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Predictors of associate degree nursing program completion

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PREDICTORS OF ASSOCIATE DEGREE NURSING
PROGRAM COMPLETION

A Thesis

Presented to

The Faculty of the Department of Psychology

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Science

by

Rajinder S. Samra

May 2006

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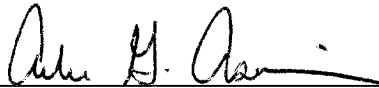
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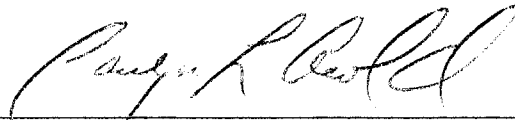
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ABSTRACT

PREDICTORS OF ASSOCIATE DEGREE NURSING PROGRAM COMPLETION

by Rajinder S. Samra

This study examined the relationship between demographic and preprogram academic variables and the completion of the Associate Degree Nursing (ADN) program at a California community college. The sample consisted of 191 students who entered an ADN program between 1996 and 2002. Results of the study indicated that each of the following preprogram academic variables were related to finishing the ADN program: a high college grade point average, a high core science grade point average (comprised of grades in Anatomy, Microbiology, and Physiology), none or a few repetitions in core science courses, and a high grade in an introductory college-level English course. Furthermore, it was found that a logistic regression model containing the above preprogram academic variables accurately predicted ADN program completion. In addition, individuals whose primary language was English, older individuals, and Caucasians were associated with completion of the ADN program. Implications of the study are discussed.

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Introduction

California, like most of the nation, is facing a severe nursing shortage. In 2000, there were about 184,300 licensed registered nurses (RNs) employed in California, which resulted in only 542 RNs per 100,000 population in the State. This is considerably fewer than the national rate of 780 (US Department of Health and Human Services, 2004). Moreover, California ranks near the bottom at 49th among the states in RNs per capita. To compound the problem, a report issued by the California Workforce Initiative estimated that as many as 77,000 additional nurses will be needed in California by 2020 (Coffman et al., 2001).

The consequences of the nursing shortage are detrimental to the health and safety of patients. A study by the Institute of Medicine found that the surroundings in which nurses are employed are breeding grounds for medical errors, which will continue to threaten patient safety until substantially reformed. The study found increased infections, bleeding, and cardiac and respiratory failure associated with inadequate nurse staffing (Institute of Medicine, 2003). Moreover, the Joint Commission on Accreditation of Healthcare Organizations reported that the short supply of nurses contribute to nearly a quarter of the unexpected problems that result in death or injury to hospital patients (Joint Commission on Accreditation of Healthcare Organization, 2002). In addition, the nursing shortage is taking a huge financial bite as preventable medical errors cost the US an estimated \$17 to \$29 billion annually (Institute of Medicine, 2003).

The primary purposes of the current study are to assess which variables are associated with Associate Degree Nursing (ADN) program completion and determine the

set of preprogram academic variables that most accurately predicts completion of the ADN program.

Reasons for the Nursing Shortage

A number of reasons have been cited for the nursing shortage in California: a growing and aging population whose needs for medical attention is increasing, an older registered nurse workforce whom will retire in the near future, a complex managed care environment that limits spending on nursing care, poor working conditions, and anticipated changes in California State law that will require lower patient/nurse ratios (Seago & Spetz, 2003).

A major contributing factor cited by health professionals for the shortage of nurses is the relatively high rates of attrition among nursing programs. Attrition is frequently defined as “departure from a nursing program without successful completion of the program (Seago & Spetz, 2003). Attrition rates in some community college nursing programs have been reported as high as 50 percent and were attributed primarily to the admission of minimally qualified students (Leovy, 1999 & Comins, 2000).

What is an Associate Degree Nursing Program?

The Associate Degree Nursing program prepares graduates to become members of the nursing profession. Associate Degree Nursing (ADN) programs are offered at community and junior colleges and take between two to three years to complete. In 2004, there were 846 RN programs that awarded associate degrees (US Department of Statistics, Bureau of Labor Statistics). After completion of the two-year program,

graduates are eligible to take the National Council Licensing Examination for Registered Nursing (NCLEX-RN).

The present research was conducted at a two-year nursing program approved by the California Board of Registered Nursing. According to the community college's catalog, the ADN program "prepares graduates who can contribute to the advancement of nursing science and influence changes in a variety of settings within the health care system. The graduate possesses a repertoire of knowledge, skills, and attributes that serve as the foundation for safe, competent practice and lifelong learning."

The ADN program requires the completion of 52 units of nursing courses. During the first year, students complete major coursework in fundamentals of nursing practice and nursing care of the childbearing family and minor coursework in clinical nutrition and pharmacological basis of therapeutics. Major coursework in the second year includes issues in adult health and pathophysiology and minor coursework in intravenous therapy and physical assessment.

Factors that Affect Student Success in Higher Education

The main factors that are likely to affect student success in higher education can be placed into three general categories: situational, institutional, and dispositional factors. Situational factors are those arising from one's circumstances in life at a given time and are considered to be out of one's control to a certain degree. Situational factors may include family needs such as child care, changes in job responsibilities or work schedules, transportation difficulties, relocating, or medical problems. In addition,

money problems and lack of material resources is often cited as a challenge for many community college students (Cross, 1981).

Institutional factors consist of institutional practices and procedures that may affect participation in educational activities. Institutional factors can include pre-admission program requirements, inconvenient class schedules, amount of time required to complete program of study, and requirement of a minimum number of units (Cross, 1981).

Situational and institutional factors have been demonstrated to affect student success in higher education. However, these factors were not examined in the current study because data on situational and institutional factors were not available. Furthermore, institutional factors that may affect student success are typically studied by making comparisons between colleges, and the current study was conducted at only one college.

Dispositional variables are those that originate from the behaviors, attitudes, self-perceptions, personality, and abilities of the student (Cross, 1981), which includes performance in courses and tests.

Literature Review of Dispositional Variables

Citing national and local attrition concerns, a study by Bello and associates (1977) researched factors associated with nursing student success. Nursing student success was defined as completing the nursing program and passing the Connecticut State Board Test Pool Examination for Registered Nurse Licensure (State Board Exam). The study

collected data from 358 community college students who entered the ADN program from 1969 to 1974.

The dispositional data was comprised of academic variables of high school rank, and high school grades in algebra, biology, and chemistry grades; college grades in anatomy, physiology, microbiology, and nursing courses; assessment scores in English, reading, and math; and the non-academic dispositional variable of age.

The results of the study showed a strong relationship between academic dispositional variables and composite score on the State Board Exam. Higher grades in science courses were associated with an increased likelihood of passing the State Board Exam, as shown by the following correlations between science course grades and State Board Exam composite score: Physiology I ($r=.51, p<.05$), Anatomy and Physiology II ($r=.41, p<.05$), and Anatomy and Microbiology ($r=.33, p<.05$). Furthermore, the probability of succeeding on the State Board Exam increased for each subsequent science course that was passed. Students who passed Anatomy and Physiology had a 77 percent likelihood of succeeding on the State Board Exam. Students who passed Anatomy, Physiology, and Microbiology had a 90 percent chance of succeeding on the State Board Exam.

