Predicting Pre-Hospital Care Students' First Year Academic Performance in a Rural University.

Submitted by

Veronica M. Madigan

Bachelor of Health Science (Pre Hospital Care).
Charles Sturt University

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School of Rural Health
Faculty of Medicine
Monash University
Melbourne, Victoria, 3001
Australia

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STATEMENT OF AUTHORSHIP

Except where reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole or in part from a thesis by which I have qualified for or have been awarded another degree or diploma.

No other person's work has been used without due acknowledgement in the main text of the thesis. This thesis has not been submitted for the award of any degree or diploma in any other tertiary institution.

All research procedures reported in the thesis were approved by the Standing Committee on Ethics in Research Involving Humans (SCERH), Monash University, Melbourne and by the Ethics Committee of the 'Rural University' involved in this study

Candidate's Signature: .....

Date: .....

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ABSTRACT

Several problems of unsatisfactory student retention and progression together with an incomplete selection criterion were evident in a newly developed, vocational orientated, pre-hospital care course at a rural Australian university. With increasing demand for student placement, the need arose to address these issues and satisfactorily resolve them. A search of the literature identified limited information with regard to predictors of academic success within the pre-hospital care discipline. Therefore, the idea to conduct a study to identify factors that are predictive of first year student achievement and to develop an appropriate student entry criterion was born. Although there was limited literature available specifically focusing on the pre-hospital care discipline, a comprehensive review of the literature identified numerous predictors of academic performance. Six predictors of academic performance for first year students at college or university that regularly emerged from the literature were selected for investigation. These predictors were; previous scholastic achievement, post-secondary educational qualifications, student entry type (mature age vs. traditional entry), previous related experience, gender and urban vs. rural background. The study employed both bivariate and multivariate analyses and found that all variables were somehow related to the various operationalizations of academic success. Results support the contention that better prediction can be achieved through the use of multiple variables. Study results led to the development of an organisational tool that can be used to assist in the effective selection of pre-hospital care students. Further, this working template has the generalizability to assist other

vocational allied health care courses with their entering student cohort selection.

CHAPTER ONE

INTRODUCTION

Universities have student education and the improvement of academic ability as their core business (Smith, 2000). Generally, universities attempt to select students who have the potential to succeed in their particular field of study. However, as the number of students applying for admission to universities continues to rise, admissions officers, committee members and course co-ordinators are faced with a number of challenges. These challenges include not only selecting a limited number of appropriate students from large pools of applicants, but in doing so, ensuring their decisions will result in satisfactory student retention rates and good outcomes (see Sadler & Hammerman, 1999; Yin & Burger, 2003).

In order to maximise the effectiveness of course recruitment and outcome it would be beneficial to have a better understanding of the factors that are predictive of student achievement. This information could then be used to develop appropriate student selection criteria. A review of the literature demonstrated several advantages for both the university and the student when using predictors of academic performance in the pre-entry selection phase. These include:

- It provides an effective, efficient and fair method of selecting students who will be most likely to succeed in their chosen field of study (see Griffiths, Bevil, O'Connor & Wieland, 1995; Stricker, Rock & Burton, 1996).

- By utilising predictors in the pre-entry phase it provides students with established guidelines to make an informed decision about their suitability for specific university courses (see Stricker, Rock & Burton, 1996).
- Academic predictors can lead to a reduction in the amount of financial, administrative and ancillary services utilised by the university and the student as a result of academic failure and student attrition (see Griffiths *et al*. 1995).

While there are advantages to trying to predict outcome, the advantages of using predictors as true indicators of academic performance in the pre-entry phase at university are not applicable unless valid (measurable) and reliable (consistent) predictors are being utilised (Dwinell, 1985; Lewis, 1995; Parahoo, 1997; Ting & Robinson, 1998; Hoefer & Gould, 2000). While there is a plethora of information available in regard to established courses, for those involved in the implementation of new courses, there is less information to call upon. Although studies relating to the predictors of academic performance are numerous, there is little or no relevant research available in either the Australian or international literature with respect to the pre-hospital care discipline. A reason for this is that the treatment of the sick and injured in the out of hospital environment (pre-hospital care) is still in its infancy, having only been established some forty years ago (McKenna & Sanders, 2002).

Background & Significance of this Study

This study evolved as a result of witnessing several problems relating to first year student selection and retention in a vocationally orientated, pre-hospital

care degree course offered through an Australian rural university. The three-year degree course was introduced in 1998 and since that time there has been hundreds of applicants each year for approximately 60 first year, on-campus placements. However, since its initial offering several problems with unsatisfactory student retention and progression have occurred. With increasing demand for student placement, the need arose to address these issues and satisfactorily resolve them.

A literature search found limited information pertaining to education and predictors of academic success within the pre-hospital care discipline. However, academics lecturing in the pre-hospital care course had anecdotal evidence that suggested that students with previous health-related experience, post-secondary educational qualifications and / or students with a rural background performed better than students without these characteristics. These experiences inspired the idea to conduct a study to identify factors that are predictive of first year student achievement and to develop an appropriate student entry criterion.

The significance of this study is multifactorial: The research will ascertain if there are predictors of academic performance for first year students enrolled into this new vocational course. If identified, the predictors will be used to substantially enhance recruitment, selection and retention of students enrolling into this, and potentially other similar vocational allied heath care courses. This research will also contribute to the new discipline of pre-hospital care by increasing the limited body of knowledge and decreasing the vocational ‘gap’ in the available literature.

Review of the Literature

Both Australian and international studies that examine predictors of academic performance for first year students at college or university were reviewed. A search of the literature utilising 'Proquest 5000' (1996-2004), 'ABI' (1993-2004), 'PAR' (1982-2004), 'ERIC' (1965-2004), 'PsycINFO' (1976-2004) and 'Medline' (1966-2004) resulted in the identification of literally hundreds of predictors of academic performance ranging from; cognitive abilities and high school grades through to socioeconomic data, personality traits, letters of reference and so on. Due to the constraints of this thesis, six variables were chosen for further investigation. These were:

- Previous Scholastic Achievement;
- Post-Secondary Educational Qualifications;
- Student-Entry Type (Traditional vs. Mature);
- Previous Related Experience;
- Gender, &
- Rural vs. Urban Background.

The decision to investigate the chosen predictors was threefold. Firstly, these predictors regularly emerged from the literature as valid (measurable) and reliable (consistent) predictors of academic performance. Secondly, some of these predictors were previously identified in the anecdotal evidence reported by academics lecturing in the pre-hospital care course as potential indicators of academic performance in first year students. Finally, the predictor information was easily obtainable from pre-existing student data already collected by the university on enrolment. The following is a presentation of research that has investigated how each of these variables related to academic achievement. In addition, this information is summarized in Table 1.

Previous Scholastic Achievement

Of all the variables studied, previous scholastic achievement has most consistently been found to predict academic performance at college or university for first year students. Examples of research that has findings in support of this relationship include: McDonnell, 1975; Eaton, 1979; Watkins, 1979; Dwinell, 1985; Zachary & Schaeffer, 1994; Stricker, Rock & Burton; 1996; Petrie & Stoever, 1997; Ting & Robinson, 1998; Garton, Dyer & King, 1999; McKenzie & Schweitzer, 2001 & Yin & Burger, 2003.

Previous scholastic performance has generally been measured using such tests as the High School Certificate (HSC), Scholastic Aptitude Tests (SAT), Composite, Verbal, Reading & Mathematics (ACT) scores or equivalent means. When test score have been compared against first year academic performance such as Grade Point Averages (GPAs), consistent relationships have been observed (see for examples, McDonnell, 1975; Tinto, 1975; Entwistle & Wilson, 1977; Mortimore & Bennett, 1978; Miller, 1978; Dwinell, 1985; Fuertes, Sedlacek & Liu, 1994; Fuertes & Sedlacek 1995; Zachary & Schaeffer, 1994; Borde 1998; Ting & Robinson, 1998; Garton, Dyer & King, 1999; McKenzie & Schweitzer, 2001; Yang & Noble, 1990; Yin & Burger, 2003).

The seminal work by Eaton (1979) relating to factors associated with academic performance and withdrawal from college has been frequently cited. Eaton (1979) collectively reviewed research involving 26,040 first year students from North America (Tinto, 1975), the United Kingdom (Entwistle & Wilson, 1977) and Australia (Mortimore & Bennett, 1978; Miller, 1978). Based on this review, Eaton concluded that previous scholastic performance was consistently related to GPA.

Dwinell (1985) concurred with the findings of Eaton (1979) with her studies in South America. Dwinell studied 281 students who matriculated in the Division of Developmental Studies at a Southern American university during the academic year of 1983-1984. The study utilised marks allocated in final high school examinations for the subjects of English, Reading and Mathematics. Students were asked to sit independent examinations in similar subject areas. The results were compared using multiple regression analysis. The study demonstrated that Scholastic Aptitude Scores and High School Grade Point Averages continue to be good predictors of academic performance. These findings are consistent with Lavin (1965), Astin (1971), Stanley (1971), Houston (1980), Hogrebe (1982), Milem & Berger (1997), Ting (1997) and Yin & Burger, (2003).

It may be argued with the earlier studies of Eaton (1979) and Dwinell (1985) that direct comparison of HSGPA (High School Grade Point Average) could not be accurately assessed with different curriculum subjects or subjects with differing content in North America, the United Kingdom and Australia. However, there seems to be general agreement in the literature that, regardless of the subjects studied, academic performance at high school equates to academic performance in at least the first year of university (see Tinto, 1975; Entwistle & Wilson, 1977; Mortimore & Bennett, 1978; Miller, 1978; Dwinell, 1985; Zachary & Schaeffer, 1994). Stricker, Lawrence & Rock's (1996) findings concur with this statement. When analysing 981 students entering several American universities in the Fall of 1988, the authors found that SAT and HSGPA scores predicted academic grades in students' first year at university.

Support for the relationship between prior educational achievement and first year university success was also found in a recent study (2001) of first year students (N=197) enrolled in an Australian university by McKenzie & Schweitzer. The study found that university entry scores (HSC & SAT) were the most significant predictor of academic performance for first year students.

Harackiewicz, Barron, Tauer & Elliot (2002) recently progressed one step further and extended the predictive powers of previous scholastic achievement from first year to the college career of the student. The authors reported on a detailed longitudinal study following the career progression of 604 students at an American university from enrolment to graduation. Of the many predictors studied, Harackiewicz *et al.* found that high school performance predicted academic performance in both the short (first year) and long term (graduation year) of the student.

Post-Secondary Educational Qualifications

Students with additional educational qualifications such as previous university studies, tertiary-bridging courses, academic short courses and Tertiary and Further Education (TAFE) courses have been found to demonstrate higher levels of academic performance in their first year than students admitted on any other basis. Studies by Power, Robertson & Baker (1987), Parameswaran (1991) and Dobson, Sharma & Haydon (1996) have supported the reliability of this predictor.

Dobson *et al.* (1996) found that students who had previous exposure to higher education demonstrated higher levels of academic performance in their first year than students admitted on any other basis. Further, the student's tertiary entrance score generally showed equivalence to their first year

academic performance. Other studies not only supported this view, but advocated the use of this predictor as a reliable indicator of first year academic performance for college or university (see Power *et al.* 1987; Parameswaran, 1991).

