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PREDICTING NCLEX-RN PERFORMANCE: AN EXPLORATION OF STUDENT  
DEMOGRAPHICS, PRE-PROGRAM FACTORS, AND NURSING PROGRAM  
FACTORS

By

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BSN, Spalding University, 2000  
MSN, University of Southern Indiana, 2004

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  
in Educational Leadership and Organizational Development

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

May 2016



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A Dissertation Approved on

March 23, 2016

by the following Dissertation Committee:

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Jacob Gross, Dissertation Chair

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Diane Chlebowy, Committee Member

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Namok Choi, Committee Member

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Jeffrey Sun, Committee Member

## DEDICATION

This dissertation is dedicated to Jason, Connor, and Caleb Mitchell. I am so thankful for your unwavering love, patience, and support. You are my sunshine.

## ACKNOWLEDGEMENTS

This dissertation was made possible by the support of many individuals. First, I want to acknowledge the mentorship from my dissertation chair, Dr. Jake Gross. Your patience, kindness, and enthusiasm made the dissertation process enjoyable. You were the perfect balance of cheerleader and critic, and I am truly thankful for your commitment to my success. I would like to thank the other members of my dissertation committee, Drs. Namok Choi, Diane Chlebowy, and Jeff Sun. I appreciate your genuine concern and thoughtful guidance throughout this process. Each of you uniquely contributed to my growth as a scholar and I am grateful for your support.

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## ABSTRACT

### PREDICTING NCLEX-RN PERFORMANCE: AN EXPLORATION OF STUDENT DEMOGRAPHICS, PRE-PROGRAM FACTORS, AND NURSING PROGRAM FACTORS

Heather Davis Mitchell

March 23, 2016

Nursing programs are experiencing a decline in National Council Licensure Examination for Registered Nurses (NCLEX-RN) pass rates among graduates. While researchers have attempted to identify predictors of performance on the NCLEX-RN, identification of predictors remains elusive. Although the literature is replete with studies exploring NCLEX-RN predictors, prediction under the new 2013 NCLEX test plan and passing standards is not well established. Considering the ever-evolving diversity in students, combined with recent changes in the NCLEX-RN, further exploration of predictors of performance is warranted.

Using a correlational design, the study sought to identify the predictors of NCLEX-RN performance for Bachelors of Science in Nursing (BSN) graduates. The focal research question for this study was, “Do baccalaureate nursing students’ academic outcomes predict NCLEX-RN performance?” To answer this primary question, the researcher conducted a retrospective review of student records at a single pre-licensure BSN program.

A binary logistic regression was performed to model the relationship between academic

outcomes and NCLEX-RN outcomes. The analysis revealed a combination of nursing program academic outcomes predicted NCLEX-RN performance. Most particularly, the use of the Adult Health course exam average, score on the Adult Health ATI exam, ATI Comprehensive Predictor performance, and graduation GPA can predict NCLEX-RN outcomes, when controlling for student profile characteristics and academic factors. This study suggests nursing exam scores and standardized test scores can aid in predicting NCLEX-RN performance for BSN graduates. Findings from this study can provide nursing educators a foundation for understanding the factors associated with NCLEX-RN performance and offer a framework for identifying students who are at-risk for NCLEX-RN failure. Moreover, study findings can provide insight into the additional needs of students in preparing for NCLEX-RN and guide educators in developing early intervention programs for high-risk students. Given the national decline in NCLEX-RN pass rates, early identification of at-risk students and implementation of interventions targeting high-risk students can offer a solution for reducing the number of graduates unprepared for the NCLEX-RN and alleviate the burden associated with failure.



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## CHAPTER I

### INTRODUCTION

Nursing professionals make up 57% of the United States' (US) healthcare workforce (Carnevale, Smith, & Gulish, 2015). As the largest portion of the healthcare providers, nurses play a pivotal role in the health care of the nation. With recent healthcare reform improving access to health services, combined with the aging of baby boomers, the US faces an increased demand for registered nurses (Carnevale et al., 2015). Despite the rise in need, Carnevale et al. (2015) projected a shortfall of nearly 200,000 nurses by 2020.

To address the anticipated nursing deficit, nursing schools face pressure to grow student enrollment and the number of graduates prepared to enter the workforce. However, nursing programs are not equipped to increase enrollment due to lack of faculty, classroom space, and clinical placement sites (Carnevale et al., 2015). Regardless of these constraints, nursing programs must ensure each admitted student is adequately prepared to enter the nursing profession upon graduation. A part of student preparedness is readiness for the National Council Licensure Examination for Registered Nurses (NCLEX-RN).

The NCLEX-RN is the final step for graduates of nursing programs to enter into the nursing profession. Completed by the graduate after earning their nursing degree, the NCLEX-RN assesses basic nursing competency and ensures graduates are safe to

practice nursing through demonstration of effective critical thinking and problem solving skills (National Council of State Boards of Nursing, 2011). Successful completion of the NCLEX-RN is required for licensure as a Registered Nurse (RN), which grants the individual the legal right to practice in the profession of nursing.

Amid the high demand for nurses and pressures for graduates to obtain nursing licensure, nursing programs are currently experiencing a decline in NCLEX-RN pass rates among their graduates. Furthermore, nursing educators struggle with identifying students in need of additional support in preparing for NCLEX-RN success. To address these challenges, researchers have attempted to identify predictors of student performance on the NCLEX-RN (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Trofino, 2013; Truman, 2012; Vandenhouten, 2008; Yeom, 2013). Despite the effort put forth in this endeavor, identification of NCLEX-RN performance predictors remains elusive.

Using Jefferys' (2004) Nursing Undergraduate Retention and Success (NURS) model as a conceptual framework for understanding NCLEX-RN performance, this study examined the predictors of NCLEX-RN performance for first-time examinees. In testing a portion of the NURS model, the study provides nurse educators a foundation for understanding the factors associated with NCLEX-RN performance and offers a framework for identifying students who are at-risk for NCLEX-RN failure.

### **Purpose Statement**

The purpose of the study was to identify the predictors of NCLEX-RN performance for BSN graduates. More specifically, the study explored whether academic outcomes of BSN graduates predict first attempt performance on the NCLEX-RN, when

controlling for student profile characteristics and academic factors. This study also empirically tested a portion of Jefferys' NURS model in predicting NCLEX-RN performance.

### **Research Questions**

The focal research question for this study was, "Do baccalaureate nursing students' academic outcomes predict NCLEX-RN performance?" To answer this primary question, the researcher developed the following four sub-questions:

*Question 1:* Do nursing course exam scores predict NCLEX-RN performance, controlling for student demographics and academic factors?

*Question 2:* Does nursing program cumulative grade point average predict NCLEX-RN performance, controlling for student demographics and academic factors?

*Question 3:* Does performance on nursing standardized testing predict NCLEX-RN performance, controlling for student demographics and academic factors?

*Question 4:* Is Comprehensive Predictor Exam (CPE) prediction of NCLEX-RN performance moderated by race?

To provide a more comprehensive understanding of the context of the NCLEX-RN problem, the following sections provide an overview of nursing licensure and significance of NCLEX-RN failure. The first section presents a brief discussion the history and evolution of the examination, followed by a discussion of the repercussions associated with NCLEX-RN failure.

