the gender differences reported for the Hogan Personality Inventory (HPI). Hogan and Hogan (1997), report that females had lower mean scores than males on Adjustment (inversely related to Neuroticism), and higher mean scores than males on Agreeability. Males were also reported to be higher than females on Intellectance (related to Openness), and Ambition and Sociability (related of Extraversion). Hogan reported no gender differences on Prudence (related to Conscientiousness) and Scholarship (related to Openness). Ones and Anderson (2002), found males to have a higher mean score than females on all seven scales of the HPI. However, only three scales were significantly different (Adjustment, Sociability and Intellectance) and these differences were subsequently attributed to sampling error.

Other studies have examined gender differences in relation to integrity tests and in terms of masculinity and femininity. Ones and Viswesvaran (1998b) examined gender differences in 724,806 job applicants and found women scored higher on overt integrity tests than men. Integrity tests reportedly measure a composite of conscientiousness, agreeableness and emotional stability (Ones & Viswesvaran, 1998a). Marusic and Bratko (1998) examined the relationship of masculinity and femininity with five-factor personality dimensions in 464 high school graduates, aged between 17 and 19. Using the NEO-PI-R, they found positive relationships between masculinity and Extraversion and Conscientiousness, and negative relationships between masculinity and Neuroticism and Agreeableness. Femininity had a strong

positive relationship with Agreeableness, and weak positive relationships with the other four personality dimensions.

4.1.6 Summary of Literature Findings

Prior research on the Five Factor Model indicates that *Conscientiousness* is positively correlated with job performance (see Barrick & Mount, 1991; Barrick, et. al., 1998; Ferguson, et. al., 2000; Ferguson et. al., 2003; Lievens, et. al., 2002; Mount, et. al, 1998; Salgado, 1997; Tokar, et. al., 1998), and academic performance (Chamorro-Premuzic & Furnham, 2003; De Fruyt & Mervielde, 1996; Ferguson, et. al., 2000; Ferguson, et. al., 2003; Lievens, et. al., 2002; Gray & Watson, 2002; Musgrave-Marquart & Bromely, 1997).

Neuroticism is a valid predictor of both occupational and academic performance, with high levels of Neuroticism inhibiting teamwork (Barrick, et. al., 1998; Mount, et. al., 1998; Rhoades, et. al., 2001), and academic performance (Chamorro-Premuzic & Furnham, 2003; McCown & Johnson, 1991; Musgrave-Marquart & Bromely, 1997). *Extraversion* is a valid predictor of both occupational and academic performance. However, although extraversion is positively correlated with performance in occupations involving social interaction and/or teamwork, or organizational training (Barrick, et. al., 1998; Barrick & Mount, 1991; Barry & Stewart, 1997), it is negatively correlated with academic performance (Chamorro-Premuzic & Furnham, 2003; Ferguson, et. al., 2003; Lievens, et. al., 2002).

Agreeableness is positively associated with occupations involving interpersonal interaction and teamwork (Barrick, et. al., 1998), however, the majority of studies have not found a significant relationship between

Agreeableness and academic performance (Chamorro-Premuzic & Furnham, 2003; De Fruyt & Mervielde, 1996; Ferguson, et. al., 2003; Gray & Watson, 2002; Lievens, et. al., 2002). Although *Openness to Experience* has been found to be a valid predictor of organizational training proficiency (Barrick & Mount, 1991), and has been linked to intellectual ability (Ackerman & Heggstad, 1997), the majority of studies have found no significant relationship between Openness and academic performance (Busato, et. al., 2000; Chamorro-Premuzic & Furnham, 2003; Ferguson, et. al., 2000; Ferguson, et. al., 2003).

In relation to gender, there is a consistent trend in the literature that males have a higher level of Openness compared to females, and that females have a higher level of Neuroticism compared to males (Feingold, 1994; Hogan & Hogan, 1997; Ones and Anderson, 2002). Females also appear to have higher levels of Agreeability (Feingold, 1994; Hogan & Hogan, 1997; Ones & Viswesvaran, 1998b), Conscientiousness (Feingold, 1994), and integrity (Ones and Viswesvaran, 1998b). There is some evidence that males are higher than females on some facets of Extraversion (Feingold, 1994; Hogan & Hogan, 1997; Ones and Anderson, 2002). The research on masculinity and femininity supports the directional trend for Agreeability, Neuroticism, and Extraversion (Marusic & Bratko, 1998).

4.1.7 Current Study

The list of personal qualities deemed desirable in medical students is vast (refer Chapter 3, Tables 6 & 7), and current medical selection procedures,

such as the written application and interview, attempt to capture these attributes by using global measures such as 'motivation' or 'interpersonal skills'. The number of interview criteria varies from three (Monash University) to seven (University of Western Australia). One aim of my study is to investigate the relationship between such personality traits and academic grades in medical training, in order to provide theoretical and empirical basis for their inclusion in the selection process.

4.1.7.1 The Hogan Personality Inventory (HPI)

This study utilized the Hogan Personality Inventory (HPI) which is theoretically based on the FFM and previously used in a number of research studies (Furnham & Drakeley, 2000; Hogan & Stark, 1992; Johnson, 2000; Muchinsky, 1993; Rybicki, 1998). Hogan (1996) expanded the FFM from five to seven dimensions (refer Table 9). Extraversion is divided into two components: Sociability, which concerns impulsivity and the need for social interaction; and Ambition, which concerns a desire for status, power, recognition and achievement. Openness is also divided into two components: Intellectance, which concerns an interest in culture and ideas; and Scholarship, which concerns academic performance. It is the refinement of the scales of Extraversion and Openness that suggest the HPI may be a more suitable measure, compared to the NEO-PI-R or CPI, of the predictive validity of personality traits in an academic setting.

Table 9

Correlations Between the Five-Factor Model (FFM) and the Hogan Personality Inventory (HPI). Source: Hogan Personality Inventory Manual (1997)

FFM Dimension	HPI Dimension	Scale Measurement	Correlation
Neuroticism	Adjustment	The degree to which a person appears calm and self-accepting or, conversely, self-critical and tense	-.70
Extraversion	Sociability	The degree to which a person seems to need and/or enjoy interacting with others	.44
	Ambition	The degree to which a person seems socially self-confident, leaderlike, competitive, and energetic	.55
Openness	Intellectance	The degree to which a person is perceived as bright, creative, and interested in intellectual matters	.33
	Scholarship (School Success)	The degree to which a person seems to enjoy academic activities and to value educational achievement for its own sake	.35
Agreeableness	Agreeability (Likeability)	The degree to which a person is seen as perceptive, tactful, and socially sensitive	.56
Conscientiousness	Prudence	The degree to which a person seems conscientious, conforming and dependable	.36

NOTE: $p < .001$, one-tailed

The seven primary scales are broad bandwidth measures that can be used to predict academic performance in medical training. There are also 43 homogeneous item composites (or subscales) that specifically assess personality traits, such as, 'empathy', 'sensitive', 'caring', 'competitive', 'leadership', 'moralistic', 'science ability', and 'education'. These narrow bandwidth measures have potential for use by medical schools to select students who have the desired traits for their medical program.

4.1.7.2 Hypotheses

Based on the existing literature, individuals who are conscientious, introverted, and emotionally stable should perform better within an academic environment. Open-minded and agreeable individuals are better performers within an organizational setting, and given the focus on interactive small group learning tasks in the JCU medical program, open-minded and agreeable medical students may perform better academically.

In terms of the HPI, there are two directional hypotheses:

H1: Adjustment, Agreeability, Prudence, Intellectance and Scholarship will be positively related to academic grades.

H2: Sociability and Ambition will be negatively related to academic grades.

Gender-based hypotheses have not been formulated as their predictive validity in relation to academic grades cannot be tested due to the small sample size.

4.2 Dysfunctional Interpersonal Behaviours

Personality disorders are generally defined as patterns of maladaptive behaviour that stem from the way an individual perceives, relates to, and thinks about the environment and oneself. Such behaviour is exhibited in a wide range of important social, personal and work contexts, and causes significant functional impairment (Durand & Barlow, 1997). However, personality disorders can also be “translated as maladaptively extreme variants of the five basic factors of personality” (Widiger, Trull, Clarkin, Sanderson & Costa, 1998, p.41). Widiger and colleagues caution that they are not implying that having an extreme score on a personality scale is equivalent to having a personality disorder diagnosis – only that extreme scores place individuals at risk for certain personality disorders. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM), third edition, (American Psychiatric Association, 1987), there are eleven major classifications of personality disorders that are divided into three clusters. Cluster A personality disorders describe people as withdrawn, cold, suspicious, or irrational (Paranoid, Schizoid and Schizotypal), Cluster B describes people as dramatic, emotional, and attention-seeking (Antisocial, Borderline, Histrionic and Narcissistic), and Cluster C describes people as anxious, tense and overcontrolled (Avoidant, Dependent, Obsessive-Compulsive, and Passive-Aggressive) (Kaplan & Sadock, 1996; Morrison, 1995). In the fourth edition of the DSM (American Psychiatric Association, 1994), Passive-Aggressive Personality Disorder has been relegated to a “personality disorder not otherwise specified”. However, it has been retained in my thesis because it remains highly relevant to situations requiring good

interpersonal skills and teamwork. In general, research on the five-factor model has indicated that extreme scores for Extraversion are associated with Histrionic (+) and Schizoid (-) personality disorders. Extreme scores for Neuroticism are associated with Borderline, Avoidant, Dependent and Passive-Aggressive (+) and Narcissistic (-) disorders. Extreme scores for Agreeableness are associated with Dependent (+) and Antisocial and Paranoid (-) disorders. Extreme scores for Conscientiousness are associated with Compulsive (+) and Antisocial and Passive-Aggressive (-) disorders. Extreme scores for Openness to Experience are associated with the Schizotypal (+) personality disorder (Wiggins & Pincus, 1998). These findings concur with the findings of a study carried out by O'Boyle and Holzer (1992) based on Eysenck's three-factor model. They found high levels of Neuroticism were most strongly associated with Avoidant, Dependent, Histrionic and Narcissistic personality disorders; low levels of Extraversion was most strongly associated with Schizoid personality disorder; and high levels of Psychoticism was most strongly associated with Antisocial Personality Disorder. As the direct relationship between the five-factors of personality and personality disorders is not the focus of my thesis, the reader is referred to Deary, Peter, Austin and Gibson (1998) and Schroeder, Wormworth and Livesley (1992, 1994) for further discussion.

Given the evidence supporting the predictive validity of the FFM in relation to academic performance, and given the relationship between the FFM and personality disorders, it is reasonable to assume that dysfunctional interpersonal behaviours associated with personality disorders will also

impact on academic performance. Dysfunctional patterns of personality are of extreme interest to medical selection for two reasons. Firstly, the integrated structure of the curriculum requires students to personally interact with patients, supervisors and peers from the outset of training. Therefore, academic merit in these situations will, in part, depend upon appropriate interpersonal behaviour. Secondly, investigating the relationship between personality disorder characteristics and academic performance will provide theoretical and empirical evidence for the recommendation that medical selection screen for extremes in personality (see Table 7, Section 3.3.1). The following review will use the DSM diagnostic guidelines to identify the dysfunctional characteristics associated with the personality disorders (Kaplan & Sadock, 1996; Morrison, 1995), it will describe their potential to impact on interpersonal relations in the course of medical training, and review the findings on their relationship with academic performance. The personality disorders are presented in their cluster groupings.

4.2.1 Cluster A Personality Disorders

The Cluster A (odd/eccentric) personality disorders include Paranoid, Schizoid, and Schizotypal. Each personality disorder reflects specific characteristics associated with psychotic disorders, such as schizophrenia. The Cluster A personality disorders and psychotic disorders represent a 'spectrum of disorder', which assumes that the personality disorders are a milder or attenuated version of the psychotic disorder (Dolan-Sewell, Krueger & Shea, 2001). Most of the research attention has been focused on

Schizotypal Personality Disorder, therefore, it will be the primary focus of discussion with a briefer description of the other two disorders in this cluster.

4.2.1.1 The Schizotypal Personality

Individuals with Schizotypal Personality Disorder have a pervasive pattern of social and interpersonal deficits marked by acute discomfort with, and reduced capacity for, close relationships (Kaplan & Sadock, 1996). They have distorted or eccentric thinking, perceptions, and behaviours that can make them seem peculiar or strange to others (Morrison, 1995). Individuals with schizotypal characteristics are seen as creative, innovative, unusual and insightful. However, while they can be a source of innovation and change, they may have trouble getting their ideas adopted because they can become easily bored and may lack follow through. They are hard to work with because of their unconventionality, eccentricity, and unawareness of how their actions affect others (Hogan & Hogan, 1997b).

Schizotypal Personality Disorder has been associated with underachievement at school (American Psychiatric Association, 2000). However, I could only find two studies that examined the relationship between schizotypal characteristics and academic performance. King (2000) found schizotypal characteristics, as measured by the Coolidge Axis II Inventory (CATI), to be negatively correlated with grade point average in college students. However, in an earlier study he did not find any significant results using the Millon Clinical Multiaxial Inventory (MCMI-II) (King, 1998). There was no significant relationship between schizotypal characteristics and

final course grade or course attendance in either study. A review of the clinical psychology literature would suggest that individuals with schizotypal characteristics have lower levels of academic performance due to cognitive deficits that impact on the learning process. Individuals with schizotypal characteristics demonstrate significant cognitive impairment in the areas of auditory working memory, immediate recall, delayed recall (Mitropoulou, Harvey, Maldari, et. al., 2002), verbal learning and attention (Siever, Koenigsberg, Harvey, et. al., 2002), psychomotor speed, early visual information processing, visual long-term memory (Ueland, Oie, Landro & Rund, 2004), concept attainment and manipulation, pre-attentional processing, and response biasing (Spaulding, Garbin & Dras, (1989). Individuals with schizoid characteristics were also more impaired, compared to normal subjects, on measures of abstract reasoning, cognitive inhibition, recognition memory, general intellectual functioning (Cadenhead, Perry, Shafer & Braff, 1999) and were more distracted by irrelevant stimuli (Braunstein-Bercovitz, 2000). Cognitive impairment in the areas of working memory, verbal learning and attention may make individuals with schizoid characteristics particularly susceptible to cognitive tasks with high context dependence (Siever, et. al., 2002).

4.2.1.2 The Paranoid Personality

The main characteristic of Paranoid Personality Disorder is a pervasive distrust and suspiciousness of others such that their motives are interpreted as malevolent (Kaplan & Sadock, 1996). Paranoid individuals fear exploitation, they will not confide in trustworthy others, they read unintended

meaning into benign comments and actions, and harbor resentment. They are rigid, often litigious, and have an especially urgent need to be self-sufficient (Morrison, 1995). Individuals with paranoid characteristics are hard to work with because they are fault finding, cynical, mistrustful and easily angered; they willingly bend the rules to defend themselves against perceived mistreatment; and they will be prone to retaliate when they feel they have been wronged (Hogan & Hogan, 1997b). Such retaliation may take the form of direct acts of aggression, such as interrupting others, obscene gestures, unfair performance evaluations, insults and sarcasm (Giacalone & Greenberg, 1997; Neuman & Baron, 1997), or indirect acts, such as, stealing (Greenberg, 1997), sabotage (Bies, Tripp & Kramer, 1997; Giacalone, Riordan & Rosenfeld, 1997), showing up late for meetings, or delaying work (Neuman & Baron, 1997).

PPD has been associated with underachievement at school (American Psychiatric Association, 2000). In relation to academic performance in college, King (2000) found paranoid characteristics, as measured by the CATI, to be negatively correlated with college grade point average and final course grade. However, no significant results were found using the MCMI-II (King, 1998). Paranoid characteristics, as measured by the Personality Disorder Questionnaire - Revised (PDQ-R), was ranked as the third highest mean score for a sample of medical students (O'Boyle & Holzer, 1992).

4.2.1.3 The Schizoid Personality

Individuals with Schizoid Personality Disorder have a pervasive pattern of detachment from social relationships and a restricted range of expression of emotions in interpersonal settings (Kaplan & Sadock, 1996). They prefer to be solitary, they avoid close personal relationships, and they seem indifferent to criticism or praise (Morrison, 1995). Individuals with schizoid characteristics do not like to call attention to themselves and dislike working in teams or meeting new people. They are hard to work with because they tend to be reserved and uncommunicative, they rarely give others feedback, and they tend not to be very insightful or perceptive about social cues or office politics (Hogan & Hogan, 1997b).

Schizoid Personality Disorder has also been associated with underachievement at school (American Psychiatric Association, 2000). In relation to academic performance in college, King (1998) found schizoid characteristics, as measured by the MCMI-II, to be positively correlated with class attendance. However, the findings were not replicated using the CATI (King, 2000). There were no significant findings in either study in relation to grade point average or final course grade.

4.2.2 Cluster B

The Cluster B (dramatic) personality disorders include Antisocial, Borderline, Histrionic and Narcissistic. There is considerable overlap between these disorders, with individuals with Borderline Personality Disorder (BPD) also meeting the criteria for Antisocial and Histrionic Personality Disorders (see

Marshall & Serin, 1997). Borderline Personality Disorder has a strong relationship with affective disorders (Marshall & Serin, 1997), while the Cluster B disorders, in general, have shown comorbidity with anxiety, substance and eating disorders (Dolan-Sewell, et. al., 2001).

4.2.2.1 The Antisocial Personality

Individuals with Antisocial Personality Disorder (ASPD) have a pervasive pattern of disregard and violation of the rights of others (Kaplan & Sadock, 1996). Although such individuals may appear superficially charming, many are aggressive and irritable. They are known to lie, cheat and steal without remorse (Morrison, 1995). Individuals with antisocial characteristics are hard to work with because they tend to test limits, ignore commitments, and take risks that may be ill-advised (Hogan & Hogan, 1997b). They lack empathy, have an inflated and arrogant self-appraisal, and are excessively opinionated (American Psychiatric Association, 2000). They are motivated by self-interest and they may employ dysfunctional impression management strategies, such as, manipulating information (Garner & Martinko, 1998), or outright lying (Grover, 1997). Such deceitfulness threatens the foundation of trust that underlies interpersonal relationships, and reduces cooperation in social and work groups (Grover, 1997).

The relationship between ASPD and academic performance is not well researched. Kodman (1984) suggests that students who excel academically have a higher level of psychopathic deviate characteristics. However, further research has failed to find a positive relationship between antisocial

personality characteristics and academic performance. King (1998, 2000) conducted two studies with similar samples and found antisocial characteristics to be negatively related to college grade point average, final course grade and course attendance. Possible explanations for the negative relationships found by King include deficits in cognitive functioning and substance abuse. ASPD has been associated with impairments in executive functioning, including the ability to manipulate information in short-term memory, reorient attention, and plan sequences of action to attain distal goals (see Rogers, 2003). Supporting evidence also comes from Dolan and Parks (2002) who found that individuals with ASPD have particular difficulties with problems requiring higher level planning ability, attentional set shifting, inhibiting responses when inhibition was the appropriate action, and delayed matching to sample.

Substance abuse has been reported to occur in 83% of people with ASPD (Barlow & Durand, 1999). Craig (2000) found that 60% of cocaine and heroin addicts ($N = 443$) had an associated antisocial personality disorder, while 34% had an associated passive-aggressive personality disorder. Within the normal population, the results from a national epidemiologic survey on alcohol and related conditions in the United States (Grant, Stinson, Dawson, et. al., 2004) found that both alcohol and drug use disorders were most strongly related to antisocial, histrionic and dependent personality disorders. Adults with substance abuse disorders show deficits in abstract reasoning, cognitive flexibility, goal persistence, attentional control, working memory, verbal fluency, and concept formation. Adolescents show the same pattern

of deficits but at a lower level of impairment (Giancola & Tarter, 1999). Zeigler and colleagues (Zeigler, Wang, Yoast, et. al., 2005) report that adolescent alcohol use is associated with neurocognitive degeneration, changes in functional brain activity, and neurocognitive impairments that effect learning abilities and intellectual development. In relation to college students, those who have alcohol dependence have greater deficits in both visuospatial ability and motor speed, compared to those who abuse alcohol (Sher, Martin, Wood & Rutledge, 1997). The relationship between substance abuse and academic performance is well-founded (for a review see Prendergast, 1994). There is a consistent finding of a negative relationship between substance abuse and academic grades (Boyd, McCabe & d'Arcy, 2003; Durkin, Wolfe & Clark, 1999; Presley & Meilman, 1994; Presley, Meilman, Cashin & Lyerla, 1996). Some self-reported behaviours that may account for the negative impact on academic performance include missing class because of a hangover, going to class after drinking, missing classes after having a drink (Walfish, Wentz, Benzing, et. al., 1981). This link between ASPD, substance abuse and academic performance is of particular relevance because there is a high incidence of substance abuse in medical training (see Ashton & Kamali, 1995; Baldwin, Hughes, et. al., 1991; Newbury-Birch, White & Kamali, 2000; Newbury-Birch, Walshaw & Kamali, 2001).

4.2.2.2 The Borderline Personality

Individuals with Borderline Personality Disorder (BPD) are characterized by a pervasive pattern of instability of interpersonal relationships, self-image, and

affects, and marked impulsivity (Kaplan & Sadock, 1996). They often show intense, inappropriate anger, they feel empty or bored, and they frantically try to avoid abandonment (Morrison, 1995). Individuals with borderline characteristics are hard to work with because they are easily offended and upset and often react with extreme sarcasm, enduring bitterness, or verbal outbursts (American Psychiatric Association, 2000). They tend to develop strong enthusiasms for people, projects or organisations, and then become disappointed with them, and reject them, when they discover flaws or shortcomings (Hogan & Hogan, 1997b).

Several studies provide evidence of borderline characteristics in psychology students (King, 1998, 2000), medical students (Drouin, 1988; O'Boyle & Holzer, 1992), and freshman undergraduates (Crawford, Moore & Ahl, 2004). In a sample of medical students, a comparison of mean scores for personality disorders revealed the mean score for borderline characteristics to be equal third highest score on the Personality Disorder Questionnaire – Revised (PDQ-R) (O'Boyle & Holzer, 1992). Borderline Personality Disorder was also a complaint for which medical students sought psychiatric assistance (Drouin, 1988). Borderline personality characteristics can have a negative impact on academic performance. Impulsiveness can lead to sudden changes in plans for careers or vocational aspirations and students may stop attending classes or drop out of school before a reasonable plan to attain a new goal is devised. Failure to attend classes or take a test when they are in good academic standing undermines the attainment of goals and may lead to negative outcomes such a low cumulative grade point average,

or being placed on academic probation (American Psychiatric Association, 2000; Bagge, Nickell, Stepp, et. al., 2004). Features of BPD also include a tendency to spend money, abuse substances and engage in promiscuous behaviour (American Psychiatric Association, 2000) which may also lead to problems in achieving academic success. Other features such as affective instability, inappropriate, intense anger or difficulty controlling anger (American Psychiatric Association, 2000) may also lead to problems in the classroom and absenteeism which may negatively impact on academic performance.

The relationship between borderline personality characteristics and academic performance is not well researched. However, there is evidence that individuals with BPD exhibit a range of neuropsychological impairments that could impact on the learning process, specifically, deficits in attention, memory and visuospatial function (see Rogers, 2003). The results of a study carried out by King (1998) demonstrated a significant negative relationship between the borderline personality scale of the MCMI-II and GPA, final course grade and class attendance within a sample of psychology students. However a later study using the borderline personality scale of the CATI with a similar sample (King, 2000) failed to replicate these findings. The results of a two-year follow up study of college graduates (Trull, Useda, Conforti & Doan, 1997) revealed that participants who were above the threshold on the Personality Assessment Inventory - Borderline Features Scale (PAI-BOR) had lower cumulative GPAs at follow-up, compared to students who were below the threshold. In addition, a higher percentage of students who were

above the threshold were deemed ineligible to re-enroll for academic reasons. A further study (Bagge, et. al., 2004) investigated the relationship of the subscales of the PAI-BOR to grade point average and academic probation. Their findings were consistent with Trull and colleagues (1997), and demonstrated that all subscales (affective instability, identity problems, negative relationships and self harm) were significantly negatively correlated with GPA. The only subscale that was not significantly related to academic probation was negative relationships.

4.2.2.3 The Histrionic Personality

Individuals with Histrionic Personality Disorder have a pervasive pattern of excessive emotionality and attention seeking (Kaplan & Sadock, 1996). Their interests and topics of conversation focus on their own desires and activities, they are overly concerned with physical attractiveness, and have a constant need for the approval of others (Morrison, 1995). Individuals with histrionic characteristics are hard to work with because they are impulsive, distractible, and disorganised. Their need for attention, inability to share credit, flightiness, lack of intellectual discipline, and short attention span tend to annoy and disorient their team members. They enjoy having several things going on at the same time, tend to manage by crisis, and have problems with organisation and follow through. They are self-promoting, do not listen well, and tend to make intuitive rather than strategic decisions (Hogan & Hogan, 1997b).

In relation to academic performance, King (1998) found histrionic characteristics to be negatively correlated with grade point average, final

course grade, and course attendance. However, these findings were not replicated using the CATI (King, 2000). A possible explanation for poor academic performance in individuals with histrionic personality characteristics is the relationship between Histrionic Personality Disorder and substance abuse, as discussed under Antisocial Personality Disorder.

4.2.2.4 The Narcissistic Personality

Individuals with Narcissistic Personality Disorder have a pervasive pattern of grandiosity (in fantasy or behaviour), need for admiration, and lack of empathy (Kaplan & Sadock, 1996). Although they feel that they are unusually special, they have fragile self-esteem and often feel unworthy. They are overly sensitive to criticism and have little apparent understanding of the feelings and needs of others. They often lie to cover up their own faults (Morrison, 1995). Individuals with narcissistic characteristics are hard to work with because they are unable to foster and develop a sense of loyalty or team work. In the face of criticism, they may react with disdain, rage, or defiant counterattack (American Psychiatric Association, 2000). Others see them as competitive, intimidating, demanding, opinionated, self-absorbed, and unresponsive to feedback (Hogan & Hogan, 1997b). Competitiveness and intimidation are both forms of aggressive behaviour which have a detrimental effect on teamwork (DeDreu & Van Vianen, 2001; Stevens & Campion, 1994).

In relation to academic performance, narcissism appears high on the list of personality characteristics in university students. In a sample of medical students, the mean score for narcissistic characteristics was the second

highest score on the PDQ-R (O'Boyle & Holzer, 1992). Narcissism also ranked as the third highest mean score in a sample of psychology students (King, 1998). King found narcissistic characteristics, as measured by the MCMI-II, to be negatively correlated with college grade point average, final course grade, and course attendance (1998). However, the findings were not replicated using the CATI (King, 2000). Conflicting results were found by Farwell and Wohlwend-Lloyd (1998), using the Narcissistic Personality Inventory, with two samples of undergraduate psychology students. The first study revealed no significant relationship between narcissism and academic grades, but the second study revealed a positive relationship between the two variables. No explanation can be found for these conflicting results. The existing research indicates that there is no relationship between narcissism and intelligence (Gabriel, Critelli & Ee, 1994), and students who are high on narcissism do not perform any better on group interaction tasks (John & Robins, 1994) or oral presentations (Robins & John, 1997). However, narcissists are overconfident (Campbell, Goodie & Foster, 2004) and optimistic (Farwell & Wohlwend-Lloyd, 1998) and this may lead to inadequate preparation for academic assessments.

4.2.3 Cluster C Personality Disorders

The Cluster C (fearful/anxious) personality disorders include Avoidant, Dependent, Obsessive-Compulsive and Passive-Aggressive. Avoidant Personality Disorder has a strong relationship with social phobia (Marshall & Serin, 1997), while the Cluster C disorders, in general, have notable relationships to mood disorders (Dolan-Sewell, et. al., 2001). Most of the

existing research on the relationship between these specific personality disorders and academic performance has focused on Obsessive-Compulsive Personality Disorder, therefore, it will be the primary focus of discussion with briefer descriptions of the other disorders in this cluster.

4.2.3.1 The Obsessive Compulsive Personality

Individuals with Obsessive-Compulsive Disorder (OCD) have a pervasive pattern of preoccupation with orderliness, perfectionism, and mental and interpersonal control, at the expense of flexibility, openness, and efficiency (Kaplan & Sadock, 1996). The traits that characterise individuals with OCD are careful, conscientious, methodical, well-organised, tidy, planful, hardworking and perfectionistic (Hogan and Hogan, 1997b). While these may appear to be adaptive traits, the rigid perfectionism associated with OCD often results in indecisiveness, preoccupation with detail, scrupulosity, and insistence that others do things their way (Morrison, 1995). Individuals with obsessive-compulsive characteristics are hard to work with because they tend to be critical, controlling and inflexible, they are reluctant to delegate thus depriving others of the opportunity to learn (Hogan & Hogan, 1997b), and they have difficulty acknowledging the viewpoints of others (American Psychiatric Association, 2000).

Several studies provide evidence of obsessive-compulsive characteristics in college students (see for example Kodman, 1984; Frost, Sher & Geen, 1986; Sher, Martin, Raskin & Perrigo, 1991). Medical students obtained the highest mean score for compulsive characteristics in relation to the classifications of

personality disorders (O'Boyle & Holzer, 1992). It appears that students who excel academically have a higher level of obsessive-compulsive characteristics (Kodman, 1984; Orange, 1997). This is supported by King (1998, 2000) who found the compulsive scales on both the MCMI-II and the CATI were positively correlated with college grade point average, final course grade and course attendance. However, obsessive-compulsive characteristics have the potential to negatively impact on academic performance. The tendency to be excessively careful, the proneness to repetition, the extraordinary attention paid to detail, and the repeated checking for possible mistakes (American Psychiatric Association, 2000) all delay the completion of assignments and projects, cause missed deadlines, and impact of examination performance. High levels of obsessionality have been associated with low levels of academic motivation, a lack of self-confidence, and aggressive tendencies (Trijsburg & Duivenvoorden, 1987). Mrdjenovich and Bischof (2003), using the Maudsley Obsessional-Compulsive Inventory (MOCI), found students who reported a higher level of obsessive-compulsive complaints had significantly lower course grades. Poorer academic performance was associated with checking and repeating behaviour, the feeling that carefully executed tasks are not quite right, over-attention to detail, and failure to complete necessary tasks. Other studies have found positive relationships between perfectionism and academic performance, and perfectionism and procrastination. Brown and colleagues (Brown, Heimberg, Frost, et. al., 1999) studied perfectionism from two dimensions: high personal standards (PS) and maladaptive concern over mistakes (CM). They found PS was associated with more frequent study

behavior, evaluation of the course as more important, higher standards and expectations for academic performance, and better grades. However, CM was not related to better grades, and was associated with perceptions of greater course difficulty, higher anxiety, and more negative mood prior to exams. Flett, Blankstein, Hewitt and Koledin, (1992) examined perfectionism from three dimensions: self-oriented (high standards and motivation for the self to attain perfection), other-oriented (tendency to expect others to be perfect), and socially prescribed perfectionism (other people expect oneself to be perfect). They found that socially prescribed perfectionism was most strongly correlated with academic procrastination, and a fear of failure was associated with all three dimensions.

