

VARIABLES PREDICTIVE OF PROGRAM AND NCLEX SUCCESS FOR
ASSOCIATE DEGREE NURSING STUDENTS

A DISSERTATION
SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF PHILOSOPHY
IN THE GRADUATE SCHOOL OF THE
TEXAS WOMAN'S UNIVERSITY

COLLEGE OF NURSING

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AUGUST 2001

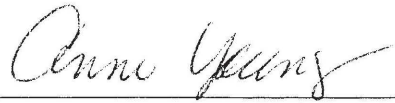
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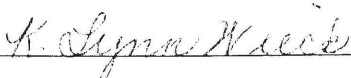
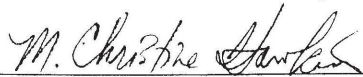
To the Dean of Graduate Studies and Research

I am submitting herewith a dissertation written by Thelma A. Percoco entitled "Variables Predictive of Program and NCLEX Success for Associate Degree Nursing Students." I have examined this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy with a major in nursing.



Anne Young, Ed.D., Major Professor

We have read this dissertation
And recommend its acceptance:



Accepted



Dean of Graduate Studies and Research

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ACKNOWLEDGEMENTS

I am grateful to those people that assisted with this project. A special thank you to Dr. Anne Young for her guidance and encouragement from the beginnings of this project and for the editing and assistance with statistical interpretations for the duration of the project. I also want to express my appreciation to the committee members, Dr. Lynn Wieck and Dr. Chris Hawkins for their suggestions and support in bringing this project to completion.

Variables Predictive of Program and NCLEX Success for Associate Degree Nursing Students

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August 2001

Abstract

In order to evaluate the influence of selected performance characteristics on successful completion of an associate degree in nursing program (ADN) and success on the NCLEX-RN, a retrospective study reviewed records of 177 students admitted to an ADN program from 1991 to 1997. Data collection included demographic variables, course grades in pharmacology and psychology, GPAs of biology and English courses, and total numbers of remedial courses taken. Dependent variables were successful completion of the program and the NCLEX-RN. Descriptive statistics were used for the demographic data, means and standard deviations for course grades and GPAs, and logistic regression to determine if there were any relationships between dependent and independent variables. Logistic regression revealed that psychology ($p < 0.01$) course grades, pharmacology ($p > 0.05$) course grades, and biology GPA ($p > 0.05$) were predictors of program success. This model correctly predicted program success 76.89 of the time. Pharmacology grade ($p > 0.008$) was the only predictor of NCLEX-RN success. This model using pharmacology classified those successful on the NCLEX-RN at a rate of 78%. Participation in remedial courses was not predictive of student ability to complete the program nor to be successful on the licensure exam. Findings indicate that

general education courses demonstrated relationships to success in the program; however, general education courses did not demonstrate relationships with success on the NCLEX-RN. Pharmacology, a nursing prerequisite, was the only course that demonstrated a relationship with both dependent variables.

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CHAPTER I

INTRODUCTION

In a rapidly changing health care system it is imperative that nurses be prepared for present and future challenges of providing efficient and competent care in a variety of health care settings (Hayes, 1981; McClelland, Yang, & Glick, 1992). The trends in health care are that practitioners must be better prepared and able to practice within a holistic framework. However, nursing programs have been experiencing a reduction in quality of applicants (Allen, Higgs, & Holloway, 1988; Jenks, Selekman, Bross, & Paquet, 1989; Fowles, 1992; Griffiths, Bevil, O'Connor, & Wieland, 1995). Prospective students are older, may be employed full time, during their educational program, and may need remediation in math reading and study skills (American Association of Colleges of Nursing, 1992).

Because society has a right to expect safe nursing care, nurse educators have a two-fold accountability: the needs of the students for a quality education, as well as society's need for preparation of competent professionals. Educators must ensure that nursing graduates have the knowledge and skills requisite for competent practice. With constraints of limited enrollments in schools of nursing and cost of education, selecting applicants most likely to succeed in completing the program and passing the licensing examination continues to present a challenge.

Over the years educators have studied criteria used for selecting applicants most likely to Complete the nursing program and to be successful on the licensing exam. These

criteria include cognitive predictors such as the Scholastic Aptitude Test (SAT) (Oultz, 1979); American College Testing (ACT) scores (Perez, 1977); and grade point averages (GPAs) of high school courses (Woodham & Taube, 1986). In addition, pre-nursing courses, GPAs of specific courses such as physical and social sciences (Felts, 1986; Foti & DeYoung, 1991), and social sciences (Felts, 1986; Yang, Glick, & McClelland, 1987) have been studied with varying results.

Almost all of the reviewed studies that examined attributes of successful nursing students have been with baccalaureate students, and only one (Boughan, 1993) has considered the role of educational remediation on nursing student success. In baccalaureate programs there is an advantage with a greater number of prerequisites that can be used as a basis for admission decisions. Because a significant portion of nursing education occurs at the associate degree level, it is important to consider criteria that would predict success of this student group. A particular challenge for associate degree educators is that students have taken a very limited number of prerequisites prior to being accepted into nursing programs. Therefore, less data are available for educators to use in admission decision making.

Problem of Study

To reduce waste of scarce financial resources of institutions as well as resources of prospective students, identification of predictors of academic success and professional achievement (i.e. NCLEX-RN) is becoming of greater importance to faculty, institutions, and prospective students. The problem for this study was to evaluate the influence of selected performance characteristics on successful completion of an associate degree

student in nursing (ADN) program and success on the NCLEX-RN.

Rationale for Study

In 1996 the six year trend of increasing nursing school enrollments reversed with a decrease of one percent in associate degree enrollments, the first decrease since 1986 (Nursing Data Review, 1996). However, associate degree enrollments still comprise over 50% of total enrollments in schools of nursing in the United States. In 1994 minority admissions accounted for 16.5% of total enrollment and 13.3% of all graduates with a slight increase for each minority group except for American Indians. Male enrollment in associate degree programs increased to 14 % of total enrollment in 1994.

Declining enrollments in nursing programs were attributed to specific characteristics of nursing education, general characteristics of higher education, and to voluntary reduction of program enrollments due to difficulties graduates were having in finding employment (National League for Nursing, 1996). A National League for Nursing (NLN) study of all schools of nursing revealed that planned reductions in admissions in all programs accounted for a 59% decreased enrollment in diploma programs, 26% decrease in associate degree programs, and a 21% decrease in basic baccalaureate programs (Louden & Post, 1997). Schools indicated that reduction of job opportunities and limited budgets were the reasons for fewer admissions. Although a nursing shortage now exists, nursing school enrollments have continued to decline.

Program reviews indicate that there is a substantial attrition of associate degree nursing students between admission and graduation two years later (National League for Nursing, 1996). From 1989 to 1990 the number of associate degree admissions in the

United States was 68,634. Two years later, graduation rates from these programs indicated a loss of 15,738 students. Subsequent attrition for the following years was 13,099 and 15,240. This rate of attrition is of concern for a number of reasons: a) cost of education to student/family/scholarships or institutions issuing grants, loss of expenditures for tuition in nursing curriculum courses, b) loss of opportunity for potentially successful students to fulfill a career role, c) possible loss of revenue for the institution if the student withdraws from all classes, and d) fewer graduates to replenish the nursing pool.

The drop in admissions to nursing programs and the attrition rates are also a concern for the employing institutions and the population needing the services of registered nurses. Because of an emerging nursing shortage, U. S. Congress has also expressed concerns by proposing legislation to facilitate nursing preparation. Another concern is the aging nursing workforce and the prediction of inadequate numbers of nurses available to replace those nurses who will be retiring in the near future. In 1996 the average age of all registered nurses was 44.3 years and the average age of employed registered nurses was 42.3 years, that is an age group that is nearing retirement (Buerhaus, 1998; Peterson, 1999). The average age of students being admitted to nursing programs has risen to 30 years, leaving fewer years for these graduates to remain in the workforce. In 1996 only nine percent of registered nurses in the U. S. were under 30 years of age (Ackley, 1999). The two trends of the aging workforce and decreasing student enrollments, coupled with an aging population that requires increased nursing care, are a cause for great concern in the health care area.

The economics of nursing education is of concern to prospective students as well as educational institutions and funding sources that support the institutions. Attrition from educational programs is costly to students, their families, and institutions. Students investing physical, mental, and financial resources, suffer greatly if unsuccessful (Oliver, 1985). Mean annual tuition for full-time students for the year in public associate degree nursing programs (ADN) was \$1, 594. Tuition for private ADN programs was \$8,801 annually (National League for Nursing, 1997).

Nursing programs are costly for educational institutions due to the need for laboratories, equipment, and faculty. In some instance scarce resources of state governments have forced educational institutions to find alternatives for funding (Webber, 1992). In private colleges the future prediction is that there will be continued budget constraints and declining grants (Rawlins, Riordan, Delamaide, & Kilian, 1991).

Another economic concern is being able to fully utilize limited capacities for nursing program enrollment. In 1994 all ADN programs in the United States admitted 38.6% of all qualified applicants; 22.9% of applicants who qualified were not accepted and placed on waiting lists. However, not all students who entered programs remained. There was a 21% attrition rate for ADN students in 1991/92 with an increase to 28% of admitted students by 1995/96 (National League for Nursing, 1997). When students are selected but unable to remain in the program, underutilization of the facility resources occurs as well as loss of potentially successful applicants who were not selected. With these economic concerns, selection criteria that are predictive for applicants most likely to complete the program successfully are vital. It is essential that the most promising

candidates be chosen for the limited enrollments to fully utilize the educational resources available.

Because the number of program applicants exceeds the number that can actually be admitted nursing educators have had the opportunity to select applicants for admission. With this opportunity comes the dilemma of deciding which criteria will aid in selecting those applicants most likely to be successful. The criteria on which to base nursing student selection has been a subject of study by nurse educators for a number of years. Seither (1980) found GPAs of biological sciences to be valid predictors for success in a baccalaureate program; the addition of behavioral sciences added increased predictive power. Others (McClelland, Yang, & Glick 1992; Glick, McClelland, & Yang, 1986; & Felts, 1986) also found biology and social science courses to be predictors of performance in the nursing program. Perez (1977) commented that GPAs in social sciences may be as valuable as the biology GPAs as predictors of success. Felts (1986) and Hayes (1981) found basic English a significant predictor of success in nursing programs. However, these findings were not supported by Fowles's study (1992), which did not find English courses to be predictive. With the exception of the study by Felts, all the studies cited above were done with baccalaureate nursing programs. The dependent variables studied (biology, social science, and English courses) are common components of the curriculum in baccalaureate and associate degree programs. No studies reviewed included pharmacology grades as predictors of success in a nursing program.