### **History of NCLEX-RN**

#### **Early Licensure Exam**

No formal licensure programs for nurses existed prior to the 1900's. During this



time period, individuals immediately practiced nursing after completing a nurse training program, which consisted of on-site education lasting as little as three weeks (Benefiel, 2011). Beginning in the early 1900's, nurse program trainees electively underwent a registration process, consisting of a written and practical examination, to earn the designation of RN. Successful completion of the nursing board examination registered the individual with the state and awarded the examinee with a permissive license. Although the permissive license granted the right to the individual to use the title RN, there was no legislation in place to prevent non-RNs from engaging in nursing practice (Benefiel, 2011; NLN, 1981).

From the early to mid-1900's, nursing registration underwent several iterations, culminating in a mandatory licensure process (Benefiel, 2011; NLN, 1981). In 1947, New York became the first state to institute mandatory licensing legislature for nursing practice (Benefiel, 2011). Eventually, each state passed legislature mandating licensure for RNs and have since assumed responsibility for authorizing nursing licensure of all candidates. Charged with overseeing the licensure of practicing nurses, each state established a Board of Nursing to protect the public and establish individual accountability in delivering safe patient care through licensure (NLN, 1981). By the end of the 1950's, the state licensing boards committed to using a single standardized examination to determine licensure, making nursing the first profession with a national examination for licensure (Benefiel, 2011).

Following the adoption of a national examination for nursing licensure, the licensing board formed the National Council of State Boards of Nursing (NCSBN). Since its' inception in 1976, the NCSBN has assumed responsibility for the development and

administration of the national nursing licensure exam. While the NCSBN is responsible for the national examination, each state board of nursing maintains the power to grant licensure to the applicant following successful completion of the examination (Benefiel, 2011).

### **Evolution of NCLEX-RN**

In 1982, the NCSBN established the NCLEX-RN. The first iteration of the NCLEX-RN required examinees to earn a minimum score of 1,600 points (67%) to pass (Benefiel, 2011). Over the next several years, the NCSBN revised the NCLEX-RN test plan and by 1988, the examination transitioned into a pass/fail report. By 1994, the NCLEX-RN transitioned to a computer adapted test (CAT) format (Benefiel, 2011). According to the NCSBN (2015), the NCLEX-RN CAT format improves precision of measurement of the examinee's entry-level nursing knowledge through reduction of items that may skew results. With each item presented, the computer re-estimates the examinee's knowledge and adjusts the questions accordingly (NCSBN, 2015).

With the change to a pass/fail examination, the NCSBN adopted a policy to revise the NCLEX-RN test plan every three years and adjust the passing standard according to nursing practice needs. The NCSBN calculates the passing standard on a logit scale, which is a statistical calculation in the difference between a candidate's estimated ability and item difficulty (NCSBN, 2010a). A higher logit (closer to a positive value) indicates less difference between estimated ability and item difficulty, in comparison to a lower logit (further from a positive value). An examinee's calculated logit must equal to or exceed the established NCLEX-RN passing standard logit to pass the examination.

After implementation of the CAT format in 1994, modification of the NCLEX-

RN passing standard has occurred seven times, with each modification resulting in a higher passing standard. Table 1 represents the change in the passing standard over the preceding seven iterations of the NCLEX-RN CAT. As the passing standard has increased over the years, the NCLEX-RN has grown increasingly difficult to pass. As demonstrated in Table 1, the current passing standard is higher than prior standards, indicating the NCLEX-RN is more challenging to pass than in previous versions.

Table 1

*NCLEX-RN Passing Standard History*

	1994	1995	1998	2001	2004	2007	2010	2013
Logits	-0.4766	-0.42	-0.35	-0.28	-0.28	-0.21	-0.16	-0.00

(Benefiel, 2011; NCSBN, 2014a)

As expectations raise with each iteration of the examination, nursing schools faces challenges associated with maximizing student success and identifying students at risk for NCLEX-RN failure. While the NCSBN charges nursing schools with preparing students for the NCLEX-RN, concerns with NCLEX-RN performance extend beyond the academic institution.

**Significance of the Problem**

Successful completion of the NCLEX-RN is a concern for graduates, faculty, nursing programs, and society by creating a burden for all involved (Roa, Shipman, Hooten, & Carter, 2011). The following section discusses the impact of NCLEX-RN failure on graduates, nursing program and faculty, and the community.

**Impacts on Nursing Graduates**

Failure on the NCLEX-RN may result is negative consequences for the graduate, which include low self-esteem and increased anxiety, as well as feelings of embarrassment, guilt, and grief (Roa et al., 2011; Frith, Sewell, & Clark, 2005). In

addition, failure also carries a financial burden for the graduate. According to Roa et al. (2011), NCLEX-RN failure begins a cascade of costly events, which includes the loss of RN wages and fees associated with additional preparation and repeating the examination. Combined, the financial burden to students may be as great as \$11,000 (Roa et al., 2011).

### **Impacts on Nursing Faculty and Programs**

In addition to the impact on the individual, a graduate's NCLEX-RN failure affects faculty and administrators of pre-licensure programs. For a nursing education program to maintain approval, the program must meet established criteria by their respective State Board of Nursing. In the majority of states, State Boards of Nursing require educational programs to maintain a minimum annual NCLEX-RN pass rate to maintain approval as a provider of pre-licensure nursing education. State board approval is a requirement for nursing programs in the US; without state board approval, graduates cannot sit for the NCLEX-RN, essentially nullifying the student's education and preventing their practice as a RN (Kentucky Board of Nursing, 2012). Although an institution's pass rates are only one measure of an educational program's quality, achieving the pass rate requirement is a condition of maintaining approval status. According to Beeson and Kissling (2001), programs failing to meet state NCLEX-RN pass rate standards are required to develop plans for improved student performance and re-design program curriculum. For programs with low pass rates, the mandate for additional programming/services and curricular redesign create a financial burden. Furthermore, programs with sustained failure to meet the state benchmark may also lose their approval status, necessitating the closure of the nursing program.

Low pass rates also affect the recruitment of students and faculty at institutions of

higher education (Beeson & Kissling, 2001), which directly decreases the number of nurses entering the workforce. NCLEX-RN pass rates are a matter of public record and the public perceives pass rates as an indicator of program quality. Low pass rates may dissuade students from enrolling, resulting in an overall decline in student enrollment and reduction in revenue from tuition. Likewise, low NCLEX-RN pass rates may amplify difficulties for institutions in attracting qualified faculty, which negatively affects nursing programs. According to the AACN (2014c), there were 1,358 nursing faculty vacancies in baccalaureate and graduate nursing programs in 2013, which attributed to over 78,000 qualified student applicants denied admission. With nursing programs struggling to attract faculty, low program NCLEX-RN pass rates potentially influence faculty recruitment and can ultimately reduce the number of students admitted into and completing nursing programs.

### **Impacts on the Community**

The impact of NCLEX-RN failure extends beyond the student and nursing program. First, failure of a new graduate creates a financial burden for healthcare employers. When hiring a new nursing graduate, employers expect the employee will pass the NCLEX-RN on the first attempt. Roa et al. (2011) estimated the employer costs associated with the failure of a new graduate is near \$87,000, due to position vacancy and loss of investment with orientation created from failure.

Second, NCLEX-RN failure influences national health through direct reduction in the number of nurses entering the profession. Bargaliotti (2009) portrayed a critical picture of the impending nursing shortage across the US, with a projected shortage of 1 million nurses by the year 2020. Given the anticipated shortage of nursing staff across the

US, the reduction of nurses entering the profession due to NCLEX-RN failure is a concern for an already strained healthcare workforce.