4.2.3.2 The Avoidant Personality

Individuals with Avoidant Personality Disorder have a pervasive pattern of social inhibition, feelings of inadequacy, and hypersensitivity to negative evaluation. They avoid occupational activities that involve significant interpersonal contact, because of fears of criticism, disapproval, or rejection (Kaplan & Sadock, 1996). They avoid personal risk or new activities for fear of embarrassment, and they are convinced that they are inferior, unappealing or inept (Morrison, 1995). Individuals with avoidant characteristics appear to be unassertive, indecisive, conservative and fretful. They are hard to work with because of their need to stay within the lines and their unwillingness to innovate or try new procedures (Hogan & Hogan, 1997b).

In relation to academic performance, King (2000) found avoidant characteristics (as measured by the CATI) to be negatively correlated with grade point average and course attendance. However, no significant results were found using the MCMI-II (King, 1998). Avoidant Personality Disorder (APD) has strong comorbidity with Generalised Social Phobia (GSP): “there are many cases of GSP without APD but few cases of APD without GSP” (Widiger, 1992, p.1). This may offer an explanation as to how avoidant characteristics impact on academic performance. Individuals with social phobia avoid situations that involve significant interpersonal contact, they are reticent in social situations because of a fear of saying something inappropriate or foolish, and they are fearful of being embarrassed by blushing, crying, or showing signs of anxiety in front of other people (Turner, Beidel & Townsley, 1992). Individuals with APD experience greater subjective anxiety during role-play (Herbert, Hope & Bellack, 1992), and have a hypersensitivity to criticism or rejection (Turner, Beidel, Dancu & Keys, 1986). Together, these characteristics may inhibit sufferers from speaking out in class and prevent them from getting better grades due to nonparticipation in class discussions (Turner, et. al., 1986), or seminar presentations.

4.3.2.3 The Dependent Personality

Individuals with Dependent Personality Disorder have a pervasive and excessive need to be taken care of that leads to submissive and clinging behaviour and fears of separation. They have difficulty making everyday decisions without an excessive amount of advice and reassurance from

others. They have difficulty expressing disagreement with others because of fear of loss of support or approval. They have difficulty initiating projects or doing things on their own because of a lack of self-confidence in judgment or abilities. They go to excessive lengths to obtain nurturance and support for others, to the point of volunteering to do things that are unpleasant (Kaplan & Sadock, 1996). They also tend to belittle themselves and agree with people who they know are wrong (Morrison, 1995). Individuals with dependent characteristics are hard to work with because of their indecisiveness, conformity, and reluctance to make independent decisions (Hogan & Hogan, 1997b). This pattern of ingratiation behaviour has negative consequences for a workgroup as opinion conformity can result in suboptimal decision making (Garner & Martinko, 1998).

In relation to academic performance, King (2000) found dependent characteristics to be positively correlated with grade point average and course attendance using the CATI. Similar results for course attendance, but not grade point average, were found using the MCMI-II (King, 1998). The positive findings for course attendance can possibly be explained by the intense discomfort individuals with Dependent Personality Disorder feel when they are alone (Kaplan & Sadock, 1998). While individuals with Dependent Personality Disorder (DPD) are similar to those with Avoidant Personality Disorder (APD) - they share feelings of inadequacy, sensitivity to criticism and the need for reassurance - they differ in that individual with APD avoid relationships while those with DPD respond by clinging to relationships

(Barlow & Durand, 1999). Thus, individuals with DPD may be more willing to join a study group which results in better grades.

4.2.3.4 The Passive-Aggressive Personality

Individuals with Passive-Aggressive Personality Disorder passively resist fulfilling routine social and occupational tasks. They complain of being misunderstood and unappreciated by others, they are sullen and argumentative, and they express envy and resentment towards those more fortunate. Their behaviour alternates between hostile defiance and contrition (Kaplan & Sadock, 1996). Individuals with passive-aggressive characteristics are difficult to work with because they insist on working according to their own timetable and standards of performance. They resist being hurried or coached by others, and become resentful and irritated when asked to increase the speed or quality of their performance. They retaliate by being late for meetings, procrastinating, ignoring constructive criticism and complaints, covertly questioning other team members' competence, and putting off tasks that they see as personally irrelevant (Garner & Martinko, 1998; Hogan & Hogan, 1997b; Neuman & Baron, 1997).

In relation to academic performance, King (1998, 2000) found passive-aggressive characteristics to be negatively correlated with grade point average. He also found negative relationships between passive-aggressive characteristics and both final course grade and course attendance using the MCMI-II (1998). Again, the relationship between this personality disorder

and substance abuse (Grant, et. al., 2004) may offer an explanation for the negative relationship.

4.2.4 Gender Differences in Personality Disorders

As reported in the DSM-IV-TR (American Psychiatric Association, 2000), the Cluster A personality disorders (Paranoid, Schizoid and Schizotypal) are more common in males. Within Cluster B, Antisocial and Narcissistic personality disorders are more common in males, while Borderline Personality Disorder is predominately found in women. Histrionic Personality Disorder has similar prevalence rates among males and females. Within Cluster C, Obsessive-Compulsive Personality Disorder is twice as common in males, while Avoidant and Dependant Personality Disorders have similar prevalence rates among males and females. The sex ratio of Passive-Aggressive Personality Disorder has not been adequately studied (Kaplan & Sadock, 1998).

4.2.5 Summary of Literature Findings

There are very few studies that have investigated the direct relationship between personality disorders and academic grades (Bagge, et. al., 2004; Brown, et. al., 1999; Farwell & Wohlwend-Lloyd, 1998; King, 1998, 2000; Mrdjenovich & Bischof, 2003; Trull, et. al., 1997). The result of this small body of research is conflicting, depending upon the measure of personality disorder used. However, in general, the studies suggest that there is a negative relationship between academic grades and Schizotypal, Paranoid, Antisocial, Borderline, Histrionic, Avoidant, and Passive-Aggressive

personality disorders. There is a positive relationship between academic grades and both Dependent (King, 2000) and Obsessive-Compulsive Personality Disorders (King, 1998, 2000). It appears that only specific facets of perfectionism negatively impact on academic grades (Brown, et. al., 1999). The relationship between Narcissism and academic grades is uncertain, with one study finding a negative relationship (King, 1998) and another study, a positive relationship (Farwell & Wohlwend-Lloyd, 1998).

In relation to other aspects of academic performance that may indirectly impact on grades, obsessive-compulsive characteristics were negatively related to low academic motivation and a lack of self-confidence (Trijsburg & Duivenvoorden, 1987), higher anxiety and negative mood before exams (Brown, et. al. 1999), academic procrastination and fear of failure (Flett, et. al., 1992). Borderline personality characteristics were positively related to academic probation (Bagge, et. al., 2004; Trull, et. al., 1997), while low course attendance was associated with antisocial, borderline, histrionic, narcissistic, avoidant, and passive-aggressive personality characteristics.

Within the clinical literature, there is evidence that the Schizotypal (Braunstein-Bercovitz, 2000; Cadenhead, et. al., 1999; Mitropoulou, et. al., 2002; Siever, et. al, 2002; Spaulding, et. al., 1989; Ueland, et. al., 2004), Antisocial (Dolan & Parks, 2000; Rogers, 2003), and Borderline personality disorders (Rogers, 2003) are associated with certain cognitive deficits that impact on the learning process. There is also an observed comorbidity between the Antisocial, Histrionic, Dependent (Grant, et. al., 2004), and

Passive-Aggressive (Craig, 2000) personality disorders with substance abuse disorders. There is a body of literature on the adverse effects of substance abuse on cognitive functioning (Giancola & Tarter, 1999; Grant, et. al., 2004; Sher, et. al., 1997; Zeigler, et. al., 2005), academic grades (Boyd, et. al., 2003; Durkin, et. al., 1999; Presley & Meilman, 1994; Presley, et. al., 1996), and academic performance (Walfish, et. al., 1981), thus, supporting the indirect effect of personality disorders on academic performance.

Each of the personality disorders are associated with social skills deficits and patterns of dysfunctional interpersonal behaviour, which impact upon personal and social relationships (see American Psychiatric Association, 2000; Kaplan & Sadock, 1996, 1998; Morrison, 1995). These patterns of behaviour also inhibit interpersonal occupational relationships (DeDreu & Van Vianen, 2001; Garner & Martinko, 1998; Giacalone, et. al., 1997; Greenberg, 1997; Grover, 1997; Neuman & Baron, 1997; Stevens & Champion, 1994), and are detrimental to team effectiveness.

Finally, males are more likely to possess paranoid, schizoid, schizotypal, antisocial, narcissistic, and obsessive-compulsive personality characteristics, compared to females. Conversely, females are more likely to possess borderline personality characteristics. Histrionic, avoidant and dependent personality characteristics are just as likely to occur in males as females.

4.2.6 Current Study

The current selection criteria used by medical schools aims to identify negative qualities that are undesirable in medical students, for example:

neuroticism, rigidity, psychoticism, and dishonesty; as well as the extremes of introversion/extroversion, compulsiveness/disorganization, obsessiveness/poor motivation and mania/apathy. One aim of my study is to investigate the relationship between such negative qualities and academic grades in medical training, in order to provide theoretical and empirical support for their inclusion in the selection process.

4.2.6.1 The Hogan Development Survey (HDS)

The Hogan Development Survey (HDS) will be used to assess dysfunctional behaviours. The HDS is theoretically based on the DSM-IV taxonomy of personality disorders, although it departs from this taxonomy in two ways. Firstly, the HDS retains the category of Passive-Aggressive personality (Leisurely) because aggression is an important dysfunctional organisational behaviour. Secondly, the HDS measure of the Antisocial personality (Mischievous) is designed to assess classic psychopathic tendencies, such as, manipulation, deceitfulness and exploitation, rather than a delinquent lifestyle. In addition to corresponding with the personality disorders, the HDS scales are designed to be grouped into three dimensions of dysfunctional behaviour which relate to Karen Horney's interpersonal strategies for dealing with conflict (Horney, 1979) (see Figure 2). The HDS has been specifically designed to assess aspects of dysfunctional behaviour that impede the development of working relations with others. It provides indepth information about interpersonal problems that are hard to detect in an interview. In this respect, the HDS is an appropriate measure to identify negative qualities in medical school candidates.

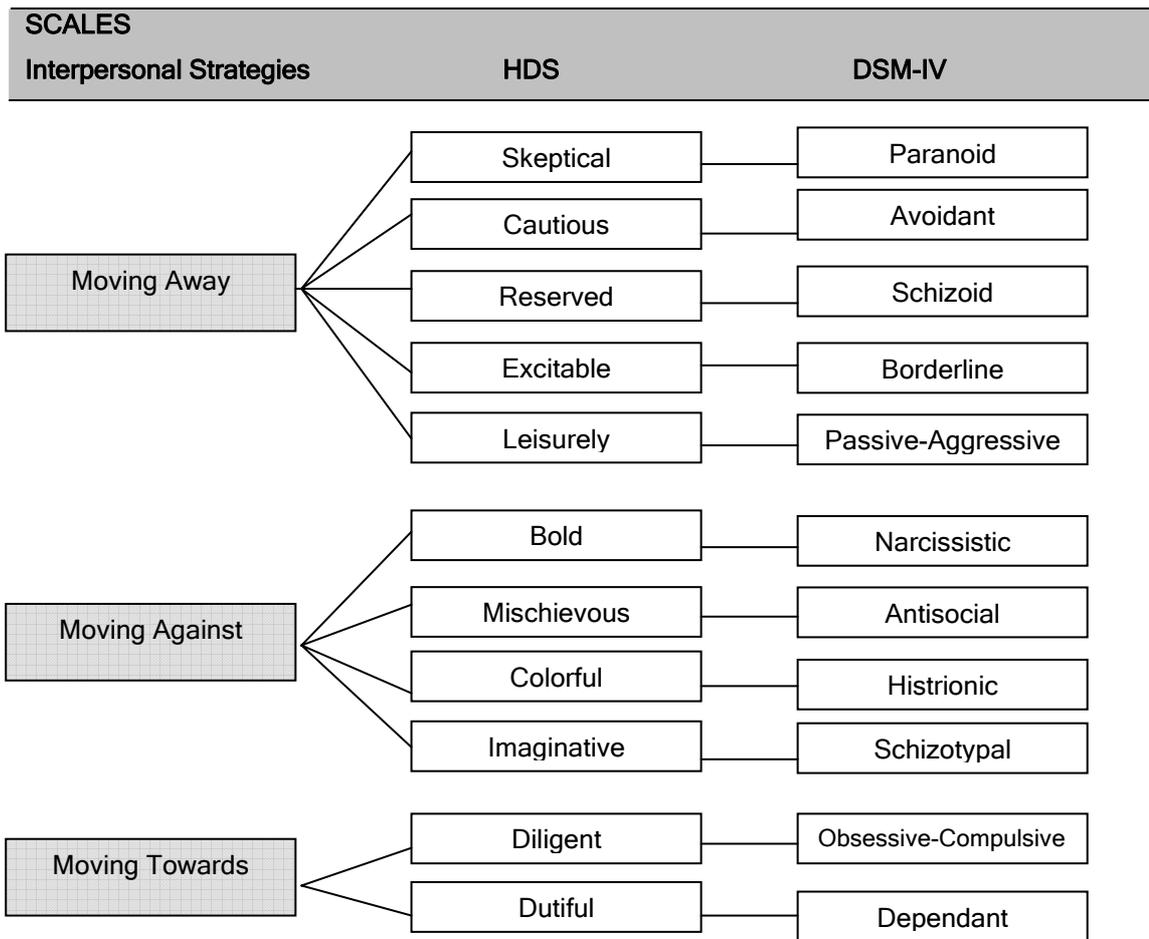


Figure 2

Overlapping Themes HDS, DSM-IV, and Horney Interpersonal Strategies

4.2.6.2 Hypotheses

Based on the literature pertaining to personality disorders and academic performance, and in terms of the HDS syndromes, it is hypothesised that:

H3: The syndrome of *Moving Against* (Bold, Mischievous, Colorful and Imaginative) will be negatively related to academic grades.

H4: The syndrome of *Moving Away* (Skeptical, Cautious, Reserved, Excitable and Leisurely) will be negatively related to academic grades.

H5. The syndrome of *Moving Towards* (Dutiful and Diligent) will be positively related to academic grades.

4.3 Motives, Values and Interests

It has been suggested that interest is the motivating force behind the acquisition of knowledge. The more interested a person is in a domain of knowledge, the greater the intellectual investment, and the greater the acquisition of domain knowledge (Ackerman & Heggestad, 1997). The relationship between interests and academic performance has also been explained in terms of the congruency between personality and environments (Holland, 1973, 1992). Holland formulated a model of personality types and vocational environments, known as the RIASEC model. In essence, Holland proposed that there are six different personality types that have different abilities, interests, attitudes and values, and there are six corresponding environments that require, reinforce and reward these attributes. Within an academic environment, students search for and select academic majors that match their distinctive patterns of abilities, interests and personality profiles. The reward and reinforcement patterns of their chosen academic environment will then socialize them towards the acquisition of distinctive patterns of abilities, interests and values that are reflective of the environment (or vocation). The level of student achievement then becomes a function of the congruence between the student's dominant personality type and the academic environment (Feldman, Ethington & Smart, 2001). All things being equal, it is assumed that congruence of the person and the environment will lead to higher levels of educational stability, satisfaction, and achievement. Conversely, incongruence will lead to lower levels of educational stability, satisfaction and achievement (Feldman, Smart & Ethington, 1999).

The identification of congruent interests and values has become one of the major aims of the medical selection interview. The existing literature proposes that medical students should have a genuine interest in, and commitment to, the study of medicine, together with a strong desire to help people. However, there is no empirical evidence that the possession of such attributes is related to academic performance. By investigating the relationship between interests-values and academic performance, I hope to provide theoretical and empirical evidence for their inclusion in the selection process for medical training. The following review will describe the RIASEC model and discuss academic performance within the bounds of self-selection, socialization and congruency. I will then discuss the need to go further than interests and look at the underlying construct of values. Finally, I will review the existing literature on the relationship between values and performance, both within the workplace and education.

4.3.1 The RIASEC Model

4.3.1.1 Personality Types

In the same way the Five-Factor Model provides a theoretical framework for grouping personality traits, the RIASEC model (Holland, 1992) provides a theoretical framework for grouping vocational interests and vocational environments. According to the RIASEC model there are six personality types: realistic [R], investigative [I], artistic [A], social [S], enterprising [E], and conventional [C]. Each type is based on a distinctive pattern of abilities, attitudes, interests and personality traits (Table 10). The model also allows for a simple ordering of a person's resemblance to each of the six personality types, thus providing the possibility of 720 different personality patterns. This

Table 10
Holland's Six Personality Types (Source: Holland, 1992).

PERSONALITY TYPE	PREFERRED ACTIVITIES	OCCUPATIONS	VALUE	PERSONALITY TRAITS			
Realistic	Work with objects, tools, machines and animals	Skilled trades, technical and service	Money, power and status	Asocial Hard-headed Persistent Thrifty	Conforming Materialistic Practical Uninsightful	Frank Natural Self-effacing Uninvolved	Genuine Normal Inflexible
Investigative	Observe and systematically examine physical, biological or cultural phenomena	Scientific and some technical	Science	Analytical Curious Pessimistic Retiring	Cautious Independent Precise Unassuming	Critical Intellectual Rational Unpopular	Complex Introspective Reserved
Artistic	Ambiguous and unstructured. Manipulation of physical, verbal or human materials to create art forms or products	Artistic, musical or literary	Aesthetic qualities	Complicated Idealistic Independent Original	Disorderly Imaginative Introspective Sensitive	Emotional Impractical Intuitive Open	Expressive Impulsive Nonconforming
Social	Work with others to teach, develop, cure, or enlighten	Educational and social welfare	Social and ethical activities and problems	Ascendant Generous Kind Tactful	Cooperative Helpful Persuasive Understanding	Patient Idealistic Responsible Warm	Friendly Empathic Sociable
Enterprising	Manipulating others to attain organisational goals or economic gains	Managerial and sales	Political and economic achievement	Acquisitive Domineering Extroverted Sociable	Adventurous Energetic Flirtatious Talkative	Agreeable Exhibitionistic Optimistic	Ambitious Excitement-seeking Self-confident
Conventional	Explicit, ordered, systematic manipulation of data	Office and clerical	Business and economic achievement	Careful Efficient Obedient Prudish	Conforming Inflexible Orderly Thrifty	Conscientious Inhibited Persistent Unimaginative	Defensive Methodical Practical

can be illustrated using the field of medicine. Medicine is an investigative environment and, according to the Occupational Finder (Holland, 1992), medical practitioners are primarily classified as Investigative types. However, they are attracted to different specializations according to the secondary personality type that they resemble, then the third type, and so on. For example, as illustrated in Figure 3, the personality pattern of a pathologist is I-A-R, the family physician or psychiatrist is I-S-A, while the surgeon is I-R-A. The surgeon whose secondary resemblance is to the Realistic type prefers to work with objects, tools and machines, while the psychiatrist who next resembles the Social type prefers to work with others to cure or enlighten them. It is reasonable to assume that medical students would have a similar mix of primary, secondary, and tertiary personality types.

The magnitude of personality characteristics would differ depending upon the specific tasks undertaken in each job or specialization. Psychiatrists would be expected to have a higher level of Likeability and Sociability than surgeons, because psychiatrists are more prone to be patient, friendly, helpful, empathic and understanding. On the other hand, surgeons would be expected to have a higher level of Prudence than pathologists, and a lower level of Adjustment than psychiatrists. However, the magnitude of the variations attributed to the secondary types does not affect the model's sensitivity to differentiate between the six primary personality types (Holland, 1992).

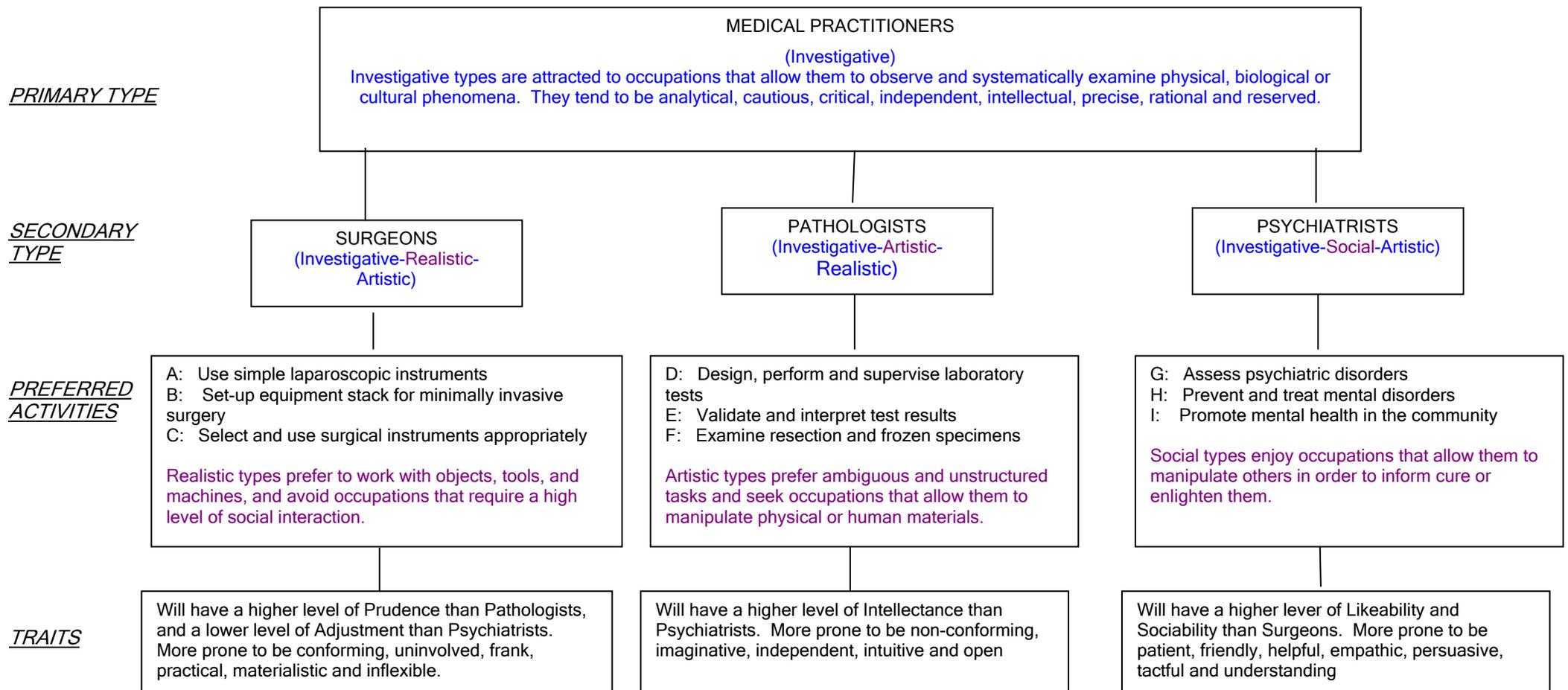


Figure 3

Parallels between RIASEC Types and Job Classification. Adapted from P. M. Muchinsky (2000, p. 68), Holland (1992), RANZCP (2002), RACP (2002), RACS (2002).

4.3.1.2 Academic Environments

There are also six model environments that correspond with each of the six personality types. Each basic environment is dominated by a given type of personality and typified by physical settings posing special problems and opportunities (Table 11). Personality types are assumed to flourish in corresponding environments because that environment provides opportunities, activities, tasks, and roles congruent with the competencies, interests, and self-perceptions of its parallel personality type (Thompson & Smart, 1999).

There are broad differences in the general instructional practices and departmental goals of the distinctive Holland-classified academic environments (Thompson & Smart, 1999). Thompson and Smart report that faculty in *Investigative* and *Realistic* academic environments were more likely to utilize more formal and structured subject-matter oriented instructional approaches (for example, lecture-discussion format), whereas their colleagues in *Social* and *Artistic* academic environments were more likely to use more informal and unstructured instructional approaches that are student-centred (for example, small-group discussions). It should be noted that these findings were based on a 1974 study. Since then there has been a move from a traditional to an integrated medical curriculum, with a focus on small group learning tasks, suggesting that medical education now shares features with both Investigative and Social academic environments. Thus, students with characteristics and values associated with a dominant Social

Table 11

Holland's Six Academic Environments (Source: Holland, 1997)

REALISTIC academic environments emphasize concrete, practical *activities* and the use of machines, tools, and materials. These behavioral tendencies of Realistic environments lead, in turn, to the acquisition of mechanical and technical *competencies* and to a deficit in human relations skills. Students in Realistic environments are encouraged to perceive themselves as having practical, productive, and concrete values. Realistic environments *reward* students for the display of conforming behavior and practical accomplishment.

INVESTIGATIVE academic environments emphasize analytical or intellectual *activities* aimed at the creation and use of knowledge and devote little attention to persuasive, social, and repetitive activities. These behavioral tendencies of Investigative environments lead, in turn, to the acquisition of analytical, scientific, and mathematical *competencies* and to a deficit in persuasive and leadership abilities. Students in Investigative environments are encouraged to perceive themselves as cautious, critical, complex, curious, independent, precise, rational, and scholarly. Investigative environments *reward* students for skepticism and persistence in problem solving, documentation of new knowledge, and understanding solutions of common problems.

ARTISTIC academic environments emphasize ambiguous, free, and unsystemized *activities* that involve emotionally expressive interactions with others and devote little attention to explicit, systematic, and ordered activities. These behavioral tendencies of Artistic environments lead, in turn, to the acquisition of innovative and creative competencies—language, art, music, drama, writing—and to a deficit in clerical and business system competencies. Students in Artistic environments are encouraged to perceive themselves as having unconventional ideas or manners and possessing aesthetic values. Artistic environments *reward* students for imagination in literary, artistic, or musical accomplishments.

SOCIAL academic environments emphasize *activities* that involve the mentoring, treating, healing, or teaching of others and devote little attention to explicit, ordered, systematic activities involving materials, tools, or machines. These behavioral tendencies of Social environments lead, in turn, to the acquisition of interpersonal *competencies* and to a deficit in manual and technical competencies. Students in social environments are encouraged to perceive themselves as cooperative, empathetic, generous, helpful, idealistic, responsible, tactful, understanding, and having concern for the welfare of others. Social environments *reward* students for the display of empathy, humanitarianism, sociability, and friendliness.

ENTERPRISING academic environments emphasize *activities* that involve the manipulation of others to attain organizational goals or economic gain. Such environments devote little attention to observational, symbolic, and systematic activities. These behavioral tendencies of Enterprising environments lead, in turn, to an acquisition of leadership, interpersonal, speaking, and persuasive *competencies* and to a deficit in scientific competencies. Students in Enterprising environments are encouraged to perceive themselves as aggressive, ambitious, domineering, energetic, extroverted, optimistic, popular, self-confident, sociable, and talkative. Enterprising environments *reward* students for the display of initiative in the pursuit of financial or material accomplishments, dominance, and self confidence.

CONVENTIONAL academic environments emphasize *activities* that involve the explicit, ordered, systematic manipulation of data to meet predictable organizational demands or specific standards. The behavioral tendencies of conventional environments lead, in turn, to the acquisition of clerical, computational, and business system *competencies* necessary to meet precise performance standards and to a deficit in artistic competencies. Students in Conventional environments are encouraged to perceive themselves as having a conventional outlook and concern for orderliness and routines. Conventional environments *reward* students for the display of dependability, conformity and organizational skills.

personality should do equally as well as students with a dominant Investigative personality.

There are also significant variations in the educational orientation of faculty members. Thompson and Smart (1999) report that *Social* and *Artistic* academic environments value student freedom and independence in the teaching-learning process, preferred to treat students as colleagues, and believed students do their best work independently. Conversely, *Realistic* and *Investigative* academic environments valued examinations and grades, emphasized student achievement of a priori course requirement, and preferred to interact with students in a more formal, distant, and structured manner. Again, Thompson and Smart are commenting on the findings of a study carried out in 1976. Nearly thirty years has passed since that study and the new integrated approach to medical education has been accompanied by a more *Social* approach to the teaching/learning process.

4.3.2 Propositions of the RIASEC Model

There are three general propositions of the RIASEC model that pertain to university students and their development during university life: self-selection, socialization, and congruency (Feldman, et. al., 2001). Section 4.3.2 will address these propositions from the perspective of interests and abilities, while Section 4.3.3 will address the propositions from the perspective of values.

4.3.2.1 Self-Selection

The self-selection proposition postulates that individuals search for and select academic majors that match their distinctive patterns of abilities, interests and personality profiles (Feldman, et. al., 2001). This proposition has been supported by a number of studies. Miller and Newell (1992) administered the Self-Directed Search (SDS; Holland, 1985) to university seniors who were majoring in chemistry/chemical engineering, elementary education and office administration. They found a high degree of agreement between the SDS three-letter summary codes and the three-letter college major codes (IRE, SAE and CSE, respectively). deFruyt and Mervielde (1996) found that university students enrolled in industrial, bio-agricultural and applied engineering had the highest scores on the *Realistic* scale compared to students from the behavioural and social sciences and humanities. Students enrolled in science and bio-engineering majors shared characteristics of the *Investigative* type; while students from majors such as languages and history, law, economics, and political and social sciences had the lowest scores on this scale. Students of language/history and arts/history had the highest scores on the *Artistic* scale, followed by psychology and educational majors, and political and social sciences. Students of psychology and educational sciences were most closely aligned with the *Social* type; while students of engineering, science and economics had the lowest score on this scale. Students from economics, political/social science, and law, scored higher on the *Enterprising* scale. Economics students shared most characteristics with the *Conventional* type; while psychology, education, and language/history students were the least Conventional.

In relation to the study of medicine, Henry and Bardo (1987) found 46% of premedical students were of a dominant Investigative type. Codes consisting of ISA, and the various arrangements, accounted for 61% of premedical students, and one of the first two letters (I or S) was the highest mean value in 88% of cases. A subsequent study, also confirmed the validity of Holland's hexagonal structure of personality environmental types as measured by the SDS (Henry, 1988).

4.3.2.2 Socialisation

According to Feldman and colleagues (2001), the socialization proposition postulates that the key element in developing one, rather than another, set of competencies and talents is the academic environment that the student enters. That is, the likelihood of students collectively developing any specific repertoire of competencies and values is singularly dependent upon their entry into an academic environment that requires, reinforces and rewards that particular repertoire. However, the effects of academic environments are not inherently dependent upon the personality type of the students entering them – the academic environment has a similar effect on all students. For example, Feldman and colleagues (2001, 2004) found that the pattern of gain or growth on a cluster of abilities and interests related to a specific academic environment was essentially the same for all students in that environment, regardless of whether the student had a congruent or incongruent dominant personality type. However, while both the congruent and incongruent group made similar gains, the initial gap between the groups did not significantly reduce. Compared to the incongruent group, the congruent group had higher

scores on the abilities and interests relevant to the academic environment/
major, both upon entry and four years later.

