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Predicting a Passing Outcome on the National Council Licensure Examination for Registered Nurses by Associate Degree Graduates

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PREDICTING A PASSING OUTCOME ON THE NATIONAL COUNCIL LICENSURE EXAMINATION FOR REGISTERED NURSES BY ASSOCIATE DEGREE GRADUATES

by

Patricia M. Collins

A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Education
Department of Teaching, Learning, and Leadership

Western Michigan University
Kalamazoo, Michigan
December 2002
This ex-post facto study was conducted to determine whether grades in pre-program science courses, pre-program cumulative grade point average (GPA) and grades in selected nursing theory courses predict pass/fail performance on the National Council Licensure Examination for Registered Nurses (NCLEX-RN) for graduates of an Associate Degree Nursing (ADN) program. A small, rural community college in western Michigan participated in the study. The subjects included 159 graduates, (143 females, 16 males) admitted to the program beginning fall semester 1992 through May 2001. Data was obtained from the college data files. The independent variables were the four pre-program science courses, Anatomy and Physiology I and II, Chemistry; and Microbiology; the cumulative pre-program GPA; and the grade from the first three nursing theory courses in the first two semesters of the program.

Pearson Product Moment Correlation and logistic regression were used to analyze the data. The results indicated that significant but weak correlations were found between success on the NCLEX-RN and the pre-program science courses. Anatomy and Physiology I was the weakest of all the variables. The pre-program
cumulative GPA was moderately significant in predicting performance on the NCLEX-RN. The GPA in the three selected nursing theory courses were the strongest variables to correlate with performance on the NCLEX-RN. GPA in the Drug Therapy course taught during the second semester of the program was the strongest predictor overall ($p<.000$).

Results of the study indicated that selected pre-program and beginning nursing theory courses could be used to predict pass or fail on the NCLEX-RN and would act as an “early warning” system for at-risk students.
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Patricia M. Collins
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CHAPTER I

INTRODUCTION

Background

The National Council Licensure Examination for Registered Nurses (NCLEX-RN) has been in place since 1982, under the auspices of The National Council of State Boards of Nursing. The NCLEX-RN is the nationally recognized measure of minimum nursing competencies necessary to secure a license to practice as a Registered Nurse. The NCLEX-RN is criterion referenced and based on knowledge and behaviors identified as minimal criteria for safe and competent nursing care (Wendt, 1998). Examinees must obtain a minimum score on the entire examination to become licensed. In other words, graduate nurses must successfully complete a state approved nursing education program and pass the NCLEX-RN to qualify for a license to practice as a Registered Nurse. A degree in nursing is not, in itself, sufficient to practice nursing.

The ability to predict successful completion of the NCLEX-RN on the first attempt has significant implications for the following: nurse education programs and educators; potential nursing students; enrolled nursing students, and the nurse marketplace. The passing percentage of those taking the NCLEX-RN for the first time is used as a uniform measurement standard. The passing percentage rate is evidence that the nursing program curriculum either contained, or did not contain, essential
content to assure graduate entry into the practice arena at the minimally competent level (Wendt, 1998; Wolahan & Wieczorek, 1992).

Nursing educators continuously strive to increase the percentage of graduates who, on the first attempt, are able to pass the NCLEX-RN (Briscoe & Anema, 1999; Lewis & Lewis, 2000; Wilson, 1999; Wolahan & Wieczorek, 1992; Woodham & Taube, 1986; Yocum & Scherubel, 1985). Nurse educators compare the passing percentages of their students against their own experience from the years before, and thereby establish a trend from which they can draw conclusions as to the direction of the program. Nurse education programs with consistently high percentages of first time pass rates use the NCLEX-RN results as a marketing tool, and those programs find it easier to recruit and maintain students. College and university administrators market high pass rates as a means to attract students to their nursing programs. Educators use poor NCLEX-RN results as a prompt to take a critical look at their nursing programs and make corrective changes designed to raise the NCLEX-RN pass rates.

Nurse educators and nurse education institutions can compare their NCLEX-RN results to similar institutions, to schools in their region, to state averages, or against best practice, i.e., highest pass percentage. Prospective nursing students and their parents also find the NCLEX-RN results helpful. Prospective students infer that a high NCLEX-RN passing percentage equates to a strong educational program that will, in turn, prepare them to successfully complete the NCLEX-RN.

Nursing student retention and the students' ability to successfully complete the NCLEX-RN and obtain a RN license is equally important to the healthcare market.
place. The U.S. Department of Health and Human Services prediction for health care in future decades includes a stronger emphasis on nurses as primary providers of preventive, basic, and long-term care (Buerhaus, Staiger, & Auerbach, 2000; Healthy People 2010, 1999).

Nurses are an increasingly important resource as the nation commits to continued cost cutting in health care delivery systems (Liegler, 1997; Louden & Post, 1995). Trends identified within the health care environment of direct significance for nurse educators include: (a) a change in hospital practices with nurses caring for more critically ill patients; (b) a demand for nurses with more competent skills; (c) a move for more nurses to practice with more autonomy and responsibility in alternative settings; (d) a greater emphasis on critical thinking skills in collaboration, and skills in shared decision-making (Buerhaus et al., 2000; Pew Commission, 1991).

The American Association of Critical Care Nurses estimates that the health care system will need nearly double the current supply of 223,000 critical care nurses in the next ten to fifteen years (Thornby, 2000). In addition, the country will have a shortage of well over 800,000 nurses, 20% below requirements in 2020 when over 78 million baby boomers will be retired and health care demands will be increasing (Buerhaus et al., 2000).

Nursing education has a two-fold accountability, for it must meet the needs of students for a quality education and society’s need for professionals capable of delivering safe, competent nursing care to meet its health care needs. Because of the value attributed to the passing of the licensure exam, it is important for nursing educators to
have valid and reliable predictive measures of licensure success. Early variables, effectively predicting pass or fail on the NCLEX-RN, can provide a benchmark for admission criteria. Most institutions have limited enrollment numbers due to restricted clinical space and limited number of qualified faculty. Therefore, admission committees need to identify and select those students with the highest potential for successfully completing not only the nursing program but also the NCLEX-RN. Beneficiaries of such a predictive process would include the student, the nursing program, the college or university, the profession and the general public (Briscoe & Anema, 1999; Fowles, 1992; Lauchner, Newman, & Britt, 1999; McKinney, Small, O'Dell, & Coonrod, 1988).

Effective prediction is always a question of selecting and utilizing those indicators most directly related to outcomes. Earlier researchers (Aldag & Rose, 1983; Dell & Halpin, 1984) examined predictive variables using the State Board Test Pool Examination (SBTPE) as a measure of students' success. The SBTPE was the first national test for the licensure of nurses (Matassarin-Jacobs, 1989) and was used for that purpose from 1942 through 1982. To argue that the same variables will also predict academic success as measured by the NCLEX-RN today is to generalize that the predictors of the SBTPE are valid predictors of the NCLEX-RN. The NCLEX-RN is based on a different set of nursing behaviors and cognitive skills than was the SBTPE. The knowledge base for current nursing licensure has changed, as current standards of nursing practice have kept pace with a changing patient population and changes in the health care system. With these practice changes, the National Council of State Boards...
of Nursing has changed, modified, and/or updated their examinations to reflect the changes in nursing practice required of a licensed registered nurse. The SBTPE is obsolete in this regard; therefore, those variables that had predicted success may not be predictive of success on the NCLEX-RN of today (Matassarin-Jacobs, 1989).

NCLEX-RN

Since 1982, the NCLEX-RN has tested competencies for nursing licensure. It is a criterion-referenced examination and requires a score of 1600 or greater to pass. The NCLEX-RN from 1982-1988 was a paper/pencil examination and required two days for completion. Upon completion, the examinees and the nursing programs received the results in a numerical format (Mattassarin-Jacobs, 1989).

The post-1988 NCLEX-RN continued to be paper/pencil and criterion referenced, but the numerical scores were no longer issued. The post-1988 examination results were issued as pass or fail only to both the candidate and to the nursing program. In April 1994, the NCLEX-RN changed from the paper/pencil administration to Computerize Adaptive Testing (CAT). The CAT provides for year round testing instead of the two yearly administrations and streamlined the process for a shorter testing time. The NCLEX-RN CAT requires a maximum of five hours or 250 questions. Results continue to be reported in the pass/fail format. Although the technology changed, the purpose of the NCLEX-RN remains the same, to determine if a candidate possesses minimal essential skills and knowledge necessary for entry into the practice of nursing, ensuring the public that the candidate possess adequate
knowledge and skills necessary for public safety (Chornick, 1997).

Predictor Variables

Previous studies have examined the correlation between academic and non-academic pre-admission data, nurse theory and clinical course data, scores on nursing achievement tests, nursing competency exams, demographic data, and psychosocial data with the first time pass rate of the NCLEX-RN (Aber & Arathuzik, 1996; Ashley & O'Neil, 1994; Barkley, Rhodes, & Dufour, 1998; Byrd, Garza, & Nieswiadomy, 1999; Boyle, 1986; Campbell & Dickson, 1996; Dell & Halpin, 1984; Fowles, 1992; Manuel & Sorenson, 1995; Sharp, 1984; Whitley & Chadwick, 1986; Yocum & Scherubel, 1985). However, the majority of these studies have investigated the Bachelor of Science in Nursing (BSN) programs of study. Fewer studies have investigated the Associate Degree Nursing (ADN) programs, and ADN studies are needed to increase the body of knowledge on this subject for the ADN educators (Aldag & Rose, 1983; Alexander & Brophy, 1997; Anderson, 1993; Brisco & Anema, 1999; Drake & Michael, 1995; Felts, 1986; Lengacher & Keller, 1990; Waterhouse, Carroll & Beeman, 1993). Nurse educators must utilize all means to identify students' strengths, weaknesses, and potential for success early in their education and use these findings to intervene academically, as appropriate.

BSN programs require more credit hours and pre-requisites for program admission than do ADN programs. In most BSN programs, students complete sixty hours of pre-requisite coursework before they are admitted into the nursing
curriculum. ADN students may apply for admission with fewer, if any pre-requisite courses. Since typically BSN students enter the program with a more extensive education background, admission predictors of NCLEX-RN performance for BSN students may not be appropriate as admission predictors of ADN programs (Nnedu, 2000).

Despite numerous studies evaluating the predictive ability of a variety of academic and non-academic variables, and their relationship to a successful first time outcome on the NCLEX-RN, the results are still inconclusive. Nursing programs continue to have graduates who fail to obtain their RN license (Briscoe & Anema, 1999; Endres, 1997; Fowles, 1992; Vance & Davidhizar, 1997). In 1999, on a national level, only eighty five percent (85%) of the nursing graduates passed the NCLEX-RN. The state of Michigan is currently experiencing one of its lowest percentage of passing rates in many years. The Michigan 1999 BSN passing percentage was only 68%, while the ADN passing rate was 75%.

In summary, clearly, work needs be conducted to determine predictor variables that will be more reliable in increasing the first-time pass rate. It is also clear that the preponderance of past studies has investigated predictors of the NCLEX-RN at the Baccalaureate level, and the results utilized by nurse educators at ADN and BSN levels of education. ADN program educators need to know which indicators are predictive of performance for ADN students in order to select those students with the best chance for success and to provide early intervention for those students in jeopardy of failure.
Statement of the Problem

Schools of Nursing presently use specific entrance requirements for acceptance into the nursing program. For example, grades in pre-requisite biological and physical science courses, cumulative grade point average of general education courses, and SAT or ACT scores are often required. A review of the literature revealed conflicting results concerning these variables as predictors of successful completion of the nursing program and the NCLEX-RN (licensure examination). The literature review also discloses extensive research on BSN admission predictors, but only minimal research on admission predictors as they are related to the ADN programs. ADN predictors must have further review and research, if nurse educators of ADN programs are to know which indicators are predictive of successful performance on the NCLEX-RN for ADN students. This study was conducted to determine if pre-admission academic variables along with academic achievement in the first two semesters of the nursing program are predictive of ADN student success on the NCLEX-RN.

The variables under study, if found to be predictive of NCLEX-RN success, will then be used to identify those students who might require additional academic support throughout the nursing program to allow the student greater opportunity for success. The ability to predict NCLEX-RN success allows nurse educators to develop structural remediation and/or tutorial programs for students who have the potential for NCLEX-RN failure.
The purpose of this study was to determine the extent to which achievement as measured by selected academic variables can predict the success or failure on the post 1994 NCLEX-RN of students who have matriculated through the required Associate Degree Nursing curriculum. This ex-post facto study examined the relationship between cognitive pre-nursing program and nursing program level variables with the pass/fail results of the post-1994 computerized NCLEX-RN. Pre-program variables were course grades from the biological science courses that must be satisfactorily completed (with a C or 2.0 GPA) prior to admission into the nursing program and the cumulative GPA from all required pre-program course work. The student must earn a minimum cumulative GPA of 2.0 (C) in all pre-program required courses with nothing less than a C (2.0) in the biological science courses to qualify for admission into the nursing program. The program level variables were the theory grade of three nursing courses in the first two semesters of the program.

Significance of the Study

The demonstration of certain variables to predict successful performance on the NCLEX-RN is significant to current and potential nursing students, nurse educators, nurse program administrators, nurse employers, as well as college and university administration and the general public. The information provided by this study may be useful to nurse educators to improve the admission process and to assist decision making about the admission and progression of students throughout their nursing
The data may also be utilized to monitor the progress of students through the pre-admission course requirements as well as throughout their prescribed nursing program curriculum, and could then be used to identify those students who might require additional academic support while taking the pre-admission course work or early in the nursing program itself.