Through early identification and implementation of interventions targeting high-risk students, nursing programs can reduce the number of graduates unprepared for the NCLEX-RN and alleviate the burden associated with failure. The current study provides educators with an understanding of the student factors that predict NCLEX-RN performance, which can aid in early identification of those at-risk for failure.

### **Rationale for the Current Study**

Through empirical testing of Jeffreys' NURS model, this study attempted to fill gaps in the existing literature. The study addressed the predictors of NCLEX-RN performance following implementation of the higher NCLEX-RN passing standard in 2013. At the time of this study, no studies on NCLEX-RN prediction following the 2013 revisions were available.

In addition, the study targeted graduates of baccalaureate nursing programs. With BSN program enrollment growth outpacing two-year program growth (NLN, 2013); this study examines the fastest growing nursing program type. The following section will provide a further discussion of the recent changes in NCLEX-RN passing standard, followed by an overview of the change in BSN enrollment.

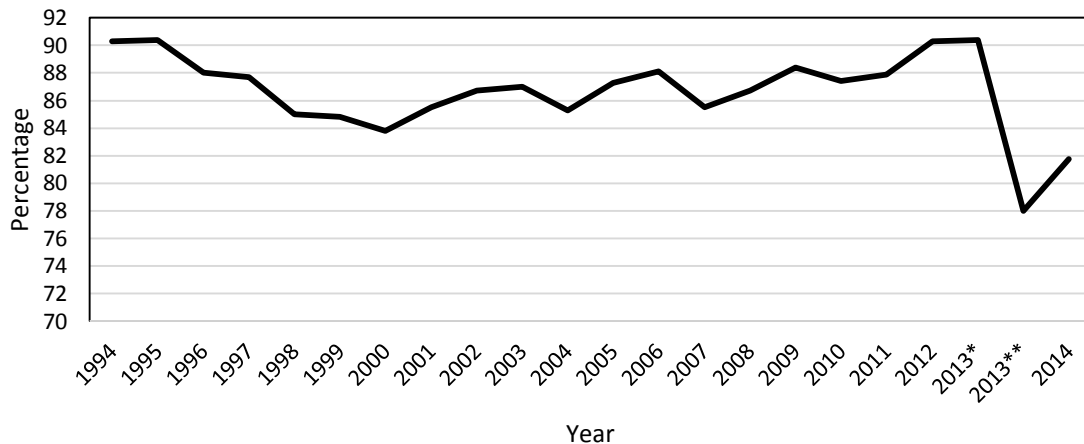
### **NCLEX-RN Passing Standard Revisions**

As previously discussed, the 2013 revisions yielded the largest change in passing standard since implementation of the modern day NCLEX-RN (Table 1). The recent increase in the NCLEX-RN passing standard has resulted in higher expectations for examinees to earn licensure (NCSBN, 2014a). According to the NCSBN (2014a), the

change in passing standard was in response to increased patient acuity and changes in the healthcare needs of the nation. While the recent increase in passing standard reflects the greater knowledge required by today's practicing nurses, the increased expectations have negatively affected the number of examinees successfully completing the NCLEX-RN.

Prior to the April 2013 revisions, the yearly national pass rate maintained relative stability. With the exception of a slight dip in 2000 to 83.8%, the national NCLEX-RN pass rates of first-time, US educated examinees consistently ranged from 85% to 91% from 1994 through 2012 (NCSBN, 2014b). Following implementation of the current passing standard, the national NCLEX-RN pass rates for first-time, US educated graduates has declined. During the first year of implementation (April to December 2013), examinee success dropped below 78%, with a low of 69% reported from August to December 2013 (NCSBN, 2014b). Despite an improvement of the national pass rates of the first-time, US educated graduates to 81.78% in 2014, the pass rates remain below the previously established pass rate range of 85 to 91% from 1994 to 2012 (NCSBN, 2014b). Figure 1 presents the national NCLEX-RN pass rates for first-time, US educated examinees from 1994 to 2014.

With the current NCLEX-RN pass rates remaining below the 1994-2013 range, stakeholders face the burden of increased failures while nursing programs face increased pressure to produce graduates prepared to pass the NCLEX-RN. Although the national pass rate may stabilize over time, early identification of students at high risk for NCLEX-RN failure is critical during this period of uncertainty.



\*Prior to 2013 NCLEX-RN passing standard revisions  
 \*\*Following 2013 NCLEX-RN passing standard revisions  
 (NCSBN, 2014b)

Figure 1. *National NCLEX-RN pass rates: First-time, US educated examinees (1994-2014)*

### Recent Changes in BSN Enrollment

There are two primary educational entry routes into professional nursing practice: Associate Degree in Nursing (ADN) programs and BSN programs. In comparing the two types of programs, BSN programs include all of the course work from ADN programs plus additional coursework in physical and social sciences, nursing research, community health, and nursing management (AACN, 2014a). According to the AACN (2014a),

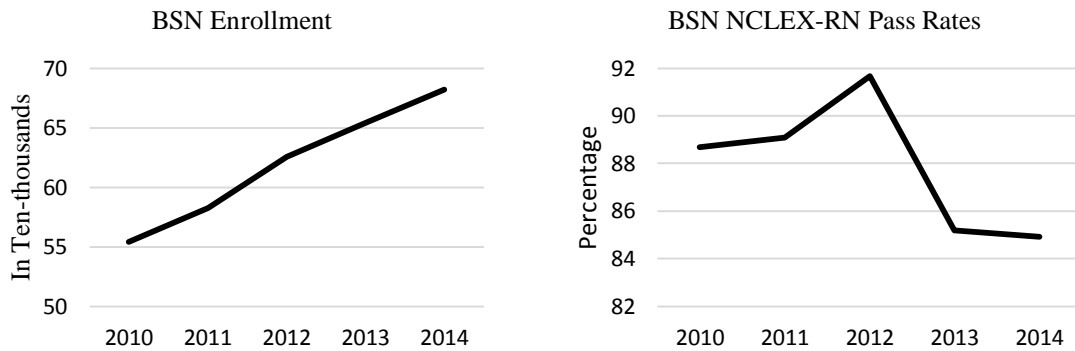
the additional course work enhances the student’s professional development, prepares the new nurse for a broader scope of practice, and provides the nurse with a better understanding of the cultural, political, economic, and social issues that affect patients and influence health care delivery.

Over the past five years, there has been a national emphasis to increase the number of nurses prepared at the baccalaureate level. Citing studies linking baccalaureate education to lower patient mortality rates, the Institute of Medicine (IOM, 2010) released



their landmark report *The Future of Nursing* issuing a call for increased education in nursing. In this report, the IOM (2010) urged the profession of nursing to increase the number of baccalaureate prepared nurses to 80% by 2020.

Following the IOM's (2010) call to increase BSN degrees, students enrolling in BSN programs steadily increased (AACN, 2014b). As the number of BSN graduates has risen over the preceding years, the NCLEX-RN pass rates of BSN graduates have recently dropped. Figure 2 compares increased BSN enrollment to NCLEX-RN performance for BSN graduates.



(NCSBN, 2014b)

Figure 2. *BSN enrollment and BSN NCLEX-RN pass rates: 2010-2014*

Considering the increased preparation of the BSN graduate and the link between increased education and improved patient care and decision making (Blegen, Goode, Park, Vaughn, & Spetz, 2013; Kendall-Gallagher, Aiken, Sloane, & Cimiotti, 2011), one would expect BSN graduates to be better prepared for the NCLEX-RN and experience less of an impact with changes in the passing standard. The recent push for BSN graduates and subsequent increase in BSN enrollment, combined with the decline in BSN pass rates, indicate a need for exploration in predictors of performance specific to the

BSN graduate.