4.3.2.3 Congruency

The congruency proposition assumes that, all other things being equal, congruence of personality and environment is related to higher levels of satisfaction, achievement, and educational stability (Feldman, et. al., 2001). There have been conflicting findings on the relationship between satisfaction and congruence. Two meta-analyses of the literature (Assouline & Meir, 1987; Tranberg, Slane & Ekeberg, 1993) found little evidence for a relationship between interest congruence and job or academic satisfaction. However, Tranberg and colleagues point out that 81% of the studies reviewed in their meta-analysis took an oversimplified view of congruence, satisfaction, and the relationship between the two. They argue that Holland's conceptualizations have not really been tested by the simpler congruence measures. Since then a study has been carried out which operationalises 'satisfaction' as the level of involvement in and satisfaction with academic and social activities, personal costs and discontents (Feldman, et. al., 2004). Feldman and colleagues found that there was no significant difference between students who entered congruent or incongruent academic environments in relation to these variables. Both groups had comparable collegiate experiences in terms of the level of their involvement in academic activities, the frequency of their engagement in social activities, their satisfaction with their academic programs and career counseling services, and the degree of various personal costs and discontents they experience.

In relation to achievement, Bruch and Krieschok (1981) found that dominant Investigative-type engineering students (congruent group), enrolled in a program that emphasized Investigative coursework, achieved a higher mean GPA compared to incongruent students. Premedical students (congruent group) who had a dominant Investigative personality also achieved significantly higher cumulative GPA and science GPA, compared to incongruent students (Henry, 1989). Conversely, other studies (de Fruyt & Mervielde, 1996; Fritzsche, et. al., 2001) found little support for the predictive validity of the RIASEC model in relation to academic grades. However, the first used a sample of students from various majors and gave no explanation as to how the majors and RIASEC environments were matched, while the latter classified personality and environment into three-letter RIASEC codes. The different operationalisations may account for the different findings.

In the area of educational stability, Antony (1998) investigated the stability of medical career aspirations among university students. He found that the *Investigative* personality was the strongest predictor of initial medical career aspirations, followed by the *Social* personality, and then the *Artistic* personality. The *Enterprising* personality type was a negative predictor of initial medical career aspirations. Antony also found that students who had personality characteristics in common with Investigative and Social types maintained those initial aspirations four years after entering university. While students who had a dominant Investigative personality maintained medical career aspirations, they were also likely to elect career alternatives related to

the sciences. After four years, those students with Enterprising characteristics were more likely to elect business-related or law careers.

4.3.2.4 Summary of Literature Findings

The above research provides support for the proposition that students select vocations/majors that correspond to their personality type (deFruyt & Mervielde, 1996; Feldman, et. al., 2001; Miller & Newell, 1992). In relation to medical training, it appears that an Investigative-Social-Artistic personality, or various combinations thereof, is associated with both initial medical career aspirations (Antony, 1998; Henry, 1987, 1988; Henry & Bardo, 1989), and the maintenance of those aspirations over the course of training (Antony, 1998). However, it appears that incongruence between personality type and environment does not affect the ability to acquire the skills and abilities that are fostered by the environment. Incongruent types make similar gains to congruent types, although the gains are parallel rather than convergent (Feldman, et. al., 2001, 2004). All other things being equal, incongruent personality types report comparable levels of involvement in academic and social activities, similar levels of satisfaction with their academic programs, and a comparable degree of personal costs and discontents (Feldman, et. al., 2004). There is also little supporting evidence, when taking into consideration secondary and tertiary personality types, that incongruent students have lower academic grades (deFruyt & Mervielde, 1996; Fritzsche, et. al., 2001).

The lack of predictive validity of the SDS in relation to academic grades may be due to the broad range of content (activities, competencies, occupations, and self-ratings) measured by the SDS. While these criteria may be relevant to the investigation of job performance, they may not encompass the criteria relevant to academic performance. Given that an interest in a medical career could conceivably represent any of a number of underlying needs or motives (e.g., a desire to help people, money, power, recognition, status or prestige), and given the strong focus on identifying motivation in the medical selection interview, investigating the predictive validity of the values underlying the RIASEC personality types may offer a better alternative.

4.3.3 Values

There is a lack of consensus on the nature of values, they have been conceptualised as needs, motivations, goals, utilities, attitudes, interests, and non-existent mental entities (Meglino & Ravlin, 1998). These definitions are all closely related motivational constructs, which differ primarily in their breadth and abstraction (Hogan & Blake, 1996; Hogan & Hogan, 1996). *Needs* can be defined as a state of arousal – a motive that impels us to act (Reber, 1995). *Values* are objectives sought to satisfy needs (Hogan & Blake, 1996) - they are a set of core beliefs held by individuals relating to how they should behave over a broad range of situations. Values influence how we think, feel and behave (Hogan & Blake, 1996; Meglino & Ravlin, 1998; Ravlin, 1995). *Interests* and preferences are the specific activities and objects through which an individual pursues values and satisfies needs

(Hogan & Hogan, 1996). The relationship between motives, values, interests and academic performance is depicted in Figure 4.

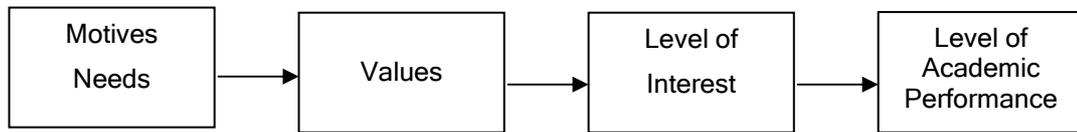


Figure 4

Relationship between Needs, Values, Interests and Academic Performance

It is the strength of the value that directs the energies of a motive or need (McClelland, 1987; Feather, 1995); it is the value that influences our choice of vocation (Holland, 1992); it is the level of interest in that vocation that influences how much effort a person puts into related activities and how long they will persist at those activities (Ackerman & Heggestad, 1997); and it is the amount of knowledge obtained that will influence the level of academic performance (Ackerman & Heggestad, 1997). Thus, values influence one's commitment to learning (Huang & Healy, 1997) and have the potential to impact on academic grades.

4.3.3.1 Values Underlying the RIASEC Typology

According to the RIASEC model, individuals search for academic environments that allow them to express their attitudes and values (Holland, 1992). *Realistic* environments reward valuing money, power and status; *Investigative* environments reward displays of scientific values; *Artistic* environments reward the display of aesthetic values; *Social* environments reward the display of social values; *Enterprising* environments reward viewing the world in terms of power, money, status, and responsibility; and

Conventional environments reward valuing money, dependability, and conformity (Holland, 1992). Support for this relationship between values and personality types has been provided by Huang and Healy (1997) who found students planning *Artistic* majors, and to a lesser degree *Investigative* majors, rated 'obtaining recognition' higher than students planning other majors. Students entering *Artistic* majors also more highly valued 'creating artistic work'. Compared to students planning other majors, students anticipating *Enterprising* and *Conventional* majors more highly valued 'having administrative responsibility' and 'being well off', while students entering *Social* majors more highly valued 'helping others'. Their study also suggested that academic majors play a role in shaping and/or reinforcing student's work values. After a four year period, high scores in 'having administrative responsibility' and 'being well off' were associated with majoring in *Enterprising* and *Conventional* subjects, while low scores were associated with majoring in *Artistic* subjects. High scores in 'helping others' were associated with *Social* majors, and high scores in 'creating artistic work' were associated with *Artistic* majors. Conversely, low scores in 'having administrative responsibility' were associated with *Investigative* majors, low scores in 'helping others' were associated with *Realistic* majors, and low scores in 'creating artistic work' were associated with *Conventional* majors.

4.3.3.2 Values of Medical Students

Earlier research has found that students entering medical school reported social and/or altruistic reasons (working with people, helping others), and the opportunity to become involved in a challenging occupation as the most

important reasons for choosing a medical career (Feather, 1982). 'True friendship' and 'happiness' were rated as the most important personal values, and 'social recognition' and 'a comfortable life' among the least important (Feather, 1982; Furnham, 1988). Simpson (1993) found that medical students entered medical school with values about their work which remained relatively unchanged over the duration of their training. Their top values included improving the patient's quality of life, treating illnesses, and close patient contact. These students also highly valued using academic and intellectual skills, using the skills of the physician, and working with other doctors. These findings are also supported by a more recent study (Murdoch, Kressin, Fortier, Giuffre & Oswald, 2001) that found the three highest mean scores for medical student career values were prestige, biosocial orientation and academic interest.

4.3.4 Current Study

The current selection criteria used by medical schools aims to identify candidates who have the appropriate motivation to study medicine. The existing literature proposes that medical students are a combination of Investigative, Social and Artistic personalities, who are motivated by scientific, social, affiliative and aesthetic values. This study investigates the relationship between these motives/values/interests and academic grades, in order to provide empirical support for their inclusion in the selection process for medical training.

4.3.4.1 Motives, Values and Preferences Inventory (MVPI)

The Motives, Values and Preferences Inventory (MVPI) will be used to assess patterns of behaviour and identify underlying motives, values and interests. The information gained from the MVPI complements that gained from the HPI, however, while research has found small to moderate correlations between vocational interests and personality traits, the two domains remain fundamentally separate (Hogan & Blake, 1999). Unlike the HPI, the information gained from the MVPI can be used to assess the motivational state behind, for example, the 'desire to study medicine', and can identify those candidates whose occupational interests are incongruent with the study of medicine.

There is evidence of convergent validity between the MVPI and the SDS.

The primary intercorrelations revealed that the MVPI scale of Scientific was related to Holland's Realistic and Investigative types; the MVPI scale of Aesthetic was related to the Artistic type; the MVPI scales of Altruistic, Affiliation and Aesthetic were related to the Social type; the MVPI scale of Commercial was related to the Conventional type; and the MVPI scales of Commercial, Power, and Recognition were related to the Enterprising type (Hogan & Hogan, 1996).

4.3.4.2 Hypotheses

Based on the literature pertaining to vocational interests and values, and academic performance in medical training, additional hypotheses can be generated. In terms of the MVPI:

H6: Scientific, Altruistic, Affiliation and Aesthetic motives, values and preferences will be positively related to academic grades.

4.4 Summary

This chapter has reviewed the literature pertaining to the relationship between academic performance and three distinct aspects of personality (traits, dysfunctional interpersonal behaviours, and motives/values/interests). The literature indicates that personality traits based on the five-factor taxonomy have predictive validity in relation to academic grades. Dysfunctional interpersonal behaviours related to the DSM personality disorders are reported to have a negative impact on social relationships, teamwork, and academic performance. The existing literature on values and the RIASEC model of personality types and environments suggests that motives/values/ interests can be used to predict academic grades. Based on this review, hypotheses have been formulated to test the relationship between academic grades and these three aspects of personality. The remaining chapters of this thesis will focus of validating and discussing these hypotheses. Each dimension of personality has been treated as a separate entity as medical schools need to develop selection criteria that are compatible with the philosophy of their medical program. Some medical schools may place a higher emphasis on personality traits, while others may decide that it is more important to focus on the motivation to study medicine or the impact of dysfunctional interpersonal behaviour, or a combination thereof.

CHAPTER 5

Methodology

- 5.0** Research aim and hypotheses

- 5.1** Variables impacting on academic performance

- 5.2** Sample
 - 5.2.1 Response rate for personality inventories
 - 5.2.2 Age restrictions
 - 5.2.3 Missing data

- 5.3** Materials
 - 5.3.1 Selection process data
 - 5.3.1.1 Queensland Overall Position (OP) ranks
 - 5.3.1.2 Written application
 - 5.3.1.3 Selection interview
 - 5.3.2 Personality data
 - 5.3.2.1 Hogan Personality Inventory (HPI)
 - 5.3.2.2 Hogan Development Survey (HDS)
 - 5.3.2.3 Motives, Values & Preferences Inventory (MVPI)
 - 5.3.3 Grades data

- 5.4** Procedure

- 5.5** Statistical analyses

5.0 Research Aim and Hypotheses

The first objective of my research is to investigate the predictive validity of components of the current selection process for medical training at JCU. The second objective is to investigate the potential of personality variables to predict academic grades. Based on theoretical and empirical evidence, hypotheses have been formulated in respect to personality variables that have the potential to become valid selection criteria. One of the aims of this study is to validate these criteria by investigating their predictive validity in relation to academic grades. The third objective of my study is to extend existing research by investigating the incremental validity of the current selection components and hypothesised personality variables. Based on the research presented in Chapter 4, it was hypothesised that:

- H1:** *Adjustment, Agreeability, Prudence, Intellectance and Scholarship, will be positively related to academic grades.*
- H2:** *Sociability and Ambition will be negatively related to academic grades.*
- H3:** *The syndrome of Moving Against (Bold, Mischievous, Colorful and Imaginative) will be negatively related to academic grades.*
- H4:** *The syndrome of Moving Away (Skeptical, Cautious, Reserved, Excitable and Leisurely) will be negatively related to academic grades.*
- H5:** *The syndrome of Moving Towards (Dutiful and Diligent) will be positively related to academic grades.*
- H6:** *Scientific, Altruistic, Affiliation and Aesthetic motives, values and preferences will be positively related to academic grades.*

5.1 Variables Impacting on Academic Performance

Age and gender have both been cited as covariates of academic performance, however, the findings are conflicting. Studies have found the risk of experiencing academic difficulty was associated with age: Huff and Fang (1999) report a 3% estimated increase in risk associated with each one-year increase in age at matriculation; Parker (1993) found younger medical students in Australia had a superior level of academic performance, compared to older students; and Haist and colleagues (Haist, Wilson, Elam, Blue & Fosson, 2000) found younger students were least likely to experience academic difficulty. However, contrary results were obtained in an Australian study by Kay-Lambkin and colleagues (2002), where older students were less likely to receive a grade of 'not satisfactory', compared to younger students, in the first year of medical training.

The finding that females outperform males in medical training is frequently quoted in the literature (Ferguson, et. al., 2002; Haist, Witzke, Quinlivan, Murphy-Spencer & Wilson, 2003; McDonough, Horgan, Codd & Casey, 2000). However, these findings are not supported by the research of DeClercq, Pearson and Rolfe (2001), who found female first year medical students at Newcastle University were significantly more likely to receive a 'not satisfactory' initial assessment.

The relationship between age and academic performance, and gender and academic performance, appears to vary across the years of medical training. Ramsbottom-Lucier, Johnson and Elam (1995) categorized students into three age groups: less than 23 years of age at matriculation, 23 to 27 years

of age at matriculation, and 28 or older at matriculation. They found younger students performed better than older students, and men performed better than women, in the first year of medical training. In the second year these differences disappeared. At the beginning of clinical experience in the third year of training, younger students performed better than older students. Finally, in fourth year, younger students again performed better than older students, but the women performed better than men. Haist and colleagues (2000) also discovered an interaction effect between age and gender in relation to academic performance. Using the age categories of younger and older than 23, they found that older women performed better than older men, and marginally better than younger women, while younger men performed better than older men. In light of the existing research, my research has accounted for these potential covariates of academic performance (as shown in Figure 5).

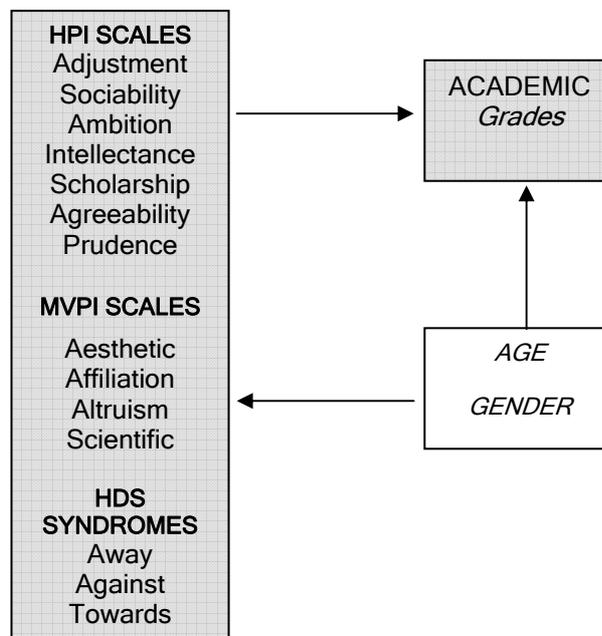


Figure 5
Conceptual Model of the Relationship between hypothesized facets of the HPI, MVPI and HDS and Academic Grades.

5.2 Sample

The sample was derived from the selection data, provided by the Chair of the Selection Committee for the JCU School of Medicine, for 212 students entering the program in 2000 (29.7%), 2001 (38.2%) and 2002 (32.1%). There was no need for a random selection process as, due to the small size of the population, every student was invited to participate in the research project.

5.2.1 Response Rate for Personality Inventories

One hundred and ninety-two students completed the Hogan Personality Inventory (HPI). However, 10 cases were deleted as their validity score on the HPI was ≤ 9 , indicating careless or random responding on the inventory (Hogan & Hogan, 1997). A further case was deleted as the participant had completed the HPI in both 2000 and 2001 - the first HPI completed in 2000 was retained in the database. One hundred and fifty-nine medical students completed the Motives, Values and Preferences Inventory (MVPI), with four cases being deleted due to the inventories having $\geq 70\%$ of missing data. One hundred and fifty-nine medical students completed the Hogan Development Survey (HDS). Thus, there were 181 valid HPI inventories, 155 valid MVPI inventories and 159 valid HDS inventories.

5.2.2 Age Restrictions

Age was grouped into four categories (14-17, 18-21, 22-29 and 30-49), in accordance with research findings on significant personality differences between certain age groups (McCrae, et. al., 1999; McCrae, et. al., 2000) (see Section 5.1.2). The 22-29 age group ($n = 8$) and the 30-49 age group (n

= 4) were excluded from the analysis due to the extremely small sample size of each group. In relation to the 14-17 age group, the majority of students were age 17 with a few students entering the program at age 16.

5.2.3 Missing Data

As identified in the Missing Values Analysis based on a database of 200 students between the ages of 17 and 21, there were 31 cases with a missing HPI, 50 cases with a missing HDS, and 51 cases with a missing MVPI. This was the result of students electing not to complete the personality inventories (see Section 5.2.1.1). Given that students were informed that completion of the personality inventories was voluntary, and given the absence of signed consent from those students who did not wish to participate, it would be unethical to then include them in the study and use mean substitution for non-existing personality inventories.

As a result of attrition, there were 21 sets of incomplete grades data. Twelve students withdrew from the medical program during the first year of training, five students withdrew during the second year, and a further four students withdrew during the third year of training. As the medical school does not carry out exit interviews, there is no way of ascertaining why these students withdrew from the medical program. The grades' data were the dependent variables in my study. To estimate the missing data for a dependent variable by an imputation process, and then use the estimated values in the analysis of the dependence relationship, may result in an artificial increase in the explanatory power of the analysis (Hair, Anderson, Tatham & Black, 1998, p. 52). Therefore, these cases were excluded from the analyses.

In relation to the selection criteria, there were 14 missing OP ranks, 7 missing sets of application data, and 8 missing sets of interview data. These missing values related to indigenous, special-entry, and mature-age students. As these students entered the program under a different set of selection criteria, they were excluded from the analyses. There were an additional 59 missing values relating to the application scale of “rural interest”, because this scale was not used in the selection process for the first cohort of students. As the remaining application scales were highly correlated and thus represented the intent of the ‘rural interest’ scale, this variable was excluded from the analyses (Hair, et. al., 1998, p. 52).

While missing values within existing sets of application and interview data were replaced with the median for each scale, mean substitution was not used for sets where 100% of data was missing. When combining all data into a single database (32 variables), the missing values referred to above still accounted for between 5.6% and 52.8% of the total data, on a case-by-case basis.

5.3 Materials

5.3.1 Selection Process Data

5.3.1.1 Queensland Overall Position (OP) Ranks

One hundred and seventy-three (173) students had a recorded unweighted Queensland OP rank or an equivalent rank recorded by the JCU Medical School. I calculated equivalent unweighted ranks for an additional 13 students who had a recorded interstate UAI, ENTER, or TER rank, using the

2000 and 2001 Conversion Tables. The medical school had no accessible record of OP ranks or equivalents for 26 students.

5.3.1.2 Written Application

Written applications were scored on six scales: motivation, activities, rural interest, other information, supplementary information, and overall rating. As the scale of 'rural interest' was only used for Cohorts 2 and 3, it was excluded from the analyses. The first five scales were scored on a five-point scale (1 = poor, 2 = fair, 3 = good, 4 = very good, and 5 = outstanding). The sixth scale, 'overall rating' assessed the applicant's suitability for interview and was scored on a four-point scale according to their interview status (A = Definitely, B = Preferably, C = Probably, and D = Possibly).

5.3.1.3 Selection Interview

The interview was scored on six behaviorally anchored scales: motivation, self-reliance, interpersonal style, communication 1, communication 2, and overall rating. All scales had a scoring range of 1 to 10. There were a minuscule number of selected students who scored at or below 5 on these scales, as it was the medical school's intention that these scales would result in positive skewness among selected students. In order to rectify the skewness in the data and facilitate its use in regression analyses, scales 6 to 10 were recoded as scales 1 to 5.

5.3.2 Personality Data

5.3.2.1 Hogan Personality Inventory (HPI)

The HPI contains seven primary scales and six occupational scales, which contain a total of 206 items arranged in 45 Homogenous Item Composites

(HICs). A sample of the HPI items can be found in Appendix A3. No items overlap on HICs and no HICs overlap on scales. The HPI and HIC scales are detailed in Table 12 and a description of the constructs measured by the HPI has previously been presented in Table 9 (see Section 4.1.7.1).

Table 12

HPI Scales and Homogenous Item Composites (HICS)

HPI Scale	Homogenous Item Composites (HICs)
Adjustment	Empathy, Not Anxious, No Guilt, Calmness, Even Tempered, No Somatic Complaints, Trusting, Good Attachment (37 questions)
Ambition	Competitive, Self Confidence, No Depression, Leadership, Identity, No Social Anxiety (29 questions)
Sociability	Likes Parties, Likes Crowds, Experience Seeking, Exhibitionistic, Entertaining (24 questions)
Likeability	Easy to Live With, Sensitive, Caring, Likes People, No Hostility (22 questions)
Prudence	Moralistic, Mastery, Virtuous, Not Autonomous, Not Spontaneous, Impulse Control, Avoids Trouble (31 questions)
Intellectance	Science Ability, Curiosity, Thrill Seeking, Intellectual Games, Generates Ideas, Culture (25 questions)
School Success	Education, Maths Ability, Good Memory, Reading (14 questions)
Validity	14 questions
Used in Occupational Scales only	Self-focus, Impression Management, Appearance (12 questions).

The HPI contains a validity scale, consisting of 14 items, which is designed to detect careless or random responding. There is no overlap among the primary scales and the validity scale. The response format is a True/False dichotomous scale (0 = false, 1 = true) for each of the 206 statements. Responses are entered on an answer sheet by filling in the circle that corresponds to the selected answers. There are no hand scoring keys for

the HPI. Answer sheets are forwarded to Davidson Trahaire, HPI distributors, in Sydney for processing.

The HPI has been found to have good internal consistency with reliabilities for the primary scales range between .71 (Agreeability) and .89 (Adjustment), with an average Alpha is .80. Alpha reliabilities for the HICs vary between .29 (Sensitive) and .82 (Leadership), with 34 of the 41 HICs having Alphas greater than .50. Test-retest reliabilities for the primary scales range between .74 (Prudence) and .86 (Adjustment), with an average $r = .71$. Test-retest reliabilities for the HICs range between .34 (Not Autonomous) and .86 (No Somatic Complaints), with 36 of the 41 HICs having test-retest reliabilities above .50.

5.3.2.2 Hogan Development Survey (HDS)

The HDS was used as a measure of interpersonal behaviour. It contained 168 items in the form of statements to which a respondent indicates "agree" or "disagree". A sample of the HDS items can be found in Appendix A.4. There are 11 scales and each scale contains 14 items that were derived rationally using the distinguishing features of each syndrome. There is no item overlap among the 11 scales (Table 13). The response coding uses a dichotomous scale (0 = disagree and 1 = agree) and each scale contains 14 items. Therefore, the scale scores range from 0 - 14. Items are scored in the direction of the syndrome, so that a higher score represents more dysfunctional tendencies. Responses are entered on an answer sheet by filling in the circle that corresponds to the selected answers.

Table 13

Hogan Development Survey - Scales and Definitions

HDS Scales	Definitions
Excitable	Concerns seeming moody and inconsistent, being enthusiastic about new persons or projects and then becoming disappointed with them.
Skeptical	Concerns seeming cynical, distrustful, overly sensitive to criticism, and questioning others' true intentions
Cautious	Concerns seeming resistant to change and reluctant to take even reasonable chances for fear of being evaluated negatively
Reserved	Concerns seeming socially withdrawn and lacking interest in or awareness of the feelings of others
Leisurely	Concerns seeming autonomous, indifferent to other people's requests, and becoming irritable when they persist
Bold	Concerns seeming unusually self-confident and, as a result, unwilling to admit mistakes or listen to advice, and unable to learn from experience
Mischievous	Concerns seeming to enjoy taking risks and testing the limits
Colorful	Concerns seeming expressive, dramatic, and wanting to be noticed
Imaginative	Concerns seeming to act and think in creative and sometimes unusual ways
Diligent	Concerns seeming careful, precise, and critical of the performance or others
Dutiful	Concerns seeming eager to please, reliant on others for support, and reluctant to take independent action

Internal consistency or alpha reliabilities (adults mostly job incumbents or applicants, $N = 2071$) vary between .50 (Dutiful) and .78 (Excitable) with an average alpha of .67. Test-retest reliabilities (graduate students, $N = 60$ over a 3 month interval) ranged from .87 (Excitable) to .58 (Leisurely) with an average reliability of .75. The standard error of measurement (adult sample) was consistent across all scales and averaged .06.

In general, the average scores are similar for gender, race and age. Men were reportedly slightly higher than females on the Reserved scale (0.5 points). Those under 40 are reportedly slightly higher than those over 40 on the Skeptical scale (0.7 points) (Hogan & Hogan, 1997b).

5.3.2.3 Motives, Values and Preferences Inventory (MVPI)

The MVPI was used to assess individuals' motivations, values and work preferences. This inventory contains 200 items in the form of statements to which a respondent indicates "agree", "uncertain", or "disagree". A sample of the MVPI items is attached as Appendix A.5. There are 10 scales and each scale contains 20 items that were derived rationally from hypotheses about the likes, dislikes, and aversions of the "ideal" exemplar of each motive. There is no item overlap among the 10 scales (Table 14). The response coding uses a 3-point scale (1 = disagree, 2 = uncertain, 3 = agree) and scale contains 20 items. Therefore, the scale scores range from 20 - 60. Responses are entered on an answer sheet by filling in the circle that corresponds to the selected answers.

Internal consistency or alpha reliabilities (adults - mostly job applicants or incumbents, N = 3015) vary between .70 (Security) and .84 (Aesthetic) with an average alpha of .77. Test-retest reliabilities (advanced undergraduate students, N=50) ranged from .88 (Tradition) to .64 (Hedonistic) with an average reliability of .77. Standard error of measurement (adult sample) was consistent across all scales and averaged .125.

Men and women reportedly obtain comparable scores across all scales. Men score slightly higher on the Scientific scale (2 points) and slightly lower on the Aesthetic scale (3 points) compared to women. Those under 40 reportedly have slightly higher scores for Hedonistic (3 points) and Recognition (2 points) compared to those over 40 (Hogan & Hogan, 1996).

Table 14

Motives, Values and Preferences Inventory (MVPI) - Scales and Definitions

MVPI Scale	Definitions
Aesthetic	Motives are associated with an interest in art, literature, music, the humanities and a lifestyle guided by questions of culture, good taste, and attractive surroundings
Affiliation	Motives are associated with a desire for and enjoyment of social interaction.
Altruistic	Motives involve concern about the welfare of others, especially the less fortunate, a desire to help them, and in some way, contribute to the development of a better society.
Commercial	Motives reflect an interest in business and business-related matters such as accounting, marketing, management and finances
Hedonistic	Motives produce an orientation towards fun, pleasure and enjoyment
Power	Motives are associated with a desire for success, accomplishment, status, competition, and control
Recognition	Motives reflect responsiveness to attention, approval, praise, a need to be recognised, and an appreciation for the role of recognition in human motivation
Scientific	Motives are associated with a desire for knowledge, an enthusiasm for new and advanced technologies, and a curiosity about how things work
Security	Motives reflect a desire for certainty, predictability, order, and control in one's life
Tradition	Motives are typically expressed in terms of a dedication to ritual, history, spirituality, and old-fashioned values

Each scale is composed of 5 themes (Table 15):

Table 15

MVPI Sub-Scales and Definitions

MVPI Sub-Scale	Definitions
Lifestyles	Concern the manner in which a person would like to live
Beliefs	Involves "shoulds", ideals, and ultimate life goals
Occupational Preferences	include the work an individual would like to do, what constitutes a good job, and preferred work materials
Aversions	reflect attitudes and behaviours that are either disliked or distressing
Preferred Associates	includes the kind of persons desired as coworkers and friends

5.3.3 Grades Data

Measure of Academic Performance: The measure for academic performance is the end of year percentage mark for examination results. 'Grades 1' is the mark received in the first year of the medical program, 'Grades 2' relates to second year marks, and 'Grades 3' relates to third year marks. For 'average grade', the mark received for each year was summed and the total divided by the number of years in the medical program.

5.4 Procedure

OP scores, application and interview scores, and grades for Years 1, 2 and 3 of the medical program were supplied by the JCU School of Medicine.

Approval to use the grades and OP data was obtained from the Dean of the medical school (Appendix A.6). The HPI data for Cohort 1 was collected in Week 5, Semester 2, 2000 (McKergow, 2000). Approval to use the data is attached as Appendix A.7. HPI data for cohorts 2 and 3 were collected by the researcher in Week 5, Semester 1, in 2001 and 2002. MVPI and HDS data for were collected in Week 12, Semester 1, in 2001 (cohorts 1 and 2)

and 2002 (cohort 3). Students were contacted by email and invited to participate in the study. The surveys were conducted in a lecture theatre at the School of Medicine. After being advised of the strict confidentiality of the data, and that participation in the study was voluntary, participating students read and signed the Information and Consent Form (Appendices A.8 and A.9).

