

AN ANALYSIS OF THE RELATIONSHIP BETWEEN NLN PRE-ADMISSION SCORES,  
AGE AND STUDENT SUCCESS IN TWO NURSING PROGRAMS  
AT CHIPPEWA VALLEY TECHNICAL COLLEGE

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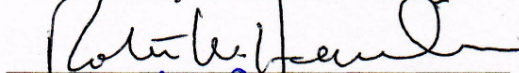
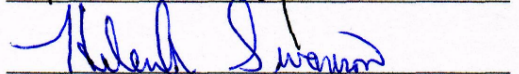
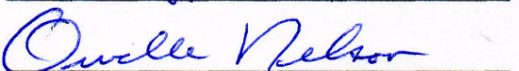
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ABSTRACT

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The current shortage of nurses, along with a need to decrease attrition rates is requiring that schools of nursing examine their admission policies. The purpose of this study was to explore the relationship between scores obtained by students on the National League for Nursing Pre-Admission Examination for Registered Nurses (NLN PAX-RN) and their level of success in an Associate Degree or Practical Nursing Programs. Correlation studies of students' scores on the four areas of the PAX-RN and course grades attained in several required nursing and science courses that most strongly reveal differences in student performance were done. Multiple regression studies further explored which combinations of factors analyzed were the best predictors of student success in their Anatomy and Physiology (A&P) course. Additionally, student success, as further defined by completion of the Associate Degree Nursing Program and

completion of the Practical Nursing Program was compared with scores attained on the PAX-RN.

The results of this study supported use of the PAX-RN as a valid and reliable predictor of student success. The Composite and Verbal components of the examination were strongly correlated to student success in selected nursing and science courses. Age was also examined as a variable associated with student success. In this study, older students tended to score higher on the PAX-RN and to have higher course grades in all of the selected courses.

As a result of this study, the college's nursing department will use the information gathered to modify their admission policies. The information can also be used to improve advisement and counseling of students, and to implement measures to further support students within the program.

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## TABLE OF CONTENTS

List of Tables.....	vi
Chapter One Introduction.....	1
Statement of Problem.....	5
Research Purpose.....	6
Research Questions.....	6
Significance of Study.....	7
Assumptions and Limitations.....	8
Definitions of Terms.....	9
Methodology.....	10
Chapter Two Review of Literature.....	11
Overview of the Health Care Crisis.....	11
Impact of Crisis on Schools of Nursing.....	12
Demographic Variables.....	13
Admission Criteria and Success.....	18
Admission Criteria and NCLEX.....	25
Summary.....	26
Chapter Three Methodology.....	28
Subject Selection and Description.....	28
Research Method.....	29
Data Collection.....	29
Instrumentation.....	30
Data Processing and Analysis.....	31
Limitations.....	32
Summary.....	32
Chapter Four Results.....	34
PAX-RN and Program Completion.....	35
PAX-RN and A&P.....	42
PAX-RN and Introduction to Nursing.....	44
PAX-RN and Pharmacology.....	45
PAX-RN and Pathophysiology.....	46
PAX-RN, Course Grades and Age.....	47
Chapter Five Discussion, Conclusions, Recommendations.....	49
Findings.....	49
Discussion of Findings.....	50
Conclusions.....	56
Limitations.....	57
Recommendations.....	58
Impact for Chippewa Valley Technical College.....	59
Further Research.....	65
Summary.....	66
References.....	69
Appendix A Tables of Further Statistical Analysis.....	75

## LIST OF TABLES

Table 1	Nursing Program Retention Rates.....	4
Table 2	Comparison of Nursing Graduates and Non-Completers.....	37
Table 3	Equality of Means for Associate Degree and Practical Nursing Students..	38
Table 4	Range of PAX-RN Test Scores.....	39
Table 5	Graduates Scoring < 50 <sup>th</sup> Percentile.....	40
Table 6	Correlations Between Nursing and A&P Courses.....	41
Table 7	T-Test for Equality of Means- Course Grades.....	41
Table 8	Multiple Regression Analysis: Age, PAX-RN and A&P.....	43
Table 9	ANOVA for PAX-RN Scores and Age as Predictors for A&P.....	44
Table 10	A Comparison of Ages, PAX-RN and Grades.....	48
Table 11	PAX-RN, Nursing Courses and Age.....	76
Table 12	Significant Correlations: PAX-RN and Courses.....	77
Table 13	Analysis of NLN PAX-RN Scores: T-test.....	78
Table 14	Comparisons of Various Coefficients.....	78
Table 15	Composite Scores < 50 <sup>th</sup> Percentile.....	79
Table 16	Composite Scores < 35 <sup>th</sup> Percentile.....	80
Table 17	NLN Percentile Scores.....	81
Table 18	Independent Samples Tests on Means.....	82
Table 19	Regression Analysis in the Prediction of A&P Course Grades.....	83

## CHAPTER I

### Introduction

The health care industry is at a critical point. An aging health care workforce, coupled with the expanding baby boomer population, increased career options for women, and a growing dissatisfaction among health care workers have contributed to a shortage of trained employees in the health care industry (Mee & Robinson, 2003; O'Neil & Seago, 2002; Berliner & Ginzberg, 2002).

The shortage of health care workers has caused schools of nursing to question their admission and acceptance policies (Fischer, 2003b; Williams, 2002; Bissett, 1995). Although some schools of nursing are experiencing a reduction in students seeking admission, other schools are faced with the daunting task of dealing with a growing number of students desiring entry into their programs (Woodards, 2003; Willaims, 2002; Swain, 1999). Many of these students have been identified as being ill prepared for college and for the demands of nursing, a profession that requires that graduates use knowledge acquired from various science, sociology, psychology, and nursing classes to make important decisions about increasingly more critical and complex patient care situations (Lewis & Lewis, 2000; McClelland, Yang, & Glick, 1992; Allen, Higgs, & Holloway, 1988). When students are unprepared for the rigors of a nursing program, academic failure can occur. These student setbacks can be expensive financially for the student and the college, and can lead to difficulty with student reentry back into the curriculum (Byrd, Garza & Nieswiadomy, 1999). These setbacks are very ego deflating for students and distressing for nursing faculty working with the students (Fischer, 2003a & b; Lengacher & Keller, 1990). Gallagher, Bomba, and Crane (2001) concluded, "The

growing shortage of nurses compels schools of nursing to admit students who are most likely to graduate and subsequently pass NCLEX-RN” (p. 135).

As a result of long waiting lists at some schools, many well-qualified students are unable to get into a nursing program, or to become nurses who would ease the health care worker shortage. The high cost of nursing education, along with limited funding for these programs, a growing number of under-prepared students, and restrictions on availability of clinical sites and nursing instructors, have forced many programs to resist the temptation to expand. Despite the need to keep enrollments high to ensure an increased number of nursing graduates, schools are also burdened with attrition rates that can be higher than 40% in some schools of nursing (Community College Week, 2000). With growing waiting lists and the need to prepare students who will both graduate and pass the licensure examination upon completion of their program, schools of nursing have been examining their admission requirements and exploring ways to increase the level of success for those students who are admitted (Ostryre, 2001). A variety of methods are currently being used to determine eligibility for admission at schools of nursing around the country. These methods include standardized tests, interviews, evaluation of a student’s high school or pre-program grade point average, and a determination of the student’s ability based on achievement in science courses.

The Nursing Program at Chippewa Valley Technical College (CVTC) offers practical nursing and associate degree nursing programs. The National League for Nursing-Accreditation Commission (NLN-AC) has accredited both programs. The associate degree program has grown from admitting 40 associate degree nursing (ADN) students twice a year prior to fall, 2002 at the Eau Claire, Wisconsin campus to the



current level of admitting 56 students twice a year to the campus in Eau Claire, and an additional 16 students annually at the River Falls, Wisconsin campus. The college also admits a number of licensed practical nurses (LPN's) who are returning to school to obtain their associate's degree in nursing. These students may or may not be graduates of CVTC's practical nursing program. Currently, these students do not take the PAX-RN examination prior to enrollment into the second year of the Associate Degree Nursing Program.

The college also admits twenty-four practical nursing students twice a year in Eau Claire and twenty-four annually in River Falls. These students are not required to take the PAX-RN examination for admission, although many graduates of the practical nursing program have taken the test in anticipation of admission to the associate degree-nursing program. Additionally, a number of students who were initially admitted to the associate degree-nursing program elect to switch to the practical nursing program for varying reasons, including lack of success in the two-year program.

Programmatic growth has occurred in response to local and state pressures to increase admissions in an attempt to produce more nursing graduates. Unfortunately, despite program growth and the establishment of a mentoring program for many of the new students admitted beginning in fall, 2002, attrition rates remain high for the ADN program, leading one to question whether locally, the trend towards under-prepared students is also being seen (See Table 1).

Table 1

## Nursing Program Retention Rates at Chippewa Valley Technical College

1998-1999	48%
1999-2000	49%
2000-2001	47%
2001-2002	58%

(CVTC NLNAC Self Study 2000; Program Data 2002)

Students admitted to the associate degree program for nursing at Chippewa Valley Technical College have taken the NLN Pre-Admission Examination for Registered Nurses (PAX-RN) since 1995. Students entering the program in advanced standing (LPN to ADN students) do not need to take this examination because it has been determined that these students have already demonstrated a certain level of academic achievement. Additionally, other students entering the associate degree program for nursing at CVTC may be waived from the admission-testing requirement if they have taken other comparable college admission tests, or if the student who presents has already attained a bachelor's degree in another field.

CVTC has established a standard of achievement on the PAX-RN at  $\geq$  the 50<sup>th</sup> percentile for each of the three subject areas (mathematics, science and reading) and for the composite score on the examination. As of fall 2003, any student who obtains a composite score less than the 35<sup>th</sup> percentile on the PAX-RN will be denied admission into the associate degree-nursing program. In addition, any student who does not attain a score  $\geq$  the 50<sup>th</sup> percentile in any of the four areas needs to meet with a program counselor to develop a remediation plan. All components of the remediation plan must be completed before the student is accepted into the associate degree-nursing program. The student can take these courses while enrolled as a pre-program student at the college. The

remedial course work is designed to increase the likelihood of student success in the program. Currently, students are not retested after remediation is completed to determine if the process has increased their likelihood of success. A number of the students tested to date with the PAX-RN have chosen to enter the practical nursing program at the college or have transferred into the practical nursing program after initial enrollment in the associate degree program.

Student retention rates at CVTC are lower than desired. The nursing program has identified a need to explore ways to increase student success. Despite use of the PAX-RN since 1995, to date, a comprehensive analysis to determine the relationship between students' success within the nursing program and PAX-RN scores has not formally been conducted. A preliminary analysis in Spring 2003 by Ellen Kirking for a subgroup of students who had taken the examination strongly suggested that students' success was linked to the scores they attained on the PAX-RN, and prompted the researcher's desire to analyze more extensively students' scores and level of success attained. Further evaluation is necessary to enable the nursing department to both increase student success and student retention.

#### Statement of the Problem

The current nursing shortage combined with budgetary constraints and ongoing concerns about retention of students requires that the nursing department at Chippewa Valley Technical College collect data concerning students' PAX-RN scores. The findings of this study will enable the department to objectively examine their admission policies and explore ways to better utilize the PAX-RN to decrease attrition and increase student success.

### Research Purpose

The purpose of this study is to validate the relationship between students' PAX-RN scores and their level of success in a nursing program. Although graduates of the CVTC associate degree-nursing program have a passing rate of approximately 87% and graduates of the practical nursing program had a 93% passing rate as first time test takers on the NCLEX examination, (NCSBN, 2003) retention of students remains less than desired for both programs. By collecting and comparing data from all students who have taken this examination from November 1995 through May 2002 with student outcomes, the nursing program will be able to both counsel prospective students on their likelihood of success, and to develop interventions intended to increase retention and graduation rates.

### Research Questions

There are seven research questions this study will attempt to answer. They are:

1. What is the relationship between students' scores on each of the four PAX-RN examinations (mathematics, science, reading and composite score) and completion of the associate degree- nursing program?
2. What is the relationship between students' scores on each of the four PAX-RN examinations and completion of the practical nursing program?
3. What is the relationship between students' scores on each of the four PAX-RN examinations and course grades obtained in Anatomy and Physiology I?
4. What is the relationship between students' scores on each of the four PAX-RN examinations and course grades obtained in Introduction to Nursing?

5. What is the relationship between students' scores on each of the four PAX-RN examinations and course grades obtained in Pharmacology?
6. What is the relationship between students' scores on each of the four PAX-RN examinations and course grades obtained in Pathophysiology?
7. Is there a difference between NLN PAX-RN test scores and grades obtained in selected nursing and science courses for older students and younger students?