Student Entry Type (Traditional vs. Mature)

Several studies have been conducted comparing the overall academic performance of both traditional-entry and mature-entry students at university (see for example Marshall & Nicholson, 1991; Malloy & Carrol, 1992; Hartley, Trueman & Lapping, 1993; Richardson, 1994a & 1994b; Trueman & Hartley, 1996; McKenzie & Schweitzer, 2001). Traditional-entry students are reported to be approximately 17-20 years of age and apply immediately for university admission following completion of high school. Mature-entry students are reported to be over 20 years of age and have delayed entry to university for a variety of reasons.

Studies investigating the relationship between age and overall academic performance have found no significant correlation when age is used as a single predictor (see Trueman & Hartley, 1996). For example, Trueman & Hartley (1996) in their studies of first year students (N=293) in England found no difference between traditional-entry students (n=172) and mature-entry students (n=121) in relation to overall academic performance. Similarly other researchers such as Marshall and Nicholson (1991), Molloy and Carroll (1992), Hartley, Trueman and Lapping (1993), Richardson (1994a & 1994b) and McKenzie and Schweitzer (2001) have reported findings that have supported this view.

Jenkins (1998) found a similar result in her studies of 134 university accounting students at San Jose State University in America. In this study, Jenkins used a multiple regression analysis to examine the relationship between age, gender, GPA, critical thinking abilities and student academic performance. The results showed that age by itself was not a statistically significant variable for predicting academic performance (see also Carr & Echord, 1981).

Previous Related Experience

The search of the literature revealed several studies supporting previous related experience as a good predictor of academic performance in first year. Previous related experience was defined as students with community related experience and / or students with previous related studies. The literature review identified several studies supporting both community service (see McCauley, 1985; Hood, 1992; Ting, 1997; Ting & Robinson, 1998) and previous related studies (see Griffith *et al*. 1995; Rohde & Kavanagh, 1996) as predictive of academic success.

Community Service

Ting & Robinson's studies (1998) of 2,600 new students at an American south-eastern university in the Fall of 1996 found that even though GPA and SAT were strong predictors of first year academic performance, a variety of psychosocial variables were also significantly correlated to academic success. Of these, community service was one of the most important. Community service was also found to be a significant psychosocial indicator of GPA in the

first year in Ting's study (1997) of 124 white freshmen students attending an American State university.

Previous Related Studies

Rohde and Kavanagh's (1996) findings that previous related studies are a good predictor of academic performance in first year students who are enrolled in a related course suggests the importance of previous health related studies for the current endeavour. Their research investigated 508 first year accounting students at a Queensland university who had completed accounting subjects at high school and compared them against students who did not have prior knowledge of the course. The study compared students OPSCORE (similar to HSC results) at time of application against first year academic performance and the academic performance of students with previous accounting knowledge against students with no accounting knowledge. The study found that students admitted with a high OPSCORE and previous related studies in accounting consistently outperformed students with similar OPSCORES and no previous accounting studies. Rohde and Kavanagh (1996) therefore concluded that there was a positive correlation between first year academic performance and prior knowledge of accounting. However, there were a number of limitations associated with this study. Only two campuses were investigated, both of which were located in the same geographical area and a small sample of students were only involved in the study. Despite these limitations, the authors' findings were supported in similar studies by Mitchell (1985), Schroeder (1986), Farley & Ramsey (1988), Chan & Leung (1990), Keef & Hooper (1991), Auyeung (1991) & Robbins, Lauver, Le, David, Langley & Carlstron (2004).

Griffiths *et al.* (1995) demonstrated comparative findings when researching junior generic students (N=98) and assessing previous knowledge of anatomy and physiology against first year academic performance. The study found that students who had a current prerequisite in anatomy and physiology demonstrated higher academic performance than students who did not have this prerequisite. Interestingly, the study also found that students who had an appropriate prerequisite that was greater than two years old, demonstrated similar academic ability to students with no prerequisite (see also DeAngelis 2003 & Yin & Burger, 2003).

Although Griffiths' *et al*. (1995) study involved a small sample group (N=98), the results further supported the work of Yang, Glick & McClelland (1987) who also reported that current, appropriate prerequisites were reliable predictors in association with high GPAs in first year students enrolled in clinical nursing courses. Similar results were found by Dobson *et al*. (1996) in their previously reported retrospective study. The authors found that students who had completed previous TAFE related studies performed equally as well as school leavers with high GPAs. Other studies by Dobson & Sharma (1993), Haydon (1994) and Lewis (1995) have confirmed these findings. Hoefer and Gould (2000) added further support to the significance of previous related studies with their retrospective study of the admission process of graduate business students (N=700) from an American metropolitan university.

Gender

The literature review found that there was no significant correlation between student gender and overall academic performance where gender is used as a single predictor (see Stricker, Lawrence & Rock, 1996; Jenkins, 1998;

Kleinfield, 1999; McKenzie & Schweitzer, 2001). However, in Kleinfield's major review of the literature (1999) which investigated gender and academic performance, females tended to surpass males in English Literature and Liberal Studies. In contrast, males tended to surpass females in Science and Mathematics. Therefore, this predictor may be of value as the pre-hospital care, vocational course is predominately science and mathematically based (see Everett & Robins, 1991; Felder, Felder, Mauney, Hamrin & Dietz, 1995; Dalziel & Peat, 1998).

Rural or Urban Background

There is increasing anecdotal evidence amongst lecturing academics in this vocational degree course that suggests a rural background may be a predictor of first year academic success. However, studies by Edlington & Koehler (1987) need careful interpretation. The authors suggest that rural students can perform equally as well as urban students. Further, there are strong relationships between firm social support and academic success, which are commonly found in rural communities (see Downey, 1980; Edlington, Everett & Martellaro, 1984; Hemmings; White & Sedlacek, 1986; Tracey & Sedlacek, 1987; Johnson, 1989; Sedlacek & Adams-Gaston, 1992; Gerdes & Mallinckrodt, 1994; Petrie & Stoever, 1997; Kay & Hill, 1997;Ting, 1997; Dalziel & Peat, 1998; Hawkins & Adams, 2001).

Table 1

A summary of findings in relation to the identified predictor variables

Predictor	Authors	Significance	Explained Variance
Previous Scholastic Achievement	Eaton (1979)	P < .05	15%
	Entwistle & Wilson (1977)	P < .05	15%
	Ting & Robinson (1997)	P < .05	Female = 18% Male = 13%
	Petrie & Stoever (1997)	P < .05	29%
Post-Secondary Educational Qualifications	Power, Robertson & Baker (1987)	P < .05	> 12%
	Dobson, Sharma & Haydon (1996)	P < .05	> 15%
Student Entry Type (traditional vs. mature)	Trueman & Hartley (1996)	P > .08	2%
	Jenkins (1998)	P > .17	Not reported
Previous Related Experience / Study	Rohde & Kavanagh (1996)	P < .05	10%
	Griffiths, Bevil, O'Connor & Wieland (1995)	P < .05	9%
Gender	Kleinfield (1999)	P > .05	Not reported
Rural Background	Downey (1980)	P > .05	Not reported

Using variables in combination

While the discussion thus far has focused on the relationship between predictor variables and academic performance at a bivariate level, many of the studies that have been conducted have used a multivariate approach (see Table 2 for an overview). Although some variables have not been found to be significantly related to academic performance at a bivariate level, when used in combination with other variables, they make a significant contribution to the prediction model. The following is a presentation (in chronological order) of studies using a multivariate approach to predicting academic achievement. It should be noted that some smaller studies have not been included for discussion as they lacked comprehensive methodological and statistical detail (for example, see Borges, Roth, Nichols & Nichols 1980; Weidman, 1985 & Atherton, 1997).

The research by Entwistle & Wilson (1977) is one of the earliest examples of the use of multiple predictors. In their studies involving 11,540 first year students, the authors found that both previous scholastic achievement and mature aged students showed a strong correlation to academic performance with an explained variance of 15% and 11% respectively. When the mature age student variable was combined with previous scholastic achievement, previous related study and positive head teacher's report, the prediction rate of academic performance increased from a single variance of 11% to a combined variance of greater than 25%.

Based on her analysis of the early literature Eaton (1979) concluded that no single predictor (previous scholastic achievement included) achieved both a strong correlation and a higher rate of explained variance with regard

to the predictability of academic performance. This left Eaton to postulate that multiple indicators were better predictors of academic performance than was any single variable. Specifically, she hypothesised that a combination of variables would better predict academic performance than would any single variable.

Eaton tested her theory using a meta-analysis of published research findings (total N=26,040). Although these studies looked at a variety of different variables and no two studies were identical, there were generalisations made from each study. Eaton's main finding was that previous scholastic achievement was the most reliable predictor of academic performance, accounting for approximately 15% of the variability in achievement. However, in order to achieve stronger correlations and a higher rate of explained variance regarding the predictability of academic performance in first year students, the authors suggested that previous scholastic achievement be used in combination with other reliable variables. These variables included previous related studies, age and a positive head teacher's report (assessing leadership and academic performance). The data clearly showed that using this combination of variables raised the predictability rate of student academic performance from a single variance of 15%, to a combined variance of greater than 20%.

Another study supporting the use of a multivariate approach was conducted by Power, Robertson and Baker (1987). In this study the authors found that when the mature aged student variable was used individually to predict academic performance in the first year of university, only 11% of variance could be explained. When combined with other variables such as

post-secondary educational qualifications and female gender, the reported explained variance of academic performance exceeded 27%.

Griffiths *et al* (1995) reported comparable results when investigating first year nursing students (N=98) at an American health college. The authors found that previous related study was a strong predictor of academic performance with an explained variance of 9%. However, when this predictor was combined with the type of college attended and previous scholastic achievement, the explained variance rose from 9% to 39%.

Rohde & Kavanagh (1996) also found results in favour of using a multivariate approach. Their studies reported the individual predictability rate for previous scholastic achievement and previous related study as 15% and 10% respectively. However, when the authors combined both of these strong predictors, the predictability rate of academic performance for first year students exceeded 25%.

In their retrospective study of 156,752 Australian students commencing university in 1993 and 1994, Dobson, Sharma and Haydon (1996) found that the variance explained using only post-secondary educational qualification (the strongest predictor) only marginally exceeded 15%. However, when this variable was combined with mature aged student status, gender and previous related studies, the explained variance rose from 15% to greater than 25%. Based on their study findings, Dobson *et al.* (1996) reached several conclusions relating to predictors of academic performance. One such conclusion concurred with previous authors regarding the reliability of previous scholastic achievement, as well as the need for multivariate indicators to increase the predictability of first year academic performance.

The advantages of using multivariate predictors to assess academic performance are again evident in Ting & Robinson's study of 1998 (N=2,600). The study found that even though previous scholastic achievement was a strong predictor of academic performance, it only explained 15.3% of the variance. However, when multiple predictors were used for all students in order to predict GPA for the Fall of 1996, the variance increased from 15.3% to between 18.6% and 22.8%. Several other findings by Ting & Robinson (1998) were of interest to this study:

- Firstly, previous scholastic achievement (HSGPA) was a stronger predictor of academic performance in the case of female students (n= 1,090) than it was for male students (n=1,508); with an explained variance equal to 18% and 13% respectively.
- Secondly, additional variables that increased the prediction rate for male students in this semester included mathematical scores and community service. When several of these variables were combined, the prediction rate for academic performance in first semester for male students increased from an explained variance of 13.3% to 24%.
- Additional variables that increased the prediction rate for female students in this semester included background, social support and leadership experience. When several of these variables were combined, the prediction rate for academic performance in first semester for female students increased from an explained variance of 18.4% to 25.2%.