5.5 Statistical Analyses

The Statistics for the Social Sciences programme (SPSS Version 11.0) was used to conduct analyses of this stage of the study. Excel XP was used for some graphics. The processing of completed personality inventories was carried out by Davidson-Trahaire Pty Ltd, in Sydney. I received electronic spreadsheets containing subjects' percentile and raw scores for each of the inventories, which were then imported into SPSS Version 11 for statistical analysis.

Initial screening of the data was carried out in accordance with the procedures outlined in Tabachnick and Fidell (2001). Fisher's Measure of Skewness (FMS) and Fisher's Measure of Kurtosis (FMK) were used to statistically examine the normality of interval data and acceptable levels of skewness and kurtosis defined as, z scores ≤ 3.29 , $p > .001$, (two-tailed). These statistical tests were supplemented with the visual assessment of histograms, normal and detrended probability plots, and boxplots (Jacoby, 1997; Munro, 1997; Pett, 1997). An outlier was defined as "a score that is unusually far from the mean and apparently disconnected from the rest of the

scores” (Tabachnick & Fidell, 2001, p.44). Outliers were first identified by visual assessment of the boxplots and confirmed by visual assessment of histograms. Extreme outliers were assigned new scores one unit smaller or larger than the next most extreme score in the distribution, as recommended by Tabachnick and Fidell (2001, p.44).

Factor analyses and reliability analyses of the personality inventories were not carried out due to commercially restricted access to information pertaining to the item construction of the inventory scales. However, an item analysis of the data was conducted by the developer of the scale, Professor Robert Hogan, upon request. Statistical analysis included a missing values analysis, independent t-tests to explore age and gender differences on the personality inventories, a correlation analysis to explore the predictive validity of all variables in relation to grades, and hierarchical regression analyses to determine incremental validity. Unless otherwise stated, an alpha level of .05 was used for all statistical tests. I have focused more on the pattern and magnitude of the effects rather than trying to minimise Type 1 errors. Thus, Bonferroni adjustments have not been made to the correlation analysis. Statistical power and/or effect size for t-tests and correlations were calculated using the “G-Power” program (University of Duesseldorf), and Cohen’s power tables (Cohen, 1988). The effect size for regression analyses was calculated using the formula $f^2 = R^2/1-R^2$ (Howell, 2001-2002) based on Adjusted R^2 as only 54% ($n = 115$) to 63% ($n = 133$) of students were included in the regression analyses.

CHAPTER 6

Results

- 6.0** Reliability analysis

- 6.1** Missing data analysis

- 6.2** Age and gender difference on personality inventories
 - 6.2.1 Data screening
 - 6.2.2 Descriptive statistics
 - 6.2.3 Independent sample t-tests

- 6.3** Correlational analysis
 - 6.3.1 Age and gender
 - 6.3.2 Selection criteria
 - 6.3.3 Personality variables

- 6.4** Regression analysis – personality traits (HPI)
 - 6.4.1 Assumption testing
 - 6.4.2 Results

- 6.5** Regression analysis – dysfunctional behaviour (HDS)
 - 6.5.1 Assumption testing
 - 6.5.2 Results

- 6.6** Regression analysis – motives/values/interests (MVPI)
 - 6.6.1 Assumption testing
 - 6.6.2 Results

6.7 Ancillary analyses

6.7.1 Ancillary regression analyses - HPI

6.7.1.1 Assumption testing

6.7.1.2 Results

6.7.2 Ancillary correlation analyses

6.7.2.1 Application and interview criteria

6.7.2.2 Personality variables and OP ranks

6.7.2.3 Personality variables and application criteria

6.7.2.4 Personality variables and interview criteria

6.0 Reliability Analysis

Reliability analyses revealed the HPI scales had adequate levels of reliability with Cronbach alpha coefficients ranging from .70 (Intellectance and Scholarship) to .86 (Adjustment). The HICs proved to be less reliable with Cronbach alpha coefficients ranging from .08 (Caring) to .79 (Not Anxious), thus, analyses at this level were not carried out. Seven scales of the MVPI had adequate levels of reliability (Cronbach alphas ranged from .73 to .82), while the scales of Affiliation, Commerce and Power were slightly less reliable (Cronbach alphas ranged from .67 to .68). Only three scales of the HDS (Skeptical, Cautious and Diligent) had adequate levels of reliability (Cronbach alphas ranged from .70 to .75), while the remaining scales were less reliable (Cronbach alphas ranged from .46 to .68). However, when grouped into the HDS syndromes, analyses revealed that the 'moving away' and 'moving against' syndromes had adequate levels of reliability (alpha = .74 and .73 respectively). The 'moving towards' syndrome had a very low alpha level of .05, which could possibly be explained by the fact that this syndrome was comprised of only two scales. The full range of coefficients is set out in Appendix B, Tables B1 to B4.

6.1 Missing Values Analysis

Separate Variance t Tests for indicator variables with more than 5% of missing data revealed significant mean differences between the indicator variables (present, missing), on the hypothesized scales of the HPI, MVPI and HDS, and grades data. Students who completed the HPI had significantly higher scores for Grades 1, Grades 2 and Average Grade, compared to those students who did not complete the HPI. Students who

completed the MVPI had significantly higher scores on the dysfunctional HDS syndromes of Against and Towards, while students who completed the HDS had significantly lower levels of Altruism. The mean differences are set out in Table 16. In relation to the Grades data, students who had recorded grades for the first year of training (Grades 1) had significantly higher levels of Adjustment and Ambition, compared to students with unrecorded grades data for that period. Students who had recorded grades for Year 2 had significantly higher levels of Ambition and received higher grades in the previous year (Grades 1). Students with recorded grades for the third year of training (Grades 3) and Average Grade, received higher grades in the first year of training (Grades 1) compared to students with missing scores for Grades 3 and Average Grade.

Table 16

Results of Missing Value Analysis: Significant mean differences of indicator variables with more than 5% of missing data.

	PERSONALITY SCALES					GRADES		
	HPI		MVPI	HDS		Year 1	Year 2	Average
	Adjustment	Ambition	Altruism	Against	Towards			
Adjustment: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	n/a	n/a	.026 65.50 61.05	.012 66.19 61.43	.009 66.99 62.66
Ambition: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	n/a	n/a	.026 65.50 61.05	.012 66.19 61.43	.009 66.19 62.66
Sociability: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	n/a	n/a	.026 65.50 61.05	.012 66.19 61.43	.009 66.19 62.66
Agreeability: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	n/a	n/a	.026 65.50 61.05	.012 66.19 61.43	.009 66.19 62.66
Prudence: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	n/a	n/a	.026 65.50 61.05	.012 66.19 61.43	.009 66.19 62.66
Prudence: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	n/a	n/a	.026 65.50 61.05	.012 66.19 61.43	.009 66.19 62.66
Intellectance: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	n/a	n/a	.026 65.50 61.05	.012 66.19 61.43	.009 66.19 62.66
Scholarship: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	n/a	n/a	.026 65.50 61.05	.012 66.19 61.43	.009 66.19 62.66
Aesthetic: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	.002 6.97 6.33	.018 9.08 7.33	n/a	n/a	n/a

	PERSONALITY SCALES					GRADES		
	HPI		MVPI	HDS				
	Adjustment	Ambition	Altruism	Against	Towards	Year 1	Year 2	Average
Affiliation: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	.002 6.97 6.33	.018 9.08 7.33	n/a	n/a	n/a
Altruism: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	.002 6.97 6.33	.018 9.08 7.33	n/a	n/a	n/a
Scientific: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	.002 6.97 6.33	.018 9.08 7.33	n/a	n/a	n/a
Away: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	.038 51.04 52.00	n/a	n/a	n/a	n/a	n/a
Against: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	.038 51.04 52.00	n/a	n/a	n/a	n/a	n/a
Towards: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	.038 51.04 52.00	n/a	n/a	n/a	n/a	n/a
Grades 1: P (2-tail) Mean (Present) Mean (Missing)	.005 23.48 17.00	.042 22.50 17.87	n/a	n/a	n/a	n/a	n/a	n/a
Grades 2: P (2-tail) Mean (Present) Mean (Missing)	n/a	.042 22.52 19.38	n/a	n/a	n/a	.009 65.22 51.92	n/a	n/a
Grades 3: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	n/a	n/a	.022 65.42 53.74	n/a	n/a
Average Grade: P (2-tail) Mean (Present) Mean (Missing)	n/a	n/a	n/a	n/a	n/a	.022 65.42 53.74	n/a	n/a

6.2 Gender and Age Differences on Personality Inventories

6.2.1 Data Screening

Normality checks of the HPI scales ($n = 169$) revealed the scales of Adjustment, Sociability, Prudence, Intellectance and Scholarship to be normally distributed ($z \leq 3.29, p > .001$). As shown in Figure 6, the scales of Ambition ($z = -4.25$) and Agreeability ($z = -6.86$) were negatively skewed and were transformed using a square root ($\text{SQRT}\{X\}$) and reflect and logarithm ($\text{LG10}\{K-X\}$) transformation, respectively (Tabachnick & Fidell, 2001b; Emerson & Stoto, 1983; Munro, 1997). After transformation the levels of skewness and kurtosis were at acceptable levels ($z \leq 3.29, p > .001$).

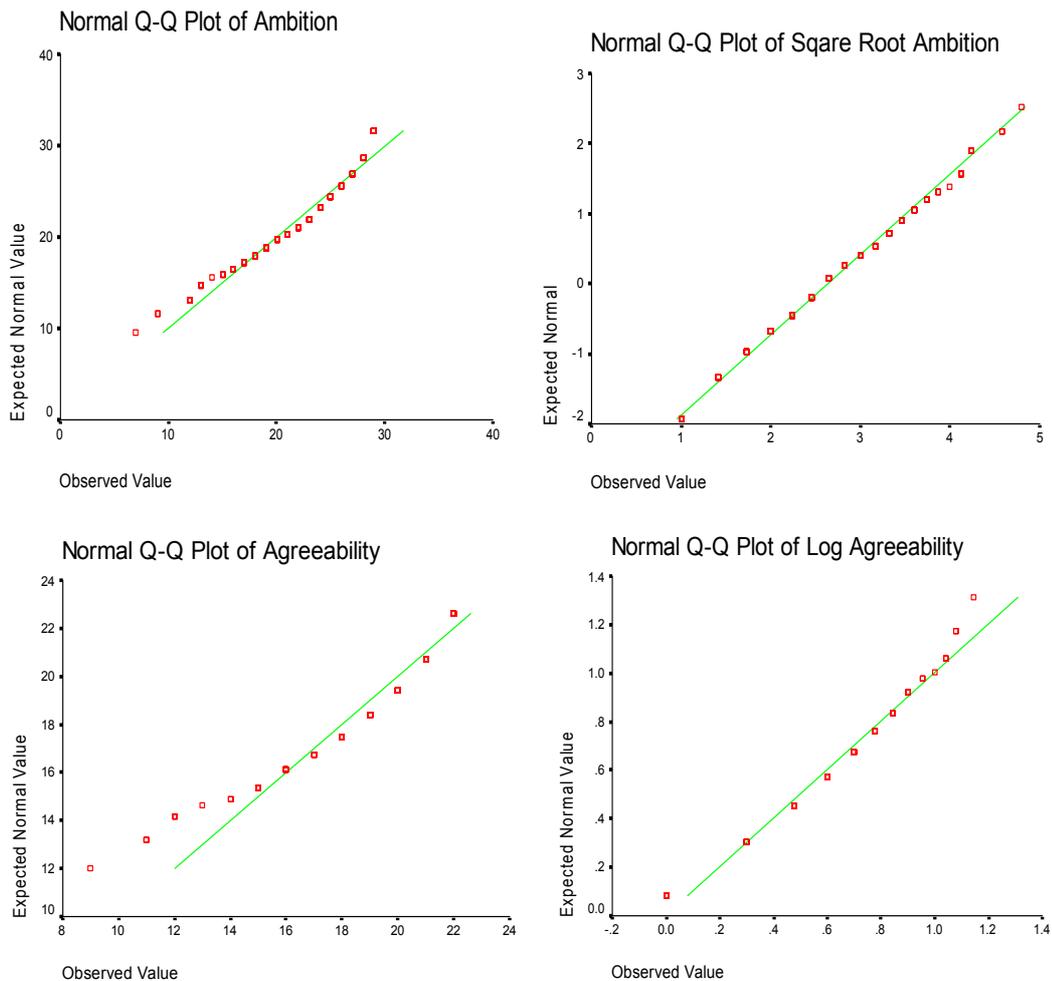


Figure 6

Normal Q-Q Plots of Ambition and Agreeability, before and after transformation

The boxplots (see Figure 7) indicated that there were outliers on the scales of Adjustment and Sociability, however, visual inspection of the histograms revealed that these scores were connected to the rest of the scores and they were retained in the database in their original form.

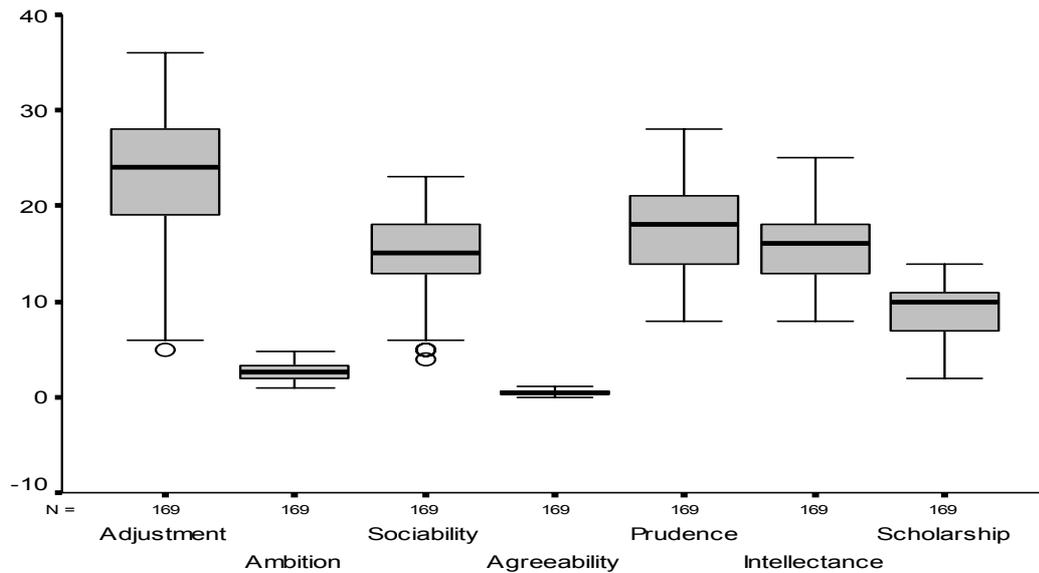


Figure 7
Boxplots of HPI Variables (Personality Traits)

Normality checks of the MVPI scales ($n = 149$) revealed the scales of Altruism and Scientific to be normally distributed ($z \leq 3.29, p > .001$). As shown in Figure 8, the scale of Aesthetic ($z = 3.51$) was positively skewed and transformed using a logarithm transformation ($LG10\{X\}$], while Affiliation ($z = -3.52$) was negatively skewed and transformed using a reflect and square root transformation ($SQRT\{K-X\}$) (Tabachnick & Fidell, 2001b). After transformation the levels of skewness and kurtosis were at acceptable levels ($z \leq 3.29, p > .001$).

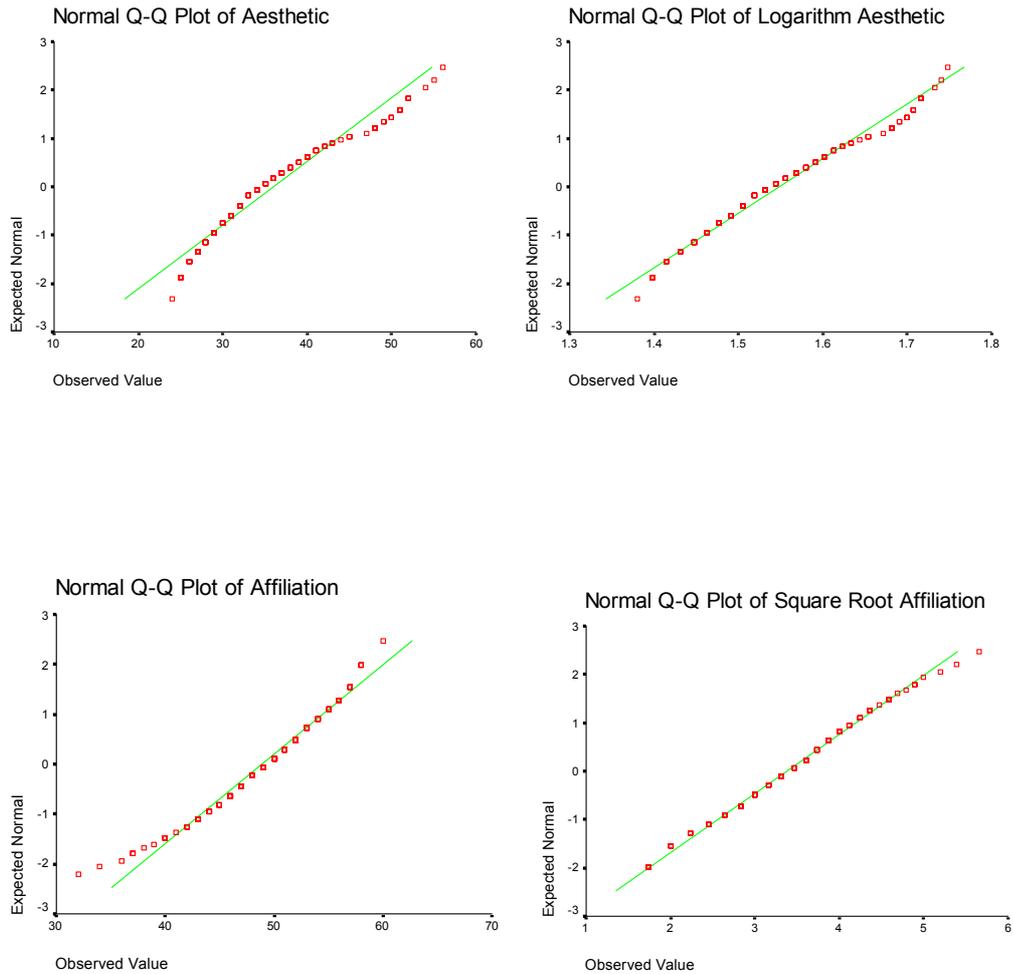


Figure 8
Normal Q-Q Plots of Aesthetic and Affiliation, before and after transformation

The boxplots (see Figure 9) indicated that there were outliers on the scales of Affiliation and Altruism, however, visual inspection of the histograms revealed that these scores were connected to the rest of the scores and they were retained in the database in their original form.

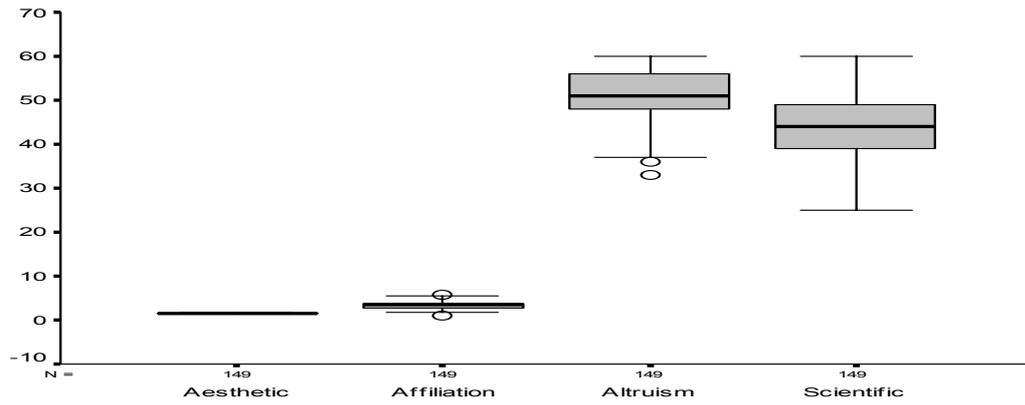


Figure 9

Boxplots of MVPI Variables (Motives/Values/Interests)

Normality checks of the HDS scales ($n = 150$) revealed the syndromes of Away, Against and Towards to be normally distributed ($z \leq 3.29, p > .001$).

As shown in Figure 10, the boxplots indicated that there were outliers on the syndromes of Away and Towards. However, visual inspection of the histogram revealed that these scores were connected to the rest of the scores and they were retained in the database in their original form.

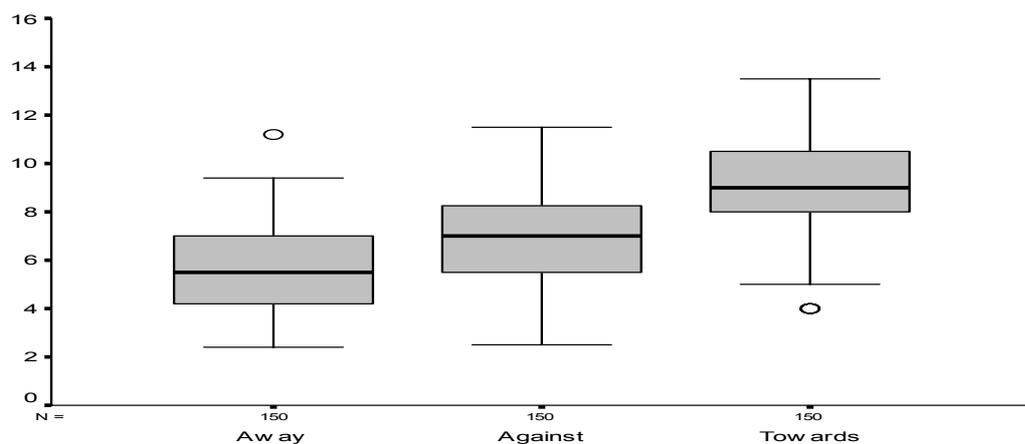


Figure 10

Boxplots of HDS Variables (Dysfunctional Interpersonal Behaviours)

6.2.2 Descriptive Statistics

The mean, standard deviation, and range of scores for the hypothesized scales of the personality inventories (HPI, MVPI, and HDS) can be found in Table 17.

Table 17

Descriptive Statistics for Personality Variables

Variable	N	Mean	Standard Deviation	Range of Scores
<i>HPI Scales</i>				
Adjustment	169	23.17	6.88	5-36
Ambition	169	22.28	4.77	7-29
Sociability	169	14.73	4.19	4-23
Agreeability	169	19.16	2.66	9-22
Prudence	169	17.78	4.49	8-28
Intellectance	169	15.60	3.98	8-25
Scholarship	169	9.34	2.71	2-14
Transformed Variables				
Ambition	169	2.63	0.87	
Agreeability	169	0.48	0.30	
<i>MVPI Scales</i>				
Aesthetic	149	36.07	7.57	24-56
Affiliation	149	48.91	5.57	29-60
Altruism	149	51.05	5.51	33-60
Scientific	149	43.98	7.14	25-60
Transformed Variables				
Aesthetic	149	1.54	0.08	
Affiliation	149	3.38	0.81	
<i>HDS Syndromes</i>				
Away	150	5.68	1.88	2-11
Against	150	6.95	2.05	3-12
Towards	150	9.04	1.88	4-14

6.2.3 Independent Sample T-Tests

Gender: The results of the t-tests for independent samples indicated that males scored significantly higher than females in relation to the personality scales of Adjustment, $t(167) = 3.006, p = .003$, Sociability, $t(167) = 2.240, p = .026$, Intellectance, $t(167) = 3.473, p = .001$, and Scientific, $t(147) = 2.164, p = .032$. Females scored significantly higher than males on the

dysfunctional syndrome of Towards, $t(148) = -2.807, p = .006$. A table of means and standard deviations is presented in Table 18.

Table 18

Means and Standard Deviations for Significant Gender Differences on Personality Scales, $p < .05$ (2-tailed)

SCALE		N	Mean	Standard Deviation
Adjustment:	Male	65	25.14	6.28
	Female	104	21.94	6.98
Sociability:	Male	65	15.63	3.59
	Female	104	14.16	4.45
Intellectance:	Male	65	16.91	3.79
	Female	104	14.79	3.89
Scientific:	Male	60	45.43	5.98
	Female	89	43.00	7.70
Towards:	Male	60	8.53	1.85
	Female	90	9.39	1.84

Age: The results of the t-tests for independent samples indicated that there were no significant differences between the 14-17 year age group ($n = 89$) and the 18-21 year age group ($n = 111$) in relation to any of the personality variables, $p > .05$.

6.3 Correlational Analysis

A list of significant correlations between independent variables (age, gender, OP ranks, application criteria, interview criteria, and personality variables) and the grades data (Years 1, 2, 3 and Average Grade) is set out in Table 19. A detailed table of all correlations can be found in Appendix B, Table B5.

Table 19

Table of Significant Correlations with Grades Data

VARIABLE	Grades							
	1		2		3		4	
	<i>N</i>	<i>r</i>	<i>N</i>	<i>r</i>	<i>N</i>	<i>r</i>	<i>N</i>	<i>r</i>
Grades: Year 1								
Year 2	183	.729 ***						
Year 3	179	.652 ***	179	.811 ***				
Average	179	.881 ***	179	.933 ***	179	.899 ***		
Gender	188	.226 **	183	.219 **	179	.299 ***	179	.247 **
OP Ranks	175	-.468 ***	172	-.431 ***	168	-.318 ***	168	-.432 ***
Application: Motivation	181	.116	176	.119	172	.173 *	172	.128
Interview: Interpersonal	186	.213 **	181	.198 **	178	.121	178	.212 **
Communication 1	186	.192 **	181	.157 *	178	.099	178	.163*
Communication 2	186	.189 **	181	.148 *	178	.085	178	.135
Overall Rating	186	.233 **	181	.154 *	178	.081	178	.171 *
HPI: Adjustment	161	.172 *	156	.098	152	.086	152	.188 *
Ambition	161	-.125	156	-.175 *	152	-.161 *	152	-.192 *
Sociability	161	-.218 **	156	-.114	152	-.186 *	152	-.200 *
Prudence	161	.271 **	156	.139	152	.209 **	152	.226 **
Scholarship	161	.044	156	.067	152	.168 *	152	.096
HDS: Away	146	-.129	141	-.235 **	139	-.223 **	139	-.213 *
Against	146	-.157	141	-.147	139	-.218 *	139	-.184*
Towards	146	.222 **	141	.111	139	.174 *	139	.163

2-tailed

ns = nonsignificant

* $p < .05$ ** $p < .01$ *** $p < .001$

6.3.1 Age and Gender

The results of the Pearson's bivariate correlations indicated that there was a significant relationship between gender and grades in each of the first three years of medical training, and in average grade (r ranges from .219 to .299, $p < .01$). There were no significant relationships between the age groups 14-17 and 18-21 on any of the grades scales, $p > .05$.

6.3.2 Selection Criteria

The results of the Pearson's bivariate correlations indicated that there was a significant relationship between OP ranks and all grades data (r ranges from -.318 to -.468, $p < .001$). The negative relationship indicates that higher OP ranks (OP1 is the highest OP rank) are associated with higher academic

grades in medical training during the first three years of training, and in average grade. There was a significant relationship between the application criteria of Motivation and grades in the third year of training. There were significant relationships for the interview scales of Interpersonal, Communication 1, and Overall Rating with first and second year grades and average grade. There was also a significant relationship for Communication 2 with first and second year grades. Interview correlations ranged from .148 to .233, $p < .05$.

6.3.3 Personality Variables

In relation to the HPI variables, the results of the Pearson's bivariate correlations indicated positive relationships for Adjustment and Prudence, and a negative relationship for Sociability, with academic grades in the first year of training. There was a negative relationship between Ambition and second year grades. There were positive relationships for Prudence and Scholarship, and negative relationships for Ambition and Sociability, with third year grades. A higher average grade was associated with higher levels of Adjustment and Prudence, and lower levels of Ambition and Sociability. Negative correlations ranged from $-.161$ to $-.218$ and positive correlations ranged from $.172$ to $.271$, $p < .05$.

In relation to the MVPI variables, there were no significant relationships with any of the grades scales, $p > .05$.

In relation to the HDS syndromes, there was a positive relationship between Towards and grades in the first year of training. There was negative

relationship between Away and second year grades. There was a negative relationship for Away and Against, and a positive relationship for Towards, with third year grades. Average grade was negatively related to both Away and Against. Negative correlations ranged from $-.184$ to $-.235$ and positive correlations ranged from $.174$ to $.222$, $p < .05$.

6.4 Regression Analyses – Personality Traits (HPI)

Hierarchical regression was used to determine if the addition of personality traits improved the prediction of academic grades beyond that afforded by the current selection process (OP ranks, application and interview criteria). Age and gender were included in the equation based on their theoretical relationship with academic performance, as previously discussed in Section 5.1. As there were four dependent variables (Grades Year 1, Grades Year 2, Grades Year 3, and Average Grade), four sets of regression analyses were conducted.

6.4.1 Assumption Testing

There are 21 independent variables and the number of cases ranged from 127 in Grades 3 to 133 in Grades 1, giving a ratio of approximately 1:6. Although below the ideal number for hierarchical regression (1:20), this number does meet the minimum requirement (1:5) (Coakes & Steed, 2001). There were no multivariate outliers, as indicated by Mahalanobis' distance values less than the critical value of chi-square ($X^2 < 46.797$, $df = 21$, $p = .001$). The normal plot of regression standardized residuals for the dependent variables indicated relatively normal distributions (see Figure 11).

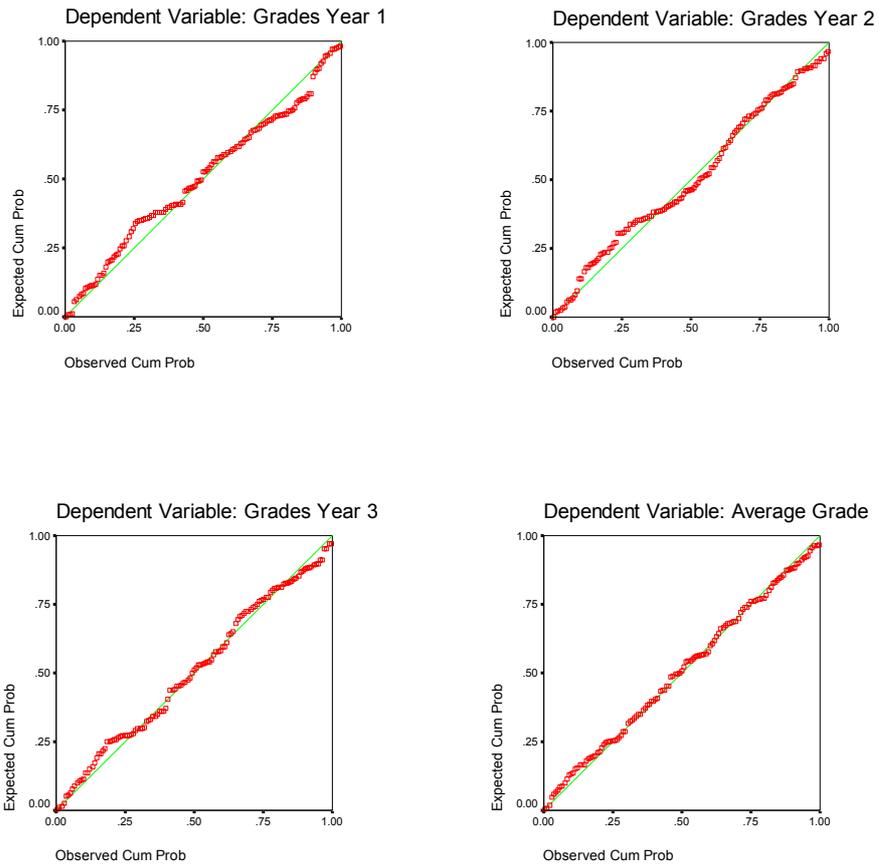


Figure 11
Normal P-P Plots of Regression Standardised Residuals - HPI

The scatterplots of residuals against predicted values (as shown in Figure 12) indicated relationships that were consistent with the assumptions of linearity, homoscedasticity, and independence of residuals.

