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DETERMINATION OF VARIABLES WHICH PREDICT SUCCESS ON THE
NATIONAL COUNCIL LICENSURE EXAMINATION (NCLEX-PN)

By

Mary A. Kleber

R.N., Diploma, Kentucky Baptist Hospital School of Nursing, 1970

B.S.N., Bellarmine University, 1988

M.S.N., University of Louisville, 1995

A Dissertation
Submitted to the Faculty of the
College of Education and Human Development of the University of Louisville
In Partial Fulfillment of the Requirements
for the Degree of

Doctor of Philosophy

Department of Leadership, Foundations, and Human Resource Education
University of Louisville
Louisville, Kentucky

December 2010

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R.N., Diploma, Kentucky Baptist Hospital School of Nursing
B.S.N., Bellarmine University
M.S.N., University of Louisville

A Dissertation Approved on

November 15, 2010

By the following Dissertation Committee

Dissertation Co-Director

Dissertation Co-Director

DEDICATION

This dissertation is dedicated

to my family:

my husband, George E. Kleber, Jr.

Who is my encourager and supporter;

to my son,

Todd Edward Kleber,

and my daughter and son-in-law,

Kyle and Kathy Russell.

ACKNOWLEDGEMENTS

“I can do all this through him who gives me strength,” Philippians 4:13

Completing a dissertation in partial fulfillment of the requirements for a doctoral degree is in part the result of dedicated chairpersons. Under the direction of Stephen K. Miller and Patricia Leitsch, I have acquired a great appreciation for research and the commitment to excellence. Dr. Miller’s unwavering commitment to excellence and willingness to read and critique all my writing has been the cornerstone of this dissertation. Dr. Leitsch’s direction, encouragement, and support permitted me to achieve a lifetime goal. Their unwavering faith in my ability to complete this study has been the impetus to complete this journey. I am forever in their debt.

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Finally, beyond those in the dedication, I thank other family and friends who encouraged and supported me throughout my life’s journey towards this goal:

Floyd M. Short, Father (deceased)

Irene Short, Mother (deceased)

Dennis and Barbara Snow, Sister and Brother-in-law

Lowell and Sarah Graham, Sister and Brother-in-law

Elizabeth Bullock, Friend

ABSTRACT

DETERMINATION OF VARIABLES WHICH PREDICT SUCCESS ON THE NATIONAL COUNCIL LICENSURE EXAMINATION (NCLEX-PN)

Mary A. Kleber

December 16, 2010

Nursing is one of the most frequently chosen programs by those entering postsecondary institutions in preparation for a career. This is in part due to the job opportunities available, interest in healthcare, and a pending shortage of nurses in healthcare. One strategy for meeting this shortage is the career pathway which encompasses the concept of lifelong learning and provides a mechanism for advancement of nurses along a continuum.

Regardless of the level that a student enters the nursing education continuum, failure on the national licensure exam becomes a burden to both graduates and faculty in time and resources expended. Whereas many empirical research studies have been conducted related to the registered nurse, few studies have been done related to the practical nurse. Therefore, this research study addresses the issue of background and curricular variables which predict success on the National Council Licensure Examination for Practical Nurses (NCLEX-PN).

Descriptive statistics, inferential statistics, and logistic regression were used to determine the predictive value of the demographic (age, gender, race) and admission requirements (math, reading); curriculum variables (pre-requisite, foundation, specialty,

and advanced nursing courses); and Exit Comprehensive Exam on NCLEX-PN status. The sample consisted of 411 students from 14 practical nursing programs within ten Kentucky Community and Technical Colleges. Independent Sample *t* Tests, Chi-square, and Correlation suggested statistically significant relationships/differences for all variables with the exception of gender, the mathematics admission exam, and number of attempts on the exit examination. The results of the logistic regression model indicated that age ($p = .002$) and the Exit Comprehensive Exam ($p = .035$) made a significant contribution to prediction of success on the NCLEX-PN on the first attempt. The demographic (gender, race); admission (math, reading); curricular, (pre-requisite, foundation, specialty, and advanced nursing courses); and mediating (number of attempts on the Exit Comprehensive Exam) variables were not significant predictors in the logistic model. These results may be used as an advisement tool for at-risk students to direct them toward interventions and resources to increase success on the NCLEX-PN.

TABLE OF CONTENTS

	PAGE
DEDICATION.....	iii
ACKNOWLEDGEMENTS.....	iv
ABSTRACT.....	vi
LIST OF TABLES.....	xi
LIST OF FIGURES.....	xiii
I. STATEMENT OF THE PROBLEM	
Introduction.....	1
The Problem Defined.....	9
Purpose of the Study.....	10
Research Questions.....	10
Significance of the Study.....	11
Assumptions and Limitations of the Study.....	14
Summary.....	15
II. REVIEW OF THE LITERATURE	
Introduction.....	18
The Nursing Shortage.....	19
Historical Perspective of Licensed Practical Nurses.....	22
The Role of the Community College in Nursing Education.....	25
Characteristics Predicting Success in Registered Nursing Education.....	26
Characteristics Predicting Success in Practical Nursing Education.....	40
Conceptual Framework.....	47
Summary.....	48

III. METHODOLOGY

Introduction.....	51
Definition of Terms	51
Implications of Variable Subdivisions	55
Sources of Data.....	56
Variables in the Study.....	57
Analysis of the Data.....	61
Validity Considerations	69
Ethical Considerations	72
Summary.....	73

IV. RESULTS

Introduction.....	74
Data Checking	74
Statistical Analyses.....	76
Inferential Analysis.....	86
Summary.....	113

V. DISCUSSION AND CONCLUSIONS

The Study in Brief	115
Discussion.....	120
Recommendations.....	134
Conclusions	138

REFERENCES	142
------------------	-----

APPENDIX A.....	153
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APPENDIX B	156
APPENDIX C	162
CURRICULUM VITAE.....	165

LIST OF TABLES

TABLE	PAGE
1. Admission Requirements and Preferences for the KCTCS PN Program	6
2. Relationship of Type of Analysis to Independent and Dependent Variables by Research Questions	63
3. Distribution of Total Sample by Demographic Characteristics	77
4. Distribution of Reading and Mathematics Assessment Scores for the Study Population ($N = 411$)	79
5. Distribution of Success Predictability on the NCLEX-PN for the Study Population ($N = 411$)	85
6. Distribution of Total Sample by National Licensure Examination (NCLEX-PN) Results	86
7. Correlations for Age with Curricular GPAs and Number of Low Grades ($N = 411$)	87
8. Independent Sample t Test for Race on Curricular GPA and Number of Low Grades	88
9. Independent Sample t Test of Gender on Curricular GPA and Number of Low Grades	89
10. Independent Sample t Test of Admission Requirements for Reading on Curricular GPA and Number of Low Grades	90
11. Independent Sample t Test of Admission Requirements for Mathematics on Curricular GPA and Number of Low Grades	91

12. Independent Sample <i>t</i> Test of Students Passing the Exit Comprehensive Exam for Age (<i>N</i> = 411).....	92
13. Independent Sample <i>t</i> Test of Students Passing the NCLEX-PN Exam for Age	98
14. Chi-Square of Demographic and Admission Requirements on NCLEX-PN (<i>N</i> = 411).....	99
15. Independent Sample <i>t</i> test of Students' Performance on the Exit Comprehensive Exam for GPA and NLG (<i>N</i> = 411).....	101
16. Independent Sample <i>t</i> test of Students Passing the NCLEX-PN Exam for Curriculum and NLG (<i>N</i> = 411)	102
17. Chi-Square of Exit Comprehensive Exam and NCLEX-PN (<i>N</i> = 411).....	103
18. Logistic Regression Constant-Only Model Results.....	105
19. Simultaneous Logistic Regression Model for Demographic/Admission Requirements, Curriculum Variables, and Exit Comprehensive Exam on NCLEX-PN Status (<i>N</i> = 411)	108

LIST OF FIGURES

FIGURE	PAGE
1. Flowchart depicting hypothesized relationships for independent and dependent variables.....	13
2. Histogram of Ages of Students ($N = 411$)	78
3. Histogram of Pre-Requisite Course Grade Point Averages ($N = 411$)	80
4. Histogram of Foundation Nursing Course Grade Point Average ($N = 411$).....	81
5. Histogram of Specialty Nursing Course Grade Point Average ($N = 411$).....	82
6. Histogram of Advanced Nursing Course Grade Point Average ($N = 411$)	83
7. Histogram of NLG Frequency ($N = 411$).....	84
8. Number of Cases by Gender for Exit Comprehensive Exam	93
9. Number of Cases by Race.....	94
10. Reading Assessment on Exit Comprehensive Exam	95
11. Mathematics Assessment on Exit Comprehensive Exam.....	97

CHAPTER I

STATEMENT OF THE PROBLEM

Introduction

Nursing is one of the most frequently chosen programs by those entering postsecondary institutions in preparation for a career. According to the Research and Statistics Branch, Kentucky Education Cabinet, Department for Workforce Investment, Office of Employment and Training, the first and third occupations in Kentucky with the most annual job openings requiring an associate degree or postsecondary education are registered nursing and practical nursing, one and three respectively. Nursing is one occupational discipline that has a defined career pathway for entry into practice and career advancement. Individuals may enter the nursing profession as a practical nurse or as a registered nurse at the associate or baccalaureate levels.

Whatever entry level is chosen, continuation of education to higher levels of educational attainment is possible thru a career pathway, important at the secondary and postsecondary levels, and defined by the League for Innovation in the Community College (2010) as “a coherent, articulated sequence of rigorous academic and career courses, commencing in the ninth grade and leading to an associate degree, and/or an industry-recognized certificate or licensure, and/or a baccalaureate degree and beyond” (p. 1). The pathway model is a “holistic approach”, addressing needs of secondary and postsecondary students, incumbent workers, businesses and communities. Because individuals may enter at different levels, the career pathway becomes one solution to the nursing shortage.

Two levels of the career path, practical nursing and associate degree nursing, are offered by the Kentucky Community and Technical College System. Both levels have a common beginning in that each level requires successful completion of a Medicaid Nurse Aide or equivalent course. The Kentucky Board of Nursing differentiates between each level of nursing as to function. The practical nurse (Kentucky Board of Nursing [KBN], 2007) is prepared to function as a direct caregiver under the supervision of other licensed health professionals, primarily in structured settings such as hospitals, nursing homes, and chronic care facilities. Practical nursing graduates who pass the licensure examination may transfer some or all of their academic credits to any Kentucky associate degree nursing program. The curriculum for the practical nursing program generally includes foundational science content and nursing courses with an emphasis on the clinical practice of skills learned in the classroom setting. Supervised clinical practice takes place in hospitals and long term care facilities. Observational experiences are provided in other settings.

The associate degree registered nurse (RN) is prepared to function as a caregiver in a variety of settings, and to work with other professional nurses and members of the health care team in planning and implementing comprehensive health care. Graduates of these programs are eligible to transfer academic credit to a baccalaureate completion program for RNs. Applicants must meet the entrance requirements of the community college as well as those of the nursing program. Many community college nursing programs require five to six semesters to complete the sequence of study. The curriculum usually includes a total of 65-70 credits with approximately half in the sciences and humanities and half in the nursing major. Graduates of these programs are prepared to provide care to individuals, families, and communities in wellness and illness settings providing comprehensive health services. They are prepared to assume positions of leadership and responsibility in a

variety of practice settings, and to enter graduate school for specialized study after completing their bachelor's degree. Applicants must meet the entrance requirements of the college or university as well as those of the nursing program.

Graduates of the associate degree program may articulate credit toward the baccalaureate degree program. Graduates of the baccalaureate program are prepared for graduate study (master's degree) with a specialization in a variety of nursing disciplines. The baccalaureate program of study usually begins with general education courses concentrated in the humanities, social, and physical sciences. The last two years build upon this broad general education base, offering courses in both nursing theory and clinical practice. Supervised clinical practice occurs in hospitals, clinics, community health agencies, and other health care delivery areas. Professional issues and beginning research techniques are also part of the curriculum.

The road to a career in nursing is demanding regardless of the pathway chosen. All trajectories must first start with the admission process. Once admitted into the nursing program, the student completes a rigorous course of study, nationally-normed assessments, and upon graduation, a culminating licensure examination which is an indication that they are safe, competent practitioners. Much time, effort, and money are expended to reach the expected outcome. To practice in the workforce, the graduate must sit for and pass the National Council Licensure Examination (NCLEX) specific to their entry level.

Graduates from practical nursing programs are prepared to take the National Council Licensure Examination for Practical Nurses (NCLEX-PN). Both associate and baccalaureate levels prepare graduates to take the National Council Licensure Examination for Registered Nurses (NCLEX-RN). If graduates fail these licensure examinations, not only are potential wages lost but nurses are prevented from entering the workforce as well.

In addition to the loss of wages and potential nurses in an era of shortages is the psychological trauma to those who are unsuccessful on the NCLEX. If variables could be identified that predicted success on the licensure examination, early interventions could be instituted to reduce the chances of failure. Thus, a review of and empirical research on existing admission practices, demographics, and curricula employed by nursing programs is needed to assist in determining those variables that predict success.

The Kentucky Community and Technical College System

Although dual credit and advanced placement opportunities are available along the career pathway, in Kentucky, nursing education is almost exclusively at the postsecondary level. The majority of practical nursing programs as well as associate degree nursing programs are managed by the Kentucky Community and Technical College System (KCTCS). KCTCS is a statewide two-year community and technical college system comprised of 16 primary colleges with sixty-eight campuses. The mission of KCTCS, as legislated in the Postsecondary Education Improvement Act of 1997, is to improve the quality of life and employability of the citizens of the Commonwealth by serving as the primary provider of certificate, diploma, technical degree, associate degree, and transfer programs; workforce training to meet the needs of existing and new businesses and industries; remedial and continuing education; short-term, customized training for business and industry; adult education; and associated services (KCTCS, 2010).

KCTCS operates twenty-one registered nursing programs and twenty-eight practical nursing programs statewide. Although four different practical nursing curricula are used within the system, twelve primary colleges (22 practical nursing programs) use the traditional curricula and were a potential sample for this study. Selective admission practices exist for all the practical nursing programs offered at KCTCS colleges.

Selective Admission Guidelines for KCTCS Practical Nursing Programs

Nursing schools are attempting to respond to the current nursing shortage around the country by increasing program admissions. Applicant pools for nursing programs/schools have grown substantially over the past few years. Although there are many applicants, admission to these programs is dependent upon the availability of resources for implementation of quality instruction, and the number of students admitted may be limited by these considerations.

Nursing admission committees strive to admit students who are likely to complete the nursing curriculum successfully and pass the licensure examination. The high cost of academic preparation and the nursing shortage make this selection process even more critical.

While these admission statements seem explicit enough to ensure common understanding and consistent application by the different college programs of nursing, the policy implications are sufficiently vague that there is varying interpretation and practice from one institution to the next. What is needed is information that can help programs of nursing create more effective, data-driven practices to enhance the academic progression of the practical nursing students.

The KCTCS (2005), Rules of the Senate, provides admission guidelines as noted in Table 1.

Table 1

Admission Requirements and Preferences for the KCTCS PN Program

Admission Requirement	Preference Given
Admission to the College	Same
Official HS Transcript/GED	Above Average Standing
Official PS ^a Transcript (if Applicable)	12 or > Credit Hours with GPA 3.0
ACT/Compass Result	ACT/Compass Result
R ACT 16	R ACT 20 or >
R COMP 76	R COMP 84-85
M ACT 16	M ACT 20 or >
M COMP 34	M COMP 64-69
Pre-Admission Conference	Same
Medicaid Nurse Aide course within the past 3 years OR Active Status on KY Nurse Aide Registry	Same

Note. *PS = Postsecondary.

Students must meet admission guidelines and complete an approved curriculum as determined by the practical nursing system curriculum committee. The curriculum is based on the research used to develop the NCLEX-PN examination as well as the standards required of accrediting bodies. Examination of courses taken as related to student outcomes and the effects created by the policy guidelines links program evaluation and

policy analysis (Boland & Boland, 1984). Impact analysis can be best achieved through assessment of records and information of those students who have completed a practical nursing program. This information can be utilized to determine if policies need to be modified or additional policies need to be created. The need to increase the number of competent students who are able to be successful on the NCLEX becomes even more important.

National Council Licensure Examination--Practical Nurse (NCLEX-PN)

Students enter a nursing program with the expectation that when they graduate, they will be prepared to pass the national licensure examination. Of those who successfully complete the rigorous course of studies, there is no guarantee that these same students will pass the licensure examination. According to the Kentucky Board of Nursing (2010), the 2007 average national pass rate for the NCLEX-PN is 87.3 percent. In the escalating nursing shortage, nursing student retention and success (graduation and licensure) is a priority.

Passing the NCLEX-PN is an accepted measure of graduate success across practical nursing programs in the United States because the licensure examination is a requirement for entry into the field of practical nursing (Ostrye, 2000). This test is devised to reflect knowledge, skills, and abilities essential for the entry-level nurse to meet the needs of clients requiring the promotion, maintenance, and restoration of health. To have a student attend nursing school for one year, two years, or four years only to fail the national licensure exam is a problem that confronts every type of nursing program. These failures not only increase the nursing shortage but are also a financial burden to the student and the faculty who have devoted time and resources in education to those who may not become licensed. The Kentucky Board of Nursing addresses this problem by holding schools of

nursing accountable for their students.

The Kentucky Board of Nursing (201 KAR 20.360, 2009) administrative regulations provide accountability guidelines for programs of nursing.

Section 2. Reports and Examination Pass Rates. (1) A program of nursing that prepares graduates for licensure shall meet all standards of 201 KAR 20:260 through 20:360 in order to retain full approval. Approval status shall be determined annually by the board on the basis of the program's annual report, NCLEX examination pass rates for first time test takers, and other pertinent data.

4) A program of nursing shall maintain at least an eighty-five 85 percent annual pass rate for graduates taking the NCLEX-RN or NCLEX-PN for the first time. Pass rates shall be published on a calendar year basis for those graduates who have tested within twelve (12) months of graduation.

(6) If a program of nursing's pass rate for first time test takers is less than eighty-five 85 percent for a calendar year, the program administrator shall submit a self study report that evaluates factors that contributed to the graduates' performance on the NCLEX examination and a description of the corrective measures to be implemented.

Section 3. Factors That May Jeopardize Program Approval Status.

Approval status may change for any of the following reasons:

- (1) Deficiencies in compliance with 201 KAR 20:260 through 20:360;
- (2) Noncompliance with the governing institution or program of nursing's stated philosophy, mission, program design, objectives/outcomes, or policies;
- (3) Continual failure to submit records or reports to the board within the designated time frame;
- (4) Failure to provide sufficient clinical learning opportunities for students to achieve stated objectives/outcomes;
- (5) Failure to comply with requirements of the board or to respond to recommendations of the board within the specified time;
- (6) Failure to maintain the pass rate on the licensure examination for first time test takers as set by Section 2(4) of this administrative regulation;
- (7) Withdrawal of accreditation by a national nursing accrediting body recognized by the United States Department of Education.

Briscoe and Anema (1999) suggest that identifying valid measures to predict success of nursing students on the NCLEX examination has captivated the interest of nursing educators for decades. Identification of valid predictors of academic success and academic risk can enable nursing educators to devise pertinent admission criteria, identify and intervene with students at risk of failing, and provide needed advisement and academic

supports to increase the probability of passing the NCLEX.

The Problem Defined

Empirical studies of registered nursing programs (Anderson, 1993; Felts, 1986; McKinney, Small, O'Dell, & Coonrod, 1988; McKinney, 1989; Sharp, 1984; Whitley & Chadwick, 1986; Woodham & Taube, 1986; Yocum & Scherubel, 1985) have indicated that admission tests and nursing courses as well as exit examinations are predictive of success on the NCLEX-RN. Studies (Krupa, Quick, & Whitney, 1988; Payne & Duffey, 1986) have also indicated that certain courses could predict early difficulties and would indicate that these students had a need for remediation or assistance in order to complete their program of study.

Much of the research concerning predictors of success in nursing has focused on the registered nurse (Alexander & Brophy, 1997; Campbell & Dickson, 1996; Horns, O'Sullivan, & Goodman, 1991). Although very little research is available in the area of predictors of success on NCLEX-PN for practical nursing graduates, in four studies National League for Nursing (NLN) scores and age were significant factors determining success on the NCLEX examination (Meadow, 1964; NLN, 1954; Parrish, 1994; Seither, 1974). Research did not agree that pre-admission tests were significant predictors.

Whereas there have been numerous investigations regarding registered nursing at the baccalaureate and associate degree levels, few empirical studies have been done for practical nursing. With the exception of Leitsch (1988), the literature review found no research related to practical nursing in Kentucky. The ability to identify predictors of success for practical nursing students is a valuable tool to use to understand when introduction of intervention strategies is appropriate. Graduation of qualified persons who can pass the NCLEX-PN is an expected outcome of all practical nursing programs

managed by the Kentucky Community and Technical College. To meet this goal, students at risk for failure need to be identified so that remediation can be obtained. Student counseling concerning review for the NCLEX-PN can also be instituted. Additionally, results of the required exit examination can be used to identify when interventions to facilitate successful NCLEX-PN performance is needed.

Purpose of the Study

This research study addressed the issue of background and curricular variables which predict success on the National Council Licensure Examination for Practical Nurses (NCLEX-PN). The current study provided the opportunity to examine both demographic data and admission criteria as related to the curriculum and exit examinations in KCTCS programs of nursing. This represents the largest number of practical nursing programs in Kentucky since KCTCS operates all but five of the practical nursing programs in the state. The information for this study represents data obtained from the KCTCS database. These data were supplemented by information related to Exit Comprehensive Exam scores and NCLEX-PN results obtained from the practical nursing administrator at each college. The central research question for the study was, “What variables predict success on the licensure examination for practical nurses?”

In addition, not all past studies have addressed the problem through a theoretical framework. This study used Carroll’s (1989) Three Stratum Theory to frame the different types of variables theoretically.

Research Questions

According to Reeves (1997), the framework of Carroll’s Model of School Learning includes student characteristics, instruction, and learning outcomes. The central research question addresses the effects of student characteristics, curriculum, and mediating

variables of the KCTCS practical nursing programs on NCLEX-PN performance (see Figure 1). The following research questions guide this investigation. They represent the relationships suggested by the six numbered arrows in the theoretical model. The dotted arrows indicate indirect influence over control or mediating variables.

1. What are the relationships for Demographic and Admission Requirements on Curriculum?
2. What are the relationships for Demographic and Admission Requirements on Exit Comprehensive Exam?
3. What are the relationships for Demographic and Admission Requirements on NCLEX-PN?
4. What are the relationships for Curriculum variables on Exit Comprehensive Exam?
5. What are the relationships for Curriculum variables on NCLEX-PN?
6. What are the relationships for Exit Comprehensive Exam on NCLEX-PN?
7. What is the predictive value of the Demographic and Admission Requirements, Curriculum variables, and Exit Comprehensive Exam on NCLEX-PN status?

Significance of the Study

There are several contributions of this study to the knowledge base on the factors affecting performance on NCLEX-PN. These factors relate to national issues as well as those specific to Kentucky. First, the Practical Nursing admission guidelines for KCTCS have been in place for less than five years for the cohort of students in this study. These admission guidelines were developed from the experience of administrators who observed the performance of students over the years. No evidence-based research data were available to determine if these variables significantly impacted the student's success in the program or their success on the NCLEX-PN. There have been many recommendations for new admission rules but lacking evidence, many new guidelines/rules have not been

implemented.

Second, the curriculum has changed over time to reflect the current competencies of an entry-level practitioner. Although most nurse administrators can predict success of students taking the NCLEX based on the student's accomplishments throughout the program, no research has been completed that supports these assumptions. Wirt (as cited in Bolland & Bolland, 1984) concludes that policy analysis should be the major thrust of research and training in educational administration. Bolland and Bolland state that "policy analysis is a modeling technique that requires the analyst to project the effectiveness (or other outcome) of each of a variety of potential public programs" (p. 334). Through empirical research on practical nursing programs and the student outcomes achieved, present policies can be validated, modified, or new guidelines created. In addition, nursing courses and curriculum can be revised to reflect the content that is needed for students to be successful on the NCLEX-PN.

Third, the current shortage of nurses has heightened educators' interest in identifying students at risk for failure. Reliable admission and progression criteria are important because limited clinical slots, qualified faculty, and financial resources restrict the enrollment capability. The increased emphasis on outcome criteria in nursing education gives added importance to determining predictors of success. In addition, the high cost of academic preparation and the nursing shortage make this selection process even more critical.

Fourth, literature dealing with predictors of success on the NCLEX-PN is sparse as compared with literature on the NCLEX-RN. Thus, this study will add to that small database.

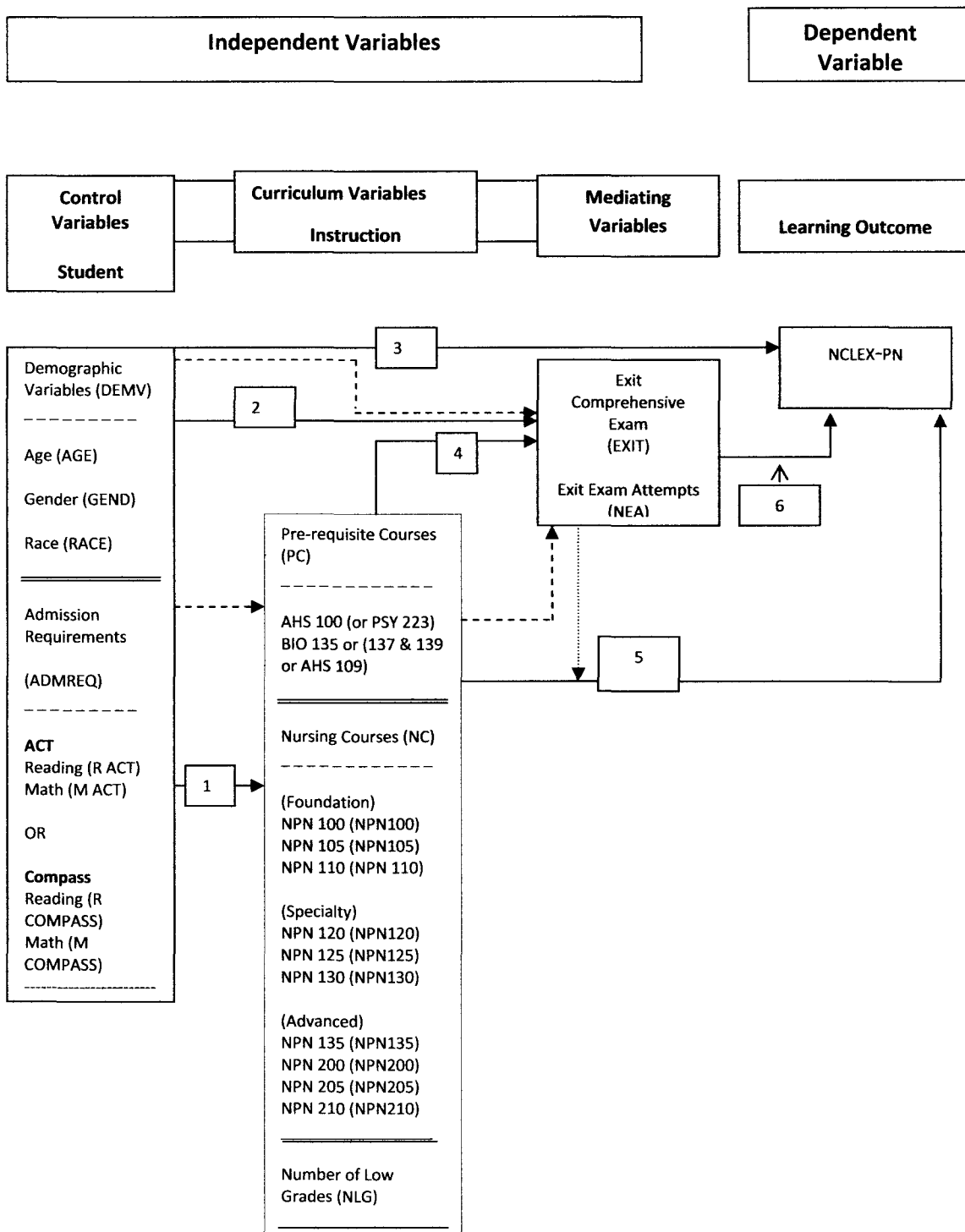


Figure 1. Flowchart depicting hypothesized relationships for independent and dependent variables.

Fifth, this study will add to the knowledge base related to diversity since community colleges are the gateway to postsecondary education for many minority, low income, and first-generation postsecondary education students.

Finally, potential students will also benefit from this study by knowing the achievement level expected of them on pre-requisite courses, the nursing program content, and the NCLEX-PN.

Assumptions and Limitations of the Study

The scope of this study is limited to the students that complete the programs of practical nursing and are eligible to sit for the NCLEX-PN. The study does not include those students who leave the programs prior to graduation.