Researchers Petrie & Stoever (1997) also reported that relying on traditional academic measures was questionable and assessing freshmen students with a combination of academic and non-academic variables was desirable. The authors reported on studies by Walter, Smith, Hoey, Wilhelm & Miller (1987) who found that SAT and HSGPA accounted for less than 20% of the variance in college football players (N=580) when compared against academic performance in the first year of university.

Similarly, when Petrie & Stoever surveyed undergraduate students (N=152) in 1997, they found that relying solely on SAT scores accounted for only 29% of the prediction rate for academic performance. However, when used in combination with another strong predictor examined in the study (social support), the prediction rate increased from 29% to 39%.

Jenkins (1998) used a multiple regression analysis to examine the relationship between age, gender, GPA, critical thinking abilities and student academic performance. GPA again proved to be the most significant predictor of academic performance. However, critical thinking abilities also proved significant in the regression model. Students with demonstrated critical thinking abilities consistently outperformed other students in the latter part of the course giving rise to the accepted theory that critical thinking evolves over time. Gender was not statistically significant across any individual field and similar findings were reported with the age variable.

Hoefer and Gould (2000) added further support to the significance of multivariate analysis with their retrospective study of the admission process of graduate business students (N=700) from an American metropolitan university. The study analysed 12 variables over the three year period from

1992 to 1994 (inclusive). The study found that UQPA (Undergraduate Quality Point Average – GPA / SAT / previous related studies), GMAT (Graduate Management Admissions Test (GMAT) and GQPA (Graduate Quality Point Average) were strong determinants of student academic performance. In assessing only the total GMAT (Graduate Management Admissions Test) score (quantitative and verbal components), the authors found that this predictor determined 20% of the variance for academic performance. If the strong determinants of academic performance were collated (UQPA, GMAT & GQPA), it was estimated that the variance for academic performance would increase from 20% to in excess of 30%. In evaluating their findings Hoefer and Gould (2000) stated that increased validity (measurability), fairness and balance were demonstrated in the pre-entry selection process of graduate students by using a combination of predictors.

Summary of Literature Review Findings

The review of the literature found that previous scholastic achievement was the most frequently used predictor of academic performance for students at university or college (Eaton, 1979; Dwinell, 1985; Stricker, Rock, Burton, 1996; Dobson, Sharma & Haydon, 1996; Ting & Robinson, 1998; Garton, Dyer & King, 1999; McKenzie & Schweitzer, 2001). However, most studies reported that observed correlations and explained variances between this predictor and first year student academic performance was relatively low. Several studies found that a combination of reliable predictors indicated academic performance better than any single predictor (see McDonnell, 1975; Tinto, 1975; Entwistle & Wilson, 1977; Eaton, 1979; Watkins, 1979; Dwinell, 1985; Stricker, Rock & Burton, 1996; Petrie & Stoever, 1997; Ting &

Robinson, 1998; McKenzie & Schweitzer, 2001; Ransdell, Hawkins & Adams, 2001; Robbins *et al*, 2004).

Previous related experience / study was found to be one such reliable predictor of academic performance of first year students which was recommended for use in conjunction with previous scholastic achievement (McCauley, 1985; Hood, 1992; Griffith *et al.* 1995; Rohde & Kavanagh, 1996; Ting & Robinson, 1998). Other predictors recommended for use in conjunction with previous scholastic achievement included post-secondary educational qualifications (see Power, Robertson & Baker, 1987; Parameswaran, 1991; Dobson, Sharma & Haydon, 1996), and age (see Stanley, 1971; McDonnell, 1975; Houston, 1980; Ting, 1997).

The literature review also found that there was a demonstrated relationship between gender and academic performance with regard to specific subjects (Stricker, Lawrence & Rock, 1996; Kleinfield, 1999). However, there was no significant correlation between gender and academic performance when gender was used as a single predictor. Further, studies by Edlington & Koehler (1987) suggested that rural students may perform equally as well urban students and do demonstrate strong social and community support. Studies by Downey (1980), Edlington, Everett & Martellaro (1984) and Hemmings, Kay & Hill (1997) also supported these findings.

The review of the literature supported the anecdotal evidence provided by academics lecturing in the vocational course. Specifically, first year students with previous health related experience (community service, related study etc), post-secondary educational qualifications and / or a rural background, academically outperformed students without these characteristics.

Table 2

Summary of research utilising multiple variables to predict academic performance

Authors	Predictors Used	Explained Variance
Entwistle & Wilson (1977)	Previous Scholastic Achievement, Previous Related Studies, Mature Aged Students & Positive Head Teacher's Report	> 25%
Eaton (1979)	Previous Scholastic Achievement, Previous Related Studies, Age & Leadership Skills	> 20%
Power, Robertson & Baker (1987)	Post-Secondary Educational Qualifications, Mature Aged Student & Female Gender	> 27%
Griffiths, Bevil, O'Connor & Wieland (1995)	Previous Scholastic Achievement, Previous Credit Related Study & Type of College Attended	39%
Rohde & Kavanagh (1996)	Previous Scholastic Achievement & Previous Related Studies	> 25%
Dobson, Sharma & Haydon (1996)	Post-Secondary Educational Qualifications, Mature Aged Student & Previous Related Studies	> 25%
Petrie & Stoever (1997)	Previous Scholastic Achievement & Social Support	39%
Ting & Robinson (1998)	Previous Scholastic Achievement, Community Service, Social Support & Background	Females = 25% Males = 24%
Jenkins (1998)	Critical Thinking, GPA, Age & Gender	>25%
Hoefer & Gould (2000)	UQPA, GMAT & GQPA	>30%

Research Question

As has been presented, the literature search revealed limited information in regard to predictors of academic success within the pre-hospital care discipline. Based on a need to better understand the factors associated with academic success, the following research question was posed: Can previously identified factors relating to academic performance (i.e. previous scholastic achievement, post-secondary educational qualifications, traditional vs. mature entry student status, previous related experience, gender, and rural background) be used to predict first year academic success for students undertaking a newly developed and vocationally orientated pre-hospital care course delivered in a rural setting? Based on the answers to this question, this study also aimed to determine if the study findings could be used to develop appropriate student selection criteria.

CHAPTER TWO

METHODOLOGY

Overview

The relationship between the six previously identified predictors and first year student academic performance at a rural Australian university was the focus of this study. The predictor information was provided by the students at the time of their application to the course and was extracted from two administrative databases located at the university. The de-identified block data was examined using statistical testing which involved the use of a quantitative regression system known as *CHAID (Categorical Hierarchical Automatic Interaction Detection)*, Analysis of Variance (*ANOVA*) and Logistical Regression Analysis.

Setting

Data relating to all first year, on campus students enrolled in the pre-hospital care course for the four-year period extending 1998-2001 was used in this study. The vocational course was offered through an Australian rural university.

Participants

The study's sample was comprised of 135 first year students; 71 females and 64 males. The average age of the group was 20.52 years. For further details regarding participants' demographic characteristics, see Table 3.

Table 3

Description of study participants' age, sex and mode of entry to university

Sample characteristic	Males	Females	Total
Sample number	64	71	135
Average age (SD)	21.14(5.36)	19.96 (3.37)	20.52(4.45)
Traditional-Entry Students	50	37	87
Mature-Entry Students	21	27	48

Variables

Independent

Based on literature review findings and the anecdotal evidence provided by lecturers teaching in the relevant course (see Chapter One), the following independent variables were chosen for inclusion in this study:

- University Admission Index (UAI)
- Post-Secondary Educational Qualifications
- Student Entry Type (traditional or mature aged)
- Previous Health-Related Experience
- Gender
- Background (rural or urban-based residential students).

The predictor variables, type and their units of measurement are presented in Table 4. Further definitional information in relation to the independent variables follows.

Table 4

Predictor variables, type and unit of measurement

Predictor	Type	Unit of Measurement
University Admission Index (or equivalent)	Continuous	Overall score submitted Possible range = 0 -100
Post-Secondary Educational Qualifications	Dichotomous	1 = Yes 2 = No
Student Entry Type	Dichotomous	1 = Traditional 2 = Mature
Previous Health-Related Experience	Dichotomous	1 = Yes 2 = No
Gender	Dichotomous	1 = Male 2 = Female
Background	Dichotomous	1 = Capital City 2 = Other

The University Admission Index

Year 12 students are allocated this score as a result of a series of state-wide examinations developed by the High School Certificate (HSC) Board. The UAI score is based on the aggregate of scaled marks in ten units of Board Developed HSC courses. Scores can range from 0.00 to 100.00 with increments of 0.05. It is generally used uniformly throughout Australia to provide a measure of overall academic achievement of Year 12 students which assists universities in ranking applicants for university selection (UNSW, 2001; UAC, 2003). As previous scholastic achievement was found to be a strong indictor of academic performance in the review of the literature,

and as UAI is the standard Australian index of academic achievement, this index was chosen as a predictor for this study.

Some universities may apply bonus points to a student's UAI score if they live in certain areas, apply under regional entry schemes or are granted special consideration under Educational Access Schemes (UAC, 2003). However, all UAI scores for this study were based on the individual student's initial UAI score prior to bonus points (if applicable). For Year 12 overseas students and some interstate students who did not posses a UAI score, their academic qualifications were generally converted to the equivalent in terms of the NSW HSC results.

Post-Secondary Educational Qualifications

Students who applied for entry into the degree program with educational qualifications including: TAFE courses accredited bridging and certificate courses and diploma and prior degrees were assessed as having post-secondary educational qualifications.

Student Entry Type

Student entry type was operationalised as either traditional or mature age. Traditional-entry students are defined as those students who have recently completed secondary school and have applied for university admission. These students are usually between 17-20 years of age. Mature-entry students are defined as those students who are older than 20 years of age and have delayed their application for university admission for various reasons such as work experience, career opportunities, travel and family (Trueman & Hartley, 1996).

Previous Health-Related Experience

Students who had undertaken some full-time or part-time employment (with or without remuneration) by an industry or profession that has appropriate accreditation, for a period of greater than one year were defined as having previous health-related experience. Appropriate industrial or professional bodies included; the Red Cross Association, St John Ambulance Australia, Surf Lifesaving Association, Army Reserve, Metropolitan Ambulance Service Victoria and Rural Ambulance Victoria. Students with previous health related studies were also assessed as having previous health-related experience.

Gender

Referred to the sex of the student.

Rural vs. Urban Background

Identified students from a rural or an urban background. The student's residential postcode at the time of application was interpreted to determine this category. Students were categorised as urban if they resided in a metropolitan area prior to enrolment (i.e. population ≥ 50,000). Students were categorized into rural if they resided in a non-metropolitan area prior to enrolment (i.e. population < 50,000) (see Strong, Trickett, Titulaer & Bhatia, 1998; Department Primary Industry & Energy, Department Human Services & Health, 1994).

Dependent

A number of markers of academic performance were chosen. The first, Grade Point Average (GPA) was chosen because of its use in the literature. Full-time, on campus students are required to complete eight (8) subjects per year (see Table 5).

Table 5
Description of first year subjects

Subject	Description
First Semester	
Clinical Studies 1A	A practical based clinical subject that assists students to formulate treatment plans by understanding the manifestations of disease and the importance of assessment findings. This introductory subject examines such general topics as patient assessment, communicable diseases and the management of cardiac and respiratory arrest.
Paramedical Science 1A	A theoretical based subject that examines human anatomy and physiology and assists in linking 'theory to practice' with sister subject Clinical Studies 1A.
Pre-Hospital Care 1	A theoretical subject involving the recognition and understanding of several theories of health.
Professional Studies 1	A theoretical subject that focuses on communication skills appropriate to the work of ambulance officers.
Second Semester	
Clinical Studies 1B	A practical based clinical subject that increases the student's understanding of the manifestations of disease. Further topics include the understanding and management of haemorrhage, shock, cardiovascular and respiratory problems. The subject then links these topics with the implementation of appropriate treatment plans specifically designed for the pre-hospital care environment.
Paramedical Science 1B	A theoretical based subject that further develops the student's understanding of human anatomy and physiology by specifically linking topics introduced in Clinical Studies 1B.
Clinical Internship 1	This subject introduces the student to the pre-hospital care environment with a range of clinical practicums. Assessment tasks and evaluation reports assist the student with specific learning objectives.
Paramedical Issues	A theoretical based subject designed to provide the student with an introduction to common ethical and legal issues in the pre-hospital care environment.