### Significance of the Study

The results of this study will provide the nursing department with objective data that will be used to validate preliminary findings done in spring 2003 by this researcher that strongly suggested a relationship between students' scores on the NLN-RN pre-admission examination and students' level of success within the nursing program. The data obtained will be inclusive of students who have taken the examination from 1995 to May 2002. The data will focus on students who have completed A&P or their first semester nursing courses. The results of the study may assist the nursing faculty and counselors at CVTC to more effectively use these scores to counsel prospective students desiring admission into the nursing program. The results may also enable the program to develop intervention strategies targeted at identified student deficits to increase retention rates, thereby increasing student success throughout the program. Due to the current shortage of nurses and other health care workers, combined with the higher than desired attrition rates, an overwhelming number of students desiring program entry, and the financial cost of failure, the nursing department needs to collect data immediately that could lead to increased student success.

## Assumptions

The following assumptions have been identified with this study:

1. The data will be inclusive of all students who took the NLN-RN pre-admission examination from 1995 through May 2002.
2. Students included in the study will have completed at least their first semester of nursing classes at CVTC.
3. Grades recorded for students' science and selected nursing courses are an accurate representation of ability.
4. Students who leave or do not complete the program do so in poor academic standing.
5. Being accredited by the National League for Nursing - Accreditation Commission (NLNAC) will not influence the CVTC nursing program's evaluation of the NLN PAX-RN as a predictor of student success.

## Limitations

The following limitations have been identified with this study

1. Those CVTC nursing students who took alternative forms of pre-admission tests and advanced placement students will not be included in the data.
2. The study is primarily focused on the associate degree-nursing program at Chippewa Valley Technical College, although students who completed the practical nursing program will also be included.
3. A comparison will be done between NLN PAX-RN scores and only selected courses within the curriculum.

4. The variables to be analyzed are limited to scores obtained on students' PAX-RN test and letter grades in A&P I and selected nursing courses.
5. Any grade inflation that might have occurred in students' course grades will be unknown.
6. Students may have left the nursing program for reasons other than academic standing (morbidity).

### Definition of Terms

There will be five terms that will be defined for clarity of understanding. These terms are:

1. Associate degree-nursing students: Students enrolled in a two-year program of study leading to an associate degree in nursing. Graduates of this program qualify to take the National Council Licensure Examination (NCLEX-RN). Candidates who pass the NCLEX-RN earn the credentials to be registered nurses (CVTC Associate Degree Nursing Program Student Handbook, 2004).
2. NLN pre-admission examination- RN (PAX-RN): The National League for Nursing pre-admission examination is a standardized examination that tests prospective students' verbal, mathematics, and science abilities. The examination provides nurse educators with an appraisal of students' academic abilities (NLN, 2003c).
3. Older student: Students over the age of 30.
4. Practical nursing students: Students enrolled in a one-year program of study leading to a diploma in nursing. Graduates of this program qualify to take the National Council Licensure Examination (NCLEX-PN). Candidates who pass

the NCLEX-PN earn the credentials to be licensed practical nurses. (CVTC Practical Nursing Program Student Handbook, 2004).

5. Student success: Student success will be defined using a leveled approach.

The following criteria will apply:

- a. Successful completion of first semester class (Introduction to Nursing 510-110).
- b. Successful completion of second semester class (Pharmacology 510-130).
- c. Successful completion of third semester class (Pathophysiology 510-122).
- d. Completion of the associate degree-nursing program (successfully passing 510-171 Nursing Practice Internship).
- e. Completion of the practical nursing program (successfully passing 510-306 Clinical Concepts for the Practical Nurse).

### Methodology

An ex post facto study will be conducted using archival data that is available to the researcher in her role as program director. Data that will be collected will include students' scores on the PAX-RN examination beginning in 1995. Additionally, grades obtained in selected nursing courses and A&P will be collected. Comparisons between the students' PAX-RN scores and their course grades will be determined. Further comparisons between the selected science and nursing course grades will also be analyzed. Finally, the variable of age will be introduced to determine if a difference exists in level of performance for students both on the PAX-RN and in the selected nursing and science courses.



## CHAPTER II

### Review of Literature

#### Introduction

This chapter will include an overview of the current health care crisis, and a discussion of the effects of the crisis on schools of nursing. Various demographic variables that have been examined as predictors of success and admission criteria used by schools of nursing will be described, along with an in-depth presentation of the National League for Nursing pre-admission examination for registered nurses' (NLN PAX-RN) test. In addition, previous findings concerning the use of various admission criteria in determining students' level of success within nursing programs and success on the National Council Licensure Examination for Registered Nurses (NCLEX-RN) and National Council Licensure Examination for Practical Nurses (NCLEX-PN) will be addressed.

#### Overview of the Health Care Crisis

A shortage of workers is creating new demands on the health care industry. With estimated shortages of registered nurses (RN's) projected to be affecting as many as 44 states including Wisconsin by 2020 (HRSA, 2002), health care agencies and schools of nursing are examining what they can do to minimize the severity of the problem.

An aging workforce, declining enrollments at many nursing programs prior to 2002, and dissatisfaction on the job have contributed to the nursing shortage. The average age of practicing RN's is 45.2 years (Berlinger & Ginzberg, 2002), and more than 27,000 fewer students took the NCLEX-RN examination in 2001 than in 1995 (AACN, 2003)

The national sample survey of registered nurses is conducted every four years to determine the current supply and projected demand for registered nurses in the United States. The study, last conducted in 2000, found the demand for registered nurses has risen dramatically. In addition, the current and future supply of RN's is projected to be inadequate to meet the needs of an aging population, with some states anticipating as many as 14% fewer RN's than needed by 2010 (HRSA, 2002).

### Impact of the Health Care Crisis on Schools of Nursing

In response to the shortage of health care workers, schools of nursing across the country have been challenged to admit and to graduate more nursing students. Many colleges and universities have seen a growing number of students who are seeking admission into their nursing programs. At least 2.9% of all college bound students expressed an interest in nursing, making it one of the more popular fields of study (Auerbach & Buerhaus, 2000). In Wisconsin, however, as in other states, students often find themselves on a waiting list to get into a nursing program along with 300-500 other students, and may have to wait for three years or longer before they are able to secure admission into one of these nursing programs (Williams, 2002).

Associate degree nursing programs traditionally offer students the ability to complete their nursing degree in two or three years, or a year or two quicker than attending a baccalaureate program. Practical nursing programs allow students to complete their programs of study in less than two years. The number of associate degree nursing programs has risen dramatically in the last forty years, from 57 programs in 1960 to 876 programs in 1997 (Auerbach & Buerhaus, 2000). A majority of these programs are located in community and technical colleges.

With growing waiting lists and limited resources, many community college schools of nursing across the country have been forced to re-evaluate their “open door” policy, a concept initiated in the 1960’s in response to the GI Bill and massive numbers of “baby boomers” entering higher education (Bissett, 1995). Theoretically, the open door policy allows all students to have open access to enter any educational program offered at the college with students admitted on a first-come, first-served basis.

The dilemma occurs, however, because students are often ill prepared for the academic rigors of a nursing program (Fischer, 2003a; Lewis & Lewis, 2000). With dwindling financial support and attrition rates climbing, colleges are questioning if prospective students should have access to rigorous programs for which they may not be well suited. In addition, despite pressures to expand, schools of nursing are mandated by regulatory agencies to maintain low faculty-to-student ratios during clinical experiences and to hire nurses for instruction who are credentialed minimally at the master’s degree level. Schools of nursing must also ensure that their graduates are prepared to pass the national licensure examination and be able to work as “safe, competent practitioner(s)” (Allen, Higgs, & Holloway, 1988, p. 113).

#### Comparison of Various Demographic Variables as Predictors of Success Within a Nursing Program and on the Licensure Examination

A variety of demographic variables have been examined as possible determiners of student success in the nursing program. Age has been cited in many studies with varying degrees of correlation seen. Lengacher and Keller (1990) found a subject’s age upon admission into the nursing program was not predictive of the graduate’s success on the Nation Council Licensure Examination for Registered Nurses (NCLEX-RN). Other

studies also reported similar conclusions (Jenks, Selekman, Bross & Paquet, 1989; Allen, Higgs & Holloway, 1992).

In a comprehensive ten-year review of predictors of retention, graduation and success on the licensure examination, Campbell and Dickson (1996) identified that age was found to be the most significant demographic predictor of student success with older students more likely to demonstrate success than younger students. These authors also found that financial status and parental educational level were more closely correlated with success on the licensure examination than any other demographic variables, and that self-esteem and level of test anxiety also correlated with success in these baccalaureate nursing students.

Age was also examined as a predictor of students' success in a nursing program, graduates' success on the state board examination, and as it related to ACT test scores for students admitted to an associate degree nursing program over a ten year period of time (Aldag & Rose, 1983). These researchers found, while a larger percentage of younger students were admitted into the program, a higher percentage of those in the older age group (30-39) actually graduated and did better on the state board examination. They also found a negative correlation between students' ages and ACT scores with bias seen against the older, nontraditional student. The authors did not identify any possible explanation to support their findings.

In a contrasting study, Byrd, Garza and Nieswiadomy (1999) found that younger students had a higher level of success than older students enrolled in a baccalaureate-nursing program. The researchers also identified that white ethnicity was highly predictive of students' graduation, but they acknowledged that a higher percentage of

white applicants had been admitted to this nursing program than other ethnic groups due to their high pre-admission GPA.

In another study prompted by concerns related to a decline in academic qualification for students entering a baccalaureate-nursing program, researchers examined the impact of forty academic and non-academic variables as predictors of success in a nursing program (Allen, Higgs & Holloway, 1988). In this study, the researchers defined success by grade point average (GPA), program completion and number of D and F grades the student received. They concluded age, sex and marital status were not correlated with program success. These researchers ironically found lower GPA's in students who reported having previous health care experience outside of nursing. They found that previous grades were strong predictors of student success in the program. These researchers also found that students who earned course grades of D's, F's, or withdrew from their pre-nursing courses frequently did not complete the nursing program once they were admitted.

Patton and Goldenberg (1999) examined the relationship between a variety of demographic variables such as age, gender, previous educational level attained, and number of dependents with baccalaureate-nursing students' levels of anxiety, psychological hardiness and academic success. They found only a weak correlation between a student's age and hardiness scores, with students over age 30 demonstrating a higher score on the commitment scale. The researchers concluded that older students' age and experience could make them more committed than younger students to accomplish their educational goals.

In a study specifically focused on practical nursing graduates' level of success on the Nation Council Licensure Examination for Practical Nurses (NCLEX-PN), a variety of demographic variables were analyzed (Ostrye, 2001). The researcher identified that the profile of the successful practical nursing student was older (over age 30), represented a lower socioeconomic level, and was female and Caucasian. The mean age for students who failed the NCLEX-PN was also higher (30.77) than for students who passed the examination (29.98). Additionally, they found married students were more likely to pass the examination than single or divorced students, and minority students had a significantly lower pass rate than Caucasians.

In a second study which examined academic, demographic and aptitude-related variables that were potential predictors of graduates' performance on the NCLEX-PN, no relationship was found between the demographic variables of socioeconomic status, age and sex (Lamm & McDaniel, 2000). These researchers found college GPA was the best predictor of success on the NCLEX-PN, and the PSB Aptitude for Practical Nursing Examination, a standardized preadmission test was determined to have a high degree of validity as a screening tool for admission into practical nursing school.

O'Connor and Bevil (1996) compared baccalaureate students' level of perceived stress in relation to a variety of demographic variables, and to level of academic performance for students enrolled in a day program and students enrolled in an evening nursing program. These researchers found younger students enrolled in the day program displayed more anxiety than older students, those with more dependents had lower levels of anxiety, and there was no identified relationship between number of hours employed for those attending school during the day and level of stress. Age was not correlated with

level of anxiety for students enrolled in the evening program; however, these students reported higher levels of anxiety when there was a reduction in their work hours.

Jeffreys (1998) examined the impact of a number of academic and nonacademic variables on student success and program retention for nontraditional students enrolled in an associate degree-nursing program. In this study, family responsibilities and family crisis were identified as significant influences on student success within the nursing program. Oliver (1985) also examined a number of demographic variables as they related to academic success for students enrolled in an associate degree-nursing program. These variables included age, marital status, sex, race, employment status, previous college coursework, and licensure as an LPN. She found age and previous college attendance were significantly correlated with students' first quarter grade point average at the .05 level. She concluded that the successful student was older, enrolled in school on a part-time basis, and had previously attended college.