First, it is assumed that the NCLEX-PN is a valid and reliable measure of performance of those individuals successfully completing the examination, that they will be competent, safe practitioners of nursing, consistent with the National Council of State Boards of Nursing.

Second, the teaching delivery methods and grading are subject to differences of faculty. According to the Southern Association of Colleges and Schools (SACS) Commission on Colleges, faculty are responsible for developing the curriculum but the implementation/delivery of that curriculum is left to the individual faculty member/college (SACS, 2010). This may differ not only in the same college but especially in other colleges offering the same courses and content.

Third, this study reviews the scores that students made on each course required in the program. Collins (2002) says that passing percent rates are used as evidence that the nursing program curriculum either contained, or did not contain, essential information that would ensure nursing graduates a successful entry into the professional nursing practice

arena. However, the test scores in this study are the results of teacher-constructed examinations given in each nursing course at each program of nursing. These exams may differ among the colleges. Although faculty are content experts, these assessments typically lack validity and reliability documentation.

Fourth, exit examinations to measure readiness to sit for the NCLEX-PN differ among the programs. Although all exit examinations claim the ability to predict successful passage on the NCLEX-PN, a common exit examination would provide a better measure for this study.

Fifth, GPA will be recorded as A, B, C for each course, but inconsistency exists between numerical cut off scores to earn A, B, C among colleges.

Sixth, studies of the effect of nursing curriculum on NCLEX performance typically control for race but not socioeconomic status of the student nurses. This study has that same limitation as no measure of this construct is available in the student record files.

Seventh, this study only examines those students who have graduated successfully, have taken the Exit Comprehensive Exam, and completed the NCLEX-PN examination. Students who were unsuccessful in the program are not included in this database.

Eighth, the NCLEX-PN provides a dichotomous result of pass or fail. Scores on each area of the assessment are not provided in the initial report.

Finally, generalizability for this study is limited in two ways. The study pertains to Kentucky; program and policy differences from state to state preclude direct comparisons. This study investigates NCLEX-PN; results are not likely to apply, at least directly, to NCLEX-RN programs.

Summary

Nursing is one of the career opportunities in great demand today due to the

increased need for nursing care, the aging population, and the lack of nurses to fill positions in healthcare institutions. In an attempt to put more nurses into the workforce, schools/programs of nursing are admitting greater numbers of students. The sample for this study is composed of graduates from the practical nursing programs operated by the Kentucky Community and Technical College System who use the traditional curriculum.

Although a selective admission process is used, the attrition rate is high for practical nursing programs. Of those students who successfully complete the program, nationally, only 87.3 percent pass the NCLEX-PN, earning the credential needed to enter the workforce as a safe, competent practitioner. These failures not only increase the nursing shortage but are also a financial burden to the student and the faculty who have devoted time and resources in education to those who may not become licensed. The Kentucky Board of Nursing addresses this problem by holding schools of nursing accountable for their students. If programs/schools of nursing do not maintain an average of 85 percent of its graduates who are successful on the NCLEX, the programs of nursing can lose full accreditation status, lose the ability to admit students, or if not corrected within three years, show cause for continuing the program of nursing.

Much of the research concerning predictors of success in nursing has focused on the registered nurse (Alexander & Brophy, 1997; Campbell & Dickson, 1996; Horns et al, 1991). Although very little research is available in the area of predictors of success on NCLEX-PN for practical nursing graduates, in four studies (Meadow, 1964; NLN, 1954; Parrish, 1994; Seither, 1974), National League for Nursing (NLN) scores and age were significant factors determining success on the NCLEX examination. Studies did not agree that pre-admission tests were significant predictors.

The combination of these factors makes it necessary for a current study to

determine the indicators that predict success on the NCLEX-PN. Are they admission or demographic variables? Are they curricular in nature or possibly the assessment instrument used as an exit examination? The current study represents the largest number of practical nursing programs in Kentucky since KCTCS operates all but five of the practical nursing programs in Kentucky. The research provides the opportunity to examine both demographic data and admission criteria as related to the curriculum and exit examinations in KCTCS programs of nursing. Thus, the central research question for this investigation is, What student characteristics, curricular, and mediating variables predict success on the National Council Licensure Examination for Practical Nurses for students in the Kentucky Community and Technical College System?

Because there are numerous technical terms related to nursing assessments, curriculum, and academic progress employed in this research, a Definition of Terms section is required. However, these definitions are included in Chapter III.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

According to the Bureau of Labor Statistics, U.S. Department of Labor (2010), *Career Guide to Industries, 2010-11 Edition*, healthcare, one of the largest industries in 2008, provided 14.3 million jobs for wage and salary workers. Ten of the 20 fastest growing occupations are healthcare related. Healthcare will generate 3.2 million new wage and salary jobs between 2008 and 2018, more than any other industry, largely in response to rapid growth in the elderly population. Although the registered nurse is the number one occupation, both the registered nurse and the practical nurse are among the top twenty occupations with greatest employment opportunities.

Along with the current fast growing occupational opportunities, a shortage of nurses in Kentucky is projected within the next twenty years due to the “graying of America” and the increased use of healthcare by Kentuckians. The opportunity for a career ladder from practical to registered nurse exists as one method for meeting the workforce needs and the projected nurse shortage. Porter-Wenzlaff and Froman (2008) support this career ladder concept stating that this method would not only address the nationwide nursing shortage, but address concerns for retention, diversity, and career advancement.

The projected nursing shortage compels looking at the present system of educating nurses and determining what elements and strategies are successful and which

strategies should be reevaluated and revised. To gather background information, sections on the projected nursing shortage, the historical perspective of the licensed practical nurse, and the role of the community college in education will be examined. The review then addresses research on success indicators for the National Council Licensure Examination (NCLEX). Literature sources were gleaned from databases such as Medline, ABI/Inform, and ProQuest as well as national nursing literature. Because the literature on practical nurses is less well developed, additional studies related to the registered nurse are included since more studies have been done at the associate and baccalaureate levels. Sections on predicting success on NCLEX for practical nurses and a conceptual framework for the current study follow. The chapter concludes with a summary.

The Nursing Shortage

As previously stated, the United States is in the midst of a nursing shortage that is expected to intensify as baby boomers age and the need for health care grows. Compounding the problem is the fact that nursing colleges and universities across the country are struggling to expand enrollment levels to meet the rising demand for nursing care.

The shortage of registered nurses (RNs) in the U.S. could reach as high as 500,000 by 2025 according to the report, *The Future of the Nursing Workforce in the United States: Data, Trends and Implications*. Buerhaus, Staiger, and Auerbach (2008) found that the demand for RNs is expected to grow by two to three percent each year.

In a statement released in March 2008, The Council on Physician and Nurse Supply, an independent group of health care leaders based at the University of Pennsylvania, has determined that 30,000 additional nurses should be graduated annually to meet the nation's healthcare needs, an expansion of 30 percent over the current number

of nursing graduates.

The latest projections from the U.S. Bureau of Labor Statistics (Dohm & Shniper, 2007) indicate that more than one million new and replacement nurses will be needed by 2016. Government analysts project that more than 587,000 new nursing positions will be created through 2016 (a 23.5% increase), making nursing the nation's top profession in terms of projected job growth.

The American Hospital Association (2007) indicated that U.S. hospitals need approximately 116,000 RNs to fill vacant positions nationwide. This translates into a national RN vacancy rate of 8.1%. The report, *The 2007 State of America's Hospitals-- Taking the Pulse*, also found that 44% of hospital CEOs had more difficulty recruiting RNs in recent years. The *Nursing Management Aging Workforce Survey* (Medical News Today, 2006) found that 55% of surveyed nurses reported their intention to retire between 2011 and 2020.

Recently, the U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA, 2006) released projections that the nation's nursing shortage would grow to more than one million nurses by the year 2020. Analysts demonstrated that all 50 states will experience a shortage of nurses in varying degrees by the year 2015.

Despite a recent strengthening of the registered nurse (RN) workforce, Buerhaus et al. (2008) project the U.S. health care delivery system will be impacted by an aging workforce and increased retirements. "Over the next 20 years, the average age of RNs will increase, and the size of the workforce will plateau as large numbers of RNs retire. Because the demand for RNs is expected to increase steadily during this same period, a large and prolonged shortage of RNs is expected to develop in the latter half of the next decade"

(p.4). Buerhaus continues by stating that this phenomenon threatens the consumer's access to quality health care and also leads to increasing health care costs. The question that must be answered is what can be done to minimize the impact of these shortages.

Demographic Trends and Practical Nurses

The U.S. General Accounting Office (2001) indicated a serious shortage of nurses is expected in the future as demographic pressures influence both supply and demand. The demand for nurses is expected to increase dramatically as the baby boomers reach their 60s and beyond. In addition, according to the report issued by the Nursing Institute at the University of Illinois College of Nursing (as cited by the AACN website), the ratio of potential caregivers to the people most likely to need care, the elderly population, will decrease by 40 percent between 2010 and 2030. Demographic changes may limit access to health care unless the number of nurses and other caregivers grows in proportion to the rising elderly population.

According to the U.S. Department of Labor, Bureau of Labor Statistics (2010), the licensed practical nurse is the primary caregiver in the long term facility which provides care for the elderly and/or infirmed. Employment of LPNs is expected to grow 21 percent between 2008 and 2018, much faster than the average for all occupations, in response to the long-term care needs of an increasing elderly population and the general increase in demand for health care services.

Many procedures once performed only in hospitals are being performed in physicians' offices and in outpatient care centers such as ambulatory surgical and emergency medical centers, largely because of advances in technology. LPNs care for patients who undergo these and other procedures, so employment of LPNs is projected to decline in traditional hospitals, but is projected to grow faster than average in most settings

outside of hospitals. However, some hospitals are assigning a larger share of nursing duties to LPNs, which will temper the employment decline in the industry (U.S. Department of Labor, 2010).

Employment of LPNs is expected to grow much faster than average in home health care services. Home health care agencies will offer a large number of new jobs for LPNs because of an increasing number of older people with functional disabilities, consumer preference for care in the home, and technological advances that make it possible to bring increasingly complex treatments into the home. Employment of LPNs in nursing care facilities is expected to grow faster than average, and provide the most new jobs for LPNs, because of the growing number of people who are aged and disabled and in need of long-term care. In addition, LPNs in nursing care facilities will be needed to care for the increasing number of patients who have been discharged from the hospital but who have not recovered enough to return home (U.S. Department of Labor, 2010).

There are many strategies for increasing the number of nurses. One of the most important is the career pathway which encourages those individuals prepared at the practical nursing level to enter the associate degree or baccalaureate programs. This permits nurses to enter nursing at the level that is most applicable to the life situations of each individual. The Kentucky Nurses Association (2008) passed a resolution to support the nursing career pathway as a means of attaining more baccalaureate nurses in the workforce.

Historical Perspective of Licensed Practical Nurses

Because this study focuses on the practical nurse, the historical perspective of the LPN will be reviewed. Licensed practical nurses (LPNs) are also known as licensed vocational nurses (LVNs) in California and Texas. These individuals usually have eighteen

months to two years of training in anatomy and physiology, medications, and practical patient care. They must pass state/national boards and renew their license periodically. LPNs perform simple as well as complex medical procedures but must operate under the supervision of a registered nurse, dentist, or a physician. They can administer most medications, perform measurements (for example, blood pressure, temperature), keep records, perform CPR, maintain sterile and isolation conditions, and administer basic care. LPNs are often found working under the supervision of physicians in clinics. In long term care facilities, they sometimes supervise nursing assistants and orderlies (U. S. Department of Labor, Bureau of Labor Statistics, 2010). The Bureau of Labor Statistics estimates that there are about 700,000 persons employed as licensed practical nurses and licensed vocational nurses in the U.S.

The first training for practical/vocational nurses (LPN/LVN) was offered in 1892 at the Young Women's Christian Association in New York City. The first official school for LVN/LPN education was established in 1893 at the Ballard School in New York: the program was three months long. The curriculum consisted of homemaking skills, in addition to techniques for caring for the sick. Students were sought who "had a special way with the sick" (Anderson, 2001, p. 17). After the turn of the century, LPN education and licensure became more formalized. The National League for Nursing developed a system for standardization of requirements for the LPN. Not all states passed LPN licensure laws until 1955 (Anderson).

World War II brought with it the need for additional nurses, which focused attention on the contributions of the LPN/LVN. The National Association for Practical Nurse Education and Service (NAPNES) was formed in 1941 and accredited LPN educational programs from 1945-1984. At that time, the NLN established the Council for

Practical Nursing Programs in 1961, which assumed the responsibility for promoting LPN interests within the NLN (Anderson, 2001).

Initially, licensure was granted by waiver based on experience and affidavits from physicians. In 1952, the State Board Test Pool Examination (National) became a requirement for licensure. With licensure required, the period for licensure by waiver was closed (Ostrye, 2000).

Licensed Practical Nurses in Kentucky

In 1957, Vocational Education assumed the operation of Practical Nursing schools in Kentucky as a result of the enactment of Public Law 911 that made federal funds available for practical nursing education. These programs were usually nine to twelve months in length with content which included anatomy and physiology, nutrition, personal vocational relationships, community health, nursing theory, and clinical experience. With waivers no longer an option, graduates were required to take a licensure exam in order to practice. The Kentucky Board of Nursing was the regulatory agency responsible for pre-licensure education and approval of each program. For many years, state sponsored programs were the only institutions that taught practical nursing. In the 60's two other private schools were opened that provided educational programs for the practical nurse (R. Forrest, personal communication, August 10, 2010).

The scope of practice for the practical nurse in Kentucky has evolved over the years. In 1994, intravenous procedures were added to the curriculum of practical nursing programs. In the late 1990's the scope of practice expanded again which permitted the practical nurse to give selected intravenous medications. Although Kentucky permits this advanced practice, not all states include this in their Nurse Practice Act.

With the passage of the Postsecondary Improvement Act of 1997, the state

sponsored practical nursing programs previously managed by the Department for Technical Education came under the management of the newly formed Kentucky Community and Technical College System (KCTCS). KCTCS manages 28 of the 34 practical nursing programs in Kentucky preparing 664 of the 1128 graduates in 2008 (Kentucky Board of Nursing, 2009).

The Kentucky Community and Technical College System manages not only 28 practical nursing programs but also 21 programs at the associate degree level, creating the perfect environment for a nursing career pathway. Students may enter the associate degree or practical nursing program and advance to the level chosen by the student. A bridge course permits the practical nursing graduate to enter the registered nursing program with advanced placement. The graduate of the associate degree program may then enter the baccalaureate program with advanced placement. Because the community college is so important in nursing education, a review of its role can lead to a better understanding of the mission and demographics of its students.

The Role of the Community College in Nursing Education

Community colleges are a vital part of the postsecondary education delivery system. They serve almost half of the undergraduate students in the United States, providing open access to postsecondary education, preparing students for transfer to 4-year institutions, providing workforce development and skills training, and offering noncredit programs ranging from English as a second language to skills retraining to community enrichment programs or cultural activities (American Association of Community Colleges [AACC], 2009).

Community colleges served more than 6.5 million credit students in the fall of 2005. The comprehensive mission of community colleges makes them attractive to a broad

range of people who seek particular programs or opportunities of special interest.

Community colleges are the gateway to postsecondary education for many minority, low income, and first-generation postsecondary education students. Since 1985, more than half of all community college students have been women. In addition, the majority of Black and Hispanic undergraduate students in this country study at these colleges (AACC, 2009).

Community colleges also provide access to education for many nontraditional students who are adults, working while enrolled. The average age of a community college student is 29 years old, and two thirds of community college students attend part-time. At the same time, community colleges are not only providing access for adult students but also serving an increasing number of traditional aged and high school students who take specific courses to get ahead in their studies. In fact, half of the students who receive a baccalaureate degree attend community college in the course of their undergraduate studies. Fifty nine percent of new nurses and the majority of other new health-care workers are educated at community colleges (AACC, 2009).

Characteristics Predicting Success in Registered Nursing Education

There are two levels of registered nurse education, the associate degree and the baccalaureate degree. There are research studies for both the baccalaureate degree (BSN) and the associate degree (ADN). Although the educational levels are different, both levels take the same licensure examination (NCLEX-RN).

Baccalaureate Studies

Sharp (1984) investigated 572 students at the University of Tennessee, Knoxville, College of Nursing, to determine whether high school GPA, school of nursing GPA, and ACT standard scores were predictors of performance on the State Board Test Pool Examination (SBTPE). It was concluded that the selected variables were statistically

related to SBTPE performance, but the positive correlation coefficients were not quite as high as would be desirable for good predictive confidence. Also, it was concluded that the higher an individual's set of GPA, NSC, and MA achievement, the higher that individual's scores are likely to be on the SBTPE.

In a retrospective study of 139 graduates from the University of Illinois, student performance (GPA) was examined prior to and following admission to a BSN program to determine if these variables were predictive of State Board results (Yocum & Scherubel, 1985). The variables of preadmission liberal arts GPA, preadmission cumulative GPA, and Psychiatric Nursing Exam were predictors of success on the State Board Exam. Cumulative clinical nursing theory GPAs were more highly correlated with State Board Exam performance than were the cumulative clinical nursing practicum GPAs.

Whitley and Chadwick (1986) investigated why one-third of the 1083 Northwestern BSN graduates failed the NCLEX-RN. Data were analyzed for correlational and causal relationships using regression analysis and tests of statistical inference. The results indicated that graduates who entered the program with low SAT scores, low cumulative and science GPAs, those who scored below the class mean on the school of nursing exam, and those who allowed their cumulative GPA to drift downward while in the school of nursing were at significantly high risk of failing NCLEX-RN.

Payne and Duffey (1986) performed a retrospective study of 283 students at the University of North Carolina to determine whether graduates of a BSN program who failed or were within a chance level of failure on the NCLEX-RN could have been identified as "risk" students during their undergraduate nursing program from data that were routinely collected. Using regression analysis as the statistical method, it was found that by the midpoint of the junior year, the student at risk of failing the NCLEX could have been

identified. Identification of the high-risk student at this level would permit interventions to be instituted prior to graduation and the possible failure of the NCLEX-RN.

Krupa, Quick, and Whitney (1988) conducted a study to determine whether grades in nursing courses required of all students could predict NCLEX-RN performance. The sample consisted of 384 BSN nursing students. Discriminant analysis revealed that graduates who passed the NCLEX-RN on the initial attempt did differ with respect to grades in nursing courses, from graduates who failed. Grades in an introductory nursing course taken during the sophomore year and in a medical-surgical course taken during the junior year were substantially and directly related to NCLEX-RN performance. Grades in the practicum courses were relatively poor predictors of NCLEX-RN performance. A classification procedure permitted correct classification of the performance of 74.9 per cent of the sample. These results indicate that grades in nursing courses can be used to predict NCLEX-RN performance.

In a study of 164 graduates of a BSN program at Eastern Michigan University, Friedemann and Valentine (1988) investigated age and nursing course GPAs in relation to passage of the NCLEX-RN using Anova and Stepwise Multiple Regression. It was found that older students performed better on the NCLEX-RN than younger students (18-21). A significant relationship was shown between all licensure exam scores and nursing course grades.

A study of 136 BSN students was performed to identify those students needing additional assistance to complete the NCLEX-RN successfully (McKinney, Small, O'Dell, & Coonrod, 1988). The variables were SAT scores, GPA (cumulative, pre-nursing, nursing theory, and clinical), Mosby Assess Test scores, and NCLEX-RN performance. There was little evidence that age, sex, and Type A personalities were predictive of nursing abilities.

Using multiple regression and Pearson product moment correlation analysis, pre-entrance test scores, GPA, Mosby Assess Test scores, and courses repeated were found to be significant predictors of NCLEX-RN success. This study concluded that educators should identify students who were at risk of failure on the NCLEX-RN and assist those students in difficulty.

McKinney (1989) investigated whether any of the pre-admission variables (HS GPA, SAT scores), matriculation variables (including the GPA from the courses in the humanities, math and natural sciences, the social sciences, nursing courses, and the Assess Test score) were singularly or in combination predictive of NCLEX-RN success. McKinney also sought to identify the point or points in time when students at risk for failure could be accurately identified. A significant positive relationship between the Assess Test score and the NCLEX-RN was demonstrated at $p < 0.05$. Assess Test score, social sciences, senior, and nursing GPA accounted for 53 percent of the variance in NCLEX-RN outcomes for the students who passed and failed.

Adams (1990) investigated the relationship between locus of control and achievement motivation in successful performance on the NCLEX-RN. The college cumulative grade-point average ranked as the best predictor for success followed by the cognate grade-point-average. In regards to the strength of the predictor variables for NCLEX-RN performance, the ACT was the most significant variable followed by the cognate grade-point-average and the cumulative college grade-point-average.

In a retrospective study, Schaal (1990) examined cognitive and non-cognitive variables as predictors of academic achievement and their relationship to the performance of graduates of a baccalaureate nursing program on the NCLEX-RN and developed an equation which could predict performance of the baccalaureate graduate on the NCLEX-

RN. With a sample of 171 baccalaureate nursing graduates, forty cognitive and non-cognitive variables were analyzed using Pearson Product-Moment Correlations and Discriminant Analysis for predictive value. The highest correlation coefficients were for GPA at the time of graduation (.5684) and nursing major GPA (.5547). With the exception of high school GPA and gender, all correlations were significant beyond the 0.05 level. Four variables that contributed significantly to the discrimination between those subjects who passed the NCLEX and those that failed were SAT combined score, nursing major GPA, type of secondary education diploma earned, and gender. A multivariate equation was developed which accurately predicted from 79.41% to 83.81% of the subjects' performance on the NCLEX-RN.

Pre-admission grade point average, gender, age, race, selected nursing clinical course GPA, NLN assessment test, and graduate GPA were variables in a study of 408 baccalaureate nursing students to predict successful passage of the NCLEX-RN (Horns, O'Sullivan, & Goodman, 1991). In NCLEX-RN scores, 67% of the variance was accounted for by admission GPA and rate (33%), one 2nd year grade (an additional 14%), the 3rd year adult health grade (an additional 11%), one 4th year theory grade, and the NLN comprehensive exam (an additional 9%). The results suggest that preadmission and sophomore year GPAs were predictors of NCLEX-RN success. These factors could be used to design early interventions for students performing poorly and at risk of failing NCLEX-RN.

Foti and DeYoung (1991) found that Pearson correlations indicated the Mosby Assess Test, overall GPA, GPA in the major, NLN Achievement Test, and SAT verbal were of moderate predictive value of success on the NCLEX-RN in 298 students at a state-supported bachelor's degree nursing program. Multiple regression analysis indicated that

the most useful combination of predictors was the Mosby Assess Test, SAT verbal, and overall GPA.

In a study by Webster (1991) of 62 graduates in a predominately black university baccalaureate nursing program, it was found that traditional academic variables such as SAT-V score, reading level, and pre-nursing GPA and traditional demographic variables such as age, marital status, prior educational experience, and the need to repeat nursing courses did not significantly differentiate successful performance on the NCLEX-RN. The data were analyzed using the *t* Test, frequency distribution, and content analysis. The study did find that students who complete general studies requirements prior to admission to the nursing major tend to be more successful in terms of performance on the NCLEX-RN than those who do not. The SAT-M mean score of graduates who passed the NCLEX-RN tended to be significantly higher than those of graduates who did not pass the NCLEX-RN.

A retrospective prediction study of 192 baccalaureate graduates conducted by Fowles (1992) using multiple regression techniques indicated that NCLEX-RN success could be predicted by GPA at the end of Level 1 in nursing, the ACT composite and social science subscale scores, Anatomy and Physiology I grade, and the percent correct on the Mosby Assess Test.

Mills, Becker, Sampel, and Pohlman (1992) in a study of 328 first-time nurse candidates for the NCLEX-RN found that the use of admission criteria was the poorest model in predicting performance on the NCLEX-RN. Using stepwise logistic regression, a series of four models were tested to determine the probability of passing the NCLEX-RN as a function of statistically significant predictors. Cumulative GPAs suggested that the end of the sophomore year was the best time for predicting success and the end of the junior year was best for predicting failure. Using cumulative nursing GPAs, the likelihood

of predicting success on NCLEX-RN increased at the end of each academic year.

In a study composed of 1069 baccalaureate nursing students, McClelland, Yang, and Glick (1992) utilized the statistical technique of Pearson Product-Moment Correlation Coefficients and found that all predictors had statistically significant relationships ($p < .001$) with NCLEX-RN scores. Although ACT composite scores ($r = .48$) were most predictive of performance on the NCLEX-RN, grades in pre-nursing were most predictive of performance in the nursing major (N-GPA).

Using a methodological design that incorporated discriminant analysis, factor analysis, and a four stage variable selection process, employed prior to the stepwise procedure, Rami's (1992) study of 216 Black graduates of three BSN programs located in Louisiana found the best predictors of success for minority BSN nursing students were the Mosby Assess Test, school comprehensive exit exams, GPA microbiology, the college cumulative GPA, nursing course cumulative GPA, and ACT composite.

Heupel (1994) examined 152 basic students who completed the baccalaureate-nursing program between 1985 and 1987 at a large mid-western university. Data were analyzed using multiple regression analysis to determine the strongest combination of variables predicting NCLEX-RN success. Pearson's Product Moment Correlation Coefficients were computed between interval level criterion and predictor variables. Results of this study indicated that selected nursing theory courses and the junior-year-grade-point-average could be used in a statistical model to predict pass or fail on the NCLEX-RN.

Alexander and Brophy (1997) in a five year study of 188 graduates' performance on NCLEX-RN found the strongest indicators of success were SAT verbal score, nursing grade point average, and NLN Comprehensive Achievement Test scores. In addition,

logistic regression analyses identified three nursing courses in combination with the NLN comprehensive Achievement Test score as a strong model for prediction. Even though pass/fail data limit statistical analyses, the predictor variables were strong at $p < .001$.

A descriptive correlation research design study by Arathuzik and Abner (1998) of 79 generic baccalaureate senior students found significant, although low, relationships between success on the NCLEX-RN and cumulative undergraduate nursing program grade point average ($r = .275$), English as the primary language spoken at home ($r = .253$), lack of family responsibilities or demand ($r = -.293$), lack of emotional distress ($r = -.240$), and sense of competency in taking tests that require critical evaluation and thinking ($r = .245$).

Roncoli, Lisanti, and Falcone (2000) compared a stratified random sampling from four graduating classes of 19 graduates who passed the NCLEX-RN with 19 students for whom no record of passing was available; investigators found no differences in age or types of programs in which students were enrolled. There was a significant difference in the GPA of students in the two groups. Students with As and Bs in science prerequisites and upper division nursing courses were significantly more likely to have evidence of passing the NCLEX-RN than students who achieved C grades or below or repeated courses.

Race and gender were found to be predictive variables in a study conducted by Haas, Nugent, and Rule (2004). The nursing program is an upper-division program, with students being admitted after completing two years of general education courses and supporting pre-nursing courses. The sample consisted of 368 students who graduated from the program between the years of 1991 and 2001. The sample was predominantly composed of Caucasian women, who were between the ages of 22 and 50 at the time of graduation. The study included variables of gender, race, age, nursing cumulative GPA,

transfer undergraduate GPA, cumulative undergraduate GPA, verbal and quantitative SAT scores. Results found that African American students and men were at greater risk for failing the NCLEX-RN ($p = 0.56$, Fisher's exact test, two sided). There were no other significant pairwise comparisons.

Harris (2006) investigated whether a statistically significant difference existed between success on the NCLEX-RN, admission grade point average, and cumulative graduating grade point average of baccalaureate nursing students. Other variables were the impact of having to repeat science courses and the relationship among the selected demographic variables such as age, gender, marital status, and ethnicity. Harris found that older nursing students were 1.19 times more likely to pass the NCLEX-RN; Caucasian nursing students were 0.48 times more likely to pass. No statistically significant differences were found between gender or marital status and success on the NCLEX-RN.

Horton (2006), in a study of 351 students who attended a baccalaureate program in the Midwest, used variables for demographics, pre-nursing science course grades, grades in junior and senior nursing courses, and GPAs calculated at specific points in the educational process to identify predictors of academic success. Neither demographic variables, nor pre-nursing science course grades, nor the number of C grades earned in nursing courses were predictive of graduation or of passing NCLEX. While GPA was statistically significant of graduation or of passing NCLEX as an individual variable ($p < .001$, although a weak predictor, $R^2 = .08$), once the student completed the junior year courses, the admission GPA was not statistically significant.