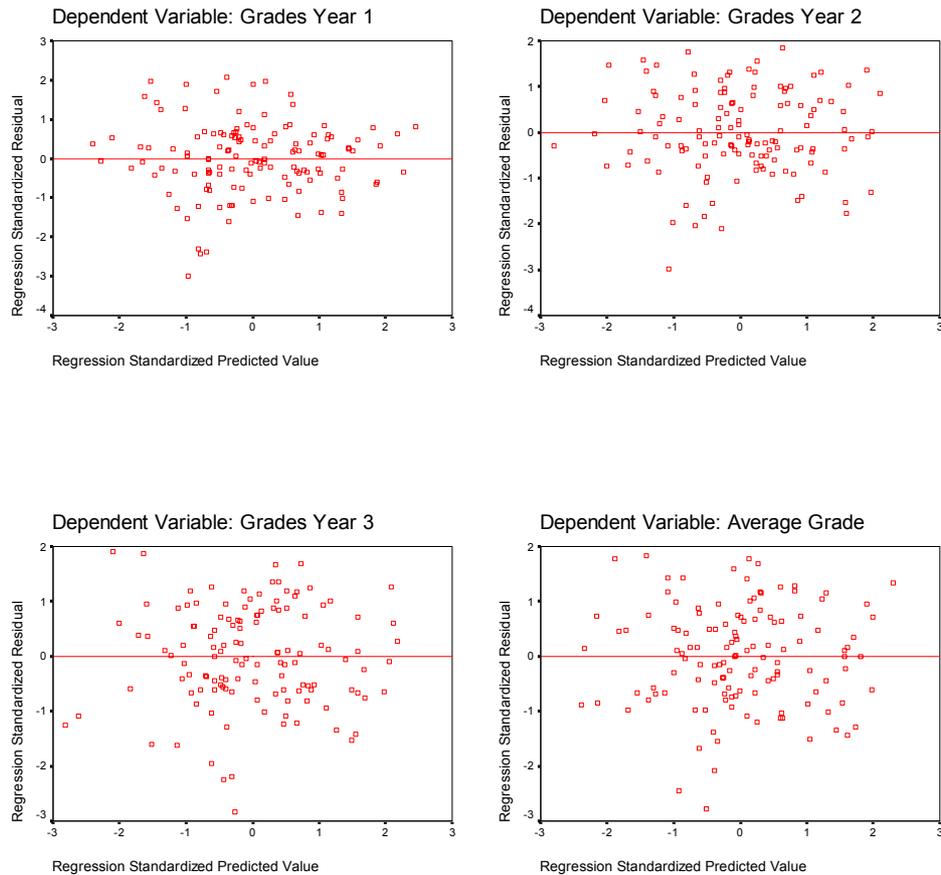


Figure 12
Scatterplots of Regression Standardised Residuals - HPI

6.4.2 Results

Grades Year 1: A summary of the regression results for Grades Year 1 is set out in Table 20. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .659$, $F(21, 111) = 4.053$, $p < .001$.

Table 20

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and HPI Variables (personality traits) Predicting Academic Grades Year 1

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.256	.066	.059	9.217 **	.066	9.217 **
2: IN: Age Category	.259	.067	.053	4.680 *	.001	.200
3: IN: OP Ranks	.515	.265	.248	15.512 ***	.198	34.745 ***
4: IN: Application Criteria	.548	.300	.255	6.657 ***	.035	1.253
5: IN: Interview Criteria	.613	.376	.301	5.069 ***	.075	2.365 *
6: IN: HPI Traits	.659	.434	.327	4.053 ***	.058	1.637

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 6.6% of the variance in academic grades in the first year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 19.8% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance. The addition of the interview criteria (model 5) resulted in a significant increment, explaining an additional 7.5% of the variance in first year grades. A review of significant beta weights reveals that the interview criterion of Interpersonal has a small correlation with first year grades, $\beta = -.248$, $t = -2.014$, $p = .046$. In model 6, the addition of personality traits (HPI variables) did not significantly improve variance in first-year academic grades. The beta weights relating to model 6 can be found in Appendix B, Table B6.

The final model of the regression analysis (model 6) had an adequate level of power (.99) and effect size ($f^2 = .485$).

Grades Year 2: A summary of the regression results for Grades Year 2 is set out in Table 21. For each of the dependent variables, *R* was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .594$, $F(21, 108) = 2.810$, $p < .001$.

Table 21

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and HPI Variables (personality traits) Predicting Academic Grades Year 2

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.246	.060	.053	8.226 **	.060	8.226 **
2: IN: Age Category	.261	.068	.054	4.647 *	.008	1.063
3: IN: OP Ranks	.472	.223	.204	12.036 ***	.155	25.054 ***
4: IN: Application Criteria	.498	.248	.199	5.001 ***	.026	.828
5: IN: Interview Criteria	.568	.323	.240	3.911 ***	.074	2.097
6: IN: HPI Traits	.594	.353	.228	2.810 ***	.031	.733

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 6% of the variance in academic grades in the second year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 15.5% of the variance in academic grades. In model 4, the addition of application criteria did not significantly increase variance, nor did the addition of the interview criteria (model 5). In model 6, the addition of personality traits (HPI variables) did not significantly improve variance in second-year academic grades. The beta weights relating to model 6 can be found in Appendix B, Table B6.

The final model of the regression analysis (model 6) had an adequate level of power (.96) and effect size ($f^2 = .29$).

Grades Year 3: A summary of the regression results for Grades Year 3 is set out in Table 22. For each of the dependent variables, *R* was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .630$, $F(21, 105) = 3.290$, $p < .001$.

Table 22

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and HPI Variables (personality traits) Predicting Academic Grades Year 3

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.286	.082	.074	11.107 **	.082	11.107 **
2: IN: Age Category	.301	.090	.076	6.166 **	.009	1.206
3: IN: OP Ranks	.479	.230	.211	12.241 ***	.139	22.275 ***
4: IN: Application Criteria	.514	.264	.214	5.284 ***	.034	1.085
5: IN: Interview Criteria	.566	.321	.236	3.776 ***	.057	1.563
6: IN: HPI Traits	.630	.397	.276	3.290 ***	.076	1.895

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 8.2% of the variance in academic grades in the third year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 13.9% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance, nor did the addition of the interview criteria (model 5). In model 6, the addition of personality traits (HPI variables) did not significantly improve variance in third-year academic grades. The beta weights relating to model 6 can be found in Appendix B, Table B6.

The final model of the regression analysis (model 6) had an adequate level of power (.99) and effect size ($f^2 = .38$).

Average Grade: A summary of the regression results for Average Grade is set out in Table 23. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .674$, $F(21, 105) = 4.167$, $p < .001$.

Table 23

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and HPI Variables (personality traits) Predicting Academic Average Grade

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.265	.070	.063	9.459 **	.070	9.459 **
2: IN: Age Category	.273	.074	.059	4.985 **	.004	.546
3: IN: OP Ranks	.533	.285	.267	16.311 ***	.210	36.136 ***
4: IN: Application Criteria	.572	.328	.282	7.191 ***	.043	1.514
5: IN: Interview Criteria	.621	.386	.309	5.032 ***	.058	1.775
6: IN: HPI Traits	.674	.455	.345	4.167 ***	.068	1.883

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 7% of the variance in the average academic grade over the first three years of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 21% of the variance in average grade. In model 4, the addition of the application criteria did not significantly increase variance, nor did the addition of the interview criteria (model 5). In model 6, the addition of personality traits (HPI variables) did not significantly improve variance in average grade. The beta weights relating to model 6 can be found in Appendix B, Table B6.

The final model of the regression analysis (model 6) had an adequate level of power (.99) and effect size ($f^2 = .52$).

6.5 Regression Analyses – Dysfunctional Behaviour (HDS)

Hierarchical regression was used to determine if the addition of dysfunctional interpersonal behaviours improved the prediction of academic grades beyond that afforded by the current selection process (OP ranks, application and interview criteria). Age and gender were included in the equation based on their theoretical relationship with academic performance, as previously discussed in Section 5.1. As there were four dependent variables (Grades Year 1, Grades Year 2, Grades Year 3, and Average Grade), four sets of regression analyses were conducted.

6.5.1 Assumption Testing

There are 17 independent variables and the number of cases ranged from 115 in Grades 3 to 120 in Grades 1, giving a ratio of approximately 1:7. Although below the ideal number for hierarchical regression (1:20), this number does meet the minimum requirement (1:5) (Coakes & Steed, 2001). There were no multivariate outliers, as indicated by a Mahalanobis' distance value less than the critical value of chi-square ($X^2 < 40.790$, $df = 17$, $p = .001$). The normal plot of regression standardized residuals for the dependent variables indicated relatively normal distributions.

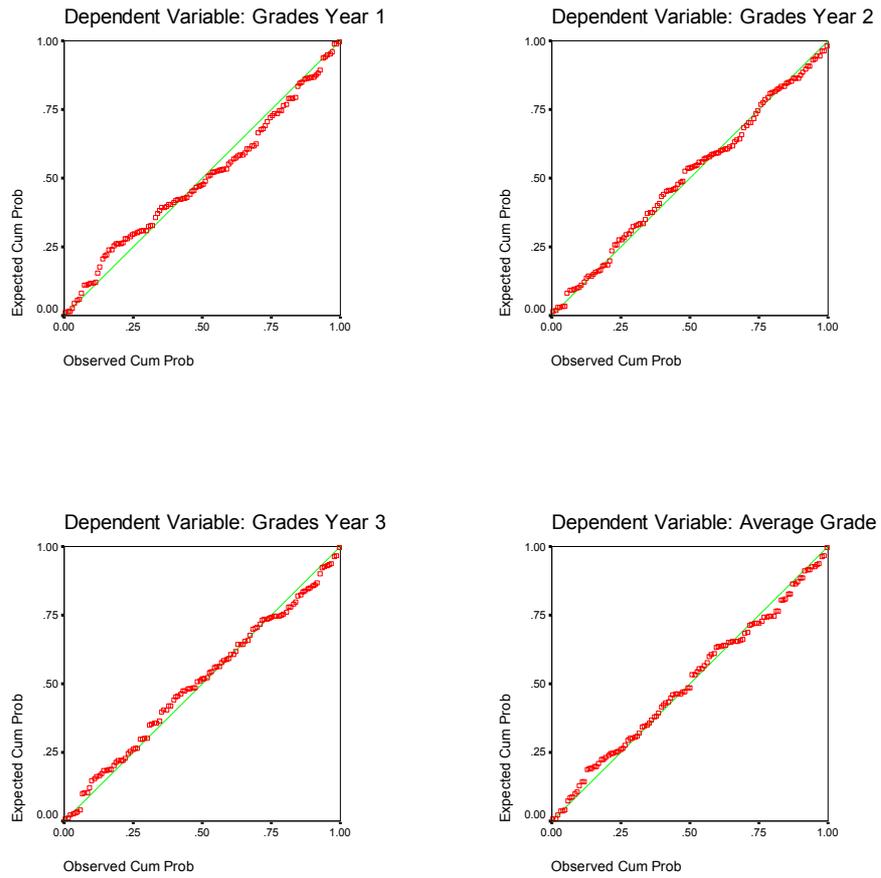


Figure 13
Normal P-P Plots of Regression Standardised Residuals - HDS

The scatterplots of residuals against predicted values indicated relationships that were consistent with the assumptions of linearity, homoscedasticity, and independence of residuals.

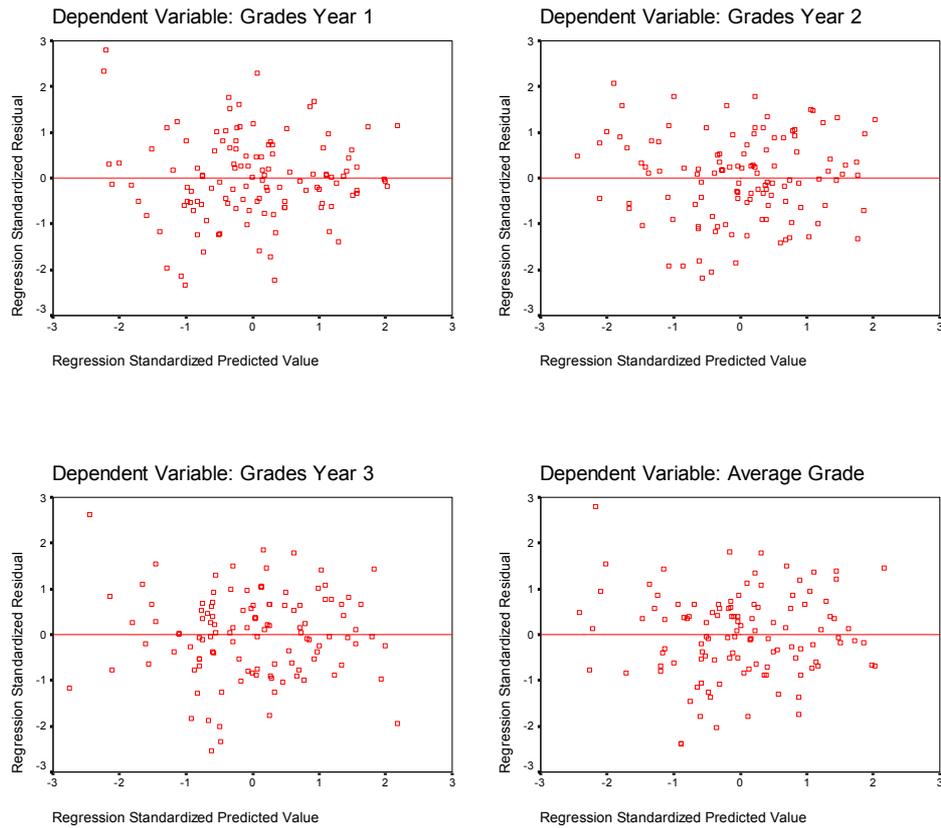


Figure 14
Scatterplots of Regression Standardised Residuals - HDS

6.5.2 Results

Grades Year 1: A summary of the regression results for Grades Year 1 is set out in Table 24. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .685$, $F(17, 102) = 5.313$, $p < .001$.

Table 24

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and HDS Variables (dysfunctional interpersonal behaviours) Predicting Academic Grades Year 1

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.259	.067	.059	8.452 **	.067	8.452 **
2: IN: Age Category	.259	.067	.051	4.194 *	.000	.006
3: IN: OP Ranks	.553	.306	.288	17.076 ***	.239	40.041 ***
4: IN: Application Criteria	.588	.345	.298	7.316 ***	.039	1.319
5: IN: Interview Criteria	.654	.428	.352	5.607 ***	.083	2.525 *
6: IN: HDS variables	.685	.470	.381	5.313 ***	.042	2.681

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 6.7% of the variance in academic grades in the first year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 23.9% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly improve variance. The addition of the interview criteria (model 5) resulted in a significant increment, explaining an additional 8.3% of the variance in first year grades. A review of significant beta weights reveals that the interview criterion of Self Reliance has a small correlation with first year grades, $\beta = -.229$, $t = -2.069$, $p = .041$. In model 6, the addition of dysfunctional interpersonal behaviours (HDS variables) did not significantly improve variance in first-year academic grades. The beta weights relating to model 6 can be found in Appendix B, Table B7.

The final model of the regression analysis (model 6) had an adequate level of power (.99) and effect size ($f^2 = .615$).

Grades Year 2: A summary of the regression results for Grades Year 2 is set out in Table 25. For each of the dependent variables, *R* was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .671$, $F(17, 99) = 4.760$, $p < .001$.

Table 25

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and HDS Variables (dysfunctional interpersonal behaviours) Predicting Academic Grades Year 2

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.253	.064	.056	7.886 **	.064	7.886 **
2: IN: Age Category	.257	.066	.050	4.028 *	.002	.223
3: IN: OP Ranks	.496	.246	.226	12.318 ***	.180	27.057 ***
4: IN: Application Criteria	.529	.280	.227	5.250 ***	.034	1.007
5: IN: Interview Criteria	.618	.382	.297	4.508 ***	.102	2.813 *
6: IN: HDS variables	.671	.450	.355	4.760 ***	.068	4.049 **

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 6.4% of the variance in academic grades in the second year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 18% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance. The addition of the interview criteria (model 5) resulted in a significant increment, explaining an additional 10.2% of the variance in second year grades. A review of significant beta weights reveals that the interview criterion of Communication 1 has a small correlation with second year grades, $\beta = .274$, $t = 2.050$, $p = .043$. In model 6, the addition of dysfunctional interpersonal behaviours (HDS variables) resulted in a significant increment, explaining an additional 6.8% of the variance in grades.

A review of significant beta weights reveals that the HDS syndrome of Away ($\beta = -.232, t = -2.891, p = .005$) is predictive of second year grades. The beta weights relating to model 6 can be found in Appendix B, Table B7.

The final model of the regression analysis (step 6) had an adequate level of power (.99) and effect size ($f^2 = .615$).

Grades Year 3: A summary of the regression results for Grades Year 3 is set out in Table 26. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .648, F(17, 97) = 4.140, p < .001$.

Table 26

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and HDS Variables (dysfunctional interpersonal behaviours) Predicting Academic Grades Year 3

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.327	.107	.099	13.512 ***	.107	13.512 ***
2: IN: Age Category	.331	.110	.094	6.898 **	.003	.361
3: IN: OP Ranks	.508	.258	.238	12.870 ***	.148	22.202 ***
4: IN: Application Criteria	.538	.290	.236	5.408 ***	.032	.949
5: IN: Interview Criteria	.599	.359	.269	3.996 ***	.069	1.790
6: IN: HDS variables	.648	.420	.319	4.140 ***	.062	3.446 *

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 10.7% of the variance in academic grades in the third year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 14.8% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance, nor did the addition of interview criteria

(model 5). In model 6, the addition of dysfunctional interpersonal behaviours (HDS variables) resulted in a significant increment, explaining an additional 6.2% of the variance in third year grades. A review of significant beta weights reveals that the HDS syndromes of Away ($\beta = -.167, t = -2.005, p = .048$) and Against ($\beta = -.188, t = -2.157, p = .003$) are predictive of third year grades. The beta weights relating to model 6 can be found in Appendix B, Table B7.

The final model of the regression analysis (step 6) had an adequate level of power (.99) and effect size ($f^2 = .47$).

Average Grade: A summary of the regression results for Average Grade is set out in Table 27. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .707, F(17, 97) = 5.699, p < .001$.

Table 27

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and HDS Variables (dysfunctional interpersonal behaviours) Predicting Academic Average Grade

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.301	.090	.082	11.243 **	.090	11.243 **
2: IN: Age Category	.303	.092	.075	5.641 **	.001	.126
3: IN: OP Ranks	.573	.328	.310	18.099 ***	.237	39.171 ***
4: IN: Application Criteria	.606	.368	.320	7.703 ***	.039	1.313
5: IN: Interview Criteria	.664	.441	.363	5.639 ***	.074	2.192
6: IN: HDS (dysfunctional interpersonal behaviours)	.707	.500	.412	5.699 ***	.059	3.785 *

* $p < .05$

** $p < .01$

*** $p < .001$

In model 1, gender explains 9% of the variance in academic grades in the average grade over the first three years of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 23.7% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance, nor did the addition of interview criteria (model 5). In model 6, the addition of dysfunctional interpersonal behaviours (HDS variables) resulted in a significant increment, explaining an additional 5.9% of the variance in average grade. A review of significant beta weights reveals that the HDS syndromes of Away ($\beta = -.173$, $t = -2.240$, $p = .027$) and Against ($\beta = -.168$, $t = -2.073$, $p = .041$) are predictive of average grade. The beta weights relating to model 6 can be found in Appendix B, Table B7.

The final model of the regression analysis (step 6) had an adequate level of power (.99) and effect size ($f^2 = .70$).

6.6 Regression Analyses – Motive/values/interests (MVPI)

Hierarchical regression was used to determine if the addition of motives, values and vocational preferences improved the prediction of academic grades beyond that afforded by the current selection process (OP ranks, application and interview criteria). Age and gender were included in the equation based on their theoretical relationship with academic performance, as previously discussed in Section 5.1. As there were four dependent variables (Grades Year 1, Grades Year 2, Grades Year 3, and Average Grade), four sets of regression analyses were conducted.

6.6.1 Assumption Testing

There are 18 independent variables and the number of cases ranged from 116 in Grades 3 to 119 in Grades 1, giving a ratio of approximately 1:6. Although below the ideal number for hierarchical regression (1:20), this number does meet the minimum requirement (1:5) (Coakes & Steed, 2001). There was one multivariate outlier, as indicated by a Mahalanobis' distance values which slightly exceeded the critical value of chi-square ($X^2 < 42.312$, $df = 18$, $p = .001$). The normal plot of regression standardized residuals for the dependent variables indicated relatively normal distributions.

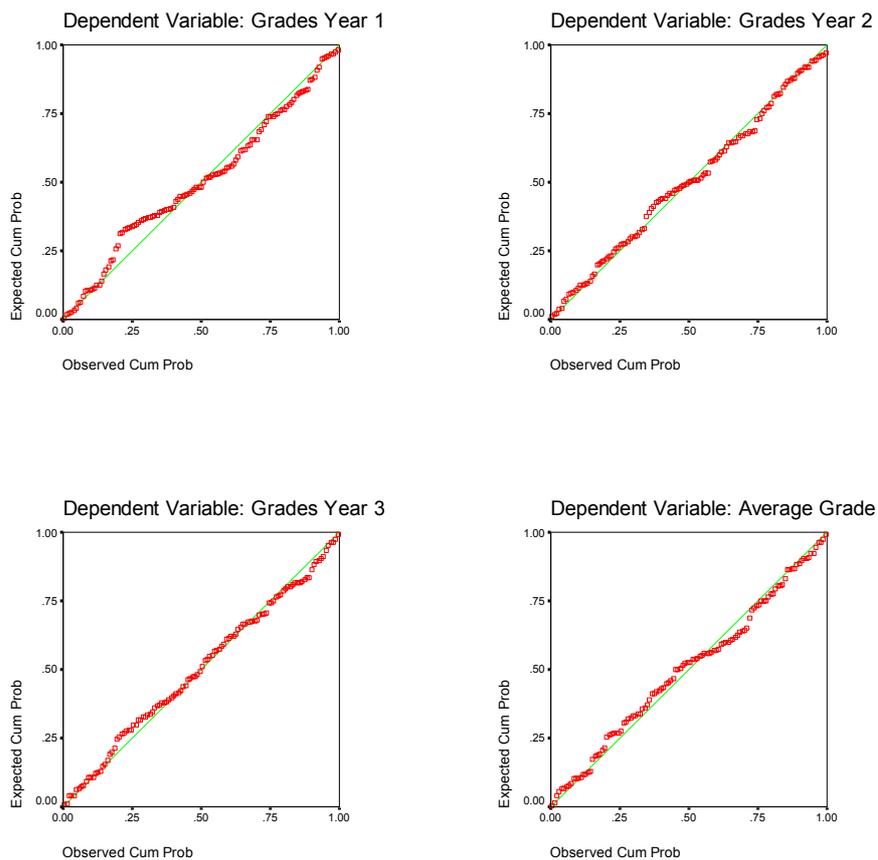


Figure 15

Normal P-P Plots of Regression Standardised Residuals - MVPI

The scatterplots of residuals against predicted values indicated relationships that were consistent with the assumptions of linearity, homoscedasticity, and independence of residuals.

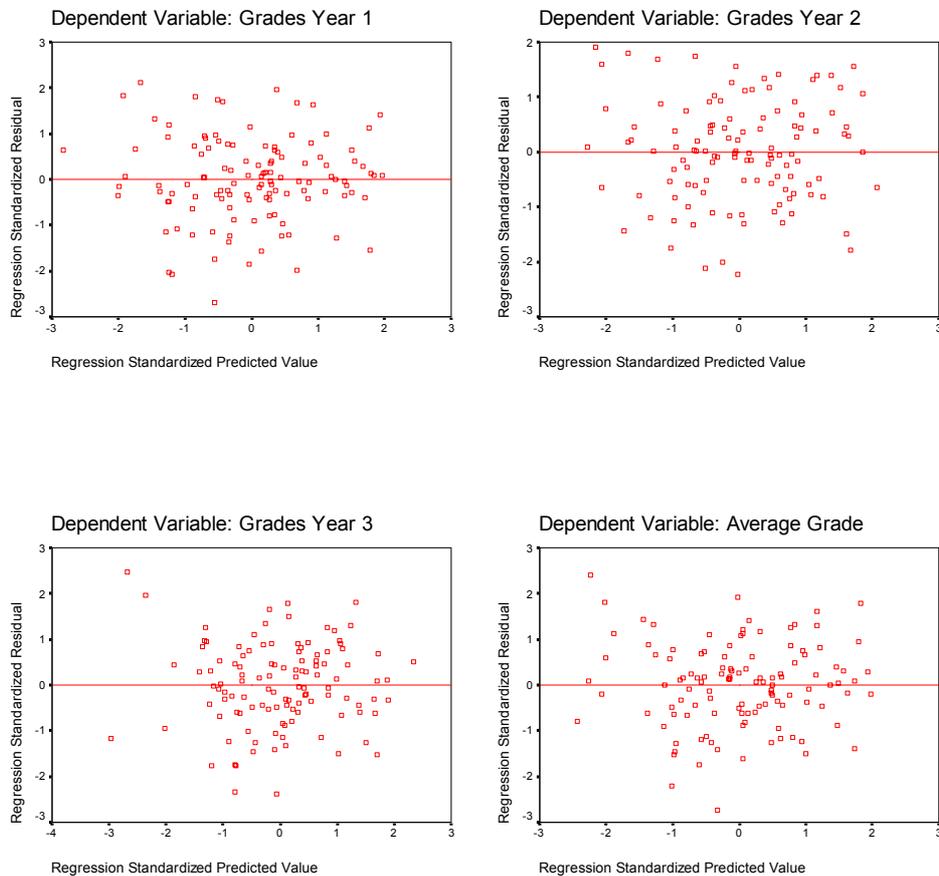


Figure 16

Scatterplots of Regression Standardised Residuals - MVPI

6.6.2 Results

Grades Year 1: A summary of the regression results for Grades Year 1 is set out in Table 28. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .643$, $F(18, 100) = 3.924$, $p < .001$.

Table 28

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and MVPI Variables (motives, values and vocational preferences) Predicting Academic Grades Year 1

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.225	.051	.043	6.257 *	.051	6.257 *
2: IN: Age Category	.225	.051	.034	3.102 *	.000	.000
3: IN: OP Ranks	.541	.293	.274	15.872 ***	.242	39.362 ***
4: IN: Application Criteria	.580	.337	.289	6.985 ***	.044	1.462
5: IN: Interview Criteria	.636	.404	.324	5.043 ***	.067	1.964
6: IN: MVPI (Motives, Values & Preferences)	.643	.414	.308	3.924 ***	.010	.409

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 5.1% of the variance in academic grades in the first year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 24.2% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance, nor did the addition of the interview criteria (model 5). In model 6, the addition of motives, values and vocational preferences (MVPI variables) did not significantly improve variance in first-year grades. The beta weights relating to model 6 can be found in Appendix B, Table B8.

The final model of the regression analysis (step 6) had an adequate level of power (.99) and effect size ($f^2 = .445$).

Grades Year 2: A summary of the regression results for Grades Year 2 is set out in Table 29. For each of the dependent variables, *R* was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .595$, $F(18, 98) = 2.989$, $p < .001$.

Table 29

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and MVPI Variables (motives, values and vocational preferences) Predicting Academic Grades Year 2

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.226	.051	.043	6.206 *	.051	6.206 *
2: IN: Age Category	.229	.053	.036	3.161 *	.001	.162
3: IN: OP Ranks	.472	.223	.202	10.793 ***	.170	24.741 ***
4: IN: Application Criteria	.508	.258	.203	4.688 ***	.035	1.020
5: IN: Interview Criteria	.577	.333	.241	3.632 ***	.075	1.908
6: IN: MVPI variables	.595	.354	.236	2.989 ***	.022	.826

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 5.1% of the variance in academic grades in the second year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 17% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance, nor did the addition of the interview criteria (model 5). In model 6, the addition of motives, values and vocational preferences (MVPI variables) did not significantly improve variance in second-year grades. The beta weights relating to model 6 can be found in Appendix B, Table B8.

The final model of the regression analysis (step 6) had an adequate level of power (.96) and effect size ($f^2 = .31$).

Grades Year 3: A summary of the regression results for Grades Year 3 is set out in Table 30. For each of the dependent variables, *R* was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .593$, $F(18, 97) = 2.917$, $p < .001$.

Table 30

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and MVPI Variables (motives, values and vocational preferences) Predicting Academic Grades Year 3

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.311	.097	.089	12.209 **	.097	12.209 **
2: IN: Age Category	.314	.099	.083	6.192 **	.002	.255
3: IN: OP Ranks	.487	.238	.217	11.635 ***	.139	20.395 ***
4: IN: Application Criteria	.519	.269	.215	4.926 ***	.032	.924
5: IN: Interview Criteria	.566	.321	.226	3.405 ***	.051	1.276
6: IN: MVPI (Motives, Values & Preferences)	.593	.351	.231	2.917 ***	.031	1.142

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 9.7% of the variance in academic grades in the third year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 13.9% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance, nor did the addition of the interview criteria (model 5). In model 6, the addition of motives, values and vocational preferences (MVPI variables) did not significantly improve variance in third-year grades. The beta weights relating to model 6 can be found in Appendix B, Table B8.

The final model of the regression analysis (step 6) had an adequate level of power (.95) and effect size ($f^2 = .30$).