The study also found that variables with the greatest explanatory power were dispositional. Dispositional variables used in the final explanatory model were age, reading assessment test scores, and grades in high school algebra. The study found that students who were older than 20 had a 68 percent success rate compared to a success rate of 43 percent for those under 21. Following age, reading comprehension and sentence

assessment scores were the most important factor with a success rate for the higher scoring group ranging from 34 percent to 75 percent. High school algebra grades were important indicators of success for those under 21; the success rate for the higher algebra grade group ranged from 29 percent to 71 percent.

Bello and associates (1977) concluded that Connecticut community colleges could improve retention, graduation, and success on the state board exams by increasing the minimum grade required in college science courses to at least a “C” in order to remain eligible for the nursing program, and implement a minimum skill levels in reading and mathematics.

In 1995, Spahr conducted a study that examined the relationship between graduating from an ADN program and academic dispositional variables of entering college GPA, grades in algebra, biology, and chemistry. The sample consisted of 255 community college students in Illinois who were admitted to an ADN program between 1990 and 1992. The study found that graduating was correlated highest with entering college GPA ($r = .29, p < .01$), followed by biology grade ($r = .22, p < .01$) and chemistry grade ($r = .19, p < .01$). Thus, students with higher entering college GPAs, higher biology grades, and higher chemistry grades had more likelihood of graduating than students who did not have as high GPAs or grades in those subjects. In addition, the study concluded that after college GPA at admission was entered in a predictive model, a student’s performance in algebra, biology, and chemistry did not add predictive power.

A study conducted by Yin and Burger (2001) examined variables identifiable at admissions to an ADN program to success on the National Council Licensure

Examination for Registered Nurses (NCLEX-RN). The sample consisted of 325 Midwestern students who graduated between 1997 and 2001. Ninety-four percent of the sample was Caucasian. The academic dispositional variables were high school GPA, high school rank, ACT composite score, college GPA at admission, number of credit hours earned prior to entering nursing program; grades in English, introductory psychology, anatomy, physiology, chemistry, and microbiology; and GPA at graduation. The non-academic dispositional variables tested were age, gender and race-ethnicity.

The study found that academic dispositional variables were associated with success on the NCLEX-RN. Students who passed the NCLEX-RN had higher college GPA prior to admission [(3.20 versus 2.99), $t(325)=2.30$, $p<.05$], higher grade in psychology [(3.11 versus 2.69), $t(325)=3.09$, $p<.01$], and higher science GPA (anatomy, physiology, chemistry, and microbiology) [(3.11 versus 2.85), $t(325)=2.45$, $p<.05$,] than those who did not pass. In addition, a number of logistic regression models were run to find the best set of variables that predicted success on the NCLEX-RN exam. The results indicated that a model containing two academic dispositional variables—college GPA prior to admission and high school rank—significantly predicted success on the NCLEX-RN exam. Thus, the higher one's pre-admission college GPA and high school rank, the more likely he or she was to succeed on the NCLEX-RN exam.

Dean and Fischer (1992) conducted a study at Saint Petersburg Junior College in Florida to identify the minimum qualifications necessary for entering students to succeed in their ADN program. Success was define as completing the nursing program in four semesters and passing the Florida Licensing Examination for Registered Nurses (State

Licensing Exam) on the first attempt. The sample contained 424 nursing students who began the nursing program between 1988 and 1989. Eighty-nine percent of the sample was Caucasian. The academic dispositional variables examined were GPA at admission, reading and math placement scores; grades in introductory college math, Basic English, and science courses (Anatomy, Physiology, & Microbiology); and GPAs for selected courses.

The results indicated that the academic dispositional predictors of successful program completion included a grade in Human Anatomy and Physiology II great than or equal to a B, and a GPA in general education science courses greater than 2.60 [$R^2 = .27$, $F(2, 419) = 8.27$, $p < .01$]. In addition, pre-admission predictors for success on the State Licensing Exam included assessment reading scores great than 38, and final grade in Microbiology Lab course of B or better and/or a GPA in general education science course greater than 2.60 [$R^2 = .17$, $F(2, 422) = 6.71$, $p < .05$]. Thus, grades in science courses and English skills, as measured by the reading assessment scores, were demonstrated to predict program completion or success on the State Licensing Exam.

A study was conducted by Carlson (1967) at San Bernardino Valley College's two-year registered nursing program in order to identify variables that predicted scores on California State Board Exams. The sample included 81 students who entered the nursing program between 1963 and 1965. Academic dispositional variables included scores on verbal and quantitative assessment scores, high school grades, grades in pre-nursing courses, and number of semesters of college prior to admission, and the non-academic dispositional variable of age.

An analysis of the results revealed that students' State board exam scores on obstetrics, nursing of children, psychiatric, medical, and surgical correlated low to moderately with the academic dispositional variables of verbal assessment ($r=.31$ to $.52$, $p<.05$), pre-nursing GPA ($r=.29$ to $.42$, $p<.05$), and high school chemistry ($r=.19$ to $.31$, $p<.05$) and the non-academic dispositional variable of age ($r=.22$ to $.44$, $p<.05$). In addition, a regression analysis of dispositional variables of verbal assessment scores, pre-nursing GPA, age, and high school chemistry grades on State board scores accounted for 33 percent of the variance. Verbal assessment scores accounted for most of the variance at 12.4 percent, followed by pre-nursing GPA (7.9%), age (7.5%), and high school chemistry grades (4.8%).

Due to the concern of high attrition rates and the need to select students who would most likely succeed in their nursing program, Donsky and Judge (1981) conducted a study of 251 former students at Lakeland Community College in Ohio to determine which variables predicted persistence in their ADN program. Ninety-seven percent of the sample was Caucasian.

Academic dispositional variables in the study included high school GPA, high school rank, entering college GPA, ACT English standard score, ACT math standard score, ACT standard score, ACT natural science standard score, and ACT composite score. In addition, academic dispositional variables included results from the National League for Nursing Examination (NLN). The NLN exam provided information on total academic aptitude percentile rank, reading comprehension percentile rank, science percentile rank, social studies percentile rank, and composite rank. Non-academic

dispositional variables included survey questionnaires on interest, skill, biographical, attitudinal, age, and sex.

The analysis of the results indicated that persisters were significantly higher than non-persisters on academic dispositional variables. Persister scored significantly higher on NLN exam's composite score [$t(140)=62.71, p<.05$], reading comprehensive score [$t(138)=66.10, p<.01$], social studies sections [$t(138)=65.56, p<.01$], high school GPA [$t(165)=2.83, p<.01$] than non-persisters. In addition, pre-admission college GPA [$t(85)=2.73, p=.06$] was almost significantly higher for persisters.

Regarding non-academic variables, persisters in the nursing program were more likely than non-persisters to be over 19 [$\chi^2(1, N = 197) = 5.47, p < .05$] and female [$\chi^2(1, N = 197) = 5.35, p = .05$]. Program persisters were significantly different in their greater perseverance [$\chi^2(3, N = 231) = 44.67, p < .01$], initiative [$\chi^2(3, N = 231) = 24.45, p < .01$], desire to overcome barriers [$\chi^2(3, N = 231) = 20.60, p < .01$], have satisfactory relationship with their peers [$\chi^2(3, N = 231) = 9.32, p < .05$], and had a strong desire to become a nurse at the time of applying for the nursing program.