Vandenhouten (2008) in a study of 296 baccalaureate graduates using the statistical technique of logistic regression found that a series of variables--older age on admission, higher ACT comprehensive scores, course grades in Pharmacology, Adult Medical

Surgical I, Community Health Nursing: Family Focused Care, and Community Health Nursing: Population Focused Care--were able to predict success on the NCLEX-RN examination. In addition, the Assessment Technologies Institute's Comprehensive Assessment and Review Program (ATI CARP) scores for Fundamentals, Maternal newborn, Medical Surgical, Leadership, Community Health, and Pharmacology were able to predict NCLEX-RN success as well. The end-of-program variables, ATI RN Comprehensive Predictor exam results and cumulative GPA also were predictive of NCLEX-RN success. Regression models were less effective at predicting NCLEX-RN failure. The age on admission, course grades for Pharmacology, Adult Medical Surgical I, and Community Health Nursing: Population Focused Care were able to predict NCLEX-RN failure to a significant degree. Findings provide preliminary evidence that the ATI CARP, course grades, and age on admission may predict NCLEX-RN success, and to a lesser degree failure.

Associate Degree Studies

The associate degree nurse is the predominant form of educational preparation for registered nurses in the United States. Associate degree programs educate about 45 percent of new RNs. According to a U.S. Department of Health and Human Services study, in 2008 about 1.4 million RNs received their initial nursing education at community colleges, compared to about 1 million who received a bachelor's degree or higher. The report also noted that 32 percent of RNs with associate degrees eventually received their baccalaureate which supports the career pathway approach to nursing practice. Research related to associate degree predictors of success on the NCLEX-RN follow.

Age was found to be a predictive variable in State Board passage rates in the research study undertaken by Aldag and Rose (1983). The relationships between age and

American College Testing (ACT) scores to college grade point average and State Board scores were studied. The sample consisted of 787 persons admitted by two different procedures to an ADN program over a ten-year period. The first group was composed of 555 traditional admissions, who initially met the admission criteria and the second group was composed of 232 nontraditional admissions who were admitted after completing 18 semester hours in a prescribed program of study with a GPA of 2.00. The nominal data were analyzed with the Crosstab program and the interval data with the ANOVA and Pearson programs. The level of confidence was selected as $p < .01$, since the number of calculations and the sample were large. The proportion of older students who graduated and passed the State Board examination was significantly higher than the proportion of younger students, $\chi^2(2) = 35.22, p < .01$. The two admission procedures resulted in similar rates for graduation and State Board passage, $\chi^2(3) = 16.86, p < .01$. Age and ACT scores were not correlated with the GPA. Age and ACT scores, with the exception of mathematics, were positively correlated with the State Board scores ($p < .010$).

Felts (1986), in an ex post facto study of five, uni-level NLN-accredited ADN programs consisting of 297 subjects, used Discriminate Analysis and chi-square ($p < .001$) to examine variables of admission criteria, GPAs in nursing courses, and age to determine if they were predictive of NCLEX-RN results. Felts found that ACT scores and GPA in college courses were predictors of pass/fail on the NCLEX-RN. Nursing course GPAs in relation to NCLEX-RN were not identified. Age was found not to be a factor.

Using multivariate regression, admission criteria and GPA of nursing courses were investigated as predictors of NCLEX-RN performance in a study of 104 graduates of an ADN program (Woodham & Taube, 1986). A significant positive relationship at $p < .01$ with passage of the NCLEX-RN was individually demonstrated with all of the seven ADN

nursing courses and with SAT verbal scores. The predicted scores correlated strongly ($n = .78551, p < .001$). Not significant were the age at graduation from the program, high school class rank percentile, and SAT math scores.

A study to provide a description of the results of overall performance and performances in the nine test plan content areas of the NCLEX-RN of 259 Ohio-educated, first-time candidates who failed the examination in February or July 1990 was conducted (Byers, 1991). Additionally, relationships were investigated between the student variables (age, race, and exit grade point average) and the nursing program (associate degree, diploma, or baccalaureate degree), financial support of nursing program, and previous nursing experience. Sixty hypotheses were tested at the 0.05 probability level using chi-squares and Pearson Product Moment Correlation Coefficients. The poorest performances for the majority of students occurred in the content areas of nursing process-analysis and the client needs category of safe, effective care environment. Type of program was found to be related to performances in the content entrance criteria and institutional effects. Among the student variables, previous nursing experience was found to be related to performances in the content areas of nursing process-Implementation and category of client needs-physiological integrity. Age was found to be related to performance in the client needs category of health/promotion maintenance. Race was found to be related to performance in the content area of nursing process/evaluation. Exit GPA was found to be related to overall performance on NCLEX-RN, but not significantly for any of the nine test plan content areas.

Stright (1992) in a study of 205 associate degree nurse graduates found that transfer status and grade point average at the end of the second semester appeared to have strong predictive value in both the chi-square and logistic regression model. However, when taken

as a set, none of the variables were able to produce a statistically significant equation. Interestingly, proportionately more licensed practical nurses passed the NCLEX-RN than did entering freshmen or transfer students. In contrast, proportionately more transfer students failed the examination than did either of the other groups.

Using logistic regression to analyze the relationship between the independent variables and the dichotomous dependent variable (NCLEX-RN), Anderson's (1993) study of 156 graduates of four ADN nursing programs found that the National League for Nursing Test (NLN) performance and GPAs for grades earned in nursing courses during semester one (N1) when considered together contributed 93 percent of the time in correctly predicting the performance on the NCLEX-RN examination.

Briscoe and Anema (1999) examined six academic and non-academic variables in 38-associate degree nursing graduates to determine if these variables could predict success or failure on the NCLEX-RN. There was no significant difference between GPA and failing a nursing course and the ability to pass the NCLEX-RN. There were significant relationships between National League for Nursing Exam I (NLN I), National League for Nursing Exam II (NLN II), age, and race and the ability to pass the NCLEX-RN.

In data collected from the educational records of sixty eight associate degree graduates, Sayles, Shelton, and Powell (2003) found that composite scores on the nursing entrance test scores (NET) ($r = 0.405, p \leq 0.001$) and Pre-RN ($r = 0.352, p \leq 0.003$) were statistically significant and were useful in predicting success on the NCLEX-RN. Consistent with the literature, this correlational study found that standardized measures and educational records may be useful screening tools for admission to nursing school and to predict success in the nursing program and the NCLEX-RN.

In a study that examined composite ACT scores as well as math, reading, English,

and science ACT sub-scores, anatomy and physiology grades, and cumulative GPA, results of an analysis of variance and logistic regression showed that all the independent variables in combination were predictors of success in the nursing program. The ACT English sub-score was statistically significant ($p < .001$) as a predictor of success in the nursing program of study. The variable of nursing GPA was the only independent predictor of NCLEX-RN success. The remaining variables showed no predictive values for predicting NCLEX-RN success (Gilmore, 2006).

In a study of 404 students enrolled in a Midwestern associate degree nursing program between 1998 and 2005, Muecke (2008) examined the relationship between selected pre- and post-admission criteria and two measures of academic success: successful completion of an associate degree registered nursing program (ADN) and first-attempt success on the National Council Licensing Examination for Registered Nurses (NCLEX-RN). Linear regression results revealed several pre- and post-admission predictors of final grade point average. Logistic regression results revealed previous college grade point average and grade in the second semester nursing theory course along with graduating class and new ACT composite were statistically significant predictors of first-attempt NCLEX-RN success. ANOVA results, including Bonferroni and Tamhane post-hoc tests, indicated several significant differences among the three groups of students.

Tipton, Pulliam, Beckworth, Illich, Griffin, and Tibbitt (2008) collected and analyzed data from four years of classes that included 385 associate degree nursing graduates. Group I consisted of 328 passing the NCLEX-RN on the first attempt and Group 2 consisted of 57 failing the NCLEX-RN on the first attempt. Specific areas examined were cumulative nursing course grades, nursing entrance test scores (NET), test taking characteristics, and stress. Participants who were successful on the NCLEX-RN had

very similar but statistically significant higher cumulative nursing course grades in comparison to those who failed the NCLEX-RN. An Independent Sample *t* Test (equal variances not assumed) revealed that there was a significant difference in average nurse course grade between the two groups. Variables that were not associated with student success included NET scores, type of test taker, and types of stress.

In a study of 298 graduates of an associate degree nursing program in the Southeastern United States, men did better than women which is a reversal of the usual findings; blacks had the highest failure rates, followed by Hispanics; older students were more likely to pass the exam than younger students; and students who passed the exam started and completed the nursing program with a higher grade point average, compared to those who failed the exam (Yates, 2007).

Characteristics Predicting Success in Practical Nursing Education

Predictors of success identified in previous studies of professional nursing students may not, however, be generalizable to practical/vocational nursing students because of differences in academic preparation, permissible practice on the job, and separate licensing examinations that test different domains of nursing practice (Ostrye, 2000). Therefore, it is essential that practical nursing studies and the characteristics that can predict success on the NCLEX-PN be reviewed.

The National League of Nursing (1954) undertook a study of 87 practical nursing schools in 1951. A total of 613 students were accepted. The study was to determine the extent to which the National League of Nursing Education (NLNE) selection tests for students and certain other personal characteristics were related to performance in the nursing program as well as to qualify for a license to practice. The results showed a positive relationship between scores earned on the NLNE preadmission and classification

examination and scores on the practical nurse assessment scores and results earned on the licensing exam. The higher preadmission and classification scores were, the more likely it was that the student would complete the course.

Meadow (1964) investigated a variety of selection techniques and their effectiveness in predicting academic success and on the job success of a selected group of 214 students in a school of practical nursing. An attempt was made to determine whether there were verifiable characteristics that distinguished the successful nursing candidate from the one who failed, and whether these characteristics can be identified in advance. The major finding in this research project was that a combination of predictor variables were found that could predict fairly accurately theory grade, achievement tests, and State Board Exam scores. The most important predictor was the composite score of the NLN pre-admission and classification test.

Seither (1974) investigated the predictive validity of selected admission screening measures involving 117 practical nursing students. Specifically, the California Short-Form Test of Mental Maturity, the California Reading Test, the California Test of Personality, and the age of the entrant were investigated. The results found that age had a positive relationship to success in practical nursing as measured by final theory grades, NLN achievement scores, licensure exam scores, and student's clinical performance. Reading comprehension predicted most of the remaining variance.

Leitsch (1988) attempted to identify factors that predict success in practical nursing programs and to identify academically deficient students. Level of educational attainment as measured by completion of high school or General Educational Development (GED) program or college courses were not found to be a useful predictor of success in LPN programs. The ability of gender to predict success was limited. Although the study found

age to be correlated with passage or failure of the LPN Exit Competency Test, overall age was not a good predictor of success in LPN programs. Race also was not a predictor of success. Tests of Adult Basic Education (TABE) reading scores accounted for the largest percentage of variance in each of the criterion variables in both single and multiple regression analysis. The R^2 was 0.0740 for the variance in passage or failure of the LPN Assessment Test (AT) accounted for by TABE reading scores. TABE mathematics scores accounted for only a small percent of the variance ($R^2 = 0.0151$).

Swift's (1989) study of 1,254 practical nursing students in 12 postsecondary schools in Georgia demonstrated no significant difference between rates of program completion for either high school graduates or GED recipients. However, GED recipients had significantly higher cumulative grade point averages as compared to high school graduates. Whereas age exhibited no significant relationship to the performance in terms of GPA and NCLEX results, race was found to be a factor in that African American students tended to have lower passage rates in comparison to the performance of Caucasian students on the NCLEX-PN.

Success is predominantly defined in the practical nursing research literature as passing on the NCLEX-PN examination. Thompson (1989) found SAT verbal, Career Placement Program Reading Test, race, and age to be predictors of success for the practical nursing licensure examination. Some of these findings were contradictory to results reported in later studies. The sample consisted of 248 practical nursing students across the state of Georgia who graduated in 1987 and wrote the licensing examination. Independent variables included Test of Adult Basic Education scores; three sub-test scores of the Career Planning Program Test (reading, numerical skills, and language skills); SAT; ACT; high school grade point average; age; and race. Sub-scores of each admission test were used as

predictor variables in stepwise multiple regression analyses and analysis of variance was used to analyze the effect of age on licensure success/failure. The mean age for the subjects who failed the nursing examination was 24.55, while the mean age for the subjects who passed the examination was 27.82. Caucasians were more likely to have passing scores as compared to minorities, and the researcher also found a significant, positive relationship between SAT verbal scores and nursing licensure scores as well as between Career Program Reading Test scores and nursing licensure scores. Chi-square analysis found suburban programs to have significantly better passage rates as compared to the passage rates of programs located in urban or rural areas.

Selected variables that might affect attrition in practical nursing programs and success on the NCLEX-PN in Alabama were examined (Parrish, 1994). Variables found to have a relationship to program outcome were age and race. The youngest age group (17 – 24) and nonwhite students were found to have a lower than expected success rate in LPN programs.

Demographic characteristics and academic variables of graduates from an urban practical nursing program were studied by Young-Richardson (1996) to assess the extent that these characteristics could predict students' performance on the NCLEX-PN. The sample consisted of 261 practical nursing graduates who wrote the licensure examination between 1982 and 1987. The seven demographic independent variables included: gender, age, high school graduate or GED, prior nursing experience, employment status while enrolled, marital status, and number of children under age sixteen. Practical Nursing Entrance Examination (PNEE) scores, National League of Nursing Achievement Test scores, grade point average at end of pre-clinical experience, and grade point average at program completion were the academic variables studied. The researcher chose multiple

linear regression to analyze the data. The results of the study indicated that students with minor children under age sixteen in the students' families had higher NCLEX-PN scores, and this variable accounted for six percent of the variance in NCLEX-PN; demographic variables as a set were not predictors of success on the NCLEX-PN; and 69 percent of the variance in NCLEX-PN performance is explained by scores on four NLN Achievement Tests scores and by scores on the PNEE.

Snook (1997) studied eight classes of practical nurses over the years 1990 to 1995 for the purpose of identifying predictors of program completion and cumulative grade point average among low-income practical nursing students. The sample consisted of 391 students of whom 146 were identified as low-income based on Federal Pell Grant eligibility. Both groups were studied separately. Data analysis included description of both low-income and non-low income groups on demographic characteristics of age, gender, marital status, full or part-time student, high school or GED, post high school education, and years of previous employment; Psychological Services Bureau (PSB) aptitude test scores; program completion; and final grade point average. Both the *t* test and chi-square test were applied to determine similarities and differences in the two groups. Predictive formulas were also developed from a step-wise multiple regression analysis. The researcher found that among the low-income group, married students were more likely to graduate than single students. Regarding final grade point average, scoring high on the PSB verbal subtest had a positive correlation with final grade point average for both low income and non-low income groups, and the variables part-time and married increased the likelihood of a student receiving a higher final grade point average.

Predicting program completion and NCLEX-PN success for remedial and non-remedial practical nursing students was the focus of the research conducted by Hawsey

(1997). Chi-square tests and logistic regression were used to analyze the following independent variables: age, gender, race, method of high school completion, receipt of need-based financial aid, participation in remedial coursework, cumulative nursing grade point average, number of nursing courses failed, and ACT-ASSET placement scores in reading, language, and numerical skills. The findings demonstrated that passing the NCLEX-PN on the first attempt was influenced by reading ability (measured by ACT-ASSET® placement examination scores), race, and cumulative nursing GPA. Program completion was influenced by age, as older students were less likely to graduate than younger students, and number of nursing courses failed. As the number of nursing courses failed increased, the likelihood of graduation decreased. The study results demonstrated no statistically significant relationship between the ASSET subtests in writing and numerical skills and first time NCLEX-PN licensure. Of particular significance to this study is that Hawsey found no difference between program completion rates of students who had undergone remediation prior to starting the nursing program compared to those who had not participated in prior remediation. This finding suggests remediation programs are successful in preparing students with academic deficiencies for the demands of a practical nursing curriculum.

Ostrye (2000) using a quantitative research design analyzed the impact of certain demographic characteristics (age, race, method of high school completion, and needs-based financial aid recipient), pre-admission variables (five Psychological Services Bureau, Inc. (PSB) Health Occupation Examination sub-scale scores, type of remedial basic skill courses taken, and repetition of remedial basic skill courses), and programmatic variables (course grade in PNU 127: Care of the Adult I and cumulative GPA at program completion) as predictors of success on the NCLEX-PN licensure examination. In addition,

this study explored whether differences in licensure rates existed among Ivy Tech State College's 16 practical nursing programs included in the study (in Indiana). The NCLEX-PN results and academic records of 114 practical nursing students were examined using forward inclusion logistic regression procedures. The results indicated the three variables of cumulative nursing grade point average, PSB-science score, and basic skill (remedial) reading was statistically significant predictors of NCLEX-PN performance. Cumulative nursing grade point average and PSB-science score increased the likelihood of passing the licensure examination on the first attempt, while taking remedial reading decreased the likelihood of obtaining a pass score. Results of a chi-square analysis indicated there was a statistically significant difference between NCLEX-PN licensure rates among Ivy Tech State College's 16 practical nursing programs when comparing the combined smaller nursing programs to each of the larger programs.

Boudreaux (2006) found that U.S. educated students were more likely to drop out or fail the practical nursing program; however, those graduating were more likely to pass the NCLEX-PN. A foreign high school education, preadmission Writing skills, and GPA contributed significantly to prediction of completion of the nursing program. A U.S. high school education, male gender, and preadmission Reading and Writing skill level contributed to success in predicting results of the NCLEX-PN for program graduates.

The population for the Hereford (2005) study consisted of 239 students who graduated from the licensed vocational nursing program at Kingwood College during a four-year period, from the nine classes beginning January 1997 through January 2001. This retrospective study utilized archival data collected from academic records. Chi-square analysis suggested statistical significance between six of the independent variables studied and the single dependent variable of successfully passing the NCLEX-PN on the first

attempt (p values ranging from $< .05$ to $< .01$). The six independent variables that demonstrated statistical significance were ethnicity, method of high school completion, pre-nursing grade point average, reading assessment score on the Texas Academic Skills Program (TASP) Test, developmental reading coursework, and developmental writing coursework. Additional analysis through logistic regression suggested that the independent variables of ethnicity, method of high school completion, pre-nursing grade point average, and reading assessment score on the TASP Test were the best combination of predictive measures for passing the NCLEX-PN on the first attempt.

Conceptual Framework

Carroll (1963, 1989) has synthesized much of the research on learning theory into his model of school learning. According to this model, there are five elements that contribute to the effectiveness of instruction:

1. *Aptitude* refers to the students' general abilities to learn.
2. *Ability to understand instruction* refers to the students' knowledge of prerequisite skills and information needed to understand a unit of instruction.
3. *Perseverance* refers to the amount of time students are willing to spend actively participating in the learning process.
4. *Opportunity* refers to the amount of time available for learning. It could include homework time as well as time in class.
5. *Quality of instruction* refers to the effectiveness with which the unit of instruction is actually delivered.

Carroll combined these elements into a model focusing on time as the key determinant in learning. The five elements described above contribute to either time needed to learn or time spent in learning. Carroll stated that the degree of learning can be described as a ratio between (a) time needed to learn and (b) time actually spent on learning.

Carroll's insights and formula provide the foundation for the theory of mastery learning, which has been further developed by theorists such as Bloom (1968, 1976) and Block and Anderson (1975). Carroll's model differs from Bloom's model by seeking equality of "opportunity," not necessarily equality of attainment. "Emphasizing equality of opportunity means not only providing appropriate opportunities to learn (appropriate, not necessarily equal for all students), but also pushing all student's potentialities as far as possible toward their upper limits" (Carroll 1989, p 30). According to Carroll, good planning is a key factor, but also good instructional design. Carroll's model can be a key factor in instructional design of courses that are predictors of success to increase the retention rate among nursing students.

Mastery learning described by Bloom (1968, 1976) takes into account the elements cited by Carroll (1963) and states that given enough time and help, about 95 percent of the learners in any group can gain complete mastery of the designated instructional objectives. Mastery learning is not synonymous with pass/fail grading, nor does it imply that standards should be lowered. When mastery learning is successful, high standards are articulated and students receive ample time and help to meet these standards. As nursing program faculty grapple with increasing the number of qualified nurses (both RN and PN), continued research is needed to determine: (a) what factors are central to Carroll's model when applied to nursing, and (b) what combination of curriculum and instructional support are most beneficial in helping students attain mastery of program content and successful passage of NCLEX licensure exams.

Summary

The U.S. is in the midst of a nursing shortage which will only become more critical over the next decade as baby boomers age and require increased health care and more

nurses reach retirement age. Not only do admissions need to increase, retention and graduation of those same students needs to occur.

Educational institutions today emphasize recruitment and retention of students. This is crucial in nursing where the shortage of qualified workers increases as society in the U.S. continues to age. It becomes essential that coordinators and faculty understand and implement strategies, which will retain students but also assist them in becoming successful. If students-at-risk can be identified, interventions can be instituted whereby the student can overcome the deficits and be successful on the licensure examination. The solution to the shortage of nurses means that programs need to admit, retain, and graduate competent nurses to meet the needs of the workforce. Decisions about whether to open new nursing programs or expand existing ones, to enact or change policies regarding the regulation of educational programs, and other policy decisions concerning the nursing workforce affect a wide range of stakeholders and can be the source of contentious debate. According to Fraher, Belsky, Carpenter, and Gaul (2008), the ability of educators, legislators, legislative staff, and policymakers to understand, consider, and debate pressing issues and identify potential policy solutions exists only if decision makers have access to both a ready source of rich data and researchers who can work with that data objectively to present the analyses in a truthful manner.

The literature reviewed in this chapter has examined factors that influence success in nursing programs, with emphasis on passing NCLEX licensure exams for both registered nurses and practical nurses. Although it would be difficult to replicate any of the studies due to pre-admission differences and programmatic variations; investigations have indicated that admission tests, demographic factors, nursing courses as well as exit examinations are predictive of NCLEX passage. Research also revealed that certain

courses could predict early difficulties and would indicate these students had a need for remediation or assistance in order to complete their program of study. Ostrye (2000) found that students who had remediation did equally well as those who did not require remediation prior to admission to the nursing program. This would support the need to identify predictors early in the program so that interventions could be instituted either in the “gatekeeper” courses or the actual nursing courses.

In summary, in thirteen associate degree studies, NLN score, nursing GPA, race, and ACT scores were found to be significant predictors of success on the NCLEX-RN. Studies did not agree that age was a significant predictor. More studies were found at the baccalaureate level. Twenty-one of the studies found a significant correlation between nursing course GPA and success on the NCLEX. In those few studies that used NLN and Mosby Assess Test, both examinations were found to be predictors of success on the NCLEX-RN. Studies differed on the significance of High School GPA, repeated coursework, age and SAT (verbal and math) scores. No correlation was found in any study between marital status, type A personality, gender and success on the NCLEX-RN.

In thirteen studies of practical nursing programs, the majority indicated that pre-admission assessments, race, as well as age were significant factors in determining success on the NCLEX examination. Studies differed on the significance of gender and marital status as predictors of success.

Carroll’s theory of mastery learning emphasizes providing equal opportunities for learning as well as motivating students to perform at the upper limits of their potential. With the identification of courses that are predictors of success, Carroll’s model can be a key factor in instructional design of courses to increase the retention rate and graduation of nursing students that otherwise would have been unsuccessful in the program.

CHAPTER III

RESEARCH DESIGN AND METHODOLOGY

Introduction

The research conducted in this study was a quantitative analysis of postsecondary data made available from the Kentucky Community and Technical College System (KCTCS). Data were analyzed to examine the effect of background and curricular variables and the extent to which prediction of success on the National Council Licensure Examination for Practical Nurses (NCLEX-PN) could be determined. The sample for this study was composed of graduates from the practical nursing programs operated by the Kentucky Community and Technical College System who used the traditional curriculum.

Descriptive statistics, inferential statistics, and logistic regression--were used to analyze data in an attempt to isolate the separate relationships/impact of each independent variable on the dependent variable. This chapter reviews the design and data sources, population and sample, instrument, variables, and statistical analysis procedures which were utilized in this research study.

Definition of Terms

The following list of definitions refers to the terms as used in the Kentucky Community and Technical College System.

Pre-Admission Testing: Admission standards on one of three different tests. Admission standard and operational definitions of each follows: A rank of 10.1 grade level or higher on reading and math skills as measured by Reading 76, Math (Pre-Algebra Domain) 34 on

the COMPASS test or Reading 40, Math (Pre-Algebra Domain) 37-38, or an ACT of 16 or better on Reading and Math (ACT, 1999).

Nursing Courses: The Kentucky Board of Nursing prescribes content, required components of the KCTCS Practical Nursing program. NPN 100-Introduction to Nursing and Health Care System includes a historical overview of current health care including medical economics, ethical and legal parameters, roles and responsibilities of health care team members with an emphasis on reflective nursing practice. NPN 105-Development of Care Giver Role presents nursing and the nursing process as related to client activities of daily living across the life span. NPN 110-Pharmacology I introduces techniques used to administer medications. NPN 125-Mental Health permits application of the nursing process to clients experiencing common mental health problems with emphasis on assisting clients to cope with psychological problems throughout the life span, i.e., chemical dependency, violence and other stress and developmental problems related to mental health. NPN 130-Pharmacology II comprises the study of common drugs by classification and effects with emphasis on responsibility, accountability, and application of the nursing process to drug therapy. NPN 135-Introduction to Health Deviations covers the application of the nursing process for selected child/adult clients experiencing common health deviations interfering with activities of daily living. Emphasis is on the nurse as the provider of care. NPN 200-Med Surg I incorporates the application of the nursing process to selected child/adult clients experiencing common health deviations interfering with activities of daily living with emphasis on the nurse as the provider of care. NPN 120/NPN 201-Childbearing Family contains the theory and application of the nursing process to childbearing families with focus on health promotion and common health alterations in the reproductive process. NPN 205-Med Surg II is designed to apply the nursing process to

child/adult clients experiencing more complex health alterations. The focus is on multi-system failure, fluid and electrolytes, neurological problems, and cellular deviation. NPN 210-Practicum integrates the theoretical concepts learned throughout the program in application of this knowledge during the direct care of clients. It promotes critical thinking and problem solving skills during the nursing role performances of provider of care, manager of care, and member within the discipline.

Pre-requisite Courses: Although pre-requisite courses do not contain nursing care content, they provide a foundation for content that will be taught in the program. There are two required courses. Students must take a course(s) in anatomy and physiology. Choices include BIO 135-Basic Anatomy and Physiology with Laboratory or BIO 137-Human Anatomy and Physiology I and BIO 139-Human Anatomy and Physiology II. AHS 109-Introduction to Body Structure and Function may also be articulated for returning students who were admitted under a former curriculum. The courses in anatomy and physiology present the fundamental structure of the human body and the physiological mechanisms involved in normal functioning through lecture and student participation in laboratory activities. Students may also take AHS 100-Growth and Development or PSY 223-Developmental Psychology which introduce the principles of developmental psychology as seen in human growth over the entire lifespan, focusing primarily on infancy through adolescence. The courses emphasize theory and data relating to developmental aspects of cognition, language, and personality.

The Exit Exam: The Exit (EXIT) Comprehensive Exam is given to assess the student who has completed program content. It assists in identifying potential problems which could prevent the graduate from being successful on the NCLEX-PN examination. The KCTCS defined exit examination includes a choice of the National League for

Nursing (NLN) Comprehensive Examination, the Health Education Systems, Inc (HESI) examination, Educational Resources, Inc (ERI), the Assessment Technologies Institute (ATI) comprehensive examination, or a comparable nationally-normed assessment instrument.

Since each college had a choice of the exit examination that they used, the measure of performance was complicated because scores received are not equivalent. Regardless of specific tool utilized, exit examination results indicate whether the score made by the student was predictive of success on the NCLEX-PN. Therefore, P/F was used to define the predictability of success, supposedly equated across the different tests.

The National Council Licensure Examination for Practical Nursing: According to the National Council of State Boards of Nursing (NCSBN, 2008), entry into the practice of nursing in the U.S. and member board jurisdictions is regulated by the licensing authorities within each jurisdiction. To ensure public protection, each jurisdiction requires candidates for licensure to meet set requirements that include passing an examination that measures the competencies needed to perform safely and effectively as a newly licensed, entry-level practical/vocational nurse. The National Council of State Boards of Nursing, Inc. (NCSBN) develops a licensure examination, the National Council Licensure Examination for Practical/Vocational Nurses (NCLEX-PN Examination), which is used by state, commonwealth and territorial boards of nursing to assist in making licensure decisions.

Several steps occur in the development of the *NCLEX-PN® Test Plan*. The first step is conducting a practice analysis that is used to collect data on the current practice of entry-level practical/vocational nurses (*Report of Findings from the 2006 LPN/VN Practice Analysis: Linking the NCLEX-PN® Examination to Practice* [NCSBN, 2006]). Newly licensed practical/vocational nurses are asked about the frequency and priority of

performing more than 147 nursing care activities. Nursing care activities are analyzed in relation to the frequency of performance, impact on maintaining client safety, and client care settings where the activities are performed. This analysis guides the development of a framework for entry-level nursing practice that incorporates specific client needs as well as processes fundamental to the practice of nursing. The next step is the development of the *NCLEX-PN® Test Plan*, which guides the selection of content and behaviors to be tested. Variations in jurisdiction laws and regulations are considered in the development of the test plan (NCSBN, 2008).