Although identification of students at-risk for NCLEX-RN failure is an area of interest for nursing faculty and programs, accurate identification of NCLEX-RN performance predictors is tenuous. While some prior works have suggested a combination of variables may predict performance, there is no clear set of predictors universally supported in the literature (Adamson & Britt, 2009; Alexander & Brophy, 1997; Arathuzik & Aber, 1998; Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Briscoe & Anema, 1999; Crow, Handley, Morrison, & Shelton, 2004; Daley et al., 2003; Giddens & Gloeckner, 2005; Landry, Davis, Alamedia, Prive, & Renwanz-Boyle, 2010; Nibert, Young & Adamson, 2002; Seldomridge & DiBartolo, 2004; Trofino, 2013; Truman, 2012; Vandenhouten, 2008; Yin & Burger, 2003).

The findings from this study provide valuable information for both nursing programs administrators and educators in BSN programs. First, the findings of this study can inform nursing program administrators and nurse educators of pre-admission factors that may influence student success. An understanding of pre-admission factors can assist with revising admission criteria to enhance selection of applicants likely to achieve success on the NCLEX-RN. Second, results from this study can aid nurse educators in recognizing nursing program factors that predict NCLEX-RN performance. An awareness of student performance criteria that may predict failure can assist educators with early identification of at-risk students and guide implementation of early intervention programs high-risk students. Finally, findings can provide insight the additional needs of students in preparing for NCLEX-RN.

## **Organization of the Study**

The current study is organized into five sections. This chapter presented the problem statement, background of the problem, and the purpose and rationale for the study. Chapter 2 identifies the conceptual framework and provides a review of existing literature on NCLEX-RN prediction. Chapter 3 describes the research method used to conduct the study, while Chapter 4 presents the findings of the study. The final section, Chapter 5, will conclude with a discussion of the key results and implications for future research and practice.

## CHAPTER II

### REVIEW OF THE LITERATURE

This chapter synthesizes the existing research on predictors of NCLEX-RN performance. Organization of this section is as follows: (a) presentation of the conceptual framework for the current study, (b) identification of the NCLEX-RN prediction model for the current study, and (c) a review of prior research on predictors of NCLEX-RN performance.

#### **Conceptual Framework**

Nursing student success is a complex phenomena influenced by interactions between personal, academic, and environmental factors (Jeffreys, 2012). Existing literature reflects the interest in understanding nursing student success; however, many researchers fail to explicate the theoretical foundation of their studies (Beeman & Waterhouse, 2001; Beeman & Waterhouse, 2003; Beeson & Kissling, 2001; Daley, Kirkpatrick, Frazier, Chung, & Moser, 2003; Giddens & Gloeckner, 2005; Grossbach & Kuncel, 2011; Haas, Nugent, & Rule, 2004; Penprase & Harris, 2013; Seldomridge & DiBartolo, 2004; Trofino, 2013; Yeom, 2013; Yin & Burger, 2003). The current study utilized Jeffreys' (2012) Model of Nursing Undergraduate Retention and Success (NURS) to guide the empirical work.

#### **NURS Model Background**

Jeffreys' NURS model provides nurse educators a framework for exploring the

multidimensional factors that influence nursing student retention and success. The NURS model is an organizing framework for understanding and promoting undergraduate nursing student success (Jeffreys, 2012). The NURS model incorporates components of previously tested retention models, such as Tinto's Theory of Departure and Bean and Metzner's model of Nontraditional Student Retention, as well as extensive literature from both the disciplines of higher education and nursing education (Jeffreys, 2012). The predecessor models are discussed below.

According to Braxton and Hirschy (2005), researchers have studied college student retention over the past 70 years using a variety of theoretical perspectives, including psychological, organizational, and economic frameworks. Tinto's theory of student retention remains the most studied and tested model of retention in the literature (Braxton & Hirschy, 2005). Tinto's theory posits student retention is a function of the student's characteristics upon college entry (pre-entry characteristics) and subsequent interaction with the college academic and social environment. Pre-entry characteristics, which include variables such as family background, age, gender, achievement test scores, grades, and intellectual and social skills, have a direct influence on departure decisions and goal commitment. The foundation of Tinto's theory is that a student's level of academic and social integration within a higher education institution is influential in their commitment to the institution (institutional commitment) and in graduating (goal commitment), with higher levels of integration being linked to higher levels of commitment (Tinto, 1975). Tinto postulated influences within the academic system, such as grade performance and intellectual development, and influences within the social system, including peer-group interactions and faculty interactions, impact the degree of

academic and social integration. The level of commitment in both academic and social integration affect an individual's dropout decisions (Tinto, 1975). Though Tinto's theory asserts the level of academic and social integration does not need to be equal, students integrated in both dimensions are more likely to persist (Tinto, 1993).

According to DeWitz, Woosley, and Walsh (2009), many of the reasons students leave college, including financial issues, poor academic performance, lack of encouragement, and adjustment issues, are outside of Tinto's model. To address these deficiencies, additional retention frameworks have been proposed, such as Astin's (1984) student involvement model, Bean and Metzner's (1985) model of nontraditional student attrition, Nora and Cabrera's (1996) student adjustment model, and Bean and Eaton's (2000) psychological model of student retention. While multiple conceptual models of student retention are proposed in the literature, no single model has received universal support in explaining student retention decisions. This suggests the intricacy of student retention is not well understood.

Despite the gaps in Tinto's model, it remains a popular framework in retention research (Braxton & Hirschy, 2005). Researchers frequently utilize Tinto's theory to explain retention of traditional aged students at four-year institutions; however, the applicability of Tinto's integration framework to non-traditional students has garnered criticism (Braxton, 2000; Tinto, 1993). Scholars continue to question if social integration plays a role in persistence decisions of all student types, as social interactions may not appeal to non-traditional students (Braxton, 2000; Tinto, 1993). Research findings have supported precollege variables in predicting student retention (Pascaeralla & Terenzini, 1980; Pascaeralla & Terenzini, 1979); however, the use of academic and social

integration, as well as institutional and goal commitments, in predicting retention has mixed results (Nora, 1987; Nora & Rendon, 1990; Pascarella, Smart, & Ethington, 1986; Pascarella & Ternzini, 1983).

In his latter works, Tinto (2006) acknowledged his early work in retention did not recognize the process of retention differs in different institutional settings and student types (Tinto, 2006). To address the differences in retention decisions between traditional and nontraditional, older students, Bean and Metzner (1985) developed a model identifying variables associated with nontraditional student attrition. Bean and Metzner (1985) posited that background, academic performance, and environmental variables influence nontraditional retention decisions. Within this theory, background variables include age, gender, ethnicity, and other entry characteristics, whereas academic variables include those factors associated with the academic process at the institution. Environmental variables are associated with factors external to the institution and include family responsibilities, employment, and finances. Bean and Metzner (1985) argued the previously identified variables interact and result in both academic and psychological outcomes, which influence retention. However, the importance of these variables may differ between different student types or institution types (Bean & Metzner, 1985).

### **Rationale for a Nursing Specific Model**

The literature contains multiple comprehensive conceptual models and theories to explain undergraduate student attrition (Astin, 1984; Bean and Eaton, 2000; Bean and Metzner, 1985; Nora, 1987; Nora and Cabrera, 1996; Pascarella & Chapman, 1983; Tinto, 1975). Nonetheless, student retention remains a complex problem in higher education. This suggests existing retention models fail to capture the multifarious

components influencing retention and attrition. An exploration into a discipline specific model, such as the NURS model, may offer further elucidation of additional factors affecting retention for particular disciplines.