Early academic intervention will allow the student a greater opportunity for success. The ability to predict success early in the nursing program allows nurse educators to develop structured remediation and/or tutorial programs for students who have the potential for NCLEX-RN failure. The increasing demands for nurses in the ever changing health care system, the increasing demand for ADN nursing graduates to take on greater responsibilities in all areas of nursing, and the potential risk of NCLEX-RN failure make it imperative for nursing education to continue to study the area of predictor variables.

Hypotheses

Based on the stated problem and the review of the literature, the following hypotheses for this study were formed and tested.

1. There will be no significant relationship between the first time passing of the NCLEX-RN and the grades earned in the pre-requisite science courses (Anatomy & Physiology I and II, Microbiology, Chemistry).

2. There will be no significant relationship noted between the cumulative pre-requisite grade point average (GPA) of all pre-requisite courses and the first time
passing of the NCLEX-RN.

3. There will be no significant relationship between the GPA of the nursing theory courses (Foundations of Nursing, Medical-Surgical Nursing I, Drug Therapy I) in the first two semesters of the nursing program and the successful passing of the NCLEX-RN examination.

Limitations

In ex-post facto research, a limitation exists in that the independent variables are not controllable. One can only describe the existing relationship of the variables. Further, individuals in the study are unable to be randomly assigned to groups, which may lead to faulty interpretation of study results.

A second important limitation of this study is the type of score reported for the NCLEX-RN. Only dichotomous (pass/fail) data can now be used in the data analysis. Previously, ordinal level data was reported for the NCLEX-RN results. Tabachnik and Fidel stated that correlations based on dichotomous variables are lower than correlations between two continuous variables such as the numerical scores of previously reported NCLEX-RN results (cited in Foti & DeYoung, 1991, p.102). Accordingly, predictions based on the NCLEX-RN scores since 1988, are likely to be less certain than those based on earlier scores because of the changes in the NCLEX-RN testing.

A third limitation is the differences in teaching methods, testing methods, and grading among faculty. Therefore, grades cannot be standardized and GPA's may not
reflect accurately the ability of the student, rather the ability or personality of the instructor.

Assumptions

For this study, it was assumed that the science course grades, cumulative prerequisite GPA, and the early nursing course grades are reliable and valid because of the number of years these courses have been used and the number of students they have tested. It is also being assumed that differences in incentives to be successful on the licensure exam will occur randomly among the subjects.

Definition of Terms

ACT. This acronym represents the American College Test taken by students during their junior or senior year in high school. Scores range from 1 (low) to 36 (high).

Admission Criteria. These are the variables, that if met are intended to suggest a student will succeed in a higher education program and are considered when admission decisions are made.

ADN. This acronym represents the Associate Degree in Nursing which is a two to three year nursing program taught predominantly at the Community College level.

At-risk. At-risk refers to a student who repeated one or more science courses, failed a nursing course, or has a GPA less than a 2.0 (C or passing).
**Biological Science Courses.** Biological science courses that are required courses for admission into the ADN nursing program of the study. These courses provide knowledge of objects or processes observed in nature as Anatomy and Physiology, Chemistry, and Microbiology.

**BSN.** This acronym represents the Bachelor of Science in Nursing degree which is a four to five year nursing program taught predominantly at the University level.

**Clinical Nursing Courses.** Clinical nursing courses are required courses in the nursing program that involve time spent in a health care agency and time spent with patients.

**Dependent or criterion variable.** Pass or fail on the first attempt of the National Council Licensure Exam for Registered Nurses (NCLEX-RN).

**Full time Student.** Student in a college or university who is involved in a minimum of 12 credit hours per semester.

**Independent or predictor variables:** (1) Nursing theory course grades for the first two semesters of the nursing program, (2) Overall pre-requisite GPA, (3) GPA of individual pre-requisite science courses.

**LPN.** This acronym represents the Licensed Practical Nurse.

**NCLEX-RN.** This acronym represents the National Council Licensure Examination for Registered Nurses. This is a comprehensive integrated examination, developed and administered by the National Council of State Boards of Nursing, designed to test the basic competency for nursing practice. The graduate who receives a
passing grade is said to possess the minimum set of skills necessary to provide safe nursing care.

NLN. This acronym represents the National League for Nursing, an organization concerned with the improvement of nursing education, nursing service, and the provision of health care in the United States. Among its many activities are accreditation of nursing programs at all levels, preadmission and achievement tests for nursing students, and compilation of statistical data on nursing personnel and on trends in health care delivery.

Non-traditional Student. This is a student who has been out of formal education for a year or longer and is over 24 years old, as opposed to the typical 18 year old directly out of high school.

Nursing Courses. These are courses that comprise the nursing component of the Associate Degree Nursing Program or the Bachelor of Science in Nursing Program.

Pre-requisite Course. A college course required to be taken prior to enrollment in a more advanced course or enrollment into a specific program. For this study, the pre-requisite courses consist of English Composition I, English Composition II or speech; American Government; Bioethics or Introductory Humanities, Philosophy, Ethics, or Logic course; and the four science courses previously mentioned.

Progression Criteria. These are the variables that must be met by a student if that student is to proceed into the next level or next semester of the program.

RN. This acronym represents the Registered Nurse.
SAT. This acronym represents the Scholastic Aptitude Test taken by students during their junior or senior year in high school. Scores range from 400 to 1600.


Success. Program completion with a minimum of C or better and passing the NCLEX-RN on the first attempt.

Theory Courses. These are the courses or parts of courses that are wholly didactic and taught in the classroom. These courses do not involve any direct patient care.

Traditional Student. For this study is defined as the 18-24 year old student who enters college immediately following high school, who has parental support, and who is attending on a full time basis.

Brief descriptions of the three courses that will be investigated in this study are as follows:

Foundations of Nursing: Introduction and exploration of fundamentals of nursing practice and concepts necessary to meet basic needs of patients of all ages. The focus is on normal parameters of health, including physical comfort, safety, hygiene, and application of the nursing process.

Drug Therapy I: Study and application if the basic principles of pharmacology. Includes the study of basic drugs and their effect on the human system, math skills, administration of medications via all routes except intravenous.
Medical-Surgical Nursing I: Study of needs of patients with stable medical/surgical conditions in all age groups, incorporation of concepts of self-care and use of nursing process.

Organization of the Remaining Chapters

Chapter II includes an extensive review of relevant literature including research related to the major variables of this study. Chapter II is divided into three major sections, predictors of general college and university success, predictors of BSN success, and predictors of ADN success. Chapter III includes a description of the research design and the rationale for its selection. The chapter includes discussion of the sample, the instrument used, the procedure to be used for the data collection and the methodology for data analysis. Chapter IV will present the findings of the data collection and analysis. Chapter V will include discussion and interpretation of the significant findings, the implications of the study for nursing and recommendations for future research.
CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter is to review the literature relevant to predictors of successful performance by nursing program graduates on the NCLEX-RN. Populations reviewed in the literature include students in general post-secondary education and nursing students of both BSN programs and ADN programs. The literature review documents research findings, research studies, and related literature that describe predictor variables of success in the general post-secondary population and variables that have been used to predict performance on the NCLEX-RN in both BSN and ADN nursing programs.

Post-Secondary Education—Overview

While participation in post-secondary education has greatly increased during the past quarter century, the proportion of college students completing and earning a degree has not kept pace. Research studies have indicated that there has been a major decline in academic achievement of post-secondary students. The percentage of students who drop out of college in their first year has greatly increased (Ting, 1998; Tinto, 1997). It is estimated that at least 50% of all incoming freshmen enrolled in college for fall semester 2000 dropped out at some time prior to program completion (Cambiano, Denny & De Vore, 2000). Ting and Robinson (1998) indicated as Tinto
(1993) that only 15% of this student departure from the education setting was related
to academic difficulties. The other 85% of voluntary departure was related to per­
sonal, social, or financial reasons. Other factors significantly correlated with college
success are parents’ educational level, extra curricular activities, and course load
(Noble, 2001; Ting & Robinson, 1998).

Student persistence, retention, attrition, degree completion and student success
are terms used in the literature to refer to student’s enrollment and ultimate receipt of
a degree. Studies, for many years, have established that cognitive admission vari­
ables, such as high school grade point average and high school rank/standing (the stu­
dent’s position in relation to others in the class according to GPA) can be useful in
predicting student college success and program completion (Baird, 1985; Horton,
Whitehead, & Henderson, 1997; Larose & Roy, 1991; Stricker, Rock, & Burton,
1996; Ting, 2000; Ting & Robinson, 1998). Other studies have investigated the pre­
dictive quality of the scores of pre-admission standardized tests such as the Scholastic
Aptitude Test (SAT) and/or the American College Test (ACT) used for many years as
criteria for student admission, both to an institution and to specific academic pro­
grams (Cambiano et al., 2000).

SAT and ACT

The SAT and ACT were developed to enable universities to assess the aca­
demic capabilities of students from a wide variety of educational settings and to pro­
vide data for educational guidance and planning (Munday & Hoyt, 1965). These tests
are touted to measure the educational achievement of the student, and from this to predict college GPA and success. Post-secondary establishments across the United States maintain that a student who earns high scores on a standardized test (ACT or SAT) will attain higher grades in college and be more successful in their post-secondary endeavors than those students in the lower range of scores (Astin, 1993; Noble, 2001; Pascarella & Terenzini, 1991; Ting, 1997).

The SAT is the most renowned and extensively used college admission test in the world. It is reported that over 1.3 million students took the SAT prior to entering college in the fall 2001 semester (The College Board, 2001). The SAT is a multiple-choice exam that predominantly measures math and verbal achievement. It is used by post-secondary education admission committees as criteria for admission decisions and prediction of performance. Although the SAT is the most frequently requested college admission test, many admission committees also use the ACT.

The ACT, a curriculum based achievement examination, measures a student’s current level of academic development and skill needed for success in college. The ACT was designed to measure academic development in four areas; English, reading, science reasoning, and mathematics. These four areas represent the foundation of higher education curriculum (ACT, 2001).

Typically, the students’ GPA is the measure used to indicate college success or failure. In a study conducted at Trinity Christian College (Bontekoe, 1992), the records of 477 entering freshmen were analyzed to determine whether or not ACT scores could be used to predict college success. The study indicated that as the ACT
composite scores increased, so too did the student's grade point average. For exam­
ple, students with an ACT composite score between 11 and 15 had a mean college
GPA of 1.96, students with an ACT composite score between 16 and 20 had a mean
GPA of 2.20, students with an ACT composite score between 21 and 25 had a mean
GPA of 2.88, and students with an ACT composite score between 26 and 30 had a
mean GPA of 3.38. The study concluded that there was a direct relationship between
the ACT and success in college (Bontekoe, 1992). Paszczyk (1994) also investigated
this relationship between the ACT and college success. He examined the records of
428 students from a Chicago suburban university who had taken the ACT. Using
Pearson Product Moment Correlation to analyze the data, Paszczyk (1994) established
a positive significant correlation between the ACT scores and the final college GPA,
the greater the ACT composite score, the greater the student GPA upon graduation.
This research was very similar to the study by Bontekoe (1992), the difference being
that Bonteko (1992) used freshman year GPA and Paszcayk (1994) used the final
overall GPA.

In a study conducted by the ACT organization (Noble, 2001), the first year
college success for 198,329 ACT tested students was studied. It was found that the
ACT scores related directly to college success. Of those students scoring an ACT
composite score of 19 or below, 40% earned less than a 2.0 GPA in their first year of
college. In comparison, of those students earning an ACT composite score of 24-27,
over 40% earned a 3.2 or greater GPA, and of those earning a composite score of 28-
36, 66% earned a 3.5 or greater GPA (Noble, 2001).
As with the ACT, scores from the SAT are used to predict college success as measured by first year grade point average. Under the direction of the College Board, the Validity Study Service assisted 725 colleges that conducted over two thousand SAT validity studies. Studies have found that SAT scores contributed 54% of the prediction of freshman grade-point average while high school grade-point average contributed only 46% (Ramist, Lewis, & McCamley-Jenkins, 1994).

Ting and Robinson (1998) investigated cognitive and psychosocial variables in predicting college GPA with 2600 students at a southeastern public research university. SAT verbal, math, and composite scores along with high school GPA were the cognitive variables studied. The high school GPA was found to be the most significant predictor for the first year college GPA.

According to a study by Tedrow and Rust (1992), both ACT scores and age were positive predictive indicators of success in college, with age considered to be the best indicator for successful program completion and graduation. Mature students (over 21 years of age) were more likely to graduate regardless of what their ACT scores indicated. Tedrow and Rust (1992) determined in this study that the students older than 21 years of age had a better chance succeeding (42%) than did the students 21 years and younger (14% chance of success).

In contradiction to the previously mentioned studies, other researchers reported standardized test scores to be ineffective as a predictor of college success. Ting (1997) discovered in his study that ACT scores were a positive predictor, but not particularly significant predictor, of first semester college GPA. In a later study by
Ting (2000), SAT math score along with three non-cognitive variables were determined to be significant predictors of college GPA. The three non-cognitive variables were a realistic self-appraisal system, successful leadership experience, and demonstrated community service. A limitation of this study, however, was the small sample size used by Ting (n = 96).

The SAT and ACT have been used by nursing program studies in an attempt to predict success in the nursing program, and success on the NCLEX-RN (Alexander & Brophy, 1997; Byrd et al., 1999; Campbell & Dickson, 1996; Felts, 1986; Tedrow & Rust, 1992). In contrast, other research has demonstrated that the ACT and SAT scores were not predictors of success in nursing. Aldag and Rose (1983) showed evidence that the ACT had an age bias that led to the underestimation of older students, and that factors other than those measured by ACT were more relevant to college GPA for nursing students. Campbell and Dickinson (1996) reported that the SAT had a lower predictive value when compared to the ACT in regards to graduation and NCLEX-RN score. Gregorzyski (1995) on the other hand, in her study of the LPN completing a community college ADN program, discovered that the ACT and SAT scores were predictive of program completion and licensure success. A weakness of Gregorzyski’s study was the sample, which included only the LPN who had previously demonstrated success in an education program.