Program non-persisters were significantly different from persisters in some expected and unexpected ways. As expected, non-persisters study habits were poorer than persisters. Non-persisters crammed more for exams [$\chi^2(3, N = 236) = 19.66, p < .01$], and had greater difficulty paying attention in class [$\chi^2(3, N = 229) = 57.69, p < .01$] than persisters. Some unexpected findings were that non-persisters more often chose nursing for an opportunity to serve humanity [$\chi^2(3, N = 229) = 18.35, p < .01$] and to realize a lifetime ambition [$\chi^2(3, N = 230) = 18.00, p < .01$] than persisters.

Summary of the Previous Studies

There is clear evidence that certain pre-program factors can predict the likelihood of ADN program completion. Moreover, the literature review indicates that pre-admission academic dispositional variables are likely to predict success in ADN programs. Pre-admission academic variables included college GPA, grades in science courses, and outcomes in assessment tests. In addition, English skills have been shown to be related to ADN program completion. Furthermore, the non-academic dispositional variable of age has been associated with ADN program completion, as older students were more likely to complete nursing programs than younger students.

Strengths of the Previous Studies

There were a number of strengths of the previous studies. A primary strength was the use of multiple definitions of ADN success. Studies defined success as completing the ADN program, persistence, and/or performance on the State or national licensing exam. By defining success in several ways, a holistic view of ADN program success can be ascertained.

Multiple methods of data collection was another strength of the prior research. Information was collected from both archival sources, which contained data on academic performance, and surveys, which contained self-reported information on individuals' attitudes and behaviors. Multiple methods of data collection allowed for the testing of wide range of variables that were found to be associated with or predictive of ADN program success.

Limitations of the Previous Studies

There are a number of limitations with the previous studies. One limitation is the lack of generalizability of the findings. Most of the nursing studies were conducted in states other than California and included samples of mostly (at least 89%) Caucasian students. As a result, the generalizability of the outcomes may be limited to ADN programs outside California and mostly to Caucasians. The findings may not be applicable to the unique population and characteristics of ADN programs in California.

Another weakness with the previous studies is the lack of inferential research. Though there has been a good number of research studies conducted on the topic of explaining or predicting success in community college ADN programs, much of the research has been of a descriptive nature rather than inferential one (Phillips et al, 2002). This fact is also true for studies of baccalaureate-degree nursing programs. For example, a meta-analysis study researching evaluating predictors of retention, graduation, and National Council Licensure Examination of baccalaureate-degree nursing completion found that ninety-four percent of the studies they reviewed were descriptive (Campbell and Dickson, 1996).

A third shortcoming of previous studies is that none appear to have samples of students from multiple colleges. As a result, institutional factors that may affect ADN program completion among multiple colleges have not been studied. In light of some of these limitations, a study was conducted in California that used data from multiple colleges to determine factors that affect ADN program completion.

Associate Degree Nursing: Model Prerequisite Study

In 2002, the nursing shortage in California coupled with the high ADN program attrition rates prompted the California Community Colleges' Chancellor Office to initiate a study to find which pre-program variables predicted ADN program completion. The study was conducted by Phillips and associates (2002).

The study used longitudinal archival data from 5,000 ADN students from 20 California community colleges who enrolled in nursing programs during the academic years of 1994-95 through 1998-99. The sole source of the data was California's Management Information System (MIS), which provided student demographic and performance data from all California community colleges. The study tested nearly 50 variables that were divided into dispositional or institutional factors.

The academic dispositional factors included pre-admission college GPA, pre-admission core science GPA (comprised of Anatomy, Microbiology, & Physiology), repetition of core science courses, performance in specific courses (English, Chemistry, & math), terms, units, primary language, and non-academic dispositional factors of ethnic group, gender, and age.

The institutional factors included the number of pre-requisites, pre-requisite GPA, English requirement, Math requirement, Nutrition requirement, Child Development requirement, Chemistry requirement, Sociology requirement, Psychology requirement, Speech requirement, and Reading requirement. In addition, institutional factors included selection (e.g. points, lottery, etc), method (fixed or ranked), work experience, course

repetitions, interviews, community service, recommendations, number of courses taken, local residency, high school diploma, and number of times applied to the program.

The results of the study indicated that a composite regression equation containing four preprogram academic dispositional variables best predicted program completion: College GPA, Core Science GPA (Anatomy, Physiology, and Microbiology), Core Science repetitions, and English GPA. The study concluded that students who had a high college GPA, high Core Science GPA, and high English GPA, along with none or fewer core science repetitions, had the highest probability of completing the Associate Degree Nursing program.

The study's findings also indicated that individuals whose primary language was English were significantly more likely to complete the program than those with primary language other than English (78% vs. 65%). Regarding non-academic dispositional variables, females were significantly more likely to complete the ADN program than males (78% vs. 70%). Caucasians were most likely (84%) to complete the program, followed by "Other" (75%), Hispanics (75%), Asian Americans (64%), and African Americans (57%).

Institutional factors were also associated with ADN program completion. The study found that students in nursing programs with a reading requirement were more likely to complete the program (85% vs. 75%), and students in programs with a chemistry requirement were more likely to complete the program as well (81% vs. 74%). Students in ADN programs with a requirement of psychology, speech, child development, or

nutrition were less likely to complete the program than programs that didn't have such requirements.

Strengths of the Model Prerequisite Study

There were a number of strengths of the study, which included a large sample size, the examination of institutional factors that may be related to ADN program completion, and the analysis of the data by logistic regression. The study had the largest sample size of any research that investigated factors that were associated with or predicted ADN program completion. With 5,000 nursing students in the sample, the results of the study were likely generalizable to many ADN programs.

Another major strength of the study was its examination of institutional variables that were associated with ADN program completion. The study's sample had students from 20 colleges, which allowed the study to assess which admission requirements were associated with ADN program completion.

The third strength of the study was that it used logistic regression to analyze which pre-admission variables best predicted ADN program completion. There are several advantages of the logistic regression method compared to multiple linear regression or discriminant analysis. An advantage of the logistic regression method is that it does not assume a linear relationship between the predictor variables and the criterion variable. Another advantage of the logistic regression method is it gives the probability of ADN program completion between 0 and 1. A third benefit of logistic regression is that it allows predictor variables to be binary, a mixture of categorical and continuous, or just continuous.

Limitations of the Model Prerequisite Study

There were a number of limitations with the study. A primary limitation of the study was the insufficient data collection. The study's sole source of data was the California Community Colleges Chancellors Office's Management Information Services (MIS) database. As a result, certain independent variables (e.g., pre-admission college GPA) were not accurate because they excluded courses taken from outside the California community college system.

There was also a major sampling weakness with the study. The study found that the best set of predictors of ADN program completion was comprised of four academic dispositional variables: Pre-admission College GPA, Pre-admission Core Science GPA, Repetition of Core Science Courses, and English GPA. Because past academic performance was used to predict future academic performance (i.e., ADN program completion), the study should have excluded students who did not complete the ADN program due to non-academic reasons. The study assumed that failure to complete the program was solely due to academic reasons. As a result, the findings of the study were muddled.