Jeffreys' NURS is the only model specific to the discipline of nursing. The NURS model presents an organizing framework for understanding the factors influencing success of undergraduate nursing students. This model can help explain why nursing students, who have previously demonstrated high levels of academic success in numerous pre-requisite courses, experience failure in subsequent upper division nursing courses. Furthermore, it can help provide a framework for understanding why students who successfully completed nursing studies may fail to obtain licensure following graduation.

Prior retention theories may not hold true for students in upper division nursing programs. According to Braxton and Hirschy (2005), the majority of previous empirical studies on student retention primarily focused on students in their first year of study and little research has focused on student retention beyond the first year of college (Nora & Crisp, 2012). Furthermore, Tinto (1993) recognized issues influencing retention decisions in first year students might not be as important for students in the latter parts of their college career. This raises the question of applicability of existing retention models to nursing education, as students enrolled in upper division nursing programs may differ from college age freshman, as nursing students have demonstrated academic success at the college level and have completed several semesters of pre-requisite college coursework.

In the majority of BSN programs across the US, students must successfully complete multiple semesters of pre-requisite coursework prior to applying for admission



into an upper division nursing BSN program. Application into an upper division BSN program typically occurs at the conclusion of the second year of college studies, after satisfactory completion of pre-requisite coursework in humanities, social sciences, and natural sciences (AACN, 2008). In addition, students admitted into an upper division nursing program have consistently demonstrated academic success. Nursing programs limit admissions to students with sustained patterns of academic success, with the majority of US nursing schools requiring a minimum pre-admission coursework GPA between 2.5 and 3.0 on a 4.0 scale (AACN, 2015). With nursing programs admitting approximately 50% of the applicants meeting admission requirements (NLN, 2013), competitive upper division applicants often have pre-requisite GPAs in excess of 3.0.

Given the requirements for application and the competitive nature of nursing admission, it is reasonable to conclude nursing students possess a high level of academic achievement and strong level of goal commitment. Theories of student retention frequently associated high academic achievement and goal commitment with student retention (Jeffreys, 2012; Tinto, 1993); however, differences between general undergraduate students and upper division nursing students may reduce applicability of existing retention theories in explaining nursing student retention and success.

### **NURS Model Components**

Jeffreys (2004; 2012) posited an interaction of student profile characteristics, student affective factors, academic factors, environmental factors, professional integration factors, academic outcomes, and psychological outcomes underpin nursing retention decisions. Figure 3 depicts the complete NURS model.

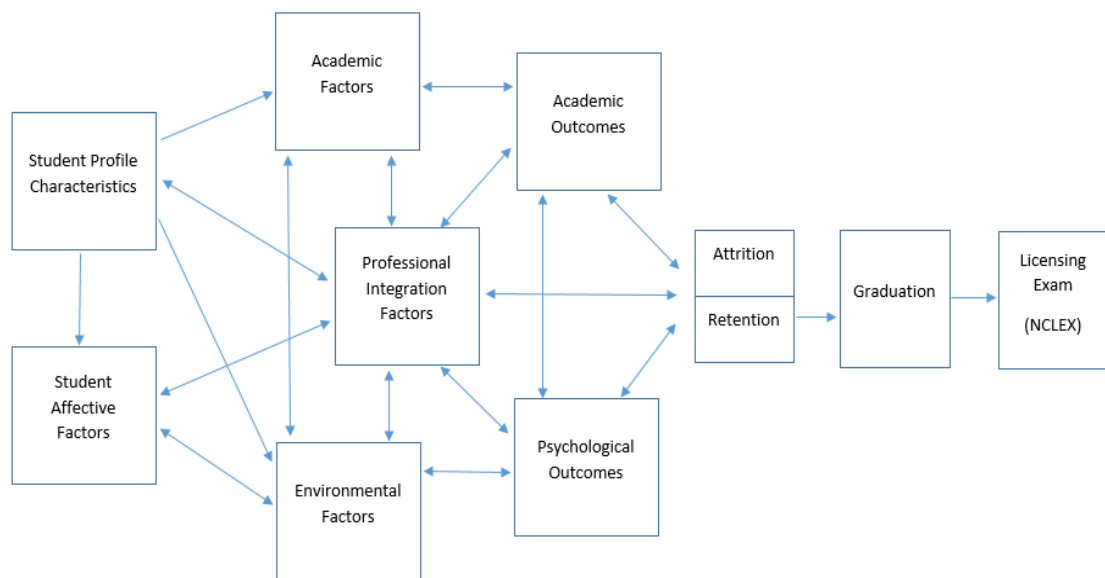


Figure 3. *Jeffreys' NURS model (2004).*

According to Jeffreys (2012), student profile characteristics include age, race, gender, language, educational background, and enrollment status directly influence academic factors, student affective factors, and environmental factors and have a bidirectional relationship with professional integration. Student affective factors include a student's attitudes, values, and beliefs and effect academic and psychological outcomes. Academic factors, which directly influence academic outcomes, include study habits, class schedule, and general academic services. On the other hand, environmental factors, such as student financial status, family issues, and living arrangements, are external to the institution and indirectly influence academic performance and retention of nursing students. Professional integration factors include faculty involvement, professional involvement, peer relationships, and enrichment activities. Professional integration factors are the central point of the model, as Jeffreys (2012) proposed these factors are at the crossroads of retention decisions and directly influence academic and psychological

outcomes. Academic outcomes, which include grades and grade point average, and psychological outcomes, which include satisfaction and stress, interact with professional integration factors and directly influence a student's retention decisions (Jeffreys, 2012). Jeffreys (2012) posited retention decisions occur during and at the conclusion of each nursing course.

Institutions of higher education define student success in multiple ways, based on the individual student's goals. An individual's goal may include completing a single class, earning a certificate, getting a job or promotion, or completion of a degree. A unique feature of Jeffreys' (2012) model is the inclusion of nursing student success extending beyond graduation. Although nursing student success can also be widely defined, the last step in the transition from student nurse to a practicing nurse is obtaining licensure. While nursing programs may define student success as persistence to graduation, nursing programs cannot consider a nursing student fully successful until they are able to obtain licensure. The NURS model incorporates licensure as a component of nursing student success, as the pathway of nursing student success culminate in licensure.

Although the NURS model is based on retention theory, the model focuses on nursing student success. Jeffreys (2012) identified nursing student success as multi-tiered process, consisting of completion of nursing coursework, graduation, and successfully obtaining nursing licensure. The NURS model can provide a framework for understanding why a previously academically successful nursing student is later unsuccessful on the licensure examination.

### **Empirical Testing of the NURS Model**

The NURS model largely remains untested in the literature; however, some

researchers have utilized this model as the theoretical framework for their studies. Aldean (2008) used the NURS model as the framework for her study on predictors of nursing student academic success and graduation. In this study, Aldean (2008) tested cognitive variables (cumulative GPA, science GPA, science credits, previous degree, reading comprehension, math skill), non-cognitive variables (stress), and demographic student profile characteristics (age, ethnicity) on the early academic success and graduation of baccalaureate nursing students. Using logistic regression, Aldean (2008) found science GPA, reading comprehension, and math skill significantly predicted early academic success in nursing studies. Aldean also found reading comprehension, math skill, and previous college degree predicted nursing program completion. Stress, age, and ethnicity were not significant predictors of neither early academic success nor graduation (Aldean, 2008).