Each NCLEX-PN examination is based on the test plan. Each examination assesses the knowledge, skills, and abilities that are essential for the entry-level practical/vocational nurse to meet the needs of clients who require the promotion, maintenance, or restoration of health (NCSBN, 2008). The NCLEX-PN® Test Plan is organized into four major Client Needs categories: Safe and Effective Care Environment, Health Promotion and Maintenance, Psychosocial Integrity, and Physiological Integrity. Clinical Problem-Solving Process (Nursing Process), Caring, Communication and Documentation, and Teaching/Learning are integrated into the Client Needs. The percentage of test items assigned to each Client Needs category and subcategory is based on the results of the NCSBN study (2006), and expert judgment provided by members of the NCSBN NCLEX® Examination Committee (NCSBN, 2008).

Implications of Variable Subdivisions

The variables for this study were selected and grouped according to knowledge gained from the literature. The student-focused control variables included age, gender, race, and admission requirements of math and reading scores. The literature review was mixed related to success on the NCLEX by age, gender, and race but did find the older

student and the Caucasian student were more likely to be successful on the examination. Although the ethnicity of the student is defined in this study by race, it is understood that some variables are less well specified than others and therefore more difficult to use as predictors. In nursing, performance of a student tends not to be linked to race but more to educational experience and socioeconomic factors, which are not as likely to be measured. Studies examining pre-admission scores were also mixed as to their ability to predict success but both math and reading were found to predict success on the NCLEX.

The curriculum variables were grouped by pre-requisite courses, foundational nursing courses, specialty nursing courses, and advanced nursing courses. The literature review supported the predictability of success on the NCLEX by the GPAs of sciences, social sciences, and programmatic courses. The programmatic courses were subdivided according to levels of progression. The review also supported the mediating variable, Exit Comprehensive Exam, as being predictive of success on the NCLEX. In addition, this study investigated the relationship of control variables to curriculum variables, the mediating variable, and the final learning outcome.

Sources of Data

Data were collected from the college files using a Records Analysis Protocol form developed by the investigator (see Appendix A). The population for this retrospective study consisted of students who had completed the practical nursing program in selected practical nursing programs which used the same curriculum and were under the management of the Kentucky Community and Technical College System and had taken the licensure examination during the academic years 2006 – 2007.

The demographic, admission, and grade point data for this study were collected from the data system, Peoplesoft, used by the Kentucky Community and Technical College

System. The exit comprehensive exam scores and the NCLEX-PN scores were collected by the investigator from the nursing administrator at the selected colleges.

Population and Sample

The population for this study consisted of students who graduated from practical nursing programs at Kentucky Community and Technical Colleges who used the traditional curriculum during the academic years 2006 – 2007. Each college determines when new classes will be admitted into the program. KCTCS is the major supplier of practical nurses for the Commonwealth of Kentucky. Of the 33 practical nursing programs in Kentucky, KCTCS manages all but five of the programs. There was no attempt to separate the records of full-time and part-time graduates since (a) the same admission criteria were required of all practical nursing students, and (b) each college in the study offered identical curriculum. The set of complete data records obtained from the KCTCS practical nursing programs constitute the effective sample. Although the current study does not examine differences from one program to the next, all student records were coded according to the program attended to facilitate subsequent analyses of that nature.

Variables in the Study

The dependent and independent variables for this study are consistent with the designated blocks of factors in Figure 1 (see Chapter I). These are described in turn.

Dependent Variable

Obtained from the nurse administrator for each program, the dependent variable for the study was the NCLEX-PN score. This constituted a predictability percentage cut score, a grade of pass/fail. Success on the NCLEX-PN value was collected for each student; the NCLEX-PN is coded as 0 = Fail and 1 = Pass.

Independent Variables

The study included three conceptually distinct types of independent variables-- Control Variables, Curriculum Variables, and a Mediating Variable. Specific predictors included under each are described in turn.

Control Variables

The research is designed to control for varying personal demographic factors likely to impact school achievement. Specific demographic considerations included in this study follow.

Age (AGE): Ratio scale coded per age of each student.

Gender (GEND): Two nominal categories coded 0 = Male and 1 = Female.

Race (RACE): Five nominal categories, coded 1 = Caucasian; 2 = African/American; 3 = Asian; 4 = Hispanic; 5 = Not Specified.

Admission Requirements (ADMREQ). For KCTCS, ACT scores for Reading and Math or COMPASS scores for Reading and Math are utilized for program admission. In some instances the ASSET is also used. The American College Testing agency provides the concordance table for placing students who take either the ACT, ASSET, or COMPASS assessments. For this study, the student either met or did not meet the cutoff scores as determined by the KCTCS Assessment and Placement policy.

Reading Score (READ). For each test, ACT, COMPASS, and ASSET, cutoff scores had been established by the KCTCS Assessment and Placement Policy. Scores of 16 for the ACT, 76 for the COMPASS, and 40 for the ASSET were required for programmatic admission. In order to combine information from disparate tests, two nominal categories were created, coded 0 = Did Not Meet; 1 = Did Meet.

Math Score (MATH). Scores included Basic Math and Elementary Algebra (Pre-Algebra Domain). Scores of 16 for the ACT, 34 for the COMPASS, and 37-38 for the

ASSET were required for programmatic admission. Again, two nominal categories were created, coded 0 = Did Not Meet; 1 = Did Meet.

Curriculum Variables

There was an approved standard curriculum for the traditional practical nursing programs within KCTCS. The curriculum incorporates courses related to writing and communication in addition to nursing-related content. In this study, only the nursing related courses were examined for their influence on NCLEX pass rates, based on the literature reviewed in Chapter II. The nursing courses were developed according to the NCLEX-PN® Test Plan, the Kentucky Board of Nursing administrative regulations (201 KAR 20:320. Standards for curriculum of pre-licensure nursing programs), the philosophy of the nursing program, and the accrediting agency guidelines.

Pre-requisite Courses (PCGPA). There were two pre-requisite courses focused on anatomy and physiology and the human life cycle, coded as a 4.0 ratio scale based on cumulative student grades for the two combined:

BIO 135 or AHS 109 or BIO 137 and BIO 139

AHS 100 or PSY 223.

Foundation Nursing Courses (FNCGPA). There were three foundation nursing courses, coded as a 4.0 ratio scale based on cumulative student grades for the three combined:

NPN 100

NPN 105

NPN 110.

Specialty Nursing Courses (SNCGPA). There were three specialty nursing courses, coded as a 4.0 ratio scale based on cumulative student grades for the three combined:

NPN 120

NPN 125

NPN 130.

Advanced Nursing Courses (ANCGPA). There were four medical surgical nursing courses, coded as a 4.0 ratio scale based on cumulative student grades for the four combined:

NPN 135

NPN 200

NPN 205

NPN 210.

Number of Low Grades (NLG). The literature indicates that low grades are often predictive of problems in passing NCLEX. For this study, this is coded as a ratio scale that is the number of repeated classes (grade of D or below) plus the number of initial grades of C, calculated across the ten nursing courses and the two required pre-requisite courses.

Mediating Variable

The purpose of this EXIT test is to evaluate whether the applicant has the knowledge and skills to be successful on the NCLEX-PN. The Mediating Exam is a standardized test that nursing students may be required to take before graduating. It is a comprehensive nurse exam that tests the student's overall knowledge in key areas of the nursing curriculum. In many ways, the Exit Comprehensive Exam is similar to the National Council of Licensing Examination for the Practical Nurse (NCLEX-PN) and, therefore, performance on the Exit Comprehensive Exam is considered to be a good predictor of a student's readiness for the licensing exam.

Exit Comprehensive Exam (EXIT). Nominal/Ordinal measure (Yaffe, 2003) of Exit

Comprehensive Exam's influence on NCLEX-PN, coded 1 = Predictive of non-success/Did Not Take, 2 = Predictive of success.

Number of Exit Comprehensive Exam Attempts (NEA). In the majority of programs, when students are not predicted to be successful on the NCLEX, students are given additional attempts. For this study, this is coded as a ratio scale that is the number of repeated attempts on the EXIT Comprehensive Exam.

Analysis of the Data

The purpose of the study was to address the issue of background and curricular variables which would predict success on the National Council Licensure Examination for Practical Nurses (NCLEX-PN). Data for this study were analyzed: (a) to examine the relationships for demographic and admission requirements on curriculum, exit comprehensive exam, and NCLEX-PN; (b) to examine the effect of curriculum variables on the exit comprehensive exam and the NCLEX-PN; (c) to examine the effect of the exit comprehensive exam on the NCLEX-PN; and (d) to examine the predictive value of the demographic/admission requirements, curriculum variables, and Exit comprehensive exam on the NCLEX-PN status.

Data Screening and Checking

The first stage of analysis was data screening and checking. Modal values were substituted for missing nominal data and mean values were substituted for missing ratio data if one or two values were missing (Peugh & Enders, 2004). If three or more pieces of data were missing, that student record was dropped. If the score related to the dependent variable was missing, the record was also dropped.

Steps in the Analysis

After the data had been filed and checked for missing data, the analysis consisted of

two stages. First, descriptive and inferential statistics for all variables were calculated and reported. The overall correlation matrix, upon which subsequent regressions were based, is included in this section.

The primary analytic tool for this investigation was logistic regression. The analyses outlined in Table 2 were followed to answer the research questions. For each research question, the specific independent and dependent variables for that question were indicated, along with the type of statistical procedure employed. For the convenience of the reader, the research questions are repeated here from Chapter I, following Table 2.

Table 2

Relationship of Type of Analysis to Independent and Dependent Variables by Research

Questions

Research Question	Independent Variables			Dependent Variable	Analysis
	Control	Curriculum	Mediating		
1	Demo/Adm ^a	Pre-req/Nsg Courses ^b			Correlation Independent Sample <i>t</i> Test
2	Demo/Adm		EXIT ^c		Independent Sample <i>t</i> Test Chi-square
3	Demo/Adm			NCLEX- PN	Independent Sample <i>t</i> Test
4		Pre-req/Nsg Courses	EXIT		Independent Sample <i>t</i> Test Correlation

(table continues)

Table 2. (continued)

Research Question	Independent Variables			Dependent Variable	Analysis
	Control	Curriculum	Mediating		
5		Pre-req/Nsg Courses		NCLEX-PN	Independent Sample <i>t</i> Test
6			EXIT	NCLEX-PN	Chi-Square Independent Sample <i>t</i> Test
7	Demo/Adm	Pre-req/Nsg Courses	EXIT	NCLEX-PN	Hierarchical Logistic Regression

Note. The study includes three conceptually distinct types of independent variables-- control variables, curriculum variables, and a mediating variable.

^aIncludes age, gender, and race for demographic variables; ACT or Compass tests, for Admission Requirements.

^bIncludes Pre-requisite courses (anatomy and physiology, and growth and development) and Nursing courses (foundation, specialty, and advanced), plus Number of Low Grades.

^cAn exit comprehensive exam to evaluate whether the applicant has the knowledge and skills to be successful on the NCLEX.

1. What are the relationships for Demographic and Admission Requirements on Curriculum?
2. What are the relationships for Demographic and Admission Requirements on Exit Comprehensive Exam?
3. What are the relationships for Demographic and Admission Requirements on NCLEX-PN?
4. What are the relationships for Curriculum variables on Exit Comprehensive Exam?
5. What are the relationships for Curriculum variables on NCLEX-PN?
6. What are the relationships for Exit Comprehensive Exam on NCLEX-PN?
7. What is the predictive value of the Demographic and Admission Requirements, Curriculum variables, and Exit Comprehensive Exam on NCLEX-PN status?

Types of Analyses

The primary analytic tool for this investigation was logistic regression. Logistic regression is a statistical technique that allows prediction of someone's score on one variable on the basis of the respective scores on several other variables. Logistic regression is indicated instead of multiple regression when the dependent variable takes the form of a dichotomous measure rather than continuous (Field, 2005). In addition to logistic regression, standard statistical procedures were also employed (see Table 2). Subsequently, the analyses outlined in Table 2 were followed to answer the research questions. For each research question, the specific independent and dependent variables for that question are indicated, along with the type of statistical procedure utilized.

Descriptive Statistics

Descriptive statistics provide a quantitative sense of the data. This study examines the minimum, maximum, range, mean, percentile, and standard deviation to determine variable characteristics.

Inferential Statistics

Inferential statistics do not examine a whole population, rather, a sample or samples are drawn from the population and the characteristics of the population are deduced or inferred from the responses of the sample (Dempsey & Dempsey, 1986). The *t* Test, chi-square, and Pearson correlation were used in this study.

An Independent Sample *t* Test was used to determine whether the differences between the means of two different sets of scores were statistically significant in Questions 1-6.

The Chi-square can be applied to nominal or higher levels of measurement and can be utilized on one or more samples. Essentially, the chi-square test is used to determine if the observed frequencies of events in certain categories fall within the range of frequencies expected to fall in these categories. The Chi-square statistical method was used to answer Questions 2 and 6.

The commonly used parametric statistic for correlation is the Pearson product-moment correlation coefficient, otherwise known as the Pearson *r* or, more simply as *r*. In this test, two different sets of continuous level data are compared to determine the degree of relationship between them. Since *rs* range from -1 to +1, data can be related either positively or negatively. The closer the correlation coefficient is to either -1 or +1, the stronger the relationship between the variables being studied. This statistical method was used to answer in part Questions 1 and 4 in this study (see Table 2).

Logistic Multiple Regression

Logistic regression is a technique derived from logit analysis, to model the relationship between a dichotomous outcome variable, e.g., NCLEX-PN licensure examination results, and a set of predictor variables. Logistic regression model is

appropriate to use when the variables are nominal and binary, meaning there are only two possible outcomes which can be represented by the values 0 and 1. This model was determined to be the most appropriate statistical technique for Question 7 in this study (see Table 2) because NCLEX-PN results were reported as pass/fail, involving a dichotomous outcome.

The goal of logistic regression is to predict correctly the category of outcome for individual cases using the most parsimonious model. To accomplish this goal, a model is created that includes all predictor variables that are useful in predicting the response variable. Several different options are available during model creation. An important step in evaluating the appropriateness of the logistic regression model is to assess how well the model fits the sample data. In this study, two statistics were assessed to determine improvement in overall goodness-of-fit of the final model. First, the likelihood-ratio test based on -2LL ratio is a test of the significance of the difference between the likelihood ratio (-2LL) for the researcher's model with predictors minus the likelihood-ratio for baseline model with only a constant in it. Significance at the .05 level or lower means the researcher's model with the predictors is significantly different from the one with the constant only. It measures the improvement in fit that the explanatory variables make compared to the null model. Chi-square is used to assess significance of this ratio. This log transformation of the likelihood functions yields a chi-squared statistic (Tabachnick & Fidell, 1996).

The Hosmer-Lemeshow statistic evaluates the goodness-of-fit by creating 10 ordered groups of subjects and then compares the number actually in each group (observed) to the number predicted by the logistic regression model (predicted). Thus, the test statistic is a chi-square statistic with a desirable outcome of non-significance,

indicating that the model prediction does not significantly differ from the observed. The 10 ordered groups are created based on their estimated probability; those with estimated probability below 0.1 form one group, and so on, up to those with probability 0.9 to 1.0. Each of these categories is further divided into two groups based on the actual observed outcome variable (success, failure). The expected frequencies for each of the cells are obtained from the model. If the model is good, then most of the subjects with success are classified in the higher deciles of risk and those with failure in the lower deciles of risk (Burns & Burns, 2008; Tabachnick & Fidell, 1996).

The ability of a model to predict correctly the outcome category for cases with known outcomes functions as a means of assessing the success of the final model. Classification tables, comparing observed and predicted probabilities, were analyzed to determine the ability of the final model to predict group membership in the pass and fail categories. For this study, a cutoff probability criterion of 0.5 was set to determine assignment for classification of cases.

Logistic response functions can be used for describing the nature of the relationship between the mean response and one or more predictor variables, and for making predictions of group membership. Although related to multiple regression analysis, this nonlinear multivariate statistical technique requires fewer assumptions. Logistic regression analysis, unlike multiple regression, is not sensitive to violations of the normal distribution of the dependent variable. (Ostrye, 2000).

Another difference between multiple regression and logistic regression is in the method used to estimate the parameters of the model. Multiple regression uses the least-squares method, whereas logistic regression estimates parameters of the model using the maximum-likelihood method; the coefficients that most closely agree with the observed

data are selected (Hosmer & Lemeshow, 1989). Logistic regression estimates the probability of an outcome occurring. The outcome is predicted not to occur if the estimated probability is less than 0.5, while the outcome is predicted to occur if the probability is greater than 0.5. Interpretation of the estimated coefficients of the model is understood in terms of the odds ratio, its measure of association. The odds ratio of an outcome occurring is defined as the ratio of the probability that it will occur to the probability that it will not (Hosmer & Lemeshow, 1989; Tobachnick & Fidell, 1996).

Tobachnick and Fidell (1996) describe logistic regression analysis as being relatively free of restrictions and of having the capacity to analyze a mix of various types of continuous, discrete, and dichotomous variables. However, there are assumptions to be met for the model to be valid. First, the outcomes must be independent in that only one outcome is recorded for an individual. Second, the categories analyzed must be collectively exhaustive and mutually exclusive. For this study, both these conditions are met.

Validity Considerations

Research instruments or research tools include the devices or equipment used to gather the research data. Research instruments must possess certain basic attributes; these assure that they will provide dependable measurements of the variables under investigation. According to Dempsey and Dempsey (1986), the most crucial attributes are (a) validity, (b) reliability, and (c) feasibility.

Validity refers to the ability of a data-gathering instrument to measure what it is supposed to measure, to obtain data relevant to what is being measured. According to Dempsey and Dempsey (1986), validity is the most important characteristic of a measuring instrument. The reliability of a measuring instrument refers to its ability to obtain consistent results when reused. Dempsey and Dempsey note that an instrument is reliable

when it consistently does whatever it is supposed to do in the same way. The feasibility of a measuring instrument refers to the practical aspects of using it. These include ease of administration, scoring, and interpretation, as well as financial, time, and energy considerations. All three of these criteria--both technical and practical aspects--should be examined for research instruments (Dempsey & Dempsey).

The dependent variable in this study is the NCLEX-PN. The validity and reliability of this instrument is discussed. According to Lunz and Bergstrom (as cited by NCSBN, 2010, p. 1), the reliability of the NCLEX examination is assessed:

via a decision consistency statistic. This statistic is used instead of a traditional reliability statistic such as Cronbach's alpha because it captures the reliability of dichotomous pass/fail decisions rather than continuous scores or ability estimates. The decision consistency statistic incorporates a candidate's ability estimate and standard error with normal theory to obtain two probabilities: the probability that the candidate's "true" ability (as opposed to the estimate of their ability) is above passing and the probability that their "true" ability is below passing.

Types of Validity

There are several different aspects of validity: content validity, face validity, construct validity, predictive validity, and scoring (passing standard) validity. National Council procedures ensure that the NCLEX examination is valid with respect to these aspects of validity (NCSBN, 2010). NCSBN describes the validity of the instrument.

Content Validity

NCSBN (2010) requests Boards of Nursing to nominate content experts with varying backgrounds in nursing education to write examination questions. The examination questions cover all aspects of nursing that would be encountered by beginning practitioners. Since it would be unrealistic to ask candidates to answer all the questions in the database, sampling validity is used.

Sampling Validity

An on-going job analysis determines the sample questions that are included in the NCLEX examination. The test plan is developed using content categories. Each question is classified under one of these categories. Each candidate has questions from each category. The number of questions from each category is determined from the job analysis (NCSBN, 2010).

Face Validity

Although the Test Plan ensures that the content of nursing is sampled adequately, it is far from a perfect sampling of the nursing domain. There is always going to be similar content across content categories but to prevent candidates from getting questions from primarily one content area, a procedure called a Face Validity review is performed. During this process, real and simulated examinations are read by experienced test developers to ensure that the balance and juxtaposition of content is, on face, representative of the domain of nursing (NCSBN, 2010).

Construct Validity

Nunnally (as cited in NCSBN, 2010, p. 3) states, “To the extent that a variable is abstract and latent rather than concrete and observable, it is called a ‘construct.’ Such a variable is literally something that scientists ‘construct’ and which does not exist as an observable dimension of behavior.”

Continuing the discussion of construct validity, the NCSBN (2010) states: If entry-level nursing competency were concrete and observable, then it would be easy to measure. However, entry-level nursing competency is latent and abstract. Therefore, the National Council has ‘constructed’ the NCLEX examination scale to produce a measure of an examinee’s entry-level nursing competency. The National Council uses measurement theory via Rasch measurement theory to construct the NCLEX examination scale. There is an abundance of research that certifies this theory’s capability to produce valid measures of a latent construct such as entry-level nursing competency. (p. 3)

Scoring Validity

During examination administration, each examinee receives ‘tryout’ items that are not counted but tracked for all participants. This allows the National Council to determine the exact difficulty of each item. Using this information and Rasch measurement theory, the National Council can accurately calculate a measure of each examinee’s ability (NCSBN, 2010).

Pass/Fail Decision Validity

According to the NCSBN (2010), the Pass/Fail Decision Validity is determined by a passing standard established by the National Council’s Board of Directors after review of information gathered from several sources. This process ensures that the passing standard is current and valid. The NCLEX-PN is a web-based assessment that is graded by the computer and verified by a contracted vendor. The vendor notifies the state boards of nursing and graduates of the exam results. Graduates receive notification within a month of the exam. Thus, the feasibility of the exam is good.

Ethical Considerations

Permission for this study was obtained from the Human Subjects Protection Program at the University of Louisville as well as KCTCS Office of Research and Policy Analysis (Appendix B). The purpose of these approvals was to ensure that confidentiality and other human subject protection are met and that the study poses no more than minimal risk to any persons. The researcher will also inform the selected Practical Nursing Program Coordinators of the purpose and nature of the study prior to data collection. No unique student identifiers were used in the collection of the data; therefore, the research design poses no threat or risk to individuals. As such, the application received the status of Exempt research. The Human Subjects consent form is also included at Appendix B.

Summary

The research conducted in this study was a quantitative analysis of postsecondary data made available from the Kentucky Community and Technical College System (KCTCS). The population for this study was composed of graduates from the practical nursing programs operated by the Kentucky Community and Technical College System who used the traditional curriculum for the academic years of 2006-2007.

The study included three conceptually distinct types of independent variables-- control variables, curriculum variables, and a mediating variable, and one dependent variable. Data were analyzed to examine the effect of background and curricular variables and the extent to which prediction of success on the National Council Licensure Examination for Practical Nurses (NCLEX-PN) could be determined.

Since the results of the NCLEX-PN are reported as pass/fail, involving a dichotomous response, and because of the dichotomous nature of some of the independent variables, logistic regression analysis was required for some of the analyses. Descriptive and inferential statistics were also utilized. Table 2 summarizes the specific variables utilized for the separate research questions and delineates the type of statistical analyses for each. The NCLEX-PN was reviewed for content, sampling, face, construct, scoring, and pass/fail decision validity. Reliability and feasibility were adequate.

Ethical considerations were met for this study in that permission for this exempt study was obtained from the Human Subjects Protection Program at the University of Louisville and KCTCS. The research design is unobtrusive and nonreactive in nature, thus protecting the subjects and college personnel in the sampled schools from ethical harm.

CHAPTER IV

RESULTS

Introduction

The purpose of this study was to identify background and curricular variables which predict success on the National Council Licensure Examination for Practical Nurses (NCLEX-PN). This chapter presents the findings from the theoretical perspectives outlined in Chapter I, and as delineated operationally in Chapter III. This analytical discourse reports Independent Variables of demographic information; admission scores; grade point averages in pre-requisite, foundational, specialty, and advanced programmatic courses; outcomes on exit comprehensive exams; and the combined number of attempts taking the exit comprehensive exam with the number of low grades. The Dependent Variable is the reported outcome of National Council Licensure Examination. The Kentucky Community and Technical College (KCTCS) database provided delimited data collected from practical nursing coordinators' records on the student variables.

The remainder of this chapter is divided into sections that address data checking, data screening, descriptive statistics, inferential statistics, the research questions, and a summary. For the sections on descriptive and inferential statistics, the information is arranged consistent with the three types of independent variables in Figure 1--Control Variables, Curricular Variables, and Mediating Variables. For the research questions, the logic of the specific query guided the investigation, as delineated in Table 2.

Data Checking

Descriptive statistics (Hinkle, Wiersma, & Jurs, 2003) represent a collection of methods for classifying and summarizing numerical data. Inferential statistics constitute a collection of methods for making inferences about the characteristics of the population from knowledge of the corresponding characteristics of the sample.

Procedure/Process

Records for 2006 – 2007 graduates of the practical nursing programs were initially requested and obtained from the KCTCS PeopleSoft database. Because of the large number of records received and in an effort to have an accurate database, it was necessary to determine if those records were within the parameters of this study. Because two colleges offered a curriculum other than the traditional curriculum, those records were removed from the database. To differentiate records within the 2006 – 2007 academic year versus those outside that range, records were checked against the graduate list submitted to the KCTCS Board of Regents. In addition, records were verified with nursing program coordinators as to the student's date of graduation.

Data Screening

The screening described here began with 581 records. The rules on missing data resulted in the deletion of 129 records across the three types of independent variables. Of the 129 records deleted, forty-eight records were deleted because NCLEX results were not reported. In addition, forty one records were deleted because they were outside the parameters of the academic year surveyed. The next step was to examine these remaining “essentially complete” records ($N = 411$) for specific missing values among the three types of independent variables. Missing scores were imputed via the decision rules enumerated in Chapter III. Following this protocol left a set of records ($N = 411$) with all information on the independent variables.

Statistical Analyses

A retrospective, cross sectional design was used in this study. Simple means and standard deviations were used at the descriptive level to make observations and describe certain aspects of the data. Correlational, Independent Sample *t* Tests, and chi-square analyses were performed on the independent variables to determine whether there were significant relationships between the variables and the outcome of the NCLEX-PN. Logistic regression analyses were conducted to identify variables that may assist in predicting the outcome on the NCLEX-PN.

The dependent variable used in this study was the outcome (pass or fail) on the NCLEX-PN exam. Independent variables included selected cognitive (READ, MATH); curricular (PCGPA, FNCGPA, SNCGPA, ANCGPA, Number of Low Grades); mediating (EXIT, NEA); and demographic (age, gender, race) student profile characteristics.

Descriptive Analysis

Descriptive statistics are reported separately for the independent and dependent variables. The three types of Independent Variables--Control, Curriculum, and the Mediating variables--are presented in separate sections. The specific variables under each section follow the outline in Figure 1, as delineated in Chapter III.

Independent Variables

The independent variables in this study are divided into three distinct groups of Control, Curriculum, and Mediating variables.

Control Variables

The control variables include demographic variables of age, gender, and race plus admission variables of reading and mathematics.

Demographic characteristics. The demographic learner entry characteristics are

defined as the specific attributes of learner’s age at the time of program graduation, gender, and ethnicity. Table 3 presents the distribution of demographic learner entry characteristics for the population used in this study in frequencies and percentages. According to Table 3, the sample can be described as 91.7% female and 84.4% Caucasian. Ages for the population ranged from 19 to 58 with a mean age of 31.85 ($SD = 8.105$) and a median of 30. The mean age for males ($n = 34$) was 32.03 whereas for females ($n = 377$), it was 31.85. This finding is evidence of the non-traditional student served by the colleges’ practical nursing program.

Table 3

Distribution of Total Sample by Demographic Characteristics

Characteristic	Frequency	Percent
Gender	411	100.0%
Male	34	8.3%
Female	377	91.7%
Ethnicity	411	100.0%
Caucasian	347	84.4%
African-American	22	5.4%
Asian	3	0.7%
Hispanic	2	0.5%
Not Specified	37	9.0%

The ages of the students in the sample were plotted in a histogram to examine distribution. As noted in Figure 2, the age distribution was positively skewed with mass of

the ages being on the younger range of age. The overall sample had fewer older students than younger students. The most frequently reported age at graduation was 25.