Average Grade: A summary of the regression results for Average Grade is set out in Table 31. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 6, with all independent variables in the equation, $R = .639$, $F(18, 97) = 3.712$, $p < .001$.

Table 31

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and MVPI Variables (motives, values and vocational preferences) Predicting Academic Average Grade

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.280	.079	.071	9.726 **	.079	9.726 **
2: IN: Age Category	.281	.079	.063	4.852 **	.000	.060
3: IN: OP Ranks	.550	.303	.284	16.201 ***	.224	35.901 ***
4: IN: Application Criteria	.586	.344	.295	7.003 ***	.041	1.338
5: IN: Interview Criteria	.633	.401	.318	4.830 ***	.057	1.611
6: IN: MVPI variables	.639	.408	.298	3.712 ***	.007	.282

* $p < .05$

** $p < .01$

*** $p < .001$

In model 1, gender explains 7.9% of the variance in average grade over the first three years of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 22.4% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance, nor did the addition of the interview criteria (model 5). In model 6, the addition of motives, values and vocational preferences (MVPI variables) did not significantly improve variance in average grade. The beta weights relating to model 6 can be found in Appendix B, Table B8.

The final model of the regression analysis (step 6) had an adequate level of power (.99) and effect size ($f^2 = .42$).

6.7 Ancillary Analyses

The correlation analysis indicated that personality traits had predictive validity in relation to academic grades, however, the regression analyses indicate that they did not have incremental validity when used in conjunction with the existing selection components. One possible explanation for this finding is that personality traits share variance with the interview criteria. In order to test this hypothesis, I have conducted ancillary analyses that exclude the interview criteria. In addition, a number of significant relationships revealed by the correlation analysis have been highlighted as they have implications for the selection process. These include relationships between the application and interview criteria, and the relationship between personality variables and components of the selection process (OP ranks, application and interview criteria).

6.7.1 Ancillary Regression Analyses - HPI

Hierarchical regression was used to determine if the substitution of personality traits for the interview criteria would improve the incremental validity of both personality traits and the selection process. Age and gender were included in the equation based on their theoretical relationship with academic performance, as previously discussed in Section 5.1. As there were four dependent variables (Grades Year 1, Grades Year 2, Grades Year 3, and Average Grade), four sets of regression analyses were conducted.

6.7.1.1 Assumption Testing

There are 15 independent variables and the number of cases ranged from 135 in Grades 3 to 142 in Grades 1, giving a ratio of approximately 1:9. Although below the ideal number for hierarchical regression (1:20), this number does meet the minimum requirement (1:5) (Coakes & Steed, 2001). There were no multivariate outliers, as indicated by Mahalanobis' distance values less than the critical value of chi-square ($X^2 < 37.697$, $df = 15$, $p = .001$). The normal plot of regression standardized residuals for the dependent variables indicated relatively normal distributions (see Figure 15).

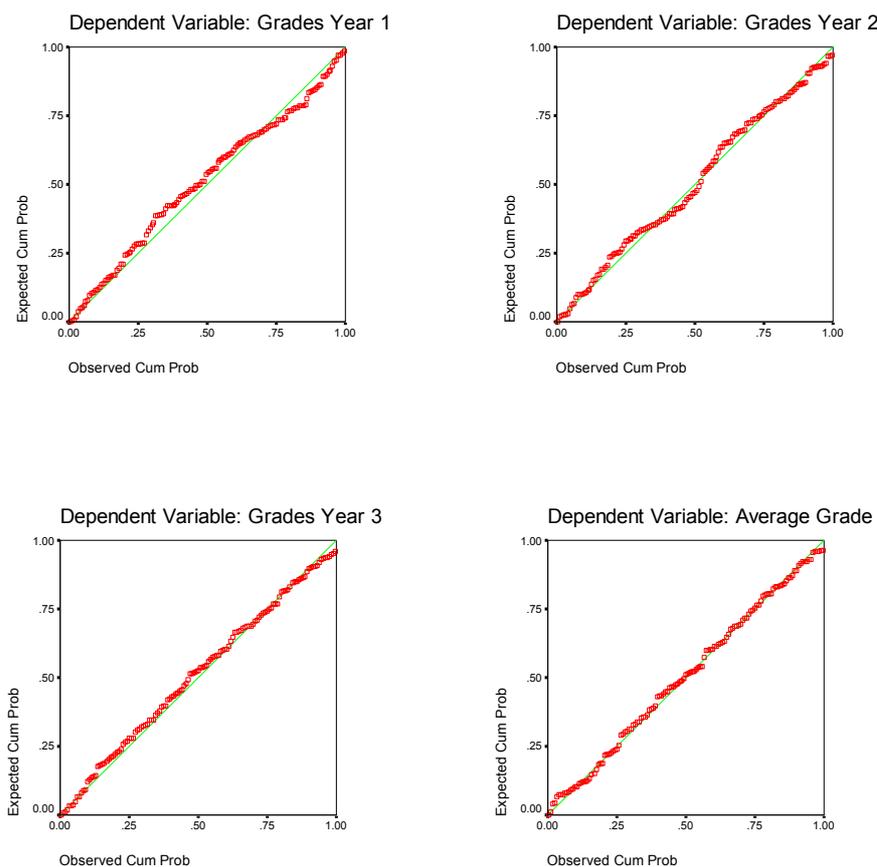


Figure 17

Normal P-P Plots of Regression Standardised Residuals - HPI

The scatterplots of residuals against predicted values (as shown in Figure 16) indicated relationships that were consistent with the assumptions of linearity, homoscedasticity, and independence of residuals.

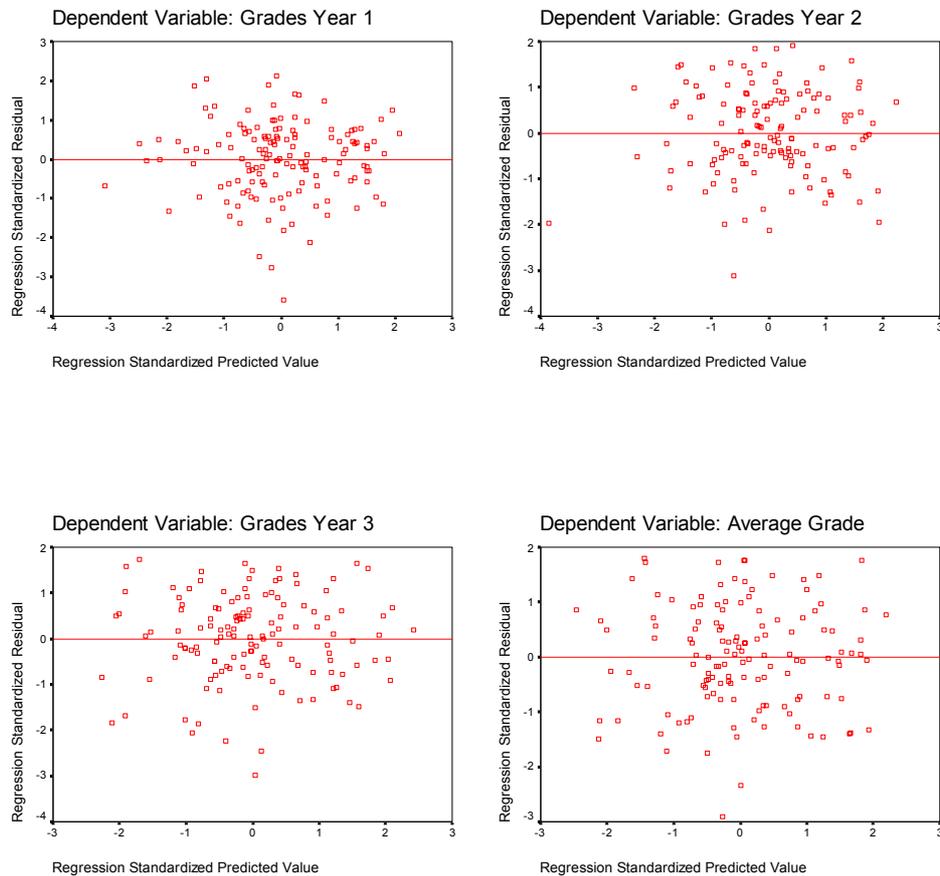


Figure 18

Scatterplots of Regression Standardised Residuals - HPI

6.7.1.2 Results

Grades Year 1: A summary of the regression results for Grades Year 1 is set out in Table 32. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 5, with all independent variables in the equation, $R = .614$, $F(15, 126) = 5.072$, $p < .001$.

Table 32

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, and HPI Variables (personality traits) Predicting Grades Year 1

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.274	.075	.068	11.330 **	.075	11.330 **
2: IN: Age Category	.274	.075	.062	5.630 **	.000	.011
3: IN: OP Ranks	.524	.275	.259	17.438 ***	.200	38.051 ***
4: IN: Application Criteria	.560	.313	.272	7.585 ***	.038	1.488
5: IN: HPI Traits	.614	.376	.302	5.072 ***	.063	1.824

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 7.5% of the variance in academic grades in the first year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 20% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance. In model 5, the addition of personality traits (HPI variables) did not significantly improve variance in first-year academic grades. The beta weights relating to model 5 can be found in Appendix B, Table B9.

The final model of the regression analysis (model 5) had an adequate level of power (.99) and effect size ($f^2 = .432$).

Grades Year 2: A summary of the regression results for Grades Year 2 is set out in Table 33. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 5, with all independent variables in the equation, $R = .583$, $F(15, 123) = 4.220$, $p < .001$.

Table 33

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, and HPI Variables (personality traits) Predicting Grades Year 2

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.259	.067	.060	9.839 **	.067	9.839 **
2: IN: Age Category	.264	.070	.056	5.081 **	.003	.369
3: IN: OP Ranks	.533	.284	.268	17.824 ***	.214	40.369 ***
4: IN: Application Criteria	.552	.304	.262	7.110 ***	.021	.772
5: IN: HPI Traits	.583	.340	.259	4.220 ***	.035	.943

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 6.7% of the variance in academic grades in the second year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 21.4% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance. In model 5, the addition of personality traits (HPI variables) did not significantly improve variance in second-year academic grades. The beta weights relating to model 5 can be found in Appendix B, Table B9.

The final model of the regression analysis (model 5) had an adequate level of power (.99) and effect size ($f^2 = .349$).

Grades Year 3: A summary of the regression results for Grades Year 3 is set out in Table 34. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 5, with all independent variables in the equation, $R = .577$, $F(15, 119) = 3.953$, $p < .001$.

Table 34

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, and HPI Variables (personality traits) Predicting Grades Year 3

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.300	.090	.083	13.173 ***	.090	13.173 ***
2: IN: Age Category	.318	.101	.088	7.431 **	.011	1.627
3: IN: OP Ranks	.487	.237	.219	13.555 ***	.136	23.294 ***
4: IN: Application Criteria	.518	.268	.222	5.767 ***	.031	1.072
5: IN: HPI Traits	.577	.333	.248	3.953 ***	.065	1.645

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 9% of the variance in academic grades in the third year of medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 13.6% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance. In model 5, the addition of personality traits (HPI variables) did not significantly improve variance in third-year academic grades. The beta weights relating to model 5 can be found in Appendix B, Table B9.

The final model of the regression analysis (model 5) had an adequate level of power (.99) and effect size ($f^2 = .329$).

Average Grade: A summary of the regression results for Average Grade is set out in Table 35. For each of the dependent variables, R was significantly different from zero at the end of each step. After step 5, with all independent variables in the equation, $R = .631$, $F(15, 119) = 5.242$, $p < .001$.

Table 35

Summary of Hierarchical Multiple Regression Analyses for Gender, Age, OP Ranks, Application Criteria, and HPI Variables (personality traits) Predicting Average Grade

MODEL	R	R ²	Adjusted R ²	F(Eqn)	R ² Ch	FCh
1: IN: Gender	.271	.073	.066	10.532 **	.073	10.532 **
2: IN: Age Category	.278	.077	.063	5.513 **	.004	.531
3: IN: OP Ranks	.523	.273	.257	16.435 ***	.196	35.405 ***
4: IN: Application Criteria	.569	.324	.281	7.547 ***	.051	1.882
5: IN: HPI Traits	.631	.398	.322	5.242 ***	.074	2.087

* $p < .05$ ** $p < .01$ *** $p < .001$

In model 1, gender explains 7.3% of the variance in academic grades in the average grade achieved in medical training. In model 2, the addition of age did not significantly increase variance. The addition of OP ranks (model 3) resulted in a significant increment, explaining an additional 19.6% of the variance in academic grades. In model 4, the addition of the application criteria did not significantly increase variance. In model 5, the addition of personality traits (HPI variables) did not significantly improve variance in average grades. The beta weights relating to model 5 can be found in Appendix B, Table B9.

The final model of the regression analysis (model 5) had an adequate level of power (.99) and effect size ($f^2 = .474$).

6.7.2 Ancillary Correlation Analyses

6.7.2.1 Application and Interview Criteria

As shown in Table 36, there are a number of significant correlations between the application criteria and the interview criteria.

Table 36

Table of Correlations between Application and Interview Criteria ($n = 191$)

INTERVIEW CRITERIA	APPLICATION CRITERIA		
	Activities	Other Information	Supplementary Information
Motivation	.198 **	.150 *	.189 **
Interpersonal	.018	.040	.156 *
Self-reliance	.117	.146 *	.143 *
Communication 1	.080	.158 *	.079

2-tailed ns = non significant * $p < .05$ ** $p < .01$ *** $p < .001$

The results revealed that the interview criterion of Motivation was positively related to scores on the Activities, Other Information and Supplementary Information scales. The interview criterion of Interpersonal was positively related to scores for Supplementary Information, and the interview criterion of Communication 1 was positively related to scores for Other Information. The interview criterion of Self-Reliance was positively associated with Other Information and Supplementary Information.

6.7.2.2 Personality Variables and OP Ranks

There was a significant negative relationship between OP ranks and Prudence $r = -.201, p < .05, n = 155$. This indicates that higher levels of academic ability (OP1 being the highest level of ability) were associated with higher scores for Prudence.

6.7.2.3 Personality Variables and Application Criteria

As shown in Table 37, there are a number of significant correlations between personality variables and the application criteria. The application scale of Motivation was positively related to Prudence, and negatively related to

Table 37

Table of Significant Correlations between Personality Variables and Application Criteria (HPI, $n = 163$; MVPI, $n = 142$)

PERSONALITY VARIABLES	APPLICATION CRITERIA			
	Motivation	Other Information	Supplementary Information	Overall Rating
HPI Ambition	-.121	-.163 *	-.083	.047
Sociability	.008	.171 *	.072	-.053
Agreeability	-.085	-.054	-.163 *	.085
Prudence	.177 *	-.079	-.003	-.062
MVPI: Aesthetic	-.168 *	.032	-.137	-.015
Affiliation	-.032	-.021	-.205 *	.009
Altruism	.100	.151	.173 *	.010
Scientific	-.036	-.120	-.077	.200 *

2-tailed ns = non significant * $p < .05$ ** $p < .01$ *** $p < .001$

Aesthetic values. Other Information was positively related to Sociability, and negatively related to Ambition. Supplementary Information was positively associated with Altruistic values, and negatively associated with both Agreeability and Affiliation. The scale of Overall Rating was positively related to Scientific values.

6.7.2.4 Personality Variables and Interview Criteria

As shown in Table 38, there are a number of significant correlations between personality variables and the interview criteria. The interview scale of Motivation was positively related to Prudence, and negatively related to Ambition and Intellectance. The scale of Interpersonal was positively associated with Adjustment and Prudence, and negatively related to Ambition and the dysfunctional behavioural syndrome of Away. Self-Reliance was positively related to Altruistic values and the dysfunctional syndrome of Against, and negatively related to Ambition, and both Aesthetic and Affiliation values. Communication 1 was positively associated with Adjustment,

Table 38

Table of Correlations between Personality Variables and Interview Criteria
(HPI, $n = 168$; MVPI, $n = 148$; HDS, $n = 149$)

PERSONALITY VARIABLES	INTERVIEW CRITERIA					
	Motivation	Inter-personal	Self-Reliance	Comm 1	Comm 2	Overall Rating
HPI: Adjustment	.117	.190 *	-.007	.154 *	.170 *	.151
Ambition	-.180 *	-.262 **	-.164 *	-.267 ***	-.308 ***	-.210 **
Agreeability	-.087	-.151	.008	-.087	-.213 **	-.116
Prudence	.229 **	.198 *	-.006	.042	.126	.181 *
Intellectance	-.189 *	-.064	-.095	-.029	-.069	-.143
Scholarship	.093	.070	-.029	.186 *	.139	.056
MVPI: Aesthetic	.128	.116	-.164 *	.139	.188 *	.159
Affiliation	.015	-.124	-.221 **	-.087	-.042	-.098
Altruism	.099	.116	.191 *	.156	.166 *	.135
HDS: Away	-.099	-.240 **	-.103	-.099	-.187 *	-.199 *
Against	.070	.052	.210 *	.226 **	.178 *	.177

2-tailed ns = non significant * $p < .05$ ** $p < .01$ *** $p < .001$

Scholarship and the dysfunctional syndrome of Against, and negatively related to Ambition. Communication 2 was positively associated with Adjustment, Aesthetic and Altruistic values, and the dysfunctional syndrome of Against, and negatively related to Ambition, Agreeability and the dysfunctional syndrome of Away. Overall Rating was positively associated with Prudence, and negatively related to Ambition and the dysfunctional syndrome of Away.

CHAPTER 7

Discussion and Conclusion

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7.0 Reviewing the Research Objectives

The objectives of my research were threefold: 1) to investigate the predictive validity of the current selection process for medical training at JCU (OP ranks, application and interview criteria); 2) to investigate the potential of personality variables (traits, dysfunctional interpersonal behaviours, and motives/values/interests) to predict academic grades; and 3) to investigate the incremental validity of the current selection components and personality variables in relation to academic grades in each of the first three years of medical training, and in relation to overall performance (average grade). In order to explore the true predictive validity of these variables, potential covariates of academic performance (i.e. age and gender) were accounted for in the statistical analyses.

7.1 Reliability of Personality Inventories

Details of the item construction of the personality inventories were not commercially available, however the author of the scales agreed to carry out an item analysis of these inventories on my behalf. The results of the item analysis for the HPI, which was used to assess personality traits, revealed the reliability coefficients for the primary scales were comparable to those reported in the HPI manual (alpha range .71 to .89). The reliability coefficients for the primary scales of the MVPI, which was used to assess the motives, values and vocational preferences of medical students, were slightly lower than those reported in the MVPI manual (alpha range of .70 to .84). The reliability coefficients for the primary scales of the HDS, which was used to assess dysfunctional interpersonal behaviours, were also slightly lower than those reported in the HDS manual (alpha range of .50 to .78).

Unfortunately, details of the procedure used for the item analysis have not been forthcoming. I computed reliability coefficients for the HDS syndromes, based on groupings of the primary scales. The coefficients for 'away' and 'against' were adequate (alpha .74 and .73, respectively). As the coefficient for the syndrome of 'towards' was based on only two scales, its reliability remains unconfirmed.

Although the internal reliability coefficients of certain scales are lower than the generally accepted level of .70, the instruments do have a high degree of relevance to the area of organizational selection. Guion (1988) advocates that internal consistency is less important for measures justified mainly on content sampling . . . "evidence of internal consistency may be less relevant than evidence of internal completeness or relevance in domain sampling" (p.245). Guion further advocates that the required degree of internal consistency varies with the 'breadth' of the construct under consideration. For example, an acceptable reliability coefficient for the broad bandwidth measure of 'Adjustment' (HPI) will be lower than for the narrow bandwidth measures that make up the scale of 'Adjustment'.

7.2 Gender and Age Differences in Personality

7.2.1 Gender

My finding that males were significantly higher in Adjustment, Sociability and Intellectance, compared to females, is supported by previous research on gender differences in personality. Feingold (1994), Hogan and Hogan (1997), and Ones and Anderson (2002) found males had lower levels of Neuroticism compared to females. There is a high negative correlation (-.70)

between the five-factor model facet of Neuroticism and the HPI facet of Adjustment. Marusic and Bratko (1998) also found a negative relationship between masculinity and Neuroticism in high school graduates aged between 17 and 19. This age group corresponds with my sample of medical students aged between 17 and 21.

In relation to Sociability, the five-factor facet of Extraversion is correlated with both the HPI scale of Sociability (.44) and Ambition (.55). My finding that males were significantly higher in Sociability, compared to females, is inconsistent with the previous research of Feingold (1994) who conducted a meta-analysis on gender differences in personality. He found that while males scored higher on 'assertiveness' (which is aligned with the HPI scale of Ambition), they scored lower on 'gregariousness' (which is more closely aligned with the HPI scale of Sociability).

Feingold (1994), Hogan and Hogan (1997), and Ones and Anderson (2002) found males had a significantly higher level of Openness, compared to females. The five-facet facet of Openness is correlated with both the HPI scales of Intellectance (.33) and Scholarship (.35). My research found that while males were significantly higher than females on the HPI scale of Intellectance, there were no gender differences on the HPI scale of Scholarship. Thus, while males may be perceived as brighter, more creative, and more interested in intellectual matters, compared to females, both sexes equally enjoy academic activities and value educational achievement.

My finding that males scored significantly higher than females on the MVPI scale of Scientific is consistent with the findings of Hogan and Hogan (1996). This result is also consistent with my finding that males were higher on Intellectance. As stated above, Intellectance is associated with brightness, creativity, and an interest in intellectual matters, while scientific motives are associated with a desire for knowledge, enthusiasm for new and advanced technologies, and a curiosity about how things work. There was a positive correlation between both variables (.39).

In relation to the HDS syndromes, I found that females scored significantly higher than males on the syndrome of 'Towards'. This syndrome is comprised of two personality disorders (Obsessive-Compulsive and Dependent). Previous research found males are more likely to possess obsessive-compulsive traits, while dependent personality characteristics are just as likely to occur in males as females (American Psychiatric Association, 2000). Thus, combining both disorders, males would be expected to score higher than females. However, this expectation was not supported by my research.

7.2.2 Age

My research did not find any differences between the 14-17 and 18-21 year age groups on any of the personality variables. This finding is consistent with the research of Hogan and Hogan who reported no age differences on the MVPI scales of Altruism, Affiliation, Aesthetic or Scientific (1996), or on the HDS scales (1997b). However, my finding was contrary to previous research

which found 14-17 year-old British students to have significantly lower levels of Openness (equivalent to Intellectance and Scholarship), compared to 18-21 year-old British students (McCrae, et. al., 2000). This contrary finding can be explained by the fact that the overwhelming majority of students in my 14-17 year age group were age 17. Only a few students were age 16 on entry to the medical program.

7.3 Findings Relating to Predictive Validity

7.3.1 Gender and Age

I did not find any significant age effects in relation to any of the grades scales. This was not surprising considering that students in this particular analysis were under 21 years of age (the 22-29 and 30-49 age groups being excluded from the analysis – see Section 5.2.1.2). Previous studies that have found age effects were based on age as a continuous variable (Kay-Lambkin, et. al., 2002), or age groups that accounted for students over 21 years of age (Ramsbottom-Lucier, et. al., 1995).

My findings revealed that females had significantly higher levels of academic performance, compared to males, in each of the first three years of the medical program, and in relation to the students' average grade. These findings are consistent with a large body of research that has found females outperform males in medical training (Ferguson, et. al., 2002; Haist, et. al., 2000; McDonough, et. al., 2000). However, the finding is contrary to the results of a study at Newcastle University (De Clercq, et. al., 2001) who found that females were more likely to receive a grade of 'not satisfactory' in their first assessment following entry into medical school. The different

results may possibly be attributed to the fact that Newcastle study used a dichotomous outcome variable of 'satisfactory' or 'not satisfactory' in their assessment measure, whereas my study has operationalised academic performance as a continuous variable represented by percentage marks.

7.3.2 Predictive Validity of Selection Components

7.3.2.1 OP Ranks

My research found that previous academic performance was a good predictor of current performance in medical training. There was a strong relationship between OP ranks and academic grades in each of the first three years of the medical program, and in the overall grade. Correlations ranged from $-.318$ to $-.468$, ($p < .001$), with the magnitude of the correlation weakening over the three year period. My findings are consistent with Australian research which found secondary school exit results were associated with overall achievement in medical training at the University of Queensland (Lipton, et. al., 1984), Monash University (Tutton, 1997) and the University of Newcastle (Kay-Lambkin, et. al., 2002). My results are also consistent with a large body of international research linking previous academic achievement to success in medical training (Collins, et. al., 1995; Hoschl & Kozeny, 1997; McManus, 1982; Montague & Odds, 1990; Richardson, et. al., 1998; Salvatori, 2001; Weiss, et. al., 1988). However, the findings of my research are contrary to those of Walton (1987, p.28) who quotes "it (high school aggregate) cannot be said to provide a really good guide to first year performance. It provides an even poorer guide to performance in the second year". They are also contrary to the research of

Green and colleagues (1991), who found no relationship between A-level results and subsequent medical school academic performance. A possible explanation for this inconsistency is that Green and colleagues used a dichotomous outcome variable of 'pass' or 'fail' in their measurement of medical school performance, whereas my study has operationalised academic performance as a continuous variable represented by percentage marks.

7.3.2.2 Application Criteria

In relation to the application criteria, my research found only a very small correlation between Motivation and grades in the third year of training. This finding may possibly be due to a Type II error in light of the large number of intercorrelations and the absence of any other significant findings in the remaining grades. The lack of significant findings is consistent with that of Ferguson and colleagues (2000), who found the written application was not predictive of preclinical performance in medical school. My non-significant finding on the scale of 'supplementary information' is also consistent with a body of research that has found letters of recommendation to be poor predictors of performance (Ferguson, et. al., 2003; Muchinsky, 1979, 2000; Powis, 1998; Salvatori, 2001; Walton, 1987).

7.3.2.3 Interview Criteria

In relation to the interview criteria, my research revealed that the scales of Interpersonal, Communication 1, Communication 2 and Overall Rating, were predictive of academic grades in the first and second year of the medical program, and (with the exception of Communication 2) overall performance.

These findings are consistent with those of Tutton (1997) who found similar interview criteria used by Monash University predicted clinical and communication skills in the first three years of medical training. However, my findings are contrary to other studies that have found interview scores to be non-predictive of success in cognitively-oriented course components (see Morris, 1999; Salvatori, 2001; Tutton, 1997). The integrated curriculum of the JCU medical program may offer an explanation for my findings. The JCU program is both vertically and horizontally integrated which facilitates problem-focused learning. Students acquire both basic and clinical course material, and utilize this information to identify and solve diagnostic problems. The interview criteria represent a set of personal qualities that may have facilitated engagement in groupwork activities.

7.3.3 Predictive Validity of Personality

7.3.3.1 Personality Traits

The hypothesis that Adjustment, Agreeability, Prudence, Intellectance, and Scholarship were positively associated with academic grades was partially supported. Three of these variables were positively related to academic performance at various times during the first three years of medical training, however, there were no significant relationships between either Agreeability or Intellectance and academic grades. High levels of Adjustment are related to calmness, self-acceptance, and an ability to handle stress. The HPI scale of Adjustment is negatively correlated with the five-factor model's facet of Neuroticism (-.70). My research found a positive correlation between Adjustment and academic grades in the first year of training, and in overall

performance. The absence of a significant relationship in the second and third years of medical training is consistent with previous research which has failed to find significant relationships between Neuroticism and academic performance in medical training (Ferguson, et. al., 2000; Ferguson, et. al., 2003; Lievens, et. al., 2002). One possible explanation for the significant relationship in the first year of medical training is elevated levels of anxiety. Almost all students have just left school and have embarked on the arduous task of medical training. For many students, it is their first year away from home and familiar surroundings. McCown and Johnson (1991) suggest that anxiety inhibits the motivation to study - studying cues increase anxiety in neurotic students who then avoid studying to reduce anxiety.

The hypothesis that Ambition and Sociability would be negatively associated with academic grades was supported. High levels of Ambition are associated with social self-confidence, leadership ability, competitiveness, and high energy. High levels of Sociability are related to the need and/or enjoyment of interacting with other people. Both of these HPI scales are positively correlated with Extraversion. My research found that Sociability had a negative impact on academic grades in the first and third years of medical training, and in relation to overall performance. This finding makes intuitive sense – sociability interferes with studying due to pre-planned social activities, and impulsive and unplanned study distractions (McCown & Johnson, 1991). My finding is also consistent with a body of research that has found a negative correlation between Extraversion and academic performance (Chamorro-Premuzic & Furnham, 2003; Lievens, et. al., 2002;

Ferguson, et. al., 2003). In relation to Ambition, I found a negative relationship between this variable and grades in the second and third year of medical training, and in overall performance. The most plausible explanation for my finding is that competitiveness is detrimental to effective group work, which is an integral part of the JCU medical program. This proposition is supported by the positive correlation between Ambition and the HDS syndrome of Away ($r = .548$). Higher levels of Ambition correlate with a greater tendency to be critical, over-reactive to difficult situations, uncooperative, defensive and sensitive to criticism, procrastinate and a greater desire to work alone.

High levels of Prudence are associated with conscientiousness, conformity and dependability. Prudence is positively correlated with the five-factor model's facet of Conscientiousness (.36). My finding that Prudence is positively related to academic grades in the first and third year of medical training, and in overall performance, is consistent with a large body of research that has found Conscientiousness to be the most consistent personality predictor of academic performance in university students (Chamorro-Premuzic & Furnham, 2003; De Fruyt & Mervielde, 1996; Ferguson, et. al., 2000; Ferguson, et. al., 2003; Gray & Watson, 2002; Lievens, et. al., 2000; Musgrave-Marquart & Bromely, 1997).

High levels of Scholarship are associated with the enjoyment of academic activities together with the valuing of educational achievement. The HPI scales of Scholarship and Intellectance are positively correlated with the five-

factor model's facet of Openness (.35 and .33, respectively). My research found a significant relationship between Scholarship and academic grades in the third year of medical training. This finding is consistent with that of Lievens and colleagues (2002) who also found a positive relationship between Openness and grades in the third year of medical training. Musgrave-Marquart and Bromely (1997) also found a positive relationship between Openness and GPA in university students. The absence of a significant relationship between Scholarship and grades in the first and second year of training may be due to the fact that the medical curriculum becomes more complex and challenging with each year of the program. In relation to Intellectance, there were no significant findings in my research. This is consistent with another body of research which has failed to find a positive association between Openness and academic performance (Busato, et. al., 2000; Chamorro-Premuzic & Furnham, 2003; Ferguson, et. al., 2000; Ferguson, et. al., 2003).