Horton (2006) utilized the NURS model as the theoretical framework in studying the predictors of nursing student success, identified as both graduation and successful completion of NCLEX-RN. Using this model, Horton tested multiple demographic, pre-admission and program grades, GPA, and exit exam scores as predictors of NCLEX-RN performance. Horton (2006) found the best predictors of graduation were grades in three junior-level nursing courses, junior level GPA, and the GPA of all nursing courses, whereas the best predictor of NCLEX-RN performance were exit exam scores, junior level GPA, and cumulative GPA (Horton, 2006). Similar to the results of Aldean's (2008) study, Horton (2006) found demographic variables did not predict graduation nor NCLEX-RN performance.

## Use of the NURS Model for the Current Study

Using the NURS model as the conceptual framework, this study examined the influence of: 1) student profile characteristics, 2) academic factors, and 3) academic outcomes on NCLEX-RN performance. Figure 4 depicts the empirical model tested in this study.

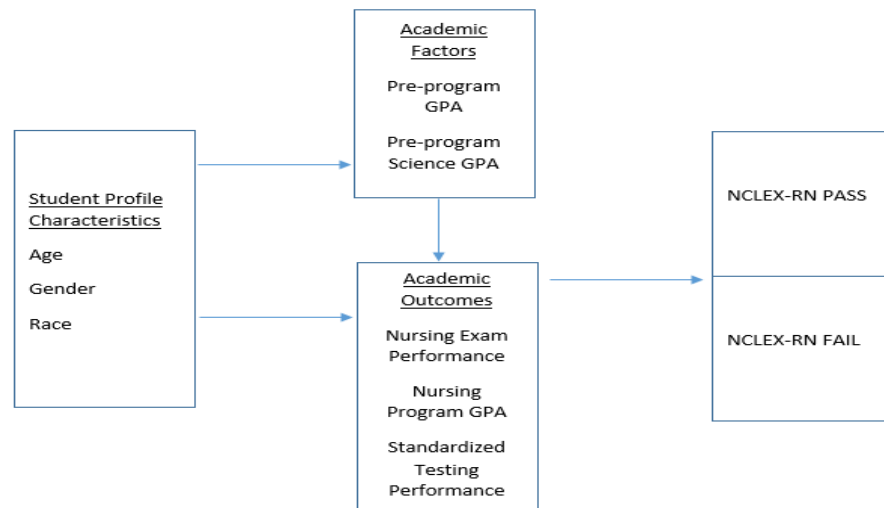


Figure 4. *Empirical model for study*

While NURS model remains largely untested in the literature, the literature does suggest individual aspects of the model may be useful in predicting nursing student success. The proceeding literature review presents the existing evidence on prediction of NCLEX-RN performance, with emphasis on the components of the NURS model.

### **Predictors of NCLEX-RN Performance**

A majority of studies exploring nursing student success have been conducted as retrospective designs, with the most common outcome variable identified as NCLEX-RN success (Adamson & Britt, 2009; Alexander & Brophy, 1997; Arathuzik & Aber, 1998; Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Briscoe & Anema, 1999; Crow,

Handley, Morrison, & Shelton, 2004; Daley et al., 2003; Giddens & Gloeckner, 2005; Haas et al., 2004; Landry, Davis, Alamedia, Prive, & Renwanz-Boyle, 2010; Nibert, Young & Adamson, 2002; Seldomridge & DiBartolo, 2004; Trofino, 2013; Truman, 2012; Vandenhouten, 2008; Yin & Burger, 2003). With the transition to CAT, the frequent changes in the NCLEX test plan, and the increasing diversity of nursing graduates, prediction of NCLEX-RN performance is dynamic and complex. Although the literature is replete with studies exploring the predictors of NCLEX-RN performance, the literature has yet to address NCLEX-RN prediction under the new 2013 NCLEX test plan and passing standards.

Prior to the 2013 NCLEX-RN revisions, researchers attempted to use a wide range of academic and non-academic variables to predict NCLEX-RN performance. Despite much effort, accurate and consistent prediction remains elusive. Lack of consistency and accuracy in prediction may be a result of changes in student demographics, variability in nursing programs, and changes in the passing standard over the preceding years. Furthermore, many studies did not ground their studies in student success theory, resulting in statistical modeling of a wide array of NCLEX-RN predictors and inconsistent support for a uniform set of predictors. In reviewing the literature, the most commonly tested predictors have included aspects of student demographics, pre-admission academic performance, and nursing program academic performance. The following section presents the findings from prior studies in the context of the conceptual model and constructs for the current study.

### **Student Profile Characteristics**

Nursing is historically a white, female dominated profession; however, the

millennium has brought a change in student demographics. At the turn of the century, only 16% of students enrolled in BSN programs were minorities (AACN, 2012). A dramatic increase in the racial diversity of nursing students has occurred over the past decade, with 28% minority enrollment in BSN programs in 2011 (AACN, 2012). Additionally, males and older students are enrolling at higher rates than in the past decade. According to the NLN (2013a, 2013b), approximately 31% of students enrolled in associate and baccalaureate nursing programs in 2003 were over the age of 30; this number increased to nearly 46% in 2012. The same has held true for males, with male student enrollment increasing from 10% to 15% over the same timeframe (NLN, 2013b). As the number of diverse students in nursing programs has increased, researchers have explored the relationship between demographics and NCLEX-RN performance.

**Age.** According to the NLN (2013a), approximately 20% of baccalaureate nursing students and 50% of associate degree nursing students are over 30 years old. With the large number of non-traditional age students enrolling in nursing programs, it is essential for nurse educators to explore the potential impact of age on NCLEX-RN success. Although several researchers have investigated the impact of age on NCLEX-RN performance, the findings are inconclusive. Beeson and Kissling (2001) found students of non-traditional age ( $\geq 23$  years old) tend to pass the NCLEX-RN at higher rates than their traditional-aged counterparts ( $<23$  years old). These findings were also supported by Haas et al. (2004), who reported younger students were more successful on the exam. Conversely, Briscoe and Anema (1999), Daley et al. (2003), Trofino (2013), and Vandenhouten (2008) found older student were more successful on the NCLEX-RN. Despite the aforementioned studies finding significant relationships between NCLEX

success and age, several researchers found age was not significantly correlated with NCLEX-RN success (Beeman & Waterhouse, 2003; Giddens & Gloeckner, 2005; Truman, 2012; Yin & Burger, 2003). Combined, these studies do not clearly link age with NCLEX-RN performance, indicating the need for further exploration of this variable.

The inconsistencies in the operationalizing of age may contribute to the discrepancy in findings. In several studies, age was defined as the age of the student upon entry into the program (Seldomridge & DiBartolo, 2005; Truman, 2012; Vandenhouten, 2008; Yin & Burger, 2003), whereas others considered age upon graduation and licensure (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Daley, et al., 2003; Giddens & Gloeckner, 2005; Landry et al., 2010). Several studies did not explicitly indicate the timing in calculating age (Ostrye, 2001; Haas et al., 2004; Trofino, 2013). The lack of uniformity in operationalizing age potentially affects the interpretability of the findings. In considering the length of most upper division nursing programs of 2 to 3 years, a student may be categorized as a traditional student ( $\leq 24$  years old) at program entry, but could be categorized as a non-traditional student ( $\geq 24$  years old) in another study which considers age at graduation.