Another imperfection of the study was related to the data used to calculate English GPA. Grades from both remedial English and college-level English courses were used to calculate English GPA. Remedial English courses and college-level English courses are taken by students who are at different English skills levels. Thus, English skills level was not properly represented by English GPA.

The lack of ethnic diversity in the sample was a weakness because it limited generalizability of the findings. While the study sampled a more diverse population than previous studies, Caucasians still represented a substantial proportion (51%) of the students. The remaining race-ethnicities were “Others” (20%), Hispanics (14%), Asian Americans (9%), and African Americans (6%).

Why a New ADN Study is Warranted

Previous research indicated that dispositional academic and non-academic variables have been associated with ADN program completion. However, due to the limitations of the California study, which included insufficient data collection, sampling issues, lack of accurately capturing English skills level, and concerns of the generalizability of findings to diverse populations, a new study is warranted. These limitations will be addressed in the current study.

Insufficient data collection is addressed in this study by collecting data from all student transcripts—including those from all California community colleges, University of California (UC), California State University (CSU), private colleges, out-of-state and out-of-country colleges. As a result, all of the variables tested will be accurately calculated.

Sampling concerns in the current study are addressed by using a proper sample of students. This study excludes students who failed to finish the ADN program due to non-academic reasons. These non-academic reasons included family or job responsibilities.

Another limitation was related to the lack of accurately capturing English skills level. This limitation is addressed by assessing the performance of students in the English course they are all likely to take: an introductory college-level English course.

Lastly, concerns of the generalizability of the findings to diverse populations are addressed by conducting the present study in an ADN program that is more racially and ethnically diverse than previous studies. Most previous ADN program research findings were generalizable to predominately Caucasian students. The most racial-ethnically diverse study reviewed was conducted by Phillips and associates (2002), which still had a majority (51%) of Caucasian students in its sample.

Purpose and Hypotheses

The literature review indicates that there are a number of dispositional academic and non-academic variables that have been associated with ADN program success. These variables will be tested in the current study in order to examine which are related to ADN program completion. In addition, a logistic regression analyses will be conducted in order to assess which set of pre-admission academic variables most accurately predicts ADN program completion. The present study tested the following hypotheses:

Hypothesis 1. Those with a higher Pre-admission College GPA will be more likely to complete the ADN program than individuals with lower Pre-admission College GPA.

Hypothesis 2. Those with a higher Pre-admission Core Science GPA will be more likely to complete the ADN program than individuals with a lower Pre-admission Core Science GPA.

Hypothesis 3. Those with no or low number of repetitions of Core Science Courses will be more likely to complete the ADN program than individuals with higher number of repetitions of Core Science Courses.

Hypothesis 4. Those with a higher Pre-admission Introductory College English Grade will be more likely to complete the ADN program than individuals with lower Pre-admission Introductory College English Grade.

Hypothesis 5. Individuals whose primary language is English will be more likely to complete the ADN program than individuals whose primary language is not English.

Hypothesis 6. Older individuals are more likely to complete the ADN program than younger individuals.

Hypothesis 7. Females will be significantly more likely to complete the ADN program than males.

Hypothesis 8. Caucasians will be significantly more likely to complete the ADN program than non- Caucasians.

After all of the hypotheses are tested, a logistic regression analysis will be run between the set of pre-admission academic predictors that have been demonstrated to be statistically significantly related to the completion of the ADN program and the criterion variable of ADN program completion. The effectiveness and soundness of the logistic regression model in predicting ADN program completion will be assessed by a) the

evaluation of the overall model, b) statistical tests of individual predictors, c) goodness-of-fit statistics, and d) the validation of predicted probabilities.

A stepwise logistic regression analysis will also be run on the same academic variables that were entered in the standard logistic model analysis. In addition, the stepwise logistic model will be compared with the standard logistic model in order to assess which is a better predictor of ADN program completion.

Method

Data Sources

The data sources for the present study were college transcripts and college admissions applications. College transcripts contained all course grades—including grades in science courses and in English—and college grade point average. Moreover, all student college transcripts were reviewed to ascertain the data, including transcripts from California community colleges, University of California system, California State University system, private California colleges, out-of-state colleges, and out-of-country colleges. College admissions applications contained information on primary language, age, gender, and ethnicity.

Participants

The sample consisted of 191 nursing students (Male = 26, Female =165) who entered the ADN program between 1996 and 2002. These students met the prerequisite requirements for admission to the ADN program and were placed into a pool from which they were randomly selected. Prerequisites for the ADN program were a Pre-admission College GPA of 2.70 and a Pre-admission College Science (Anatomy, Microbiology, and Physiology) of 2.30. Students who did not finish the ADN program due to situational reasons were excluded from the sample. Situational reasons included family and financial responsibilities.

The mean age of the sample was 30.7 years (demographic data for the sample are presented in Table 1). With regard to race-ethnicity, the sample was diverse—36.6 percent were Caucasian, 22.0 percent Filipino, 12.6 percent were African American,

Table 1

Demographic Data for the Sample of Nursing Students (N = 191)

Variable	N	%
Gender		
Male	26	13.6%
Female	165	86.4%
Age (in years)	<i>M</i> = 30.69	<i>SD</i> = 8.00
Race-Ethnicity		
African American	24	12.6%
Asian/Pacific Islander	24	12.6%
Filipino	42	22.0%
Latino	22	11.5%
Caucasian	70	36.6%
Other	9	4.7%
Primary Language		
English	128	68.1%
Non-English	60	31.9%

12.6 percent were Asian/Pacific Islander, 11.5 percent were Latino, and 4.7 percent were Other (Middle Eastern, Native American) or Unknown. In addition, 68 percent of the sample's primary language was English.

Predictor Variables

Pre-admission College GPA. This variable was calculated using only college-level courses. The GPA was on a four-point (0 to 4.00) scale. In order to calculate GPA, the number of credits for each course was multiplied by the number of points (Grade of A=4 pts, B=3 pts, C=2 pts, D=1 pts, and F=0 pts) earned in each of course. Then the total number of grade points earned in every college-level course was divided by the total number of credits attempted. Courses with grades of Credit/No Credit, Pass/No Pass, Incomplete, In Progress, and Withdrawals were not used to calculate GPA.

Pre-admission GPA in Core Sciences. Pre-admission GPA in Core Sciences was calculated using grades in Anatomy, Microbiology, and Physiology. Each science course was required to cover specific coursework in order to be included in the calculation of the Core Science GPA.

Anatomy 1 (General Human Anatomy) course was required to cover the structure and function of the human body, gross anatomy, and developmental anatomy. The course also required dissection and microscopic examination of normal and pathological tissues.

Microbiology 1 course required the study of bacteria, fungi, protozoans, parasites, and viruses, with an emphasis on their relationship to humans. The course also needed to include issues related to cultivation, control, metabolism, body's defense against disease,

microbial genetics, laboratory tests, and contemporary diseases. The lab portion of the course required staining, investigation, cultivation, identification of unknowns, and sensitivity testing.

Physiology 1 (Human Physiology) required the examination of cellular and systemic body functions. In addition, the course required study of physico- and electro-chemical and clinical methods, collection and analysis of data, extrapolations, and conclusions.