7.3.3.2 Motives, Values and Vocational Interests

The hypothesis that Scientific, Altruistic, Affiliation and Aesthetic motives, values and preferences would be positively related to academic grades was not supported. This hypothesis was based on Ackerman and Heggestad's (1997) proposition that interest is the motivating force behind the acquisition of knowledge – the greater the interest in a certain field of knowledge, the greater the intellectual investment, the greater the acquisition of domain knowledge, the higher the academic grades. Holland's RIASEC model (1973, 1992) postulates that specific personality types, with distinctive patterns of

abilities, interests and personality characteristics, are drawn toward corresponding academic environments that require, reinforce and reward those specific characteristics. Congruency between the dominant personality type and the academic environment positively impacts on academic performance (Feldman, et. al., 2001). Previous research has supported the congruency proposition in relation to educational satisfaction, stability, and academic performance in general. Evidence for the predictive validity of the RIASEC model in relation to academic grades is lacking. Earlier studies finding a significant relationship between RIASEC types and grades focussed only on dominant personality types (Bruch & Krieschok, 1981; Henry, 1989), ignoring the combinations of the three-letter codes. More recent studies have provided little support for the predictive validity of the RIASEC model in relation to grades in university students (de Fruyt & Mervielde, 1996; Fritzsche, et. al., 2001).

Recent research has revealed that the pattern of gain or growth on a cluster of abilities and interests related to a specific academic environment is essentially the same for all students in that environment, regardless of congruency of the dominant personality type (Feldman, et. al., 2001, 2004). This, together with research findings that indicate medical students are a combination of Investigative-Social-Artistic personality types, led me to believe that investigating the predictive validity of the values underlying the RIASEC personality types may offer a better alternative. My hypothesised variables of Aesthetic, Affiliation, Altruism and Scientific correspond to the values underlying the RIASEC personality types of the Investigative, Social

and Artistic types. The inventory used to measure these values (the MVPI) has convergent validity with the SDS used in previous research on the RIASEC model. No explanation can be offered for the lack of significant findings in my research.

It is of interest to note the correlations between the hypothesised values and the HPI scales: Affiliation values were negatively related to Adjustment (-.201) and Sociability (-.481), and positively related to Agreeability (.306) and Ambition (.236), $p < .05$. This suggests that, in this sample, social interaction is motivated by maladjustment and a high level of ambition, rather than by desire or enjoyment. Altruistic values were positively related to Prudence (.234) and Intellectance (.173), and negatively related to Agreeability (-.240), $p < .05$. Thus, students who are conscientious, bright and creative, are motivated by a concern for others and have a desire to help the less fortunate. Unfortunately, this is also accompanied by a lack of tactfulness and social sensitivity. Scientific values were positively related to Agreeability (.180), Intellectance (.397) and Scholarship (.234), $p < .05$. This suggests that students who are perceptive, bright, creative and value educational achievement, are motivated by a desire for knowledge, advanced technologies, and a sense of curiosity.

7.3.3.3 Dysfunctional Interpersonal Behaviours

My research findings supported the hypotheses that the HDS syndromes of Away and Against would be negatively related to academic grades, while the syndrome of Towards would be positively related to academic grades. The

syndrome of Away is comprised of the HDS scales of Excitable, Skeptical, Cautious, Reserved and Leisurely. It reflects the characteristics associated with the DSM-III's Paranoid, Avoidant, Schizoid, Borderline and Passive-Aggressive personality disorders. This syndrome is associated with a tendency to be somewhat unpredictable, critical, over-reactive to difficult situations, uncooperative, defensive and sensitive to criticism, reluctant to try new methods, slow to make decisions, procrastinate, and prefer to work alone. My research gave support to these descriptors by revealing the syndrome of Away to be associated with low levels of Adjustment (-.517), Sociability (-.156), Prudence (-.276), Scholarship (-.230), and Altruism (-.163), and high levels of Ambition (.548) and Affiliation (.294), $p < .05$. I found the syndrome of Away to be negatively correlated to academic grades in the second and third year of medical training, and in overall performance. My finding is consistent with that of King (1998, 2000) who found paranoid, avoidant, borderline and passive-aggressive characteristics were negatively correlated with college grade point average and final course grade. It is also consistent with that of Trull and colleagues (1997) and Bagge and colleagues (2004), who found borderline characteristics to be negatively correlated with college grade point average. Borderline characteristics have been linked to cognitive deficits that impact on the learning process (Rogers, 2003), and impulsiveness which can lead to sudden vocational changes, failure to attend classes, or take examinations (American Psychiatric Association, 2000; Bagge, et. al. 2004).

The syndrome of Against is comprised of the HDS scales of Bold, Colorful, Imaginative and Mischievous. It reflects the characteristics associated with the DSM-IV's Narcissistic, Antisocial, Histrionic, and Schizotypal personality disorders. This syndrome is associated with a tendency towards self-confidence and assertiveness, an absence of fear of failure or rejection, impulsiveness and risk-taking, quickness to make decisions, a lack of focus and distractibility, activity but not necessarily productivity, unconventionality, creativity and good problem solving abilities. My research gave support to these descriptors by revealing the syndrome of Against to be associated with low levels of Ambition (-.287), Prudence (-.438) and Affiliation (-.385), and high levels of Sociability (.669), Intellectance (.314), Scholarship (.219), Aesthetic (.238), and Scientific values (.193), $p < .05$. I found the syndrome of Against to be negatively correlated to academic grades in the third year of medical training, and in overall performance. My finding is consistent with that of King (1998, 2000), who found antisocial, histrionic, and narcissistic characteristics to be negatively associated to college GPA, final course grade, and course attendance. King (2000) also found schizotypal characteristics to be negatively related to grade point average. It has been suggested that students with schizotypal characteristics have lower levels of academic performance due to cognitive deficits that impact on the learning process (Mitropoulou, et. al., 2002; Siever, et. al., 2002; Ueland, et. al., 2004). Students with antisocial, histrionic and narcissistic characteristics are also more likely to be involved in substance abuse, which can lead to cognitive deficits that impact on the learning process, and behaviours that negatively impact on academic performance (Boyd, et. al., 2003; Durkin, et.

al., 1999; Presley & Meilman, 1994; Presley, et. al., 1996; Walfish, et. al., 1981).

The syndrome of Towards is comprised of the HDS scales of Diligent and Dutiful. It reflects the characteristics associated with the DSM-IV's Obsessive-Compulsive and Dependent personality disorders. This syndrome is associated with a tendency to be attentive and good with details, orderly, rational, well-organised and careful, pleasant and friendly, and a good team player. However, at the extreme, individuals become picky, critical and stubborn, they create stress for themselves by trying to do too much, failing to delegate, and trying to do everything equally well. They become indecisive and conforming, relying on others to make decisions, and making unrealistic promises in an effort to please other team members. My research gave support to these descriptors by revealing the syndrome of Towards to be associated with high levels of Prudence and Altruism (.461 and .218, respectively, $p < .01$). However, my finding of a negative relationship between this syndrome and Sociability (-.264) is inconsistent with the descriptors. I found the syndrome of Towards to be positively correlated to academic grades in the first and third year of medical training. My finding is consistent with that of King (1998, 2000) who found obsessive-compulsive and dependent characteristics to be positively correlated with grade point average, final course grade and course attendance. Students who excel academically have a higher level of obsessive-compulsive characteristics (Kodman, 1984; Orange, 1997). It is only at the extreme level that these

characteristics have the potential to impact negatively on academic performance.

7.4 Incremental Validity of Selection Components and Personality

The discussion so far has been focussed on the predictive validity of individual components of the current selection process and potential personality variables. In general, the findings of my research have been consistent with that of the existing literature in this area. However, one of the shortcomings of medical school selection is the decision to include components in the selection process based on this type of analysis. There are few medical schools that investigate the incremental validity of their selection components. In a series of hierarchical regression analyses, I investigated the incremental validity of the JCU medical selection process to determine if the addition of personality would “add value” to the existing process. I conducted twelve sets of regression analyses – one for each aspect of personality (traits, dysfunctional behaviours, motive/values/interests), for each level of the dependent variable (Grades Year 1, Year 2, Year 3 and Average Grade). Age and gender were included in each analysis due to their reported relationship with academic grades.

Across each of the regression analyses, gender and OP ranks were consistent predictors across all grades scales. Gender accounted for between 4.3% and 9.9% of the variance in academic grades, while OP ranks accounted for between 20.2% and 31% of the variance. Conversely, the age groups of 14-17 and 18-21, and the application criteria, had no incremental

value across any of the analyses. This latter finding is not surprising given the results of the correlation analyses presented in Table 19 (Section 6.3). The interview criteria had incremental validity in the prediction of first year and second year grades, accounting for between 7.5% and 10.2% of the variance. An inspection of the beta weights revealed Interpersonal, Self-Reliance and Communication 1 were significant predictors of academic grades.

In relation to the set of analyses involving personality traits (HPI) and motives/values/interests (MVPI), neither personality dimensions had incremental validity. Given the absence of significant correlations between the MVPI variables and grades, this result is not surprising. However, there were significant correlations between the HPI variables and grades and these variables were expected to have incremental validity in the regression analyses. Ancillary analyses were conducted to determine whether the lack of incremental validity was due to shared variance with the interview criteria. However, even without the interview criteria in the regression equation, personality traits did not significantly improve variance, and accounted for only 3.5% to 7.4% of the variance in academic grades. The lack of incremental validity may be due to the large number of significant inter-correlations (50%) between the HPI variables, r ranging from $\pm.171$ to $\pm.453$, $p < .05$. The set of analyses involving dysfunctional interpersonal behaviours (HDS) indicated that the syndrome of Away was predictive of second year grades, and the syndromes of Away and Against were predictive of third year and average grades. The addition of dysfunctional interpersonal behaviours

results in a significant increment, explaining between 5.9% and 6.8% of the variance in academic grades.

7.5 Implications for Medical Selection

7.5.1 Selection Criteria

Early research pointed to previous academic performance being predictive of preclinical performance but not clinical performance. This research was based on the traditionally structured curriculum with its clear delineation between the preclinical and clinical years. Given the trend toward an integration of the preclinical and clinical years, it was suggested that academic merit might prove to have less predictive value in the early years of medical training. However, my findings clearly indicate that this is not the case. OP rank remains the strongest, most consistent predictor of academic grades over the first three years of medical training, and of overall performance. However, given that there is only one significant correlation between personality variables and OP ranks (Prudence), there is the potential for personality to have incremental validity in the selection process.

The written application criteria have little validity in predicting academic performance in medical training. However, correlations with the interview criteria indicated that the application criteria did identify potential candidates who were motivated and self-reliant, and who possessed good communication and interpersonal skills. Given the large number of applicants for the JCU medical program, and the relatively small number who are chosen for interview, the application process appears to be a useful tool in

selecting candidates with those personal qualities deemed appropriate for the JCU medical program.

My findings offer empirical support for the inclusion of personal qualities in the selection process. Interpersonal and communication skills assessed by the selection interview do have significant predictive and incremental validity in relation to the grades obtained in the first and second years of medical training, and in overall performance. Although the incremental validity of the interview criteria was not consistently, statistically, significant throughout the regression analyses, the interview criteria did account for between 5.7% and 10.2% of the variance in academic grades in each set of analyses. However, given the paucity of research on the construct validity of interview criteria used in medical selection, there was a need to validate the interview criteria, to confirm that they were measuring the desired personal qualities and not some other personal construct.

The results detailed in the ancillary analyses indicated that the interview criterion of Motivation is associated with low levels of Ambition ($r = -.180$) and Intellectance ($r = -.189$), and high levels of Prudence ($r = .229$). Potential medical students need to have a desire to study medicine, a good idea of what it entails, and be committed to an extended period of training. Prior research has reported that students enter medical school for social and/or altruistic reasons, and that they value using academic and intellectual skills. Thus, I would have expected to see a positive relationship between this interview criterion and the personality traits of Prudence, Intellectance and

Scholarship, and a positive relationship between Motivation and the values of Affiliation, Altruistic and Scientific. My findings indicated that the interview criterion of Interpersonal is associated with low levels of Ambition ($r = -.262$) and dysfunctional interpersonal behaviour (Away) ($r = -.240$), and high levels of Adjustment ($r = .190$) and Prudence ($r = .198$). Good interpersonal skills/behaviour, and the ability to work with others, are necessary prerequisites to success in medical training. This result indicates that this interview criterion is selecting well-adjusted, conscientious students who have the potential to be good team players. I found the interview criterion of Self-Reliance to be associated with low levels of Ambition ($r = -.164$) and Affiliation ($r = -.221$), high levels of Aesthetic ($r = .164$) and Altruistic ($r = .191$) values, and high levels of dysfunctional interpersonal behaviour (Against) ($r = .210$). Affiliation represents a need for interaction with others, thus it is not surprising to find a negative correlation between it and Self-Reliance. However, Ambition is associated with social self-confidence and leadership ability and I would have expected to see a positive correlation between it and Self-Reliance. One possible explanation is that the JCU selection process attempts to deselect candidates who are potentially aggressive and competitive, therefore, interviewers may be overly sensitive to any behaviours that are reflective of these traits, e.g., high levels of social self-confidence may be interpreted as arrogance or competitiveness. Another concern is the positive relationship between Against and this interview criterion. The syndrome of Against is related to self-confidence and assertiveness, an absence of fear of failure, and good problem solving skills. Naturally, it is positively correlated with Self-Reliance. However, at extreme

levels, self-confidence turns into arrogance and assertiveness turns into aggressiveness, both of which are detrimental to groupwork activities. My findings have indicated that high levels of this syndrome are related to academic failure. While self-reliance may be a necessary attribute for medical students to cope with community placements in rural and remote areas, and for self-directed learning, extreme levels may not be conducive to groupwork activity which is now an integral part of the medical curriculum. Medical schools using this criterion in their selection interview need to determine how self-reliance will impact upon all areas of their curriculum. The criterion of Communication 1 is associated with low levels of Ambition ($r = -.267$), and high levels of Adjustment ($r = .154$), Scholarship ($r = .186$) and dysfunctional interpersonal behaviour (Against) ($r = .226$). The criterion of Communication 2 is associated with low levels of Ambition ($r = -.308$), Agreeability ($r = -.213$) and dysfunctional interpersonal behaviour (Away) ($r = -.187$), and high levels of Adjustment ($r = .170$), Aesthetic ($r = .188$) and Altruistic ($r = .166$) values, and dysfunctional interpersonal behaviour (Against) ($r = .178$). As discussed above in relation to Self-Reliance, Ambition relates to social self-confidence, leadership ability, competitiveness and high energy, and again I would have expected to find a positive relationship between Ambition and communication skills. Against is associated with self-confidence and assertiveness, an absence of fear of failure, and good problem solving skills, and it is not surprising that this syndrome has a positive correlation with communication skills. However, extreme levels of these qualities (i.e., arrogance and aggressiveness) are detrimental to the student-patient relationship and groupwork activities. My

findings have indicated that high levels of this syndrome are related to academic failure. Again, medical schools using these criteria in their selection interview need to determine the level of communication skills they are seeking. The final criterion, Overall Rating, is associated with low levels of Ambition ($r = -.210$) and dysfunctional interpersonal behaviour (Away) ($r = -.199$), and high levels of Prudence ($r = .181$). As this criterion has significant weight in selecting medical students, I feel that it does not adequately reflect the personal qualities measured by the other criteria.

My findings highlight the need for medical schools to investigate the construct validity of the interview criteria they use in their selection process. The JCU interview criteria appear to be measuring additional constructs not captured by the HPI. Future research may elect to investigate the convergent validity of the interview criteria with other personality inventories, for example, the CPI or the NEO-PI-R.

7.5.2 Personality Variables

While personality traits did have predictive validity in relation to academic grades, they did not have incremental validity when used as an additional component to the existing selection process. Nor did they have incremental validity when substituted for the selection interview. Therefore, the current interview criteria used in the JCU selection process has more potential as a selection predictor compared to personality traits as measured by the HPI. My findings emphasise the disadvantage of including selection tools in the selection process on the basis of predictive validity alone. A substantial

financial cost is involved in the purchase, administration, scoring and interpretation of personality tests. They should only be included if they “add value” to the selection process.

The motives, values, and interests measured by the MVPI did not have predictive or incremental validity in relation to academic grades. Given the strong focus in the selection process on identifying candidates who have a desire and commitment to study medicine, future research may elect to investigate the relationship between motives/values/interests and attrition. To enrol and teach students who fail to graduate, need to repeat, chose not to pursue a career in medicine upon graduation, or become inefficient practitioners is costly. The costs are not only financial but can also be defined in terms of places denied to more suitable candidates. The bottom line for any medical school is that failure and attrition reduces the cost-effectiveness of the selection process.

Patterns of dysfunctional interpersonal behaviour had both predictive and incremental validity in relation to academic grades. This is an extremely important dimension of personality because the negative implications go far beyond the impact on academic grades. A tendency towards aggressive, self-promoting behaviour may foreshadow the potential for students to engage in abuse of other students or patients (see Baldwin, Daughtery, et al., 1991; Kassenbaum & Culter, 1998; Lubitz & Nguyen, 1996), or to engage in cheating or other unethical conduct (see Baldwin, et al., 1996; Glick, 2001; Sheenan, et al. 1990; Wolf, et al, 1991). A tendency for indecisiveness and

conformity, or reluctance to express disagreement, may result in some students becoming a target for more aggressive students. This may lead to vulnerable students internalizing their emotions resulting in substance abuse (see for example Ashton & Kamali, 1995; Baldwin, Hughes, et. al. 1991; Kumar & Basu, 2000), stress, anxiety, depression, dysphoria, anger and suicide (Aristeiguieta, 1998; Baldwin, Daugherty, et. al., 1991), decreased self-confidence in clinical abilities and a decreased ability to learn (see Kassenbaum & Cutler, 1998; Lubitz & Nguyen, 1996). Medical schools may need to consider the provision of training courses in interpersonal skills or team-based behaviours as part of their curriculum, and ensure that the appropriate resources, for example counseling or grievance reporting systems, are available for students.

7.6 Research Constraints, Limitations and Future Directions

There are a number of major constraints and limiting factors related to this research:

(1) *Hogan Assessment System (HAS)*: The first concern relates to the commercial restriction of information relating to the item structure of the HPI, MVPI and HDS. Without this information, I was unable to confirm the validity and reliability of these inventories when used with an Australian sample of medical students. This is a major limitation because if these inventories were to be given high weighting in selection process, they would become highly influential in deciding who gets selected into medical training. If the HPI and MVPI are not accurately measuring those personal traits and values that are deemed prerequisites for training, and if the HDS mistakenly identifies

potential candidates as having extremely high levels of dysfunctional interpersonal behaviours, then there will be a mismatch between the personality characteristics of the successful candidate and the personality requisites of medical training. The 'best candidate' may not be selected and this may open the door for a legal challenge based on discrimination (Guion, 1998; Schmitt & Chan, 1998). To help address this issue, the HPI, MVPI and HDS should be readministered to the first cohort of students at the end of medical training, to at least assess the test-retest reliability of these instruments.

(2) Integrity of delivery and assessment of the medical program: The conceptual criterion for a 'good medical student' was based on specific KSAOs and expert opinion relating to desirable personality characteristics. The JCU curriculum was designed to foster these KSAOs and personality characteristics and ensure congruent assessment. The actual criterion used to measure the conceptual criteria was academic grades because this was the performance outcome upon which entry to the next year of training was based. Therefore, in accordance with the principles of organizational selection theory, that was the performance outcome that had to be measured.

The JCU medical curriculum was based on co-operative learning groups that required team approaches to specific learning tasks and small group active-learning exercises. Therefore, it was predicted that academic performance would have high criterion relevance, with those students higher on certain

KSAOs and personality characteristics, obtaining higher grades and remaining in the medical program. In the event of low criterion relevance, students who matched the KSAOs might not get good grades, and/or get good grades but be a poor match to the KSAOs. For example, if lectures delivered a comprehensive coverage of the subject material, there would be a decreased need for students to actively participate within group learning exercises. Subsequently, a high level of academic performance would be less contingent upon the sought personality variables and more influenced by individual academic ability. The positive correlation between “Towards” (which represents perfectionistic tendencies that hinder groupwork) and academic grades suggests that individualistic effort, rather than co-operative groupwork, was instrumental in grade attainment.

Regrettably, there is an absence of data to demonstrate an achieved level of integrity in the delivery and assessment of the medical program. If there was a discrepancy between intended and actual delivery and assessment, the hypothesized links between personality and academic performance may not have been relevant. There is a need for a comprehensive program evaluation of medical programs to eliminate this area of uncertainty - to maximise the degree of criterion relevance between the selected predictive and actual criteria.

(3) Inadequate attention paid to situational variables: Criterion relevance may also have been affected by contamination of the actual criteria.

Academic grades may have been influenced by situational variables that

were unaccounted for in my research. For example, physical health (Roberts, Warner, Lyketsos, Frank, Ganzini, et. al., 2001), marital problems (Baldwin, Hughes, et. al., 1991) or interpersonal relationships (Vitaliano, Maiuro, Russo & Mitchell, 1989), study habits and test anxiety (Kleijn, van der Ploeg & Topman, 1994), or loneliness (Rimoldi, Raimondo, Erdmann & Hojat, 2002). A qualitative analysis of situational variables that affect academic performance may have enhanced this research project. However, due to the heavy demands of the medical program, this additional analysis would have proved to be a serious disruption to both students and academic staff. This remains a potential area for future research.

(4) No comparison made between accepted and rejected candidates: This research would also have been enhanced by comparing the personality profiles of those candidates who were selected into the JCU medical program, and those candidates who were rejected. Unfortunately, research of this nature was cost prohibitive in light of the large number of potential candidates who were interviewed. A future study using a similar instrument that can be hand-scored (for example, the NEO-P-RI which is based on the Five Factor Model) may glean some useful information in this respect.

(5) Generalisability: Finally, the restricted age range of the students limits the generalisability of findings to similar age groups in undergraduate medical programs. However, this research has provided specifically useful information to the JCU School of Medicine that has implications for the training and pastoral care of students, and it has provided data that can be

used to refine the selection process in future years. Thus, this research has achieved higher relevance by trading off some generalisability (Campbell, 1987).

7.7 Contributions to Theory and Practice

Despite the research constraints and limitations described above, my research findings have a number of important implications for theory and practice. Firstly, from the perspective of medical education, the bulk of the published literature indicates that medical selection is based more on shared opinion, experience and debate, than on theory and research. My research demonstrates the applicability of organizational selection theory to the field of medical selection and paves the way for increased application of theory-based research. My findings provide a sound theoretical and empirical basis for including a measure of dysfunctional interpersonal behaviour in the selection process for medical training.

Secondly, my research has examined the incremental validity of selection components, a study that is rarely carried out in the field of medical selection. It explored the potential of personality to “add value” to the existing selection process. My findings have highlighted the need for individual medical schools to look at the incremental validity, as opposed to the predictive validity, of their selection components. It has contributed to theory by investigating the construct validity of interview criteria, and assessing the incremental validity of the interview criteria and personality traits, to determine which of these two variables was the best predictor.

Thirdly, my research has extended the study of personality in medical selection beyond the study of traits, to encompass motives/values/interests, and dysfunctional interpersonal behaviours. While traits and dysfunctional behaviours measure how we learn, motives/values/interests measure why we learn. Including both aspects in one study provides a broad picture of the relationship between personality and learning outcomes. This has never been done before in the field of medical selection.

Finally, medical training is both critical to society and extremely expensive. To enrol and teach students who fail to graduate, need to repeat, chose not to pursue a career in medicine upon graduation, or become inefficient practitioners is costly. Even a minimal rate of failure reduces the cost-effectiveness of the selection process. My research has contributed to practice by providing preliminary data evaluating the efficiency of the current selection process, which can be used to refine the JCU selection process in later years.

7.8 Summary and Conclusion

The reforms in medical training over the last thirty years have changed the face of medical school selection processes. Prior to the reforms, academic merit was the sole selection criterion for entry into medical school. When the Doherty Committee was established to investigate major aspects of medical training in Australia, it recommended that selection processes include an evaluation of personal characteristics to assess the candidate's maturity, life

experience, and personality traits deemed necessary or desirable for the practice of medicine. Proponents argued that secondary school results did not give an accurate picture of personality, ability, maturity and readiness for independent study, they did not indicate whether the student was a flexible or rigid thinker, could tolerate the uncertainties of medicine, or identify motivation to study medicine. The majority of Australian medical schools responded to the Doherty Committee's recommendations by adopting the Undergraduate Medical Admissions Test (UMAT) and the selection interview in an endeavour to identify these personal qualities. Unfortunately, a lack of research has resulted in a question mark over the predictive validity of the UMAT and the selection interview. It also appears that the arguments for adopting many of the desired personality variables are based on expert opinion, practical experience and debate, rather than on theory and research.

My research evaluated the predictive validity of previous academic performance, application criteria and interview criteria (selection components commonly used by medical schools in Australia). It has taken the current research a step further by investigating whether we actually need all of these components to predict academic performance. In response to the move to include personality in the selection process for medical training, I reviewed the relationship between personality and academic performance from three perspectives: personality traits, motives/values/interests, and dysfunctional interpersonal behaviours. I formulated personality hypotheses based on theory and research, and tested their potential to predict academic grades. I found that gender and previous academic performance (OP ranks) had good

predictive and incremental validity across each of the first three years of medical training, and in overall performance. Females had a higher level of academic performance, compared to males, throughout the three-year period. Consistent with existing literature, the application criteria did not have any notable relationship with grades. However, the application criteria did identify candidates who possessed the personal qualities sought in the interview process. The interpersonal, self-reliance and communication interview criteria did have predictive and incremental validity in the second and third year of training. In relation to personality, traits were predictive of academic grades at various stages of training and/or overall performance in the first three years of the medical program. However, the addition of personality traits to the selection process did not significantly account for more variance. Motives, values and interests lacked both predictive and incremental validity in relation to grades. In hindsight, attrition may be a more appropriate outcome variable in assessing the desire and commitment to study medicine. Patterns of dysfunctional interpersonal behaviour proved to be a significant predictor of academic grades, possessing both predictive and incremental validity.

Within the JCU medical program, the divide between the basic sciences and clinical practice was eliminated. Students supplemented their studies with clinical practice from the outset of their training. The curriculum was designed so that only a brief outline of the subject material was delivered as a lecture - the 'real learning' was intended to take place during small group exercises and tutorials. The delivery and assessment of the curriculum was

designed to promote deep learning strategies. Within this type of learning environment, it was assumed that personality characteristics would play an important role in the achievement of high levels of academic performance. Unfortunately, there is no existing data to test this assumption. From a theoretical and empirical standpoint, personality characteristics should have accounted for a larger proportion of the variance in academic grades. Although my research did identify some aspects of personality that were related to specific stages of medical training, the results were disappointing. If the curriculum was not delivered and assessed as intended, this would have resulted in deficiency and contamination of the actual criteria (i.e. academic grades).

One of the main questions that my research does answer, is whether the conceptual criteria (i.e. the personality characteristics identified by shared opinion) do in fact have relevance to medical training, as distinct from medical practice. The results of my research indicate that there is a strong theoretical basis for selecting medical students who are open to intellectual pursuit and scholarship, who have a desire to study medicine and help people, and have interpersonal behaviours that facilitate teamwork and act as a buffer for stress. However, apart from interpersonal behaviours, these personal attributes did not prove to be imperative for academic success in medical training. Possession of intellectance, scholarship, scientific values, and altruistic and affiliative tendencies do not result in higher grades. This suggests that although shared opinion on the above characteristics may be

right, medical training has not been structured to allow academic performance to reflect these characteristics.

In conclusion, medical selection is a costly process. To be cost-effective, selection criteria must be based on theoretical and empirical evidence and validated by measuring its predictive validity in relation to performance outcomes. Furthermore, each component of the selection process must have incremental validity, that is, it must significantly contribute to the predictive power of the selection process. My research has highlighted how medical education can apply this approach to the medical selection process. It has highlighted the need for medical schools to more tightly define their conceptual criteria and validate these criteria through systematic, theory-driven, research.

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LIST OF APPENDICES

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Appendix A.1

Ethics Approval to Carry Out Research

JAMES COOK UNIVERSITY

Townsville QLD 4811 AUSTRALIA



Tina Langford, Ethics Administrator, Research Office. Ph: (07) 4781 4342, Fax: (07) 4781 5521.

ETHICS REVIEW COMMITTEE (Human Ethics Sub-Committee) <i>APPROVAL FOR RESEARCH OR TEACHING INVOLVING HUMAN SUBJECTS</i>			
PRINCIPAL INVESTIGATOR	<i>Ms Janice Knights</i>		
SCHOOL	<i>Psychology/Medicine</i>		
PROJECT TITLE	<i>Selecting Medical Students: Personality as a Selection Predictor</i>		
DATE	<i>14 September 2002 – 31 December 2002</i>	CATEGORY	<i>2</i>
This project has been allocated Ethics Approval Number with the following provisos and reservations:			H1436
<ol style="list-style-type: none"> 1. All subsequent records and correspondence relating to this project must refer to this number. 2. The Principal Investigator must advise the responsible Monitor appointed by the Ethics Review Committee: <ul style="list-style-type: none"> - periodically of the progress of the project; - when the project is completed or if suspended or prematurely terminated for any reason; - if serious or adverse effects on participants occur; and if any - unforeseen events occur that might affect continued ethical acceptability of the project. 3. In compliance with the National Health and Medical Research Council (NHMRC) "National Statement on Ethical Conduct in Research Involving Humans" you must provide an annual report detailing security of records and compliance with conditions of approval. The report should very briefly summarise progress or in a final report detail the outcomes of your research. 			