**Gender.** Similar to age, the literature reports inconclusive findings in regards to the impact of gender on NCLEX-RN performance. Several studies asserted gender was not associated with NCLEX-RN performance (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Daley et al., 2003; Giddens & Glockner, 2005; Trofino, 2013; Truman, 2012; Vandenhouten, 2008; Yin and Burger, 2003); however, Haas et al. (2004) found this not hold true. While gender has been an area of interest for some researchers, other



studies exploring demographic factors such as age and race failed to include gender as a variable for study (Briscoe & Anema, 1999; Landry et al., 2010; Ostrye, 2001; Sayles, Shelton, & Powell, 2003). The aforementioned studies paint an unclear picture of the impact of gender on NCLEX-RN performance.

A possible reason for the inconsistency in gender as a predictor may be the limited number of males include in the samples for the respective studies. RN programs have experienced a steady increase in the number of male students enrolled across the country, with males representing 15% of total RN student enrollment in 2012 (NLN, 2013a). While the number of males enrolling in nursing programs is increasing, males remain underrepresented in NCLEX-RN predictor studies. The samples for Beeman and Waterhouse (2001), Beeson and Kissling (2001), Giddens and Glockner (2005), Haas et al. (2004), and Yin and Burger (2004) were comprised of less than 10% male participants, with other studies exploring gender reporting a male sample of less than 25% (Daley et al, 2003; Trofino, 2013; Truman, 2012). Although the latter studies' male percentage is more representative of the current national average, the low composition of male students in both the NCLEX pass and fail groups for most studies threatens the validity of the findings.

**Race.** In addition to the increased enrollment of males and older students, nursing programs have also experienced an increase in students from diverse backgrounds. According to the NLN (2013b), enrollment of minority students in RN programs has nearly doubled over the past 2 decades, with approximately 30% of students identified as minority students in 2012. With historical concerns over disparities in standardized testing performance between racial groups (Jenks & Phillips, 1998), it is not surprising

race is a commonly tested variable for NCLEX-RN prediction.

While there is no clear consensus on the impact of race on NCLEX-RN performance, Haas et al. (2004), Crow et al. (2004), and Nnedu (2000) reported a statistically significant difference on NCLEX-RN results across racial groups. Haas et al. (2004) reported a higher NCLEX-RN failure rate for Asian graduates (37.5%) compared to White graduates (8.1%;  $p = .026$ ), but only a marginal difference between Black graduates (18.8%) and Whites ( $p = .064$ ). Sayles et al. (2003) also reported a statistically significant correlation between race and NCLEX-RN performance, with 40% of Black graduates failing the NCLEX-RN on their first attempt, compared to 7.9% of their White counterparts. Some researchers also have suggested programs with higher percentages of minorities are more likely to have lower NCLEX-RN first-time pass rates (Crow et al., 2004; Seago & Spetz, 2005).

Although multiple studies found differences between racial groups on NCLEX-RN performance, the literature does not conclusively support these findings. Briscoe and Anema (1999), Daley et al. (2003), Truman (2012), and Yin and Burger (2004) reported no statistically significant differences in NCLEX-RN pass rates between racial groups. While several researchers have suggested race predicts NCLEX-RN performance, these finds are not consistently supported.

Similar to the potential impact of sample size on gender analysis, the underrepresentation of minority students in the studies and the limited number of racial groups included in the studies may influence the results. Although the sample in Daley et al. (2003) included Asian, Black, and Hispanic racial groups, the predominant racial group was White (83.5%) with Blacks being the highest minority group represented

(5%). The racial group representation was similar in Haas et al. (2004), with the sample comprised of predominantly White students (91.9%) and only 8 Asians and 2 Hispanics were included in the total sample ( $n = 368$ ). Other studies had similar underrepresentation of minority students (Sayles et al., 2003; Yin & Burger, 2004), with Crow et al. (2004) reporting the highest representation of minorities at 19% and Truman (2012) reporting the lowest minority representation at 2.1%. The inclusion of a small sample of minority students and comparing a disproportionate number of White students to minority students may contribute to inconsistencies in findings.

Across the three aspects of student profile characteristics, there are inconclusive findings of the usefulness of age, gender, and race on NCLEX-RN. While multiple researchers have supported the use of these variables of predictors, others have not yielded similar results. It is not clear if individual student profile characteristics predict NCLEX-RN performance; however, the combination of this set of predictors may account for a portion of the variance in NCLEX-RN outcomes and need additional testing.

### **Academic Factors**

As previously discussed, declaration of a nursing major in college does not equate to admission into an upper division nursing program. With the limited number of slots for upper division applicants, nursing programs seek the most qualified candidates for admissions. Typically, nursing programs evaluate student's academic ability and likelihood of success in nursing education through use of pre-nursing grade point average, performance on standardized tests, and admissions test scores (Byrd, Garza, & Nieswiadomy, 1999; Gallagher, Bomba, & Crane, 2001). Crow et al. (2004) found

college cumulative GPA (86.9%) was the most predominant criteria for admission decisions. While nursing programs may use these criteria as indicators to evaluate applicants for admission, the literature does not clearly establish if admission factors alone predict an individual's success on NCLEX-RN.

**Pre-nursing grade point average.** As previously discussed, admission into an upper division nursing BSN program is competitive and nursing programs seek the most qualified candidates for admission. A student's pre-nursing GPA is usually considered a reliable indicator of the individual's academic achievement and the candidate's readiness for the rigors of undergraduate nursing education (Crow et al., 2004; Newton, Smith, Moore, & Magnan, 2007; Sayles et al., 2003). Nursing programs often use cumulative pre-nursing college GPAs in upper division admission decisions. In a survey of 160 baccalaureate nursing programs, nearly 87% reported pre-nursing GPA as a variable included in admission decisions (Crow et al, 2004).

Early NCLEX-RN predictor studies found pre-nursing science GPAs was a significant predictor of NCLEX-RN performance. In their meta-analysis of NCLEX-RN studies from 1981 to 1990, Campbell and Dickson (1996) found pre-nursing science GPA was one of the greatest predictors of NCLEX-RN success. The majority of the 47 studies included in Campbell and Dickson's review were prior to the transition in 1988 to the pass/fail format of NCLEX-RN and all were prior to the 1994 transition to CAT.

Since the transition to CAT, reports of a relationship between either general pre-nursing or science GPA and NCLEX-RN performance are mixed. In a more recent meta-analysis of 31 studies on NCLEX-RN predictors, Grossbach and Kuncel (2011) found a significant correlation between pre-nursing GPA and NCLEX-RN success. While several

researchers reported a significant correlation between pre-nursing GPA (general or science) and NCLEX-RN success (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Daley et al., 2003; Newton & Moore, 2009; Sayles et al., 2003; Seldomridge & DiBartolo, 2004; Truman, 2012; Yin & Burger, 2003), other studies did not establish this association (Briscoe & Anema, 1999; Crow et al., 2004; Jeffreys, 2007; Seldomridge & DiBartolo, 2005; Trofino, 2013). Although the reason for these conflicting findings is not clear, the variability in courses included in pre-nursing GPAs, grading scales, and quality point assignments may influence the outcomes of these studies.

While several studies have investigated pre-nursing GPA as a predictor of NCLEX-RN success, courses considered in pre-program GPA calculation is diverse. Some studies have included all pre-requisite nursing courses in calculation of pre-program GPA (Crow et al., 2004; Sayles et al., 2003; Seldomridge & DiBartolo, 2004; Truman, 2012; Yin & Burger, 2003), while others considered GPAs derived only from performance in selected courses (Beeson & Kissling, 2001; Daley et al., 2003; Newton & Moore, 2009; Seldomridge & DiBartolo, 2004; Trofino, 2013; Truman, 2012). Seldomridge and DiBartolo (2004) and Truman (2012) explored pre-program GPA from both a general pre-nursing GPA perspective, including all pre-requisite courses to determine GPA, and pre-nursing science GPA perspective.