Repetition in Core Science Courses. Repetition in three core science courses (Anatomy, Microbiology, and Physiology) was represented as a whole number between 0 and 3. If one core science course was repeated, it was coded as a “1”. If two or three core science courses were repeated, values of “2” and “3” were coded respectively. If no science courses were repeated, a “0” was recorded.

Pre-admission Introductory College English Grade. This variable measured English skills level prior to enrollment in the nursing program. In order for a course to be considered an introductory college-level English course, its content had to match one of two English course descriptions. One English course description required the integration of reading, writing, and critical thinking intended to develop ability to read and write complex, college-level prose. The course also required examination of ideas in relation to individuals' world view and contexts from which these ideas arise. The second English course description required the development of reading and writing skills, with a focus on academic and career-oriented materials.

Grades in the introductory college-level courses were coded in the following way: A=4, B=3, C=2, D=1, and F=0. If students withdrew or did not take an introductory college-level English prior to entering the program, their English grade was coded as a “0”.

Primary Language. The primary language of the students was ascertained from the college admissions application. The applications asked: “Is English your primary language?” If students stated yes, it was coded as “1”. If students stated no and/or selected Chinese, Spanish, Tagalog, Arabic, or other as their primary language, it was coded as “0”.

Demographic Variables. Age at admission to the ADN program, Gender (Female = 1, Male = 0), and ethnicity (White = 1, Non-White = 0) were available from the college admissions application.

Dependent Variable (Completion of the ADN program within at least two years)

Students had a minimum of two years (equivalent to four semesters) to complete the 52 units of nursing courses in the ADN program. ADN completion was coded as “1” and ADN non-completion was coded as “0”. Students who began the program earlier (e.g., 1996) were allowed a longer time to complete the program than students who started the program more recently (e.g., 2002). The following were the entering years and the corresponding time allowed for students to finish the ADN program: Fall 1996, eight years; Fall 1997, seven years; Fall 1998, six years; Fall 1999, five years; Fall 2000, four years; Fall 2001, three years; and 2002, two years.

Results

There were two primary purposes of the present study. The first purpose was to test which academic and non-academic dispositional variables were associated with completion of the ADN program. The second purpose was to determine the set of preprogram academic variables that most accurately predicts ADN program completion.

The overall ADN program completion rate was 77 percent. Both *t*-tests and Chi-square tests were run in order to test this study's research hypotheses. Results of the *t*-tests and Chi-square tests are provided in Table 2.

Tests of Hypotheses

The first hypothesis stated that those with a higher Pre-admission College GPA would be more likely to complete the ADN program than individuals with a lower Pre-admission College GPA. This hypothesis was tested using independent samples *t*-test. The results of the *t*-test supported the hypothesis and found that individuals who completed the ADN program had a higher mean Pre-admission Overall GPA ($M = 3.17$) than those who did not complete the ADN program ($M = 2.99$), $t(191) = -3.77, p < .01$.

The second hypothesis predicted that individuals with a higher Pre-admission Core Science GPA would be more likely to complete the ADN program than individuals with a lower Pre-admission Core Science GPA. This hypothesis was also tested using the independent samples *t*-test. The results of the test found that Individuals who completed the ADN program had a statistically significantly higher mean Pre-admission Core Science GPA ($M = 3.10$) than those who did not complete the ADN program ($M = 2.81$), $t(184) = -3.14, p < .01$.

Table 2

Means and Percentages of Academic and Demographic Variables in Successful and Non-successful Groups (N = 191)

		Successful (N= 148)	Non-Successful (N= 43)	Test of Differences
Pre-admission College GPA	Mean (SD)	3.17 (.34)	2.99 (.25)	$t = -3.77^{**}$
Pre-admission Core Science GPA	Mean (SD)	3.10 (.54)	2.81 (.44)	$t = -3.14^{**}$
Repetition of Core Science Courses	Mean (SD)	.23 (.58)	.51 (.77)	$t = 2.23^*$
Introductory College English Grade	Mean (SD)	3.01 (.86)	2.51 (1.32)	$t = -2.34^*$
Primary Language				
Non-English	N = 34	23.4%	26 60.5%	$\chi^2 = 20.91^{**}$
English	N = 111	76.6%	17 39.5%	
Age	Mean (SD)	29.87 (6.77)	33.47 (10.87)	$t = 2.05^*$
Gender				
Male	N = 19	12.8%	7 16.3%	$\chi^2 = .34$
Female	N = 129	87.2%	36 83.7%	
Ethnicity				
Non-Caucasian	N = 82	55.4%	39 90.7%	$\chi^2 = 17.88^{**}$
Caucasian	N = 86	44.6%	4 9.3%	

Note: * $p < .05$, ** $p < .01$

The third hypothesis stated that those with no or low number of repetitions of Core Science Courses would be more likely to complete the ADN program than individuals with a higher number of repetitions of Core Science Courses. The results of the independent samples *t*-test found that individuals who completed the ADN program had a lower mean repetition of core science courses ($M = .23$) than those who did not complete the ADN program ($M = .51$), $t(191) = 2.23, p < .05$.

The fourth hypothesis predicted that those with a higher Pre-admission Introductory College English Grade will be more likely to complete the ADN program than individuals with lower Pre-admission Introductory College English Grade. The results of the *t*-test found that individuals who completed the ADN program had a statistically significantly higher mean Introductory College English Grade ($M = 3.01$) than those who did not complete the ADN program ($M = 2.51$), $t(191) = -2.34, p < .05$.

The fifth hypothesis stated that individuals whose primary language was English would be more likely to complete the ADN program than individuals whose primary language was not English. A Chi-square test was conducted in order to test this hypothesis. It was found that individuals whose primary language was English were more likely to complete the ADN program (87%) than those whose primary language was not English (57%) ($[\chi^2(1, N = 188) = 20.91, p < .01]$).

The sixth hypothesis predicted that older individuals would be more likely to complete the ADN program than younger individuals. A *t*-test was conducted and found that individuals who completed the ADN program had a statistically significantly higher

mean age at admission ($M = 33.47$) than those who did not complete the ADN program ($M = 29.87$), $t(189) = 2.05$, $p < .05$.

The seventh hypothesis stated that females were more likely to complete the ADN program than males. The results of the Chi-square test revealed that females were not more likely to complete the ADN program (78%) than males (73%) [$\chi^2(1, N = 191) = .34$, $p = .56$].

The eighth hypothesis predicted that Caucasians would be more likely to complete the ADN program than non-Caucasians. The Chi-square test revealed that Caucasians were statistically significantly more likely to complete the ADN program (94%) than non-Caucasians (68%) [$\chi^2(1, N = 191) = 17.88$, $p < .01$].

There were statistically significant differences between the two groups with regard to Pre-admission College GPA, Pre-admission Core Science GPA, Repetition of Core Sciences, and Pre-admission Introductory College English Grade, primary language, age, and ethnicity. There was no statistically significant difference between females and males.