Endres (1997) also examined the level of success attained on the NCLEX-RN by African-American, foreign-born and white baccalaureate nursing graduates. The author concluded that one's ethnicity was not related to passing the licensure examination, but those students who had gotten more D's and F's in their program of study were more likely to fail the examination. She further identified that African-American graduates who passed the examination often were enrolled in school for a significantly longer period of time than foreign born or white graduates who also passed the examination. Age and previous licensure as a practical or vocational nurse were not found to be significant variables in this study.

Endres (1997) did identify limitations to this study included only a small number of foreign-born and African-American graduates. She also cautioned against making admission decisions based largely on ethnicity. She encouraged faculty to examine reasons why students receive failing grades, and to more actively work to identify students who are potentially at risk for failing the NCLEX-RN.

#### Admission Criteria as Predictors of Success in a Nursing Program

Although many community colleges continue to maintain their “open door” policies, other schools have minimal to very selective admission processes in place. Bissett (1995) identified that selective admission policies allowed better-prepared students to enroll in nursing, thereby increasing student retention, and inevitably putting more nurses into practice. Campbell and Dickson (1996) identified that it is critical for schools of nursing to decrease their attrition rates and work to promote student success. In California, schools have been encouraged to address the problem of high attrition rates. The California Post-Secondary Education Commission recommended that schools both standardize admission procedures and set aside some spaces for those students who demonstrate the highest degree of academic potential (Fischer, 2003a). Despite these opinions, the use of admission testing at community colleges remains a controversial topic (Linn, 1990), and the question remains whether schools can determine those students who are most likely to be successful in the program.

Schools of nursing across the country currently employ a variety of admission practices. A majority of the studies found in the literature that address the ability of these practices to predict academic success focus on baccalaureate students (Byrd, Garza, & Niews, 1999; Allen, Higgs, & Holloway, 1988). In this difficult economic and political



time, baccalaureate, associate degree and practical nursing schools must actively begin to engage in research for the purpose of collecting data both to support and validate their admission practices and to increase student success for those students who are admitted (Bissett, 1995; Griffiths, Bevil, O'Connor, & Wieland, 1995).

Prospective students' grade point average (GPA) is one variable that many nursing programs consider when evaluating students' potential success within a nursing program. Drake and Michael (1995) concluded that GPA acquired by students in a variety of nursing courses at a two year associate degree nursing program was the strongest predictor of NCLEX success, but they did question the validity of the methodology they had chosen. These authors further concluded that high school or pre-nursing achievement were not predictors of success on the licensure examination. Campbell and Dickson (1996) studied many variables, including GPA, as a determination of success. They found that students' grades in science courses were strongly predictive of overall student success in a nursing program. They identified that students who performed poorly in nursing courses typically had also struggled in their science courses, too.

Griffiths, Bevil, O'Connor, and Wieland (1995) found students' A&P science course grades were highly suggestive of future success in a study done at one baccalaureate-nursing program. The researchers concluded that the grade obtained by students in A&P could serve as the basis to counsel students about their potential for success in a nursing program. In a study of factors contributing to student attrition, Potolsky, Cohen and Saylor (2003) found previous performance in science courses had a statistically significant relationship with students' academic performance in nursing. In

this study of baccalaureate students, the researchers suggested that schools of nursing should consider establishing a grade of B in science courses as a prerequisite for entry into the nursing program. They further posed that students who had failed and then successfully repeated one of their science courses not be allowed into the school of nursing.

Lewis and Lewis (2000) found that baccalaureate students who had taken more A&P credits had a somewhat higher level of academic success in a nursing program than students who had not fulfilled their A&P course requirements prior to beginning their nursing classes. Both of these studies also found baccalaureate-nursing students were more successful in their programs of study if they had taken their A&P courses at a four-year institution.

Some schools of nursing conducted interviews as part of their admission process (Land, 1994). The interview process was viewed as a means to match the student with the right program, just as an employer would be matching the new employee with the right job for optimum success. Through interviews, educators assessed variables such as level of interest and motivation. These variables were not otherwise typically considered with the more traditional admission processes such as use of standardized tests. Land (1994) noted the need for examiner objectivity when using interviews, while essential, can be difficult to sustain.

Many schools used pre-admission diagnostic examinations. These examinations were described as a way for schools to assess students' potential for success within their nursing programs (NLN, 2003b). For the student, these examinations allowed the individual to see where his/her strengths and weaknesses lie (NLN, 2003b; Franklin &

Tolbert, 1995). An area of concern with standardized tests was that institutions or programs might place too much emphasis on these tests in making decisions about admissions (Linn, 1990). He further indicated, “Admissions tests have a useful degree of relationship with subsequent grades or other indicators of academic performance.... Nonetheless, the predictions are far from perfect...” (p. 303). The NLN (2003b) concurred and stated that the test was really the best estimate of a student’s ability and potential.

The SAT and ACT examinations were the most frequently cited tests described in the literature as predictors of student success (retention, graduation, and NCLEX achievement). The ACT examination is comprised of four tests (English, mathematics, reading and scientific reasoning), and requires that the student use analysis, reasoning, and problem solving skills (ACT, 2003). Gabsch (2001) conducted a study that compared the ACT or Assessment of Student Skills for Entry Test (ASSET) and various grades attained by students in science and general education coursework with students’ abilities to successfully complete an associate degree-nursing program. The author found graduates who tended to obtain more A’s in their science and general education courses and showed somewhat higher scores on the standardized tests than students who did not graduate; however, she noted the scores were not significantly different between the two groups.

In another study addressing baccalaureate-nursing students, researchers found the SAT scores for graduates who failed the NCLEX-RN were significantly lower than those who passed this examination (Alexander and Brophy, 1997). Demographic variables such

as age and years of high school chemistry were not found to be statistically significant in this study.

The Entrance Examination for Schools of Nursing (RNEE) was another tool that has been used by colleges for over 50 years to examine prospective students' levels of readiness for the academic rigor of a nursing program. The tool measures students' performance and abilities in five areas (verbal, numerical, life science, physical science, and reading comprehension). Users of the RNEE are encouraged to develop their own "cut scores" based on the scores of students at their college and the resultant success of these students in their nursing program (Gallagher, Bomba, & Crane, 2001).

Gallagher, Bomba and Crane (2001) conducted a study to examine the relationship between the RNEE and the Nurse Entrance Test (NET), another diagnostic tool used by some schools of nursing to screen applicants desiring admission into their nursing program. The researchers found the RNEE was a good predictor of success in a beginning level nursing class and that success in this course strongly correlated with overall success in the program and on the NCLEX-RN. They found that the sub-score for reading comprehension was the best predictor of student success in the program. This researcher also found the RNEE test was a better predictor of student success than the NET.

The National League for Nursing (NLN) Pre-Admission Examination for Registered Nurses (PAX-RN) was another tool that has been used by schools across the country. This standardized multiple-choice examination was developed to enable schools of nursing to have greater success in assessing, counseling, and placing students desiring admission into their programs. Students' verbal, mathematics, and science abilities are

evaluated with this tool. Each of these scores is reported, along with the composite score that the student attained. The composite score is a weighted combination of the other three areas on the test (NLN, 2003b).

The NLN pre-admission tests are sold as “reliable and valid predictors of student success in nursing programs” (NLN, 2003c, p. 2). In using the test, each school of nursing must determine the desired level of success that students are expected to achieve to gain admission into the nursing program. According to Arthur Ellen, Psychometrician for the National League for Nursing (NLN) (telephone conversation June 13, 2003), schools of nursing need to establish their own “cut scores.” He indicated typical cut scores are verbal 36, math 21, and science 30-31, while a typical composite score is the 35<sup>th</sup> percentile or a score of 90. He further indicated a composite score of 100 equated to roughly the 50<sup>th</sup> percentile. In a recent NLN newsletter, Ellen indicated that the typical score used by schools to determine admission was a composite score of 100 (Corcoran, 2003), and that while schools should not rely solely on one score when making admission decisions, this score tended to be a reliable indicator of students’ future success. He also stated that the composite score was the most reliable score, and that no set of national data could replace extensive local experience with the test (Arthur Ellen, telephone conversation, June 13, 2003).

Students can obtain composite scores of 0-200. The four scores are also reported as percentile norms. The percentile scores are viewed as the more significant of the two reported scores, and these scores can range from 0-99 (NLN, 2003b).

The National League for Nurse’s Assessment and Evaluation Unit conducted a validation study on the PAX-RN in 1984-85 (Breyer, n.d.). Sixty-eight RN programs

were included in the study. Three of the 68 programs reported using the scores from the PAX-RN for advisement purposes while ten used the results of the test to determine student admission. About one-third of the respondents had established “cut scores” for the three content areas. Those scores ranged from the 20<sup>th</sup> to the 70<sup>th</sup> percentile, with the 50<sup>th</sup> percentile most frequently cited. Sixty-three percent of schools that participated in the study indicated “cut scores” for the composite, with ranges from the 18<sup>th</sup> to the 50<sup>th</sup> percentile. The 50<sup>th</sup> and 40<sup>th</sup> percentiles for the composite score were cited as being used most frequently by schools. In this study, the researcher found that for associate degree nursing (ADN) programs, higher scores in the verbal, science, and composite areas increased the likelihood that the student would obtain a grade point average (GPA) of C+ or higher. For ADN programs, the composite score had a higher correlation with students’ total GPA after one year in the program. Breyer indicated this “was expected since the reliability of the composite score... is greater than that of any of the individual tests (p. 8).

In contrast, verbal and science scores were more closely correlated with first year GPA for students in baccalaureate programs. Breyer (n.d.) concluded that the composite score should be considered the best predictor of student success and should be used by schools of nursing if the college uses a selective admission process.

Unfortunately, few studies exist in the literature that describes the ability of the PAX-RN to predict academic success. Campbell and Dickson (1996) did describe the results of one study in which they found that the PAX-RN was seen as a significant predictor of graduate success on the NCLEX examination, but the authors noted that their findings were limited by the fact that they uncovered only one study that focused on the

PAX-RN in their 10 year review of the literature on pre-admission tests as predictors of student success.

#### Various Criteria as Predictors of Success on the Licensure Examination

While some nursing schools have defined success by graduation or by progress made through the nursing program, other schools defined success by achievement of the registered or practical nursing credentials (passing the NCLEX-RN or NCLEX-PN examination). McClelland, Yang, and Glick (1992) examined success on the NCLEX-RN with various factors including students' high school grade point average (GPA) and ACT scores for graduates from a baccalaureate nursing program. The scores attained on the test were strongly correlated with the likelihood of graduates passing the NCLEX-RN.

In a similar study comparing GPA and ACT scores for students at a large community college with their performance on the NCLEX-RN, students were required to obtain certain scores on the ACT mathematics and English portions of the test to be eligible for admission to the college (Lengacher & Keller, 1990). These researchers found students' ACT scores in English were strongly correlated with success on the NCLEX-RN. They also found the ACT composite score was a strong predictor of students' success on the licensure examination.

In another study, similar results were found. Fowles (1992) found the ACT composite score and grade attained in A&P I by students were predictors of success on the licensure examination. The author suggested that schools of nursing could use these variables to predict success on the NCLEX-RN. In the case of the ACT test, that likelihood could be predicted even before students were admitted to a nursing program.

Jenks, Selekman, Bross and Paquet (1989) stressed that early identification of academic difficulty would enable nursing faculty to institute intervention strategies to increase the likelihood of student success. These researchers stated that SAT scores and other pre-nursing variables were not valid predictors in their study of baccalaureate students' academic success and ability to pass the NCLEX-RN. In this study, students' success within the program was viewed as the best predictor of success on the NCLEX-RN.

### Summary

A few conclusions can be drawn from the review of the literature. These conclusions are:

- a. The current shortage of nurses requires that schools of nursing evaluate their admission criteria and implement measures to increase students' success within the nursing program and on the licensure examination. Early identification of at-risk students is critical.
- b. Faculty at schools of nursing need to gather data concerning their use of pre-admission testing to determine how the test results can be best used to assist students and their nursing programs.
- c. A variety of admission procedures are currently being done by nursing programs across the country with mixed success in predicting if students will complete a nursing program or pass the licensure examination.
- d. The NLN PAX-RN, despite limited studies focused on the relationship between the test and student success, appears to be valid and reliable.



- e. Students' grades attained in science courses tend to be an accurate predictor of future success in nursing programs.