None of these studies included students' needs for remedial courses in reading, writing, and math and the relationships of remediation to student success. However,

Markus and Zietlin (1993) indicated that remedial education has been and will continue to be an important part of undergraduate curriculums. Various studies have been conducted to evaluate outcome of student success following completion of remedial courses. Although England (1994) found that students requiring remedial courses did not perform as well in college level work compared to students not requiring remedial courses, other researchers have offered contrary findings. Johnson (1996) found that developmental course performance was positively related to student success. Hamilton (1994) found that remediation improved retention and overall performance of students. Strehlow (1996) found students completing remedial writing courses had higher GPAs in English courses. A recent research report, "Academic Progress," (1995) indicated that remediation increases retention and that students remediating have similar completion rates and GPAs as those students not requiring remediation. Conversely, Boughan (1993) surveyed nursing students to determine progress, performance, and NCLEX-RN results of students whose placement test scores indicated the need for remedial courses and found only modest gains in the probability for graduation shown for students doing remedial courses. Among students determined to be in need of remediation and those completing the courses, English placement scores demonstrated a relationship with NCLEX-RN pass rates; reading scores demonstrated a fair relationship; but no relationship was found between math placement test scores and NCLEX-RN success.

Non-cognitive predictors such as personality traits (Hayes, 1981; Huch, Leonard, & Gutsch, 1992; Leners, Beardslee, & Peters, 1996) and demographic data of age, race, and sex (Felts, 1986; Reed & Feldhusen, 1972; Woodham & Taube, 1986) are generally not

correlated with success in nursing programs. In the past, recommendations to eliminate admission interviews were proposed due to inability to determine reliable scores in evaluating the interviews (Stronck, 1979). Stronck also suggested eliminating letters of recommendation since they have not been demonstrated to serve as predictors of future performance. However, some programs are reconsidering this issue.

Most studies on success in nursing programs use subjects enrolled in baccalaureate nursing programs. Few studies have examined success in associate degree programs. Studies have resulted in mixed findings regarding predictors of program and licensure success. Minimal studies were reported that included relationships between the need for remediation in reading, writing, and math.

Characteristics of the applicant pool are changing. Increasing age of applicants, decreasing numbers, mixed findings about the best selection criteria, the role of remediation for some students, and associate degree applicant's previous college level class-work generate a need to determine the best criteria to predict success in the ADN program and on the licensing exams.

Theoretical Framework

Weiner's (1985) attributional theory of motivation and achievement was the basis for this study. The theory consists of identification of attributes that relate to consequences such as success or failure in an activity. The perceived causes of failure or success have three common properties: stability, locus of causality, and controllability. These three dimensions are linked with esteem-related emotions, expectancy change, and interpersonal judgments. Additional dimensions of the theory include ability, effort, task

difficulty, persistence, and academic self-concept (Weiner, 1972, 1985, & 1992).

The stability dimension contains a continuum that ranges from stable to unstable. Stable is perceived as an invariant characteristic and unstable as a variant characteristic. The perceived stability of a cause influences the probability of success after previous failures or successes. A cause perceived as lasting increases the certainty of the outcome of a prior activity will be repeated in the future. For instance, if success is ascribed to a stable factor of ability there is higher expectancy of success than expectations from a less stable factor of effort. The causal dimensions, outcomes of an activity and specific causes, influence the emotions experienced after success or failure to meet a goal. The emotions linked to causal dimensions include hopelessness, resignation, gratitude, guilt, shame, and pity (Weiner, 1992).

The locus of causality may be internal or external to individuals and is related to self-esteem and pride in accomplishment or negative feelings in failure. For example, persons may attribute failure to external causes that prevented their success. Lack of the internal attribute of ability is a particularly devastating causative factor for those persons perceiving the lack of the attribute. Favorable outcomes of an event may be attributed to internal factors that individuals perceive as under their control (Weiner, 1992).

Controllability relates to self-directed effects of guilt or shame. Guilt follows when a controllable cause, such as effort, was seen as the reason for failure; conversely, shame follows when an uncontrollable cause, such as ability, is seen as the reason for failure or negative outcome (Weiner, 1979 & 1985).

Causal thinking includes a variety of information and processes to reach a causal

decision. For example, what are the causes of success and failure in school? In 1992, Weiner stated that in achievement domains, and in school contexts particularly, a set of fairly well agreed-on causes for success and failure characteristics, include: immediate and long range effort (persistence), ability, task, intrinsic motivation, luck, and teacher competence.

With the relationship between attributions/causes and performance implied by Weiner's theory, this study is based on the proposed relationships. The specific attributes included in this study are: a) stability as demonstrated by applicants successful completion of remedial courses and/or general education courses in the curriculum; b) locus of causality of the internal attribute of ability is demonstrated by course grades and GPAs achieved by the student, and c) controllability encompasses the controllable cause of effort and persistence and the uncontrollable cause of ability as related to completion of an ADN curriculum and success on the NCLEX-RN.

Assumptions

Assumptions for this study are derived from Weiner's (1979) attributional theory:

1. Specific attributes can serve as predictors of success for selection of applicants who will successfully complete the program
2. Specific attributes can serve as predictors for selection of applicants who will be successful on the NCLEX-RN.
3. Students records provide a reliable data source from which to obtain information on the attributes proposed for this study.

Research Questions

The questions posed for this study were as follows:

1. What is the relationship of pharmacology grade, psychology grade, biological sciences GPA, English composition GPA, and participation in remedial courses to the ADN program student's successful completion of a nursing program?
2. What is the relationship of pharmacology grade, psychology grade, biological Sciences GPA, English composition GPA, and participation in remedial courses to the ADN program student's successful completion of the NCLEX-RN?

Definition of Terms

The following terms were defined for this study:

1. ADN students - individuals who submitted applications for acceptance to a selected ADN program between the years 1991 to 1997. Operationally ADN students are defined as those individuals meeting requirements for admission and electing to attend a selected ADN program.
2. Biological sciences GPA: composite of course grades received for the study of living organisms and vital processes, particularly in humans. The biological science GPA is operationally defined for this study as the composite GPA of three courses: Anatomy and Physiology I and II, and Microbiology.
3. English composition GPA: composite of course grades received for the study of fundamentals of English usage, principles of biological reading and writing prose, and effective writing through analysis of novels, poems and plays. Operationally defined for this study, English composition GPAs are the composite grade points of

two basic required English composition courses.

4. Grade point average (GPA): conceptually GPA is a composite index of performance in a group of courses. Operationally defined GPA is the average of the sum of grade points (D = 1 point, C = 2 points, B = 3 points, A = 4 points), each multiplied by the number of credit hours of the courses in the designated courses, then divided by number of credit hours accrued.
5. NCLEX-RN: National Council Licensure Examination in which a graduate nurse must achieve a passing score to be recognized as a Registered Nurse. Operationally defined, success on NCLEX-RN will be a pass status.
6. Pharmacology: the study of classification of drugs, their therapeutic uses and reactions. Operationally pharmacology is defined as the grade in the three-hour course.
7. Program completion: implied by students graduating from the program. Defined operationally as those students completing the course of study and graduating with an associate degree as compared to those not completing the course of study.
8. Psychology: the study of the science of the mind and behavior of humans. Operationally defined for this study, psychology will be the grade in the three-hour introductory course.
9. Remedial courses: special courses designed to up-grade student skills in reading, writing, and math. The student's need for remedial courses was based on their placement test scores in reading, writing, and math. Remediation is a requirement for those students not achieving a passing score on placement tests. Remedial

courses are taught at the college by faculty in the discipline. The student must successfully complete the remedial courses before enrolling in college courses in that area. Students with previous college course credits are exempt from placement testing. Operationally defined for this study, remediation is the number of remedial courses completed in reading, writing, and math respectively. Scores can range from 0 to 3 in each area.

Limitations

The study was limited to one school of nursing, and a limited number of attributes or independent variables were studied. In addition, generalization to other populations is not possible because of the use of a convenience sample and lack of random selection of student records for the study. Because there were no attempts to manipulate or control the variables of interest, causal relationships between variables cannot be established.

Summary

Preparing graduates capable of practicing in the changing health care delivery system has a two-fold responsibility for nursing educators to students and to the general public. With limited enrollments in schools of nursing, determining the criteria for selection of applicants most likely to succeed becomes a major issue. The cost for students, pursuing a course of study in which they are unlikely to be successful raises concerns. Vacancies left by unsuccessful student are a lost opportunity for other applicants. Therefore, identification of criteria that are most likely to indicate student success is of great importance.

CHAPTER 2

REVIEW OF LITERATURE

Prediction of applicant success in nursing programs and on the licensure exam has been a concern of many educational programs. With the demand for nurses outstripping the supply of program graduates, it is important that nursing programs admit applicants that are most likely to complete the program and successfully pass the licensure exam. Weiner's (1985) attributional theory of motivation and achievement is the basis for this study and related literature.

Past studies examining non-cognitive and cognitive factors and placement test scores with subsequent need for developmental course work associated with program success are presented. Most studies found were done in baccalaureate programs and few in associate degree programs (Felts, 1986; Lengacher & Keller, 1990; Oliver, 1985; Reed & Feldhusen, 1972; Woodham & Taube, 1986; Yess, 1980). However, there are a number of variables/courses that have been included in the studies that are required in both types of curriculums.

The review of literature included discussion of studies with non-cognitive and/or cognitive factors as variables. Finally, a discussion of placement testing, developmental courses and their relationship to success in higher education concludes the review.

Non-cognitive Factors

Non-cognitive factors are those psychosocial variables that are non-grade or test related. During the 1970's to 1990's numerous studies of predictors of success in

nursing included only non-cognitive variables or included them with cognitive variables. By the 1990's fewer studies considered the impact of non-cognitive variables. The non-cognitive studies reviewed included personality, applicant's interests, self-concept and self-esteem, letters of recommendation, and interviews with applicants as basis for selecting or predicting success in a nursing program.

In a study with 151 students Burgess, Duffy, and Temple (1972) found measurements of creativity, determination of applicant's interest, personality, and self-concept demonstrated no significance in predicting applicant's success. The variable of self-esteem in Dell and Valine's (1990) study of 78 students did not contribute to prediction of student success. Stronck's study (1979) examining performance of 501 students, concluded that recommendations from faculty advisors based on applicant interviews and letters of recommendation were not useful predictors. Similar non-predictive results were found by Allen, Higgs, and Holloway (1988) with data collected from 296 students' reference letters that proved to be of no value in predicting student success.

Other non-cognitive variables of age, marital status, amount of time students worked while in a nursing program, and previous experience as a nurse aide or licensed practical nurse were not found to be significant in student success in nursing. Studies in associate degree programs by Felts (1986) with 297 students and Yess (1980) with 75 students also found that student age and being a licensed practical nurse did not contribute to program completion and success on the NCLEX-RN. However, Yess found SAT math scores as the most important predictor (16%, $p > 0.05$). Marital status, both

past and present demonstrated the second highest importance with an additional (6%, $p > 0.05$) of the variance in contributing to the dependent variable of student cumulative point average (QPA) as an indicator of student success. McKinney, Small, O'Dell, and Coonrod (1988) found that age, sex, and Type A personality were not predictive of nursing abilities in a study of 136 students. In another study conducted in an associate degree program, Lengacher and Keller (1990) included age and perception of role strain as part of the selection criteria of 146 students and found the variables had no predictive value for performance in the program.