Standard Logistic Regression

As demonstrated by the t -tests, Pre-admission College GPA, Pre-admission Core Science GPA, Repetition of Science Courses, and Grade in Introductory College English course were statistically significantly related to ADN program completion. These academic variables were placed into a standard logistic regression analysis in order to assess how well the set of variables predict ADN program completion. Only academic variables were tested because results of the analysis could be used by colleges to help

select students who would most likely succeed. Colleges cannot discriminate against applicants based on race-ethnicity, gender, or age and therefore these variables were not considered in the logistic regression analysis. The effectiveness and soundness of the logistic regression were assessed using the recommendations provided by Peng, C, Lee, K, and Ingersoll, G. (2002). These recommendations were 1) the evaluation of the overall model, 2) statistical test of the individual predictors, 3) goodness-of-fit statistics, and 4) the validation of predicted probabilities. The results of the analyses are provided in Table 3.

The evaluation of the overall model was conducted using three inferential statistics: the likelihood ratio, score, and Wald tests. These tests assess the difference between the intercept-only model (also known as the null model), which contains no predictors, and a full model that contains all of the predictors. A logistic model provides a better fit with the data if it demonstrates an improvement over the null model. The results of the likelihood ratio test [$\chi^2(4) = 22.12, p < .01$], score test [$\chi^2(4) = 20.65, p < .01$], and Wald test [$\chi^2(4) = 18.05, p < .01$] revealed that the model was statistically more effective than the null model.

The statistical significance of each regression predictor was tested using the Wald chi-square statistics. The results indicated that Pre-admission College GPA, Pre-admission Core Science GPA, and Repetition of Core Science Courses were not significant predictors of ADN program completion ($p > .05$). Grade in Introductory College English was a significant predictor ($p < .05$) of ADN program completion.

Table 3

*Standard Logistic Regression Analysis of
Associate Degree Nursing Program Completion (N = 191)*

Criterion: Associate Degree Nursing Program Completion						
Predictor	β	SE β	Wald's		<i>p</i>	e^{β} (odds ratio)
			χ^2	<i>df</i>		
Constant	-5.41	2.35	5.29	1	.02	NA
Pre-admission College GPA	1.09	.86	1.61	1	.20	2.99
Pre-admission Core Science GPA	.73	.48	2.32	1	.13	2.08
Repetition of Core Science Courses	-.42	.27	2.45	1	.12	.66
Grade in Introductory English	.47	.18	6.72	1	.01	1.60
Test			χ^2	<i>df</i>	<i>p</i>	
Overall model evaluation						
Likelihood ratio test			22.12	4	.00	
Score test			20.65	4	.00	
Wald test			18.05	4	.00	
Goodness-of-fit test						
Homser & Lemeshow			5.70	8	.68	

Notes. Cox & Snell $R^2 = .11$. Nagelkerke R^2 (Max rescaled R^2) = .17.

Kendall's Tau-a = .15. Goodman-Kruskal Gamma = .43. Somer's Dxy = .43.

c-statistic = 71.30%. NA = not applicable.

Table 4, which displays the Pearson correlations between academic predictors and the criterion variable of ADN program completion, gives clues as to why most of the academic variables did not become statistically significant when entered into the standard logistic regression analysis. As shown in Table 4, Pre-admission College GPA, Pre-admission Core Science GPA, and Repetition of Core Science Courses were highly correlated with one another and therefore canceled each other out when entered as a set into the logistic regression analysis. For example, Pre-admission College GPA was correlated statistically significantly with Pre-admission Core Science GPA ($r=.63, p<.01$) and Repetition of Core Science Courses ($r=-.23, p<.01$).

The model's Goodness-of-fit was assessed using the Hosmer-Lemeshow (H-L) test. Goodness-of-fit statistics evaluate the fit of a logistic model against actual outcomes. The results of the H-L test were found to be not significant [$\chi^2(8) = 5.70, p>.05$]. This indicates that the model fits well to the data. In addition, the Cox and Snell's $R^2 = .11$ and Nagelkerke's $R^2 = .17$. These statistics do not equate to variance explained or correspond to the efficiency of the prediction (Long, 1997 & Menard, 2000). Regardless of the apparent lack of usefulness of these statistics, they are recommended to be reported as supplementary information (Peng & So, 2002).

The validation of the predicted probabilities (i.e., measuring the extent to which predicted probabilities agree with actual outcomes) was tested using the four recommended measures of association and by a classification table. The four measures of association are Kendall's Tau- a , Goodman-Kruskal's Gamma, Somers's D , and the c -statistic. Kendall's Tau- a statistic uses rank-order correlation coefficient without making

Table 4

Pearson Correlation Matrix of Predictors and Criterion (N = 191)

Variables	1	2	3	4	5
1 Pre-admission College GPA	--				
2 Pre-admission Science GPA	.63 **	--			
3 Repetition of Science Courses (0 - 3)	-.23 **	-.17 *	--		
4 Introductory College English Grade	.16 *	.08	-.01	--	
5 ADN Program Completion	.23 **	.23 **	-.19 *	.21 **	--

* p<.05, ** p<.01

adjustments for ties. However, there were a few ties in both outcomes and predicted probabilities. As a result, Goodman-Kruskal's Gamma, which is based on Kendall's coefficient, is a more useful measure of association because it adjusts for ties. The Gamma statistic for the standard regression model was .43 and indicated that 43 percent fewer errors were made in predicting which students were likely to complete ADN program than by chance alone. The Somers's D, which is an extension of the Gamma, is .43 and confirms the Gamma statistic. The *c* statistic is a measure of the discriminative power of the logistic equation and it represents the percentage of all possible pairs of cases in which the model assigns a higher probability to a correct case than to an incorrect case. The *c* statistic for the standard logistic regression was fairly high at 71.3 percent.

A classification table, which compares observed and predicted outcomes, establishes the validity of predicted probabilities. Table 5 displays the classifications. The overall correct prediction was 81.18 percent. There are four methods of assessing the classification of data: sensitivity, specificity, false positive, and false negative. Sensitivity indicates the proportion of correctly classified events (i.e., those predicted to complete the ADN program). Specificity measures the proportion of correctly classified nonevents (i.e., those not predicted to complete the ADN program). False positives and false negatives are data that are misclassified. False positives are data that were observed to be nonevents (i.e., did not complete the ADN program), but were predicted as events (i.e., completed the ADN program). False negatives, on the other hand, were data that were observed to be events, but were predicted to be nonevents. Sensitivity and

Table 5

The Observed and the Predicted Frequencies for ADN Program Completion by Logistic Regression With the Cutoff of .50

Observed	Predicted		% Correct
	Yes	No	
Yes	143	2	98.62
No	33	8	19.51
Overall % Correct			81.18

Note. Sensitivity = $143/(143+2)\% = 98.62\%$. Specificity = $8/(8+33)\% = 19.51\%$. False positive = $33/(33+143)\% = 18.75\%$. False negative = $2/(2+8)\% = 20.00\%$.

specificity were 98.62 percent and 19.51 percent, respectively. The false positive and false negative were relatively low at 18.75 percent and 20.00 percent, respectively.

Stepwise Logistic Regression

Following the standard logistic regression, a stepwise logistic regression was conducted in order to determine which variables were statistically the best predictors of ADN program completion. Pre-admission College GPA, Pre-admission Core Science GPA, Repetition of Science Courses, and Pre-admission Grade in Introductory College English were entered into the analysis. The results of the stepwise logistic regression analysis are displayed in Table 6. The evaluation of the overall model, statistical tests of the individual predictors, goodness-of-fit statistics, and the validation of predicted probabilities were assessed.