The eight (8) subjects are divided into four (4) first and second semester subjects respectively. Semester GPAs (i.e. Semester 1 GPA and Semester 2 GPA) was calculated by adding up the student's raw scores obtained in each subject and then dividing by the number of subjects in which the student was enrolled. The student's average GPA for the year was calculated by adding student's Semester 1 GPA to Semester 2 and then dividing by two. GPA values ranged between 0 and 4.99 with 0 being the lowest possible score and 4.99 being the highest possible score (see Table 6 for further details). It should be noted that 1998 was the first year this vocational course was offered and as such only seven (7) subjects were completed by first year students (4 subjects in semester one and 3 subjects in semester two). The theoretical subject Paramedical Issues joined the curriculum in 1999. Hence, the GPA for that year was appropriately adjusted.

Table 6

Possible range and interpretation of GPA scores

Possible Range	Interpretation
0 – .99	Failing Grade
1 – 1.99	Passing Grade
2.00 – 2.99	Credit Grade
3.00 – 3.99	Distinction Grade
4.00 – 4.99	High Distinction Grade

Because many students had not completed all subjects at the time of data extraction, a second dependent variable was employed namely the GPA of students who completed at least one subject in the first year.

A third operationalization of academic success was also employed based on questions that arose regarding being able to predict which students would successfully complete first year and thus be eligible to proceed to second year. Therefore, a final dependent variable 'successfully completed or not' was chosen. Students were deemed to have successfully completed (passed) if they completed at least one subject in the year and their GPA was 1.00 or more. Students were classified as not successfully completed if they did not fulfil this criterion for any reason.

Procedure

Existing data was collected from 135 first year, on campus students enrolled in a pre-hospital care course. The students provided the information of interest at the time of their application to the course, and as such, there was no direct student participation in this study. Data was downloaded to SPSS (Statistical Package for Social Science) from two administrative databases located at the university.

Ethical clearance to conduct the research was sought and obtained from both the Australian rural university and Monash University's Standing Committee on Ethics in Research Involving Humans (SCERH). In order to protect student confidentiality, the retrieved data was immediately de-identified with the use of alphanumerical coding and then only the block de-identified data was used for this study.

Data Analysis

The de-identified data was downloaded to SPSS and then verified, coded and analysed with the aid of an independent statistician. Associations between the six independent variables and the dependent variables were examined using a variety of statistical regression techniques. Statistical testing involved the use of a quantitative regression system known as *CHAID*, facilitated by an Analysis of Variance (*ANOVA*) (see Statistical Definitions) and Logistic Regression.

The CHAID regression analysis was chosen because it is a reliable and valid exploratory data analysis method. It was used in this study to examine the relationship between one consistent or dependent variable, and a series of possible predictor variables, as well as to evaluate their interactions (see Kas, 1980; Breiman, Friedman, Olshen & Stone 1993; Magidson 1994; Tabachnick & Fidell, 2001; SPSS, 2002)

Logistic regression was chosen for a number of reasons. Firstly, the dependent variable was binary in nature and there was a combination of continuous and dichotomous independent variables. Secondly, logistic regression is recognised amongst several disciplines (health science and education included) as the standard method of analysis when describing the relationship between a dependent variable and several independent variables (Kuzma, 1992; Allen, 1997; Hosmer & Lemeshow, 2000). Finally, logistic regression provides a more flexible method of analysis than other regression techniques because it makes no assumptions about the distribution of the independent variables and cannot produce negatively predicted probabilities (Hosmer & Lemeshow 2000; Tabachnick & Fidell 2001).

Statistical Definitions

CHAID is an acronym for Categorical Hierarchical Automatic Interaction Detection. It has also been defined by Magidson (1994) as the Chi-squared Automatic Interaction Detector. CHAID is one of the oldest tree classification systems and is essentially a heuristic statistical method that examines relations between several predictor variables and a single outcome variable (Kas, 1980).

Apart from providing a useful method for determining the relative importance of variables in predicting an outcome, it is also helpful in determining how to categorise continuous or ordinal variables for the purpose of analysis. In addition, CHAID provides summary tree diagrams that relate the predictors to the outcome and highlight subgroups with the highest percentages. When more comprehensive information has been required, the results from the CHAID analysis have been translated into a gains table. The gains table displays cumulative results at fixed percentage points to allow ease of interpretation (Magidson, 1994; Tabachnick & Fidell, 2001).

Understanding the CHAID Algorithm

Given a set of predictors (IVs) and a dependent variable (DV), CHAID will first perform an Analysis of Variance (ANOVA) between each of the predictor variables and the outcome, and test for significance using an F-test (a statistical function used to test the significance of both single and multiple regression coefficients – see Allen, 1997). If more than one of these relations is statistically significant, CHAID will select the predictor that is most significant. If a predictor has more than two categories, CHAID compares them and collapses together those categories that show no differences (the

least significant are merged first). Thus, CHAID systematically splits the data file into subgroups (called nodes) which shows significant differences as they relate to the outcome measure. The results of this process are displayed in a tree diagram that branches out as additional splits are made (see Breiman *et al*, 1993).

Methodology Justification

A quantitative research paradigm was selected for this study for two reasons. Firstly, it is the most appropriate paradigm with which to answer the research question as the issues have been identified, are relatively simple, unambiguous and amenable to valid and reliable measurement (Bowling, 1997). Secondly, a study of short duration was warranted with a low tolerance for ambiguity (Sprinthall, 1994; Creswell, 1998).

With regard to the population's sample size, the recommended case to IV ratio is $N \geq 50 + 8m$ (where m is the number of IVs). With six IVs, a minimum of 98 cases [50 + (8 x 6) = 98 cases] is necessary to satisfy this requirement. Thus, with a sample population of 135 students, this more than fulfils the suggested requirements (Sprinthall, 1994; Tabachnick & Fidell, 2001).

Exploratory Analysis

Due to issues associated with missing data (i.e. only 55% of mature-entry students had a UAI) the decision was made to analyse the two groups separately. Separate exploratory analyses using the CHAID technique were undertaken using the traditional-entry student group (n=87), the mature-entry student group (n=48) and then the entire cohort (N=135) (with GPA as the DV). This technique afforded some insight into the capacity of students to

comprehend academic content and perform well in their assessments. In contrast, the logistic regression analysed the entire student cohort (N=135) (see third DV) using a ‘successfully completed or not criteria’. The logistic regression analysis was therefore assessing the likelihood that students would complete the first year of the course successfully. The following chapter details the results of the statistical testing.

CHAPTER THREE

RESULTS

Overview

The study's findings are presented in three sections:

- The first contains the results of the univariate and bivariate analysis.
- The second section contains results from the CHAID analysis. This analysis was conducted to determine if the selected predictors were significantly related to first year academic performance. This was measured using GPA against 2 criteria; students that completed all required first year subjects and students that completed at least one subject in the year. Traditional-entry students, mature-entry students and the entire student cohort were individually examined.
- The final section details results from the logistic regression analysis. This analysis was performed to determine if the selected variables were significantly related to whether a student would successfully complete first year.

Section One - Descriptive Statistics and Results from the Univariate & Bivariate Analysis

Descriptive statistics for each of the study variables cross-tabulated by student entry type (mature aged vs. traditional entry) are provided in Table 7. Of those who did not successfully complete first year (n = 57), 46 did not attempt to undertake all of the required subjects. Of those who did attempt all required subjects, 11 achieved a GPA of less than 1.

Table 7

Descriptive statistics for each of the study variables cross-tabulated by student entry type (mature vs. traditional)

Variable	Student Entry Type					
	Traditional (n=87)		Mature (n=48)		Total (N=135)	
	N	%	n	%	N	%
Previous Scholastic Achievement (UAI)						
None / Missing	24	28%	22	46%	46	34%
< 50	18	21%	7	15%	25	19%
50 or more	45	52%	19	40%	64	47%
Post-Secondary Education						
Yes	15	17%	26	54%	41	30%
No	72	83%	22	46%	94	70%
Previous Health-Related Experience						
Yes	29	33%	30	63%	59	44%
No	58	67%	18	38%	76	56%
Gender						
Male	37	43%	27	56%	64	47%
Female	50	57%	21	44%	71	53%
Background						
Rural	45	52%	27	56%	72	53%
Urban	42	49%	21	44%	63	47%
GPA*						
0-0.99	30	35%	9	19%	39	29%
1-1.99	43	49%	15	31%	58	43%
2.0-2.99	11	13%	19	40%	30	22%
3.0-3.99	3	3%	5	10%	8	6%
Successfully completed first year						
Yes	43	49%	34	72%	78	58%
No	44	51%	13	27%	57	42%

*For students completing at least one subject.

In total 41 students had post-secondary educational qualifications, with a higher proportion of mature-entry students having these qualifications (54%) than traditional-entry students (17%). Mature-entry students were less likely to receive a failing GPA (less than 1) (19% vs 35%) and were more likely to successfully complete first year than traditional-entry students (72% vs 49%). Overall, mature-entry students received higher grades when compared to traditional-entry students (credits 40% vs 13% and distinctions 10% vs 3%).

When the bivariate analyses were conducted and all students were included in the evaluation, it was found that UAI, post-secondary education, previous health-related experience and student entry type were significantly related to GPA (see Tables 8A & 8B for further details). For students who had completed all subjects, the only significant differences that were observed were that mature-entry students and those with post-secondary education achieved higher grades (see Table 8A). When the analyses were conducted using students who had completed at least 1 subject (see Table 8B), it was found that students with a UAI of 50 or more had significantly higher GPAs than did students without a UAI, and students with a UAI of less than 50 ($p < .05$). When the analysis was restricted to only traditional-entry students, UAI was the only variable found to be related to GPA. Again, students with a UAI of 50 or greater had significantly higher GPAs than did students with no UAI or a UAI of less than 50. When the analysis was restricted to only mature-entry students, students with a UAI of 50 or over were found to perform significantly better than students with no UAI. In addition, the mature-entry students with previous health-related experience were found to perform better than student without this predictor.

Table 8A

Relationship between individual predictor variables and grade point average (GPA) for students undertaking all first year subjects

Predictor Variable	GPA Mean (SD)		
	Traditional (n = 49)	Mature (n = 40)	Total (N = 89)
Previous Scholastic Achievement (UAI)	F = 2.57	F = 2.62	F = 2.99
None / Missing	1.31 (.49)	1.70 (.78)	1.55 (.70)
0-49	1.35 (.63)	1.75 (.89)	1.56 (.76)
50-100	1.72 (.61)	2.27 (.71)	1.91 (.69)
Post-Secondary Education	F = 0.05	F = 1.40	F = 4.08*
No	1.58 (.58)	1.78 (.65)	1.64 (.61)
Yes	1.63 (.72)	2.08 (.89)	1.95 (.85)
Previous Health-Related Experience	F = 0.25	F = 1.75	F = 3.57
No	1.55 (.61)	1.71 (.93)	1.60 (.72)
Yes	1.64 (.60)	2.07 (.72)	1.88 (.70)
Gender	F = 1.47	F = 1.13	F = 0.02
Male	1.49 (.60)	2.07 (.68)	1.76 (.69)
Female	1.70 (.60)	1.79 (.94)	1.73 (.75)
Background	F = 1.32	F = 2.68	F = 2.71
Rural	1.48 (.55)	1.79 (.77)	1.63 (.78)
Urban	1.68 (.65)	2.20 (.80)	1.88 (.75)
Student Entry Type			F = 6.02*
Traditional			1.59 (.60)
Mature			1.95 (.80)

* $p < .05$.