Summary-Post Secondary Education

As the literature indicates, many people believe that ACT and SAT scores
function to measure a student's ability to do college-level work. These entrance examinations are actually measuring knowledge developed in secondary school; such as the skills necessary to read, write, comprehend, to do mathematical computations, and to problem-solve. Nursing programs, specifically BSN programs, to predict success on the NCLEX-RN as well as in the program itself, have used both of these national tests. This will be illustrated in more detail in the following sections of this review.

NCLEX-RN Predictors

Performance on the NCLEX-RN is vital to nursing students, faculty, parents, administrators, and the general public. The ability of nursing administration and admission committees to accurately select students with the greatest probability of successfully completing the nursing program and the NCLEX-RN is of the utmost importance (Alexander & Brophy, 1997). Identification of valid predictors of successful performance could enable nursing program educators to devise pertinent admission criteria, identify and intervene with students at risk of failure early in the program, and provide needed advisement and academic support to increase the probability of passing the NCLEX-RN. A number of research studies over the last twenty years have examined factors that could possibly predict successful performance on the NCLEX-RN. Most of the studies to date have investigated predictor variables and their relationship to BSN programs and the NCLEX-RN (Campbell & Dickson, 1996). Fewer studies have examined predictor variables and their relationship to
ADN programs and the NCLEX-RN as can be seen in the charts included in Appendices A and B.

Today the surging demand for competent prepared nurses has outstripped the supply (Griffiths, Bevil, O'Connor, & Weiland, 1995). The enrollment in nursing programs has declined, and schools of nursing have also experienced significant change in the demographic and academic characteristics of its student body (Lockie & Burke, 1999; McKinney et al., 1998; Wolahan & Wieczorek, 1992). Contributing to the reduced enrollment in nursing programs is a decline in the number of college-aged individuals and an increase in career options for women (Fitzsimons & Kelley, 1996).

Variables that predicted success in the 80's and early 90's are not going to be the same variables that will predict success with today's students. Today's student population is more diverse. Students today are older, many are working parents, some are from disadvantaged backgrounds, and many are single parents. Sixty percent of incoming students at the ADN level are enrolled in remedial courses prior to acceptance in the nursing program and only one in six (16%) will complete programs at the associate degree level (Fitzsimons & Kelley, 1996).

**Nursing Theory GPA and Science GPA - BSN**

Campbell and Dickson (1996) conducted a meta-analysis to analyze research findings on the variables used as predictors of success on the NCLEX-RN. Their research identified and integrated results from 47 different studies conducted from 1981 through 1990. All studies dealt with attempts by researchers to predict BSN
graduate success on the NCLEX-RN. The majority of the studies reviewed were written before the current "pass/fail" test plan was introduced. The aggregated evidence indicated that the most frequently studied cognitive variables included college GPA, pre-nursing GPA, nursing program GPA, and GPA from required science courses. SAT, ACT, and NLN Competency Examinations were the most frequently studied standardized tests. The non-academic or demographic variables most frequently considered were age, race, gender, and financial status. Findings from the meta-analysis indicated that GPA in Nursing and GPA in science coursework were the most frequently significant cognitive predictors, with age being the most significant demographic predictor overall.

Foti and DeYoung (1991) used a sample of 92 BSN graduates for their study, and identified that work done in college, specifically measured by nursing theory GPA, contributed most to performance on the NCLEX-RN. In addition, both sophomore nursing GPA and science GPA (pre-requisite courses) were found to be sufficient admission predictors of NCLEX-RN performance, while NLN Achievement Test scores effectively predicted performance during the program. Interestingly, pre-college factors, such as SAT results, were not deemed predictive of future success on the NCLEX-RN. Limiting for this study is the very small sample size. Other researchers (Rami, 1992; Schaal, 1990) showed similar findings.

**Nursing Theory GPA and SAT/ACT**

Fowles (1992) conducted a retrospective study of 192 graduates of a BSN
program in Illinois and determined that successful performance on the pass/fail results of the NCLEX-RN could be predicted using nursing program Level I GPA, ACT composite score, and the percent of correct responses on the Mosby Assess Test. This was a complicated study because part of the students took the pre-1988 NCLEX-RN while the other part took the post-1988 NCLEX-RN, resulting in two sets of NCLEX-RN data. One set of data yielded raw scores (pre-1988) while the other set yielded ordinal scores of pass/fail data (post-1988 NCLEX-RN). Results indicated a decrease in the amount of explained variance when using the dichotomous variables (pass/fail) as opposed to using raw data on the NCLEX-RN. Fowles’ study (1992), however, indicated that valid predictors of future success on the NCLEX-RN could be determined from the college academic performance. This concept is consistent with the findings of Foti and DeYoung (1991).

Aber and Arathuzik (1998) examined cognitive ability and non-academic variables as predictors for success on the NCLEX-RN for 123 graduates. The study reported significant correlation between NCLEX-RN results and the cumulative Nursing GPA, and the non-academic variables of emotion, anxiety, guilt, and loneliness had a negative correlation with the NCLEX-RN indicating that students with high scores on these tests of personal stressors were more likely to fail the NCLEX-RN. These authors/researchers strongly recommended establishing a comprehensive database, including factors associated with success in the NCLEX-RN and programs of advisement, tutoring, and stress management as well as classes in study skills, test taking, and NCLEX-RN preparation.
Pre-Program and Science GPA

Byrd et al. (1999) examined a larger sample, 298 BSN graduates in his study. Based on data collected, Byrd et al. attempted to correlate past academic success measured by early predictors of ACT scores, GPA of pre-program science courses and nursing courses with success on the NCLEX-RN. The study determined that the GPA of science courses and ACT Composite score both proved to be positive but moderate predictors for the NCLEX-RN. The pre-program GPA was identified as the most significant positive predictor. This study indicated that valid predictors of future success on the NCLEX-RN could be found in the early college academic performance pre-nursing coursework and science GPA. Lewis (2000), in his study of 175 ADN graduates found that the science course of Anatomy and Physiology was a moderately significant predictor of NCLEX-RN success.

GPA and Standardized Tests

In a 1988 study of 136 BSN students, McKinney et al. investigated the relationship of a combination of early and late indicators with performance on the NCLEX-RN. Pearson product moment correlations revealed that three of these predictors were significantly related to NCLEX-RN scores. The late predictor variable of the Mosby Assess Test, a post nursing examination that functions to predict readiness for the licensure examination given at the end of the students’ course work proved to be the most significant. The other late predictor of the cumulative, post-program GPA and the early predictor of the SAT verbal were also identified as
moderately significant. McKinney et al. (1988) discovered a moderate but negative relationship between NCLEX-RN success and the number of nursing program courses the student repeated. These researchers concluded that the strength of the SAT score and the Mosby Assessment Test score were important not only as an indicator of test taking ability, but also, because of the multiple choice format. These tests were similar to the format of the NCLEX-RN. The drawback to this study was the small size of the sample.

Jenks, Selekman, Bross, and Paquet (1989) conducted an ex-post facto study of a larger population of 407 BSN graduates and attempted to identify predictors of NCLEX-RN success as well as determine the best time for identifying students at-risk. Variables in this study were segregated into pre-program (lower division GPA, science GPA, type of lower division college, age, and gender), program (three nursing theory course grades), and pre-graduation variables (three senior year nursing theory course grades and the Mosby Assess Test). The results of this study indicated the Mosby Assess Test as the best predictor of performance on the NCLEX-RN. The results also suggested that pre-nursing data was unrelated and not significant to performance on the NCLEX-RN. The significance of the Mosby Assess Test was consistent with McKinney et al. (1988) and Endres (1997). Discriminate analysis was used to calculate the percentage of students correctly identified as pass or fail on the NCLEX-RN. Pre-program data collected at matriculation was found to be a poor predictor of performance on the NCLEX-RN, identifying correctly only 63% of the students who actually failed the NCLEX-RN, and incorrectly predicting failure for 37%
of the students who actually passed the NCLEX-RN. Nursing program data collected at the end of the junior year showed a significant improvement. Approximately 93% of the students who actually failed the NCLEX-RN were correctly identified while only 31% of the students who passed the NCLEX-RN were incorrectly identified as potential failures.

A more recent study by Barkley et al. (1998) investigated data obtained from the nursing records of eighty-one BSN students. Pearson product moment correlation analysis found a strong positive correlation between performance on the NCLEX-RN and results of the NLN Competency Test, the Psychiatric Mental Health nursing course grade, and the Pediatric nursing course grade. Moderate correlations were noted between several other specialty NLN tests and five other nursing courses. Additional statistical analysis indicated the problem of failure of the NCLEX-RN increased when a student earned a C in any of the nursing clinical course work, or with earning a C in a nursing theory course. The problem of failure on the NCLEX-RN rose significantly when a student earned two C's in nursing theory courses and the chance of failure on the NCLEX-RN was remarkably increased with the finding of three or more C’s earned in nursing theory courses. Again a limitation with this study is the very small sample size and therefore, the results cannot be generalized until validated with a larger population.

Waterhouse et al. (1993) pursued the question of successful completion of the NCLEX-RN with 257 BSN graduates from 1988-1990. The researchers examined 15 variables to determine their predictive value for NCLEX-RN success. Seven of these
variables were significant. A stepwise multiple regression analysis was conducted to develop a discriminant analysis equation, which led to the successful classification of 86% of the students at the end of the junior year and 91%, by the end of the program to pass the NCLEX-RN. Graduation GPA with grades in the first senior-level nursing course was the best predictor of performance, SAT verbal score and GPA at the conclusion of the second year were also statistically correlated with performance on the NCLEX-RN correctly classifying 93% of the students who passed and 80% of the students who failed the NCLEX-RN. These were some of the same variables that McKinney et al. (1988) and Yocum and Scherubel (1989) determined as significant in their studies.

**Clinical Nursing Grade**

Marquis and Worth (1992) examined clinical grades as one of the variables for predicting NCLEX-RN success. The researchers determined that the clinical grades were a positive predictor of NCLEX-RN success, but the nursing theory GPA was stronger.

In an older study, using a small sample of only 51 BSN graduates, Glick et al. (1986) reported on the relationship between pre-nursing course predictors and nursing program grades with NCLEX-RN performance. They determined significant correlations existed between clinical nursing course GPA and overall GPA with NCLEX-RN success. Nursing I clinical GPA through Nursing IV clinical GPA and pre-nursing pathology GPA accounted for 33% of the variance in NCLEX-RN performance.
Nursing III clinical course GPA was the most statistically significant of the Nursing clinical courses.

Clinical course work is very important in the nursing curriculum, but the grading of the clinical component is a very subjective endeavor. Until there are more objective criteria for clinical course work that can be somewhat standardized between programs, the use of clinical course GPA's as predictor variables is only valid for the program examined in the study.

Summary-BSN

The majority of studies conducted on both the pre-1988 and post-1988 NCLEX-RN in BSN programs were conducted on convenience samples from a single BSN program and yielded inconclusive results. Despite the fact that major changes were made in the post 1988 NCLEX-RN, the predictor variables studied remained generally the same. Although no one variable stands out as the best, the studies indicate that cumulative GPA, nursing theory grades, and the Standardized Mosby Assess Test yield significant correlations with the licensure examination. The next subsection of this review examines admission predictors in ADN programs.

Associate Degree Nursing

Although more associate degree-nursing students take the NCLEX-RN than any other group of students, fewer studies of predictor variables for performance on the NCLEX-RN in ADN programs have been published. The preponderance of
research into BSN programs can possibly be attributed to the fact that more BSN stu-
dents continue their education in postgraduate programs and thus are more likely to
conduct research. Since BSN programs require more credit hours and pre-requisites
for program admission than do the ADN programs, and since BSN students enter the
nursing program with a more extensive educational background, admission predictors
of NCLEX-RN performance for BSN students may not be appropriate as admission
predictors of NCLEX-RN performance for ADN students. The lack of research into
ADN programs further substantiates the need for this study.

Nursing Theory GPA and ACT/SAT

Woodham and Taube's (1986) research investigated both pre-program and
program predictor variables with a sample of 107 ADN students. A statistically sig-
nificant, positive relationship between both SAT verbal and grades earned in seven
nursing courses with successful performance on the NCLEX-RN was determined.
Not significant, however, was the student age at the time of graduation, high school
rank, or SAT math scores. The researchers concluded that outstanding achievement
in the nursing program affirmed outstanding performance on the NCLEX-RN. Mills
Becker, Sampel, and Pohlman's (1992) study also supported the finding that nursing
program performance (Nursing course GPA) predicted future NCLEX-RN perform-
ance. In addition, Felts (1986) concluded that performance in college courses was a
better predictor of passing or failing the NCLEX-RN than performance in high school
courses.
Lengacher and Keller (1990) in a similar study using the numerical results of the pre-1988 NCLEX-RN, identified academic predictors of success for 146 ADN graduates from a Florida Community College. The best predictors of performance on the NCLEX-RN in this study were two nursing theory courses, ACT composite scores and exit GPA. The ACT math and English scores, entrance GPA, and age exhibited no predictive value for performance on the NCLEX-RN. These results corroborate the study of BSN students by Yang et al. (1987) and the study by Woodham and Taube (1986).