The results of the stepwise logistic regression revealed that two predictors—Pre-admission College GPA and Pre-admission Grade in Introductory College English—were the best predictors of the completion of the ADN program. The evaluation of the overall model using the likelihood ratio test [$\chi^2(2) = 17.82, p < .01$], score test [$\chi^2(2) = 15.74, p < .01$], Wald test [$\chi^2(2) = 13.95, p < .01$] showed that the model was more effective than the null model.

The statistical significance of each regression predictors was tested using the Wald chi-square statistics. The results indicated that Pre-admission College GPA ($p < .01$) and Grade in Introductory English ($p < .01$) were significant predictors of ADN program completion. These significant results were expected because stepwise analysis results in only significant predictors.

Table 6

*Stepwise Logistic Regression Analysis of
Associate Degree Nursing Program Completion (N = 191)*

Criterion: Associate Degree Nursing Program Completion						
Predictor	β	SE β	Wald's χ^2	df	p	e^β (odds ratio)
Constant	-6.38	2.27	7.93	1	.01	NA
Pre-admission College GPA	2.09	.72	8.50	1	.00	8.06
Grade in Introductory English	.44	.18	6.29	1	.01	1.56
Test			χ^2	df	p	
Overall model evaluation						
Likelihood ratio test			17.82	2	.00	
Score test			15.74	2	.00	
Wald test			13.95	2	.00	
Goodness-of-fit test						
Homser & Lemeshow			8.80	8	.36	

Notes. Cox & Snell $R^2 = .09$. Nagelkerke R^2 (Max rescaled R^2) = .14.

Kendall's Tau-a = .14. Goodman-Kruskal Gamma = .40. Somer's Dxy = .40.

c -statistic = 69.90%. NA = not applicable.

The model's Goodness-of-fit was assessed using the Hosmer-Lemeshow (H-L) test. The results of the H-L test were found to be not significant [$\chi^2(8) = 8.80, p > .05$], which indicates that the model fits well to the data. In addition, the Cox and Snell's $R^2 = .09$ and Nagelkerke's $R^2 = .14$.

Regarding the validation of predicted probabilities, the four measures of association—Kendall's Tau- α , Goodman-Kruskal's Gamma, Somers's D , and the c statistic—were assessed. Goodman-Kruskal's Gamma was used because it adjusts for ties. The Gamma statistic indicated that 40 percent fewer errors made in predicting which students are likely to finish the ADN program by chance alone. The Somers's D statistic was similar and reinforced the Gamma statistic. The c statistic for the stepwise logistic regression was relatively high at 69.90 percent.

A classification table comparing observed and predicted outcomes establishes the validity of predicted probabilities. Table 7 displays the classifications derived from the stepwise logistic regression. The overall correct prediction was 77.96 percent. The sensitivity and specificity of the stepwise logistic regression were 99.31 percent and 2.44 percent, respectively. The false positive was 21.74 percent and the false negative was 50.00 percent.

The standard logistic regression analysis and stepwise logistic regression analysis resulted in two models. In order to determine the best model, a comparison of the two models needed to be made in terms of 1) the evaluation of the overall model, 2) statistical test of the individual predictors, 3) goodness-of-fit statistics, and 4) the validation of

Table 7

The Observed and the Predicted Frequencies for ADN Program Completion by Stepwise Logistic Regression With the Cutoff of .50

Observed	Predicted		% Correct
	Yes	No	
Yes	144	1	99.31
No	40	1	2.44
Overall % Correct			77.96

Note. Sensitivity = $144/(144+1)\% = 99.31\%$. Specificity = $1/(1+40)\% = 2.44\%$. False positive = $40/(40+144)\% = 21.74\%$. False negative = $1/(1+1)\% = 50.00\%$.

predicted probabilities. According to Peng and So (2002), a good model surpasses competing models in more than one area.

The standard and stepwise logistic models were assessed. The evaluation of the overall models indicated that both were more effective than the null models. The statistical tests of individual predictors indicated that the standard logistic regression model produced one significant predictor (Introductory College English Grade) and the stepwise logistic regression produced two significant predictors (Pre-admission College GPA and Introductory College English Grade). The goodness-of-fit statistics indicated that both models fit the data well. The comparison of the two models so far indicates that they are relatively similar. The next comparison of the models (i.e., validation of predicted probabilities) is where the standard logistic regression model revealed itself to be a better model than the stepwise model.

As stated earlier, the extent to which predicted probabilities agree with actual outcomes is expressed as a measure of association or classification. Comparison of the Goodman-Kruskal's Gamma, Somers's *D*, and the *c* statistic indicated that the standard logistic regression model was better than the stepwise logistic regression model. The standard logistic model produced fewer errors in prediction and assigned higher probabilities to correct cases than the stepwise logistic model.

The comparison of the classification table and the accompanying statistics—sensitivity, specificity, false positive, and false negative—further indicate that the standard logistic regression model was better than the stepwise logistic regression model. The overall correct prediction rate was slightly higher for the standard logistic model

(81.2%) than the stepwise logistic model (78.0%). The sensitivity was about the same for both models at about 99 percent. The specificity, on the other hand, was better for the standard logistic model (19.5%) than the stepwise logistic model (2.4%). The false positive and false negative were both lower for the standard logistic model than the stepwise logistic model.

Discussion

The primary purposes of the current study were to assess which variables were associated with ADN program completion and to determine the set of preprogram academic variables that most accurately predicted completion of the ADN program. This section is divided into six parts: results of the hypotheses tests; implications of the study; evaluation of the study: strengths and weaknesses; limitations of the study; future research, and conclusion.

Results of the Hypotheses Tests

The study found support for the first hypothesis, which stated that those with a higher Pre-admission College GPA would be more likely to complete the ADN program than individuals with a lower Pre-admission College GPA. The finding was consistent with previous studies. Spahr (1995) found that entering college GPA was significantly related to graduating from an ADN program in Illinois. Yin and Burger (2001) and Carlson (1967) found that individuals who passed the national nursing exam had a higher GPA than those who had not pass the exam. In addition, Phillips and his associates (2002) found that higher pre-admission college GPA was associated with graduating from the ADN program.

The second hypothesis stated that individuals with a higher Pre-admission Core Science GPA would be more likely to complete the ADN program than individuals with a lower Pre-admission Core Science GPA. This finding was supported by the data. It also corroborated earlier studies that were conducted by Saphr (1995), Yin and Burger (2001),

Dean and Fischer (1992), and Phillips (2002) that indicated the importance of the science GPA.

As predicted in the third hypothesis, those with no or a few repetitions of Core Science Courses were more likely to complete the ADN program than individuals with higher number of repetitions of Core Science Courses. The finding was consistent with Phillips and associates (2002) who found that low or few repetitions of science courses was associated with finishing the ADN program.

The fourth hypothesis stated that those with a higher Pre-admission Introductory College English Grade would be more likely to complete the ADN program than individuals with a lower Pre-admission Introductory College English Grade. This hypothesis was supported by the data. The finding was consistent with Donsky and Judge (1981), who found that individuals who scored higher on an English assessment score persisted at higher ADN program persistence rates than those who did not score as high. The current findings were also consistent with Phillips and associates (2002) who found that individuals who graduated from ADN programs had higher preprogram English GPAs than those who did not graduate.