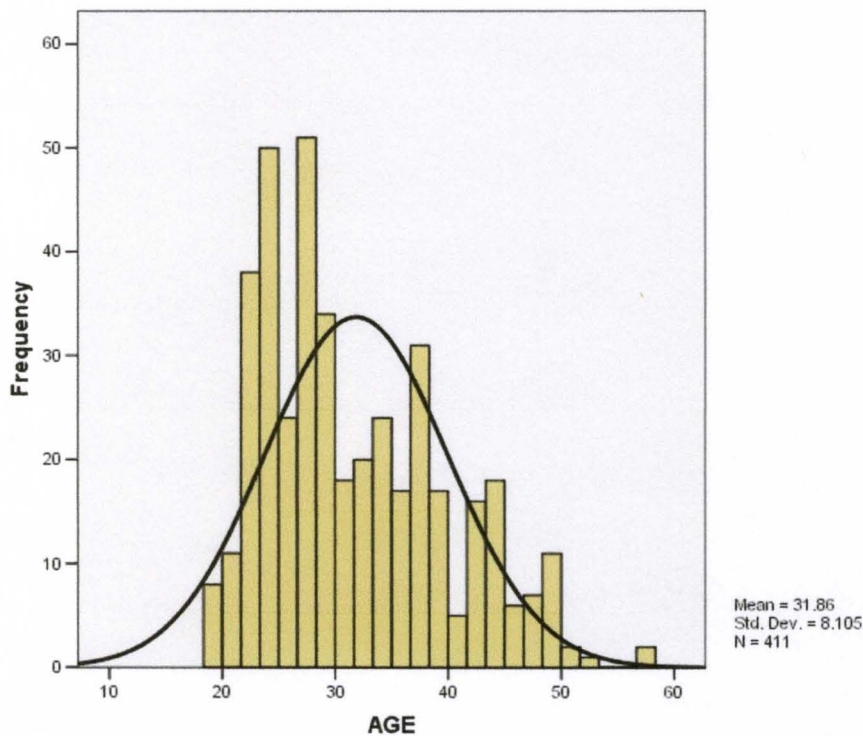


Figure 2. Histogram of Ages of Students (N = 411).

Admission requirements. Admission requirements were defined as specific attributes of ACT or COMPASS scores for Reading and Math. In some instances the ASSET was also used. The American College Testing agency provides a concordance table for placing students who take either the ACT, ASSET, or COMPASS assessments. Students must meet cutoff scores in reading and math as determined by the KCTCS Assessment and Placement Policy. Any combination of Reading scores (ACT 16, COMPASS 76, ASSET 40) and Mathematics scores [ACT 16, COMPASS 34 (Pre-Algebra Domain), and ASSET 37-38 (Pre-Algebra Domain)] that demonstrated competency met the criteria for admission. Table 4 presents the distribution of reading and

mathematics assessment scores for the population used in this study in frequencies and percentages.

Table 4

Distribution of Reading and Mathematics Assessment Scores for the Study Population

(*N* = 411)

Characteristic	Frequency	Percent
Reading Assessment Score (READ)	411	100.0%
Met the Requirements	373	90.8%
Did Not Meet the Requirements	38	9.2%
Mathematics Assessment Score (MATH)	411	100.0%
Met the Requirements	318	77.4%
Did Not Meet the Requirements	93	22.6%

Curriculum Variables

Curriculum variables were divided into four distinct levels of content. Students must make a minimum of “C” (defined as 2.0) in each course to move to the next level. The courses were divided into four levels--pre-requisite, foundation, specialty, and advanced.

Pre-requisite Courses (PCGPA). The pre-requisite content included science (anatomy and physiology) and social science (growth and development) courses. The reported score (grade point) represents the two areas of content that were averaged for each student. The pre-requisite courses grade point average had a range of 2, minimum of 2.0 and a maximum of 4.0, with a mean grade point average of 3.17 (*SD* = 0.579). Figure 3

presents the frequencies of the pre-requisite course grade point averages. The two most frequently occurring grade point averages were 3.0 (88, 21.4%) and 4.0 (74, 18.0%).

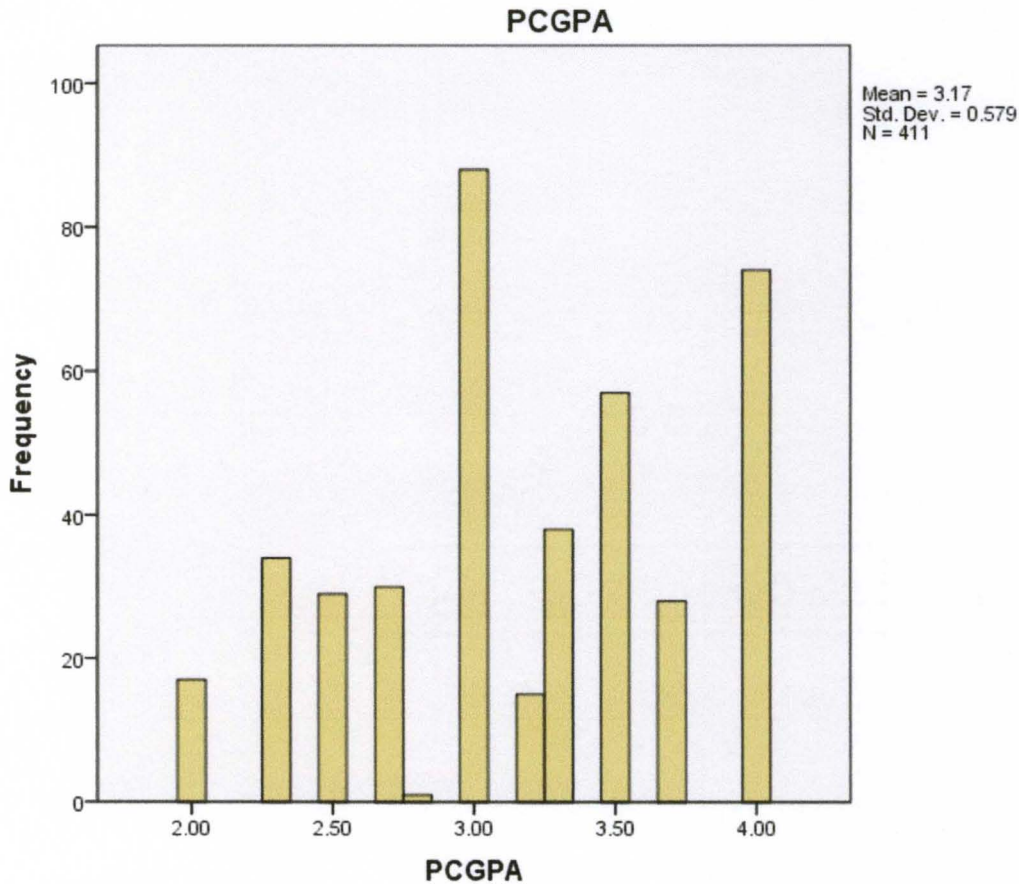


Figure 3. Histogram of Pre-Requisite Course Grade Point Averages ($N = 411$).

Foundation Nursing Courses (FNCGPA). The foundation level included three courses that presented instruction in basic nursing, nursing process, and introduction to dosages and medication administration. The GPA for the three content area courses was averaged for the reported score. The FNCGPA averages and frequencies are presented in Figure 4. The FCGPA mean was 3.2 ($SD = .4859$). The most frequently occurring GPAs were 3.0 (102, 24.8%) and 3.3 (98, 23.8%) with a range of 2, minimum of 2.0, and maximum of 4.0.

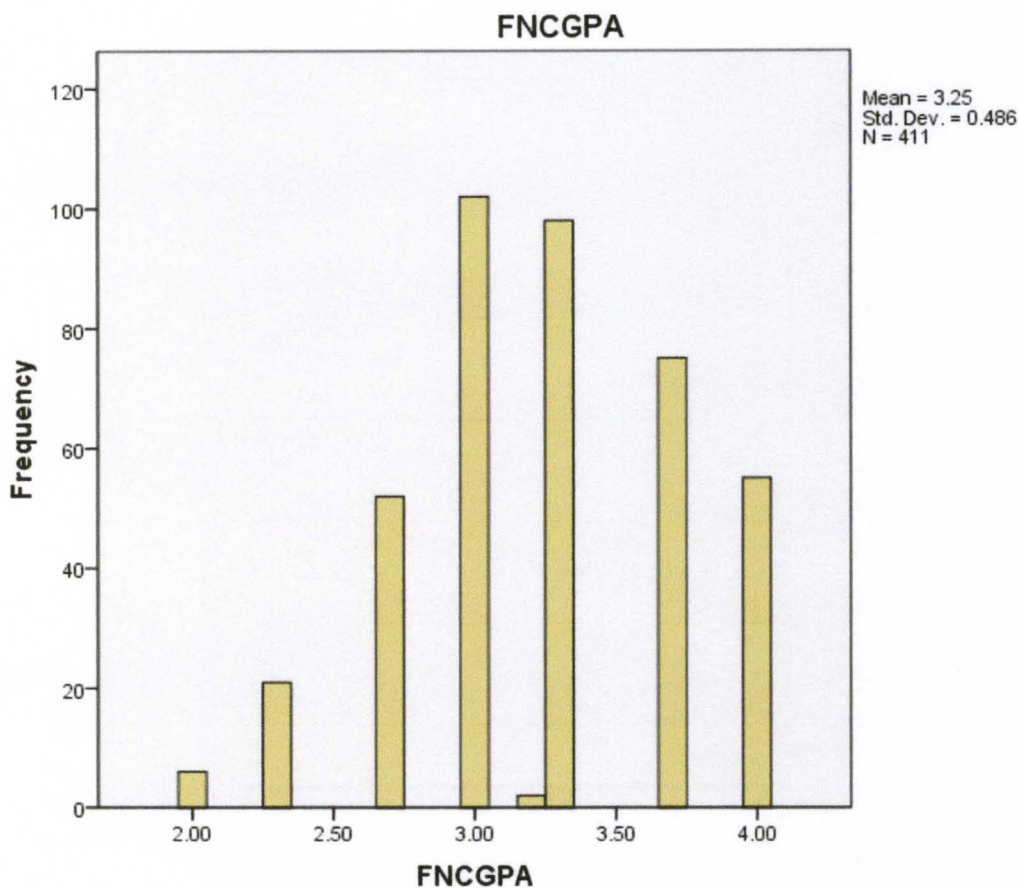


Figure 4. Histogram of Foundation Nursing Course Grade Point Averages ($N = 411$).

Specialty Nursing Courses (SNCGPA). The specialty level included three courses that presented instruction in maternal-child, behavioral health, and pharmacology. The GPA in the three areas of content was averaged for the reported score. The histogram in Figure 5 presents the frequencies and distribution of the specialty courses. The mean for the specialty nursing courses was 2.9 ($SD = 0.564$) with the most frequent GPAs of 3.0 (97, 23.6%); 2.7 (75, 18.2%); 2.3 (67, 16.3%); and 3.3 (62, 15.1%). The minimum grade point average was 2.0 with a maximum of 4.0 and a range of 2.

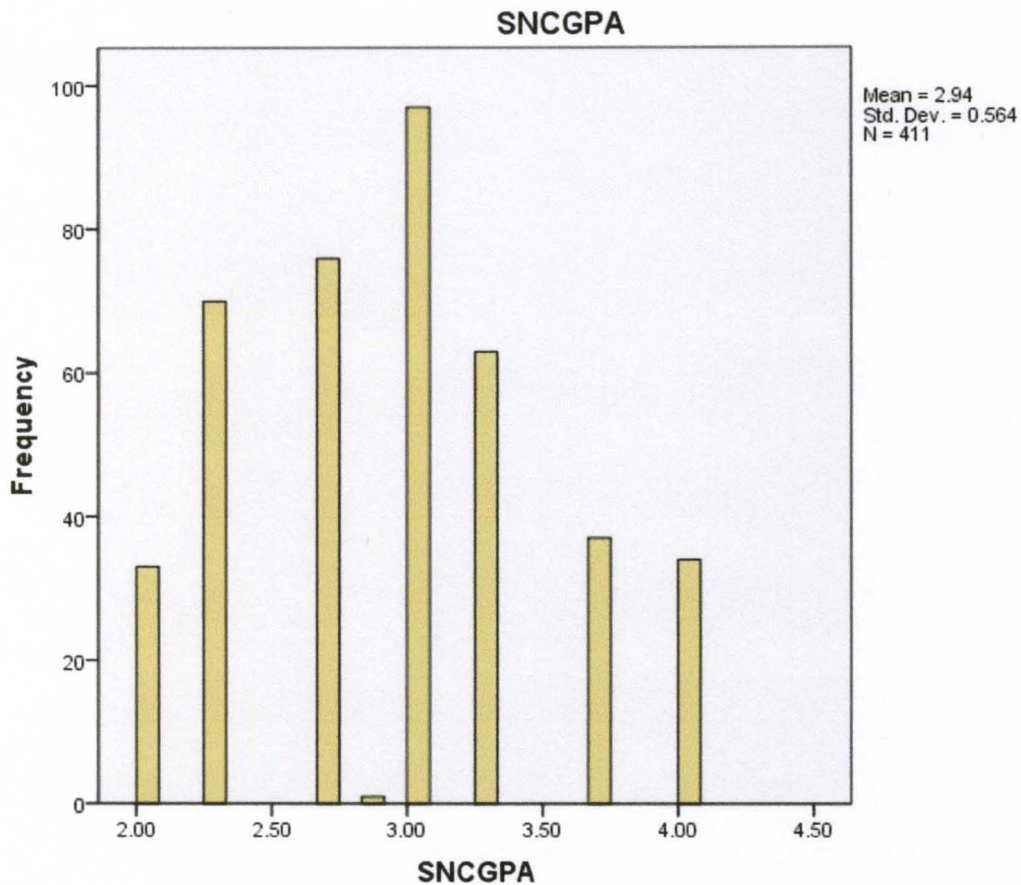


Figure 5. Histogram of Specialty Nursing Course Grade Point Averages ($N = 411$).

Advanced Nursing Courses (ANCGPA). Four courses were included in the advanced nursing content area. These courses provide instruction in health deviations and the application of the nursing process in more complex health alterations. The GPA in the four content areas was averaged for the reported score. Figure 6 presents the frequencies and distribution of the advanced nursing course grade point averages. Three grade point averages (3.25, 3.0, and 2.75) account for 54.7% of the frequencies. The range, minimum, and maximum as in the other courses were 2, 2.0, and 4.0, respectively. The mean grade point average was 3.05 ($SD = 0.497$).

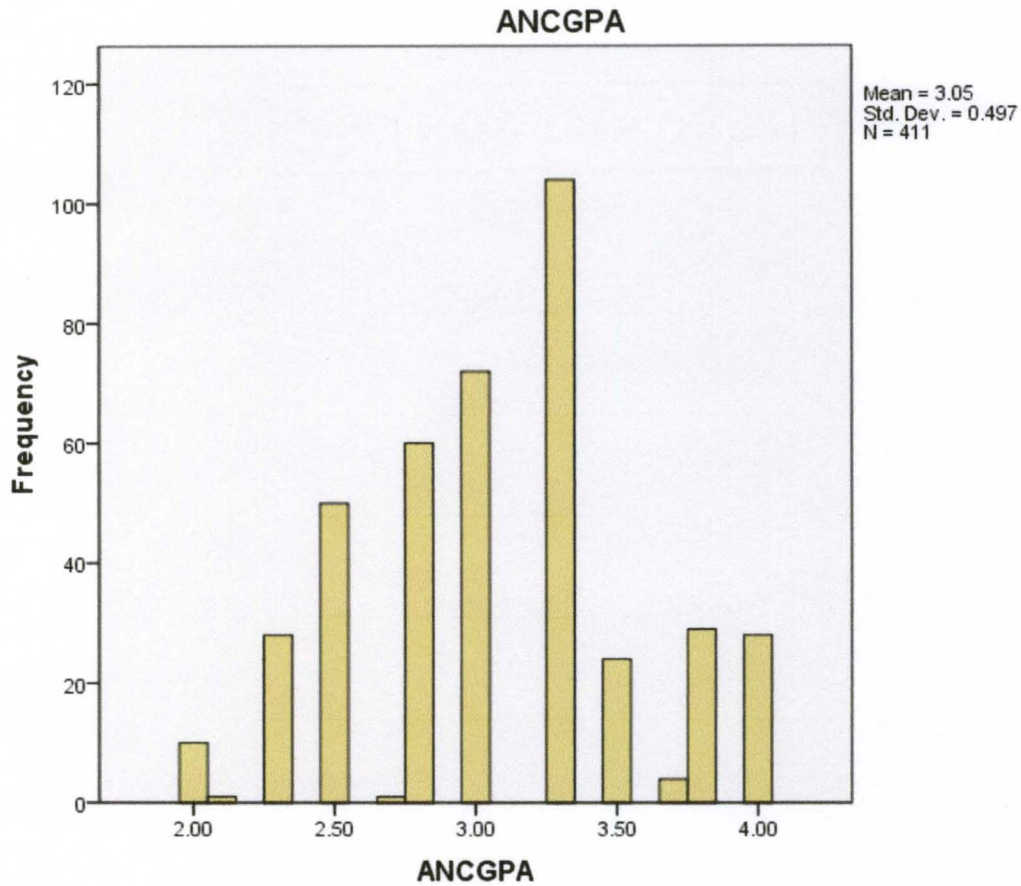


Figure 6. Histogram of Advanced Nursing Course Grade Point Averages ($N = 411$).

Number of Low Grades (NLG). The number of low grades indicates the frequency of low grades that are often predictive of problems in passing the NCLEX-PN as depicted in Figure 7. This includes the combined number of repeated classes (grade of D or below) plus initial grades of C, calculated across the ten nursing courses plus the two required prerequisite courses. The number of low grades for the population ranged from 0 to 12 with a mean number of 2.92 ($SD = 2.76$).

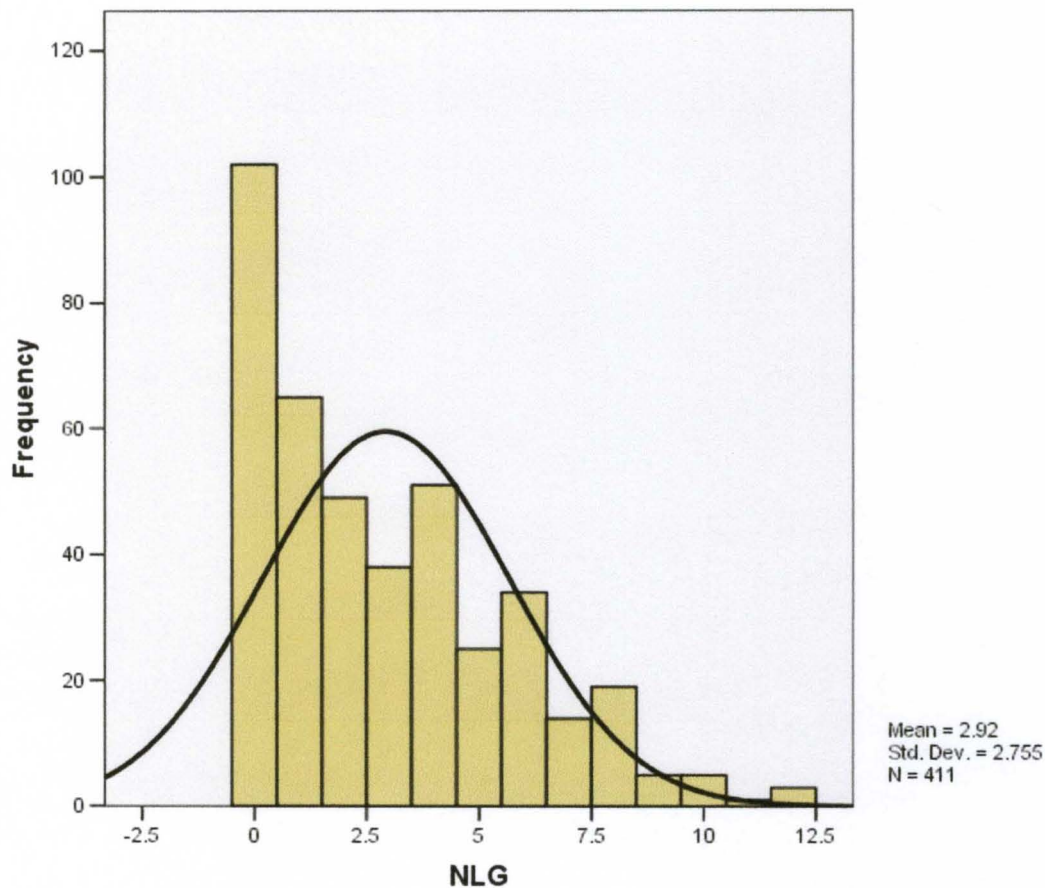


Figure 7. Histogram of NLG Frequency ($N = 411$).

Mediating Variables

The mediating variable was an Exit Comprehensive Exam to assess the student who had completed program content. It assists in identifying potential problems which could prevent the graduate from being successful on the NCLEX-PN examination.

Exit Comprehensive Exam (EXIT). The examination evaluates whether the applicant has the knowledge and skills to be successful on the NCLEX-PN. The nursing programs administered three types of examinations: the National League for Nursing Comprehensive (NLN) Exam, the Assessment Technologies Institute (ATI) Exam, and the Computerized Adaptive Test (CAT). Each exam had a cutoff score that predicted the

likelihood of success or non-success on the NCLEX-PN exam. Colleges were not required to administer an exit exam. Table 5 presents the Success Predictability of the Exit Comprehensive Exam for the NCLEX-PN.

Table 5

Distribution of Success Predictability on the NCLEX-PN for the Study Population

(N = 411)

Characteristic	Frequency	Percent
EXIT Comprehensive Exam	411	100.0%
Predicted to Pass (First Attempt)	330	80.3%
Predicted to Fail (First Attempt)	81	19.7%

Number of Exit Comprehensive Exam Attempts (NEA). In the majority of programs, when students were not predicted to be successful on the NCLEX, students were given additional attempts to take the Exit Comprehensive Exam. After one to two additional failures, students had to do remedial work in low performing areas. These students required one to three additional attempts to meet the cutoff scores.

Dependent Variable--NCLEX-PN

The dependent variable in this study was passing National Licensure Examination for Practical Nursing (NCLEX-PN) on the first attempt. Table 6 illustrates the distribution of the population. Of the 411 program graduates, 95.4% (392) successfully passed the licensure examination on the first attempt while 4.6% (19) did not pass the test on the first attempt.

Table 6

Distribution of Total Sample by National Licensure Examination (NCLEX-PN) Results

Characteristic	Frequency	Percent
NCLEX-PN Results	411	100.0%
Passed on First Attempt	392	95.4%
Did Not Pass on First Attempt	19	4.6%

Inferential Analysis

In order to answer the first six research questions, inferential statistics--correlation, Independent Sample *t* Tests, and chi-square analyses--were used to determine if there was a relationship between specific variables and the strength of that relationship. Finally, logistic regression was conducted with the independent predictor variables that demonstrated significance through chi-square to answer Research Question 7. Logistic regression was selected for this study because the dependent variable examined was recorded on a binominal scale and has only two possible outcomes. Logistic regression is also valuable in that it has predictive ability as well as provides information regarding the strength of the relationship between the independent variables examined and the dependent variable through analysis of the odds ratio.

Research Questions

There are seven research questions which address relationships among background, curricular, mediating variables, and success on the National Council Licensure Examination for Practical Nurses (NCLEX-PN).

Research Question 1

What are the relationships for Demographic and Admission Requirements on Curriculum?

Correlation and Independent Sample *t* Tests were used to examine the relationships for demographic and admission requirements with Curriculum. Using Pearson Correlation, there were significant associations for the demographic variables of age, number of low grades, and the curricular GPA (see Table 7). Examination of the correlations revealed moderate to strong relationships between the NLG and the GPA. As the NLG increased, the GPAs in all the courses decreased ($p < .01$). Compared to each other, the GPAs of the courses revealed moderate correlations ($p < .01$).

Table 7

Correlations for Age with Curricular GPAs and Number of Low Grades (N = 411)

	PCGPA	FNCGPA	SNCGPA	ANCGPA	NLG
AGE	.20**	.11*	.08	.07	-.14
PCGPA	--	.45**	.37**	.32**	-.57**
FNCGPA		--	.60**	.58**	-.71**
SNCGPA			--	.64**	-.75**
ANCGPA				--	-.72**

Note. PCGPA = Pre-requisite Courses Grade Point Average; FNCGPA = Foundation Nursing Courses Grade Point Average; SNCGPA = Specialty Nursing Courses Grade Point Average; ANCGPA = Advanced Nursing Courses Grade Point Average; NLG = Number of Low Grades.

* $p < .05$. ** $p < .01$.

An Independent Sample *t* Test was used to examine Race on Curricular GPA and number of low grades. For this statistical procedure, due to low cell numbers, a decision was made to collapse the race groups into Caucasian and Others. Table 8 represents the findings. No relationships approached statistical significance between race and curricular GPA and number of low grades.

Table 8

Independent Sample t Test for Race on Curricular GPA and Number of Low Grades

Curricular Area	Caucasian		Other ^a		<i>t</i>	Sig <i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
PCGPA	3.16	.585	3.25	.541	-1.110	.268
FNCGPA	3.26	.482	3.16	.503	1.550	.122
SNCGPA	2.94	.573	2.89	.516	.638	.524
ANCGPA	3.06	.503	2.98	.457	1.218	.224
NLG	2.88	2.732	3.19	2.889	-.831	.407

Note. PCGPA = Pre-requisite Courses Grade Point Average; FNCGPA = Foundation Nursing Courses Grade Point Average; SNCGPA = Specialty Nursing Courses Grade Point Average; ANCGPA = Advanced Nursing Courses Grade Point Average; NLG = Number of Low Grades.

^aOther = African/American, Asian, Hispanic, Not Specified.

Parallel to race, no statistically significant differences were noted for gender with Curricular GPA or NLG (see Table 9 for Independent Sample *t* Test for males and females). The means of males were somewhat higher in the first two curricular groups

whereas, the means for females were higher in the last two groupings.

Table 9

Independent Sample t Test of Gender on Curricular GPA and Number of Low Grades

Curricular Area	Male ^a		Female ^b		<i>t</i>	Sig <i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
PCGPA	3.19	.61	3.17	.58	.127	.812
FNCGPA	3.30	.46	3.24	.49	.716	.839
SNCGPA	2.93	.58	2.94	.56	-.038	.931
ANCGPA	3.03	.56	3.04	.49	-.095	.420
NLG	3.18	2.79	2.90	2.76	.556	.770

Note. PCGPA = Pre-requisite Courses Grade Point Average; FNCGPA = Foundation Nursing Courses Grade Point Average; SNCGPA = Specialty Nursing Courses Grade Point Average; ANCGPA = Advanced Nursing Courses Grade Point Average; NLG = Number of Low Grades.

^a*n* = 34 for males.

^b*n* = 377 for females.

Using Independent Sample *t* Test of Admission Requirements on Curricular GPA and Number of Low Grades, no statistically significant differences in GPA or NLG were noted between those that met Reading admission requirements and those that did not take/did not meet the admission requirements (see Table 10). Although there was very little difference between the means of those who met the cutoff scores in Reading and those that did not meet the requirements, it was expected that those meeting the

requirements would have a higher mean than those that did not meet the requirements. This was not the case for Reading admission requirements on FNCGPA, SNCGPA, and ANCGPA. However, these differences appear to represent random fluctuation as only the grades for prerequisite courses approached (but did not reach) significance.

Table 10

Independent Sample t Test of Admission Requirements for Reading on Curricular GPA and Number of Low Grades

Curricular Area	<u>Met^a</u>		<u>Not Met^b</u>		<i>t</i>	Sig <i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
PCGPA	3.19	.58	3.02	.58	1.752	.081
FNCGPA	3.24	.49	3.30	.44	-.687	.492
SNCGPA	2.93	.56	2.96	.57	-.328	.743
ANCGPA	3.04	.49	3.07	.53	-.343	.731
NLG	2.90	2.76	3.13	2.73	-.486	.627

Note. PCGPA = Pre-requisite Courses Grade Point Average; FNCGPA = Foundation Nursing Courses Grade Point Average; SNCGPA = Specialty Nursing Courses Grade Point Average; ANCGPA = Advanced Nursing Courses Grade Point Average; NLG = Number of Low Grades.

^aAny combination of the following Reading scores: ACT 16, COMPASS 76, ASSET 40, met the KCTCS program requirements for program entry.

^bStudents not meeting the cutoff Reading scores or students not taking the Reading admission assessment.

No statistically significant differences in GPA or NLG were noted for those that met and those that did not meet the Mathematics admission requirements for entry into the Practical Nursing program. Table 11 represents the Independent Sample *t* Test results.

Table 11

Independent Sample t Test of Admission Requirements for Mathematics on Curricular GPA and Number of Low Grades

Curricular Area	<u>Met^a</u>		<u>Not Met^b</u>		<i>t</i>	Sig <i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
PCGPA	3.18	.57	3.15	.62	.437	.662
FNCGPA	3.26	.49	3.20	.47	.935	.350
SNCGPA	2.94	.57	2.91	.56	.331	.741
ANCGPA	3.06	.49	3.00	.52	.991	.322
NLG	2.85	2.76	3.17	2.74	-.985	.325

Note. PCGPA = Pre-requisite Courses Grade Point Average; FNCGPA = Foundation Nursing Courses Grade Point Average; SNCGPA = Specialty Nursing Courses Grade Point Average; ANCGPA = Advanced Nursing Courses Grade Point Average; NLG = Number of Low Grades.

^aMathematics scores [ACT 16, COMPASS 34 (Pre-Algebra Domain), and ASSET 37-38 (Pre-Algebra Domain)] that demonstrated competency met the criteria for admission.

^bStudents not meeting the cutoff Mathematics scores or students not taking the Mathematics admission assessment

Research Question 2

What are the relationships for the Demographic and Admission Requirements on Exit Comprehensive Exam?