Huch, Leonard, and Gutsch (1992) used the Sixteen Personality Factor Questionnaire (16PF) profile to compare different personality variables among 151 students graduating, those transferring to other majors, and students leaving the program and not continuing to other studies. Discriminate function analysis findings revealed some differences among the personality profiles for the three groups. The personality profiles of graduates ($n = 121$) was more mature, stable, calm, assertive, self-assured, self-reliant, and realistic. Graduates were no-nonsense, tough minded, competitive persons with a down-to-earth approach to life. On the other hand, transfer subjects ($n = 16$) were more dependent, docile, submissive, and easily led; they seemed more impatient, temperamental, more easily annoyed, and more easily frustrated. The subjects who left nursing and not continuing any study ($n = 14$) were more demanding, dependent, impatient, temperamental, unrealistic, fussy, and seemed less capable of becoming team players.

The findings of Huch, Leonard, and Gutsch (1992) differed from those of Hayes

(1981) in measuring personality factors of 156 students utilizing the California Psychological Inventory (CPI) and the Survey of Interpersonal Values (SIV). Variables included a wide range of personality characteristics such as self-acceptance, sense of wellbeing, self-control, independence, conformity, flexibility, and leadership. Hayes failed to find that these personality factors significantly predicted student success.

Oliver (1985) took a somewhat different approach to a study in an associate degree program of 171 students. The majority of the variables were non-cognitive and included: race, sex, age, marital status on admission, part/full time status, previous college attendance, previous experience as a licensed practical nurse; and finally the nursing faculty's prediction of first quarter GPAs and success/non-success of the student completing the program. The cognitive variables included students ranking in high school, and grades in English, algebra and biology courses. Results of discriminant analysis on successful/non-successful program completion were part-time/full-time status ($F = 8.1274, p < 0.05$), and faculty GPA prediction ($F = 17.9120, p < 0.05$). Faculty correctly predicted completion for 46 of the 67 students (69%).

Generally, non-cognitive variables have limited predictive ability for indicating student success in nursing programs. More recent studies to determine predictors of student success have focused on cognitive attributes.

Cognitive Factors

Cognitive factors are those variables related to measurement of a person's knowledge demonstrated by test grades, course grades and GPAs. Studies using cognitive variables as predictors/selection criteria for admission are more prevalent and

have shown better predictive ability, although with varied success. The majority of the studies conducted in the 1990's have focused on cognitive variables of high school rank, SAT and ACT scores, college course GPAs, pre-requisite course grades, nursing theory and clinical course grades. The variable of required remediation in reading, writing, and math for students not meeting minimum requirements prior to proceeding with college course work and possible relationship to student success was also included in a few studies. However, only the need for developmental courses was identified with no requirements that students enroll and complete developmental courses before moving into college credit work.

Grade point average (GPA) of pre-nursing courses was the variable found most often studied, with science courses/science GPA being the second most frequently included variable. The Scholastic Aptitude Test (SAT) and American College Testing (ACT) scores, either the total score or one or more of the individual test scores were frequently included as additional variables for study. GPAs or students rank in high school courses were included with some frequency in studies completed between 1972 and 1986.

Only two studies in 1990 and 1992 included variables from high school performance. It was noted by Seidl and Sauter (1990), and Griffiths, Bevil, O'Conner, and Wieland (1995) that fewer applicants were recent high school graduates, usually between the age of 17 to 22, and referred to as traditional students. More of the applicants were 25 years old and older, may not have been high school graduates, or may have attended other colleges, and probably held jobs. This older group was frequently

referred to as the non-traditional student. Due to these changes in applicant characteristics, performance in high school seems less relevant a predictor of student's success. Studies including student's performance in English, psychology, or humanities courses as variables to determine relationships to success in the program and on NCLEX-RN have been used less often. Felts (1986) indicated that there is a lack of literature exploring sciences and humanities contribution to success in nursing programs.

Lengacher and Keller (1990) conducted a study in an associate degree program for the purpose of examining the relationship between admission variables and performance on NCLEX-RN ($N = 146$). The variables included entrance and exit GPA, ACT scores in English, math and composite ACT score, age, perception of role strain, achievement in clinical and nursing courses, achievement on NLN examinations, and exit GPA. Investigators found significant correlations between NCLEX-RN success and entrance GPA ($r = 0.5113$, $p > 0.001$) and ACT English ($r = 0.5320$, $p > 0.001$). Using multiple regression the admission variables that were the best predictor of performance on the NCLEX-RN was ACT composite score that accounted for 56% of the variance. Age, perception of role strain, and ACT math and English scores had no predictive value in this study.

The purpose of the study by McClelland, Yang, and Glick, (1992) was to investigate the relationships between admission selection variables, Assess Test scores, and courses in the program with success in the program and on the NCLEX-RN scores. The study included a statewide sample of 1,069 graduates from baccalaureate programs. Significant correlations were found between the NCLEX-RN and high school GPA, ACT

sub-test and composite scores, grades from all pre-nursing courses, nursing course grades, and the Assess Test ($r = 0.28$ to 0.48 , $p < 0.001$). In the stepwise multiple regression ACT composite score contributed the greatest amount of variance (13%; $p < 0.001$, $n = 426$) with the NCLEX-RN. Assess Test scores accounted for an additional 12% of the variance, and nursing GPA accounted for an additional 5% of the variance ($p < 0.001$).

Several variables were examined in Foti and DeYoung's (1991) study including overall GPA, GPA in the major, science GPA, SAT verbal and quantitative, NLN Comprehensive Baccalaureate Achievement Test scores, Mosby Assess Test scores and performance on the NCLEX-RN ($N = 298$). The highest correlation of 0.66 was between the Mosby Assess Test and the NCLEX-RN. Using multiple regression analysis the combination of Mosby Assess Test, overall GPA and SAT verbal score accounted for (49%) of the variance in NCLEX-RN success. The remainder of the variables added no further predictive value.

In an effort to replicate a study conducted by Kissinger and Munjas (1982), Wold and Worth (1990) used four variables to determine instruments most predictive of student success in the nursing program's theory and clinical grades, and clinical course ratings assessed by faculty. As in the Kissinger and Munjas study, instruments used were the Witkin's Group Embedded Figures Test, a test to predict success in problem-solving as needed in the nursing process; the Extended Range Vocabulary Test to measure both verbal ability and the attribute of convergent thinking; the Inference Test to measure logical reasoning; and SAT verbal scores. For this study one additional variable of the

GPA of seven prerequisite courses was added. The prerequisite courses included anatomy and physiology, bacteriology, organic chemistry, inorganic chemistry, general psychology, and child development. Due to missing data the sample size was reduced from 155 subjects to 57. In three regression evaluations one produced a statistically significant result. The pre-requisite GPA and SAT verbal scores accounted for 46% of the theory and clinical course grades and clinical rating. These findings did not support those of the Kissinger and Munjas's study in which SAT scores and the three tests identified students successful in implementing the nursing process.

Hayes (1981) included cognitive variables of SAT verbal and quantitative scores, freshman semesters GPAs (two chemistry and two psychology courses, one course in English, history, math, philosophy and speech). Non-cognitive variables included personality factors measured by the California Psychological Inventory (CPI), Survey of Interpersonal Values (SIV), and success on the NCLEX-RN ($N = 290$). In multiple regression analysis all of the cognitive variables accounted for 62% of the variance. The predictor accounting for 37% of the variance was the GPA for the second freshman semester. Adding grades in math and psychology, 50% of the variance ($R^2 = .509$) was accounted for. The non-cognitive variables of CPI and SVI did not contribute significantly to the variance of NCLEX-RN success.

Woodham and Taube (1986) conducted a study in an associate of science nursing program for the purpose of determining predictors of student performance on the licensing exam ($N = 107$). The variables were high school percentile rank, age on graduation from the nursing program, SAT verbal and math score, scores of nursing

major courses, and NCLEX scores. All nursing course grades ($r = 0.51147$ to 0.66746 , $p < 0.001$) and SAT verbal scores ($r = 0.62677$, $p < 0.001$) demonstrated a significant correlation at with success on the NCLEX-RN. Age at graduation, high school percentile rank, and SAT math scores were not significantly correlated. The weighted sum of the course grades accounted for 67% of the variance in the NCLEX-RN scores.

McKinney, Small, O'Dell, and Coonrod (1988) examined relationships between pre-entrance test scores of SAT total, math and verbal; cumulative GPAs of pre-nursing, nursing theory and clinical courses; Mosby Assess Test scores; Type A personality, age and sex with results on the NCLEX-RN ($N = 136$). SAT verbal scores were ($r = 0.610$), SAT total ($r = 0.577$), SAT math at ($r = 0.374$), and pre-nursing GPA correlated at ($r = 0.387$, $p < 0.001$) with success on the NCLEX-RN. Clinical nursing courses, sex and personality type did not demonstrate significance.

To examine admission criteria to a nursing program, Stronck (1979) studied 501 applicants to determine the correlation between minimum cumulative GPA of prerequisites, recommendations from a nursing advisor based on an interview, recommendations from employers or high school/college instructors, and the students' performance in the upper division courses. The pre-requisite courses included anatomy and physiology, chemistry, microbiology, nutrition, introduction to sociology and growth and development. Results of the study found GPAs of all courses taken before admission and prerequisite courses for the nursing program were significantly correlated to future academic performance. Specific correlation numbers were not included in the report.

A study by Seither (1980) proposed to search for valid predictors of academic

success and on-the-job performance of baccalaureate nursing program graduates ($N = 180$). The variables included high school percentile rank, high school class size, Strong Vocational Interest Test scores, GPAs in biological and behavioral sciences, achievement on each state board scores (older terminology for NCLEX-RN) and supervisors ratings on the job performance. GPAs of biological science were the best predictors on all exam scores with 54% of the variance, except, the psychiatric nursing portion of the exam. Social science GPAs were most predictive and accounted for the greatest portion of the remaining variance 11%, and high school rank accounted for 2% of the variance. None of the variables were found to be predictive of supervisor's rating of on-the-job performance.

Yang, Glick, and McClelland (1987) conducted a study ($N = 210$) to determine if there was a relationship between admission selection variables of high school rank, ACT scores, GPAs for chemistry, biological sciences, social sciences, GPA of all pre-nursing courses and success on the NCLEX-RN. Findings from correlations revealed GPAs of all pre-nursing courses ($r = 0.65$, $p < 0.01$, $n = 197$) were best predictors for success in clinical nursing courses, followed by social science GPA ($r = 0.57$, $p < 0.01$, $n = 194$), biology GPA ($r = 0.56$, $p < 0.01$, $n = 195$). ACT social science score ($r = 0.48$, $p < 0.01$, $n = 204$) was highest correlation predictor for success on the NCLEX-RN followed by biology GPA ($r = 0.39$, $p < 0.01$, $n = 195$) and sociology GPA ($r = 0.38$, $p < 0.01$, $n = 194$). In stepwise multiple regression with NCLEX-RN as the dependent variable and six independent variables ACT composite accounted for 14% of the variance followed by chemistry GPA of 3%, and pre-nursing GPA of 2% for a total of 19% of the variance.