## CHAPTER III

### Methodology and Procedure

#### Introduction

The purpose of this study was to determine the relationship between scores obtained by students on the National League for Nursing (NLN) pre-admission examination for registered nurses (PAX-RN) and their success within an associate degree or practical nursing program. A desire to increase student retention rates and increase student success was the driving force behind the study. This chapter will include a description of the subjects selected for this ex post facto study, along with the tools used for data collection, discussion of the methods of statistical analysis used, and an identification of limitations evident during this process.

#### Subject Selection and Description

The sample selected for this study was students who have taken the NLN PAX-RN test from August, 1995 through May, 2002 prior to their subsequent admission into a nursing program at Chippewa Valley Technical College. A number of other prospective students who have taken the PAX-RN, but who did not enroll in a nursing program at the college, or who had not completed their first semester of nursing or A&P courses were excluded from the sample. While a large number of the selected sample will have completed either the associate degree or practical nursing program at the college, some students in the sample group are also still in process, having completed at least their first semester nursing or A&P classes. Students who took the NLN PAX-RN test after May 2002 were excluded from the study because these prospective students had not entered

the nursing program yet and/or had not completed their first semester of science or nursing courses.

The demographics of the students included in the study, while varied, were not examined other than age at the time the PAX-RN was taken. A vast majority of the students were female and Caucasian. All students completed their program of study in a CVTC nursing program at the Eau Claire Wisconsin campus.

### Research Method

This ex post facto study was conducted to examine the relationship between AD-nursing students' PAX-RN scores and the course grades obtained in their A&P course (810-140) and a selected nursing course at each level of the students' program of study. The selected nursing courses were: first semester- Introduction to Nursing (510-110); second semester- Pharmacology (10-130); third semester- Pathophysiology (510-122), and fourth semester- Nursing Practice Internship (510-171). Additionally, because some students chose to exit out of the nursing program as practical nursing graduates, a relationship between their NLN PAX-RN scores and completion of Clinical Concepts for the Practical Nurse (510-306) was also conducted.

### Data Collection

Archival data used in this study was obtained from pre-existing records that are available to the researcher through the college's computer system known as Banner. Assistance from computer support personnel to obtain desired data (PAX-RN scores and course grades in A&P and selected nursing courses) was requested. Nursing instructors who worked with these students and who had course grades recorded were consulted for

additional assistance if any uncertainty about students' success within the program could not be ascertained through the computer-generated records.

### Instrumentation

The NLN PAX-RN is a standardized multiple-choice examination that is given to all nursing students seeking admission into the associate degree-nursing program at Chippewa Valley Technical College. Students who have previously obtained baccalaureate degrees, or who have passed another comparable pre-admission examination do not need to take the PAX-RN test prior to program admission. These students were not part of the sample group studied.

Validity and reliability studies conducted on the PAX-RN (Breyer, n.d.; Campbell, & Dickson, 1996) found the examination was a significantly strong predictor of an associate degree-nursing program graduate's success on the NCLEX-RN. The results of the PAX-RN are reported to colleges in both raw scores and percentile scores. The students' raw scores attained on each of three subject areas, along with the composite scores were used to determine the relationship between these scores and the students' grades attained in various nursing and A&P courses. The percentile scores were also used in determining some of the descriptive findings. The percentile scores are used by the college as the basis for acceptance into the nursing program and to counsel students on their need to complete remedial coursework prior to program admission.

Only the researcher had access to the names of students involved in the study. Students' confidentiality was preserved in reporting the research results.

## Data Processing and Analysis

Students' course grades for their nursing and A&P I courses were converted numerically using a 1-4 point scale (A=4; D/F= 1). The nursing department's grading policies require that all students' grades in nursing and supportive courses be at or above a C-. Although a number of students had repeated one or more courses in their programs of study, the analysis for this study was based only on grades obtained by students in their initial attempt at each of the selected courses.

The researcher utilized various statistical measurements available through the Statistical Package for the Social Sciences for Windows (SPSS) program to determine the relationship between a number of students' course grades and their PAX-RN scores. The mean and range of scores for each of the four areas on the PAX-RN was determined using percentile scores. These variables were determined for: (a) all students who took the PAX-RN test who had at least one recorded grade in A&P or one of the selected nursing courses; (b) all students who took the PAX-RN who completed the associate degree nursing program (those students who successfully completed Nursing Practice Internship- 510-171); and (c) all students who took the PAX-RN but completed the practical nursing program at the college (those students who successfully completed Clinical Concepts for the Practical Nurse 510-306 and Nursing Pharmacology 510-130).

Additional comparisons were conducted between students' four PAX-RN scores and students' scores obtained in A&P I, and selected nursing courses at each of the first three levels of the four semester program: Introduction to Nursing, Pharmacology, and Pathophysiology. Students' scores in these courses for those who took the PAX-RN and who completed the associate degree program were compared with those who completed

the practical nursing program after taking the examination. Finally, through multiple regression analysis, a comparison was made between students' ages at the time they took the PAX-RN and student success.

#### Limitations of the Methodology

The sample selected included only students who were admitted to the associate degree and practical nursing program after they had taken the NLN PAX-RN. Some of these students have chosen to exit the program. Any student who had completed at least A&P or the first semester of classes in the nursing program was included on at least one level of data analysis. Another identified limitation of this study was that any students who were exempt from taking the PAX-RN prior to admission into the nursing program were not included in the study. A final limitation to this study was that some students completed their A&P I course prior to enrolling at CVTC. Any grades that were accepted as transfer credits were not accessible in the computer database. As a result, any students who are missing any of the identified course grades were omitted in some aspects of the statistical analysis for this study.

#### Summary

The intent of this ex post facto correlation study was to determine whether a relationship exists between scores obtained by students on each of the four areas on the PAX-RN and student success within the nursing program. Students' grades obtained in A&P I and selected Nursing courses were compared with the students' PAX-RN scores. Utilization of pre-existing data that could be obtained from the college's computer bank allowed the researcher to gather a substantial amount of information. This data was

analyzed using a variety of statistical tests to determine whether a correlation existed between these variables. The students' ages at the time of the examination was further analyzed in conjunction with the other research findings using multiple regression studies. Results from the study will potentially be used to modify admissions' requirements for the associate degree-nursing program and to explore ways to assist future students who exhibit at-risk behaviors (based on grades obtained in courses at each level of the program) to succeed after they are admitted into the program.

## CHAPTER IV

### Results

#### Introduction

The purpose of this study was to determine if there was a relationship between scores obtained by students on the National League for Nursing (NLN) pre-admission examination for registered nurses (PAX-RN) and their success within an associate degree or practical nursing program. A desire to decrease attrition rates while increasing student success was the driving force behind the study.

This chapter will include a description of the subjects selected for this ex post facto correlation study. Seven research questions were posed prior to beginning the study. This chapter will describe the results for each of these questions.

This study examined the pre-admission test scores and selected science and nursing course grades for 247 associate degree nursing graduates and 65 practical nursing graduates who took the NLN PAX-RN at Chippewa Valley Technical College between 1995 and May 2002. An additional 564 students who completed at least their beginning level science or nursing courses were also included at some level of data analysis. Some of these students are currently enrolled in nursing at the college while 106 of the total studied have left the nursing program due to academic or nonacademic reasons.

A total of 418 students included in this study have completed either the associate degree or practical nursing program, or have left the program after beginning their first semester nursing courses. The 106 students who did not complete the program after beginning the course Introduction to Nursing (510-110) represent 25.4% of this total.



The 247 associate degree graduates represent 59.1% of the total, and the 65 practical nursing graduates represent 15.6% of this total.

Forty-three of the sixty-five practical nursing graduates initially started in the associate degree program, but later switched into the practical nursing program for varying reasons. The remaining 22 practical nursing graduates took the NLN PAX-RN test, but did not enroll in the associate degree program. Two of the 65 practical nursing graduates also went on to complete the associate degree program. In both programs, 92.3% of the graduates were female, while 7.7% of the graduates were male.

#### Relationship between PAX-RN and Completion of a Nursing Program

The first two questions posed for this study intended to examine the relationship between students' scores on the 4 areas of the PAX-RN and completion of either the associate degree or practical nursing program. These two questions will be examined together.

Prior to 2002, the PAX-RN scores were reported to the institution and to the student in the form of the percentile rank and raw score attained in each portion of the test. The ordinal data associated with percentile scores has the effect of exaggerating the apparent differences of those who score near the mean. Percentile ranks are not considered acceptable data for use in correlation and regression statistics. Therefore, any student data that was used after 2001 was converted to raw score form based on prior test data in which both the raw score and percentile rank were indicated.

Prior to fall 2003, the Nursing Department at Chippewa Valley Technical College had established a desired cut-score of the 50<sup>th</sup> percentile for each of the four areas of the PAX-RN. Any student who scored less than the 50<sup>th</sup> percentile was required

to complete various remedial courses prior to admission into the Associate Degree Nursing Program. These courses included Medical Terminology, Math for Medical Personnel, College Reading and College Success. Upon completion of these courses, the student was ensured admission.

As a result of an analysis done by this researcher in spring 2003 on a small number of NLN PAX-RN test scores, it was determined that students who had a composite score of less than the 35<sup>th</sup> percentile were not likely to complete the associate degree program. Based on this finding, in fall 2003, the Nursing Department implemented a policy that identified that any student who had a composite score of less than the 35<sup>th</sup> percentile would not be considered for admission to the associate degree program. Students would have the ability to re-test in one year in an attempt to obtain the required score for program admission. Additionally, any student who scored less than the 50<sup>th</sup> percentile on any of the four test areas would still be required to complete remedial course work prior to program admission.

An analysis of test scores in the current study revealed that only two graduates of the associate degree program (0.8%) and six practical nursing graduates (9.2%) had a composite score less than the 35<sup>th</sup> percentile. A total of twelve of the 106 students (11.3%) who did not complete the nursing program had a composite score less than the 35<sup>th</sup> percentile. An additional thirteen students (12.3%) of those who did not complete the nursing program had a composite score less than the 50<sup>th</sup> percentile (See Table 2).

Table 2

## Comparison of Nursing Graduates and Non-Completers

Group	Composite < 35 <sup>th</sup> percentile	% of Total N N=418	Composite < 50 <sup>th</sup> percentile	% of Total N N=418
Associate Degree Graduates	2/247 (0.08%)	2/418 (0.05%)	26/247 (10.5%)	26/418 (6.2%)
Practical Nursing Graduates	6/65 (9.2%)	6/418 (1.4%)	16/65 (24.6%)	16/418 (3.8%)
Non-Completers	12/106 (11.3%)	12/418 (2.9%)	25/106 (23.6%)	25/418 (6.0%)

Further analysis of the data indicated that an additional 24 associate degree graduates (9.7%) and an additional 10 practical nursing graduates (15.4%) had a composite score less than the 50<sup>th</sup> percentile, or the level that required students to complete the remedial coursework prior to program admission.

The verbal component of the PAX-RN proved to be difficult for a large number of graduates in both programs with 8.1% of those who completed the associate degree and 19.0% of the practical nursing graduates scoring less than the 35<sup>th</sup> percentile. Furthermore, 41.8% of the associate degree graduates and 84.1% of the practical nursing graduates scored less than the 50<sup>th</sup> percentile.

An examination of the other PAX-RN areas indicated that only 1.2% of the associate degree graduates and 4.8% of the practical nursing graduates had test scores less than the 35<sup>th</sup> percentile in mathematics. While only 4.9% of the associate degree students obtained a score less than the 50<sup>th</sup> percentile in mathematics, 23.8% of practical nursing graduates did not meet this mark. Finally, 4.5% of associate degree graduates and 15.9% of the practical nursing graduates scored less than the 35<sup>th</sup> percentile in science, and 14.3% of associate degree graduates and 42.9% of practical nursing graduates had scores on the science test that were less than the 50<sup>th</sup> percentile.

Several other findings from this study also suggested that there is a correlation between how well the students scored on the PAX-RN and their level of success in the associate degree program. The average test scores obtained by associate degree nursing graduates varied, but overall, the results showed that the associate degree graduates consistently scored higher than the practical nursing graduates. The associate degree graduates' average composite percentile score was 74.0 compared to 61.2 for the practical nursing graduates. The average percentile score for the associate degree graduates was 78.8 in mathematics compared to 67.8 for the practical nursing graduates. The associate degree graduates obtained an average percentile score of 59.9 for the verbal examination versus 48.8 for the practical nursing graduates. Finally, the associate degree graduates had an average percentile score of 73.5 for science while the practical nursing graduates score was 60.2.

Statistical analysis on the group means for the associate degree and practical nursing graduates revealed statistically significant differences for each of the four PAX-RN tests. The raw score for each of the four tests was used in the analysis (See Table 3).