**Nursing Theory GPA and Science GPA**

Based on data collected from 350 ADN students at Fresno City College, Drake and Michael (1995) investigated predictive validity coefficients of grades earned in various nursing courses, science related courses, and composite GPA as they related to the pass/fail on the NCLEX-RN exam. In addition, the researchers also investigated the inter-correlation of nursing theory and laboratory courses and attempted to determine if the combination of three specific GPA predictor variables could be used to a higher degree of validity in predicting success on the NCLEX-RN than the use of any one variable alone. Results of this study indicated that course achievement prior to entering the nursing program (pre-nursing GPA) had little if any validity in predicting pass/fail on the NCLEX-RN. The pre-nursing science courses were also a very weak indicator. The combined GPA of the eight nursing theory courses proved to be moderately positive as a predictor of success, and the addition of other variables did
not increase the validity of predicting who would pass and who would fail the NCLEX-RN. As with studies by Anderson (1993), Felts (1986), Lengacher and Keller (1990), and Woodham and Taube (1986), those variables occurring prior to entry into the nursing program were only weakly significant.

**Standardized Tests**

Anderson (1993) utilizing 156 ADN graduates examined eleven cognitive variables and their relationship to NCLEX-RN performance. Pearson Product Moment Correlation coefficients and multivariable logistic regression were used to analyze the data. The weakest correlation was found in the relationship between high school GPA and NCLEX-RN performance. The strongest correlation with NCLEX-RN performance was found in the relationship with the NLN Competency test scores. Statistical analysis of the eleven predictor variables revealed that only two of the variables, first semester GPA and NLN achievement test scores produced a statistically significant difference between students who passed and students who failed the NCLEX-RN.

Over a five-year period, Alexander and Brophy (1997) investigated graduate ADN performance on the NCLEX-RN. The researchers identified variables that occurred early in the students program to enable those students at risk for failure time for intervention, counseling, and remediation. A retrospective quota sample of 188 ADN students, July 1988 to February 1994, which included 94 first time failures and 94 randomly selected who passed the NCLEX-RN was used for this study. The analysis of the data revealed that the SAT verbal scores and SAT composite score for
those who failed the NCLEX-RN were significantly lower than for those who passed. Those who failed had a mean composite SAT of 785 while those who passed had a mean composite of 884. The mean SAT verbal score for those passing the NCLEX-RN in this study was 443, which was also consistent with the findings of Foti and DeYoung (1991).

A more recent study by Briscoe and Anema (1999) examined data obtained from the records of 38, May 1997, ADN graduates from a public urban university. Grades on two NLN achievement exams taken during the two years of the nursing program and success on the NCLEX-RN were moderately significant at the .01 level. The better the students performed during the program, the more likely the students were to pass the NCLEX-RN. The remaining two variables that Briscoe and Anema identified as significant, age and race were non-academic in nature. The older aged student was more likely to pass the NCLEX-RN with the mean age of the group being 35 years. Age was one of the strongest predictors indicated in the meta-analysis of BSN program studies by Campbell and Dickinson and held true for this study of ADN students by Briscoe and Anema (1999). However, in the studies by Woodham and Taube (1986) and Lengacher and Keller (1990), the variable of age was significant.

Clinical Course Grades

Very few of the studies reviewed indicated that nursing program clinical grades should be used as predictors of NCLEX-RN success. The specific studies where clinical course grades were examined found that the mean GPA from clinical
courses tends to be higher overall than the GPA of Nursing theory coursework. Krupa, Quick, and Whitley (1988) and Marquis and Worth (1992) identified a similar dichotomy related to nursing theory and clinical grades in their studies. Clinical instructors base clinical course grades primarily on the subjective grading and evaluation of students. Nursing theory course grades are for the most part based on objective criteria such as examinations, quizzes, and other written work. Because of the lack of uniform criteria based on the method of evaluation of students in the clinical setting, clinical grades are deemed poor predictors of NCLEX-RN performance and will not be used in this study as a predictor of successful NCLEX-RN performance.

**Summary-ADN**

The research studies discussed disagreed on which variables are predictive of NCLEX-RN performance. Briscoe and Anema (1999) determined that standardized test scores, age, and race were significant predictors of performance on the NCLEX-RN. The ACT composite score as a significant predictor variable is substantiated by studies conducted by Felts (1986) and Lengacher and Keller (1990); however, Lengacher and Keller (1990) did not find age to be a valid predictor. Lengacher and Keller (1990) found the exit GPA to be a valid predictor; whereas Anderson (1993) found the first semester GPA to be a significant predictor. Drake and Michael (1995) identified nursing course grades as moderately predictive and also determined science GPA to be a positive predictor. The fairly limited number of ADN program research studies examining predictors of success on the post-1988 or post 1994 NCLEX-RN
makes it difficult to draw concrete conclusions. Studies conducted on pre-program and program predictors appear to be just as inconclusive for ADN programs as they are for BSN programs.

Conclusion

The nursing research studies described in this literature review indicated that a wide variety of variables have been used to predict performance on the NCLEX-RN with some conflicting results. The variables included high school ranking, pre-requisite GPA’s and GPA’s in sciences, composite scores on national standardized tests such as ACT, and SAT. In some studies these variables were cited as predictive of NCLEX-RN results and in other studies the variables were cited as non-predictors. In addition, nursing course GPA’s and standardized nursing examinations, such as the Mosby Assess Test or National League for Nursing achievement and competency tests have also been shown to be predictive and non-predictive of NCLEX-RN performance. Variables correlated with success on the NCLEX-RN identified as moderate indicators in some studies while other studies were reported highly significant in others. Most of the studies reported in the literature used only one school.

As previously noted, many of these studies involved BSN programs not ADN programs and very few involved the post 1994 computerized NCLEX-RN. Most BSN students enter the program with at least sixty hours of college credit. Therefore, admission predictors of NCLEX-RN performance for BSN students are different from admission predictors of ADN students who often enter the nursing program with little
college credit. This literature review confirms that consistent pre-program admission predictors of NCLEX-RN performance have not been identified.

Performance within the nursing curriculum has been identified in many of the studies reviewed as a positive predictor of success on the NCLEX-RN. Cumulative nursing GPA grades in individual nursing didactic, theory and practicum courses have been some the most frequently identified predictors of successful performance on the NCLEX-RN. The Mosby Assess test and the NLN Competency test have also been identified as a strong indicator of success on the NCLEX-RN. Several studies stated that NCLEX-RN success can be most accurately predicted at the end of the senior or final year of the program, but this is too late to be amendable for the student at risk. The optimal time to identify the student at risk for failure would be at the end of the first or second semester of the professional program of study (Barkley et al., 1998).

There are some early predictor variables that have been studied. Horns, O'Sullivan, and Goodman (1991) reported that 67% of the variance in success on the NCLEX-RN was accounted for by admission GPA while only 11 per cent by junior year grades. According to Mills et al. (1992), the end of the sophomore year was the best time for predicting success on the NCLEX-RN, which still left time for remediation for those at risk students. Fowles (1992) indicated that the GPA of the introductory nursing courses, the ACT, the pre-requisite social science courses, and the anatomy and physiology GPA could predict NCLEX-RN success.

Since timing of intervention is crucial to the success of the at-risk students, this study will be conducted to examine the input variables of the pre-program and
science course GPA's and the process variables, the GPA of the first two semesters nursing courses as worthwhile predictors of ADN student performance on the post-1994 NCLEX-RN. Hopefully, this study will then add to the limited body of knowledge related to early predictors of success and the post-1994 NCLEX-RN for ADN programs. The methodology devised to make these determinations is found in the next chapter of this study.

Hypotheses

The purpose of this study was to examine selected cognitive variables with an ADN student population and determine if these variables can predict success or failure on the NCLEX-RN.

Based on the stated problem and review of literature, the following hypotheses were formed and tested:

1. There will be no significant relationship between the first time passing of the NCLEX-RN and the grades earned in the pre-requisite science courses (Anatomy & Physiology I and II, Microbiology, Chemistry).

2. There will be no significant relationship noted between the cumulative pre-requisite grade point average (GPA) of all pre-requisite courses and the first time passing of the NCLEX-RN.

3. There will be no significant relationship between the GPA of the nursing theory courses (Foundations of Nursing, Medical-Surgical Nursing I, Drug Therapy I) in the first two semesters of the nursing program and the successful passing of the NCLEX-RN examination.
CHAPTER III

METHODOLOGY

The purpose of this study was to examine the extent to which academic achievement, as measured by pre-program science course grades, grade point average (GPA) of all pre-program requirements, and GPA of three nursing theory courses in the first two semesters of the program, was predictive of performance of graduates of the selected Associate Degree Nursing (ADN) program on the post 1994 National Council Licensure Examination for Registered Nurses (NCLEX-RN). The methodology used to achieve this purpose is described in this chapter. The methodology section is composed of the following: (a) Research design, (b) Participating college and nursing program, (c) Participating sample, (d) Variables, (e) Data collection process, (f) Data analysis procedure.

Research Design

As the purpose of this study was to examine selected cognitive pre-program and first year nursing program variables that might be predictive of performance on the post 1994 NCLEX-RN, the use of a non-experimental correlation research design was anticipated. This design functioned to establish the strength and direction of the relationship between two or more variables. As the independent variable is continuous and the dependent variable is dichotomous, a logistic regression analysis was also
used to explore the nature of the relationship between the predictor variables and the outcome (pass/fail) on the first attempt on the post 1994 NCLEX-RN.

Participating Community College

This study was conducted at a rural, public, state supported community college in northwestern Michigan. The North Central Association for Colleges and Secondary Schools is the accrediting body for the Community College. The predominant market area for the college consists of four rural counties where the primary industry is agriculture. The college student population averages 1300-1400 students per semester. The college offers a variety of terminal career programs, career transfer programs, and transfer oriented liberal arts programs.

ADN Program

The selected ADN program is a two-year, career ladder program that is approved by the Michigan Board of Nursing. The career ladder program allows students to exit after successful completion of the first year, take the licensure examination to become a Licensed Practical Nurse (LPN), or to continue through completion of the two years and become a Registered Nurse (RN). The program also allows LPN’s to enter at the beginning of the second year and earn their ADN degree upon completion of that year. The ADN graduate enters practice at the beginning level of the health care setting. The graduates must pass the NCLEX-RN to obtain a license and practice as a Registered Nurse.
Admission Requirements

The program admits approximately 70 students per year to the two levels of the program. The admission requirements for the nursing program are more stringent than those of the general college population and include a high school diploma or GED and the completion, with a C (2.0) or better, the pre-program academic courses. These pre-program courses include English, Anatomy and Physiology, Microbiology, Chemistry, Humanities/Ethics, and Government.

Participating Sample

The subject sample for this study will consist of ADN program graduates for the years 1994 through May 2001, which successfully completed the ADN program and were eligible to take the NCLEX-RN. The sample will be limited to those students who began the first year of the program at the Community College. The study will exclude those students who entered the program as Licensed Practical Nurses (LPN) in the second year, as three of the predictive variables examined are in the first two semesters of the two-year program. The LPN entering the second year would not have been exposed to those variables. Individual student records with missing data will be eliminated. With the application of these criteria, the sample will consist of 189 beginning first level students, predominantly white, non-hispanic and female students (n = 189).
Variables

Independent Variables

The variables for this study measuring academic achievement were the grades of the pre-program science courses, Anatomy and Physiology I and II, Elementary Microbiology, and Chemistry, the cumulative GPA of all pre-program courses, and the course grades for Foundations of Nursing theory, Medical-Surgical Nursing I theory, and Drug Therapy theory.

Grades and GPA

For many years, it has been a common consensus that grades and GPA are two of the best indicators that a teacher has of a student’s performance. Grades in specific courses are often used as indicators to determine if the student is ready to advance to a higher level in that subject area. Grade point average is a widely used and universally accepted standard of a student’s academic achievement. Grade point averages are often used for obtaining scholarships, determining a students’ academic standing or rank in a class, for admission to college or for admission to a specific program within a college or university.

In preparation for the NCLEX-RN and a career as a Registered Nurse, the nursing curriculum is designed to allow students to gradually develop the knowledge and skills needed to implement the nursing process in both the classroom and clinical settings. To be successful in these goals, the nursing faculty has established academic
requirements that the students must meet. In order to be admitted and to remain in the nursing program at the community college of this study, the student must have a minimum grade of C (75% or 2.0) in all science, pre-requisite, and nursing courses. In order to graduate, the student must have an overall grade-point average of C (2.0).

It is the responsibility of the nursing faculty to ensure that the student is adequately prepared to pass the licensure examination and to be successful as a Registered Nurse. This is achieved through the development of a departmental teaching philosophy as well as relevant course content and a variety of nursing care experiences. Examinations, developed and reviewed by the faculty, are designed to test the knowledge of the nursing process and assess the student's knowledge and application of the material. A test review and feedback session was provided for students on the day of each examination. Students are evaluated in both the clinical and theory portions of the nursing courses each semester and receive a separate grade for clinical and theory portion of each course.

Through these arduous evaluation processes, the major goals of the nursing department are realized—to produce students who are successful at completing the NCLEX-RN and to produce caring, competent, Registered Nurses. The students who hope to attain these goals are expected to perform in highly stressful and demanding situations, both in and out of the classroom. It is expected that those individuals who have had previous success in their academic careers as measured by their GPA in their pre-requisite and science courses are more likely to be prepared for the demands of a challenging nursing program and are therefore, more likely to reach the goals of that
program by passing the NCLEX-RN.

Course Descriptions

Anatomy and Physiology I and II concern the study of the human body, its structure and intricate workings. It includes organs, organ systems, and their involvement in maintaining homeostasis of the body. The courses stress the relationship between anatomic dysfunction and clinical symptomology. These courses are the basis for much of the theory on health, disease, and pharmacology within the nursing curriculum (West Shore Community College Catalog, 2000).

Microbiology teaches students the description of bacteria and its related forms of microorganisms. The course includes information on the growth and nature of the bacteria, their application in industry, and their place and control in the health of the public. This course, for nursing students, also contains basic knowledge needed to understand and conceptualize the theory related to the treatment and cure of disease (West Shore Community College Catalog, 2000).