As predicted in the fifth hypothesis, individuals whose primary language was English were more likely to complete the ADN program than individuals whose primary language was not English. The findings corroborate previous research by Phillips and associates (2002).

The sixth hypothesis stated that older individuals were more likely to complete the ADN program than younger individuals. This hypothesis was not supported by the

data. In fact, the opposite was found to be supported. The results indicated that individuals who completed the ADN program had a statistically significantly lower mean age at admission than those who did not complete the ADN program. A plausible explanation for the unexpected finding was that the average age of 30 in the current study was much higher than previous studies. Previous studies had average ages at admission of 24 (Bello, 1977), 25, (Donsky, 1981), and 26 (Carlson, 1967). In addition, older students may have financial, job, or family reasons that may make it harder for them to finish the nursing program.

The seventh hypothesis stated that females were more likely to complete the ADN program than males. The results of the analysis revealed that females were not more likely to complete the nursing program than males. The lack of support for the hypothesis may be directly related to the low number of men in the present study. Males represented only 26 of the 191 students in the sample. Phillips and associates (2002) study, which found significant differences by gender, had about 800 males in their sample of 5,000 individuals. In addition, females and males in the present study had similar performance in the preprogram academic variables and therefore similar rates of nursing program completion would be expected.

As predicted in the eighth hypothesis, Caucasians were more likely to complete the ADN program than non-Caucasians. Phillips and associates (2002) found similar results in their study. A plausible explanation for this finding may be related to primary language. As stated previously, individuals whose primary language was English were more likely to finish the ADN program than those whose primary language was not

English. Nearly all (ninety-three percent) of Caucasians reported English as their primary language, while less than half (45 percent) of non-Caucasians reported English as their primary language. Thus, primary language could be contributing to the significant results found by race-ethnicity.

A standard logistic regression analysis was run on the data using the academic variables that were found to be statistically significant—Pre-admission College GPA, Pre-admission Core Science GPA, Repetition of Core Science Courses, and Pre-admission Introductory College English Grade—in order to determine if they predict nursing program completion. The standard logistic model was found to be more effective than the null model. Only Introductory College English Grade was found to be statistically significant. The data also showed that the model fit well to the data. The tests of the predicted probabilities show that fewer errors were made by the model than by chance alone. The model also assigned a higher probability to the correct cases. In addition, the classification table comparing the observed and predicted outcomes indicated that the model had a high percentage of correctly classified event and non-events. Furthermore, the model had a relative low percentage of false positives and false negatives.

A stepwise logistic regression was also run on the data to assess which academic variables statistically best predicted program completion. The results of the stepwise logistic regression analysis produced a two-variable model containing Pre-admission College GPA and Introductory College English Grade. The model was more effective than the null model and fit the data very well. The measures of association indicated

fewer errors were made than by chance alone and that correct predictions scored higher probabilities than non-correct predictions. The classification table showed that the model gave higher probabilities to correct cases.

A comparison of the standard logistic model and stepwise logistic model indicated that the former was a slightly better model than the latter. Both models were better than null models and fit the data well. The measure of association indicated that fewer errors were made than by chance alone in the standard model than the stepwise model. In addition, correct predictions scored higher in the standard model than the stepwise model.

The classification table showed that the standard logistic model had a higher overall correct prediction rate than the stepwise logistic regression model. Both models had about the same sensitivity, which indicates the proportion of correctly classified events. Specificity, which measures the proportion of correctly classified nonevents, was higher in the standard logistic model than the stepwise logistic model. Furthermore, false negative and false positive were lower in the standard logistic model than the stepwise logistic model.

Implications of the Study

There are a number of implications of the current study. The primary implication is to use the standard logistic regression model to screen for applicants who would most likely complete the ADN program. For each applicant, the standard logistic regression model produces a probability of ADN program completion between 0 and 1. Institutions

can decide to accept applicants who score the highest probability of finishing the nursing program. As a result, this may increase completion rates.

The second implication is related to the English skills level. The study showed the importance of English skills as represented by the Grade in Introductory College English. It was the sole significant predictor in both the standard logistic regression and stepwise logistic regression. As a result, ADN programs should be well aware of the role English skills play in completion of the ADN program. Moreover, ADN programs should provide support services to students who lack English skills.

Evaluation of the Study

Strengths of the Study. There are number of strengths of the current study. A primary strength of the current study was it used multivariate regression analysis to predict ADN program completion. This study went beyond descriptive and univariate analysis to assess how multiple predictors combine to predict completion of the ADN program.

Another benefit of this study was that it used logistic regression analysis, which allowed the probability of ADN program completion to be calculated between 0 and 1 for each individual. Moreover, the logistic regression analysis produced a model that demonstrated a high accuracy in predicting correct outcomes. The overall correct prediction rate was slightly above 80 percent.

A third strength of the study was the racially and ethnically diverse sample of students. It is currently the most diverse ADN study of its type. As a result, the findings can be generalized to diverse populations.

Limitations of the Study. There were a number of limitations with the current study. A primary limitation of the study was that similar grades in science and English courses might not have accurately reflected similar subject knowledge in those courses. Some science and English courses were taken at universities and some were taken at community colleges. Because courses were taken at various institutions of higher learning, grades may not be comparable. For example, a “B” grade in Anatomy at the University of California may not be equivalent to a “B” grade at a community college.

Another weakness of the study was that the recency of the science courses was not considered. The results of the present study showed that Core Science GPA (comprised of courses in Anatomy, Microbiology, and Physiology) was related to ADN completion. However, some students may have taken the core science courses some time ago, while some may have taken it more recent. Recency could have affected ADN program completion.

Future Research

Future research should study the relationship between previous college or university of students and ADN program completion. In particular, there needs to be research that explores if there are differences in completion rates of students who enter ADN programs from universities versus community colleges.

Another plausible future study is to examine the relationship between recency of courses and completion of the ADN program. Recency of courses may be related to a higher likelihood of ADN program completion. For example, students who finish a core science course (e.g., Anatomy) just before entering the ADN program may be able to

better apply that knowledge than students who took the course years before entering the ADN program.

Future research should also concentrate on factors that are associated with ADN program completion after students have entered the nursing program. If there are factors that help or hinder nursing program completion, they need to be identified and communicated to nursing faculty.

Conclusion

The results of this study indicate that demographic and academic factors are associated with finishing the ADN program. Moreover, the current study found that preprogram academic variables—overall College GPA, Core Science GPA, repetition of Core Science Courses, and Grade in an Introductory College English Course—can predict the likelihood of ADN program completion.

Among the four preprogram academic variables, Grade in an Introductory College English Course appeared to be the most important predictor. This study suggests that English skills play an essential role in finishing the nursing program. Applicants to the nursing program may have a high overall GPA, a high core science GPA, and have repeated no or a few core science courses, but probability of them finishing the nursing program is low if their English skills are insufficient.

The findings of the present study can be used by ADN programs to select students who are mostly likely to finish the ADN program. This could lead to an increase in the number of students graduating from ADN programs and could help alleviate the nursing shortage faced by the US.

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