Table 3

t-test for Equality of Means for Associate Degree and Practical Nursing Graduates

PAX-RN Test	t	Sig. (2 tailed)	Practical Nursing Mean	Associate Degree Mean
NLN Verbal	-4.876	.001	PN= 31.88	AD= 41.88
NLN Mathematics	-3.554	.001	PN= 21.61	AD= 24.25
NLN Science	-4.671	.001	PN= 32.93	AD= 37.99
NLN Composite	-5.646	.001	PN= 104.19	AD= 119.99

The negative values evident in the table illustrated that the test looked at how much lower the practical nursing graduates were than the associate degree-nursing graduates on each of the four areas of the PAX-RN.

When an examination of the range of scores obtained was done, some variation in results was also noted (See Table 4). The scores attained by the associate degree graduates indicated a narrower range in each of the four areas. Additionally, the associate degree graduates consistently demonstrated that their test scores did not extend to the low level seen by those who completed the practical nursing program.

Table 4

Range of PAX-RN Test Scores

	All Students	AD Graduates	PN Graduates
Verbal	0-99	18-99	0-88
Mathematics	0-99	35-99	15-97
Science	0-99	31-97	0-95
Composite	1-99	37-99	1-97

An examination of successful associate degree graduates revealed that 66.3% scored above the 49<sup>th</sup> percentile in the verbal test, 96.3% scored above the 49<sup>th</sup> percentile in mathematics, 90.2% scored above the 49<sup>th</sup> percentile in science, and 89.4% scored above the 50<sup>th</sup> percentile on the composite test. In contrast to these findings, only 34.9% of practical nursing graduates scored above the 49<sup>th</sup> percentile on the verbal examination, 73% scored above this mark in both the science and composite portions of the test, and 81% scored above the 49<sup>th</sup> percentile in the mathematics test.

Variation between the two programs' graduates was also seen when looking at the number of graduates who scored less than the 50<sup>th</sup> percentile on other areas of the PAX-RN (See Table 5). The practical nursing graduates consistently scored much lower on the

four areas of the PAX-RN. Additional breakdowns of scores obtained by the associate degree and practical nursing graduates are found in Table 17 in the appendix.

Table 5

Graduates Scoring < the 50<sup>th</sup> Percentile on an Area of the PAX-RN

	Associate Degree	Practical Nursing
< 50 <sup>th</sup> percentile on one area of the PAX-RN	37.2%	69.2%
< 50 <sup>th</sup> percentile on four areas of the PAX-RN	0.04%	9.2%
< 30 <sup>th</sup> percentile on one area of the PAX-RN	9.7%	23.1%
< 20 <sup>th</sup> percentile on one area of the PAX-RN	4.0%	15.4%

Additional Pearson R studies done on the data indicated that the Composite and Verbal raw scores were correlated for all students at .840, which was significant at the .001 level (See Table 12 in the appendix). This correlation indicates a very strong relationship between these two tests. These two tests were also the strongest predictor of success in the selected nursing and science courses that were examined. Some of the correlations related to the PAX-RN scores that were significant at the .001 level for all students included the Composite and Mathematics raw scores at .709 (N= 876), the Composite raw score and students' grades earned in A&P at .398 (N=817), the Composite score and grades obtained in Introduction to Nursing at .350 (N=543), and the Composite score and Pharmacology grade at .327 (N=449). The sample size for each of these areas was large, yet the correlation coefficients for all of these areas would have been significant at .001 level at df of  $\geq 90$ .

Course to course correlations for all students were also done with several correlations evident at the .001 level as indicated in Table 6.

Table 6

## Correlations Between Nursing and A&amp;P Courses

Course	Coefficient	N
A&P and Introduction to Nursing	.537	485
A&P and Pharmacology	.561	397
A&P and Pathophysiology	.558	330
Introduction to Nursing and Pharmacology	.525	444
Introduction to Nursing and Pathophysiology	.443	374
Pharmacology and Pathophysiology	.713	365

All students enrolled in the associate degree and practical nursing program completed A&P, Introduction to Nursing and Pharmacology, however, only those students desiring the associate degree were required to complete Pathophysiology. Some of the graduates of the practical nursing program took Pathophysiology. A large N was noted for each of the course correlations, thus minimizing the significance of each finding.

Table 7 represents the results of a t-test that was done to determine equality of means for the selected nursing and science courses. This test revealed that the practical nursing graduates scored lower in all of their nursing and science courses than the associate degree-nursing graduates. The negative values indicated how much lower the practical nursing graduates' grades were than the associate degree nursing graduates with the grades attained in Pathophysiology indicating the largest degree of difference.

Table 7

## t –test for Equality of Means

Course	t-test	Signif ( 2 tailed)	Associate Degree Mean	Practical Nursing Mean
Anatomy & Physiology	-3.683	.001	2.80	2.35
Introduction to Nursing	-4.667	.001	2.98	2.59
Pharmacology	-4.508	.001	2.75	2.25
Pathophysiology	-6.793	.001	2.47	1.56

Additional t-test findings differentiating associate degree and practical nursing students are included in Table 18 in the appendix. Further results concerning each of these courses will be discussed as they relate to the following research questions.

#### Relationship between PAX-RN Scores and Anatomy and Physiology Course Grades

The third research question asked if there was a relationship between students' scores on each of the four PAX-RN tests and the course grades they received in Anatomy and Physiology (A&P). Graduates of the associate degree program had an average score of 2.80 (B-) in A&P while practical nursing graduates' average score was 2.35 (C+). A grade of F was earned by 42.7% of all students who had a composite score that was less than the 35<sup>th</sup> percentile on the PAX-RN and who had enrolled in A&P. Only 6.1% of these students received a letter grade of A. None of the associate degree graduates whose composite score was less than the 35<sup>th</sup> percentile obtained a grade higher than C in A&P (see Table 16 in the appendix).

For all students who had a composite score of less than the 50<sup>th</sup> percentile, 35.5% of these students received an F while only 8.1% had earned an A in A&P. For associate degree graduates, 3.8% earned an A, but no F's were assigned. The practical nursing graduates did not earn any A's in A&P while 6.25% of these students had received an F in the course.

The correlation between the PAX-RN composite score and course grades obtained by students in A&P was .398, which was significant at the .001 level (See Table 12 in the appendix). A total of 817 students that were included in the study had taken A&P.

Multiple regression analysis was used to determine which combinations of predictor variables (test scores and age) best aid in the prediction of course grades. (See



Tables 13, 14 and 19 in the appendix). Stepwise regression was selected in SPSS for this analysis. It begins by first selecting the one variable that is most powerful in the prediction of the criterion variable (course grade). It proceeds by adding one at a time, a variable, which, in combination with the one or more variables in the previous model, might add the greatest contribution in prediction power that can result in a statistically significant improvement over the previous simpler model. This analysis stops at the point when no additional variable can add unique information that improves prediction at a statistically significant level.

Multiple regression analysis revealed that three of the PAX-RN scores (NLN-composite, NLN- verbal and NLN-mathematics), and age were all predictors of students' A&P grades (See Table 8). Interestingly, the NLN-science score failed to help boost the prediction of success in A&P.

Table 8

Multiple Regression Analysis: PAX-RN, Age and A&P

PAX-RN Score	t-test	Significance (2 tailed)
NLN Composite	5.981	.001
NLN Verbal	-2.631	.001
Age	7.808	.001
NLN Science	1.171	.242
NLN Mathematics	-2.202	.028

Older students with the same entrance scores as younger students tended to do somewhat better in Anatomy and Physiology (A&P). Additional correlations that were done on the selected courses also revealed older students consistently demonstrated attainment of higher grades in their coursework.

The NLN Composite score was identified as the best single predictor of success in A&P, followed by the Composite and Age (See Table 9). The Composite, Age and Verbal Scores were next, followed by these three variables and mathematics.

Table 9

Analysis of Variance (ANOVA) for PAX-RN Scores and Age as Predictors for A&P

Model	Source of Variation	Sum of Squares	Df	Mean Square	F	Sig
Composite	Regression	134.037	1	134.037	153.687	.000
	Residual	710.793	815	.872		
	Total	844.830	816			
Composite and Age	Regression	181.496	2	90.748	111.360	.000
	Residual	663.334	814	.815		
	Total	844.830	816			
Composite, Age and Verbal	Regression	184.693	3	61.564	75.820	.000
	Residual	660.137	813	.812		
	Total	844.830	816			
Composite, Age, Verbal and Math	Regression	189.460	4	47.365	58.685	.000
	Residual	655.370	812	.807		
	Total	844.830	816			

1= Composite; 2= Composite and Age; 3= Composite, Age and Verbal; 4= Composite, Verbal, Age and Math

#### Relationship between PAX-RN Scores and Introduction to Nursing Course Grades

The fourth research question asked if there was a relationship between students' scores on each of the four PAX-RN tests and the course grades they received in the course Introduction to Nursing. Introduction to Nursing is a beginning level nursing course that students take during the first year of the associate degree and practical nursing programs.

Graduates of the associate degree program had an average score of 2.98 (B) in Introduction to Nursing, while practical nursing graduates had an average score of 2.59 (B-/C+) in this course. For graduates whose composite score was less than the 50<sup>th</sup> percentile, 3.9% of associate degree completers compared to 6.25% of practical nursing

graduates received a grade of A, while 7.7% of associate degree graduates and no practical nursing graduates received a grade of F in Introduction to Nursing. When examining all students who scored less than the 50<sup>th</sup> percentile, 19.4% received an F and only 3.2% of students earned a course grade of A (see Table 15 in the appendix).

In contrast to these findings, for those with a composite score less than the 35<sup>th</sup> percentile, all associate degree graduates received grades higher than C+, while all but one practical nursing graduate received C's in the course. For all students who scored less than the 35<sup>th</sup> percentile on the composite test, 31.3% had earned a grade of an F (see Table 16 in the appendix).

The correlation between the PAX-RN composite raw score and grades obtained in Introduction to Nursing was a coefficient of .350 for all students, which was significant at the .001 level. A total of 543 students had enrolled in Introduction to Nursing.

#### Relationship between PAX-RN Scores and Pharmacology Course Grades

The fifth research question asked if there was a relationship between students' scores on each of the four PAX-RN tests and the course grades they received in Pharmacology. Pharmacology is a second semester nursing course that all associate degree and practical nursing students must take.

Nursing graduates of the associate degree program had an average score of 2.75 (B-) in Pharmacology while practical nursing graduates earned an average score of 2.25 (C+) in the course. For graduates who had a composite score of less than the 50<sup>th</sup> percentile, 68.2% of associate degree students earned a course grade of A or B and 11.6% received an F in the course. In contrast to the associate degree graduates, only 18.75% of practical nursing graduates received an A or B in Pharmacology while a comparable

12.5% earned an F. For all students whose composite score was less than the 50<sup>th</sup> percentile, 9.1% received an A while 34.8% of all students got an F (See Table 15 in the appendix).

Further analysis of students and graduates who scored less than the 35<sup>th</sup> percentile on the NLN composite examination revealed that 5.6% of all students received an A in Pharmacology while 44% of this group earned an F. All but one of the practical nursing graduates (N=6) whose composite score was less than the 35<sup>th</sup> percentile received grades of C in Pharmacology. It was interesting to note that despite the low composite scores obtained by the practical and associate degree students, no graduate earned an F in this course (See Table 16 in the appendix).

The correlation between the PAX-RN composite raw score and grades obtained in Pharmacology was a coefficient of .327 for all students, which was significant at the .001 level. A total of 449 students had enrolled in Pharmacology.

#### Relationship between PAX-RN Scores and Pathophysiology Course Grades

The sixth research question asked if there was a relationship between students' scores on each of the four PAX-RN tests and the course grades they received in Pathophysiology. Graduates of the associate degree program in nursing obtained an average score of 2.47 (C+/B-) in Pathophysiology, while graduates of the practical nursing program had an average course grade of 1.56 (< C-). As previously noted, Pathophysiology is not required in the practical nursing program. A number of practical nursing graduates enrolled in the course, however, because they intended on completing the associate degree program. Their lack of success in Pathophysiology may have led many of these students to transfer into the practical nursing program.

For nursing graduates of the associate degree program who scored less than the 50<sup>th</sup> percentile on the PAX-RN composite test, 46.2% received a course grade of A or B in Pathophysiology while 15.3% earned an F. All of the practical nursing graduates included in the study that scored less than the 50<sup>th</sup> percentile on the composite test failed Pathophysiology. For all students that scored less than the 50<sup>th</sup> percentile on the composite examination, 44% received an F, while only 4% received an A (See Table 14 in the appendix).