Whitley and Chadwick (1986) studied an unusual failure rate on the NCLEX-RN of graduates from a baccalaureate program. Concern was voiced that an integrated curriculum and teaching methods used were associated with the higher failure rate. The study group included 176 graduates (148 were successful, 28 were not). The study variables included SAT verbal and math scores, prerequisite science GPA, prerequisite GPA, exit GPA, academic warnings, junior and senior year exam scores, age, ethnicity, and marital status. Correlations were computed with all variables. Those found to be the strongest predictors were science GPAs ($r = .48$, $p = 0.000$) and prerequisite GPA ($r = 0.43$, $p > 0.000$) success on the NCLEX-RN. SAT verbal ($r = 0.33$, $p > 0.05$, $n = 41$) and SAT math ($r = 0.23$, $p > 0.01$, $n = 41$). Non-successful candidates had more academic warnings, and their GPA gradually decreased in the nursing major courses at a much higher rate than the successful graduates

Mills, Sampel, Pohlman, and Becker (1992) conducted a study to identify predictors of success on the NCLEX-RN ($N = 531$). The use of admission criteria of high school GPA, ACT sub-scores on social science, natural science, mathematics and English, and cumulative GPA for nursing courses at the end of each of the four academic years. A series of five models were tested to determine the odds for passing NCLEX-RN. The initial model included high school GPA, four ACT sub-scores, sex, and age. An odds ratio showed that students could increase their chance of passing NCLEX-RN by 10.12 times for each unit increase on the ACT social science sub-score. The second model included all variables from the first model with addition of the freshman cumulative GPA in the regression equation. Results from the second model showed

students had a five times better chance of passing NCLEX-RN with each full letter grade increase. In the third model all variables in the first and second models were present with cumulative GPA and sophomore year GPA added. The highest sensitivity of all five models occurred in the third model with a 76.6% possibility of correctly identifying students to pass NCLEX-RN. In this study admission variables were the poorest predictor of success on the NCLEX-RN. Those students who maintained a C+ average in course work in the nursing program decreased their probability of success on the NCLEX-RN. Students maintaining a B or better increased their probability of success on the examination. Unfortunately, it is not possible to use nursing course work averages for ADN admission decisions.

Burgess, Duffy, and Temple (1972) conducted two studies to determine predictors of success in a nursing program. The first study ($N = 76$) included 56 intellectual, interest, personality, educational variables, and pre-nursing GPA. Pre-nursing GPA emerged as the most significant predictor ($r = .56$, $p < .01$). The second study ($N = 74$) served as a cross validation study with the same variables except, the pre-nursing GPA was deleted. When the pre-nursing GPA was removed from the matrix there was considerable prediction shrinkage. Conclusion of the researchers was that pre-nursing GPA was the most significant factor in overall prediction.

The purpose of a study by Dell and Valine (1990) was to determine relationships among SAT/ACT scores, collegiate GPA, self-esteem, and age and scores on the NCLEX-RN. The subjects were senior generic students volunteers ($N = 78$) from three small four year schools. In multiple regression analysis 64% of the variance included

SAT/ACT scores, GPA, self-esteem, and age. However, GPA accounted for 58% of this variance.

Allen, Higgs, and Holloway (1988) expressed a concern that there was a decline in the quantity and quality of applicants resulting in an increase in applicants who were at risk for academic difficulty. The purpose of their study was to identify characteristics that might indicate those students at risk as well as identify factors for success. Variables included were demographic data of; personal/personality; sociologic/situational; and scholastic performance, non-grade and grade related. Scholastic performance, grade-related variables included GPA on biophysical science prerequisites, total prerequisite GPA, and cumulative GPA at the time of application. Also, the pattern and number of withdrawals from all college work, number and pattern of D grades, pattern, presence, or absence of F grades. The data was analyzed using Chi-square, t test, analysis of variance (ANOVA), correlation, and multiple regression.

Chi-square analysis was used to determine relationship of factors to earning a grade of F in nursing course work. The variables of receiving more than two D grades ($\chi^2 = 17.91, p > 0.000$), and more than two withdrawals from courses ($\chi^2 = 16.62, p > 0.0008$), and combination of D and F grades, and more than two withdrawals ($\chi^2 = 12.02, p > 0.005$) were the scholastic variables that demonstrated the highest relationship of factors related to earning a grade of F. Students with lower grades and prior course withdrawals were more likely to earn failing grades. Chi-square was also used to determine factors related to non-completion of the nursing program. Previous D grades ($\chi^2 = 7.07, p > 0.007$), combination of grades of D and F with more than two withdrawals ($\chi^2 = 6.25, p =$

0.01), and previous F grades ($\chi^2 = 4.05$, $p > 0.03$) were the three scholastic variables that related the most to non-completion of the nursing program.

Factors related to earning a grade of F in nursing course work and factors related to non-completion of the nursing program were assessed using a t test. Lower cumulative GPA ($t = 3.55$, $p > 0.000$) and lower prerequisite GPA ($t = 2.35$, $p > 0.018$) were the only two variables with significant relationship to earning a grade of F. Lower cumulative GPA ($t = 2.67$, $p > 0.01$) and lower prerequisite GPA ($t = 2.28$, $p > 0.026$) were also the only two variables demonstrating a significant relationship with non-completion of the nursing program.

Analysis of variance was used to determine factors associated with lower nursing grade point averages. Multiple D grades ($F = 8.38$, $p > 0.0000$) and lower reference scores on verbal fluency ($F = 6.10$, $p = 0.003$) were the two variables demonstrating the most differences in GPAs. Students making multiple D's and having lower verbal fluency had significantly lower GPA. Pearson correlation was used to determine factors related to lower nursing GPAs. The four variables, lower prerequisite GPA ($r = 0.53$), fewer outstanding prerequisites ($r = 0.50$), lower admission committee rank ($r = 0.45$), and lower cumulative GPA ($r = 0.23$) were all significant at $p > 0.000$. In the stepwise multiple regression of pre-admission variables with nursing GPA results reflected the following amounts of the variance; prerequisite GPA 28%, cumulative GPA an additional 2%, previous baccalaureate degree 3% more, and a pattern of D grades represented an additional 1%, for a total of 34% of the variance in nursing grade point average.

In summary, findings of the Allen, Higgs, and Holloway study demonstrated

demographic pre-admission variables such as age, references, amount of time students worked and prior health care experience were not significantly related to a lower nursing GPA. The prerequisite GPA accounted for the largest portion of variance in the nursing GPA with the cumulative GPA at the time of selection adding little additional variance. Previous degrees and a pattern of D grades accounted for little variance in the nursing GPA. However, the authors concluded that the findings demonstrate the usefulness of the cumulative and pre-requisite GPAs as predictors of success or to identify at-risk students.

The primary objective of the study by Perez (1977) was to determine variables of the sophomore year ($N = 123$) that would best predict BSN student success on the NCLEX-RN. The 12 predictor variables selected were ACT scores, GPAs at various academic levels, GPAs for science and social science prerequisites, and the National League for Nursing (NLN) score. The NLN scores are sometimes viewed as potential indicators of the student's success on the licensing exam. In a series of six regression equations the 12 variables were examined for their ability to predict performance on the five areas of the State Board Nurse Exam (medical nursing, surgical nursing, obstetrical nursing, nursing of children, and psychiatric nursing) and total Board performance. Out of the twelve predictor variables 11 variables (all except the NLN achievement test) contributed to the regression equations. In terms of medical nursing 68% of the total score variance was predicted; surgical nursing 78%, obstetrics 75%, pediatrics 75%, psychiatry 77%, and total state board score 76%. The three variables that appeared earliest in the regression equations and appeared to be the most sensitive predictors were

ACT Social Science Reading score, GPA on completion of the freshman year and social science GPA. The author commented that the length of the regression equations were disappointing and made application impractical.

Fowles (1992) studied 182 graduates to determine predictors of success on NCLEX-RN and implications for early intervention for students at risk. Variables included ACT composite and separate scores, lower division GPA that included English, speech, philosophy, microbiology, anatomy and physiology, chemistry, statistics, social sciences, psychology and growth and development; GPA of lower division science courses, GPA in liberal arts, grade in anatomy and physiology I and II, GPA at the end of nursing curriculum Level II that included nursing clinical courses, and Mosby's Assess Test percentages. Thirty percent of the variation in NCLEX-RN scores were explained by GPA of Level I, percentile score on the Mosby Assess Test, and ACT social studies subscale.

Payne and Duffy (1986) gathered data over a two-year period from 283 graduates' records to determine if academic variables could be used to identify those students at risk and in need of special interventions. The independent variables used were pre-nursing GPA, SAT math, verbal, and total, and nursing course GPAs. When the variables of pre-nursing GPA with SAT scores were combined, the predictive coefficient demonstrated 33.3% of the variance with the NCLEX-RN scores. When the variable of mid-junior year nursing GPA was included with the first two variables, prediction was increased to account for 48.3% of the variance in the NCLEX-RN score, and to 53% of the variance of all of the above variables with the mid-senior year GPA included.

Glick, McClelland, and Yang (1986) investigated relationships between admission selection variables, achievement in clinical nursing courses, relationships among the variables, and achievement in the program and the NCLEX-RN ($N = 51$). The variables included high school rank and GPA, ACT composite and individual scores, grades from all required pre-nursing and nursing courses, and NCLEX-RN scores. Results of the study demonstrated a correlation between biology GPA and nursing courses of ($r = 0.63$, $p < 0.0001$) and pre-nursing GPA with nursing GPA ($r = 0.57$, $p < 0.01$). No statistically significant relationships between pre-nursing GPA and biology GPA with the NCLEX-RN score were found. A stepwise multiple regression revealed that the pathology grade contributed 10% of the nursing GPA variance. Biology, social science, and pre-nursing GPAs were not significant predictors. In assessing the influence of clinical courses on NCLEX success, the first clinical course accounted for 31% of the variance in NCLEX scores, the second clinical course added 1% to the variance while the third clinical course added an additional 1% for a total explained variance of 33%.

Jenks, Selekman, Bross, and Paquet (1989) had similar findings to Glick et al. where pre-nursing data did not correlate with success on the NCLEX-RN. The purpose of this study was to identify predictors of success and provide interventions for students who were identified at risk. The study included review of records of 407 graduates of a baccalaureate program over a four year period. The variables were lower division GPA, science GPA, lower division college previously attended, age, sex, nursing theory course grades, and the Mosby Assess Test. Results of correlation demonstrated the Mosby Assess Test as having the strongest relationship with the dependent variable of NCLEX-

RN ($r = 0.730$, $p < 0.0001$). Stepwise multiple regression analysis was done at three points of time, at time of entrance to the program, end of junior year, and at graduation. For the regression analysis at time of entrance, transfer GPA, science GPA, transfer credits, sex, age, type of institution attended accounted for little variance (15%) on NCLEX-RN scores. With the inclusion of three clinical nursing courses the variance the variance increased to 47%, and at graduation with the addition of four clinical nursing courses the variance increased to 61%.