Table 8B

Relationship between individual predictor variables and grade point average (GPA) for students undertaking at least one first year subject

Predictor Variable	GPA Mean(SD)		
	Traditional (n = 87)	Mature (n = 48)	Total (N = 135)
Previous Scholastic Achievement (UAI)	F = 9.16*	F = 2.86	F = 8.66*
None / Missing	1.00 (.84)	1.57 (.89)	1.27 (.91)
0-49	.78 (.66)	1.58 (.92)	1.01 (.81)
50-100	1.55 (.66)	2.17 (.74)	1.73 (.74)
Post-Secondary Education	F = 2.22	F = 3.73	F = 13.82*
No	1.18 (.75)	1.55 (.76)	1.26 (.76)
Yes	1.51 (.91)	2.03 (.91)	1.84 (.93)
Previous Health-Related Experience	F = 1.28	F = 5.64*	F = 10.80*
No	1.17 (.82)	1.44 (.94)	1.23 (.86)
Yes	1.37 (.67)	2.03 (.76)	1.71 (.79)
Gender	F = 0.15	F = 0.05	F = 0.82
Male	1.28 (.83)	1.83 (.85)	1.51 (.87)
Female	1.21 (.75)	1.78 (.92)	1.37 (.84)
Background	F = 2.86	F = 0.99	F = 2.82
Rural	1.10 (.70)	1.70 (.77)	1.33 (.77)
Urban	1.38(.85)	1.95 (.99)	1.57 (.93)
Student Entry Type			F = 15.22*
Traditional			1.23 (.78)
Mature			1.81 (.87)

* $p < .05$.

Bivariate comparisons of the relationship between the independent and the pass vs. fail outcome variables (see Table 9) indicate that male, mature-entry students with a UAI of 50 or above and those with previous health-related experience were more likely to successfully complete first year.

Table 9

Relationship between individual predictor variables and the successful completion of first year

Predictor Variable	Successfully Completed First Year	
	No	Yes
	57 (42%)	78 (58%)
Previous Scholastic Achievement (UAI) *		
None / Missing	24 (52%)	22 (48%)
<50	15 (60%)	10 (40%)
>50	18 (28%)	46 (72%)
Post Secondary Education		
No	44 (47%)	50 (53%)
Yes	13 (32%)	28 (68%)
Previous Health-Related Experience *		
No	41 (54%)	35 (46%)
Yes	16 (27%)	43 (73%)
Gender *		
Male	21 (33%)	43 (67%)
Female	36 (51%)	35 (49%)
Background		
Rural	31 (43%)	41 (57%)
Urban	26 (41%)	37 (58%)
Student Entry Type *		
Traditional	44 (51%)	43 (49%)
Mature	13 (27%)	35 (73%)

* $p < .05$ (Pearson Chi-Square)

Section Two – Analysis Utilising CHAID to Predict First Year GPA

The aim of this analysis was to select the combination of variables that best predicted first year GPA. This was achieved by firstly examining students that completed all first year subjects and secondly, by examining students that completed one subject for that year.

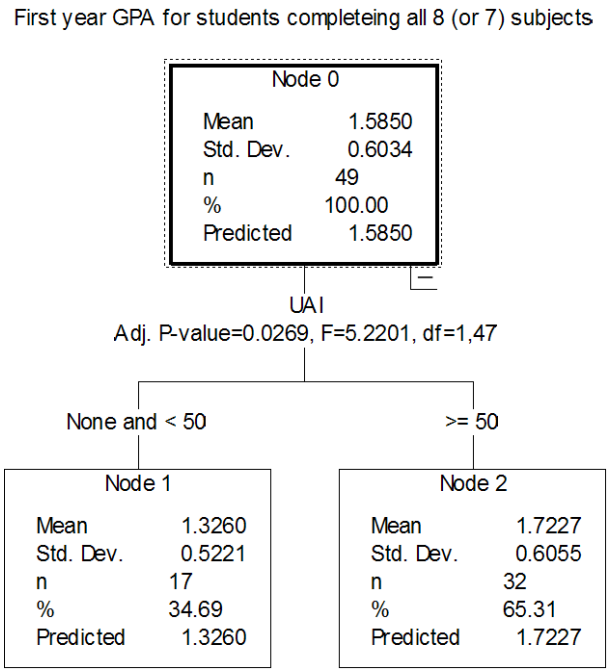
Prior to the conduction of the CHAID analysis, the data were checked for accuracy and completeness. As a result of this evaluation, it was decided to merge two categories of students; students with no UAI and students with a UAI less than 50. This occurred because the mean GPA for students without a UAI was quite similar to the mean GPA of students with a UAI of less than 50.

Traditional-entry students completing all first year subjects

The results of the traditional-entry student analysis evaluating all first year subjects taken, is presented in Figure 1. Although having a UAI of 50 or more was found to be related to GPA, results indicate that students who completed all subjects were, on average, likely to receive a passing grade.

Figure 1

Results of CHAID analysis aimed at determining which variables were related to GPA for traditional-entry students who completed all first year subjects (n=49).

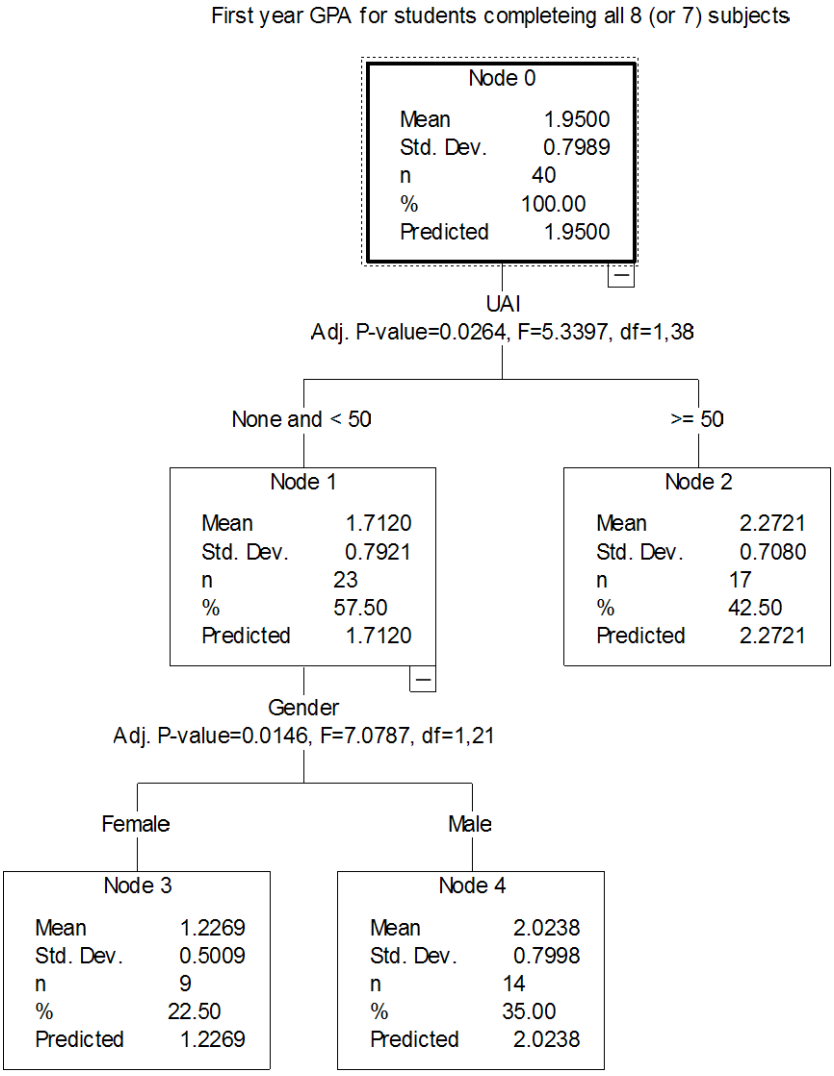


Mature-entry students completing all first year subjects

In this analysis, UAI and gender were found to be statistically significant predictors of academic performance when assessing the completion of all subjects. Students with no UAI / UAI < 50 averaged a passing grade, while those with a UAI of > 50 averaged a credit. Of the 40 students that completed all subjects, female students with no UAI / UAI < 50 were more likely to achieve a passing grade (mean GPA = 1.22). In comparison, male students with no UAI / UAI < 50 were likely to obtain a credit grade (mean GPA = 2.02). Interestingly, this credit grade was equivalent to students with a UAI > 50 (mean GPA = 2.27).

Figure 2

Results of CHAID analysis aimed at determining which variables were related to GPA for Mature-Entry Students who completed all first year subjects (n=40).

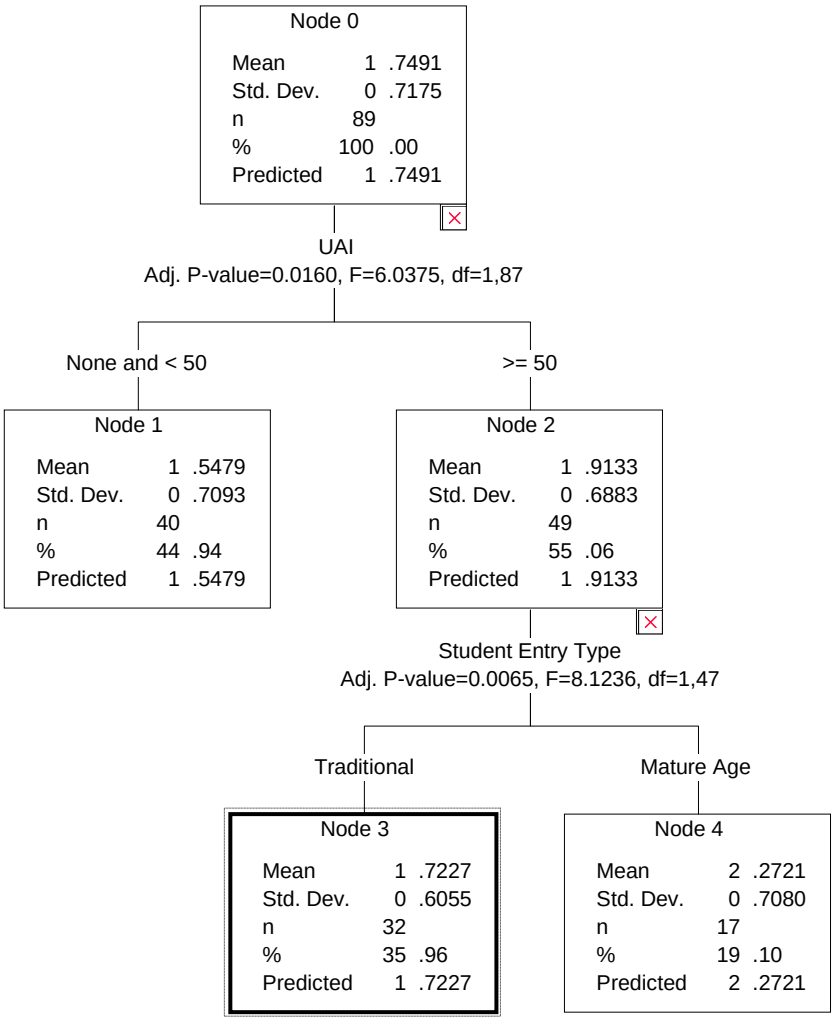


All students completing all first year subjects

The results of this analysis indicated that both UAI and Student Entry Type were found to be statistically significant predictors of first year academic performance. Students with no UAI / UAI < 50 averaged a pass grade for the year (mean GPA = 1.54). However, students with a UAI > 50 were likely to receive a high pass for the year (mean GPA = 1.91). If students had a UAI > 50 and were also mature-entry, their average grade for the year was found to be a credit (mean GPA = 2.27). In comparison, traditional-entry students with a UAI > 50 averaged only a passing grade (mean GPA = 1.72).