An examination of all students whose composite score was less than the 35<sup>th</sup> percentile found that 66.7% had received an F in Pathophysiology, and no student in this group received an A in the course. Only one practical nursing graduate who scored less than the 35<sup>th</sup> percentile had enrolled in Pathophysiology. That student also received an F in the course (See Table 16 in the Appendix).

#### Relationship between PAX-RN Scores, Course Grades and Age

The final research question posed asked if there was a difference between NLN PAX-RN test scores and grades obtained in selected nursing and science courses for older and younger students. The average age of associate degree students in this study was 25.7 years compared to 24.4 years for the practical nursing graduates. The difference of means in age was not significant.

Several interesting findings were identified when the variable of age was introduced during data analysis (See Table 10). The raw scores obtained by students in each of the four tested areas on the PAX-RN increased with age. Additionally, students' course grades got progressively higher as their age increased. The younger age group consistently had lower grades than any of the other age groups.

Table 10

## A Comparison of Age Groups, PAX-RN Scores and Course Grades

	16-19 years	20-24 years	25-29 years	30-39 years	≥40 years
Verbal Raw Score	31.88	35.27	37.29	37.66	41.88
Math Raw Score	21.61	23.14	22.79	21.86	24.25
Science Raw Score	32.93	34.63	34.53	33.32	37.99
Composite Raw Score	104.19	111.68	113.44	111.93	119.99
A&P Grade	2.09	2.30	2.62	2.81	3.19
Introduction to Nursing Grade	2.48	2.63	2.78	2.75	3.22
Pharmacology Grade	2.37	2.30	2.53	2.59	3.02
Pathophysiology Grade	2.09	2.07	2.13	2.26	2.57
NLN test N	206	318	139	140	73
% of total test takers	23.5%	36.3%	15.9%	16.0%	8.3%

Associate Degree and Practical Nursing Combined

Further correlations that looked at varying age groups, PAX-RN scores and course grades are found on Table 11 in the appendix.

## Chapter V

### Discussion, Conclusions and Recommendations

#### Introduction

This ex post facto correlation study was done to examine the relationship between scores obtained by students on the National League for Nursing (NLN) preadmission examination for registered nurses (PAX-RN) and their success within an associate degree and a practical nursing program. All students who were included in the study took the NLN PAX-RN between 1995 and May 2002. A total of 247 Associate Degree graduates and 65 Practical Nursing graduates, along with an additional 564 additional students were included at some level of data analysis. Seven research questions were initially identified, and the findings were presented. This chapter will discuss the findings of this study, and identify conclusions that can be made. Limitations of this study and recommendations for the future will also be described.

#### Summary of Findings

Several findings were realized based on the analysis of the data in this study. These findings include:

- (a) The associate degree graduates consistently scored higher than the practical nursing graduates on the NLN PAX-RN examination and in the selected nursing and science courses.
- (b) The associate degree graduates were slightly older than the practical nursing graduates, but the difference was not statistically significant. Older students were

somewhat more successful than younger students in completion of a nursing program.

- (c) The NLN PAX-RN Comprehensive examination was the strongest predictor of students' success in A&P, followed by the NLN PAX-RN Verbal test.
- (d) A substantial number of students who scored less than the 50<sup>th</sup> percentile were unsuccessful in the nursing program. An even larger percentage of students who scored less than the 35<sup>th</sup> percentile were unsuccessful in completion of a nursing program.
- (e) A strong relationship existed between success in one nursing or science course and another one of the selected courses. Course grades attained by nursing students in earlier courses were strong predictors of course grades in their higher-level courses.

## Discussion of Findings

### *Differences between Associate Degree and Practical Nursing Graduates*

The first finding from this study was that the associate degree graduates consistently scored higher than the practical nursing graduates on the NLN PAX-RN examination and in the selected nursing and science courses. Statistical analysis on the mean scores for these two groups supported this finding. Students in the first year of the associate degree and practical nursing programs at Chippewa Valley Technical College (CVTC) take essentially the same cluster of nursing and science classes. Each of the first year courses identified in the study consistently showed a statistically significant difference between grades attained by the two groups. The literature search did not reveal any studies that examined the success of practical nursing and associate degree nursing



students or graduates who took the same courses in their programs of study even though many associate degree programs are designed to reflect a one-plus-one curriculum. The first year in these types of programs equals the practical nursing program while the second year leads to the associate degree in nursing.

This study found a significant difference between the two groups of students who were taking the same courses and in graduates' performance on the NLN PAX-RN. A higher percentage of practical nursing graduates than associate degree nursing graduates had an NLN Composite score less than the 35<sup>th</sup> percentile, the level established in fall 2003 as the cut-off for admission into the associate degree program. Additionally, a higher percentage of practical nursing graduates than associate degree graduates scored less than the 50<sup>th</sup> percentile on the NLN Composite examination. This level is the point below which students must complete remedial coursework prior to admission into the associate degree-nursing program. Conversely, a higher percentage of associate degree graduates performed well on the PAX-RN examination with consistently higher scores in each of the four subtests, along with differences in the range of scores attained by both groups.

The NLN PAX-RN verbal sub-score for both groups was lower than anticipated, however, a higher percentage of practical nursing graduates had scores that required remedial course work to be completed prior to program admission. Given the complexity of readings required in nursing and other health programs, the low verbal scores that were seen as a cause for concern that was identified in this study, and one finding that supports the nursing program maintaining high standards for admission.

### *Age of Graduates*

A second finding in this study was that associate degree graduates were slightly older than the practical nursing graduates, however the difference in age was not statistically significant. The average age for both groups of graduates was between 24-26 years of age. The age range for all students was 16 years to over 60 years of age.

Although the average age of students for these two groups was not found to be statistically significant, differences in all students based on their ages was seen both in their PAX-RN raw scores as well as in the grades students received in the selected science and nursing courses. The results of this study found that older students received higher grades in their coursework and higher scores in each of the four PAX-RN subtests. Those students over the age of 40 years attained grades in some of their science and nursing courses that were more than one course grade higher than students in the 16-19 year old age group.

Age has been identified in several studies with varying correlation seen between age and level of success either on the state board examination or in relation to level of success within an associate degree or baccalaureate-nursing program. In one study specifically focused on practical nursing students, Ostryre (2001) found the more successful student was older (over 30 years), female, Caucasian, and of a lower socioeconomic status than students who were less successful.

Overall, when analyzing research findings over the last 20 years, the results in relation to age do not strongly support age as a variable associated with student success. The results of this study, however, strongly suggest that age is an important variable related to student success in the associate degree-nursing program. While age was found

to correlate with student success in this study, caution should be used when looking at how to best use this information, however, to avoid any sense of discrimination in one's admission or grading policies.

#### *Comprehensive Score as Predictor of Success*

A third finding evident in this study was that the NLN PAX-RN comprehensive raw score was the most accurate predictor of students' success in A&P. Three of the four NLN scores were predictors of success. Ironically, the NLN science PAX-RN raw score failed to boost the prediction of success in A&P.

The NLN comprehensive test has been identified as the most valid and reliable indicator of students' future success in a nursing program. A typical composite cut score was the 35<sup>th</sup> percentiles according to Arthur Ellen of the National League for Nursing (2003), however, a majority of schools use a composite score of the 50<sup>th</sup> percentile for program admission. The average percentile score obtained by successful associate degree nursing student in this study was 74.0 while practical nursing graduates had an average composite score of 61.2. Approximately 10% of associate degree graduates and 25% of practical nursing graduates had composite scores that were less than the 50<sup>th</sup> percentile. A total of 197 of the 876 students (22.5%) who took the PAX-RN and enrolled in A&P scored less than the 50<sup>th</sup> percentile, and 82 (9.4%) of the total number of students scored less than the 35<sup>th</sup> percentile.

Breyer's (n.d.) validation study on the NLN PAX-RN confirmed students who scored highly on the verbal, science and composite components of the examination had a higher likelihood of success in an associate degree-nursing program. In his study, the composite score was the best predictor of student success after one year in the program.

The results of this study concur with the results evident in Breyer's study with the exception of the value of the science score as a predictor of student success. In this study, the composite and verbal scores were both very strong predictors of student success.

*Success in Nursing Based on PAX-RN Scores*

The fourth finding evident in this study was that a substantial number of students who scored less than the 50<sup>th</sup> percentile were unsuccessful in the nursing program. A high percentage (66%) of the practical nursing graduates in the study were originally enrolled in the associate degree program. It was assumed that lack of success in the associate degree program led to the decision of a majority of these students to transfer into the practical nursing program. As a whole, the practical nursing graduates had a lower average grade in all courses examined, and in the four areas of the PAX-RN.

For all students in this study who scored less than the 50<sup>th</sup> percentile on the composite, a higher percentage of failing grades was noted in A&P (35.5%), Introduction to Nursing (19%), Pharmacology (34.8%), and Pathophysiology (44%). Grades obtained by students during the first time they enrolled in a course were used in these calculations. For all students who scored less than the 35<sup>th</sup> percentile on the composite portion of the test, an even higher percentage of students failed these courses with as many as 66.7% failing Pathophysiology, 44% failing Pharmacology, and 42% failing A&P.

The high course failure rate demonstrated that students who performed poorly on the NLN PAX-RN were less likely to be successful in a nursing program at the college. This information is very important to note as the NLN has identified that local experience with the NLN PAX-RN and analysis of the findings are invaluable for determining how to best use the tool both for advisement of students, and for establishment of admission

policies. In this case, the findings strongly suggest that students who perform poorly on the NLN PAX-RN are not good candidates for admission into a nursing program at the college because they are not likely to be successful.

*Correlation Between Beginning Level and Advanced Coursework*

A final finding from this study was that an analysis of selected courses revealed a high correlation between the beginning level nursing and science courses and subsequent nursing courses within the program. Students who performed well in earlier level nursing and science courses tended to also do well in their higher level courses, while students who did poorly in first semester nursing and science courses also demonstrated poor performance as they progressed through the curriculum.

Course grades obtained in A&P has been identified in several prior studies as a predictor of future success within a nursing program and on the NCLEX-RN licensure examination. Campbell and Dickson (1996) found students' science grades were highly predictive of overall student success in a nursing program. Other researchers have found similar results. In fact, Potalsky, Cohen and Saylor (2003) suggested that students who failed and then successfully repeated one of their science courses not be allowed into a school of nursing. They also recommended schools should establish a minimum grade of B in all science courses for students desiring entry into a nursing program.

Course grades in general have also been identified in other studies as indicators of future performance in a nursing program. Allen, Higgs and Holloway (1988) found students who had obtained D's and F's, or who withdrew from pre-nursing courses had a lower rate of program completion. Endres (1997) found that increased difficulty with

one's program of study correlated with the graduate having a higher likelihood of failing the NCLEX-RN.

### Conclusions

There are three main conclusions that can be made based on this research study. The most significant conclusion is that the students who scored highly on the NLN PAX-RN were more likely to be successful in completion of the associate degree-nursing program than students who scored poorly on this examination. The NLN PAX-RN comprehensive score was the most accurate predictor of student success in nursing. The verbal score was the second most accurate predictor of student success. A surprisingly high number of students did not meet the 50<sup>th</sup> percentile on the verbal subtest. Because nursing programs demand that students read a large amount of material presented at a high level, a deficiency in one's verbal skills decreases the likelihood of student success.

A second conclusion based on this research study is that older students tended to be more successful in a nursing program than younger students and to score higher on the PAX-RN. Possible explanations for this might include the older student could be more goal-directed, might view their education as an opportunity for self-improvement, or they might be able to expand on previous educational or work experiences that they have had in their lives. Some of the older students may have also already had success in their careers or prior educational experiences. Prior positive educational experiences have been identified in the literature as a factor related to academic success.

Additionally, as previously stated, the value of the finding associated with age is limited because reverse ageism could easily be claimed if age was used as a basis for program admission, and a younger student was denied admission to the program. It is

interesting to note, however, that educational institutions have questioned whether age bias against the older student exists in relation to the ACT and SAT examinations. This study indicated that older students actually did better on the NLN PAX-RN test.

A third conclusion that can be drawn from this study was that graduates of an associate degree program tended to obtain higher pre-entrance test scores and course grades than practical nursing students did. The increased level of difficulty found in the second year of the associate degree program requires that schools of nursing look for applicants who are highly qualified, and thus, increasingly more likely to be successful in the nursing program.