Felt's study (1986) determined which cognitive variables predicted success in an associate degree nursing program and examined the relationship between cognitive and demographic variables and success on the NCLEX-RN ($N = 297$). The cognitive variables included high school GPA, ACT scores, nursing achievement tests, grades in support courses, GPAs in humanities, biology, physical and social sciences, and influence of being a licensed practical nurse on the pass rate on the NCLEX-RN. To determine if any admission variables were useful in predicting nursing course GPAs, a forward stepwise multiple regression as done. The ACT composite score was a significant predictor and accounted for 27% ($p < 0.001$) of the variance in nursing Support course GPAs and microbiology were also significant predictors ($p < 0.001$) and increase the total variance accounted for to 46%.

Calculation of the discriminant function of course grades revealed significant discrimination between the NCLEX-RN pass/fail groups where microbiology, anatomy/physiology, sociology, child psychology, and English I grades explained 29% of the variance of group membership. Age and previous licensure as a practical nurse were

not associated with passing the NCLEX-RN (Felts, 1986).

Quick, Krupa, and Whitley (1985) explored the possibility of using data from pre-nursing courses at the time of application for admission to clinical nursing courses to predict performance on the NCLEX-RN ($n = 182$). The variables included SAT verbal and math scores, freshman course GPA, college algebra, theory and laboratory grades in chemistry, biochemistry, and anatomy and physiology. The results of the discriminant analysis revealed that predictor variables did discriminate between the pass and fail group ($p < 0.0001$). Pre-nursing GPA was the best predictor of NCLEX success with a standardized coefficient of 0.6752, followed by SAT verbal scores (0.5910), and anatomy and physiology lecture course grades (0.2540). Grades in chemistry and biochemistry courses were inversely related to NCLEX-RN performance. Prior nursing GPA, SAT verbal scores and anatomy and physiology course grades correctly classified students in terms of NCLEX performance with 83.3% accuracy for students passing. For students predicted to fail, 84.2% ($n = 16$) did fail.

Other studies did not find biology /science courses to be predictive of success in a nursing program or on the NCLEX-RN. Foti and DeYoung (1991) found no correlation between science GPA and success on the NCLEX-RN. Yang, Glick, and McClelland (1987) reported that biology GPA demonstrated no predictive value for pass/fail on NCLEX-RN. Glick, McClelland, and Yang (1986) study demonstrated a correlation between biology GPA and nursing GPA, but no relationship between biology GPA and success on the NCLEX-RN.

In summary, multiple cognitive variables have been used in studies with multiple

combinations to determine selection criteria for nursing programs that will select those students most likely to be successful in the program and on the NCLEX-RN. Findings have varied from study to study, but the variable of grades in college biology courses/GPA of biology courses are the variables most often associated with predictions of success. The SAT and ACT composite/sub-scores have demonstrated a degree of predictiveness. Studies using nursing theory and clinical course grades have proven to be useful predictors in some studies.

Placement Testing and Developmental Courses

Several studies reviewed revealed mixed findings on subsequent performance for students who required remedial courses and their subsequent success in higher education. Markus and Zeitlin (1993) stated that remedial education has been and will continue to be an important part of undergraduate curriculums. England (1994) found that students ($N = 743$) in a community college requiring remedial courses did not perform as well in college level work when compared to students not needing remedial courses. Students needing developmental courses in at least three areas were less likely to transfer to upper level colleges (12.1%) compared to non-developmental students whose transfer rate was 45.6%.

Hamilton (1994) compared two groups of students who were at risk for academic failure. The first group ($n = 68$) were placed in a program that included developmental courses, academic support services, and counseling. The second group ($n = 233$) did not receive additional services. After one year the developmental group had average GPA of 2.22 compared to the second group with an average GPA of 1.70. Sixty nine percent of

students in the developmental group returned for the second quarter compared with 79% for the non-developmental group. The author concluded that the developmental program produced a better overall academic outcome for the at-risk students.

Strehlow (1996) also found that remediation improved success. In a study at a community college, students completing remedial writing courses had a median GPA of 2.0 in English courses compared to non-completers who had a median GPA of 1.0. In addition, developmental completers had a higher median ratio of credits completed compared with non-completers (0.85 versus 0.44) and a higher GPA (2.28 versus 0.9) at the end of the year.

A recent report (Academic Progress of Developmental Students, 1995) found that 45% of students who took developmental courses then enrolled in a higher level course. Two-thirds of the developmental students were then successful in the higher level course. It was also noted that developmental students had better overall retention rates (42%) over the non-developmental students.

Sometimes students needing developmental assistance failed to take advantage of help available. Foti and De Young (1991) commented that the academic support program available at the institution was not utilized by students. Nursing student's skills in vocabulary and reading comprehension were tested and students not meeting the minimum requirements were referred to an academic enhancement program. The program offered assistance with note taking, test taking, stress reduction and reading comprehension skills. However, not all students referred took advantage of the help available.

Boughan (1993) studied 853 nursing students to evaluate progress and performance of developmental students from admission to taking the NCLEX-RN, between placement test scores and performance on the NCLEX-RN. Almost half of the students chose not to do placement testing or did not complete developmental courses. For those completing developmental courses, only modest gains in the probability for progress, performance, graduation, and success on the NCLEX-RN was noted. Students who required developmental coursework were less likely to pass the NCLEX-RN on initial try, than those not needing developmental course work. The pass rate on the NCLEX-RN on first try for the non-developmental students was 91% as compared to students needing remediation who had a pass rate of 78%. The students needing developmental course work may have needed one or all three developmental courses. Students not completing all developmental courses had a first try pass rate of 77%, compared to developmental completers who had a 81% pass rate on first try of NCLEX-RN.

English placement scores demonstrated a good relationship with first try NCLEX-RN pass rates ($r^2 = 0.094$,); reading scores ($r^2 = 0.037$) demonstrated a fair relationship; but no relationship was found between math placement test scores and NCLEX-RN success. The author commented that 167 students per year would have to be accepted to graduate 100 students per year.

Summary

The attempts to determine the best predictors of nursing students' success in a nursing program and on the licensing exam, is an effort of long standing. The studies focusing on non-cognitive variables provided little direction in utilizing them as criteria

in student selection. Placement testing and provision of developmental courses for those students not meeting minimum scores in reading, writing and math have demonstrated varied results. The studies that focused on cognitive variables proved predictive in some studies and non-predictors in others resulting in mixed results. As the characteristics of the pool of applicants change, continued study of cognitive predictors, placement testing and effect of developmental courses is warranted.

CHAPTER 3

PROCEDURE FOR COLLECTION AND TREATMENT OF DATA

The purpose of this study was to determine the relationship of selected performance characteristics of ADN program students to program completion and success on the RN licensing exam. This study used an ex post facto design used to describe existing data. In an ex post facto design there is no manipulation of the independent variable, because the event being investigated has occurred (Talbot, 1995). This design simply provides an opportunity to describe associations found following the event of interest.

Since the study was retrospective, extraneous variables were not subject to control, or included as a part of the study design. Description of results of independent variables as predictors will be reported, but no causal relationships can be projected from the measurements. According to Pedhazur and Schmelkin (1991) causal relationships cannot be projected as explanations for a subsequent event.

Setting

The setting for this study was a community college with enrollments that average approximately 6,000 students per semester. The college is located in a city of approximately 70,000 population in the metropolitan area of a large city in the south central United States. The nursing program is accredited by the National League for Nursing. The school of nursing admits 60 to 72 students per year using specified admission criteria. Students attending the college come from the city in which the

college is located, the surrounding rural area within a 60 to 70 mile radius of the school, small towns within the rural area; and some from the nearby large city.

Admission to the nursing program is determined by calculation of a score for the applicants. Points are assigned for: a) numbers of hours completed in the nursing curriculum prior to their official admission; b) number of pre-requisites hours completed in the nursing curriculum; c) overall GPA of courses completed in the nursing curriculum; d) GPA of all science courses completed in the nursing curriculum; and e) hours successfully completed with a "C" or above in natural sciences not required in the nursing curriculum. The points from each section are totaled for an overall score. There is no preset number of points required for admission. Those applicants receiving the highest scores are accepted into the program. The number of applicants accepted is governed by availability of faculty and clinical slots.

The majority of the applicants and eventual nursing students are Caucasian. From 1990 to 1993 the number of minority students (Asian, Black, and Hispanic) ranged from 11 to 15 in classes of 70 plus students. In 1995 the number of minority students entering the program rose to 30 in a class of 79. The number of male student admissions has ranged from three to 10.

Prior to the early 1990's, the average retention rate of students in the nursing program was in 90% range. Starting with the class admitted in 1990 the retention rate dropped to 61% and a low of 30% retention with the class admitted in 1996. For all classes admitted between 1990 to 1996 the average retention rate has been 53%.

Population and Sample

The population for this study will be students who have completed high school or the alternative Graduate Equivalency Diploma (GED); met the requirements for entry to the college; and have completed specific general education courses required for the nursing curriculum. The target population will be those students who were accepted for the ADN program. Therefore, a convenience sampling method will be used including all students who were admitted between 1991 to 1997.

To determine an appropriate sample size, the effect size (ES), alpha, and power needed was determined (Cohen, 1988). To calculate power for logistic regression a quantification of the relationship, or an odds ratio, is needed to determine the odds of an event occurring to the odds the event not occurring (Kleinbaum, Kupper, Muller, & Nizam, 1998). No such ratios were found in the literature so an estimation of ratios was used as a basis for the calculations of effect and sample size. An odds ratio of 1.73 was derived by taking nursing curriculum cumulative GPAs of students failing the program ($N = 41$), determining percents of students with a GPA of less than 3.0 and dividing that number by the percent of students with a GPA of 3.5 or above. For an alpha of 0.05 and power of .80, and an odds ratio of 1.73, it was determined that a sample size of 166 subjects will be needed to find relationships if there are relationships between the independent and dependent variables.

Protection of Human Subjects

The study was exempt from institutional review because this research involved collection of existing data that were publicly available for research purposes and because

students were not identified. Agency permission was obtained prior to collection of data (Appendix A).

Because only readily available data were collected from student records, the only risk to the student was possible loss of confidentiality. To preserve confidentiality, a master list of student names with an assigned study code number was kept in a locked file cabinet in the investigator's office. The students' study code numbers were placed on student records when the records were identified as meeting the criteria for the study. The recordings of information on the variables did not include the student names, only the assigned study code number.