The Chemistry course includes content on the laws, principles, and theories related to the essential elements of inorganic chemistry. Topics of study include structure of atoms, periodic classification, chemical bands, stoichiometry, and states of matter, thermodynamics, solutions, reaction rates, equilibrium and oxidation-reduction. This information is particularly needed for nursing students as a basis for their study of drugs and pharmacology (West Shore Community College Catalog, 2000).
The Foundation of Nursing Theory course is the exploration of the fundamentals of nursing practice and concepts necessary to meet the basic needs of patients of all ages. The course focus is on the study of normal parameters, physical comfort, safety, hygiene, and the application of the nursing process. The course must be passed with a 75%, C (2.0) or better for the student to progress in the nursing program (West Shore Community College, 2000).

Medical Surgical I theory consists of the study of patients with stable medical and/or surgical conditions in all age groups. The course includes incorporation of self-care and the use of the nursing process. As previously stated, the course must be passed with minimum 75%, C (2.0) for the student to be allowed to progress to the next semester of the program (West Shore Community College Catalog, 2000).

Drug Therapy I theory is the study of the basic principles of pharmacology. It includes the study of basic drug classifications and their effect on the human system. This course as well, must be passed with a minimum of 75%, C (2.0) for the student to be allowed to progress to the next semester of the program.

During the seven-year span of this research study, there were no major changes in the pre-program or nursing program curriculum. Faculty in the nursing program saw one new professor following a retirement. Faculty in the science department for the courses examined remained stable.

Data Entry

The pre-program course work may be transferred in from another college or
university or taken at the participating community college. The course grades will be
taken from the transcripts of the students included in the sample. Students' grades in
Anatomy and Physiology I & II, Chemistry I, and Microbiology were transformed to a
corresponding number: A = 4.0; B = 3.0, C = 2.0, D = 1.0 and F = 0, respectively.
These numbers correspond to the grading scale at the participating college. For stu­
dents repeating a science course, because of an unacceptable grade, the first grade
recorded will be used for the statistical analysis.

The cumulative GPA for all of the pre-program courses (CUMGPA) con­sisted of the GPA earned for the 29 credit hours of general education and science
courses. The GPA was computed from the grades recorded on the student transcript.
The same sample of students was utilized. The CUMGPA was recorded as the
numerical value that is computed.

The three nursing program courses each have a clinical and theory component.
Only the grade for the theory course was used in this study. The actual percentage
grade earned by the students in the sample was obtained from the course files con­tained in the nursing department. Clinical grades were not used relative to the lack of
uniform criterion based methods of evaluating students in the clinical setting. The
theory grades are based on objective data only.

**Dependent Variable**

Success or failure on the NCLEX-RN was the dependent variable for all
research questions. This examination must be taken and successfully completed by all
nursing students in the United States in order to practice as a Registered Nurse. There is no numerical grade given for the NCLEX-RN, only a pass/fail result.

**NCLEX-RN**

The NCLEX-RN is a multiple-choice test that places emphasis on a nursing process approach; nursing behavior in a variety of various nursing situations. Clinical situations or case studies are presented to measure the students' knowledge, skills, and competence in the areas of assessing, analyzing, planning, implementing, and evaluating patient care situations. In addition to nursing behaviors, the test focuses on patient health requirements and cognitive ability (National Council of State Boards of Nursing, 1997). The NCLEX-RN is the examination that determines who has the basic knowledge to practice as a Registered Nurse. According to the National Council of State Boards of Nursing (1997), passing the test indicates that the nurse has a minimum level of competencies to practice as an entry-level registered nurse.

The validity of the NCLEX-RN is well established by time and attention given to its construction. The plan for the examination is developed and approved by the National Council of State Boards of Nursing, which includes representatives for each State Board of Nursing. Nursing authorities from throughout the United States contribute potential test questions for the examination. The test questions are evaluated by the testing service to ensure that all questions meet the organizational plan, are not biased, and are grammatically correct. A panel of content experts then examines the items to confirm that each question is accurate, current, meaningful, and legally
defensible. After the questions are approved, they are included in current examina-
tions on a trial basis, but do not count toward the students' score on the exam. Each 
student taking the NCLEX-RN takes fifteen trial questions. Finally, the questions are 
subjected to statistical analysis to confirm reliability and validity (National Council of State Boards, 1997).

To be valid, the NCLEX-RN must measure the minimum competencies neces-
sary for safe and effective entry level nursing practice, and it must distinguish 
between graduates who do and do not have these competencies (National Council of State Boards, 1997). To establish the minimum competencies needed for safe effective nursing practice, test items must correlate with the duties practiced on the job. The correlation between test items and professional duties is measured by a job analy-
ysis; that is, the duties that are actually performed by entry level nurses, and its rela-
tionship to the NCLEX-RN test plan. The test plan describes the organization and percentage allocation of test items on the NCLEX-RN. To distinguish between competent and incompetent graduates, the National Council of State Boards of Nursing (1997) has established a criterion-referenced licensure examination.

Criterion-referenced means that the NCLEX-RN is measured by an established criterion, not measured based upon scores of other test takers. The criterion level represents a certain minimum number of correct responses that indicate that the gradu-
ate possesses competency and basic skills necessary to provide safe, effective nursing care. A panel of nurse judges chosen by the National Council of State Boards of Nursing determines the criterion level of the NCLEX-RN. Potential questions for the
NCLEX-RN are submitted by nurses and nurse educators from associate degree, diploma, and baccalaureate degree programs in nursing (National Council of State Boards of Nursing, 1997). Questions developed for the NCLEX-RN are based upon the current test plan.

The reliability of the NCLEX-RN is determined by its ability to consistently pass or fail candidates having the "same level of competence". The reliability index for the NCLEX-RN is psychometrically sound and ranges from .87 to .92 (National Council of State Boards of Nursing, 1997).

The NCLEX-RN results used in this study were the pass/fail results of the computerized-adaptive testing (CAT) version of the NCLEX-RN. This version was used for the first time in 1994 and continues to be used today. The CAT version of the NCLEX-RN is a method for administering tests that uses current computer technology and measurement theory. The computer program creates examinations that are unique for each candidate; the exam is assembled interactively as the individual is tested. Therefore, no two examines receive the same set of questions. As the candidate answers each question, the computer calculates a competence estimate based on all earlier answers. The test questions, which are stored in a large item bank and classified by test plan area and level of difficulty, are then scanned. The question determined to measure the candidate most precisely in the appropriate test plan area is selected and presented on the computer screen. This process is repeated for each question, creating an examination tailored to the individual's knowledge and skills while fulfilling all NCLEX-RN test plan requirements. The examination continues in
testing, avoiding questions that do not contribute to determining a candidate's level of nursing competence. The licensing examination is therefore tailored to the individual's knowledge and skills, yet still measures competence as required by the test plan (National Council of State Boards of Nursing, 1997).

The examination for each individual, ranges in length from a minimum of 60 scored items to a maximum of 250 scored items. Each exam contains 15 practice questions, which are not counted toward the candidate's competence level. Every examination, whatever its length, contains a controlled percentage of questions from each of the content areas covered in the NCLEX-RN test plan. The examinee has a maximum time limit of five hours and/or 250 questions to prove competence and pass the exam. Whenever the candidate reaches the point of proving competence or incompetence as determined by the computer program, the examination ends. The dichotomous information relating to passing or failing of the NCLEX-RN will be coded 1 or 0, 1 indicating passing the NCLEX-RN and 0 indicating failure of the NCLEX-RN.

Confidentiality of Subjects

Research involving human populations may present possible source of ethical problems. Therefore the first step in the data collection was to obtain the approval of the Western Michigan University Human Subject Institutional Review Board. In addition, approval needed to be obtained from the Dean of Student Services at the
participating college (Appendix A). This research involved the investigation of existing data and the information obtained was recorded in a way to ensure anonymity and confidentiality of the subjects.

Data was collected by an examination of the computerized records of those students who went through both years of the ADN program at the participating college and who had completed the ADN program during the academic years 1994-95, 1995-96, 1996-97, 1997-98, 1998-99, 1999-00, 2000-01. The specific nursing course grade data was collected from the course files maintained within the nursing department.

Data collected from the sample included the student’s gender, pass/fail on the NCLEX-RN, pre-program science course grades, GPA of all pre-program courses, theory grades earned in Foundations of Nursing, Medical-Surgical Nursing I and Drug Therapy I. All data was treated as confidential and coded for analysis (Appendix C).

**Data Analysis**

Both descriptive and inferential statistics were used to analyze the data and test the hypotheses. At the descriptive level, simple means and standard deviations, as well as frequency distributions were employed. At the inferential level, however, Pearson Product Moment Correlation Coefficients (Pearson r) was used to answer the following question: “Are there statistically significant relationships between the selected independent variables and the dependent variable, and among the independent variables?” Correlations were computed between each independent variable and
the dependent variable. These correlations were also computed among the independent variables. Statistical significance was established at the .05 level.

In addition a logistic regression analysis was performed to determine the whether the passing or failing of the NCLEX-RN will occur and to identify the variables most significant in making this prediction. Previous studies have shown that single predictors can be useful, however, they do not reflect accurately the complexity of today's world. A regression analysis will help explain the reality of how several independent variables can simultaneously affect and predict the dependent variable.

Data was entered in the Statistical Package for Social Sciences 7.5 (SPSS) (Norissus, 1995).
CHAPTER IV

DATA ANALYSIS AND DISCUSSION

The purpose of this study was to determine the relationship between academic achievement in selected pre-program and nursing program courses and the pass/fail performance on the National Council Licensure Examination for Registered Nurses (NCLEX-RN) by graduates of a selected associate degree-nursing program. It was hypothesized that (a) there would be no statistically significant relationship between the dependent variable, pass/fail result of the NCLEX-RN, and the independent variables as measured by the academic achievement in the pre-program science course grades, Anatomy and Physiology I & II (A&PI, A&PII); Microbiology (MICRO); Chemistry (CHEM); (b) there will be no significant relationship between the NCLEX-RN results and the cumulative grade point average (GPA) of all required pre-program courses; and (c) there will be no significant relationship between NCLEX-RN results and the GPA of the theory portion of the first three nursing courses in the first two semesters of the nursing program Fundamentals of Nursing (FND), Medical-Surgical Nursing I (MSI), and Drug Therapy (DT).

Data Analysis

In this chapter, the results of the data analyses are presented. The research portion of this study dealt only with recorded data. The numbers recorded in the
students' permanent records were the variables of interest. Whether these numbers were accurate and valid indicators of other things, such as aptitude or achievement is a separate issue not addressed in this study.

The statistical analysis the researcher used was dependent upon the nature of the research question addressed and the essence of the data collected. Both descriptive and inferential statistical methods were used to analyze the data. The researcher used a non-experimental correlation statistical procedure to explore the strength, direction and relationship possible between the indicated variables.

At the descriptive level, simple means and standard deviation as well as frequency distribution were employed. Pearson's Product Moment Coefficients were calculated to help identify the magnitude and direction of the relationships between independent and dependent variables. In addition, data was analyzed with the application of a logistic regression analysis. The dependent variable, the NCLEX-RN, had only two values, pass (1) or fail (0). Therefore, a least squares analysis that requires a continuous dependent variable was not adequate. The logistic regression analysis was performed with the intention of making predictions regarding the fit of a phenomena, predicting pass/fail on the NCLEX-RN.

Demography of Population

The demography of the population sample is presented in Table 1 and Table 2. The vast majority of the students (90%) in the nursing program during 1994-2001 were females.
Table 1

Demographic Characteristics of the Subjects Combined Classes (N=159)

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCLEX-RN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pass</td>
<td>159</td>
<td>138</td>
<td>86.7</td>
</tr>
<tr>
<td>Fail</td>
<td>21</td>
<td>21</td>
<td>13.3</td>
</tr>
<tr>
<td>GENDER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>159</td>
<td>15</td>
<td>9.5</td>
</tr>
<tr>
<td>Female</td>
<td>144</td>
<td>144</td>
<td>90.5</td>
</tr>
</tbody>
</table>

Table 2

Pass/Fail by Gender (N=159)

<table>
<thead>
<tr>
<th></th>
<th>Female</th>
<th>Male</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCLEX-RN</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fail</td>
<td>16 (11.1%)</td>
<td>5 (33.3%)</td>
<td>21 (13.3%)</td>
</tr>
<tr>
<td>Pass</td>
<td>128 (88.9%)</td>
<td>10 (66.6%)</td>
<td>138 (86.7%)</td>
</tr>
<tr>
<td>Total</td>
<td>144 (100%)</td>
<td>15 (100%)</td>
<td>159 (100%)</td>
</tr>
</tbody>
</table>

As indicated by the data results in Table 2, 88.9% of all female graduates passed the NCLEX-RN while only 66.6% of the male graduates passed. Overall, 86.7% of those students taking the NCLEX-RN for the first time passed the examination.
Table 3 presents the descriptive statistics for the independent variables. The mean and standard deviation for the academic variables are presented for all students and for those students failing the NCLEX-RN. The mean grades of the nursing theory courses are comparable to one another for all students. There is a more noticeable gap in the mean grades of those failing the NCLEX-RN. The mean grades for the science courses for all students are also quite comparable.