#### Limitations

A number of limitations were realized both in anticipation of this research study, and as a result of the data analysis. The limitations previously listed in Chapter One included: (a) only students who took the PAX-RN examination between 1995 and May 2002 were included in the study. Students who took alternative forms of pre-admission tests and advanced placement students were not included in the study; (b) The study focused only on nursing graduates from one college; (c) Only selected nursing and science courses were chosen for this study. In hindsight, no fourth semester nursing course was chosen for analysis. Grades attained by students in the fourth semester course, Nursing Practice Internship, were retrieved, however, these grades were used only for the purpose of identifying those who graduated from the associate degree program. Additional course comparisons would have provided more data concerning student success within the nursing program; (d) the study primarily examined success of students who graduated from the practical nursing and associate degree nursing programs. While

analysis also included students who had minimally taken their first semester nursing or science courses, students who left the programs for academic and non-academic reasons (morbidity) were not excluded from this study.

Additional limitations that were realized during data analysis included the study only examined success within the nursing program. The study did not address how well the students had performed on the NCLEX examination, the test required for entry into nursing practice. Several previous studies found in the literature included this variable in their comparisons.

Another limitation evident for this study is that some of the students who left the associate degree program and completed the practical nursing program made this change for non-academic reasons. A number of these students actually obtained both high PAX-RN scores as well as high scores in their nursing and science courses. These students' academic performance and test scores likely elevated the findings for the practical nursing group. If these students had been excluded, a higher degree of difference between the two groups may have been found.

A final limitation evident for this study was that demographic variables were limited to age. Although the percentage of males and females in each program was determined, this data was not used in the data analysis. Additional variables that could have been addressed include previous experience working in health care, prior educational experience, number of hours worked per week, and ethnicity.

### Recommendations

Based on this study, the following recommendations are offered:



1. Schools of nursing must continue to maintain high admission standards for both associate degree and practical nursing programs. In this study, student success in the nursing program was highly correlated with the scores received on the PAX-RN. In an effort to ensure qualified students, and an increase in student success and program retention, schools of nursing need to keep admission standards at high levels.
2. Schools of nursing must collect trended, aggregate data on an on-going basis to validate their current admission policies, or to determine need for a change in these policies. Collection of data can assist in accurate counseling of students for program success.
3. Schools of nursing must actively work to develop measures to increase student success for those students with test scores that are at or near the minimum cut-score determined by the school.
4. Schools of nursing should consider the NLN PAX-RN as a pre-assessment screening tool for student admission into a nursing program. Schools of nursing must also consider other variables that may increase likelihood of student success.

#### Impact of this Study for Chippewa Valley Technical College

This study was begun for the purpose of gathering data concerning the nursing programs at one technical college in Wisconsin with the hope that the information obtained could be used to enhance admission policies, counseling of students, and inevitably, student success. In response to the present and anticipated shortage of nurses and other health care providers, schools of nursing are being challenged to look at their

admissions' policies. Questions have been raised concerning the use of the open-door policy as seen in many community and technical colleges. As identified in the literature, many prospective students nationally and in Wisconsin are often unable to gain admission into a nursing program due to long waiting lists. The need to deal with growing waiting lists is coupled with the desire to meet the health care needs of the region, while maintaining fiscal responsibility. These issues are challenging because attrition rates found in many schools of nursing are higher than desired and nursing education is very expensive to provide due to the need for a low student: teacher ratio required for clinical and laboratory courses.

This study identified that many of the students who were admitted to the associated degree-nursing program were not strong candidates for program admission or for success in nursing. The study also provided extremely valuable data to support the NLN PAX-RN as a valid and reliable instrument in predicting student success in the CVTC nursing program. As previously stated, local research and data analysis is invaluable for developing effective admission and counseling strategies.

Despite the strong validity evident for the NLN PAX-RN, the nursing department at CVTC recently made a decision to cease using this assessment measurement. The department has made the decision to begin to use the ACT test in June 2004 as the pre-admission assessment that will be required for all students desiring admission into the Associate Degree and Practical Nursing programs.

Several variables have influenced the nursing department to make this decision to abandon the NLN PAX-RN examination. The first reason for this change is that the college maintains two nursing programs, the associate degree and practical nursing

programs. Although the associate degree-nursing students were required to take the NLN PAX-RN prior to admission into the program, the practical nursing students were not required to take a comparable examination. An increasingly higher number of practical nursing graduates are opting to apply for advanced standing into the associate degree program. These students were not required to take the NLN PAX-RN examination prior to program admission. As a result, the department has identified that a number of students who were pursuing advanced standing in this program were not adequately prepared for the rigors of the second year of the associate degree program, and were not successful.

In an effort to try to increase the standards for students admitted into the practical nursing program, the ACT test will be implemented. While some may question the logic behind increasing admission standards for the practical nursing program, given the high level of success on the state board examination that graduates have realized, recent information disseminated by the National Council for State Board of Nursing has indicated that the accepted passing rate for both registered nursing and licensed practical nursing candidates will be increasing. Health care has become increasingly more complex. The level of knowledge and skill required by nurses in the work environment is substantially greater than it was 10-20 years ago. By raising the admission's standards for the practical nursing students, it is anticipated that a higher percentage will be successful on the state board examination and will find also success in the associate degree-nursing program.

Nursing programs are responsible for monitoring their state board passing rates and program retention numbers. With the passing standard on the state board examination being raised to reflect the complexity of health care, a higher skill level will also be

required of students entering a nursing program. By raising the admission standards for the practical nursing program, it is anticipated that program retention in both the practical nursing and associate degree nursing programs will increase. Students will likely be more successful in their transition from the practical nursing program to the associate degree-nursing program, and the program's retention numbers should improve as well.

Another variable contributing to the decision to abandon the NLN PAX-RN is that CVTC has been actively involved over the last two years in the development of a new nursing curriculum that will be shared by all 16 technical colleges in the state. Currently, CVTC is the only technical college in Wisconsin that uses the PAX-RN. While a variety of other nursing specific admission tests are used throughout the state, the ACT test is the most universally accepted standard in the other 15 schools. Use of the ACT may enhance a student's ability to more quickly transfer from one college to another because the other technical colleges throughout the state accept the ACT. Additionally, the new associate degree program has been developed as a one-plus-one curriculum (1<sup>st</sup> year equals the practical nursing degree; 2<sup>nd</sup> year equals the associate degree). This change will lead to a blurring of the two curricula currently in place. There will be greater similarity as all students who complete the practical nursing program and all students who complete the first year of the associate degree program will be eligible to take the state board examination for licensure as an LPN. Similar admission standards are needed as the first year of these two programs become more similar during year one. The program has also decided not to give the practical nursing students the PAX-RN examination. While it might seem realistic to administer this examination to the advanced

placement students, this option is viewed as putting one more barrier in place for students desiring entry into this nursing program.

Another variable that influenced the nursing department to select the ACT test is that prospective students have easier access to taking the ACT examination than the NLN test. Students can take the ACT test as many times as they desire, and they can take the examination as often as it is administered. The NLN PAX-RN test has limitations to the frequency to which students could take the examination. Students were only allowed to take the NLN test once a year. For those students who were unsuccessful, they had to wait an extended period of time to retake the examination. This time delay was a source of frustration for many students.

The NLN PAX-RN examination was also administered at the college. This factor potentially led to some difficulty in staffing of the examination. Because the ACT test is given on a frequent basis at many sites throughout the region, student access will be higher, and stress on the college will be minimized.

Another variable that led to the program's decision to change from the PAX-RN to the ACT test was that prior remediation courses required of students who did not achieve the 50<sup>th</sup> percentile on any of the four areas of the examination were not viewed as successful in increasing the likelihood of student success. Students often took all or most of the required remediation courses prior to taking the PAX-RN. Even if the student scored poorly in the examination after completing these courses, the program could not prevent a student from being admitted to the program.

CVTC has not done any prior formal analysis on the PAX-RN examination and student success. In addition, there are few documented studies concerning the validity,

reliability and use of the PAX-RN. Because of these variables, even though the nursing program will be abandoning its use of the examination, the information gained through this study has significance both locally and for other schools of nursing.

The results of this study will be provided to a committee from the Wisconsin Technical College System who has been assembled to analyze whether health programs within the system should be more selective in their admission of students. There has been a strong level of hesitancy to change the open door policy, the hallmark of many technical and community colleges in this country. The findings from this study support the fact that success in nursing is related to having well-qualified students who are capable of performing highly on pre-entrance examinations.

The results of this study will also be disseminated locally and nationally at nursing conferences, in a nursing publication and informally upon request. The NLN Educational Summit is held each year for the purpose of disseminating information for nursing instructors on up-to-date practices that may be relevant to nursing education. Materials will be submitted for the researcher to present at the 2004 NLN Educational Summit. Locally, this information will be sent to the University of Wisconsin- Eau Claire for possible inclusion into the Sigma Theta Tau Research Day in 2005. The results will be submitted to a national nursing publication such as *Nursing Education Perspectives*, a magazine published by the National League for Nursing. It is anticipated that the NLN will be particularly interested in the findings from this study because the results continued to demonstrate the validity of the NLN PAX-RN as a predictor of success in a nursing program. Finally, the results have and will be provided to other individuals and colleges who are using the PAX-RN, or who are contemplating its use. Some of the

findings from this study were provided to the Program Director for Nursing at Western Wisconsin Technical College (WWTC) in La Crosse, Wisconsin. WWTC is considering use of the tool for program admission. Information concerning the high predictive capacity of the tool was provided to the college, along with evidence to support maintaining high ( $\geq 50\%$ ) cut scores for all students admitted into the program.

#### Further Research

As a result of the analysis of data in this study, the following suggestions for future research are offered:

- (a) An analysis examining the relationship between the PAX-RN and selected demographics not previously addressed could be performed. The nursing program has admitted a number of students who represent a more diverse population. This comparison would aid the program in looking at other variables that are potentially linked to student success.
- (b) A similar study to the current one could be run comparing ACT scores and student success in the nursing program. This study would not be able to be done for at least five years since many of the students currently waiting for program admission to the associate degree program have already taken the NLN PAX-RN examination, and many students waiting to get into the practical nursing program have already taken the COMPASS test.
- (c) A comparison of relative prediction power could be run between results obtained through use of the ACT test and those obtained with use of the NLN test. This study would look at which of the two tests was identified to be a better predictor of student success in the nursing programs.

- (d) An analysis could be done to explore the relationship between the PAX-RN results and one or two additional courses in the nursing courses. As previously identified, this study only looked at selected nursing and science courses in the program, and did not include any fourth semester courses. A recent concern expressed within the CVTC nursing department is that students who did poorly in their final nursing theory course were seen as having an increased likelihood of failing the NCLEX-RN.
- (e) Ex post facto correlation studies between the NLN PAX-RN test scores and the NCLEX-RN and the NCLEX-PN could also be performed. The NCLEX examination is considered the ultimate measurement of graduate success in nursing. Many of the studies in the literature looked at passing the NCLEX as one variable that defined success for the graduates.
- (f) An ex post facto study could also be done to explore the relationship between students' scores on the PAX-RN and their level of success in the new nursing curriculum that will be implemented in fall 2004. All of the associate degree nursing students who will be enrolled in their first semester courses in fall 2004 and spring 2005 will have taken the PAX-RN.

### Summary

This study was conducted to examine the relationship between scores obtained by students on the National League for Nursing (NLN) pre-admission examination for registered nurses (PAX-RN) and their success within an associate degree and practical nursing program. Data was obtained from 876 students who took the examination between 1995 and May 2002. A total of 247 associate degree graduates and 65 practical



nursing graduates were identified in this study. An additional 564 students were also included at some level of data analysis.

The results from this study supported a relationship between students' scores on the PAX-RN and success in the nursing program. Students with higher scores on their pre-admission examination had a higher likelihood of success in the program compared to students who scored at levels that required the student to complete remedial course work prior to admission into the program. The NLN PAX-RN composite score was the best predictor of student success in Anatomy and Physiology. The PAX-RN science score was not identified as a predictor of success.

Older students in this study tended to score higher on the PAX-RN and to have more success in the program than younger students. Although age will not be used to determine program admission, the results suggest that older students can be very successful in nursing programs.

On-going analysis of admission examination results should be done to enable the nursing program to continue to work on process improvement, program improvement, and to develop more effective means for counseling students on the appropriateness of nursing as a career choice based on their admission scores. The results of the current study have already been utilized for this purpose. The program director and counselors for nursing will continue to use students' admission scores as a tool to work with students to increase their likelihood of success in the nursing program. An awareness of possible deficits that a student possesses as determined by the admission test results could enable the nursing program to initiate early intervention strategies that would enhance student success. Early intervention strategies might include required attendance at review

sessions, assignment of an academic advisor, or the development of a cluster of remedial courses more tailored to meet the needs of the individual student.