Instruments for the Study

The aim of this study was to determine criteria for selection of students most likely to be successful in the nursing program and on the NCLEX-RN. One instrument, the Student Data Sheet, was used to gather data for this study (Appendix B). Descriptive data of age, sex, ethnicity, prior college degrees, and number of semesters required to complete the program, and GPA of all curriculum courses at graduation were collected. Data collected from each record included the five independent variables that are course grades in pharmacology and introduction to psychology, the biology and English GPA, and evidence of remedial course completion. The dependent variables for the study are completion or failure in the nursing curriculum, and pass or fail on the NCLEX-RN. Students withdrawing from the nursing program with a passing average in the course were excluded from the study. Students withdrawn from the program after a course failure or withdrawing from a course with a failing average remained in the study. In

some instances the student has reentered the program and completed the program after a nursing curriculum course failure. These students were retained in the study.

Factors for the Student Data Sheet were obtained from the literature of previous studies done to determine predictiveness of various criteria deemed appropriate for determining applicants' success in schools of nursing. Nunnally and Bernstein (1994) state that predictive validity concerns the use of an instrument to estimate some specific behaviors or a relationship between the predictor and some events occurring before, during, or after the predictor is applied. To determine the predictive validity of the independent variables for this study, the literature was reviewed to determine correlations between the proposed independent variables and the dependent variables. The independent variables were age, sex, ethnicity, prior college degrees, number of semesters required to complete the program, and GPA of all curriculum courses at graduation, as well as, course grades in pharmacology and introduction to psychology, biology and English GPAs, and if the applicant was required to take remedial courses prior to proceeding with credit courses. All students have access to the same remediation system at this college, but the remediation is targeted at the student's particular deficit. The dependent variables were successful completion of the nursing program and passing the NCLEX-RN.

To determine the validity of the variables proposed for the study, content validity was established. The Student Data Sheet with an explanation of the purpose of the study was sent to a panel of experts who were asked to review the items to determine if there is agreement with the scope of the items and if they reflect the question under

consideration. The panel of experts included 10 Deans of associate degree nursing programs. Five responses (50%) were returned. To evaluate the responses the Content Validity Index (CVI) as described by Lynn (1985) was used. The responses on pharmacology grade and science GPA were judged "relevant" and "very relevant" (CVI = 1.0). Course grades in psychology and English GPA were judged "somewhat relevant" to "relevant" (CVI = 0.4). The variable of number of remedial courses taken was judged "somewhat relevant" to "relevant" (CVI = 0.2). For the total instrument of seven variables the CVI = 0.6. However, when scores for remedial courses were eliminated the CVI = 0.7). As suggested by Lynn, scores not achieving minimum agreement of the experts should be eliminated or revised. The variable of the number of remedial courses a student was required to take was revised to include clarification of the specific number of remedial courses.

Intrarater reliability was done to determine clarity of the instrument, reliability of measurements and recording of information over a time span. Intrarater reliability was conducted between initial and subsequent recording of data from the same student records by the same rater. LoBindo-Wood, & Haber (1990) and Smola (1988) state a level of 0.70 or higher is considered an acceptable level of reliability. The criterion data on the Student Data Sheet requires recording of objective data that is not open to subjective interpretation that invites variable interpretation of data. The expected intrarater reliability for this instrument was placed at 0.80. Intrarater reliability was done on 17 records following a lapse of seven to ten days between record reviews with a resulting 93% agreement. As recommended by Brennan and Hays (1992), in addition to

percentages, Kappa scores were calculated. The rationale given was that calculation of percentage agreements may reflect an inflated agreement score, because agreements due to chance are not eliminated from percentage calculations. However, Kappa determines the extent of agreement beyond that which would be expected by chance. The result of the Kappa calculation was 0.94. Thus the percentage and Kappa calculation of intrarater reliability exceed the minimal score of 0.80.

Content validity of the NCLEX-RN is an ongoing process and based on job analysis done quarterly with reports published every three years (National Council of State Boards of Nursing, 1995). Reliability of the NCLEX-RN is based on a decision consistency statistics that has been running 0.87 to 0.92. Validity of the test is tested by procedures that assure content, face, construct, predictive, and scoring validities (National Council of State Boards of Nursing, 2000, on line). In Payne & Duffey's (1986) study the validity of the NCLEX-RN was supported.

Procedure for Data Collection

After permission to review records had been given by the agency, records of all students admitted to the ADN nursing program over a period of six years meeting the criteria of completion of courses in the study were reviewed. Initially records were reviewed to determine if the study criteria were met. The criteria for inclusion in the study were the availability of recorded grades for pharmacology, introduction to psychology, anatomy and physiology I and II, microbiology, and English I and II. Records, and demographic data meeting the criteria were reviewed and data were recorded on the Student Data Sheet.

Pilot Study

Prior to the major study a pilot study was conducted using 17 student records. After receiving permission to review student records, the following procedure for data collection was followed. To include records of students admitted over several years (1991-1996) every tenth record was reviewed. It was found that the records had been sorted into graduated and non-graduates and filed in separate file cabinets. To provide representation from both groups, a random record was pulled from each group and then every tenth record from each group till information from a total of 17 records had been obtained.

The total sample for the pilot study included information from 17 records, nine records were students who were successful in the program and on the NCLEX-RN. The remaining eight records represented information from students who had not been successful in the program. No records drawn reflected a student being successful in the program but not on the NCLEX-RN.

For the total sample of 17 records the means and standard deviations (SD) for the courses grades and GPAs were as follows: pharmacology mean = 2.8, (SD = .73); psychology mean = 3.3, (SD = .69); GPA of biology mean = 3.9, (SD = .69); GPA of English mean = 2.9, (SD = .72).

A comparison of course grades and GPAs between records of the nine students that passed and the eight that failed the program the statistics are displayed (Table 1). The

mean scores of all courses and GPAs were consistently higher for those passing the program.

Table 1

Mean Scores for Pass/Fail the Program.

| | PASS | | FAIL | |
|---------------------|-------------|-------------|-------------|-------------|
| | MEAN | S.D. | MEAN | S.D. |
| Pharmacology | 3.12 | 0.64 | 2.55 | 0.73 |
| Psychology | 3.62 | 0.52 | 3.00 | 0.71 |
| Biology GPA | 3.01 | 0.71 | 2.72 | 0.62 |
| English GPA | 2.75 | 0.80 | 2.94 | 0.77 |
| Reading | 148 | 15.67 | 136 | 4.94 |
| Writing | 5.2 | 0.95 | 5.4 | 1.34 |
| Math | 17.8 | 6.18 | 17 | 8.27 |

Eight (47%) of the 17 records reviewed had scores of reading, writing and math placement testing. All students passing in the program also passed the NCLEX-RN. The mean for the eight reading scores was 141.4 (SD = 12.08) with a range of scores from 131-169. Writing score mean was 5.33 (SD = 1.11) with a range of scores from 4-7. Math scores ranged from 3-32 with a mean score of 17.33 (SD = 6.98). The means of reading and math scores were higher for those successful in the program, however, the mean remedial writing scores were slightly higher (0.02) in the unsuccessful group.

Forward stepwise logistic regression findings did not reveal any independent

variables as significant in predicting success in the program. The grade in psychology was the only variable entered when the estimation was terminated at 10 iterations because the Log Likelihood decreased by less than 0.01 percent.

Treatment of Data

Descriptive statistics were used to describe the total sample and sub-samples according to outcomes in the program and on the NCLEX-RN. Age, sex, ethnicity, prior college degrees, numbers of semesters required to complete the program, and GPA of all curriculum courses at graduation were discussed. The means, standard deviations, frequencies, and percents of course grades, GPAs of courses, and number of remediation courses with pass/fail designations were displayed in tables. Completion of the nursing program and pass/fail on the NCLEX-RN are nominal level data from which frequencies and percentages in each category were determined.

To answer the research questions, logistic regression was used to determine the degree of predictiveness of the individual independent variables on the dependent variables. The logistic regression design allows use of passive observational methods, which are appropriate when the intent is to determine if certain variables can predict outcomes, without manipulation. Logistic regression requires no assumptions on the normalcy of the distribution of the predictor variables or linear relationships between independent and dependent variables. The predictor variables can be a mix of continuous/interval, discrete, and dichotomous variables. In addition, logistic regression allows for prediction of discrete, dichotomous outcome variables such as pass or fail. Logistic regression predictors are included and removed from the equation based on

statistical criteria (Tabachnick & Fidell, 1996).

CHAPTER 4

ANALYSIS OF DATA

To determine predictors of nursing student program and NCLEX-RN success, an ex post facto study consisting of a student record review was conducted. Ex post facto studies are useful for determining associations between variables after an event has occurred. The basis for this study was Weiner's (1985) attributional theory of motivation and achievement. Data were gathered from records of students who graduated from an ADN program in a community college between the years 1991 to 1997. The data were coded and analyzed using the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were used to describe the sample and logistic regression used to answer the research questions. Information in this chapter includes a descriptive analysis of the sample and finding in relation to the two research questions.

Description of the Sample

One hundred and seventy seven student records were randomly selected and reviewed to determine if they met the inclusion criteria. Data were collected from those records that had all information required for the study. Demographic data collected included information on sex, age, ethnic origins, number of remedial courses taken, and previous college degrees. The following sections summarized this information. Of the 177 records reviewed the majority of the sample was females 88.7% ($n = 157$) while 10% were males ($n = 19$). Ethnic distribution was: Caucasian (71.8%), black (16.9%), Hispanic (7.3%), Asian/Pacific Islander (2.8%), and International (1.1%). Table 2

summarizes this information. Ages ranged from a minimum of 19 to a maximum of 58 years with a mean age of 31.5 years ($SD = 9.05$).

Table 2

Number and Percentages of Ethnicity of Admissions, Graduates, and Pass NCLEX-RN

| ETHNICITY | NURSING ADMISSIONS $\underline{N} = 177$ \underline{n} | NURSING GRADUATE $\underline{n} = 136$ \underline{n} | PASS NCLEX-RN $\underline{n} = 106$ \underline{n} |
|-----------------------------------|---|---|--|
| Caucasian | 128 71.8(%) | 108 79.4(%) | 87 82.0(%) |
| Black | 30 16.9(%) | 16 11.8(%) | 13 12.3(%) |
| Hispanic | 12 7.3(%) | 9 6.6(%) | 6 5.7(%) |
| Asian/Pacific Islander | 5 2.8(%) | 2 1.5(%) | 0 0(%) |
| International | 2 1.1(%) | 1 .7(%) | 0 0(%) |

Of the 177 students 78% ($\underline{n} = 138$) required no writing remediation, 76% ($\underline{n} = 135$) required no reading remediation, and 54% ($\underline{n} = 96$) required no math remediation. Table 3 summarizes this information. The percentages of students not needing remediation in the areas of writing, reading, or math were similar for both those who passed the program and those who were successful on the NCLEX-RN. Approximately one third of students in these groups needed remedial math.