Table 3

<table>
<thead>
<tr>
<th>Variable</th>
<th>All Students (N=159)</th>
<th>Failing NCLEX-RN (N=21)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev.</td>
</tr>
<tr>
<td>A &amp; P I*</td>
<td>3.36</td>
<td>0.74</td>
</tr>
<tr>
<td>A &amp; P II*</td>
<td>3.26</td>
<td>0.74</td>
</tr>
<tr>
<td>MICRO*</td>
<td>3.25</td>
<td>0.77</td>
</tr>
<tr>
<td>CHEM*</td>
<td>3.07</td>
<td>0.83</td>
</tr>
<tr>
<td>CUM GPA*</td>
<td>3.21</td>
<td>0.52</td>
</tr>
<tr>
<td>FND Grade**</td>
<td>87.41</td>
<td>3.78</td>
</tr>
<tr>
<td>MSI Grade**</td>
<td>83.53</td>
<td>5.75</td>
</tr>
<tr>
<td>DT Grade**</td>
<td>85.01</td>
<td>4.83</td>
</tr>
</tbody>
</table>

*grade point average (GPA) based on 4.0 scale
**grade based on 100% possible
Testing the Hypotheses

Correlation analysis was used to measure the strength of association between the results of the NCLEX-RN and each of the predictor variables. In Table 4, the Pearson Product Moment Correlation Coefficients between the eight independent variables and the dependent variable, pass or fail on the NCLEX-RN, are presented. An examination of the data in Table 4 reveals that grades in all of the predictor variables are significantly correlated with the NCLEX-RN results, \( p < .05 \). However, the

<table>
<thead>
<tr>
<th>Variable</th>
<th>NCLEX</th>
<th>A &amp; PI</th>
<th>MICRO</th>
<th>CHEM</th>
<th>FNDGPA</th>
<th>CUMGPA</th>
<th>MS1GPA</th>
<th>DTGPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCLEX</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A &amp; PI</td>
<td>.167</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A &amp; PII</td>
<td>.284</td>
<td>.491</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MICRO</td>
<td>.343</td>
<td>.372</td>
<td>.504</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM</td>
<td>.278</td>
<td>.255</td>
<td>.407</td>
<td>.434</td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CUMGPA</td>
<td>.345</td>
<td>.616</td>
<td>.695</td>
<td>.678</td>
<td>.515</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FNDGPA</td>
<td>.446</td>
<td>.311</td>
<td>.478</td>
<td>.554</td>
<td>.398</td>
<td>.566</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>MS1GPA</td>
<td>.374</td>
<td>.227</td>
<td>.388</td>
<td>.436</td>
<td>.217</td>
<td>.414</td>
<td>.629</td>
<td>1.000</td>
</tr>
<tr>
<td>DTGPA</td>
<td>.467</td>
<td>.270</td>
<td>.378</td>
<td>.500</td>
<td>.309</td>
<td>.418</td>
<td>.681</td>
<td>.651</td>
</tr>
</tbody>
</table>

\( p < .000 \)
\( p < .05 \)
science course grades, the cumulative GPA, and the grade of the Medical-Surgical I course were the least effective predictors of NCLEX-RN (A & P1, r = 0.167, p<.05; A & PII, r = 0.284; MICRO, r = 0.343; CHEM, r = 0.278; CumGPA, r = 0.345; MedSurg I, r = 0.374, p<.000). As the presented data also indicates, the grade for the Fundamentals course (r = 0.446, p<.000) and for the Drug Therapy course (r = 0.467, p<.000) are moderately strong predictors of NCLEX-RN results. The three program variables, the theory grade for Fundamentals, Medical-Surgical I, and Drug Therapy demonstrate a high degree of inter-correlation suggesting a great deal of consistency with in the nursing curriculum itself. The grade in the A & P1 course was the least effective of all of the variables as evidenced by its low correlation coefficient (r = .167, p<.05), while the Drug Therapy was the best predictor (r = .467, p<.000).

H01 There is no significant relationship between the pre-requisite science course grades (Anatomy & Physiology I & II; Microbiology; and Chemistry) and the first time passing of the NCLEX-RN examination.

The results of the logistic regression analysis are presented in Tables 5, 6, and 7. A logistic regression analysis was performed rather than a linear regression due to the dichotomous value of the dependent variable. Logistic regression analysis was conducted with all four of the pre-program science courses, Anatomy and Physiology I and II, Chemistry and Microbiology, as the independent variables.

As illustrated in Table 5, the model of the four pre-program science courses was weakly significant in rejecting the null hypothesis. The independent science variables were not linearly related to the log odds of the NCLEX-RN. The science
The A & P I course was the least predictive of the NCLEX-RN performance.

As illustrated in the data of Table 6, when using the pre-program science GPA:

<table>
<thead>
<tr>
<th>Predicted</th>
<th>Percent Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Observed</strong></td>
<td><strong>FAIL</strong></td>
</tr>
<tr>
<td><strong>FAIL</strong></td>
<td>F</td>
</tr>
<tr>
<td><strong>PASS</strong></td>
<td>P</td>
</tr>
<tr>
<td>Overall</td>
<td>88.05%</td>
</tr>
</tbody>
</table>
grades, it was more difficult to predict those who failed than the students predicted to pass the NCLEX-RN. Only 9.2% of the students predicted to fail actually failed.

The Wald statistics and significance levels in Table 7 indicate that Chemistry has the most significant effect on the NCLEX-RN. A & P 1 is again noted to be the least significant of the predictor variables in this analysis. The null hypothesis was rejected.

Table 7

Variables in the Equation — Pre-Program Science GPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>Std. Error</th>
<th>Wald</th>
<th>dF</th>
<th>Sig.</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP I</td>
<td>-.0398</td>
<td>.3846</td>
<td>.0107</td>
<td>1</td>
<td>.9176</td>
<td>.0000</td>
</tr>
<tr>
<td>AP II</td>
<td>.6636</td>
<td>.4203</td>
<td>2.4932</td>
<td>1</td>
<td>.1143</td>
<td>.0630</td>
</tr>
<tr>
<td>CHEM</td>
<td>.6558</td>
<td>.3319</td>
<td>3.9036</td>
<td>1</td>
<td>.0482</td>
<td>.1238</td>
</tr>
<tr>
<td>MICRO</td>
<td>.5099</td>
<td>.3633</td>
<td>1.9703</td>
<td>1</td>
<td>.1604</td>
<td>.0000</td>
</tr>
<tr>
<td>Constant (NCLEX)</td>
<td>-3.3781</td>
<td>1.3789</td>
<td>6.0018</td>
<td>1</td>
<td>.0143</td>
<td></td>
</tr>
</tbody>
</table>

$H_0$: There is no significant relationship between the cumulative grade point average (GPA) of all pre-requisite courses and the first time passing of the NCLEX-RN.

Table 8, 9, and 10 exhibit the logistic regression analysis data between the first time passing of the NCLEX-RN and the cumulative pre-requisite GPA. The data
analysis indicated a weak but significant relationship between the cumulative pre-requisite GPA and the first time pass of the NCLEX-RN ($X^2 = 20.24; p<.000$). The cumulative pre-requisite GPA accounted for 11.9% of the variance in NCLEX-RN results.

Table 8

Logistic Regression Analysis Cumulative Grade Point Average (GPA)

| -2 Log Likelihood | 103.996 |
| Goodness of Fit    | 431.961 |
| Cox & Snell – $R^2$| .119    |
| Nagelkerke – $R^2$| .219    |

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chi-Square</th>
<th>dF</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>20.124</td>
<td>1</td>
<td>.0000</td>
</tr>
<tr>
<td>Block</td>
<td>20.124</td>
<td>1</td>
<td>.0000</td>
</tr>
<tr>
<td>Step</td>
<td>20.124</td>
<td>1</td>
<td>.0000</td>
</tr>
</tbody>
</table>

The data analysis in Table 9, the Classification table, reveals that when using the CumGPA, only 9.52% of those predicted to fail actually failed, while 98% of those predicted to pass actually did so. These results are similar to the results of the analysis of the pre-program science course grades and the NCLEX-RN. It was more difficult to predict those who would actually fail the NCLEX-RN than those who would pass.

Table 10 illustrates the analysis of the CumGPA variable and the NCLEX-RN
Table 9

Classification Table for NCLEX-RN With CumGPA

<table>
<thead>
<tr>
<th>Predicted</th>
<th>Observed</th>
<th>Percent Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAIL</td>
<td>F 2 19</td>
<td>9.52%</td>
</tr>
<tr>
<td>PASS</td>
<td>P 136</td>
<td>98.55%</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td>86.79%</td>
</tr>
</tbody>
</table>

Table 10

Variables in the Equation — CumGPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>Std. Error</th>
<th>Wald</th>
<th>dF</th>
<th>Sig.</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>CUMGPA</td>
<td>2.1955</td>
<td>0.5518</td>
<td>15.8315</td>
<td>1</td>
<td>0.0001</td>
<td>0.3338</td>
</tr>
<tr>
<td>Constant (NCLEX)</td>
<td>-4.7292</td>
<td>1.5893</td>
<td>8.8542</td>
<td>1</td>
<td>0.0029</td>
<td></td>
</tr>
</tbody>
</table>

as the constant. The Wald statistic specifies a significant effect on predicting NCLEX-RN success when using the CumGPA. The null hypothesis was rejected.

HO_3: There will be no significant relationship between the GPA of the nursing theory courses (Fundamentals of Nursing (FND); Medical-Surgical I (MSI); Drug Therapy (DT) in the first two semesters of the nursing program and the successful passing of the NCLEX-RN.
The logistic regression analysis between the subjects' GPA in the selected nursing theory courses and the first time passing of the NCLEX-RN is illustrated in Tables 11, 12, and 13. The data analysis, as seen in Table 11, indicates the three nursing theory courses as being significantly related to the first time passing of the NCLEX-RN ($X^2 = 44.607, p.000$). These theory course GPA's accounted for 24.5% of the variance in the NCLEX-RN pass rate.

Table 11

Logistic Regression Analysis -- Nursing Theory GPA

<table>
<thead>
<tr>
<th>-2 Log Likelihood</th>
<th>79.513</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goodness of Fit</td>
<td>108.049</td>
</tr>
<tr>
<td>Cox &amp; Snell – $R^2$</td>
<td>0.245</td>
</tr>
<tr>
<td>Nagelkerke – $R^2$</td>
<td>0.451</td>
</tr>
</tbody>
</table>

Model Chi Square -- Nursing Course GPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chi-Square</th>
<th>dF</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>44.607</td>
<td>3</td>
<td>.0000</td>
</tr>
<tr>
<td>Block</td>
<td>44.607</td>
<td>3</td>
<td>.0000</td>
</tr>
<tr>
<td>Step</td>
<td>44.607</td>
<td>3</td>
<td>.0000</td>
</tr>
</tbody>
</table>

In reviewing Classification Table 12, it is noted that, as before, it was more difficult to predict those who were to fail and actually did so, than to predict those who passed. The prediction of failures was only 42.86% correct. Twelve people, who had been predicted to fail using the GPA's of the nursing theory courses, in
Table 12

Classification Table for NCLEX-RN and Nursing GPA

<table>
<thead>
<tr>
<th>Predicted</th>
<th>Observed</th>
<th>F</th>
<th>I</th>
<th>P</th>
<th>Percent Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAIL</td>
<td>+--------</td>
<td>+</td>
<td>+</td>
<td></td>
<td>42.86%</td>
</tr>
<tr>
<td>PASS</td>
<td>+--------</td>
<td>P</td>
<td>I</td>
<td>133</td>
<td>96.38%</td>
</tr>
<tr>
<td>Overall</td>
<td>+--------</td>
<td>+</td>
<td>+</td>
<td></td>
<td>89.31%</td>
</tr>
</tbody>
</table>

reality, passed the NCLEX-RN.

Table 13 reveals that two of the three nursing courses had a significant effect on predicting the NCLEX-RN results. Drug Therapy GPA and Fundamentals GPA indicated a significance at the p<.05 level. The null hypothesis was rejected.

Table 13

Variables in the Equations — NCLEX-RN and Nursing GPA

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>Std. Error</th>
<th>Wald</th>
<th>dF</th>
<th>Sig.</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNDGPA</td>
<td>.2271</td>
<td>.1010</td>
<td>5.055</td>
<td>1</td>
<td>.0246</td>
<td>.1569</td>
</tr>
<tr>
<td>DTGPA</td>
<td>.2310</td>
<td>.0903</td>
<td>6.542</td>
<td>1</td>
<td>.0105</td>
<td>.1913</td>
</tr>
<tr>
<td>MS1GPA</td>
<td>.0469</td>
<td>.0804</td>
<td>.3400</td>
<td>1</td>
<td>.5598</td>
<td>.0000</td>
</tr>
<tr>
<td>Constant (NCLEX)</td>
<td>-40.3556</td>
<td>8.5845</td>
<td>22.0992</td>
<td>1</td>
<td>.0000</td>
<td>.0000</td>
</tr>
</tbody>
</table>

p<.05

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To further test the differences among the two groups (pass and fail) in the sample population, a logistic regression analysis was conducted with all eight predictor variables, A & P I, A & P II, Chemistry, Microbiology, cumulative pre-program GPA, Fundamentals of Nursing GPA, Medical-Surgical I GPA, and Drug Therapy GPA. The Model Chi Square, illustrated in Table 14, was significant, ($X^2 = 51.078$, $p<.000$), indicating that using all eight of the predictors differentiating the passing or failing of the NCLEX-RN. The eight variables accounted for approximately 27.5% of the variance in the NCLEX-RN results.

Table 14

Logistic Regression Analysis -- All Eight Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Chi-Square</th>
<th>df</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model</td>
<td>51.078</td>
<td>8</td>
<td>.0000</td>
</tr>
<tr>
<td>Block</td>
<td>51.078</td>
<td>8</td>
<td>.0000</td>
</tr>
<tr>
<td>Step</td>
<td>51.078</td>
<td>8</td>
<td>.0000</td>
</tr>
</tbody>
</table>

In Classification Table 15, using all eight variables, 89.94% of the graduates were classified correctly to either pass or fail the NCLEX-RN. However, as the previous data indicates, it was more difficult to accurate predict failure (42.86%) on the
Table 15
Classification Table for NCLEX-RN and All Eight Variables

<table>
<thead>
<tr>
<th>Predicted</th>
<th>PASS</th>
<th>Percent Correct</th>
</tr>
</thead>
<tbody>
<tr>
<td>F I P</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Observed</td>
<td>F I 9</td>
<td>42.86%</td>
</tr>
<tr>
<td>FAIL</td>
<td>+-----+</td>
<td></td>
</tr>
<tr>
<td>PASS</td>
<td>P I 4</td>
<td>97.10%</td>
</tr>
<tr>
<td></td>
<td>+-----+</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>89.94%</td>
<td></td>
</tr>
</tbody>
</table>

Of the eight variables in the equation, Drug Therapy GPA was the only variable that had a significant effect on the dependent variable at the p<.05 level as illustrated in Table 16 (Wald = 6.6727, p<.05). Drug Therapy was also the strongest predictor indicated in the data analysis of three nursing theory courses and in the correlation analysis.