Figure 3

Results of CHAID analysis aimed at determining which variables were related to GPA for all students who completed all first year subjects (n=89).



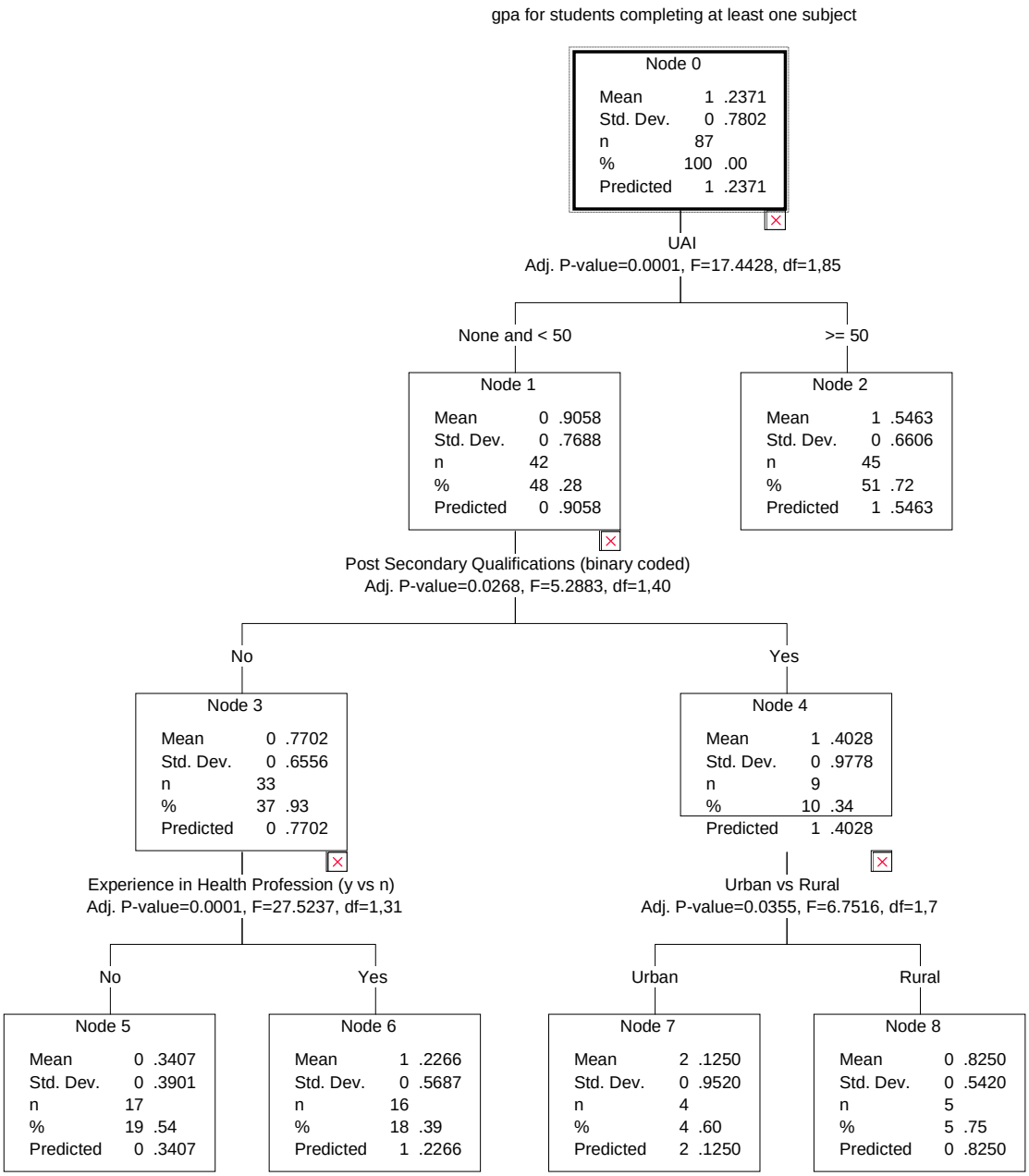
Traditional-entry students completing at least one first year subject

This analysis examined 87 traditional-entry students completing at least one subject in the year. As is presented in Figure 4, the analysis found that UAI, post-secondary educational qualifications, previous health-related experience and urban vs. rural background were statistically significant predictors of academic performance for the traditional-entry cohort.

Specifically, traditional-entry students with a UAI > 50 averaged a passing grade (mean GPA = 1.54). In comparison, traditional-entry students with no UAI / UAI < 50 received, on average, a failing grade (mean GPA = 0.90). Urban background students with no UAI / UAI < 50, but with post-secondary educational qualifications achieved a credit grade (mean GPA = 2.12). However, this relationship was not observed in students from a rural background (mean GPA = 0.82). Students with no UAI / UAI < 50, no post-secondary qualifications, but previous health-related experience on average achieved a passing grade (mean GPA = 1.22).

Figure 4

Traditional-entry students completing at least one subject in the year to predict GPA



Mature-entry students completing at least one first year subject

As is displayed in Figure 5, UAI, previous health-related experience and background were all found to be statistically significant indicators of academic performance for mature-entry students completing at least one subject in the year (n = 48).

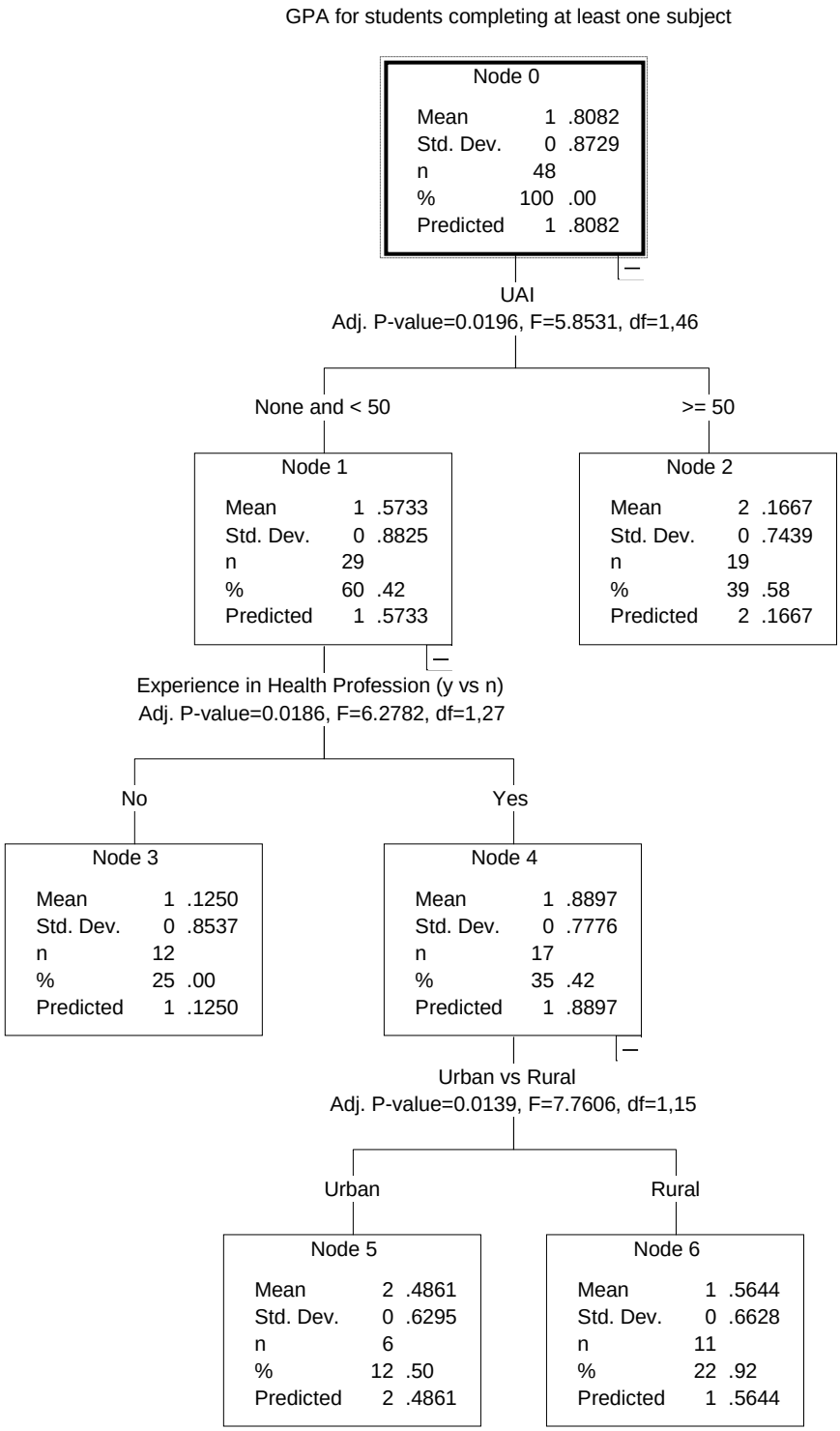
Specifically, students with a UAI > 50 were more likely to achieve a credit average (mean GPA = 2.16). However, mature-entry students with no UAI / UAI < 50 were still likely to pass the first year at university (mean GPA = 1.57).

Mature-entry students with no UAI / UAI < 50 and previous health-related experience averaged a high pass, whereas the same students without previous health-related experience averaged a low pass.

Interestingly, mature-entry students from an urban background with no UAI / UAI < 50 who possessed previous health-related experience were more likely to receive a credit average (mean GPA = 2.48) for the year. In contrast, mature–entry students from a rural background with previous health-related experience were only likely to obtain a passing grade for the year (mean GPA = 1.56).