Table 3

Frequencies and Percentages of Students Admitted Taking Remedials, Completing the Program and Passing NCLEX-RN

| | NURSING ADMISSIONS | NURSING GRADUATE | PASS NCLEX-RN | DID NOT COMPLETE PROGRAM |
|----------------|-------------------------------|-----------------------------|--------------------------|---|
| WRITING | <u>N</u> = 177 | <u>n</u> = 136 | <u>n</u> = 106 | <u>n</u> = 41 |
| No courses | 138 (78%) | 110 (81%) | 89 (84%) | 27 (66%) |
| One course | 30 (17%) | 20 (15%) | 13 (12%) | 10 (24%) |
| Two courses | 7 (4%) | 5 (3%) | 3 (3%) | 3 (7%) |
| Three courses | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Four courses | 2 (1%) | 1 (0.7%) | 1 (0.9%) | 1 (3%) |
| READING | | | | |
| No courses | 135 (76%) | 109 (80%) | 87 (82%) | 26 (63%) |
| One course | 32 (18%) | 21 (15%) | 15 (14%) | 11 (27%) |
| Two courses | 8 (5%) | 5 (4%) | 3 (3%) | 3 (7%) |
| Three courses | 1 (0.6%) | 0 (0%) | 0 (0%) | 1 (3%) |
| Four courses | 1 (0.6%) | 1 (0.7%) | 1 (0.9%) | 0 (0.0%) |
| MATH | | | | |
| No courses | 96 (54%) | 85 (63%) | 67 (63%) | 11 (27%) |
| One course | 50 (28%) | 30 (22%) | 23 (22%) | 20 (49%) |
| Two courses | 23 (13%) | 16 (12%) | 12 (11%) | 7 (17%) |
| Three courses | 4 (2%) | 3 (2%) | 3 (3%) | 1 (2%) |
| Four courses | 3 (2%) | 1 (0.7%) | 1 (0.9%) | 2 (5%) |
| Eight courses | 1 (0.6%) | 1 (0.7%) | 0 (0.0%) | 0 (0.0%) |

Few students had previous college degrees. Nine (6.6%) had Associate Degrees, five (2.8%) had baccalaureate degrees, and two (1.1%) had Masters degrees. The number of semesters in the program ranged from a minimum of five to a maximum of 17 with a mean of 10.6 (\underline{SD} = 2.34), and median of 10 semesters for all 177 students who entered the first clinical nursing course.

The mean GPA for all students who entered the program was 2.98 (SD = 2.31). The cumulative GPA means for program graduates was 2.95 (SD = 0.38) and for students not completing the program it was 3.09 (SD = 4.80). These findings reflect that often non-completers withdraw from nursing courses to avoid receiving a grade of D or F. Cumulative program GPAs for those passing NCLEX-RN was 3.00 (SD = 0.39) and for those not successful on NCLEX-RN the mean cumulative GPA was 2.76 (SD = 0.30). In terms of general education courses, program graduates had higher grades than nongraduates (see Table 4). Students passing the NCLEX-RN attained higher general education course grades than those who did not pass.

Table 4

Means and Standard Deviations of Selected Course Grades and GPAs

| | Pharmacology <u>M</u> <u>SD</u> | Psychology <u>M</u> <u>SD</u> | Biology GPA <u>M</u> <u>SD</u> | English GPA <u>M</u> <u>SD</u> |
|--|--|--|---|---|
| ADMISSIONS <u>N</u> = 177 (100%) | 2.76 + <u>0.70</u> | 3.14 + <u>0.73</u> | 2.85 + <u>0.62</u> | 2.88 + <u>0.65</u> |
| GRADUATES <u>n</u> = 136 (79%) | 2.85 + <u>0.67</u> | 3.25 + <u>0.70</u> | 2.94 + <u>0.62</u> | 2.94 + <u>0.64</u> |
| NON COMPLETERS <u>n</u> = 41 (23%) | 2.44 + <u>0.70</u> | 2.78 + <u>0.77</u> | 2.55 + <u>0.52</u> | 2.68 + <u>0.63</u> |
| PASS NCLEX-RN <u>n</u> = 106 (78%) | 2.93 + <u>0.68</u> | 3.29 + <u>0.70</u> | 2.97 + <u>0.65</u> | 2.95 + <u>0.64</u> |
| NON SUCCESSFUL NCLEX-RN <u>n</u> = 30 (22%) | 2.56 + <u>0.62</u> | 3.10 + <u>0.66</u> | 2.83 + <u>0.51</u> | 2.88 + <u>0.65</u> |

Findings

Prior to performing a logistic regression, correlations were completed assessing the relationships of the independent variables of general education courses to the dependent

variables of program completion and NCLEX-RN success. Correlations between pharmacology grade, psychology grade, and biology GPA with the dependent variable, program success were significant ($p < 0.01$); English GPA also correlated with program success ($p < 0.05$). There were inverse correlations between remedial math, remedial reading, and program completion. Remedial math demonstrated a negative correlation ($p = 0.01$) and remedial reading correlated negatively ($p = 0.05$) with program success (see Table 5).

Correlations of independent variables with the dependent variable, passing the NCLEX-RN, demonstrated a significant correlation with pharmacology ($p < 0.01$). None of the other independent variables demonstrated any significant correlation. The remedial courses showed no relationship to passing the NCLEX-RN.

Table 5

Correlations Between Predictor Variables, Program, and NCLEX-RN Success

| | PROGRAM SUCCESS R * | NCLEX-RN SUCCESS R |
|-------------------------|------------------------------------|-----------------------------------|
| Pharmacology | .248** | .231** |
| Psychology | .271** | .115 |
| Biology GPA | .264** | .092 |
| English GPA | .164* | .047 |
| Remedial Writing | -.123 | -.405 |
| Remedial Reading | -.153* | -.068 |
| Remedial Math | -.195** | -.079 |

* $p < 0.05$ ** $p < 0.01$

The research questions were answered using logistic regression. The findings are presented according to the research questions posed.

Research Question 1

What is the relationship of pharmacology grade, psychology grade, biological sciences GPA, English composition GPA, and participation in remedial courses to the ADN program student's successful completion of a nursing program?

Logistic regression was used to determine the probability of a student passing the ADN program using six independent variables of course grade in pharmacology, psychology, GPAs of biology and English courses, and numbers of remedial courses taken in reading, writing, and math. Remedial writing was dropped from the regression model because the correlations demonstrated no relationship between taking remedial writing courses and program success. As shown in Table 6 the overall predictive model was statistically significant ($p < 0.0000$). Three of the predictor variables were significantly related to the likelihood of graduating from the program: higher biology GPAs demonstrated the greatest odd ratio of 2.3, psychology course grades had the second highest odds ratio of 2.2, and pharmacology grades demonstrated a 1.9 odds ratio for graduating from the program. Students with higher grades in biology, psychology, and pharmacology were more likely to be successful in the program. Using a model that incorporates biology, psychology, and pharmacology, program success can be correctly predicted 76.8% of the time.

Table 6

Logistic Regression Results for Predicting Graduation from the Program

| PREDICTOR VARIABLES | B | WALD | ODDS RATIO |
|--|----------|----------|------------|
| Pharmacology | .6297 | 3.9632* | 1.9 |
| Psychology | .7842 | 6.7821** | 2.2 |
| Biology GPA | .8274 | 4.6466* | 2.3 |
| English GPA | -.1499 | 0.1788 | 0.9 |
| Reading Remedial | -.5515 | 2.6860 | 0.6 |
| Math Remedial | -.1644 | 0.6160 | 0.8 |
| Constant | - 4.3190 | 8.8563** | |
| -2 Log Likelihood | 160.151 | | |
| Model Chi-square (<i>df</i> = 6) | 31.451 | | |
| <i>P</i> | 0.0000 | | |
| Overall rate of correct classification | 76.8% | | |

* $p < .05$ ** $p < .01$ Research Question 2

What is the relationship of pharmacology grade, psychology grade, biological sciences GPA, English composition GPA, and participation in remedial courses to ADN program student's successful completion of the NCLEX-RN?

Logistic regression was used to determine the probability of a student passing the NCLEX-RN using the independent variable of course grade in pharmacology. The model was limited to pharmacology grades because the other independent variables were not correlated to NCLEX-RN success. As shown in Table 7 the overall predictive model with only pharmacology was statistically significant ($p = 0.0061$). The Chi-squared model correctly predicted that 100% would be successful, and had an overall correct predictive value of 78%. Only one variable was significantly related to the likelihood of

passing NCLEX-RN, the course grade in pharmacology with an odds ratio of 2.4 (see Table 7).

Table 7

Logistic Regression Results for Predicting Passing NCLEX-RN

| PREDICTOR VARIABLES | B | WALD | ODDS RATIO |
|--|----------|-------------|-----------------------|
| Pharmacology | 0.8898 | 6.9274** | 2.4 |
| Constant | -1.1851. | 1.6543 | |
| -2 Log Likelihood | 136.005 | | |
| Model Chi-square (<i>df</i> = 1) | 7.51 | | |
| <i>p</i> | 0.0061 | | |
| Overall rate of correct classification | 78% | | |

p* < .05 *p* < .01

Summary of Findings

Following review of 177 records descriptive statistics were used to describe the sample and logistic regression used to determine predictors of program success and NCLEX-RN success. Female students between the ages of 19 and 58 comprised the majority of the sample. The means of course grades and GPAs for those successful in the program and on the NCLEX-RN were consistently higher. Logistic regression results revealed that psychology course grades, pharmacology course grades, and biology GPA were predictors of program success. Pharmacology grade was the only predictor of

NCLEX-RN success. Participation in remedial courses was not predictive of student ability to complete the program or to be successful on the licensure exam.

CHAPTER 5

SUMMARY OF THE STUDY

Accepting students who are most likely to be successful in associate degree nursing programs would maximize resource utilization and assist in meeting the need for competent nursing graduates. The purpose of this study was to explore relationships of course grades and GPAs in selected nursing curriculum courses to success in the program and on the NCLEX-RN. Greater knowledge about factors associated with student's success would facilitate nurse educators decisions regarding program admissions for qualified students. Weiner's (1996) attributional theory of motivation and achievement were used to guide the study.

This chapter contains a summary of the study, a discussion of the findings, in relationship to Weiner's theory and the literature. Finally the conclusions and implications for nursing education and recommendations for further nursing research are presented.

Summary

In this ex post facto study 177 randomly selected records of students who were admitted to an associate degree school of nursing between 1991 and 1997 were reviewed. Data were collected on selected course grades and GPAs in the nursing curriculum, and the number of remedial courses in reading, writing, and math taken by the student. Two

research questions were examined using logistic regression. The research questions were:

- 1, What is the relationship of pharmacology grade, psychology grade, biological sciences GPA, English composition GPA, and participation in remedial courses to the ADN program student's successful completion of a nursing program?
2. What is the relationship of pharmacology grade, psychology grade, biological sciences GPA, English composition GPA, and participation in remedial courses to the ADN program student's successful completion of the NCLEX-RN?

Study findings demonstrated students with higher grades in biology, psychology, and pharmacology were more likely to be successful in the program. Remedial course participation was not related to program success. Only one variable, pharmacology course grade was predictive of the likelihood of passing NCLEX-RN.