Summary

This chapter has presented the analysis of the data collected, the computer generated model of significant correlations of independent and dependent variables. The description and demographics of the sample population are displayed in Tables 1, 2, and 3. Logistic regression and correlation analyses were used to evaluate hypothesis one, two, and three. These findings have been displayed in Tables 4 though 13. The logistic regression analysis resulted in the independent variables being
significantly correlated with success on the NCLEX-RN. The three nursing theory courses were shown to have more of a significant effect on the independent variables in predicting results on the NCLEX-RN than the other variables examined.

Table 16

Variables in the Equation — All Eight Variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>Std. Error</th>
<th>Wald</th>
<th>dF</th>
<th>Sig.</th>
<th>R</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNDGPA</td>
<td>-.1705</td>
<td>.1123</td>
<td>2.3045</td>
<td>1</td>
<td>.1290</td>
<td>.0495</td>
</tr>
<tr>
<td>DTGPA</td>
<td>.2640</td>
<td>.1022</td>
<td>6.6727</td>
<td>1</td>
<td>.0098</td>
<td>.1940</td>
</tr>
<tr>
<td>MS1GPA</td>
<td>.0592</td>
<td>.0906</td>
<td>.4273</td>
<td>1</td>
<td>.5133</td>
<td>.0000</td>
</tr>
<tr>
<td>AP I</td>
<td>-.1894</td>
<td>.5351</td>
<td>.1253</td>
<td>1</td>
<td>.7234</td>
<td>.0000</td>
</tr>
<tr>
<td>AP II</td>
<td>-.4726</td>
<td>.5647</td>
<td>.7004</td>
<td>1</td>
<td>.4027</td>
<td>.0000</td>
</tr>
<tr>
<td>CHEM</td>
<td>.5579</td>
<td>.4076</td>
<td>1.8733</td>
<td>1</td>
<td>.1711</td>
<td>.0000</td>
</tr>
<tr>
<td>CUMGPA</td>
<td>2.2076</td>
<td>1.2597</td>
<td>3.0712</td>
<td>1</td>
<td>.0797</td>
<td>.0929</td>
</tr>
<tr>
<td>MICRO</td>
<td>-.7140</td>
<td>.5134</td>
<td>1.9341</td>
<td>1</td>
<td>.1643</td>
<td>.0000</td>
</tr>
<tr>
<td>Constant (NCLEX)</td>
<td>-43.1486</td>
<td>10.4671</td>
<td>16.9935</td>
<td>1</td>
<td>.0000</td>
<td></td>
</tr>
</tbody>
</table>

p<.05
CHAPTER V

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

Discussion

The purpose of this study was to determine the relationship between academic achievement as measured by grades earned in pre-program science courses, cumulative pre-program grade point average (GPA), and grades earned in the first three nursing theory courses with the pass or fail results of the National Council Licensure Examination for Registered Nurses (NCLEX-RN). The subjects were 159 associate degree graduates from a rural Michigan community college from the years 1994-2001 who had completed the Associate Degree Nursing (ADN) program and taken the NCLEX-RN examination. Data for the study was obtained from the academic records of the graduates.

Pearson Product Moment Correlation was computed between each independent variable and the NCLEX-RN result and among the variables themselves. Each independent variable was then entered into a logistic regression equation model to determine the probability that the event, passing of the NCLEX-RN, will occur and to evaluate the relationship between the predictor variables and the criterion variable.

Statistically significant correlations were found between performance on the NCLEX-RN and grades in the four pre-program science courses, the pre-program
cumulative grade point average (GPA), and the three nursing theory grades. Pearson Product Moment Correlation was found to be significantly positive ($p<.05$) between the pre-program science grades and NCLEX-RN results, between the cumulative GPA and NCLEX-RN results, and between the three nursing theory grades and NCLEX-RN results.

Logistic regression analysis revealed that the pre-program science course grades, the cumulative pre-program GPA, and the grades in the three selected nursing theory or didactic courses were a good fit ($p<.05$). Therefore, the three null hypotheses were rejected. The pre-program science GPA accounted for 9.7% of the variance in the NCLEX-RN results. The cumulative GPA also accounted for 11.9% of the variance, while the nursing program courses were a stronger predictor accounting for 24.5% of the variance in NCLEX-RN scores. Logistic regression analysis was performed on all eight of the variables with the model chi square indicating statistical significance ($p<.05$). It was noted that the combination of the eight variables accurately predicted 89.94% of the pass/fail results on the NCLEX-RN.

Overall the results of this study are comparable to some of the previous studies that have been completed (Alexander & Brophy, 1997; Briscoe & Anema, 1999; Byrd et al., 1999; Drake & Michael, 1995; Endres, 1997; Fitzsimons & Kelley, 1996; Fowles, 1992; Heupel, 1994; Lengacher & Keller, 1990; Yocum & Scherubel, 1985; Younger & Grap, 1992). Results of this study indicate that it is possible identify variables and to predict success or failure on the NCLEX-RN early in the students program using readily available data from student records and transcripts and without
looking at additional testing. Potential at risk students, those predicted to fail, could then be provided with the necessary help to increase their chance of success on the NCLEX-RN.

Nurse educators need to be cognizant of predictors related to success, passing of their students on the NCLEX-RN. However, there were things in regard to this study that limit the usefulness of the findings for other programs. First, the nature of this study does not lend itself to random sampling. Second, the study involved only a convenience sample of subjects from a small rural community college. Third, there was a total of 189 records examined with 30 having missing data and unable to be used in the study. This made for a smaller sample to be investigated. Fourth, of the 159 complete records, only twenty-one or 13.2% had actually failed the NCLEX-RN over the seven years the study covered. This is a relatively small percentage of failures and limits the statistical analysis.

Conclusions

Statistical significance was found between performance on the NCLEX-RN and grades in the four pre-program science courses. The results were weak, but positive correlations ($p<.05$) of NCLEX-RN results. The correlation analysis indicated that the Microbiology (MICRO) GPA was the strongest predictor of the four science courses ($r = 0.343, p<.05$) and Anatomy and Physiology I (A & PI) the weakest of the science predictors ($r = 0.167, p<.05$). This investigation supported the findings of the study by Felts (1986), identifying microbiology to be one of the significant predictors.
for college success and for the NCLEX-RN results. However, Krupa et al. (1988) found A & PI as a strong predictor directly related to performance on the NCLEX-RN, which is contradictory to the findings of this study. In other studies involving BSN programs, Fowles (1992) and Lewis and Lewis (2000) determined that A & P I was a moderately significant predictor for NCLEX-RN results, while this study found it to be only weakly significant. Whitley and Chadwick (1986) also established that pre-program science grades were a significant predictor of performance on the NCLEX-RN as did Byrd et al. (1999) and Krupa et al. (1988). Drake and Michael (1995) investigated pre-program science courses as they related to pass/fail on the NCLEX-RN for ADN graduates and found no increase in validity of predicting pass or fail with the science related courses.

Campbell and Dickson in their 1996 meta-analysis indicated that the GPA in the science courses along with the nursing courses to be the greatest and most significant cognitive predictors of student success. Campbell and Dickson (1996) affirmed that considering the consistent ability of grades in science course to predict student success, interventions for the at-risk student population should begin at the pre-program level prior to beginning any nursing coursework.

Nursing faculty need to discuss with students the need for content mastering of these required science courses. Students must understand that in order to master the nursing program and coursework, they must have a strong science background. Knowledge of Anatomy and Physiology is fundamental for nurses and nursing students when assessing human responses to health or illness.

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The pre-program cumulative GPA was also determined to be statistically significant in predicting NCLEX-RN results \((r = .345, p<.05)\), and accounted for 11.9% of the variance in the pass/fail results of the NCLEX-RN. The results of this study were supported by the research implemented by Arathuzik and Aber (1998), Byrd et al. (1999), Horns et al. (1991), Lengacher and Keller (1990), Woodham and Taulbe (1986), and Yang, Glick, and McClelland (1987).

In studies involving ADN programs, Horns et al. (1991) identified that pre-program coursework was strongly predictive accounting for 67% of the variance in NCLEX-RN. While Anderson (1993) and Lengacher and Keller (1990) established that the pre-program GPA had little or no value in predicting NCLEX-RN results. Anderson (1993), Drake and Michael (1995), and Felts (1986) in each of their respective studies, discovered, as did this study that those variables occurring prior to entry into the nursing program coursework were statistically significant but weak in their ability to predict NCLEX-RN results. Jenks et al. (1989) concluded in their study that pre-nursing data was unrelated and not significant to NCLEX-RN performance.

Byrd et al. (1999), in a more recent study of BSN programs, discovered a strong positive relationship between pre-program GPA and NCLEX-RN results. Pre-program cumulative GPA was also one of the variables that Arathuzik and Aber (1998) found to be significantly correlated with NCLEX-RN results. There were others that found pre-program coursework unrelated to NCLEX-RN prediction. Mills et al. (1992) found pre-program criteria to be the poorest model in their logistic regression analysis for NCLEX-RN prediction.
The data from this study suggested that taking steps to identify students with weak performance prior to entry into the nursing program remains a viable option, but should be used along with other stronger predictive variables. However, interventions taken with the students with poor pre-program grades might well improve their success while in the program, and thereby also increase their ability to pass the NCLEX-RN. The college has, with in the past year, instituted a new policy limiting the number of times a student may repeat a class to improve their grade. A student, who has taken a course three times, may no longer enroll for that course. This policy may prevent some of the very weak students from entering the program.

Significant positive relationship was found in this study between the performance on the NCLEX-RN and grades in the first three nursing theory courses in the first two semesters of the ADN program. Data analysis identified that the GPA of the Fundamentals of Nursing (FND), Medical-surgical Nursing I (MSI), and Drug Therapy (DT) had a significant effect on the passing of the NCLEX-RN, and the null hypothesis was rejected. Pearson Product Moment Correlation established positive statistical significance ($p<.05$) between the nursing theory course grades and the NCLEX-RN. Overall these results are comparable to many previous studies using nursing theory course work as predictor variables in both ADN and BSN programs. The results are supported by studies by Alexander & Brophy, (1997), Barkley et al., (1998), Drake & Michael (1995), Endres (1997), Fowles (1992), Lengacher, and Keller (1990), Marshall, (1999), Mills et al. (1992), Rami (1992), and Woodham and Taube (1986).
Grades in the indicated nursing courses should be considered an important variable to identify those students at high risk for NCLEX-RN failure as well as those students who might benefit from academic tutoring while completing their nursing studies. Students should not, however, be denied the opportunity to take the NCLEX-RN based solely on a prediction to fail the licensure examination. Nursing educators need to proceed with caution when informing students of their high risk status, in order to minimize additional stress and anxiety for the student and to guard against a decrease in student motivation.

Mills et al. (1992), suggested, in their study, that using the first semester nursing GPA with ADN students, they were able to predict 94% of those who failed the NCLEX-RN. In the study by Drake and Michael (1995), the nursing theory GPA was only a modest predictor as with this study. However, Drake & Michael (1995), indicated that the nursing GPA did offer the most promise for identifying those students most likely to succeed on the NCLEX-RN. The small sample (N = 159) utilized in this study decreases the credibility of the findings for the nursing theory grades to be used by others as predictor variables. The correlation in this study between nursing courses and performance on the NCLEX-RN is not generalizable beyond the curriculum for which the study was completed and should be interpreted cautiously by others. Nursing programs do not have a standardized content or delivery of curriculum. Content is distributed differently in programs and the first three nursing courses offered may or may not have like content. In addition, the students in this study had been enrolled in a varying number of semester credit hours and were allowed to repeat
courses numerous times to improve their pre-program GPA. These two factors may have influenced the nursing GPA's reported in this study.

Since performance may also reflect instruction more than content, it is possible that the nursing courses, Fundamentals, Medical-Surgical I, and Drug Therapy, which did contribute significantly to prediction of licensure examination results, may depend more on the particular instructor or a principal method of instruction (lecture/discussion/group work) rather than on content. The same may be said of the pre-program science course work. A course, which provides a particularly unique method of instruction, may enhance prediction as viable criteria for that program and not prove to be predictive to other programs.

The current nursing shortage magnifies the need for decreasing failure rates in the NCLEX-RN. A number of potential nurses are lost from the profession because their entry into the practice arena is delayed with a failure on the NCLEX-RN. This failure comes after the student has invested a significant amount of time and money as has the nursing program and the college. Thus, identifying potential students and implementing programs to decrease the risk of failure would prove to be a value to all involved.

One of the goals of this researcher for this study was to be able to predict students at risk for possible failure of the NCLEX-RN early in their educational career in order to facilitate early intervention. The three nursing courses used are completed at the end of the second semester of the two-year ADN program. Knowing these grades could be used to predict possible NCLEX-RN failure at that time would indeed
facilitate time to intervene with various programs to improve the student outcome. Faculty should also study the specific characteristics of these predictive courses, especially the Drug Therapy course which proved to be the strongest as a single predictor. Faculty need to determine why performances in this course relate more strongly than others to NCLEX-RN performance and then add these features to other courses within the program.