NAME OF RESPONSIBLE MONITOR	<i>Dr Michele Surbey</i>
SCHOOL	<i>Psychology</i>
APPROVED AT MEETING	<i>Date: 31 July 2002</i>
APPROVED (Conditions Approved by Monitor)	<i>Date: 14 September 2002</i>
EXECUTIVE APPROVAL Chair, Ethics Review Committee	<i>Date:</i>
[forwarded by email without signature]	
Tina Langford Ethics Administrator Research Office Tina.Langford@jcu.edu.au	<i>Date: 17 September 2002</i>

Appendix A.2



Ethics Approval to Obtain Additional Grades Data

JAMES COOK UNIVERSITY
Townsville Qld 4811 Australia

Tina Langford, Ethics Administrator, Research Office. Ph: 07 4781 4342; Fax: 07 4781 5521

ETHICS REVIEW COMMITTEE Human Ethics Sub-Committee APPROVAL FOR RESEARCH OR TEACHING INVOLVING HUMAN SUBJECTS			
PRINCIPAL INVESTIGATOR	Janice Knights		
CO- INVESTIGATOR	Dr Barbara Kennedy		
SCHOOL	Psychology		
PROJECT TITLE	Selecting medical students: Personality as a selection predictor		
APPROVAL DATE	25 Mar 2005	EXPIRY DATE	30 Jun 2005
			CATEGORY 1
This project has been allocated Ethics Approval Number with the following conditions:			H 2035
<ol style="list-style-type: none"> 1. All subsequent records and correspondence relating to this project must refer to this number. 2. That there is NO departure from the approved protocols unless prior approval has been sought from the Human Ethics Sub-Committee. 3. The Principal Investigator must advise the responsible Ethics Monitor appointed by the Ethics Review Committee: <ul style="list-style-type: none"> • periodically of the progress of the project; • when the project is completed, suspended or prematurely terminated for any reason; • if serious or adverse effects on participants occur; and if any • unforeseen events occur that might affect continued ethical acceptability of the project. 4. In compliance with the National Health and Medical Research Council (NHMRC) "National Statement on Ethical Conduct in Research Involving Humans" (1999), it is MANDATORY that you provide an annual report on the progress and conduct of your project. This report must detail compliance with approvals granted and any unexpected events or serious adverse effects that may have occurred during the study. 			
NAME OF RESPONSIBLE MONITOR	Swinbourne, Anne		
EMAIL ADDRESS:	anne.swinbourne@jcu.edu.au		
ASSESSED AT MEETING	Date: 25 Mar 2005		
APPROVED	Date: 25 Mar 2005		
[forwarded by email without signature]			
Tina Langford Ethics Administrator Research Office Tina.Langford@jcu.edu.au			Date: 4 April 2005

APPENDIX A.3

HOGAN PERSONALITY INVENTORY

Representative Sample of Questions (every sixth question)

- ❖ My success depends on how others perceive me.
- ❖ As a child I was always reading.
- ❖ It upsets me to hurt people's feelings.
- ❖ I like classical music.
- ❖ I hold grudges for a long time.
- ❖ I am tetchy and irritable when I don't feel well.
- ❖ I would like to learn to scuba dive.
- ❖ When I was in school I gave the teachers a lot of trouble.
- ❖ I get nervous if I think someone is watching me.
- ❖ I don't mind talking in front of a group of people.
- ❖ I do my job as well as I possibly can.
- ❖ I often feel anxious.
- ❖ I am good at telling jokes and funny stories
- ❖ I don't let little things bother me.
- ❖ I like to try new, exotic foods.
- ❖ I would like a job that requires travelling.
- ❖ No matter what happened, I always felt my parents loved me.
- ❖ I sometimes do things just so that other people will notice me.
- ❖ I am almost always too hot or too cold.
- ❖ I am a quick-witted person.
- ❖ I am often the life and soul of the party.
- ❖ Planning things in advance takes the fun out of life.
- ❖ If something is worth doing, it is worth doing well.
- ❖ In school, maths was easy for me.
- ❖ Most of the time I expect to succeed.
- ❖ I am an ambitious person.
- ❖ I am a hard and steady worker.
- ❖ I rarely get angry with others.
- ❖ I never resent being asked for a favour.
- ❖ I would like to change a lot of things about my past.
- ❖ I often analyse my motives.
- ❖ I don't hate anyone.
- ❖ When I was young, there were times when I felt like leaving home.

Appendix A.4

HOGAN DEVELOPMENT SURVEY

Representative Sample of Questions (every fifth question)

- ❖ I like spending time by myself.
- ❖ When someone does me a favour, I wonder what they want.
- ❖ I often do things on the spur of the moment.
- ❖ Sometimes I feel a kind of power around me.
- ❖ In time people will recognise my importance.
- ❖ I have almost never broken off a friendship.
- ❖ At work, people often ask me to do more than my fair share.
- ❖ I have never hated anyone.
- ❖ It doesn't bother me to criticise or contradict the people who are above me at work.
- ❖ I am very conscientious about my work.
- ❖ It is easy for me to make new friends.
- ❖ Others seem to find me attractive.
- ❖ I don't have many close friends
- ❖ No one gets the opportunity to take advantage of me more than once.
- ❖ If I wanted to, I could disguise myself as someone else.
- ❖ People with my special talents don't need many friends.
- ❖ I have a natural talent for leadership.
- ❖ I have had several stormy personal relationships.
- ❖ I am much better at my job than my boss thinks I am.
- ❖ Other people have always been kind to me.
- ❖ I take pride in being a good follower.
- ❖ I plan my work carefully in advance.
- ❖ My feelings are easily hurt.
- ❖ I love it when the phone rings and people want to talk.
- ❖ I can usually sense another person's mood.
- ❖ There are some people I will never forgive.
- ❖ Some laws were just made to be broken.
- ❖ So far my life has been very ordinary.
- ❖ No one ever got ahead by being modest.
- ❖ My life is pretty exciting.
- ❖ I sometimes put off doing things for people I don't like.
- ❖ I am a good listener no matter who I talk to.
- ❖ I often ask other people for help.

APPENDIX A.5

MOTIVES, VALUES AND PREFERENCES INVENTORY

Representative Sample of Questions (every sixth question)

- ❖ I like to spend my spare time helping others.
- ❖ I believe in the existence of something larger and more enduring than myself.
- ❖ I don't like serious, straight-laced people.
- ❖ There are many things I would never do because I believe they are wrong.
- ❖ I don't like unpredictable people.
- ❖ I like to spend my free time reading novels and listening to classical music.
- ❖ I enjoy being in charge.
- ❖ The most important part of a job is the holiday entitlement.
- ❖ The goal of life is to compete at something important and succeed.
- ❖ Art and literature are the highest forms of expression in life.
- ❖ The principal goal of life is enjoyment.
- ❖ It irritates me when people don't treat me with proper respect.
- ❖ I enjoy reading about science.
- ❖ I prefer good-natured people who know how to enjoy themselves.
- ❖ I know immediately when I have done something morally wrong.
- ❖ It is important to stay in close contact with your friends.
- ❖ I'm often invited to parties with important and influential people.
- ❖ I am a better manager than most of the people I have worked for.
- ❖ I would like to be in business for myself.
- ❖ The arts are the highest calling in life.
- ❖ I am very safety conscious.
- ❖ I prefer to work alone.
- ❖ I don't understand people who ignore data and facts.
- ❖ I dislike people who think that because something is expensive it must be tasteful.
- ❖ I don't like people who are serious all the time.
- ❖ I believe in people.
- ❖ I am not a thrill seeker.
- ❖ I would like a job that puts me in the public eye.
- ❖ I don't like people who ignore the problems of third world countries.
- ❖ Many of my friends do voluntary work for organisations that help the disadvantaged.
- ❖ My friends keep up with recent advances in science.
- ❖ I go to a lot of parties with my friends.
- ❖ I would like to visit the great holiday resorts of the world.

Appendix A.6

Letter of Approval from the Dean, JCU School of Medicine

THE CONTENTS OF THIS PAGE HAVE BEEN REMOVED DUE TO
REASONS OF CONFIDENTIALITY

Appendix A.7

Letters of Approval to Use Data from Previous Research Studies

THE CONTENTS OF THIS PAGE HAVE BEEN REMOVED DUE TO
REASONS OF CONFIDENTIALITY

Appendix A.8

James Cook University School of Psychology

Information Sheet and Consent Form

This study will contribute to the ongoing development of the selection procedures for the James Cook University, School of Medicine. Should you decide to participate in this phase of the study, you will be asked to respond to two questionnaires about your approaches to studying. You will also be asked to complete the Hogan Personality Inventory. This should take approximately 40 minutes in total.

All participants have the right to withdraw at any time. I understand that I may withdraw without this affecting my university education now, or at any time in the future.

All data will remain strictly confidential. Identification numbers, which have no relevance to participant names, will be assigned to all responses. No member of the School of Medicine will have access to any individual data.

I am aware that the aggregate data is to be used in a PhD (Doctor of Philosophy) thesis, but recognise that complete confidentiality and anonymity of my individual responses is assured. My personal responses to the questionnaires will not be available to any person except the researcher, and consent forms will be filed securely separate from participant responses.

I understand that group feedback will be available in second semester, after the second phase of the research is completed, whether or not I participate in both phases. I understand that if I so wish, I can seek additional feedback at that time. All participants are entitled to obtain results of the study as soon as they are available.

Should I need to discuss any concerns arising from the study at any time, I understand that I may approach the researcher or supervisor at any time.

If you have any questions or concerns relating to your participation, please contact either of the following:

Janice Knights Phone: 4781 5523 Email: Janice.Knights@jcu.edu.au

Dr Barbara Kennedy Phone: 4781 4862 Email: Barbara.Kennedy@jcu.edu.au

Name:

Signature: Date:

Signature of Researcher:

Appendix A.9

James Cook University School of Psychology

Information Sheet and Consent Form

I have been informed that this study will contribute to the ongoing development of the selection, training and career pathing procedures for the James Cook University, School of Medicine. Participation in this, the second phase of the study, will involve responding to two inventories: The Hogan Development Survey which relates to interpersonal behaviour and the Motives, Values and Preferences Inventory which relates to motivational behavior. Each inventory will take approximately 20 minutes to complete.

All participants have the right to withdraw at any time. I understand that I may withdraw without this affecting my university education now, or at any time in the future.

All data will remain strictly confidential. Identification numbers, which have no relevance to participant names, will be assigned to all responses. No member of the School of Medicine will have access to any individual data.

I am aware that the aggregate data is to be used in a PhD (Doctor of Philosophy) thesis, but recognise that complete confidentiality and anonymity of my individual responses is assured. My personal responses to the questionnaires will not be available to any person except the researcher, and consent forms will be filed securely separate from participant responses.

I understand that group feedback will be available in second semester, after the results of phase 1 and phase 2 have been processed and analysed. This feedback is available regardless of whether or not I participated in phase 1. I also understand that I may seek additional feedback at that time. All participants are entitled to obtain results of the study as soon as they are available.

Should I need to discuss any concerns arising from the study at any time, I understand that I may approach the researcher or supervisor at any time. If you have any questions or concerns relating to your participation, please contact either of the following:

Janice Knights Phone: 4781 5523 Email: Janice.Knights@jcu.edu.au

Dr Barbara Kennedy Phone: 4781 4862 Email: Barbara.Kennedy@jcu.edu.au

Name:

Signature: Date:

Signature of Researcher:

APPENDIX B

Table B1

Reliability Analysis of Hogan Personality Inventory (HPI) - Individual Scales and Homogenous Item Composites (HICs).

SCALE/HIC	ALPHA LEVEL	SCALE/HIC	ALPHA LEVEL
Adjustment	.86	Agreeability	.80
Empathy	.57	Easy to Live With	.64
Not Anxious	.79	Sensitive	.34
No Guilt	.71	Caring	.08
Calmness	.39	Likes People	.69
Even Tempered	.55	No Hostility	.41
No Somatic Complaints	.50	Sociability	.76
Trusting	.45	Likes Parties	.56
Good Attachment	.71	Likes Crowds	.70
Ambition	.82	Experience Seeking	.55
Competitive	.40	Exhibitionistic	.74
Self Confidence	.49	Entertaining	.55
No Depression	.65	Intellectance	.70
Leadership	.75	Science Ability	.46
Identity	.78	Curiosity	.53
No Social Anxiety	.65	Thrill Seeking	.62
Prudence	.71	Intellectual Games	.58
Moralistic	.46	Generates Ideas	.68
Mastery	.51	Culture	.42
Virtuous	.46	Scholarship	.70
Not Autonomous	.66	Education	.67
Not Spontaneous	.56	Maths Ability	.63
Impulse Control	.62	Good Memory	.51
Avoids Trouble	.38	Reading	.72

Table B2

Reliability Analysis of Motives, Values and Preferences Inventory (MVPI)

SCALE	ALPHA LEVEL	SCALE	ALPHA LEVEL
Aesthetic	0.8162	Power	0.6776
Affiliation	0.6731	Recognition	0.8172
Altruism	0.7545	Scientific	0.7710
Commerce	0.6819	Security	0.7606
Hedonism	0.8074	Tradition	0.7302

Table B3

Reliability Analysis of Hogan Development Survey (HDS)

<u>SCALE</u>	<u>ALPHA LEVEL</u>	<u>SCALE</u>	<u>ALPHA LEVEL</u>
Excitable	0.6894	Mischievous	0.6294
Skeptical	0.7044	Colorful	0.6673
Cautious	0.7105	Imaginative	0.6324
Reserved	0.5858	Diligent	0.7531
Leisurely	0.4198	Dutiful	0.4684
Bold	0.6462		

Table B4

Reliability Analysis of Hogan Development Survey (HDS) -
According to Horney's Syndromes of Flawed Interpersonal Tendencies

<u>Syndrome</u>	<u>Scale</u>	<u>Cronbach Alpha Coefficient</u>
Away	Bold	.74
	Colourful	
	Imaginative	
	Mischievous	
Against	Excitable	.73
	Skeptical	
	Reserved	
	Cautious	
	Leisurely	
Towards	Diligent	.05
	Dutiful	

Table B5

Correlation Matrix: Grades, Gender, Age, Selection Components and Personality

	VARIABLE	Grades				Gender	Age	OP Rank	Application Criteria			
		1	2	3	4	5	6	7	8	9	10	11
1	Grades Year 1											
2	Grades Year 2	.729 ***										
3	Grades Year 3	.652 ***	.881 ***									
4	Grades Average	.881 ***	.933 ***	.899 ***								
5	Gender	.226 **	.219 **	.299 ***	.247 **							
6	Age	-.032	.090	.101	.060	-.015						
7	OP Ranks	-.468 ***	-.431 ***	-.318 ***	-.432 ***	-.081	.120					
8	Application: Motivation	.116	.119	.173 *	.128	.136	.085	-.068				
9	Activities	-.055	-.033	-.019	-.067	.205 **	.136	.103	.369 ***			
10	Other Information	.001	.019	.014	.006	.069	.054	-.062	.370 ***	.329 ***		
11	Supplementary	.091	.100	.012	.074	.051	-.102	-.065	.131	.288 ***	.290 ***	
12	Overall Rating	.026	-.032	-.009	.057	-.118	-.107	.036	-.530 ***	-.481 ***	-.509 ***	-.199 **
13	Interview: Motivation	.141	.031	-.075	.018	.179 *	.019	-.012	.062	.198 **	.150 *	.189 **
14	Interpersonal	.213 **	.198 **	.121	.212 **	.181 *	-.086	-.150 *	-.003	.018	.040	.156 *
15	Self-reliance	.076	.129	.034	.073	.147 *	.057	.082	.019	.117	.146 *	.143 *
16	Communication 1	.192 **	.157 *	.099	.163 *	.108	-.027	-.140	.077	.080	.158 *	.079
17	Communication 2	.189 *	.148 *	.085	.135	.154 *	.038	-.038	.051	.088	.126	.089
18	Overall Rating	.233 **	.154 *	.081	.171 *	.124	.040	-.081	.007	.079	.089	.102
19	HPI: Adjustment	.172 *	.098	.086	.188 *	-.227 **	-.058	-.040	-.009	.017	-.035	.150
20	Ambition	-.125	-.175 *	-.161 *	-.192 *	.040	.001	.036	-.121	-.097	-.163 *	-.083
21	Sociability	-.218 **	-.114	-.186 *	-.200 *	-.171 *	-.005	.157	.008	-.005	.171 *	.072
22	Agreeability	.028	.042	.052	.044	-.106	.006	-.053	-.085	-.126	-.054	-.163 *
23	Prudence	.271 **	.139	.209 **	.226 **	.097	.027	-.201 *	.177 *	.019	-.079	-.003
24	Intellectance	-.141	-.109	-.110	-.129	-.260 **	-.030	.076	-.042	-.008	.047	-.103
25	Scholarship	.044	.067	.168 *	.096	.141	-.075	-.098	.083	.056	.059	-.057
26	MVPI: Aesthetic	.007	-.131	-.079	-.069	.150	-.026	-.060	-.168 *	-.010	.032	-.137
27	Affiliation	.103	-.006	.013	.033	-.059	-.040	-.165	-.032	-.124	-.021	-.205 *
28	Altruism	.045	-.029	-.063	-.026	.088	-.002	.035	.100	.016	.151	.173 *
29	Scientific	.012	-.041	.077	.024	-.168 *	-.023	-.127	-.036	-.117	-.120	-.077
30	HDS: Away	-.129	-.235 **	-.223 **	-.213 *	-.089	.000	-.129	-.023	-.136	-.052	-.143
31	Against	-.157	-.147	-.218 *	-.184 *	-.082	.060	.016	-.020	.032	.065	.020
32	Towards	.222 **	.111	.174 *	.163	.225 **	.009	-.048	.066	.071	-.019	-.048

* $p < .05$ ** $p < .01$ *** $p < .001$

Table B5 Continued

	VARIABLE	App	Interview Criteria						HPI Scales			
		12	13	14	15	16	17	18	19	20	21	22
1	Grades Year 1											
2	Grades Year 2											
3	Grades Year 3											
4	Grades Average											
5	Gender											
6	Age											
7	OP Ranks											
8	Application: Motivation											
9	Activities											
10	Other Information											
11	Supplementary											
12	Overall Rating											
13	Interview: Motivation	-.086										
14	Interpersonal	.029	.551 ***									
15	Self-reliance	-.024	.540 ***	.558 ***								
16	Communication 1	-.134	.493 ***	.613 ***	.531 ***							
17	Communication 2	-.050	.613 ***	.693 ***	.641 ***	.774 ***						
18	Overall Rating	.009	.691 ***	.781 ***	.718 ***	.704 ***	.785 ***					
19	HPI: Adjustment	.041	.117	.190 *	-.007	.154 *	.170 *	.151				
20	Ambition	.047	-.180 *	-.262 **	-.164 *	-.267 ***	-.308 ***	-.210 **	-.433 ***			
21	Sociability	-.053	-.112	-.042	.072	.059	.046	-.025	.035	-.403 ***		
22	Agreeability	.085	-.087	-.151	.008	-.087	-.213 **	-.116	-.453 ***	.290 **	-.171 *	
23	Prudence	-.062	.229 **	.198 *	-.006	.042	.126	.181 *	.254 **	-.072	-.433 ***	-.304 ***
24	Intellectance	-.060	-.189 *	-.064	-.095	-.029	-.069	-.143	.118	-.254 **	.356 ***	-.083
25	Scholarship	-.080	.093	.070	-.029	.186 *	.139	.056	.224 **	-.306 ***	.105	-.204 **
26	MVPI: Aesthetic	-.015	.128	.116	.164 *	.139	.188 *	.159	-.071	.093	.116	.042
27	Affiliation	.009	.015	-.124	-.221 **	-.087	-.042	-.098	-.201 *	.236 **	-.481 ***	-.240 **
28	Altruism	.010	.099	.116	.191 *	.156	.166 *	.135	.020	-.085	.061	.306 ***
29	Scientific	.200 *	-.057	-.111	-.049	.005	-.035	-.075	-.123	-.032	.040	.180 *
30	HDS: Away	.111	-.099	-.240 **	-.103	-.099	-.187 *	-.199 *	-.517 ***	.548 ***	-.156	.484 ***
31	Against	-.005	.070	.052	.210 *	.226 **	.178 *	.177	.051	-.287 **	.669 ***	.022
32	Towards	-.014	.138	.071	.033	.070	.074	.033	-.049	.035	-.264 **	-.153

* $p < .05$ ** $p < .01$ *** $p < .001$

Table B5 Continued

	VARIABLE	HPI Scales			MVPI Scales				HDS Syndromes		
		23	24	25	26	27	28	29	30	31	32
1	Grades Year 1										
2	Grades Year 2										
3	Grades Year 3										
4	Grades Average										
5	Gender										
6	Age										
7	OP Ranks										
8	Application: Motivation										
9	Activities										
10	Other Information										
11	Supplementary										
12	Overall Rating										
13	Interview: Motivation										
14	Interpersonal										
15	Self-reliance										
16	Communication 1										
17	Communication 2										
18	Overall Rating										
19	HPI: Adjustment										
20	Ambition										
21	Sociability										
22	Agreeability										
23	Prudence										
24	Intellectance	-.088									
25	Scholarship	.073	.253 **								
26	MVPI: Aesthetic	-.162	.114	.056							
27	Affiliation	.139	-.169	-.046	.050						
28	Altruism	.234 **	.173 *	.077	.100	-.294 ***					
29	Scientific	-.026	.397 ***	.234 **	.098	-.030	.222 **				
30	HDS: Away	-.276 **	-.163	-.230 **	.095	.294 ***	-.163 *	.114			
31	Against	-.438 ***	.314 ***	.219 *	.238 **	-.385 ***	.020	.193 *	.064		
32	Towards	.461 ***	-.041	.051	.038	.054	.218 **	.084	.079	-.201 *	

* $p < .05$ ** $p < .01$ *** $p < .001$

Table B6

Hierarchical Multiple Regression: Table of Beta Weights for Model 6 for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and HPI Variables Predicting Academic Grades

VARIABLE	Grades Year 1			Grades Year 2			Grades Year 3			Average Grade		
	<i>B</i>	<i>t</i>	<i>Sig</i>	<i>B</i>	<i>t</i>	<i>Sig</i>	<i>B</i>	<i>t</i>	<i>Sig</i>	<i>B</i>	<i>t</i>	<i>Sig</i>
Gender	.269	3.041	.003 **	.225	2.340	.021 *	.269	2.854	.005 **	.262	2.916	.004 **
Age	.075	.983	.328	.129	1.532	.129	.104	1.264	.209	.105	1.338	.184
OP Rank	-.339	-3.966	.000 ***	-.315	-3.368	.001 **	-.302	-3.267	.001 **	-.338	-3.849	.000 ***
Application:												
Motivation	.081	.841	.402	.053	.518	.605	.148	1.468	.145	.134	1.401	.164
Activities	-.029	-.298	.766	-.070	-.665	.507	.101	.980	.329	.007	.070	.944
Other Information	.051	.547	.585	.052	.533	.595	.024	.257	.797	.046	.513	.609
Supplementary	.125	1.515	.133	.115	1.301	.196	.090	1.030	.305	.103	1.251	.214
Overall Rating	.225	2.009	.047 *	.069	.580	.563	.214	1.875	.064	.238	2.193	.030 *
Interview:												
Motivation	-.033	-.335	.738	-.118	-1.109	.270	-.297	-2.868	.005 **	-.194	-1.976	.051
Interpersonal	-.280	-2.276	.025 *	-.025	-.187	.852	-.152	-1.126	.263	-.088	-.683	.496
Self Reliance	-.083	-.802	.424	.155	1.395	.166	.066	.607	.545	.043	.419	.676
Communication 1	.165	1.313	.192	.264	1.928	.056	.126	.943	.348	.226	1.786	.077
Communication 2	.246	1.714	.089	.122	.790	.431	.156	1.032	.304	.127	.880	.381
Overall Rating	.148	.961	.338	-.220	-1.316	.191	.046	.284	.777	-.011	-.070	.944
HPI:												
Adjustment	.168	1.806	.074	.055	.547	.585	.052	.527	.600	.133	1.431	.155
Sociability	-.023	-.225	.822	-.034	-.297	.767	-.034	-.298	.767	-.056	-.524	.601
Agreeability	.216	2.349	.021 *	.158	1.557	.122	.272	2.766	.007 **	.256	2.737	.007 **
Ambition	-.002	-.023	.981	-.123	-1.196	.234	-.105	-1.024	.308	-.094	-.966	.336
Prudence	.143	1.452	.149	.046	.422	.674	.165	1.549	.124	.108	1.063	.290
Intellectance	.002	.021	.983	-.050	-.535	.594	-.041	-.443	.658	-.047	-.541	.590
Scholarship	-.071	-.829	.409	-.025	-.273	.785	.108	1.145	.255	-.001	-.014	.989

Significant results in bold print * p < .05 ** p < .01 *** p < .001

Table B7

Hierarchical Multiple Regression: Table of Beta Weights for Model 6 for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and HDS Variables Predicting Academic Grades

VARIABLE	Grades Year 1			Grades Year 2			Grades Year 3			Average Grade		
	<i>B</i>	<i>t</i>	<i>Sig</i>									
Gender	.233	2.800	.006 **	.211	2.452	.016 *	.287	3.217	.002 **	.270	3.257	.002 **
Age	.073	.952	.344	.123	1.554	.123	.071	.863	.391	.098	1.275	.205
OP Rank	-.368	-4.265	.000 ***	-.363	-4.036	.000 ***	-.351	-3.781	.000 ***	-.403	-4.668	.000 ***
Application:												
Motivation	.106	1.091	.278	.112	1.141	.256	.188	1.861	.066	.133	1.415	.160
Activities	-.031	-.332	.741	-.123	-1.268	.208	.010	.096	.924	-.052	-.556	.579
Other Information	.069	.774	.441	.056	.610	.544	.006	.062	.951	.041	.468	.641
Supplementary	.049	.599	.550	.062	.739	.461	.032	.365	.716	.061	.749	.456
Overall Rating	.239	2.230	.028 *	.158	1.463	.147	.216	1.963	.053	.232	2.269	.025 *
Interview:												
Motivation	-.083	-.812	.419	-.144	-1.353	.179	-.205	-1.867	.065	-.160	-1.570	.120
Interpersonal	-.083	-.632	.529	.051	.371	.711	-.167	-1.165	.247	-.057	-.427	.670
Self Reliance	-.166	-1.487	.140	.278	2.411	.018 *	.121	1.004	.318	.082	.732	.466
Communication 1	.206	1.626	.107	.317	2.416	.018 *	.207	1.528	.130	.298	2.365	.020 *
Communication 2	.106	.710	.480	.097	.634	.527	.221	1.376	.172	.128	.857	.394
Overall Rating	.205	1.242	.217	-.339	-1.972	.051	-.096	-.532	.596	-.091	-.545	.587
HDS:												
Away	-.095	-1.221	.225	-.232	-2.891	.005 **	-.167	-2.005	.048 *	-.173	-2.240	.027 *
Against	-.126	-1.538	.127	-.152	-1.801	.075	-.188	-2.157	.033 *	-.168	-2.073	.041 *
Towards	.148	1.841	.069	.057	.688	.493	.091	1.050	.296	.099	1.223	.224

Significant results in bold print * p < .05 ** p < .01 *** p < .001

Table B8

Hierarchical Multiple Regression: Table of Beta Weights for Model 6 for Gender, Age, OP Ranks, Application Criteria, Interview Criteria and MVPI Variables Predicting Academic Grades

VARIABLE	Grades Year 1			Grades Year 2			Grades Year 3			Average Grade		
	<i>B</i>	<i>t</i>	<i>Sig</i>									
Gender	.272	3.214	.002 **	.262	2.909	.004 **	.368	4.063	.000 ***	.328	3.791	.000 ***
Age	.092	1.121	.265	.123	1.416	.160	.081	.928	.355	.105	1.249	.215
OP Rank	-.395	-4.167	.000 ***	-.369	-3.684	.000 ***	-.348	-3.466	.001 **	-.407	-4.240	.000 ***
Application:												
Motivation	.072	.690	.492	.028	.254	.800	.099	.896	.372	.065	.614	.541
Activities	.000	-.003	.998	-.074	-.712	.478	.045	.431	.667	-.012	-.118	.907
Other Information	.046	.488	.627	.065	.658	.512	.032	.323	.748	.049	.515	.608
Supplementary	.121	1.356	.178	.126	1.329	.187	.129	1.354	.179	.144	1.588	.116
Overall Rating	.251	2.210	.029 *	.104	.866	.389	.154	1.274	.206	.194	1.679	.096
Interview:												
Motivation	-.024	-.230	.819	-.138	-1.237	.219	-.189	-1.686	.095	-.137	-1.273	.206
Interpersonal	-.078	-.555	.580	.100	.653	.515	-.068	-.438	.662	.004	.026	.979
Self Reliance	-.241	-2.073	.041 *	.153	1.244	.217	-.011	-.090	.928	-.045	-.374	.709
Communication 1	.149	1.132	.260	.252	1.788	.077	.115	.813	.418	.230	1.699	.093
Communication 2	.099	.618	.538	.114	.672	.503	.233	1.352	.180	.130	.789	.432
Overall Rating	.208	1.223	.224	-.227	-1.507	.135	-.046	-.248	.804	-.041	-.233	.816
MVPI:												
Aesthetic	.079	.951	.344	-.133	-1.502	.136	-.074	-.825	.411	-.044	-.515	.608
Affiliation	.048	.553	.582	.015	.159	.874	.005	.051	.959	.007	.079	.937
Altruism	.048	.551	.583	-.056	-.611	.543	-.133	-1.431	.156	-.066	-.745	.458
Scientific	.003	.033	.974	-.017	-.187	.852	.149	1.628	.107	.056	.635	.527

Significant results in bold print * p < .05 ** p < .01 *** p < .001

Table B9

Ancillary Hierarchical Multiple Regression: Table of Beta Weights for Model 5 for Gender, Age, OP Ranks, Application Criteria, and HPI Variables Predicting Academic Grades

VARIABLE	Grades Year 1			Grades Year 2			Grades Year 3			Average Grade		
	<i>B</i>	<i>t</i>	<i>Sig</i>	<i>B</i>	<i>t</i>	<i>Sig</i>	<i>B</i>	<i>t</i>	<i>Sig</i>	<i>B</i>	<i>t</i>	<i>Sig</i>
Gender	.304	3.639	.000 ***	.257	2.935	.004 *	.282	3.164	.002 **	.302	3.567	.001 **
Age	.075	1.018	.311	.129	1.659	.100	.155	1.956	.053	.119	1.582	.116
OP Rank	-.379	-4.861	.000 ***	-.419	-5.156	.000 **	-.287	-3.410	.001 **	-.344	-4.309	.000 ***
Application:												
Motivation	.128	1.424	.157	.081	.890	.375	.163	1.736	.085	.168	1.880	.063
Activities	-.047	-.492	.623	-.109	-1.120	.265	.019	.188	.851	-.062	-.658	.512
Other Information	.040	.447	.655	.011	.115	.909	.027	.289	.773	.042	.470	.640
Supplementary	.061	.773	.441	.094	1.138	.257	.058	.689	.492	.061	.765	.446
Overall Rating	.181	1.676	.096	.037	.330	.742	.183	1.637	.104	.209	1.974	.051
HPI:												
Adjustment	.194	2.144	.034 *	.037	.394	.694	.052	.538	.592	.162	1.784	.077
Sociability	.005	.055	.956	-.028	-.269	.788	-.056	-.511	.610	-.061	-.592	.555
Agreeability	.198	2.202	.029 *	.131	1.382	.169	.214	2.234	.027 *	.217	2.388	.019 **
Ambition	-.100	-1.099	.274	-.180	-1.898	.060	-.127	-1.307	.194	-.169	-1.826	.070
Prudence	.122	1.316	.190	-.014	-.145	.885	.088	.874	.384	.051	.531	.596
Intellectance	-.047	-.563	.575	-.028	-.323	.747	-.025	-.281	.779	-.040	-.482	.631
Scholarship	-.039	-.493	.623	.000	-.000	1.000	.128	1.495	.138	.016	.193	.848

Significant results in bold print * p < .05 ** p < .01 *** p < .001