Figure 5

Mature-entry students completing at least one subject in the year to predict GPA



All students completing at least one first year subject

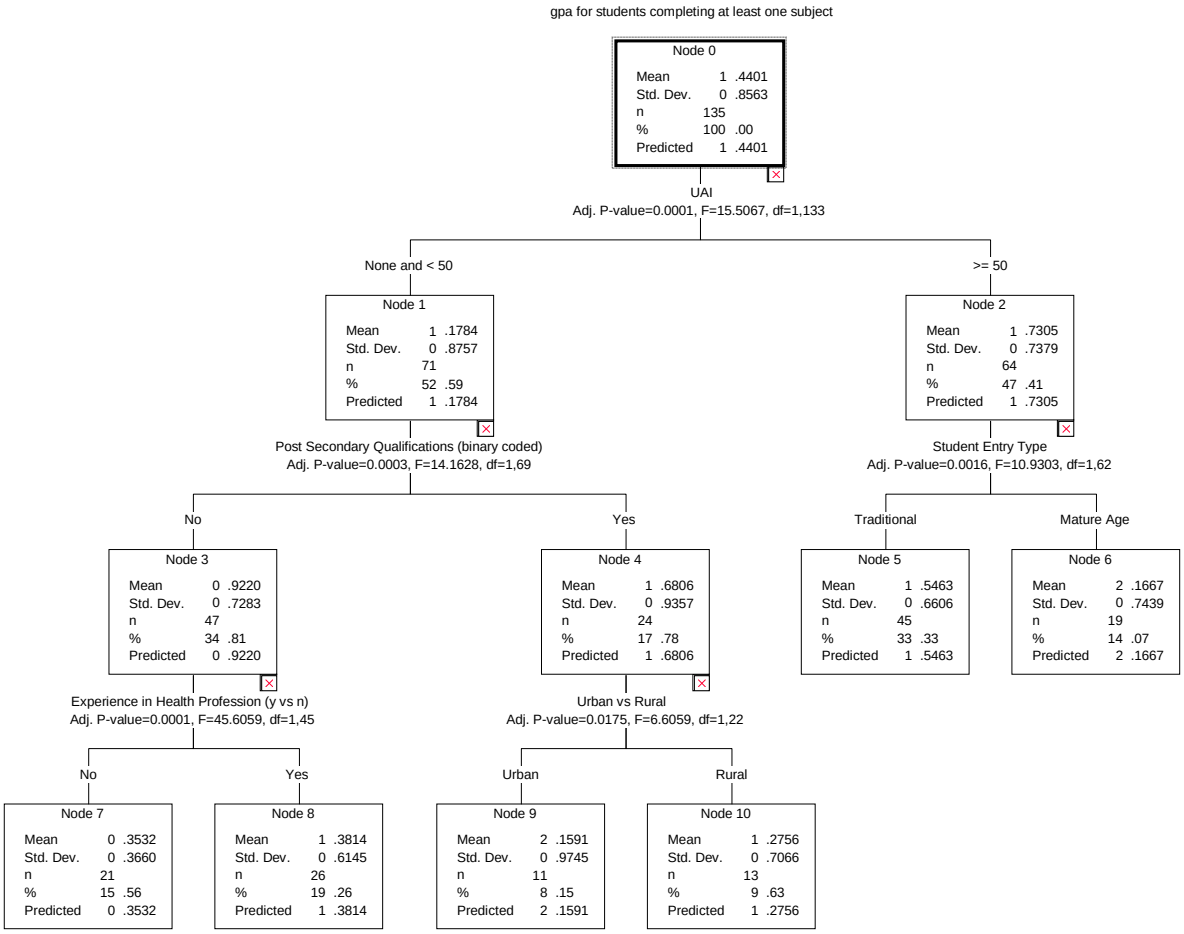
This analysis examined the entire student cohort (N=135) completing at least one subject in the year in order to predict GPA. As is displayed in Figure 6, the predictors of UAI, post-secondary educational qualifications, student entry type, previous health-related experience and background were all found to be statistically significant indicators of academic performance.

The evaluation found that students who had a UAI > 50 averaged a high passing grade (mean GPA = 1.73); however students whose UAI was < 50 averaged a low pass (mean GPA = 1.18). Mature-entry students with a UAI > 50 averaged a credit grade (mean GPA = 2.16). In comparison, traditional-entry students with a UAI > 50 only averaged a passing grade for the year (mean GPA = 1.54).

Students with no UAI / UAI < 50, previous health-related experience and from an urban background averaged a credit grade (mean GPA = 2.16), whereas similarly qualified students from a rural background on average achieved a passing grade (mean GPA = 1.28). Students with no UAI / UAI < 50, no post-secondary qualifications but possessed previous health-related experience averaged a passing grade (mean GPA = 1.38). If students had no UAI / UAI < 50, no post-secondary qualifications and no previous health-related experience they averaged a failing grade (mean GPA = 0.35).

Figure 6

Results of CHAID analysis aimed at determining which variables were related to GPA for students who competed at least one first year subject (n=135)



Section Three - Predicting Successful Completion of First Year

The aim of this analysis was to determine if successful completion of first year could be predicted using the selected variables. The data set was the same as that used in the earlier analysis. Since student-entry type, background and gender were dichotomous variables; the categories did not need to be collapsed. UAI was analysed using 4 categories: none, 30-49, 50-69, and 70-100. As was the case with the CHAID analyses, previous health-related experience and post-secondary educational qualifications were dichotomised.

The results from the regression analysis indicated that the model classified students as successfully completed or not significantly better than could be achieved by chance (χ^2 (8) = 38.73, p<0.001). The analysis indicated that UAI, previous health-related experience and gender all related to the successful completion of first year (see Table 10).

The strength of the effect can be gauged by the *'odds'* column, which presents the ratio of the likelihood that students in one group will pass the first year and the likelihood that other students will pass. It should be noted that the 95% confidence interval for the UAI variable between 70 and 100 has a large range because there were only three students in this group. Hence, the estimates of the 'odds' category is likely to be unstable.

Table 10

Results of Logistic Regression Analysis

Effect	Beta	SE	Sig.	Odds	95% CI Lower	95% CI Upper
Female vs. Male	-.917	.443	.038	.396	.166	.954
Mature vs. Traditional	.557	.491	.257	1.745	.6634	4.596
Urban vs. Rural	-.145	.414	.721	.861	.3812	1.945
Qualifications vs. None	.452	.511	.375	1.471	.572	4.307
Health Experience vs. None	1.181	.453	.008	3.167	1.335	7.987
UAI						
30-49 vs None	-.025	.5426	.954	.969	.331	2.830
50-69 vs None	1.565	.568	.006	4.706	1.562	14.759
70-100 vs None	3.154	.752	.000	22.571	5.362	103.03
Constant	-.554	.560	.322	.572		

The results of the logistic regression resemble those obtained with the CHAID analysis. Both previous health-related experience and UAI were found to be significant predictors of first year academic performance.

- Students with previous health-related experience are 3.2 times more likely to pass first year than students without previous health-related experience.
- Students with a UAI between 30 and 49 are no more likely to successfully complete first year than those students who did not have a UAI.

- However, students with a UAI between 50 and 69 are 4.7 times more likely to pass first year than students without a UAI.
- Students with a UAI over 70 are 22.5 times more likely to pass first year than students without a UAI.
- Female students were less likely to pass than males.

There were also several notable differences found between these two analyses which will be discussed in the next section. Further, the following chapter will discuss the study's findings and make relevant observations and recommendations.

CHAPTER FOUR

DISCUSSION

Overview

The following is a discussion of the research findings. Firstly, a short summary of the study's results in relation to the posed research question is advanced. Then, a comparison of the current findings with relevant available research is undertaken. The limitations of the research are then reported. Finally, the advancement this research has made to the tertiary sector and the pre-hospital care industry is discussed, citing several relevant applications for the study's findings and affirming the need for further research in this area.

The Findings in Relation to the Posed Research Question

The aim of this study was to answer the posed research question and in doing so, increase the limited body of available pre-hospital care research and knowledge. The research sought to discover if previously identified factors relating to academic performance, could be used to predict first year academic success for students undertaking a newly developed, and vocationally orientated, pre-hospital care course, delivered in a rural setting. And, if this was the case, could this information be used to develop appropriate student selection criteria.

The study utilised six previously identified predictors well supported in the literature namely; previous scholastic achievement, post-secondary educational qualifications, student entry type (traditional or mature aged), previous health-related experience, gender and background (rural or urban

based). These predictors were compared against three markers of academic performance coded as dependent variables. The first dependent variable assessed academic performance (GPA) of students who completed all required first year subjects. The second dependent variable assessed the student's GPA based on the completion of at least one subject in the first year. The final dependent variable assessed the student's ability to successfully complete first year, utilising academic results over two semesters.

Predicting GPA

Traditional-Entry Students

The results of the CHAID analysis examining traditional-entry students completing all required subjects in the year found that UAI was a significant predictor of academic performance. When assessing the traditional-entry students who completed at least one first year subject, the analysis again found that UAI was a significant indicator of academic performance. In addition, results indicated that previous health-related experience, post-secondary educational qualifications and urban vs. rural background were also significant predictors of academic performance.

Mature-Entry Students

The results of the CHAID analysis examining mature-entry students who had completed all required first year subjects found both UAI and gender to be significantly related to academic performance. When examining mature-entry students who had completed at least one subject in the academic year, UAI, previous health-related experience and background were found to be statistically significant predictors.

Entire Cohort

When analysing the entire cohort over the academic year who completed all first year subjects, both UAI and Student Entry Type were found to be statistically significant indicators of academic performance. When assessing the entire cohort who completed of at least one subject in the year, UAI, post-secondary educational qualifications, student entry type, previous health-related experience and background were all found to be significant indicators of academic performance.

Successfully Complete First year

The results of the third analysis (successfully complete first year) were not entirely consistent with analysis of GPA. UAI, previous health-related experience, and gender were similarly found to be significant predictors of first year completion; however, post-secondary educational qualifications were not. The variance in the finding is to be expected as these analyses addressed conceptually different issues. The analyses of GPA afforded some insight into the capacity of students to comprehend the content and perform well in their assessments. In contrast, the logistic regression examines the likelihood that students will complete the first year of the course successfully.

Findings in Relation to Relevant Available Research

Previous Scholastic Achievement

Previous scholastic achievement was chosen as a predictor because it was found to be the most reliable pre-entry predictor of academic performance at college or university for first year students in the review of the literature (see Chapter One). Similar findings were noted in this study, with UAI found to be a

significant indicator of academic performance for first year students. With regard to academic performance, the study consistently found that students with a UAI of 50 or more had significantly higher GPAs than students with no UAI or a UAI less than 50.

The study's findings indicated that when combining a number of indicator variables, including UAI > 50, prediction of first year academic performance increased. Specifically, students that had a UAI >50 and were mature-entry received a high credit for the academic year, whereas traditional-entry students with a UAI > 50 would only receive a passing grade for the academic year. The literature review reported similar findings using multivariate predictors stating that these predictors were stronger indicators of academic performance than single predictors (see Eaton, 1979; Ting & Robinson, 1998; Petrie & Stoever 1997).

It is interesting to note Harackiewicz *et al* (2002) in their studies of the career progression of American university students. The researchers followed the academic progression of students from enrolment to graduation, postulating that the predictive powers of previous scholastic achievement extended across all three / four years of university. Thus students with satisfactory UAIs could theoretically complete university as previous scholastic achievement was seen to be a sound indicator of both short and long term achievement. For the purposes of this study, it would have been interesting to follow the students' academic progression throughout all three years of the course and further test Harackiewicz *et al's* research findings and the reliability of previous scholastic achievement.

Previous Health-Related Experience

The review of the literature found that previous health-related experience was a reliable predictor of first year academic performance when students were enrolled in relevant courses or possessed related experience (see McCauley, 1985; Hood, 1992; Ting, 1997; Ting & Robinson, 1998; Griffith *et al* 1995; Rohde & Kavanagh, 1996). The current study found that not only was previous health-related experience a reliable indicator, but it was also a significant indicator of first year academic performance when assessing traditional-entry students, mature-entry students and the entire student cohort.

Interestingly, the literature review cited some American universities finding success in using previous health-related experience, in conjunction with previous scholastic achievement, in selecting their entering first year cohort (see McCauley, 1985; Ting 1997; Ting & Robinson, 1998). Such has been the experience of this study with both previous scholastic achievement and previous health-related experience being identified as significant predictors of first year academic performance. Therefore, it would appear to be a useful inclusion when developing student selection criteria for this and other relevant courses.