Independent Sample *t* Tests were used to examine age between those passing and those failing the Exit Comprehensive Exam. Age was not found to have a significant difference between those passing and those failing the Exit Comprehensive Exam as illustrated in Table 12.

Table 12

Independent Sample t Test of Students Passing the Exit Comprehensive Exam for Age (N = 411)

Exit Comprehensive Exam	<i>M</i>	<i>SD</i>	<i>t</i>	Sig <i>t</i>
<hr/>				
AGE				
Met ^a	31.99	8.26	.626	.531
Did Not Meet ^b	31.36	7.49		

^aMet = At or above Cutoff Score that predicted the likelihood of success on the NCLEX-PN exam.

^bDid Not Meet = Below Cutoff Score that predicted the likelihood of being successful on the NCLEX-PN.

Figure 8 presents the Cross tabulation and Chi-square which were used to examine frequencies for differences in passing the Exit Comprehensive Exam based on

Gender. No significant differences in proportions were noted in the groups of men compared to women passing the Exit Comprehensive Exam, $\chi^2(1) = .586, p = .444$.

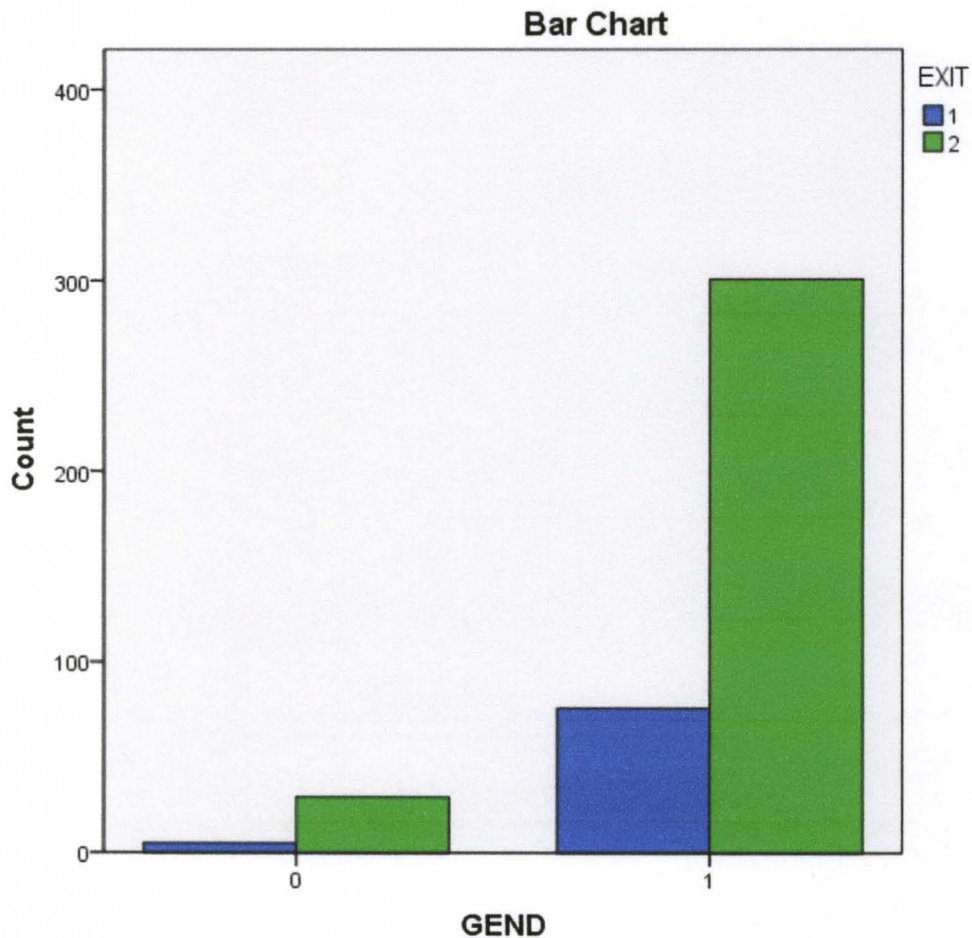


Figure 8. Number of Cases by Gender for Exit Comprehensive Exam.

Note. For Gender, Male = 0; Female = 1. For Exit, Predicted non-success on EXIT = 1; Predicted success on EXIT = 2.

Frequencies of those students passing the Exit Comprehensive Exam by race revealed no significant race differences in the numbers of those passing the Exit Comprehensive Exam compared to those failing it, $\chi^2(4) = 3.456, p = .485$. As noted in

Figure 9, cases plotted by race reveal a mostly Caucasian sample with low frequencies in the other categories of race.

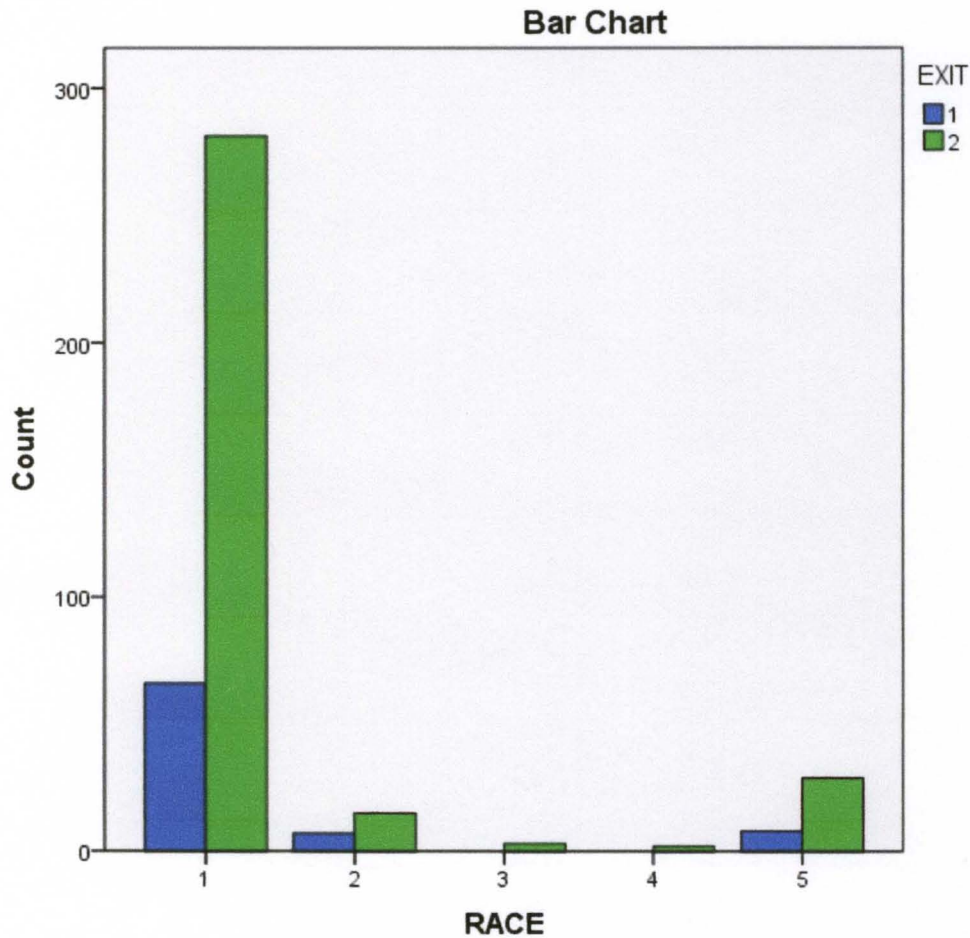


Figure 9. Number of Cases by Race.

Note. For Race, Caucasian = 1; African American = 2; Asian = 3; Hispanic = 4; and Not Specified = 5. For EXIT, Predicted non-success on EXIT = 1; Predicted success on EXIT = 2.

Cross tabulation and Chi-square were also used to examine frequencies for differences in passing the Exit Comprehensive Exam based on reading and mathematics admission assessments. There was a significant association between the admission

assessment of Reading and whether or not students would meet the cut-off scores on the Exit Comprehensive Exam, $\chi^2(1) = 5.565, p = .018$. Those meeting the reading admission requirements were more likely to meet the cut-off scores on the Exit Comprehensive Exam than those not meeting it. Figure 10 illustrates Reading Assessment and Exit Comprehensive Exam frequencies.

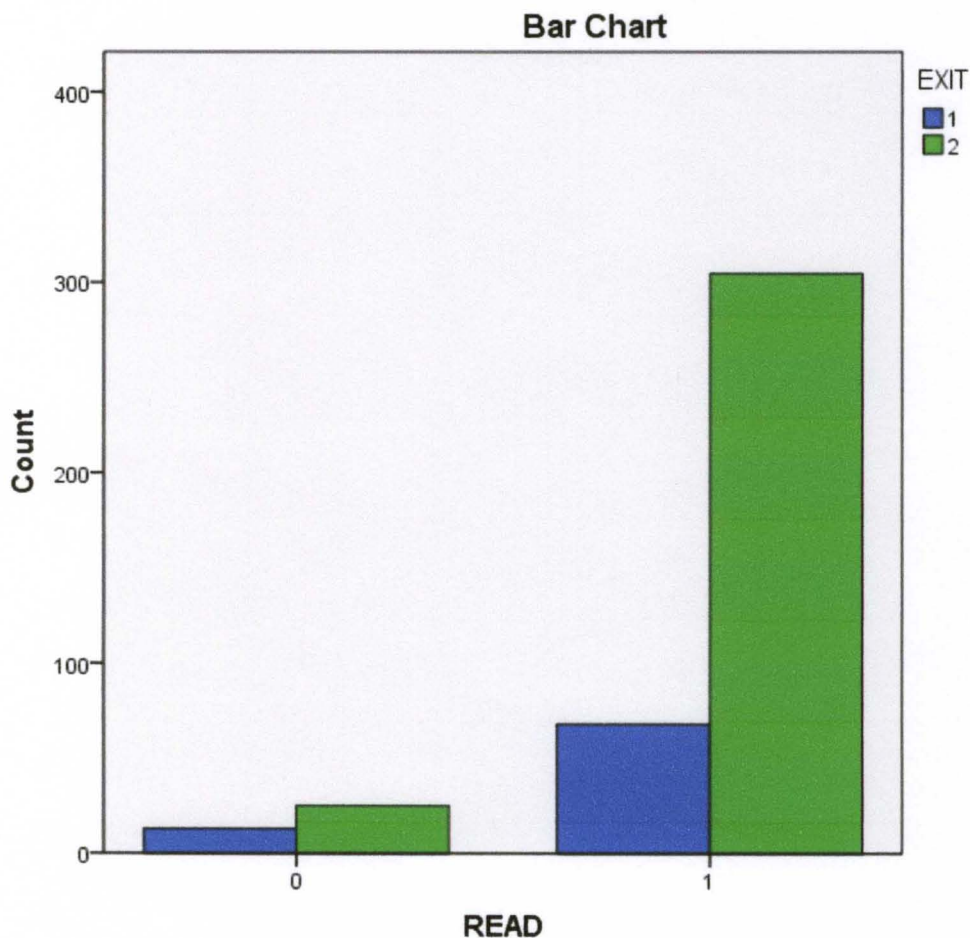


Figure 10. Reading Assessment on Exit Comprehensive Exam.

Note. For Read, Students not meeting the cutoff Reading scores or students not taking the Reading admission assessment = 0; Any combination of the following Reading scores-- ACT 16, COMPASS 76, ASSET 40--met the KCTCS program requirements for program entry = 1. For EXIT, Predicted non-success on EXIT = 1; Predicted success on EXIT = 2.

There was not a significant association between the admission assessment of Mathematics and whether or not students would meet the cut-off scores on the Exit Comprehensive Exam, $\chi^2(1) = 1.917, p = .166$. Those meeting the math requirement were no more likely to meet the cut-off scores on the Exit Comprehensive Exam than those that did not meet them (see Figure 11).

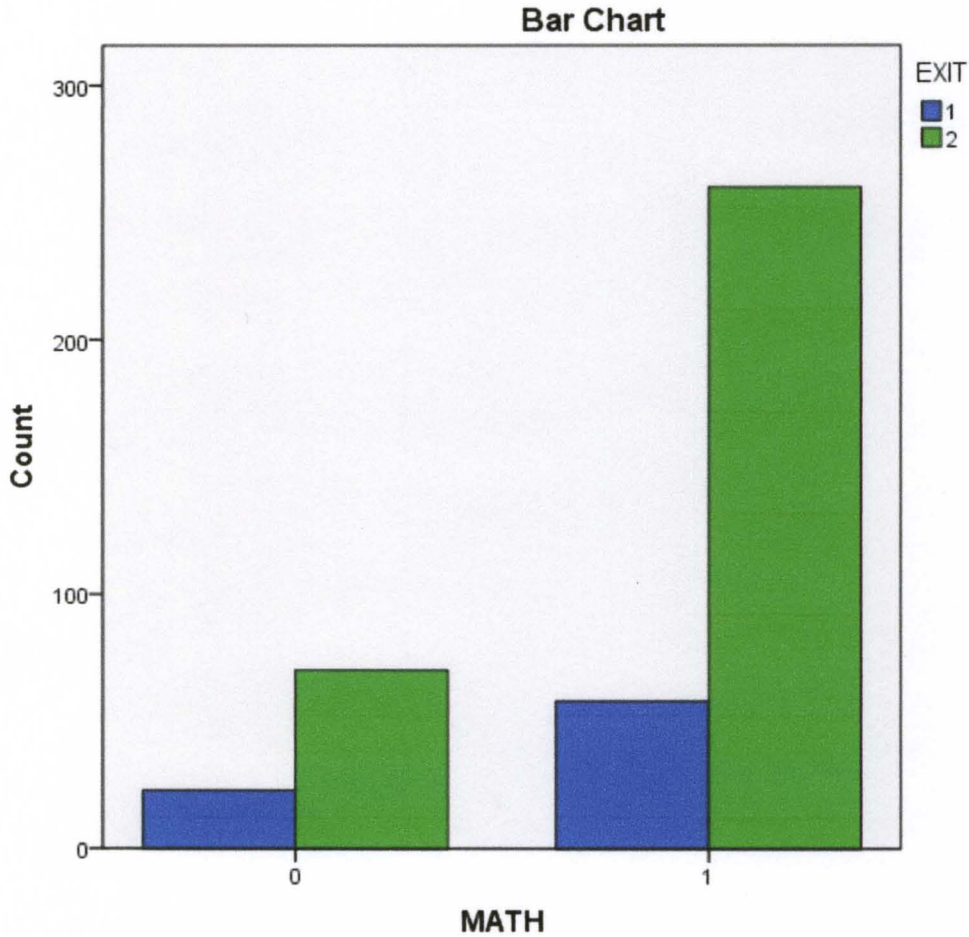


Figure 11. Mathematics Assessment on Exit Comprehensive Exam.

Note. For MATH, Students not meeting the cutoff Mathematics scores or students not taking the Mathematics admission assessment = 0; Mathematics scores [ACT 16, COMPASS 34 (Pre-Algebra Domain), and ASSET 37-38 (Pre-Algebra Domain)] that demonstrated competency met the criteria for admission = 1. For EXIT, Predicted non-success on EXIT = 1; Predicted success on EXIT = 2.

Research Question 3

What are the relationships for Demographic and Admission Requirements on NCLEX-PN?

An Independent Sample *t* Test was used to examine age between those passing the

NCLEX and those failing. Levene’s test was significant at $p = .001$ which indicated that the null hypothesis was incorrect and that the variances were significantly different, thus violating the assumption of homogeneity of variance. Using Equal Variances not Assumed to read the test statistics, these results suggest that age does contribute to the outcome of whether the graduate passes or fails the NCLEX-PN. Table 13 indicates that on average, there was a significant difference in the ages for those who failed the NCLEX-PN and those who passed.

Table 13

Independent Sample t Test of Students Passing the NCLEX-PN Exam for Age

	NCLEX-PN	Mean (SD)	<i>t</i> (df)	Sig <i>t</i>
AGE				
	Passing	32.17 (8.12)	6.002 (24.02)	< .001
	Failing	25.47 (4.53)		

Note. Equal variances not assumed.

Differences in the proportions of ethnicities and proportion of men versus women and admission requirements of those passing the NCLEX and those failing it were examined using Cross tabulations and Chi-square. No significant differences were noted (see Table 14) in passing the NCLEX-PN exam based on gender, race, or admission requirements.

Table 14

Chi-Square of Demographic and Admission Requirements on NCLEX-PN (N = 411)

Demographic and Admission Requirements	NCLEX-PN		χ^2 (df) ^a	p
	Successful	Not Successful		
Race	392	19	6.09 (4)	.19
Caucasian	331	16		
African/American	19	3		
Asian	3	0		
Hispanic	2	0		
Not Specified	37	0		
Gender	392	19	1.48 (1)	.22
Male	31	3		
Female	361	16		
Admission Requirements				
READ	392	19	.00 (1)	1.00
Met ^b	356	17		
Not Met ^c	36	2		

(table continues)

Table 14. (continued)

Demographic and Admission Requirements	NCLEX-PN		χ^2 ^a (df) ^a	p
	Successful	Not Successful		
MATH	392	19	1.02 (1)	.31
Met	301	17		
Not Met	91	2		

Note. Successful = Passed the NCLEX-PN on the first attempt. Not Successful = Did not Pass the NCLEX-PN on the first attempt.

^aYates correction for expected frequencies < 5.

^bMet = READ = any combination of the following Reading scores: ACT 16, COMPASS 76, ASSET 40, met the KCTCS program requirements for program entry. MATH = Mathematics scores [ACT 16, COMPASS 34 (Pre-Algebra Domain), and ASSET 37-38 (Pre-Algebra Domain)] that demonstrated competency met the criteria for admission.

^cNot Met = READ = Students not meeting the cutoff Reading scores or students not taking the Reading admission assessment. MATH = Students not meeting the cutoff Mathematics scores or students not taking the Mathematics admission assessment.

Research Question 4

What are the relationships for Curriculum variables on Exit Comprehensive Exam?

NLG and GPA of students that passed and failed the Exit Comprehensive Exam were examined using the Independent Sample *t* Test. On average, students who had lower

grade point averages in SNCGPA were more likely to fail the Exit Comprehensive Exam. This difference was statistically significant at $p = .005$. It should be noted that NLG was almost significant at $p = .052$. Table 15 represents the Independent Sample t Test of Students meeting the cutoff scores on the Exit Comprehensive Exam for predictability of success by GPA and NLG.

Table 15

Independent Sample t Test of Students' Performance on the Exit Comprehensive Exam for GPA and NLG (N = 411)

Curricular Area	Met ^a		Not Met ^b		t	Sig t
	M	SD	M	SD		
PCGPA	3.18	.58	3.15	.57	.375	.710
FNCGPA	3.24	.49	3.26	.48	-.254	.800
SNCGPA	2.97	.56	2.78	.57	2.794	.005
ANCGPA	3.05	.50	3.02	.50	.443	.658
NLG	2.79	2.7	3.46	2.9	-1.947	.052

Note. As NLG mean increases, the student is more likely to fail the Exit Comprehensive Exam.

^aMet = Cutoff score that predicted the likelihood of success on the NCLEX-PN exam.

^bDid Not Meet = Cutoff score that predicted the likelihood of being unsuccessful on the NCLEX-PN.

Using Pearson Correlation, the number of attempts taking the Exit Comprehensive Examination was negatively correlated with the GPA (see Table C1) in curricular courses

(PCGPA, FNCGPA, SNCGPA). There was a positive correlation between NLG and NEA.

Research Question 5

What are the relationships for Curriculum variables on NCLEX-PN?

Examination of the differences in the number of low grades and GPA on curriculum between students passing the NCLEX-PN and those failing revealed significant differences in the number of low grades and all the GPAs between students who failed the NCLEX-PN and passed the NCLEX-PN. Table 16 represents the Independent Sample *t* Test of students passing the NCLEX-PN Examination for Curriculum and NLG.

Table 16

Independent Sample t Test of Students Passing the NCLEX-PN Exam for Curriculum and NLG (N = 411)

Curricular Area	<u>Successful</u>		<u>Not Successful</u>		<i>t</i>	Sig <i>t</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
PCGPA	3.19	.572	2.85	.646	2.52	.012
FNCGPA	3.26	.478	2.93	.546	2.96	.003
SNCGPA	2.96	.559	2.40	.383	4.33	< .001
ANCGPA	3.07	.490	2.63	.449	3.79	< .001
NLG	2.76	2.65	6.32	2.79	-5.70	< .001

Research Question 6

What are the relationships for Exit Comprehensive Exam on NCLEX-PN?

Cross tabulations and Chi-square were used to examine differences in the proportions of those who took the Exit Comprehensive Exam and were predicted to pass

the NCLEX-PN and those that did not take the Exit Comprehensive Exam or were not predicted to pass NCLEX-PN. Those who passed the Exit Comprehensive Exam were more likely to pass the NCLEX compared to those not passing or not taking the Exit Comprehensive Exam. Those not taking the exam or not passing the exam failed the NCLEX more frequently than those who did take it and failed. As illustrated in Table 17, 80% of those taking/passing the Exit Comprehensive Exam were predicted to pass the NCLEX- PN while 20% were not predicted to be successful. Of those predicted to be successful on the NCLEX, 78% were successful while 2% were not; of those predicted not to pass the NCLEX, 18% were successful while 2% were not.

Table 17

Chi-Square of Exit Comprehensive Exam and NCLEX-PN (N = 411)

Exit Comprehensive Exam	NCLEX-PN		χ^2 ^a	P
	Successful	Not Successful		
Predicted to Pass	78%	2%	7.87	.005
Not Taken/Not Predicted to Pass	18%	2%		

^aYates correction for expected frequencies < 5.

An Independent Sample *t* Test (using equal variances not assumed) revealed no significant difference ($p = .162$) in the Number of Exit Comprehensive Exam attempts (NEA) and students who failed or passed the NCLEX- PN.

Research Question 7

What is the predictive value of the demographic/admission requirements, curriculum variables, and Exit Comprehensive Exam on NCLEX-PN status?

Logistic Regression comparing independent variables entered simultaneously, based on the above findings and correlations (see Table C1), was conducted to determine the model that best predicts variables that would increase the probability of success on the NCLEX-PN. Based on the findings, the default method of conducting the regression was used, i.e., the same as forced entry in multiple regression in that all of the covariates are placed into the regression model in one block, and parameter estimates are calculated for each block. Another reason for using the default (Enter) method is the concern that stepwise techniques are influenced by random variation in the data and so seldom give replicable results if the model is retested within the same sample (Field, 2005).

In this study, two statistics were assessed to determine improvement in overall goodness-of-fit of the three steps in the model. First, the likelihood-ratio test based on -2LL ratio is a test of the significance of the difference between the likelihood ratio (-2LL) for the researcher's model with predictors minus the likelihood ratio for baseline model with only a constant in it. Significance at the .05 level or lower means the researcher's model with the predictors is significantly different from the one with the constant only. The second test for goodness-of-fit is the Hosmer-Lemeshow statistic. This statistic evaluates the goodness-of-fit by creating 10 ordered groups of subjects and then compares the number actually in each group (observed) to the number predicted by the logistic regression model (predicted). Thus, the test statistic is a chi-square statistic with a desirable outcome of non-significance, indicating that the model prediction does not significantly differ from the observed. The constant only model presents the results with

only the constant included before any coefficients are entered into the equation. Logistic regression compares this model with a model including all predictors (control, curriculum, and mediating variables) to determine whether the latter model is more appropriate (Burns & Burns, 2008; Field 2005). Table 18 notes the constant only model.

Table 18

Logistic Regression Constant-Only Model Results

Variable	<i>B</i>	<i>SE</i>	Wald	<i>df</i>	Sig	Exp(B)
Constant	3.027	.235	166.024	1	< .001	20.632

A three step default (Enter) Logistic Regression model was used to determine the predictive value of control, curricular, and mediating variables (see Table 19). Step One of the Logistic Model included the demographic and admission variables to determine the probability that demographics (age, gender, race) and admission requirements (Math, Read) would increase the likelihood of success on the NCLEX-PN. For Step 1, the Case Model has a significant Chi-Square, $\chi^2(8) = 25.918, p < .001$; and -2LL (128.007) thus, indicating that the model has a poor fit with the model containing only the constant. This supports that the predictors do have a significant effect and create essentially a different model. Another indicator that shows the goodness-of-fit is appropriate includes the Hosmer and Lemeshow (H-L) test statistic ($p = .956$). Since H-L was greater than $p = .05$, the model's goodness-of-fit is acceptable.

Step 1 results show a Nagelkerke's R^2 of .196 which indicates a weak relationship between prediction and grouping. Prediction success overall was 95.4%. This percentage is no greater than the constant model which is a prediction by chance. The Wald criterion

demonstrated that only age ($p = .002$) made a significant contribution to prediction. Because the value of EXP(B) is above 1, the value indicates that when age increases by one unit (one year), the odds ratio increases 1.197 times for each year of age. No other demographic (gender, race) or admission requirement (Math, Read) variables were significant in Step 1.

Step 2 of the Logistic Model retained the demographic and admission variables and added the curricular variables of pre-requisite, foundation, specialty, and advanced courses and the number of low grades. For Step 2 of the Logistic Model, the Case Model has a Chi-Square and significance of $\chi^2(13) = 51.990$, $p = < .001$; -2 LL of 101.936; and a H-L test statistic of $p = .956$, indicating that Step 2 of the Model passed the goodness-of-fit test. Although Nagelkerke's R^2 of .380 is greater than in Step 1, it only demonstrates a weak to moderate relationship between prediction and grouping. Prediction success overall was 95.9% (99.7% for predicting the probability of success and 15.8% for predicting those more likely to be unsuccessful) which is an increase over the Constant Model and that of Step 1. The Wald criterion demonstrated that only age ($p = .002$) made a significant contribution to prediction. The EXP(B) value of 1.219 indicates that when age increases by one unit (one year), the odds ratio is 1.219 times more likely to pass the NCLEX-PN. No additional variables were significant in Step 2 although NLG was close at $p = .063$.

For Step 3 of the Logistic Model, the Exit Comprehensive Exam and Number of Exit Attempts were added to the other variables in the model. The Case Model had a Chi-Square and significance of $\chi^2(15) = 57.674$, $p < .001$; -2LL of 96.252; and a H-L test statistic of $p = .834$. Thus, Step 3 of the Model passed the goodness-of-fit test. Nagelkerke's R^2 of .419 is greater than Steps 1 and 2, indicating a moderate relationship between prediction and grouping. Prediction success overall was 95.9% (99.2% for

predicting the probability of success and 26.3% for predicting those more likely to be unsuccessful) which represents an additional increment over Step 2 and that increase over Step 1 (95.4%) and the Constant Model (95.4%). The Wald criterion demonstrated that age ($p = .002$) and the Exit Comprehensive Exam ($p = .038$) made a significant contribution to prediction. The EXP(B) value for age (1.228) and the Exit Comprehensive Exam (.171) indicate that when age increases by one unit (one year), the odds ratio is 1.228 times more likely to pass the NCLEX-PN. Because the Exit Comprehensive Exam results are under 1, any increase in the predictor leads to a drop in the odds of the outcome. Thus, as students fail the Exit Comprehensive Exam or do not take it, the odds of passing the NCLEX-PN decrease by 83%. Although no other variable was statistically significant, gender and number of low grades would have been significant for $\alpha = .10$ at $p = .094$ and $p = .097$, respectively.