The current shortage of health care workers requires that schools of nursing evaluate their admission policies and work to increase the likelihood of student success in their programs. The need to produce more qualified health care workers demands that schools of nursing maintain rigorous standards that will lead to increased retention and graduation rates.

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Appendix A:  
Tables of Further Statistical Analysis

Table 11  
NLN PAX-RN Scores and Selected Nursing Courses for All Students by Age Groups

	16-19 years	20-24 years	25-29 years	30-39 years	≥40 years
NLNVR and NLNCR	Pearson .826** Sig. (2 tailed) .000 N= 206	Pearson .831** Sig. (2 tailed) .000 N= 318	Pearson .799** Sig. (2 tailed) .000 N= 139	Pearson .853** Sig. (2 tailed) .000 N= 140	Pearson .837** Sig. (2 tailed) .000 N= 73
NLNMR and NLNCR	Pearson .667** Sig. (2 tailed) .000 N= 206	Pearson .678** Sig. (2 tailed) .000 N= 318	Pearson .718** Sig. (2 tailed) .000 N= 139	Pearson .815** Sig. (2 tailed) .000 N= 140	Pearson .805** Sig. (2 tailed) .000 N= 73
NLNSR and NLNCR		Pearson .838** Sig. (2 tailed) .000 N= 318	Pearson .790** Sig. (2 tailed) .000 N= 139	Pearson .859** Sig. (2 tailed) .000 N= 140	
NLNVR and NLNSR		Pearson .575** Sig. (2 tailed) .000 N= 318	Pearson .457** Sig. (2 tailed) .000 N= 139	Pearson .624** Sig. (2 tailed) .000 N= 140	
NLNVR and NLNMR					Pearson .511** Sig. (2 tailed) .000 N= 73
NLNCR and A&P				Pearson .615** Sig. (2 tailed) .000 N= 136	
NLNCR and Pharm					Pearson .424** Sig. (2 tailed) .000 N= 39
NLNCR and Intro to Nursing	Pearson .301** Sig. (2 tailed) .000 N= 119	Pearson .311** Sig. (2 tailed) .000 N= 202	Pearson .328** Sig. (2 tailed) .000 N= 90	Pearson .358** Sig. (2 tailed) .000 N= 87	
A&P and Intro to Nursing	Pearson .493** Sig. (2 tailed) .000 N= 113	Pearson .416** Sig. (2 tailed) .000 N= 162	Pearson .478** Sig. (2 tailed) .000 N= 82	Pearson .635** Sig. (2 tailed) .000 N= 83	Pearson .572** Sig. (2 tailed) .000 N= 45
A&P and Pathophysiology	Pearson .466** Sig. (2 tailed) .000 N= 69	Pearson .404** Sig. (2 tailed) .000 N= 111	Pearson .582** Sig. (2 tailed) .000 N= 58	Pearson .740** Sig. (2 tailed) .000 N= 59	Pearson .636** Sig. (2 tailed) .000 N= 33
A&P and Pharmacology	Pearson .398** Sig. (2 tailed) .000 N= 87	Pearson .500** Sig. (2 tailed) .000 N= 132	Pearson .507** Sig. (2 tailed) .000 N= 70	Pearson .711** Sig. (2 tailed) .000 N= 69	Pearson .560** Sig. (2 tailed) .000 N= 39
Intro to Nursing and Pharmacology	Pearson .486** Sig. (2 tailed) .000 N= 91	Pearson .514** Sig. (2 tailed) .000 N= 167	Pearson .540** Sig. (2 tailed) .000 N= 76	Pearson .485** Sig. (2 tailed) .000 N= 73	Pearson .421** Sig. (2 tailed) .000 N= 37
Intro to Nursing and Pathophysiology	Pearson .373** Sig. (2 tailed) .000 N= 72	Pearson .380** Sig. (2 tailed) .000 N= 146	Pearson .432** Sig. (2 tailed) .000 N= 62	Pearson .569** Sig. (2 tailed) .000 N= 62	
Pharmacology and Pathophysiology	Pearson .658** Sig. (2 tailed) .000 N= 73	Pearson .695** Sig. (2 tailed) .000 N= 141	Pearson .698** Sig. (2 tailed) .000 N= 61	Pearson .831** Sig. (2 tailed) .000 N= 59	Pearson .515** Sig. (2 tailed) .000 N= 31

Table 12

## Significant Correlations: NLN PAX-RN Scores and Selected Nursing Courses

	All Students		All Students
NLNVR and NLNCR	Pearson .840** Sig. (2 tailed) .000 N= 876	Age and NLNVR	Pearson .341** Sig. (2 tailed) .000 N= 876
NLNMR and NLNCR	Pearson .709** Sig. (2 tailed) .000 N= 876	Age and NLNCR	Pearson .224** Sig. (2 tailed) .000 N= 876
NLNSR and NLNCR	Pearson .349** Sig. (2 tailed) .000 N= 876	Age and A&P	Pearson .331** Sig. (2 tailed) .000 N= 817
NLNVR and NLNSR	Pearson .213** Sig. (2 tailed) .000 N= 876	Age and Intro	Pearson .215** Sig. (2 tailed) .000 N= 485
NLNVR and NLNMR	Pearson .392** Sig. (2 tailed) .000 N= 876	Age and Pharm	Pearson .201** Sig. (2 tailed) .000 N= 397
NLNCR and A&P	Pearson .398** Sig. (2 tailed) .000 N= 817	Age and Patho	Pearson .139** Sig. (2 tailed) .000 N= 330
NLNCR and Pharm	Pearson .327** Sig. (2 tailed) .000 N= 449		
NLNCR and Intro to Nursing	Pearson .350** Sig. (2 tailed) .000 N= 543		
A&P and Intro to Nursing	Pearson .537** Sig. (2 tailed) .000 N= 485		
A&P and Pathophysiology	Pearson .558** Sig. (2 tailed) .000 N= 330		
A&P and Pharmacology	Pearson .561** Sig. (2 tailed) .000 N= 397		
Intro to Nursing and Pharmacology	Pearson .525** Sig. (2 tailed) .000 N= 444		
Intro to Nursing and Pathophysiology	Pearson .443** Sig. (2 tailed) .000 N= 374		
Pharmacology and Pathophysiology	Pearson .713** Sig. (2 tailed) .000 N= 365		

Table 13

## Analysis of NLN PAX-RN Scores

Model	t-test	Significance
NLN Composite	5.981	.001
NLN Verbal	-2.631	.001
NLN Science	1.171	.242
NLN Math	-2.202	.028
Age	7.808	.001

Dependent Variable: A&amp;P

Table 14

## Comparisons of Various Coefficients

Model	t-test	Significance
NLN Composite	12.397	.001
NLN Composite and Age	10.445 7.631	.001 .001
NLN Composite Age and NLN Verbal	7.394 7.897 -1.984	.001 .001 .048
NLN Composite Age NLN Verbal and NLN Math	6.718 7.832 -2.950 -2.430	.001 .001 .003 .015

Dependent Variable: A&amp;P

Table 15

NLN Composite Score < 50<sup>th</sup> Percentile for Associate Degree & Practical Nursing Graduates and All Students

AD: N= 26 out of 247 graduates (10.5%); PN: N= 16/65 graduates (24.6%)

All Students: A&P= 197 Intro= 93 Pharmacology= 66 Pathophysiology= 50

#### Anatomy and Physiology

Associate Degree			Practical Nursing		All Students		
Grade	N	%	N	%	Grade	N	%
F	0	0	1	6.25%	F	70	35.5%
C+-C-	12	46.2%	7	43.75%	C+-C-	65	33%
B+-B-	12	46.2%	6	37.5%	B+-B-	46	23.4%
A-	1	3.8%	0		A – A-	16	8.1%
A	1	3.8%	0				

#### Introduction to Nursing

Associate Degree			Practical Nursing		All Students		
Grade	N	%	N	%	Grade	N	%
F	2	7.7%	0	0	F	18	19.4%
C+-C-	7	26.9%	9	56.75%	C+-C-	37	39.8%
B+-B-	16	61.5%	6	37.5%	B+-B-	35	37.6%
A-	1	3.9%	1	6.25%	A– A-	3	3.2%
A	0	0	0	0			

#### Pharmacology

Associate Degree			Practical Nursing		All Students		
Grade	N	%	N	%	Grade	N	%
F	3	11.6%	2	12.5%	F	23	34.8%
C+-C-	5	19.2%	11	68.75%	C+-C-	16	24.3%
B+-B-	16	61.5%	0	0	B+-B-	21	31.8%
A-	2	7.7%	3	18.75%	A – A-	6	9.1%

#### Pathophysiology

Associate Degree			Practical Nursing		All Students		
Grade	N	%	N	%	Grade	N	%
F	4	15.3%	6	100%	F	22	44%
C+-C-	10	38.5%	0	0	C+-C-	13	26%
B+-B-	10	38.5%	0	0	B+-B-	13	26%
A-	2	7.7%	0	0	A – A-	2	4%

Table 16

NLN Composite Score < 35<sup>th</sup> Percentile: Associate Degree & Practical Nursing  
 Graduates and All Students

Associate Degree: N= 2 out of 247 (0.8%); Practical Nursing: N= 6 out of 65 (9.2%)  
 A&P= 82 Intro= 32 Pharmacology= 18  
 Pathophysiology= 9

Associate Degree				Practical Nursing				All Students			
Course/Grade	N	%		Course/Grade	N	%		Course/Grade	N	%	
A&P C	2	100%		A&P F	1	16.7%		A&P F	35	42.7%	
Intro F	1	50%		A&P C	2	33.3%		A&P C+-C-	27	32.9%	
Intro B-	1	50%		A&P B	3	50%		A&P B+-B-	15	18.3%	
Pharm C	1	50%		Intro C	5	83.3%		A&P A- A-	5	6.1%	
Pharm B-	1	50%		Intro B	1	16.7%		Intro F	10	31.3%	
Patho F	1	50%		Pharm C	5	83.3%		Intro C+-C-	14	43.7%	
Patho B-	1	50%		Pharm A	1	16.7%		Intro B+-B-	8	25%	
				Patho F	1	100%		Intro A – A-	0	0	
								Pharm F	8	44%	
								Pharm C+-C-	6	33.3%	
								Pharm B+-B-	3	16.7%	
								Pharm A– A-	1	5.6%	
								Patho F	6	66.7%	
								Patho C+-C-	1	11.1%	
								Patho B+-B-	2	22.2%	



Table 18

t-test Differentiating Practical Nursing and Associate Degree Nursing Graduates

Graduate Variable		N	Mean	t	Sig (2 tailed)
Age:	Practical Nursing Graduate	64	24.44	-1.139	.256
	Associate Degree Nursing Graduate	249	25.67		
NLNVR:	Practical Nursing Graduate	64	33.86	-4.876	.000
	Associate Degree Nursing Graduate	249	38.82		
NLNMR:	Practical Nursing Graduate	64	23.45	-3.554	.000
	Associate Degree Nursing Graduate	249	26.45		
NLNSR:	Practical Nursing Graduate	64	32.81	-4.671	.000
	Associate Degree Nursing Graduate	249	36.36		
NLNCR:	Practical Nursing Graduate	64	107.06	-5.646	.000
	Associate Degree Nursing Graduate	249	117.97		
A&P:	Practical Nursing Graduate	58	2.3459	-3.683	.000
	Associate Degree Nursing Graduate	212	2.8031		
Intro:	Practical Nursing Graduate	64	2.5869	-4.667	.000
	Associate Degree Nursing Graduate	246	2.9785		
Pharm:	Practical Nursing Graduate	64	2.2503	-4.508	.000
	Associate Degree Nursing Graduate	247	2.7463		
Patho:	Practical Nursing Graduate	37	1.5611	-6.793	.000
	Associate Degree Nursing Graduate	247	2.4726		



Table 19

## Regression Analysis in the Prediction of Anatomy and Physiology Grades

Model 1	R <sup>2</sup>	Beta	t	significance
NLN Composite	.159	.398	12.397	.000

Model 2	R <sup>2</sup>	Beta	t	significance
NLN Composite	.215	.336	10.445	.000
Age		.245	7.631	.000

Model 3	R <sup>2</sup>	Beta	t	significance
NLN Composite	.219	.433	7.394	.000
Age		.263	7.897	.000
NLN Verbal		-.120	-1.984	.048

Model 4	R <sup>2</sup>	Beta	t	significance
NLN Composite	.224	.594	6.718	.000
Age		.260	7.832	.000
NLN Verbal		-.207	-2.950	.003
NLN Mathematics		-.124	-2.430	.015