Post-Secondary Education Qualifications

Post-secondary educational qualifications is another reliable predictor of academic performance well reported in the literature. Dobson *et al* (1996), Power, Robertson & Baker (1987) and Parameswaran, (1991) found that students with this predictor demonstrated higher levels of academic performance in their first year than students admitted on any other basis (including students with high UAIs). This study's findings found mixed results.

The current study found that the predictor of post-secondary educational qualifications was only significant when examining the entire student cohort and the traditional-entry students group who had completed at least one subject in the year. It is important to note that in the study, traditional-entry students were deemed to have post-secondary educational qualifications if they possessed TAFE qualifications, accredited certificates or bridging courses, diplomas or degrees.

In the entire student cohort evaluation, students that had no UAI / UAI < 50 would fail first year if they did not possess post-secondary educational qualifications or previous health-related experience. Further, in the traditional-entry student group, the predictability rate of first year academic performance increased from a passing grade to a credit grade when students possessed both post-secondary educational qualifications and an urban background.

Traditional-Entry and Mature-Entry Students

The literature review identified several studies comparing the academic performance of both traditional-entry and mature-entry students at university (Marshall & Nicholson, 1991; Malloy & Carrol, 1992; Hartley, Trueman & Lapping, 1993; Richardson, 1994a & 1994b; Trueman & Hartley, 1996; McKenzie & Schweitzer, 2001). The findings indicated that there was no significant correlation between student entry type and overall academic performance when student entry type was used as a single predictor. These research findings were not replicated in this study.

This study's analyses indicated that mature-entry students were more likely to pass first year and achieve higher GPAs than the traditional-entry

students. The study found 50% of mature-entry students received a grade of credit or higher, 31% received a passing grade and 19% were unsuccessful in their first year (n=48). In comparison, only 16% of traditional-entry students received a grade of credit or higher, 49% received a passing grade and 35% were unsuccessful in their first year (n=87) (See Table 7).

When assessing first year students completing subjects using multiple predictors, mature-entry students with a UAI > 50 were more likely to receive credit grades (mean GPA = 2.27) than were traditional-entry students with the same UAI (mean GPA = 1.72). A similar trend was also found when assessing the entire student cohort, with mature-entry students consistently outscoring traditional-entry students with similar UAIs. An explanation for this difference may be found in the anecdotal observation that mature-entry students appeared to be better disciplined in relation to university study; more study orientated and readily sought academic assistance when compared to the traditional-entry group. However, further research is necessary to test this personal, anecdotal theory.

Gender

The literature review found that there was no significant correlation between student gender and overall academic performance, where gender was used as a single predictor (Stricker, Lawrence & Rock, 1996; Jenkins, 1998; McKenzie & Schweitzer, 2001). Similar results were also found in this study.

However, when a combination of indicators was used to predict the GPA of mature-entry students who completed all subjects, it was found that female students with no UAI or UAI < 50 were likely to receive a passing

grade for the year (mean GPA = 1.22). In comparison, similar male students achieved a credit average for the year (mean GPA = 2.02).

Additionally, the study found that female students were one third less likely to complete first year when compared to male students. Statistically 67% of male students successfully completed first year in comparison to only 49% of female students. When a combination of predictor variables were included, the most likely student to successfully complete first year was a male, with a UAI of greater than 50, who had previous health-related experience.

Interestingly, an analysis of the average grades for female students revealed that they are academically capable of successfully completing first year, particularly when the success rates of female students with a UAI over 50 were reviewed. Therefore, it seems apparent that these female students are unsuccessful in the first year of the course for non-academic reasons. This finding warrants further research in order to identify the factors responsible for this occurrence so that they might be satisfactorily addressed.

Background (Rural or Urban)

The current study did not support the research of Edlington & Koehler (1987) nor the anecdotal evidence amongst lecturing academics in the vocational degree that suggested that a rural background maybe a reliable predictor of first year academic performance.

Of the 135 first year students analysed in the study, 72 came from a rural background and 63 from an urban background. The study found no correlation between background and first year academic performance when background was used as a single predictor. However, when background was used in combination with UAI / previous health-related experience and UAI /

post-secondary educational qualifications, the results were significant with urban students receiving higher grades than rural students.

When the analysis was conduced with traditional-entry students who had completed at least one subject, it was found that students with a UAI of < 50 on average failed; however, if the student was from an urban background and had post-secondary qualifications they generally achieved a passing grade. When mature-entry students who completed at least one subject were analysed, the results indicated that students from an urban background who possessed previous health-related experience achieved a credit average for the year (mean GPA = 2.48). In comparison, similar students from a rural background only achieved a passing grade for the year (mean GPA = 1.56). When examining the entire cohort completing at least one subject, an urban background was again found to be significant with students who did not possess a UAI or UAI <50 and who had post-secondary educational qualifications. These students averaged a credit grade for the year (mean GPA = 2.15). In comparison, students from a rural background who also possessed post-secondary educational qualifications averaged a pass grade for the year (mean GPA = 1.27).

Limitations of the Study

The findings of this study need to be interpreted in light of the methodology used. As such, the study has two main limitations. The first relates to incomplete or missing data. Initially, the study planned to have only one dependent variable to assess first year academic performance over two semesters. GPA was selected because of its strong support in the literature. However, early in the analysis it became clear that 27 students were not

assigned a GPA in the second semester because of non enrolments, withdrawals and leave of absences. Because of these findings, a comprehensive analysis utilising all students in both semesters could not be performed. However, this limitation was partially overcome by using three (3) dependent variables. The first assessed students that completed all required first year subjects. The second assessed students that completed at least one subject in the year. The third assessed the entire student cohort (N=135) using the criteria of 'successfully completed first year or not'.

The second limitation relates to the interpretations of the findings of this research. Although the study's findings are significant and important for the tertiary sector and the pre-hospital care industry, the research only involved a small cohort of first year students at one Australian university. Currently, there are several National and international universities that have similar pre-hospital care programs. Accordingly, it would be advantageous if this study was replicated to ensure consistency and reliability of its findings.

Advancement in Knowledge and Application of Findings

Currently admission officers, committee members, and course co-ordinators in the vocational / allied health care tertiary sector are faced with selecting a limited number of students from large pools of potential applicants. It is hoped that their selections will result in students with satisfactory retention rates and good outcomes (see Sadler & Hammerman, 1999). Similarly, the pre-hospital care industry has specific recruitment, selection and training requirements. Applicants applying though the general, graduate or overseas entry do so from a variety of different age groups, experiences and backgrounds. In each case, the selection, recruitment and retention of staff is a time consuming and

expensive activity that can result in poor outcomes. The findings of this study can assist both the tertiary sector and the pre-hospital care industry with this process and help maximise positive outcomes.

Since significant predictors of first year performance have been identified, these can be used to develop an appropriate student selection tool that will assist in the effective selection of pre-hospital care students. Table 11 details such a working template. This tool has the potential to not only maximise the effectiveness of course recruitment and outcome as it relates to pre-hospital care education, as well as assist non compliant students, but it may also aid in the selection and retention of students into other similar vocational allied health courses. While the generalizability of the current findings to other vocational allied health care courses is something that requires further investigation, the current findings have the potential to be applicable to other courses based on their consistency with the literature. Although it is likely that other specific criteria relevant to individual courses / industry will need to be included, the template provides a starting point based on the key findings of the current study.

Table 11

Selection tool showing admissions guidance for entry into relevant tertiary studies or the pre-hospital care industry

Entry Requirements for:

- Pre-Hospital Care Undergraduate Degree Courses
- Vocational Allied Health Care Courses
- Ambulance Service Admittance (Direct, Graduate or Overseas Entry)

Admissions Guidance:

Minimum Requirements for Traditional-Entry Students (17-20 years)

NSW HSC (or recognised equivalent) with UAI scores greater than 50

If no UAI or UAI < 50 student will likely perform better if they have post-secondary educational qualifications

If no UAI or UAI < 50 and *no* post-secondary qualifications, student should perform better if they have previous health-related experience, particularly if they are from an urban background

Minimum Requirements for Mature-Entry Students (20+ years)

Mature-entry students will likely pass and complete first year, however they will generally perform better if they have a UAI of > 50 and / or previous health-related experience.

As can be seen, the selection tool encompassed the most significant predictors of academic performance in this study. The gender variable was not included in the selection tool because it was not consistently identified as a predictor throughout the study. When this variable was identified as a predictor, it was identified at the second or third level of the analysis. Further, this predictor did not do well at consistently differentiating between those students who would pass first year and those who students who would fail first year.

Inability to Meet Selection Criteria

The selection tool provides potential students with clear and established guidelines with which to make informed decisions about their suitability for a particular course or industry choice. However, the question needs to be asked about the potentially weaker students who do not meet the selection criterion. Many universities offer short courses to students who do not meet some of the entry criteria. These so called 'Gate Way' courses are designed to facilitate entry into the university by providing a bridging course that concentrates on the necessary academic or vocational skills required at this tertiary level.

Students that do not meet the academic prerequisites could be referred to such educational institutions as TAFE to complete the necessary requirements (HSC studies, Medical Terminology, Senior First Aid etc). Students that do not meet the vocational requirements (previous health- related experience) could be referred to health related providers in their local community for 12-24 months of related experience (area health services, community hospitals, Red Cross Association, St John Association Australia etc.).

The selection tool therefore provides an effective, efficient and fair method of selecting students, as well as providing alternative solutions for less compliant students.

Further Research

Although this study's findings can greatly assist the tertiary sector and the pre-hospital care industry, more investigations are necessary to continue to grow this young research environment and decrease the vocational 'gap' in the available literature. As pre hospital care is embryonic in Australia, any research in this field is desirable; however there is insufficient data from this study to suggest that it is generalisable to other pre-hospital care courses in either the rural or urban settings. Therefore, proposed suggestions for further quantitative and / or qualitative research previously advanced in this discussion chapter include:

- Studies investigating the reliability of previous scholastic achievement from enrolment to graduation;
- Studies testing the findings that mature-entry students attain higher grades than traditional-entry students in the first year of university;
- Studies investigating the non-academic reasons why one third of first year female students were unsuccessful at university;
- Replication studies to test the findings of this Australian pre-hospital care study.

Additionally, several other research questions arose out of the findings of this study and warrant further investigation:

- Could other variables make prediction more accurate? Further replication studies or a desk top analysis could potentially identify other variables (i.e. academic & non academic) that lead to a greater prediction rate of first year students.
- Does first year success relate to vocational success? Follow up studies comparing the first year of university with the first year of vocational employment could provide an answer to this research question.
- How reliable are university based student selection criterion? Qualitative studies involving university and / or pre-hospital care industry providers could help address this interesting research question.
- Given the different academic and intellectual requirements of the various subjects in first year, does GPA show differing relevance for individual subjects?
- Can public or private schooling be used as another predictor of academic performance for first year university students? Anecdotal evidence provided by lecturing academics in this course suggests that privately schooled students may have several advantages over their public schooled cohorts.

Conclusion

This study has shown that academic performance of first year students in the pre hospital care discipline can be predicted given the appropriate selection variables. Further, that the generated ‘Student Selection Tool’ has potential application not only to the pre hospital care arena, but to other courses in the

allied health care field, given its consistency in the literature. Prospective students can now have access to clear and established entry requirements into these health care disciplines as a direct result of this study. In addition, an alternative pathway can be provided for those students who are yet to meet the specific entry requirements.

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