Table 19

Simultaneous Logistic Regression Entry Model for Demographic/Admission Requirements, Curriculum Variables, and Exit Comprehensive Exam on NCLEX-PN Status (N = 411)

Variable	B	SE	Wald	df	Sig	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
Step 1								
Age	.180	.058	9.726	1	.002	1.197	1.069	1.341
GENDER (1)	-.791	.697	1.290	1	.256	.453	.116	1.776
RACE			2.683	4	.612			
RACE (1)	-17.924	6132.813	.000	1	.998	.000	.000	
RACE (2)	-19.097	6132.813	.000	1	.998	.000	.000	
RACE (3)	2.006	19843.565	.000	1	1.000	7.432	.000	
RACE (4)	-2.591	29062.863	.000	1	1.000	.075	.000	
READ (1)	-.897	.895	1.004	1	.316	.408	.071	2.357

(table continues)

Table 19. (continued)

Variable	B	SE	Wald	df	Sig	EXP(B)	95% CI for EXP(B)	
							Lower	Upper
Step 1 (continued)								
MATH (1)	.792	.872	.826	1	.363	2.208	.400	12.196
Constant	15.958	6132.813	.000	1	.998	8517673.522		
Step 2								
Age	.198	.062	10.069	1	.002	1.219	1.079	1.398
GENDER(1)	-1.162	.800	2.109	1	.146	.313	.065	1.501
RACE			.746	4	.946			
RACE(1)	-17.691	5627.974	.000	1	.997	.000	.000	
RACE(2)	-18.388	5627.974	.000	1	.997	.000	.000	
RACE(3)	.479	20765.792	.000	1	1.000	1.614	< .001	

(table continues)

Table 19. (continued)

Variable	<i>B</i>	<i>SE</i>	Wald	<i>df</i>	Sig	EXP(B)	95% CI for EXP(B)	
							Lower	Upper
Step 2 (continued)								
RACE	-4.305	28872.918	.000	1	1.000	.014	.000	
READ(1)	-.559	1.017	.302	1	.583	.572	.078	4.200
MATH(1)	.732	.922	.630	1	.427	2.080	.341	12.680
PCGPA	-.559	.675	.688	1	.407	.571	.152	2.145
FNCGPA	-1.150	.836	1.889	1	.169	.317	.061	1.632
SNCGPA	1.336	.990	1.820	1	.177	3.802	.546	26.469
ANCGPA	.028	.882	.001	1	.975	1.028	.183	5.792
NLG	-.443	.238	3.456	1	.063	.642	.402	1.024
Constant	18.897	5627.978	.000	1	.997	1.611E8		

(table continues)

Table 19 (continued)

Variable	B	SE	Wald	df	Sig	EXP(B)	95% CI for EXP(B)	
							Lower	Upper
Step 3								
Age	.205	.067	9.506	1	.002	1.228	1.078	1.399
GEND (1)	-1.371	.819	2.804	1	.094	.254	.051	1.263
RACE			.343	4	.987			
RACE (1)	-18.062	5413.870	.000	1	.997	.000	.000	
RACE (2)	-18.586	5413.870	.000	1	.997	.000	.000	
RACE (3)	-.436	20692.222	.000	1	1.000	.646	.000	
RACE (4)	-5.144	28788.353	.000	1	1.000	.006	.000	
READ (1)	-.309	1.057	.085	1	.770	.734	.093	5.828
MATH(1)	.654	.949	.474	1	.491	1.923	.299	12.362

(table continues)

Table 19. (continued)

Variable	<i>B</i>	<i>SE</i>	Wald	<i>df</i>	Sig	EXP(B)	95% CI for EXP(B)	
							Lower	Upper
Step 3 (continued)								
PCGPA	-.380	.718	.281	1	.596	.684	.167	2.794
FNCGPA	-.723	.893	.656	1	.418	.485	.084	2.793
SNCGPA	.835	1.025	.663	1	.415	2.305	.309	17.200
ANCGPA	.239	.926	.066	1	.797	1.269	.207	7.799
NLG	-.414	.250	2.746	1	.097	.661	.405	1.079
EXIT(1)	-1.764	.834	4.466	1	.035	.171	.033	.880
NEA	.517	.883	.343	1	.558	1.677	.297	9.468
Constant	18.269	5413.875	.000	1	.997	8.594E7		

Summary

Descriptive and inferential statistics were utilized to describe the study population and analyze the data. The sample was 411 graduates from 14 practical nursing programs in ten colleges managed by the Kentucky Community and Technical College System.

Detailed descriptives of the data established that the sample was primarily female and Caucasian. The seven empirical research questions were directly connected to the central research question: what variables predict success on the licensure examination for practical nurses?

Pearson's Correlation, in response to Research Question 1, revealed significant correlations between the demographics and the curricular GPA. Using an Independent Sample *t* Test, no statistically significant differences were noted by race, programmatic courses, and the number of low grades. No statistical significance was found between the performance on curricular GPA and meeting the admission requirements.

Cross tabulation, Chi-square, and Independent Sample *t* Tests were used to answer Research Question 2. There was a significant association between the admission reading assessment and whether or not students would meet the cut-off scores on the Exit Comprehensive Exam but a significant association was not found for math. No significant differences were noted for age, gender, or race and Exit Comprehensive Exam.

Using Independent Sample *t* Tests in response to Research Questions 3, 4, and 5 indicated there was a significant difference in the ages of those who failed and those who passed the NCLEX-PN; a statistically significant difference in one level of the nursing programmatic courses (SNCGPA) between those that passed and those that failed the Exit Comprehensive Exam; and a statistically significant difference in the number of low grades and GPA on curriculum between students who failed the NCLEX-PN and passed the

NCLEX-PN. Using Pearson Correlation, there were significant negative associations between curriculum and number of low grades and the number of attempts on the Exit Comprehensive Exam.

Chi-square and Independent Sample *t* Test were used to answer Research Question 6. Those taking the Exit Comprehensive Exam were more likely to pass the NCLEX compared to those not passing or not taking the Exit Comprehensive Exam. The number of attempts on the Exit Comprehensive Exam and success on the NCLEX-PN was not found to be statistically significant.

Finally, logistic regression was used for Research Question 7 to determine the predictive value of the demographic and admission requirements, curriculum variables, and Exit Comprehensive Exam on NCLEX-PN status. Hierarchical logistic regression with simultaneous entry of variables was the method used in this study. Step 1 included the control (demographic and admission requirement) variables with only age making a significant contribution to prediction. Step 2 added the curricular variables (pre-requisite, foundation, specialty, advanced nursing courses and number of low grades) to the variables of Step 1. Age remained significant but no new predictor contributed to prediction. Step 3 added the Exit Comprehensive Exam and Number of Exit Attempts to the variables in Step 2. Two variables (age and the Exit Comprehensive Exam) were found to make a significant contribution to success on the NCLEX-PN. The admission (READ, MATH); curricular, (PCGPA, FNCGPA, SNCGPA, ANCGPA, NLG); mediating (NEA); and demographic (gender, ethnicity) variables were not significant predictors. Nagelkerke's R^2 indicated a moderate relationship (.419) between the independent variables and the ability of the logistic model to explain the variation in the Dependent Variable, NCLEX-PN.

CHAPTER V

DISCUSSION AND CONCLUSIONS

The Study in Brief

The health care system and the need for competent nursing professionals continues to grow from an urgent situation to a crisis given that the population is aging and those individuals over the age of 65 will double in the next 20 years, with persons over the age of 80 accounting for an additional 10 million people. This is further complicated by the potential retirement within the next 10 years of 40% of currently practicing registered nurses (Buerhaus, et al. 2008). Although this frequency does not include the licensed practical nurses that will also retire, it points to a nursing shortage of crisis proportion within a healthcare system with ever increasing needs for qualified nurses.

To respond to that shortage, several strategies have been proposed. One major strategy is collaboration among the educational levels of nursing in the form of a career pathway which encompasses the concept of lifelong learning. This pathway, which embraces the building of skills and knowledge throughout the life of an individual, provides a strategy for increasing the supply of nurses, especially within the Kentucky Community and Technical College System (KCTCS) which has educational programs both at the associate degree and practical nursing levels. The current nursing shortage, in conjunction with the state of the economy and need for effective use of resources, compels policymakers, administrators, and nursing associations to find effective academic and programmatic counseling as a means for recruitment, retention, and preparation of

students.

Over the past 20 years there has been much interest in researching predictors of success on the National Council Licensure Examination, but most of the research has been at the baccalaureate and associate degree levels rather than the practical nursing level. Although existing research based on the registered nurse (associate and baccalaureate levels) may provide insight into predictors of success for the licensure exam for registered nurses (NCLEX-RN), these same predictors may not be comparable to the practical nursing student. Several researchers (Alexander & Brophy, 1997; Foti & DeYoung, 1991; Fowles, 1992) have suggested that individual nursing programs identify their own success predictors since these may vary among institutions. This suggestion provides an impetus for the central research question of this study, what variables from KCTCS predict success on the licensure examination for practical nurses (NCLEX-PN)?

Purpose

This research study addressed the issue of background and curricular variables which may predict success on the NCLEX-PN. The review of the literature guided the selection of the variables to include in this study. The review demonstrated conflicting results regarding demographic variables which were predictive of success on the NCLEX-RN and NCLEX-PN. Age, specifically the older student, (Aldag & Rose, 1983; Friedemann & Valentine, 1988; Harris, 2006; Parrish, 1994; Thompson, 1989; Yates, 2007), was found to be predictive of success on the NCLEX. Studies were inconsistent as to whether gender and race were significant in success on the NCLEX-PN. Yates (2007) and Boudreaux (2006) found that males did better on the NCLEX- RN and NCLEX-PN, respectively; whereas Haas, et al., (2004) found that females were more successful. Brisco and Anema (1999), Byers (1991), and Hereford (2005) found race to be predictive of

success on the NCLEX-RN and NCLEX-PN, respectively. In particular the Caucasian student had greater success on the NCLEX than minorities (Haas et al. 2004; Harris, 2006; Parrish, 1994; Swift, 1989; Thompson, 1989; Yates 2007).

The literature results were inconsistent concerning pre-admission assessments and success of students on the NCLEX-RN and NCLEX-PN. Adams (1990), Felts (1986), Fowles (1992), Gilmore (2006), McClelland et al. (1992), Muecke (2008), Rami (1992), Sharp (1986), and Vandenhouten (2008) all found that pre-admission variables were predictive of success on the NCLEX. Although Thompson (1989) found that the math pre-admission assessment was statistically significant on the NCLEX-PN, Aldag and Rose (1983), Hawsey (2007), and Woodham and Taube (1986) found that the math assessment was not significant as a predictor of success on the NCLEX-RN and NCLEX-PN, respectively. Hawsey (1997) did find that the pre-admission assessment of reading was significant on the NCLEX-PN.

Social science and applied science courses were found to be predictive of success on the NCLEX (Fowles, 1992; McKinney, 1989; Rami, 1992; Roncoli, et al. 2000; Stright, 1992; Webster, 1991; Whitley & Chadwick, 1986; Yocum & Scherubel, 1985).

Programmatic variables were overwhelmingly found to be predictors of success on the NCLEX (Alexander & Brophy, 1997; Anderson, 1993; Arathuzik & Abner, 1998; Fowles, 1992; Heupel, 1992; Horns et al. 1991; Krupa et al. 1988; McKinney et al. 1991; Mills et al. 1992; Muecke, 2008; Ostrye, 2000; Rami, 1992; Roncoli et al. 2000; Sharp, 1986; Tipton et al. 2008; Whitley & Chadwick, 1986; Woodham & Taube, 1986; Yocum & Scherubel, 1985).

Other research (Alexander & Brophy, 1997; Anderson, 1993; Brisco & Anema, 1998; Foti & DeYoung, 1991; Horns et al. 1991; NLN, 1974; Rami, 1992; Vandenhouten,

2008; Young-Richardson, 1996) supports Exit Comprehensive Exams as a predictor for those students who are more likely to be successful on the NCLEX-RN and NCLEX-PN. The Exit Comprehensive Exams identified in the literature were the National League for Nursing (NLN) Comprehensive Exam, a School Comprehensive Exam, and the Assessment Technologies Institute (ATI) Exam.

Prior knowledge from the classroom and the literature review formed the basis for determination of the predictor variables. Controlling variables for pre-admission (READ, MATH) demographic (AGE, GEND, RACE); curricular, (PCGPA, FNCGPA, SNCGPA, ANCGPA, NLG); and mediating (EXIT, NEA) variables were examined for their impact on the prediction of success on the NCLEX-PN within this study.

This study also framed the variables around Carroll's (1989) Three Stratum Theory. According to this theory, five elements contribute to the effectiveness of instruction. First, there is aptitude or the students' general abilities to learn as demonstrated by the use of admission tests of Math and Reading and the student's preparation/readiness for entering the nursing program. Second is the ability to understand instruction which refers to the students' knowledge of prerequisite skills and information needed to comprehend a unit of instruction as demonstrated by the four distinct curricular variables. These curricular variables move from simple to complex concepts with each level being a pre-requisite for entering sequential levels. Third, the element of perseverance refers to the amount of time students are willing to spend actively participating in the learning process. This includes remediation, home work, and seeking answers to concepts that they do not understand. The fourth element is opportunity which refers to the amount of time available for learning the program content. In nursing, this element is limited. Students may only repeat a course one time. Additional opportunities to repeat the course are exceptions to the

academic progression policy. Finally, quality of instruction refers to the effectiveness with which the unit of instruction is actually delivered as demonstrated by success or failure on the NCLEX-PN. Although the competencies, outlines, and student outcomes are the same, the delivery method varies among colleges and faculty.

Methodology

Following approval of the study by the University of Louisville Institutional Review Board and by the KCTCS Human Subjects Review Board (Appendix B), data were collected from the KCTCS database and program coordinators' files. The population for this study consisted of students who graduated in 2006 – 2007 from 14 practical nursing programs in ten colleges within KCTCS and who used the traditional curriculum. The study began with 581 records. The rules on missing data resulted in the deletion of 129 records across the three types of independent variables. Of the 129 records deleted, forty-eight records were deleted because NCLEX results were not reported. In addition, forty one records were deleted because they were outside the parameters of the academic year surveyed. Following the protocol for missing data enumerated in Chapter III, a set of records ($N = 411$) were used in this study.

Analyses for this research study included descriptive and inferential statistics of the predictor variables and the dependent variable of NCLEX-PN. Hierarchical logistic regression model procedures were used to identify the contribution of the independent variables to NCLEX-PN performance and to determine the probability of passing the licensure examination according to selected independent variables. The remainder of this chapter provides an overview of the research findings from the analyses and a discussion of the results. Conclusions are also provided and recommendations for practice and further research are posed.

Discussion

At the onset of this research study, it was expected that grade point averages of the science, social science, and nursing courses would predict success on the NCLEX-PN as would the mediating variable (Exit Comprehensive Exam). It was unclear whether demographic and pre-admission variables would impact the study since the literature was inconsistent as to the statistical significance of these factors. Ultimately, the goal was that this study would provide solid empirical evidence for and knowledge about the factors related to student success on this licensure exam.

Descriptive Statistics

Descriptive statistics describe the basic features of the data in this study and provide characteristics of the sample. These calculations were produced for the students in the sample who had reported NCLEX-PN licensure examination results ($N = 411$). The age of students at the time of graduation ranged from 19 to 58 with an average age of 31.85 and a median of 30. The most reported age at graduation was 25. A greater percentage of females (91.7%) graduated from the practical nursing program as compared to males. Minorities (6.6%), as defined by race, comprised a smaller portion of the sample as compared to Caucasians (84.4%). Nine percent of the graduates reporting did not specify this factor.

Analysis

The mean age of the sample is evidence of the non-traditional student served by the colleges' practical nursing programs. Although the mean age was 31.85, the age distribution was positively skewed with mass of the ages being on the younger range of age.

The disproportional representation of males was similar to the sample distribution

of other nursing studies (Hawsey, 1997; Horns et al. 1991) and also similar to the overall distribution of practical nurses (female, 94.2%; male, 5.8%) in Kentucky (KBN, 2010). The minority sample is somewhat lower than the state average as the percentage of minority practical nurses in Kentucky (KBN 2010) is 8.9% with 1.2% of the population not specified.

Research Questions

Seven research questions were formed to examine the relationship between three sets of variables (control, curriculum, and mediating) and success on the NCLEX-PN. The following provides a summary and analysis of these seven questions.

Research Question 1

What are the relationships for Demographic and Admission Requirements on Curriculum?

Using Pearson Correlation and Independent Sample *t* Tests, significant correlations were found between the demographic variables of age, NLGs, and the GPA for the pre-requisite and three types of nursing courses. Examination of the correlations revealed moderate to strong relationships between the NLGs and the GPAs. As the NLG increased, the GPAs in all the courses decreased ($p < .01$).

Using Independent Sample *t* Tests for gender and race on Curricular GPAs and NLGs, no statistical significant differences were noted between men and women or Caucasians and minorities. Similarly, using Independent Sample *t* Test for Admission Requirements on Curricular GPAs and NLGs, no statistically significant differences in GPA or NLG were noted between those that met admission requirements and those that did not take/did not meet the admission requirements of math and reading.

Analysis

Curriculum variables were divided into four distinct levels of content: the pre-requisite, foundation, specialty, and advanced courses. While GPAs ranged from 2.00 to 4.00 in each level, the mean for each level was 3.17, 3.2, 2.9, and 3.05, respectively. The number of low grades ranged from 0 to 12.

Significant correlations were found between age and the GPAs of the first two curricular levels. Examination of the correlations revealed moderate to strong relationships between the NLGs and the GPAs; as the NLG increased, the GPAs in all the courses decreased ($p < .01$). The GPAs compared to each other indicated moderate correlation between the course GPAs ($p < .01$). These correlations provide data that should be considered when decisions are made related to prerequisites for sequential courses.

The significant correlation between GPAs compared to each other is considered a violation of intercollinearity. Although a violation, it does not really affect this study because in the final logistic regression model, they had no significance. Had the GPAs been significant predictors, this correlation between them (intercollinearity) would have been a problem as they would be measuring much the same variance.

While the mean for all courses, with the exception of the pre-requisite courses, was higher in the Caucasian student rather than the minority student, there were no statistical significant differences on the Independent Sample t Test in Curricular GPA and number of low grades by race. Similarly, there was no statistical significant difference by gender even though in the first two levels of courses males had a .02 and .06 higher mean, respectively and females had a .01 point difference in the last two levels of nursing courses plus a lesser number of low grades.

The literature demonstrated conflicting results related to pre-admission exams as predictive of success on the NCLEX. Although Thompson (1989) found that the math pre-

admission assessment was predictive of success on the NCLEX, Aldag and Rose (1983), Hawsey (1997), and Woodham and Taube (1986) found that the math assessment was not predictive. Hawsey (1997) did find that the pre-admission reading assessment was predictive of success. KCTCS uses the ACT, Compass, or Asset to assess readiness for entry into the practical nursing programs. For this study, the mathematics and reading components were used. Many of the students took the admission assessment for both math and reading three to four times in order to meet the cutoff scores. The highest score attained in each area was recorded.

In an attempt to find a common assessment score that could be used in this research study, the ACT concordance table was utilized. In the first analysis of data (computations not shown), use of the concordance scores demonstrated that multicollinearity could become an issue. Multicollinearity is a state of very high intercorrelations or inter-associations among the independent variables and therefore a type of disturbance in the data, and if present the statistical inferences made about the data may not be reliable. Multicollinearity may result from the inclusion of a variable which is computed from other variables in the equation or from the repetition of the same kind of variable. For these reasons, another method to code reading and math results was investigated.

In Hereford's (2005) study, multiple admission assessments were also used and each assessment was coded as pass/fail. A similar model was used for this study. Since students must meet cutoff scores as established by the KCTCS Assessment and Placement Policy, students who met cutoff scores on the ACT, Compass, or Asset were coded as met the requirements or did not meet the requirements.

Although the admission assessment was attempted multiple times by some students, achievement of cut off scores for reading (9.2%) or mathematics (22.6%) were

not always attained. It is possible that students could have completed a developmental course sequence and entered the nursing program without re-testing. Students who are at academic risk are a large majority of students entering postsecondary institutions. According to the Kentucky Council on Postsecondary Education (2006) report, more than half of the first-time freshmen entering Kentucky institutions were underprepared in at least one subject in both years of the study. Furthermore, the first-year drop-out rate of underprepared students was twice the rate of academically prepared freshmen. Student success based on enrollment in developmental courses and student success versus those who met the scores and did not enroll in developmental courses was not included in this study.

Research Question 2

What are the relationships for demographic and admission requirements on Exit Comprehensive Exam?

No significant difference was found between age and those passing and those failing the Exit Comprehensive Exam. In addition, no significant differences in proportions were noted in the groups of men compared to women or in comparisons based on race. Although there was a significant association between the admission assessment of Reading and whether or not students would meet the cut off scores on the Exit Comprehensive Exam ($\chi^2(1) = 5.565, p < .018$), no significant association was found between the pre-admission assessments of mathematics and cut off scores on the Exit Comprehensive Exam.

Analysis

Those meeting the reading admission requirements were more likely to meet the cut-off scores on the Exit Comprehensive Exam than those not meeting it. This result was

the only area in the study where the admission scores were found to be statistically significant. Standardized test scores have been examined regarding their relationship to NCLEX success and found to be significant predictors of success (Alexander & Brophy, 1997; Felts, 1986; Foti & DeYoung, 1991; Sharp, 1984; Woodham & Taube, 1986). In addition, Arathuzik and Abner (1998) noted a correlation between NCLEX-RN success and competency in taking tests that require critical thinking and evaluation skills. The student's failure to read the questions accurately could prevent them from achieving minimal scores on the Exit Comprehensive Exam. Carroll's (1989) Three Stratum Theory speaks to aptitude and the student's general ability to learn. Students need to be academically prepared when admitted to a program of nursing to increase their probability of success. Data from this study support the importance of reading on a standardized exit exam. The results could be used to motivate students with deficits in reading to seek assistance from available resources.

Research Question 3

What is the relationship for demographic and admission requirements on NCLEX-PN?

An Independent Sample *t* Test (equal variance not assumed used due to differences in standard deviations) was used to examine age between those passing the NCLEX and those failing. There was a significant difference ($p < .001$) found in the ages of those who failed the NCLEX-PN and those who passed. Cross tabulations and chi-square were used to examine differences in the proportions of ethnicities and proportion of men versus women and admission requirements of those passing the NCLEX and those failing it. No significant differences were noted in passing the NCLEX-PN exam based on gender, race, or admission requirements.

Analysis

These findings support previous research regarding age, primarily that the older student was more likely to be successful on the NCLEX (Aldag & Rose, 1983; Friedemann & Valentine, 1988; Harris, 2006; Parrish, 1974; Thompson, 1989; Vandenhouten, 2008; Yates, 2007). The younger student appears to be at a higher risk of failing the NCLEX-PN. No significant differences were noted in passing the NCLEX-PN exam based on gender, race, or admission requirements. Small sample size for males versus females and minorities versus Caucasian students could have had an impact on this outcome.

Research Question 4

What is the relationship for curriculum variables on Exit Comprehensive Exam?

Independent Sample *t* Tests were used to examine the differences in NLG and GPA of students that passed and those that failed the Exit Comprehensive Exam. A statistically significant difference in SNCGPA ($p = .005$) was found between those that passed and those that failed the Exit Comprehensive Exam. Pearson Correlation was used to examine the relationship between curricular variables and the number of attempts on the Exit Comprehensive Examination. Negative correlations were found between curricular variables (pre-requisite courses; foundation and specialty nursing courses) and the number of attempts on the Exit Comprehensive Exam. A positive weak correlation was found between number of low grades and the number of attempts on the Exit Comprehensive Exam.

Analysis

From these findings, students who had scored higher GPAs on SNCGPA were more likely to be successful on the Exit Comprehensive Exam. The SNCGPA grouping includes the specialty courses of pharmacology (classifications), mental health, and the

childbearing family. These courses begin the more complex concepts following the foundation courses. With the three courses grouped together in this study, it is not possible to determine which of the three would have more influence on the Exit Comprehensive Exam. Although the literature review (Anderson, 1993; Alexander & Brophy, 1997; Brisco & Anema, 1999; Foti & DeYoung, 1991; Horns et al. 1991; NLN, 1954; Rami, 1993; Vandenhouten, 2008; Young-Richardson, 1996) supported Exit exams as predictors of success on the NCLEX, particular courses that were statistically significant for success on the Exit exam were not noted. Separating the curriculum groups into individual courses for future research could determine if any of the specific courses was influential in predicting success on the Exit Comprehensive Exam or the NCLEX-PN.

The number of attempts on the Exit Comprehensive Exam was negatively correlated with pre-requisite, foundation, and specialty courses indicating that as the grade point average of these courses decreased, the number of attempts on the Exit Comprehensive Exam increased. Conversely, a positive correlation was found between NLG and NEA. As the number of low grades increased, the number of attempts on the Exit Comprehensive Exam increased. The strength of both correlations was weak.

Research Question 5

What is the relationship for curriculum variables on NCLEX-PN?

Independent Sample *t* Tests were used to examine the differences in the number of low grades and GPA on curriculum between students passing the NCLEX and those failing. Significant differences were found in the number of low grades ($p < .001$) and all GPAs (PCGPA, $p = .012$; FNCGPA, $p = .003$; SNCGPA, $p < .001$; ANCGPA, $p < .001$) between students who failed the NCLEX-PN and passed the NCLEX-PN.

Analysis

Students who failed the NCLEX-PN were more likely to have less than a 3.0 in GPAs and have six low grades. These findings are consistent with Roncoli et al. (2000) who found that students with As and Bs in science pre-requisites and upper division nursing courses were significantly more likely to have evidence of passing the NCLEX-RN than students who achieved C grades or below or repeated courses. As reported by Hawsey (1997), this finding could also impact the practical nursing population not included in this study, those who could not maintain a GPA of C and left the program, as well as those who applied but were not accepted.

Carroll's (1989) theory says that learning includes the ability to understand instruction, the element of perseverance, and opportunity. Students who are lacking in these three components may begin to have difficulty in comprehension of course content as concepts become more complex and difficult to understand. Students who begin to score lower on examinations need interventions at the onset to prevent the risk of failure. Students who require remedial coursework and those who also have a C average should be provided additional support in preparation for the Exit Comprehensive Exam and the NCLEX.

Research Question 6

What is the relationship for Exit Comprehensive Exam on NCLEX-PN?

Cross tabulations and Chi-square (Yates correction for expected frequencies < 5) were used to examine differences in the proportions of those predicted to pass and those that did not take or were not predicted to pass the Exit Comprehensive Exam compared to those passing or failing the NCLEX. Those taking and passing the Exit Comprehensive Exam were more likely to pass the NCLEX compared to those not passing or not taking the Exit Comprehensive Exam, $\chi^2(1) = 7.87, p = .005$. Using an Independent Sample *t* Test,

the number of exit comprehensive exam attempts was not statistically significant ($p = .162$).

Analysis

This study found that those who were successful on the Exit Comprehensive Exam were more likely to pass the NCLEX-PN compared to those not passing or not taking the Exit Comprehensive Exam. Research studies (Anderson, 1993; Alexander & Brophy, 1997; Brisco & Anema, 1998; Foti & DeYoung, 1991; Horns et al. 1991; NLN, 1974; Rami, 1992; Vandenhouten, 2008; Young-Richardson, 1996) supported this finding.

The Exit (EXIT) Comprehensive Exam assists in identifying potential problems which may prevent the graduate from being successful on the NCLEX-PN examination. It is constructed to provide students with questions that are similar and in the same format as those which will be asked on the NCLEX. Providing the opportunity for students to take the exam familiarizes them with the format and type of questions, which is a benefit to the student. Utilizing the results of the exam to tutor students related to deficit areas would provide additional support for students at risk of failure.

Exit Comprehensive Exams were not required in one college and four students from another college did not take the exam. The distribution of success predictability for the Exit Comprehensive Exam on the first attempt of the NCLEX was 330 (80.4%). In the majority of programs, when students were not predicted to be successful on the NCLEX, students were given additional attempts to increase the likelihood of success. After one to two failures on the Exit Comprehensive Exam, students were usually given remedial work before the exam was repeated. Of the 411 program graduates, 95.4% (392) passed the NCLEX-PN on the first attempt. Since the remediation provided for the Exit Comprehensive Exam would ultimately provide knowledge necessary for success on the

NCLEX, this could be a factor in the low percentage of predictive ability of the Exit Comprehensive Exam (80.4%) and the actual number of graduates who were successful on the NCLEX-PN (95.4%). The number of attempts on the Exit Comprehensive Exam was not statistically significant. This may be explained by the remediation that occurs. This is, to the author's knowledge, the first study to address this possibility. Future research should explore this possibility.

Research Question 7

What is the predictive value of the demographic/admission requirements, curriculum variables, and Exit Comprehensive Exam on NCLEX-PN status?

Hierarchical logistic regression compared independent variables entered simultaneously in three steps. Demographic (age, gender, race) and admission requirements (Read, Math) were added in Step 1. Nagelkerke's R^2 of .196 indicated a weak relationship between prediction and grouping. Prediction success overall was 95.4%. The Wald criterion demonstrated that only age ($p < .002$) made a significant contribution to prediction. The EXP (B) value of age was 1.197. The admission (READ, MATH) and demographic (gender, ethnicity) variables were not significant predictors in Step 1 of the logistic regression model.

In addition to the demographic and admission requirements in Step 1, the curricular and number of low grades variables were added to Step 2. Nagelkerke's R^2 (.380) indicated a stronger relationship between prediction and grouping. Prediction success was somewhat higher at 95.9% (99.7% for those who were successful on NCLEX-PN and 15.8% for those who were unsuccessful). The Wald criterion demonstrated that age ($p < .002$) made a significant contribution to success on the NCLEX-PN. The EXP(B) value of age was 1.219. No other variables were significant predictors in Step 2 of the logistic regression

model.

The last set of independent variables (mediating factors--the Exit Comprehensive Exam and number of attempts on that Exit exam) were added in Step 3. Nagelkerke's R^2 (.419) indicated a moderate relationship between prediction and grouping. Overall prediction success was equal to Step 2 (95.9%) with 99.2% for those successful on the NCLEX-PN and 26.3% for those who were unsuccessful. The Wald criterion demonstrated that age ($p = .002$) and EXIT ($p = .035$) were significant contributors to prediction of success on the NCLEX-PN. The EXP(B) values were 1.228 and .171, respectively. No significance was found for the remaining demographic (gender, race), curricular (PCGPA, FNCGPA, SNCGPA, ANCGPA, and NLG), and mediating (NEA) variables with NCLEX-PN.