This study predicted performance on NCLEX-RN for a specific group of nursing students who did not participate in any enrichment program or who had no other interventions applied. Perhaps a hypothesis for a future study would be that an intervention program, when applied has a strong chance of preventing predicted NCLEX-RN failure. Further research would also be needed to determine the most effective interventions to improve the passing rate of at-risk students.

Recommendations

The importance of maintaining accurate and current student records cannot be over emphasized. To accurately determine the effectiveness of admission and nursing course variables as predictors of NCLEX-RN success, precise, up-to-date records must be maintained. It is recommended that another study of the pre-program and early nursing course variables should be conducted again in a few years when there would be a larger sample available. It is also recommended that this study be replicated using a larger and more geographically diverse sample to facilitate generalization to the ADN programs at large.
The quantitative findings of this study suggest that early academic achievement accounts for student success as determined by the passing the NCLEX-RN. As the three beginning nursing courses were more strongly predictive than the pre-program science courses or cumulative pre-program GPA, it is recommended that nursing faculty use these courses as markers for students who need more support and help. Once a student has been identified as doing poorly, especially in the Drug Therapy course, interventions can be initiated. Research supports interventions for assisting students even if it is instituted late in the program. However, the earlier the identification and intervention is instituted, the more time for remediation and the better the results (Barkley et al., 1998; Fitzsimons & Kelley, 1996; Wolahan & Wieczorek, 1991).

A further recommendation involves using the information regarding these predictor variables to develop a risk profile. This profile could be weighted based upon the strength of the prediction of the selected variables and thus provide an “early warning” system. Nursing student advisors could use the risk profile for future guidance. Students could be tracked as they progress in the nursing program. Barkley et al. (1998) developed and recommended an NCLEX-RN Risk Appraisal Instrument (RAI), but it is only able to be used at the end of the nursing program, leaving little time for intervention and remediation. As students must maintain a 75% or C average to remain in the nursing program, a future study might relate the number of C's earned in pre-program requirements and early program courses, and the number of times a pre-program course is repeated to earn a C, to the pass/fail of the NCLEX-
It is recommended that an individual plan be developed for each at-risk student, those students with low grades in the pre-program and early nursing coursework. Students have individualized needs and as such, intervention plans need to accommodate those needs. The student would meet with a faculty facilitator throughout the remainder of the program to review their progress and to revise the remediation plan as appropriate. Also, mock NCLEX-RN examinations could be administered until the student scores above the 75th percentile. Ashley and O'Neal (1994) reported on the effectiveness of faculty-directed study groups as an intervention to remediation and support for students, particularly those students of lower academic achievement. Other researchers have examined individualized study plans for students for improvement of their skills which included practice computer examinations, teacher-directed seminars, and NCLEX-RN content review books (Beare, 1995; Eason & Woolard, 1991; Foti & DeYoung, 1991).

It is additionally recommended that an interview/survey of students' perceptions, both positive and negative of their academic and non-academic problems be completed while the student is in the program. Students would identify strategies they had used to resolve problems and what they would recommend to the institution and upcoming students in the program. The results of these interviews could be analyzed and used to determine what other problematic areas exist that perhaps the administration and faculty had overlooked. The interview/survey would also be a useful learning tool for faculty to discover what strategies aided students the most and then begin
implementing those strategies with students identified as high risk. These measures should help to enhance the retention in the nursing program followed by increased success on the NCLEX-RN.

Numerous strategies for NCLEX-RN preparation have been reported in the literature (Ashley & O’Neil, 1991; Barkley et al., 1998; Ross, Nice, May, & Billings, 1996; Vance & Davidhizar, 1997). Among those demonstrated by these researchers to be effective are tutoring, NCLEX-RN study courses, computerized NCLEX-RN review software, study skills classes, test-taking instruction, time management instruction, participation on learning teams or study groups, mock NCLEX-RN examinations, counseling and advising sessions, and stress and anxiety reduction sessions. Students could be offered tutoring and study skills classes to assist them in improving their academic performance. Non-traditional students with family responsibilities and demands could be advised and counseled on time management so as to maximize their available study time. Students demonstrating poor test taking techniques and test anxiety could be offered test taking and study skills classes as well as a stress reduction program to reduce their emotional and anxiety levels. Not only might these strategies improve the NCLEX-RN pass results, but the student’s nursing program GPA might improve as well. A study could then be designed and performed before and after the interventions are instituted to determine if the interventions, once applied, prevent a predicted failure or improve the NCLEX-RN pass rate for identified at risk students.

Further research is needed for each of the independent variables and with other
non-academic variables not considered in this study such as anxiety, stress management, age, ethnicity, and learning style. These non-academic factors might prove to be more predictive of NCLEX-RN success or failure than has been found with the academic variables. Aber and Arathuzik (1996) found anxiety and guilt emotions to be a significant predictor along with Nursing Theory GPA. Poorman and Martin (1991) found test anxiety to be inversely related to passing the NCLEX-RN. Lengacher and Keller (1990) and Graham (1994) identified age as a significant variable. The older students' performance was much stronger on the NCLEX-RN than the younger.

Reporting only pass/fail scores to schools of nursing greatly diminishes the statistical analysis and the institutional effectiveness to accurately predict which students are at-risk for success and in need of interventions. The testing service and the National Council of State Boards of Nursing should, if possible, report raw scores to each school for their graduates, or the number of questions answered, in order to enhance the identification of at-risk students.

Indicators in course achievement prior to the nursing program in this study have only weak validity in forecasting which nursing students will obtain a passing score on the NCLEX-RN. A GPA earned in the first and early didactic or theory courses seems to offer a stronger insight into identifying those students most likely to be successful on the NCLEX-RN. As an administrator, I have a moral obligation to provide scientifically sound information to students. Performance on the licensure examination has far reaching implications for students. Wrongful predictions of
student success or failure could have potential adverse effects ranging from undue emotional stress and test anxiety to altered levels of self-esteem, motivation, and self-confidence.

The major concern of this study was to identify academic predictors in the early stages of an ADN nursing program that would identify students at risk for failure on the NCLEX-RN. Predictor assessments that focus on the identification of these students can assist nurse educators to develop meaningful council and instructive programs. The application of a valued, proven, predictor risk profile to ADN students would enable faculty to correctly identify “at-risk” students thus eliminating tremendous financial burden and emotional turmoil. The benefits of these predictive assessment strategies is that nursing could increase the supply of nurses to meet the public’s needs in this time of nursing shortage.
Appendix A

BSN Research Studies
## BSN Research Studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>No. of Participants</th>
<th>Variables</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABER</td>
<td>1996</td>
<td>123</td>
<td>Nsg Theory, Anxiety, guilt, emotions</td>
<td>r = .276</td>
</tr>
<tr>
<td>BARKLEY</td>
<td>1996</td>
<td>81</td>
<td>NLN Competency, Psych. Theory GPA, Peds. theory GPA</td>
<td>r = .58</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C earned in clinical                                                     X2 = 21.77 for failure of NCLEX</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Two C's in nsg. Theory                                                  X2 = 27.76 for failure of NCLEX</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Three + C's in nsg theory                                               X2 = 44.01 for failure of NCLEX</td>
<td></td>
</tr>
<tr>
<td>BYRD</td>
<td>1999</td>
<td>285</td>
<td>ACT, Science GPA, Pre-nsg. GPA</td>
<td>r = .41</td>
</tr>
<tr>
<td>ENDRES</td>
<td>1997</td>
<td>100</td>
<td>Mosby Assess Test                                                       X2 = 9.09</td>
<td></td>
</tr>
<tr>
<td>FOTI</td>
<td>1991</td>
<td>92</td>
<td>SAT, Science GPA, Mosby Assess</td>
<td>r = .15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nsg. Program GPA</td>
<td>r = .51</td>
</tr>
<tr>
<td>FOWLES</td>
<td>1992</td>
<td>192</td>
<td>ACT Composite, Science GPA, Mosby Assess Test, Level I GPA</td>
<td>r = .39</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nsg. II Clinical GPA                                                    r = .56</td>
<td></td>
</tr>
<tr>
<td>GLICK</td>
<td>1996</td>
<td>51</td>
<td>Nsg. Program GPA, Race                                                  r = .54</td>
<td></td>
</tr>
<tr>
<td>HORNES</td>
<td>1991</td>
<td>394</td>
<td>Mosby Assess Test                                                       r = .44</td>
<td></td>
</tr>
<tr>
<td>JENKS</td>
<td>1989</td>
<td>407</td>
<td>ACT, Science GPA, Mosby Assess</td>
<td>r = .39</td>
</tr>
<tr>
<td>LEWIS</td>
<td>2000</td>
<td>175</td>
<td>A &amp; P GPA                                                                r = .41</td>
<td></td>
</tr>
<tr>
<td>MARQUIS</td>
<td>1992</td>
<td>134</td>
<td>Nsg. Theory GPA, Non-nsg. GPA</td>
<td>r = .62</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Nsg. Clinical GPA                                                       r = .40</td>
<td></td>
</tr>
<tr>
<td>McKINNEY</td>
<td>1988</td>
<td>136</td>
<td>Mosby Assess Test, SAT-verbal, Nsg. Courses repeated, Nsg. GPA, Age</td>
<td>r = .02</td>
</tr>
<tr>
<td>POORMAN</td>
<td>1991</td>
<td>102</td>
<td>SAT                                                                      t = -1.85</td>
<td></td>
</tr>
<tr>
<td>ROGERS</td>
<td>1995</td>
<td>95</td>
<td>NLN Competency                                                           r = 5</td>
<td></td>
</tr>
<tr>
<td>YOCUM</td>
<td>1989</td>
<td></td>
<td>Junior nsg. theory GPA                                                  r = .78</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Senior nsg. theory GPA                                                  r = .72</td>
<td></td>
</tr>
</tbody>
</table>

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Appendix B

ADN Research Studies
## ADN Research Studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>No. of Participants</th>
<th>Variables</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aldag</td>
<td>1983</td>
<td>787</td>
<td>ACT</td>
<td>$r = 0.27$</td>
</tr>
<tr>
<td>Alexander</td>
<td>1997</td>
<td>188, 94 pass</td>
<td>SAT verbal</td>
<td>$t = 3.33$</td>
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<tr>
<td></td>
<td></td>
<td>94 fail</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anderson</td>
<td>1993</td>
<td>156</td>
<td>HS GPA, NLN Competency</td>
<td>$r = 0.10, 0.44$</td>
</tr>
<tr>
<td>Barkly</td>
<td>1998</td>
<td>81</td>
<td>NLN Assessment tests, Nsg. Courses</td>
<td>$r = 0.42-0.58, 0.37-0.58$</td>
</tr>
<tr>
<td>Briscoe</td>
<td>1999</td>
<td>38</td>
<td>NLN Achievement Tests, Age</td>
<td>$r = 0.32-0.46, 0.37$</td>
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<tr>
<td>Drake</td>
<td>1995</td>
<td>350</td>
<td>Nsg. GPA, 4 science GPA, Pre nsg. GPA</td>
<td>$r = 0.35, 0.22-0.29, 0.196$</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Nsg. Theory courses</td>
<td>$r = 0.07-0.35$</td>
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<tr>
<td>Lengacher</td>
<td>1990</td>
<td>146</td>
<td>Nsg. GPA</td>
<td>$r = 0.68, 0.47$</td>
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<tr>
<td>Woodham</td>
<td>1986</td>
<td>107</td>
<td>Nsg. Theory Courses, SAT verbal</td>
<td>$r = 0.51-0.66, 0.62$</td>
</tr>
</tbody>
</table>

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Appendix C

Data Coding Form
<table>
<thead>
<tr>
<th>STUDENT: Pass/fail</th>
<th>A&amp;P I</th>
<th>A&amp;P II</th>
<th>MICRO</th>
<th>CHEM</th>
<th>CUM GPA</th>
<th>FND GPA</th>
<th>MSIGPA</th>
<th>DTGPA</th>
<th>Gender</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass/fail: 1 = pass, 2 = fail</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A&amp;P I: A = 4, B = 3, C = 2, D = 1, F = 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>A&amp;P II: A = 4, B = 3, C = 2, D = 1, F = 0</td>
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<tr>
<td>MICRO: A = 4, B = 3, C = 2, D = 1, F = 0</td>
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<td>CHEM: A = 4, B = 3, C = 2, D = 1, F = 0</td>
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<td></td>
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</tr>
<tr>
<td>CUM GPA: Cumulative GPA all pre-requisite courses as %</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FND GPA: Foundations of Nursing Theory grade as %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MSIGPA: Medical Surgical Theory I course grade as %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DTGPA: Drug Therapy Theory course grade as %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gender: 1 = female, 2 = male</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix D

Human Subjects Institutional Review
Board Approval Letter
Date: March 1, 2002

To: Charles Warfield, Principal Investigator
   Patricia Collins, Student Investigator for dissertation

From: Mary Lagerwey, Chair

Re: HSIRB Project Number 02-02-14

This letter will serve as confirmation that your research project entitled “Predicting a Passing Outcome on the National Council Licensure Examination for Registered Nurses by Associate Degree Graduated” has been approved under the exempt category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may only conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: March 1, 2003
Appendix E

Letter of Approval for Study From West Shore Community College Registrar's Office
September 6, 2001

Patricia Collins  
P.O. Box 445  
Pentwater, MI  49449

Dear Patricia:

Dr. Pollock forwarded your request for access to student academic records to me. This is to inform you that your request for access to course grades and GPA’s of first level nursing students for the purpose of research pertinent to your dissertation is granted.

Per your letter, students’ rights and privacy will be protected in the data collection and reporting process. We would be very interested in the results of your research project and, if we can offer further assistance, please let me know.

Sincerely,

Victoria Oddo  
Registrar

ih
BIBLIOGRAPHY


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West Shore Community College Catalog. (2000-2001). West Shore Community College, Scottville, MI.