Discussion of the Findings

Weiner's attributional theory of motivation and achievement includes three main properties of perceived causes of failure or success; stability, locus of causality, and controllability. Additional dimensions of the theory include ability, effort, difficulty, persistence, and academic self-concept. Stability is demonstrated by student's successful completion of remedial courses and/or general education courses in the curriculum. For some students this property required persistence to take remedial courses prior to taking general education courses required as prerequisites. For all students stability and persistence was demonstrated by the average of 10 to 11 semesters required to complete the program exclusive of remedial courses. The number of semesters in the program

ranged from five to seventeen semesters for reflecting the persistence of some students to complete the program. The locus of causality or the internal attribute of ability as demonstrated by higher means of course grades of successful students in pharmacology, psychology, higher mean GPAs in biology, and English for those students successful on the NCLEX-RN. Controllability encompasses the controllable cause of effort and persistence and the uncontrollable cause of ability as related to completion of an ADN curriculum and success on the NCLEX-RN. Experience has shown that, once students are admitted to a nursing program, various uncontrollable events occur in some student's lives such as illnesses and personal/family problems that adversely affect their ability to perform to their capabilities and be successful.

In this study pharmacology course grade, psychology course grade, and the composite biology GPA were found to be significant predictors of program success. These factors are similar to factors found in literature. A shortcoming of these studies is that information regarding the contribution of individual factors to student's success was not consistently reported. The majority of the studies cited in the literature were done in baccalaureate programs and most included a broader scope of independent variables.

Wold and Worth (1990) incorporated GPAs from pre-requisite courses that included the biologies, chemistry, and psychology with tests to determine students problem solving abilities and theory and clinical course grades. The composite GPA along with the SAT verbal scores accounted for 46% of the variance with the dependent variable of success in the nursing program. Individual course contributions to the

variance were not reported. These findings were congruent with this study, except that composite GPAs were used rather than course grades.

Hayes (1981) also used semester GPAs that included courses in chemistry, psychology, English, math, history, philosophy and speech in a study to determine academic success. Math and psychology grades accounted for 13% of the variance. In this study psychology grades were found to be a predictor of program success.

Stronk (1979) included anatomy and physiology, microbiology, and growth and development along with other freshman courses for a composite GPA. The findings from Stronk's study showed prerequisite courses were significantly correlated to future performance. In the present study general education courses were also predictive of student performance.

In terms of NCLEX-RN success in this study only the pharmacology course grade was found to have a significant correlation with NCLEX-RN success. This finding was different than those found in the literature. Fowle's (1992) included a combined GPA of English, speech philosophy, microbiology, anatomy and physiology, chemistry, statistics, social sciences, psychology and growth and development and found the GPA was a significant predictors of NCLEX-RN success, but no report on contribution of each course. Felts (1986) found microbiology, anatomy/physiology, sociology, child psychology and English grades explained 29% of the variance on NCLEX-RN success.

Seither's (1980) study found GPA of biological science as best predictors (54%) for all state board results. Social sciences GPA accounted for the next greatest portion of the variance (11%) although the courses included in this GPA were not specified. Yang,

Glick, and McClelland (1987) found biology GPA a significant predictor ($p < 0.01$) as did Whitley and Chadwick (1986) ($p < 0.000$) of success on the NCLEX-RN. Quick, Krupa, and Whitley (1985) found anatomy and physiology lecture course grades related to NCLEX-RN with a standardized coefficient of 0.2540. Although the results have been mixed, grades in biology courses have demonstrated significant predictiveness in some studies. Findings of this study did demonstrate biology GPA as a significant predictor ($p < 0.05$, odds ratio = 2.3) of success in the nursing program, but not a predictor for success on the NCLEX-RN. One reason that general education courses may not have been predictive of student success on the NCLEX-RN is that many other educational events following program entry occurred. Pharmacology course grade is the one nursing content prerequisite.

Other studies did not find biology/science courses to be predictive of success in a nursing program or on the NCLEX-RN. Foti and DeYoung (1991) included science GPA as a variable in a study to determine best predictors for success on NCLEX-RN success. Science GPA did not demonstrate predictive value in the study. Glick, McClelland, and Yang (1986) also found science GPA non-significant as a predictor for success on NCLEX-RN as did Jenks, Selekman, Bross, and Paquet (1989). Findings from these studies are congruent with the NCLEX-RN success predictors of this study.

Psychology course grades have been included in previous studies mostly in composite GPAs of social sciences and have demonstrated some significance in combination with other courses. In this study psychology was a significant predictor ($p < 0.01$, odds ratio = 2.2) for pass/fail in the program, but non predictive for NCLEX-RN

success. Generally, psychology courses are not usually given first considered for their predictive for success in a nursing program compared to biology courses.

No other studies were found that included pharmacology course grade as a potential predictor for pass/fail in the program or on NCLEX-RN. In data analysis for this study, pharmacology course grade was predictive for pass/fail the program ($p < 0.5$, odds ratio = 1.9) and the only significant predictor for passing the NCLEX-RN ($p < 0.01$, odds ratio 2.4). From results of this study pharmacology course grade is the strongest and most consistent predictor for success. The attrition rate in the pharmacology course is consistently high (40% - 50%) with students withdrawing as well as finishing with a grade of D or F. However, most of the students return to repeat the course successfully. Perhaps, this outcome reflects several of Weiner's theoretical attributes of persistence, motivation, increased effort, and sense of having the internal attribute of ability to be successful in the course. If ability is perceived as a stable invariant characteristic that influences success in achieving a passing grade in pharmacology, students will be successful in other courses. The same attributes then serve the student through success in the program and NCLEX-RN.

The several reviews of studies on student success following taking remedial courses revealed mixed results in how successful students were in subsequent college course. Boughan's (1993) study of nursing students found only modest gains in probability for progress, performance, graduation and success on the NCLEX-RN

In this study data analysis with all remedial courses of reading, writing, and math did not demonstrate significant correlations with the dependent variable of NCLEX-

RN success and were not included in the logistic regression analysis with NCLEX-RN. In the logistic regression analysis of independent variables with success in the program, remedial writing was excluded since it did not demonstrate significant correlation with any of the variables.

Only students with no prior college courses were required to placement test and take remedial courses in areas in which they did not achieve a specific score. Students required to take non-credit remedial courses have to overcome a sense of lack of ability, loss of self-esteem, and demonstrate persistence to complete the remedial courses prior to taking credit courses

Conclusions and Implications

Conclusions

1. Weiner's attributional theory of motivation and achievement provides a broad basis on which to build a study predicting student success
2. Performance in prerequisite courses such as pharmacology, psychology and biology can provide indicators predicting student program success.
3. It is difficult to predict NCLEX-RN success based on general education courses alone.
4. In associate degree programs predictors of program success differ from those of NCLEX-RN success.

Implications

As a shortage of nurses is emerging throughout the country and the predicted acute shortage by the year 2007 (Buerhaus, 1998), every effort should be made to select those students most likely to be successful in the program, NCLEX-RN, and for practice.

1. Selection of students for a nursing program should be based on valid predictors of success to conserve educational resources as well as conserving student's investing resources in programs in which they are less likely to succeed.
2. Information from student pre-nursing testing should be used to determine areas of student deficiencies and strengths and steps taken to assist those admitted to the program. Students whose aptitudes do not indicate nursing as a good career choice should be counseled and assisted in making other career choices.
3. English GPA has not been found to be a significant predictor of student success in the program nor on NCLEX-RN and should not be weighted heavily in a student selection process.
4. Nursing educators in associate degree programs should include courses grades in pharmacology and psychology, and biology GPA as criteria for selection of students.

Recommendations for Further Study

Recommendations for further research based on the results of this study are:

1. Institute pre-nursing testing to determine prospective student's aptitude for a career in nursing and evaluate effectiveness of testing in relation to student success in the program and the NCLEX-RN

2. Provide periodic standardized testing to investigate the effectiveness of use as a basis for identifying student at risk and providing opportunity for students to correct deficiencies.
3. More studies need to be done in the associate degree nursing programs. Due to limited numbers of pre-requisites that can be required those that are most predictive for success should be identified to assist in selecting students most likely to succeed.
4. Data collected for this study represented only one nursing program, therefore ongoing research in different associate degree programs for validation of predictor variables is needed to provide a basis for admission decisions.
5. Study other general education courses generally required in ADN programs to determine better predictors for program and NCLEX-RN success.
6. Conduct prospective studies to examine factors for student success in the program and the NCLEX-RN.

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APPENDIX A

TEXAS WOMAN'S UNIVERSITY
COLLEGE OF NURSING
1130 M. D. ANDERSON BLVD.
HOUSTON, TEXAS 77030-2897

73

AGENCY PERMISSION FOR CONDUCTING STUDY

THE Lee College

GRANTS TO Thelma A. Percoco

a student enrolled in a program of nursing leading to a M. S. in nursing at Texas Woman's University, the privilege of its facilities in order to study the following problem:

Variables Predictive of Program and NCLEX-RN Success for
Associate Degree Nursing Students

The conditions mutually agreed upon are as follows:

1. The agency (may) or (may not) be identified in the final report.
2. The names of consultative or administrative personnel in the agency (may) (may not) be identified in the final report.
3. The agency (wants) (does not want) a conference with the student when the report is completed.
4. The agency is (willing) (unwilling) to allow the completed report to be circulated through interlibrary loan.
5. Other _____

Date: 2/15/98

Thelma A. Percoco
Signature of Student

[Signature]
Signature of Agency Personnel

Signature of Faculty Advisor

*Fill out and sign three copies to be distributed as follows: Original-Student; First copy-agency; Second copy-TWU College of Nursing.

APPENDIX B

STUDENT DATA SHEET

STUDY CODE NO. _____ SEX M F AGE _____ ETHNICITY _____

| | LETTER | GPA POINTS |
|------------------------------|--------|------------|
| Grade in Pharmacology | _____ | _____ |
| Grade in Intro to Psychology | _____ | _____ |

| | LETTER | GPA PTS | CREDIT HRS | | |
|-------------------------|--------|------------|---------------|---|-------|
| Cumulative biology GPA: | | | | | |
| A&P I | _____ | _____ | X | = | _____ |
| A&P II | _____ | _____ | X | = | _____ |
| Microbiology | _____ | _____ | X | = | _____ |

Total A _____ B _____

Cumulative GPA = Total of B/Total of A = _____

| | | | | | |
|------------------------|-------|-------|---|---|-------|
| Cumulative English GPA | | | | | |
| English I | _____ | _____ | X | = | _____ |
| English II | _____ | _____ | X | = | _____ |

Total A _____ B _____

Cumulative GPA = Total of B/Total of A = _____

Remedial Classes NUMBER TAKEN (0 – 3)

| | |
|---------|-------|
| Reading | _____ |
| Writing | _____ |
| Math | _____ |

Previous Degrees _____

Graduation GPA (include Ds & Fs) _____

Number of semesters to complete program _____

| | YES | NO |
|---------------------------------------|-------|-------|
| Completion of the nursing curriculum | _____ | _____ |
| Successful completion of the NCLEX-RN | _____ | _____ |