Analysis

Two variables were found to be statistically significant for predicting NCLEX-PN performance as a result of the hierarchical logistic regression in three steps with variables entered simultaneously for the sample studied. Age and the Exit Comprehensive Exam exhibited a significant influence on the likelihood of passing the NCLEX-PN licensure examination.

The odds of a practical nursing student from this sample passing the licensure examination on the first attempt increased with each year of age. For a student whose age increased by one unit (one year), the odds ratio was 1.197, 1.219, and 1.228 times as large to pass the NCLEX-PN in Steps 1, 2, and 3, respectively. Age was also a factor in the Independent Sample t Test used in Research Question 3 to examine age between those passing the NCLEX-PN and those failing. Friedemann and Valentine (1988) also found that older students performed better on the NCLEX-RN than younger students (18-21).

Since the larger group in this study was the younger student (most reported age was 25), the maturity of the student could be a factor in this finding.

There was partial support for curriculum variables and number of low grades in previous research questions and NLGs almost reached significance at $p = .063$ and $p = .097$ in Steps 2 and 3, respectively. Probable success on the NCLEX-PN decreased with an increase in the number of low grades. The research results of McKinney et al. (1988) gives support to the finding that odds of success on the NCLEX-PN decreased with an increase in the number of low grades. Courses repeated were found to be significant predictors of NCLEX-RN success. As stated in Research Question 5, Roncoli et al. (2000) found that students scoring higher grades were more likely to be successful on the NCLEX than those who achieved C grades or below or repeated courses. Whitley and Chadwick (1986) found those who allowed cumulative GPA to drift downward while in the school of nursing were at significantly higher risk of failing the NCLEX-RN. Although curricular variables (GPAs) did not show a direct relationship with success on the NCLEX-PN in this study's logistic regression model, a student scoring a C in curricular areas or making a D or below requiring a repeat of that course appears to be a factor that would warrant providing interventions related to content when this phenomenon is noted.

For those students who failed the Exit Comprehensive Exam or did not take it, the odds of passing the NCLEX-PN decreased by 83%. It should be noted when evaluating Odds/Ratio, a positive B coefficient or an odds greater than 1.0 is associated with an increase in odds or risk. A negative B coefficient or an Odds/Ratio less than 1.0 is associated with a decrease in odds or ratio. Because the referent was coded as 2, the regression reflected is a comparison of passed to failed rather than failed to passed resulting in a negative B coefficient. Research studies (Alexander & Brophy, 1997;

Anderson, 1993; Brisco & Anema, 1998; Foti & DeYoung, 1991; Horns et al. 1991; NLN, 1974; Rami, 1992; Vandenhouten, 2008; Young-Richardson, 1996) supported the finding that failure on the Exit Comprehensive Exam increased the odds or risk of NCLEX-PN failure.

KCTCS colleges are not required to administer an Exit Comprehensive Exam. Therefore, an Exit Comprehensive Exam was not required in one college and four students from another college did not take the exam. Exit Comprehensive Exams cannot be used as the sole deciding factor for a student passing or failing the program. When students are not predicted to be successful on the NCLEX, students are given additional attempts (NEA = 0-3) to increase the likelihood of success. When Exit Comprehensive Exam failures occur, remediation is usually required prior to repeating the exam. The Exit (EXIT) Comprehensive Exam assists in identifying potential problems which may prevent the graduate from being successful on the NCLEX-PN examination. The Exit Comprehensive Exam benefits the student directly in two ways. First, it provides the opportunity to take an exam which is constructed in a similar format to the NCLEX and second, it provides feedback which can be used to counsel and tutor students in areas of weakness. These interventions would assist and support those students at risk of failure. There may be a third indirect benefit. Marginal students may get a “rude awakening” when they fail the Exit Comprehensive Exam the first time. This failure likely precipitates greater focus on preparation for the NCLEX-PN (more study) than would otherwise have been the case. However, to this author’s knowledge, this type of qualitative research has never been conducted.

It is worth noting that a general limitation of logistic regression versus multiple regression exists because of the restricted range of only two choices (pass, fail) as opposed

to a whole range of test values. Thus, it is not unreasonable to assume that at least with respect to helping students, anything that is close to significance is probably worth considering regarding curriculum planning. Examples include: NLG implications for remedial work; curriculum classes that influence Exit or NCLEX in prior research questions even if not in the final complete model.

Recommendations

The findings of this research study have implications for educators, administrators, counselors, admission staff, and students of the practical nursing programs. The recommendations also include (a) the factors that are central to Carroll's (1989) model when applied to nursing, and (b) the combination of curriculum and instructional support most beneficial in helping students attain mastery of program content and successful passage of NCLEX licensure exams. The following recommendations for policy, practice, and future considerations are proposed.

Policy

Policies act as a rule to guide decisions and outcomes. Impact analysis can be best achieved through assessment of records and information of those students who have completed a practical nursing program. This information can be utilized to determine if policies need to be modified or additional policies need to be created.

First, the KCTCS Practical Nursing program is a selective admission program. As such, preference is given for higher scores on the ACT, Compass, or Asset. Using crosstabs and chi-square, it was found that meeting the requirements for Reading and Math had no significant impact on those passing the NCLEX. In contrast, while Math had no significant impact on those passing the Exit Comprehensive Exam, those students meeting the reading admission requirements were more likely to pass the Exit Comprehensive

Exam. In the final logistic regression model, the Exit Comprehensive Exam was also found to have a significant impact on the NCLEX. Carroll's (1989) Three Stratum Theory speaks to aptitude and the student's general ability to learn. To admit students who are prepared is essential to their success. Thus, the assessment standards in KCTCS practical nursing programs should be reviewed and these results used to enhance admission decisions for the enrollment in practical nursing programs.

Second, although GPAs in the four content areas did not have a significant impact on NCLEX success in the final logistic model, using an Independent Sample *t* Test, significant differences were found in the number of low grades and all the GPAs between students who failed the NCLEX-PN and those who passed the NCLEX-PN. Although this did not hold up in the final logistic model, Carroll's (1989) theory says that learning includes the ability to understand instruction, the element of perseverance, and opportunity. It is therefore recommended that students with lower nursing GPAs, especially those needing readmission due to failure, be targeted for tutoring, peer mentoring, NCLEX review classes, and other intervention programs to prepare these individuals for licensure.

Third, the sample had low numbers of males and minorities. It is recommended that recruitment be intensified to increase the enrollment of minorities and male students.

Finally, the Exit Comprehensive Exam was found to be a significant factor in the Independent Sample *t* Test as well as in the final logistic model in predicting success on the NCLEX-PN. It is recommended that the programs continue or, in the case of the one program that did not offer an Exit Comprehensive Exam, begin to offer an exit examination.

Practice

Research provides the guidelines for evidence-based practice. The following recommendations relate to practice.

First, it is recommended that the results of this study be used as a counseling tool for students related to potential factors which could impact their success on the NCLEX.

Second, age was found to be predictive of success on the NCLEX-PN. Although the most reported age was 25, the older student had a greater probability of being successful on the NCLEX-PN on the first attempt. Faculty should be aware that younger students may need additional support and counseling to be successful on the NCLEX.

Finally, the nursing career pathway is one strategy for increasing the supply of nurses in what has been described as a pending crisis in the supply of qualified nurses. It is recommended that further research investigate the differences between the practical nursing and registered nursing levels to expand a more seamless transition between the practical nursing, associate degree, and higher levels of education.

Future Research

Throughout this study an attempt has been made to be accurate in characterizing and quantifying the major sources that provide uncertainties related to success on the NCLEX-PN. In this section, recommendations are made for future research which, if carried out, may provide additional information in this field of study.

First, because only ten colleges and 14 programs were included in the study and because the sample included low numbers of males and minorities, it is recommended that the study be repeated using a larger sample that encompasses five or more years of data to determine whether or not the study year was a statistical anomaly.

Second, it is recommended that future research be expanded to include if a difference exists between NCLEX-PN licensure rates among KCTCS's practical nursing

programs.

Third, future research should examine data sets for multicollinearity, using factor analysis to remove redundant variables prior to the study in order to use a more parsimonious set of variables.

Fourth, since this study only examined those students who graduated successfully and completed the NCLEX-PN examination, students who were unsuccessful in the program were not included. In addition, using only cognitive variables from archival records as predictors of success is a limitation for predicting success. Success of the graduate is not explained totally by academic ability alone. The student's self-esteem, motivation for learning, support system, time to devote to school work, and personal problems may contribute to failure. Exclusion of these variables does not incorporate a holistic view of why students are successful or not successful in the practical nursing program. It is recommended that a future study be conducted to investigate variables responsible for the student's departure and identify factors which were barriers to success.

Fifth, if students do not meet the assessment cut off scores for program entry, they are provided developmental education courses or supplemental instruction to elevate admission scores. It is recommended that a future study examine students that do not meet the cut-off scores and must take remedial courses and those who initially meet the scores and place directly into the program to determine if performance in programmatic courses and success on the NCLEX-PN differ between the groups.

Sixth, courses in this study were grouped into four (pre-requisite, foundation, specialty, and advanced) groups. Using an Independent Sample *t* Test, students who had lower grade point averages in SNCGPA were more likely to fail the Exit Comprehensive Exam. In order to determine which courses are best at predicting success, it is

recommended that future studies examine the specific courses that were grouped together into the four types of content in this study. This would allow better matching of specific content to success in practical nursing courses.

Seventh, whereas the Exit Comprehensive Exam was found to be predictive of success on the NCLEX-PN, the number of attempts to meet the cutoff scores that predict the likelihood of success on the NCLEX was not significant. If students fail to meet the cutoff scores one or two times, remedial instruction is usually required. Future research should investigate the role that remedial support has on the Exit Comprehensive Exam.

Eighth, although the literature consistently indicates that race is a factor, socioeconomic status is seldom examined. Given the deeply embedded relationships between poverty and race in the wider society, it may be that the “race” findings are simply masking what is really an issue of less well prepared students coming from at-risk backgrounds rather than a particular racial/ethnic designation. Studies should explore this possibility in the future.

Finally, since many of the previous studies were drawn from a narrow scope, it is recommended that a meta-analysis in the field of nursing examine the contrast between students in a narrow population versus a state wide system to determine if more consistency is present with the larger population.

Conclusions

This study has created an increased awareness and appreciation for those who conduct research to provide information that permits evidence-based decisions. This research began with a literature review which provided inconsistent results on most variables. Whereas this research supported the findings of many studies in the literature review, it found no statistical significance for others. Continued research should be

conducted in this field based on recommendations for future studies. Research should continue to examine phenomena, trends, and issues within education and practice to assist students and graduates in their endeavor to learn and be successful in their chosen professions. In particular this is true for practical nursing programs as there is far less research at this level compared to that for associate and bachelor degree registered nurses.

Although all practical nurses in the United States take the same competency examination, the generalizability of this study is limited for other levels of nursing and potentially other states due to the differences in scope of practice, curriculum, admission requirements, and exit examination choice.

Results of the literature research found inconsistencies in the variables which predicted success on the NCLEX. Many of these studies were drawn from a narrow scope. If systems have the capability of supporting research studies, a more diverse and representative sample should be examined to determine if variables are statistically significant.

Carroll's (1989) Three Stratum Theory was used as a framework for this model. According to this theory, five elements contribute to the effectiveness of instruction. These elements are aptitude, ability to understand, perseverance, opportunity, and quality of instruction. The model is appropriate for this study with some limitation on opportunity (time) since a student has a prescribed period to complete the program. Due to present admission policies, readmission is restricted to one time. In addition, students readmitted who have nursing courses greater than three years old must retake those courses as well. No differentiation was made between part-time and full time students, ability to complete the program, and success on the NCLEX-PN. All of these issues are grist for future research.

Using logistic regression, the study found age and the Exit Comprehensive Exam as predictive of success on the NCLEX-PN. Older students had a higher probability of being successful on the NCLEX-PN; meeting the cutoff scores of the Exit Comprehensive Exam increased the probability of being successful on the NCLEX-PN. The final logistic model was able to predict success overall at 95.9% (99.2% for those that were successful but less likely to predict those who would be unsuccessful at 26.3%). In addition, the number of low grades was close to significance in Step 2 and 3 of the final logistic model and this variable was significant in Research Questions 1 and 5 preliminary to the test of the full logistic model. These results support previous assumptions of the nursing faculty and can be used as advisement and counseling tools to guide students in seeking interventions to improve their probability of success.

Inferential statistics revealed significant correlations between demographics and the curricular GPA. In addition, a statistically significant difference was found in age, in number of low grades, and GPA on curriculum between students who failed and who passed the NCLEX-PN. Those taking the Exit Comprehensive Exam were also more likely to pass the NCLEX-PN compared to those not passing or not taking the Exit Comprehensive Exam. Students making less than 3.0 and having increased numbers of low grades were less likely to pass the licensure exam on the first attempt. Although intervention strategies should be pursued, these findings imply that KCTCS should not lower standards but maintain the academic progression policies of the Practical Nursing program.

Finally, failures on the National Council Licensure Examination not only impact the nursing shortage but also become a financial burden to the student, the faculty, and others who have devoted time and resources to those who may not become licensed.

Nursing education must continually search to identify valid predictors of academic success and academic risk that can enable nursing educators to devise pertinent admission criteria, identify and intervene with students at risk of failing, and provide needed advisement and academic support to increase the graduate's success on the NCLEX. Given the looming shortage of nursing professionals, that imperative becomes even more important.

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APPENDIX A
RECORD ANALYSIS PROTOCOL

Appendix A
Records Analysis Protocol

Student Identifier		College	
Demographics			
	Age		
	Gender		
	Race		
Admission Criteria			
COMPASS Score			ACT Score
Reading		Reading	
Math		Math	
Nursing Pre-requisite GPAs			
	AHS 100 or		Repeat
	PSY 223		Repeat
	BIO 135 or		Repeat
	BIO 137 and		Repeat
	BIO 139		Repeat
Nursing Course GPAs			
	(Foundation)		
	NPN 100		Repeat
	NPN 105		Repeat
	NPN 110		Repeat

Nursing Course GPAs				
	(Specialty)			
	NPN 120			Repeat
	NPN 125			Repeat
	NPN 130			Repeat
	(Advanced)			
	NPN 135			Repeat
	NPN 200			Repeat
	NPN 205			Repeat
	NPN 210			Repeat
Exit Comprehensive Exam				
	Type:			
	Pass	Fail	Repeat	
NCLEX-PN				
	Pass	Fail		

APPENDIX B
HUMAN SUBJECTS INFORMATION

APPENDIX B

IRB Letter of Approval

**UNIVERSITY OF
LOUISVILLE**
It's Happening Here.

Human Subjects Protection Program Office
MedCenter One – Suite 200
501 E. Broadway
Louisville, KY 40202-1798
Office: 502.852.5188 Fax: 502.852.2164

April 21, 2010

Patricia K. Leitsch, Ed.D.
College of Education and Human Development
University of Louisville – Bellmap ED 346
Louisville, KY40232

**RE: IRB# 228.04/ Determination of Variable Which Predict Success on the National Council
Licensure Examination (NCLEX-PN)**

Dear Dr. Leitsch:

The continuation request for the above study was reviewed by the Chair of the Institutional Review Board (IRB) through the expedited review procedure, according to 45 CFR 46.110 and 21 CFR 56.110 since this study falls under Expedited Category (5) Research involving materials (data, documents, records, or specimens) that have been collected, or will be collected solely for non-research purposes (such as medical treatment or diagnosis). The study now has continued committee approval from 5/17/2010 through 5/16/2011.

The following items were reviewed:

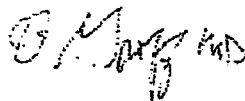
- Progress Report, dated 4/5/2010
- Protocol, not dated
- Methodology (Synopsis), not dated
- Informed Consent Form, dated 4/5/2010

This action will be reported promptly to the IRB at a scheduled full Board meeting. Please submit a Progress Report/Continuation Request Form eight weeks prior to 5/16/2011 in order to ensure that no lapse in approval occurs.

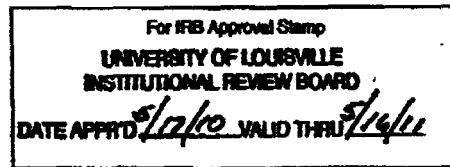
The stamped approved study document(s) are attached in this email. Please begin using your newly approved (stamped) consent(s) and/or HIPAA documents at this time. The previous versions are no longer valid.

Please send all inquires and electronic revised/requested items to our office email address at hspofc@louisville.edu.

Sincerely,



Diller Groff, M.D., Vice Chair,
Biomedical Institutional Review Board
DG/tkp



Subject Informed Consent Document

RE: Study #228.04 – DETERMINATION OF VARIABLES WHICH PREDICT SUCCESS ON THE NCLEX-PN

IRB assigned number: 228.04

Investigator(s) name & address: Pat Leitsch, PhD, Leadership, Foundations and Human Resource Education, College of Education and Human Development, U of L, Louisville, KY;

Student: Mary A. Kleber, 6510 Chenoweth Run Road, Louisville, KY 40299

Site(s) where study is to be conducted: Kentucky Community and Technical College System

Phone number for subjects to call for questions: Pat Leitsch, PhD at (502) 852-0608 or Mary Kleber at (859) 256-3302. You may contact the HSPPO at (502) 852-5188.

Introduction and Background Information

You are invited to participate in a research study. The study is being conducted by Pat Leitsch, PhD, and Mary A. Kleber, Student. The study is sponsored by the University of Louisville, Department of Leadership, Foundations and Human Resource Education. The study will take place at the Kentucky Community and Technical Colleges. Approximately 300 subjects will be invited to participate.

Purpose

The purpose of this study is to investigate the courses offered in practical nursing schools and achieved student outcomes in relation to success on the National Council Licensure Examination for Practical Nurses (NCLEX-PN).

Procedures

This study is being conducted using a Records Analysis Protocol whereby a student's grade point average in selected nursing and support courses, entrance tests scores, exit examination scores, and NCLEX-PN results are collected. The investigator will collect all information and the institutions and faculty will not have any participation time. This study will last for up to three years.

Potential Risks

There are no foreseeable risks, although there may be unforeseen risks.

Benefits

The possible benefits of this study include information that may promote interventions to be instituted for students who are at risk or failure on the NCLEX-PN. The information collected may not benefit you directly. The information learned in this study may be helpful to others.

Compensation

You will not be compensated for your time, inconvenience, or expenses for your participation in this study.

Confidentiality

Total privacy cannot be guaranteed. Your privacy will be protected to the extent permitted by law. If the results from this study are published, your name will not be made public. While unlikely, the following may look at the study records:

The University of Louisville Institutional Review Board, Human Subjects Protection Program Office
Office for Human Research Protections (OHRP),

Methods used to ensure that data collected is secure include a password protected computer, a locked file cabinet, and shredding of documents after the study is completed.

Conflict of Interest

There is no conflict of interest.

Voluntary Participation

Taking part in this study is voluntary. You may choose not to take part at all. If you decide to be in this study you may stop taking part at any time. If you decide not to be in this study or if you stop taking part at any time, you will not lose any benefits for which you may qualify.

You will be told about any changes that may affect your decision to continue in the study.

Research Subject's Rights, Questions, Concerns, and Complaints

If you have any concerns or complaints about the study or the study staff, you have three options.

You may contact the principal investigator at (502) 852-0608.

If you have any questions about your rights as a study subject, questions, concerns or complaints, you may call the Human Subjects Protection Program Office (HSPPO) (502) 852-5188. You may discuss any questions about your rights as a subject, in secret, with a member of the Institutional Review Board (IRB) or the HSPPO staff. The IRB is an

Study #228-04 - DETERMINATION OF VARIABLES WHICH PREDICT SUCCESS ON THE NCLEX-PN

independent committee composed of members of the University community, staff of the institutions, as well as lay members of the community not connected with these institutions. The IRB has reviewed this study.

If you want to speak to a person outside the University, you may call 1-877-852-1167. You will be given the chance to talk about any questions, concerns or complaints in secret. This is a 24 hour hot line answered by people who do not work at the University of Louisville.

This paper tells you what will happen during the study if you choose to take part. Your signature means that this study has been discussed with you, that your questions have been answered, and that you will take part in the study. This informed consent document is not a contract. You are not giving up any legal rights by signing this informed consent document. You will be given a signed copy of this paper to keep for your records.

Signature of Subject/Legal Representative	Date Signed
Signature of Person Explaining the Consent Form (if other than the Investigator)	Date Signed
Signature of Investigator	Date Signed

LIST OF INVESTIGATORS PHONE NUMBERS

Pat Leitsch, PhD	(502) 852-0608
Mary Kleber, (Student)	(859) 256-3302

UNIVERSITY OF LOUISVILLE
INSTITUTIONAL REVIEW BOARD
DATE APPROD 5/17/09 VALID THRU 5/14/11

300 North Main Street
Versailles, KY 40383
Telephone: (859) 256-3100
www.kctcs.edu

June 2, 2010

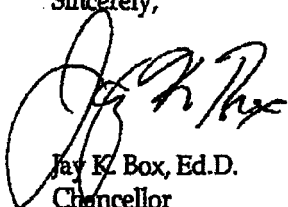
Mary A. Kleber
Kentucky Community & Technical College System
300 N. Main Street
Versailles, KY 40383

Dear Ms. Kleber,

After careful consideration of your application to KCTCS Human Subjects Review Board, I have determined that you are eligible for exemption from federal regulations regarding the protection of human subjects based on your research using a procedure that meets the exemption criteria section 7 (2). I understand that you have also requested approval from the University of Louisville's human subjects review board.

Thank you for your cooperation in meeting the federal requirements for conducting research that utilizes human subjects. We appreciate your notification to this board and we will keep your information on file.

Sincerely,



Jay K. Box, Ed.D.
Chancellor
Chair, KCTCS Human Subjects Review Board

cc: Christina Whitfield, Ph.D.
Director of Research and Policy Analysis



KCTCS is an equal opportunity employer and education institution.

KENTUCKY COMMUNITY & TECHNICAL COLLEGE SYSTEM

APPENDIX C
CORRELATION MATRIX

Table C1

Pearson r Correlation Matrix for All Independent and Dependent Variables (N = 411)

	AGE	GEND	RACE	READ	MATH	PCGPA	FNCGPA	SNCGPA	ANCGPA	NLG	EXIT	NEA
AGE	--											
GEND	-.01	--										
RACE	.04	.02	--									
READ	-.04	-.00	.01	--								
MATH	-.11*	-.02	.06	.33*	--							
PCGPA	.20**	-.01	.06	.09	.02	--						
FNCGPA	.11*	-.04	-.03	-.03	.05	.45*	--					
SNCGPA	.08	.00	.04	-.02	.02	.37*	.60*	--				
ANCGPA	.07	.01	.01	-.02	.05	.32*	.58*	.64*	--			
NLG	-.14**	-.03	-.03	-.02	-.05	-.57**	-.71**	-.75**	-.72**	--		

(table continues)

Table C1. (continued)

	AGE	GEND	RACE	READ	MATH	PCGPA	FNCGPA	SNCGPA	ANCGPA	NLG	EXIT	NEA
EXIT	.03	-.04	-.02	.12*	.07	.02	-.01	.14**	.02	-.10	--	
NEA	-.05	.02	.06	-.10*	-.02	-.15**	-.12*	-.14**	-.07	.15**	-.60**	--
NCLEX- PN	.17**	.06	.05	.01	-.06	.12*	.15**	.21**	.19**	-.27**	.15**	-.08

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

CURRICULUM VITAE

Mary A. Kleber
6510 Chenoweth Run Road
Louisville, KY 40299

Objective: To obtain a position that will utilize my experience and educational abilities.

EDUCATION

- 2010 University of Louisville, Louisville, KY, Doctor of Philosophy, Major – Educational Leadership and Organizational Development
- 1995 University of Louisville, Louisville, KY, Master of Science in Nursing – Administrative Track
- 1988 Bellarmine University, Lansing School of Nursing, Louisville, KY, Bachelor of Science in Nursing
- 1970 Kentucky Baptist Hospital School of Nursing, Louisville, KY, Diploma as Registered Nurse
- 1967 Campbellsville High School, Campbellsville, KY High School Diploma

WORK EXPERIENCE

- 2006 – Present Director of Curriculum and Program Support, Office of the Chancellor, Kentucky Community and Technical College System, 300 N. Main Street, Versailles, KY 40383
- 2004 – 2005 Interim Director of Academic Affairs, Kentucky Community and Technical College System, 300 N. Main Street, Versailles, KY 40383
- 2003 – 2006 Associate Director of Academic Services, Kentucky Community and Technical College System, PO Box 14092, Lexington, KY 40512-4092
- 1998 – 2003 Academic Officer, Division of Academic Affairs, Kentucky Community and Technical College System, PO Box 14092, Lexington, KY 40512-4092
- 1995 - 1998 Program Director, Health and Human Services, Office of Kentucky Tech, Department for Technical Education, Workforce Development Cabinet, 2016 Capital Plaza Tower, 500 Mero Street, Frankfort, KY 40601
- 1990 - 1995 Coordinator for Practical Nursing Program, KY TECH Jefferson State Regional Technology Center 800 West Chestnut Street, Louisville, KY 40203
- 1983 - 1990 KY TECH Jefferson State Regional Technology Center 800 West Chestnut Street, Louisville, KY 40203
Instructor in Practical Nursing Program
- 1980 – 1983 Baptist Hospital East, 4000 Kresge Way, Louisville, KY 40207

800 West Chestnut St., Louisville, KY 40203
1970 - 1973 Kentucky Baptist Hospital
810 Barret Ave., Louisville, KY 40204

PROFESSIONAL MEMBERSHIPS

American Nurses' Association (ANA)
Kentucky Nurses' Association (KNA)
Association of Career and Technical Education (ACTE)
Kentucky Association of Career and Technical Education (KACTE)
Health Occupation Supervisors and Teacher Educators Council (HOSTEC)
Health Occupations Students of America (HOSA)
National Network of Health Career Programs in Two-Year Colleges (NN2)

HONORS

Graduated cum laude from Bellarmine College BSN program.
Member Sigma Theta Tau - National Nurse Honor Society.
Awarded Who's Who in American Nurses 1989 – 1999.
LPN Educator Representative on Practice Committee, Kentucky Board of Nursing 1991 – 93.
LPN Educator Representative on Education Committee, Kentucky Board of Nursing 1995 – 97.
Health Occupations Students of America (HOSA) INC Board Member 1998 – 2001.
Vice President, Health Occupation Education Division of Association of Career and Technical Education, 2000 – 2003.
Secretary, Kentucky Association of Career and Technical Education Board of Directors, 2000 – 2004.
President-Elect, Kentucky Association of Career and Technical Education, 2004 – 2005.
President, Kentucky Association of Career and Technical Education, 2005 – 2006.
Vice President, Kentucky Association of Career and Technical Education Board of Directors, 2007 – Present.
Kentucky Hospital Association, Center for Health Care Professions Advisory Board, 2007 – Present.

References available upon request.

Present Responsibilities:

Review certificate, diploma, and degree programs to be approved by the Chancellor/Board of Regents.
Staff support to the KCTCS Curriculum Review Committee.
Assist colleges with curriculum development (e.g., nursing and allied health, ESL, machine tool, electronics, electricity, etc.)
Staff support to a selected group of curriculum committees.
Postsecondary State Advisor to the student organization – Health Occupations Students of America.
Responsible for the Medicaid Nurse Aide and Medication Aide Curriculum Development/Revisions as well as annual program evaluations required by the Cabinet

for Family and Health Services. Certificate in Methods of Instruction for the Nurse Aide Instructor program.

Liaison between regulatory boards (e.g., Kentucky Board of Nursing, Board of Hairdressers and Cosmetology) and KCTCS.

DACUM profiler.

Previous experience:

Staff nurse (Peer - tutored staff nurse from Mexico who could not pass Nursing Boards due to difficulty with English language), charge nurse, nursing faculty for 17 years, nurse administrator for the last 5 years of teaching, program director for all health programs in state (curriculum development and program approval as well as consultant), resource teacher for the required new teacher internship program in Kentucky (KTIP). All new teachers in primary and secondary education including career and technical education until 1998 must complete the KTIP program to be certified. The resource teacher position required mentoring as well as evaluating instructional techniques in the classroom and clinical areas. Evidence-based research methods of teaching and learning were the basis for evaluating the new teachers.

Examples of previous presentations: National Council on Occupational Education “Innovative Strategies in Curriculum,” the Association for Career and Technical Education, “Strategies for Improving Student Access & Retention in KCTCS,” Kentucky Tech Prep conference “PN to ADN Initiative,” KCTCS Nursing & Allied Health Conference “Core Curriculum,” and KCTCS New Horizons Conference, “Changing Times, Changing Curriculum.”