To make the consideration of pre-nursing GPA even more complicated, the courses considered within both the general pre-nursing GPA and pre-requisite science GPA are varied, as required pre-requisite courses may differ between institutions. Performance in anatomy has consistently been considered in calculating pre-nursing science GPA; however, inclusion of biology, chemistry, and social science courses have

been inconsistent (Truman, 2012; Beeman & Waterhouse, 2001; Trofino, 2013; Beeson & Kissling, 2001; Daley, 2003). While pre-nursing science GPA has continued to be an area of interest for predicting NCLEX-RN performance, inconsistencies in course inclusion in pre-requisite GPA calculation poses a threat to validity.

In addition to the challenges created by inconsistent course inclusion for GPA calculation, the potential variations in grading scales and quality points used in determining pre-nursing GPA affect validity. An institution using a plus/minus grading system may award more quality points for a student who earned a B+ than a student who earned a B-; whereas, a student enrolled at an institution without a plus/minus grading system may award the same quality points for a student who earned high B or low B. The variation created by the possible use of a plus/minus grading system may create discrepancies in the calculation of GPAs, especially for students who may transfer pre-requisite coursework into an institution that uses a different system than the original institution.

Differences in grading scales intensify this problem, as institutions and individual departments may differ in their grading scales for grade assignment. Some institutions or departments may use an 8-point scale (i.e., 100-93= A) to determine a final grade, while others may use a 10-point scale (i.e., 100-91= A). Although on superficial examination these discrepancies may appear insignificant, a 3.0 GPA can have a different meaning from one institution to the next. For example, a student with a 92% average in science courses may earn quality points that translate into a 3.0 GPA at an institution using an 8-point scale, whereas a student with an 81% average in similar science courses may have a 3.0 at an institution using a 10-point scale. These discrepancies are magnified when a

plus/minus grading system is used. Without thoroughly explicating the grading scales and quality point determination, it is difficult to translate prior findings into practice.

While pre-nursing GPA (either general or science) is frequently included as a variable of interest, most studies do not indicate the grading system or scale utilized at the institution of study (Beeman & Waterhouse, 2001; Beeman & Kissling, 2001; Newton and Moore, 2009; Sayles et al., 2003; Trofino, 2013; Truman, 2012; Yin and Burger, 2003). Despite the majority of studies exploring pre-nursing GPA as a NCLEX-RN predictor excluded precise details on grading scales and quality points, both Daley et al. (2003) and Seldomridge and DiBartolo (2004) included descriptions of the quality point assignments within their institution of study. Although Seldomridge and DiBartolo (2004) utilized a whole number system for quality point assignments, Daley et al. (2003) utilized a plus/minus system for quality points. No studies included in this literature review discussed the grading scale used at their institution of study. Considering the variation in courses used in pre-nursing GPA calculation, the grading scale, and quality point systems in the literature, it can be expected that prior studies have yielded inconsistencies in the predictive ability of pre-nursing GPA on NCLEX-RN outcomes. While the majority of studies suggest pre-nursing coursework is useful in predicting NCLEX-RN performance, the lack of explication of aspects in GPA calculation weakens these findings.

### **Academic Outcomes**

The most frequently studied predictors of NCLEX-RN performance include aspects of student's performance within nursing school, which fall under the auspices of academic outcomes. Academic outcomes within a nursing program include nursing GPA,

nursing course performance, content based standardized exam performance, and NCLEX-RN predictor exam scores. These factors capture a student's academic achievements during nursing studies and may best reflect their preparation for the NCLEX-RN. Across the majority of studies, researchers have found a significant relationship between NCLEX-RN outcomes and nursing program outcomes including program GPA, course performance, and exit exam scores.

**Program grade point average.** Multiple researchers have studied the relationship between nursing program GPA and NCLEX-RN performance. A majority of studies found a significant relationship between NCLEX-RN success and higher nursing GPAs (Gilmore, 2008; Daley et al., 2003; Haas et al., 2003; Salyes et al., 2003; Tipton, Pulliam, Beckworth, Illich, Griffin, & Tibbitt, 2008; Truman, 2012; Vandenhouten, 2008). Daley et al. (2004) discerned BSN graduates who were successful on NCLEX-RN on their first attempt earned a significantly higher cumulative nursing GPA ( $3.4 \pm 2$ ), in comparison to students who were unsuccessful ( $3.0 \pm 2$ ,  $p = .04$ ). Likewise, Truman (2012) found ADN graduates who were successful on the exam on their first attempt has a significantly higher nursing GPA ( $2.65$ ,  $p < .001$ ) than those graduates who failed on their first attempt ( $2.25$ ). Using logistic regression, Truman (2012) discovered that for every 1.0 point increase in nursing GPA, a student is 35 times as likely to pass the NCLEX-RN. Similarly, Yin and Burger (2003) found for every 0.1 point increase in final nursing GPA, the odds of passing the NCLEX-RN tripled.

The majority of studies exploring cumulative GPA considered all nursing courses in their calculations and measured GPA at program completion (Daley et al., 2003; Giddens & Gloeckner, 2005; Haas et al., 2004; Landry et al., 2010; Ostrye, 2001;



Truman, 2012; Yin & Burger, 2003). End-of-program GPAs have been linked to NCLEX-RN success, with significantly higher cumulative GPA in students who passed NCLEX-RN on the first attempt (Beeson & Kissling, 2001; Daley et al., 2003; Giddens & Gloeckner, 2005; Haas et al., 2004; Ostrye, 2001; Yin & Burger, 2003). While this information may indicate an individual's level of preparation for the NCLEX-RN at end-of-program, it limits the use of GPA as a tool for identification of high-risk students during studies.

Early identification of students at high risk for NCLEX-RN failure is crucial to facilitating NCLEX-RN success (Seldomridge & DiBartolo, 2004). With the use of early prediction, educators can develop early intervention programs to increase subsequent NCLEX-RN performance. To address the need for early intervention, some researchers have attempted to study nursing GPA at key matriculation points such as the end of first semester, junior year, and last semester (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Seldomridge & DiBartolo, 2004). Beeman and Waterhouse (2001) evaluated the relationship between first semester nursing GPA and NCEX-RN performance, as well as the GPA at the end of the first semester of senior year. Both first semester program GPA ( $r = .28, p < .05$ ) and end of first semester senior year ( $r = .32, p < .05$ ) were significantly correlated with NCLEX-RN performance. Beeson and Kissling (2001) also supported these findings, reporting students who passed the NCLEX-RN on their first attempt had higher significantly higher nursing program GPAs at the end of their sophomore, junior, and senior years. Combined, these findings suggest nursing course GPA at key points and at the end of the nursing program can help identify those students who are at high risk for failing the NCLEX-RN.

**Nursing course performance.** Many schools of nursing closely monitor student performance. In their survey of BSN programs, Crow et al. (2004) found course performance was the most commonly used progression criteria, with 98.1% ( $n = 157$ ) of the responding schools reporting the use of course grades in determining progress. Despite the high number of schools using course grades to determine progress, the use of specific nursing course grades as a predictor of NCLEX-RN performance has led to mixed results. In testing progression criteria as a predictor of NCLEX-RN success, Crow et al. (2004) found nursing course grades were not significantly correlated with NCLEX-RN success. However, other studies contradicted this finding, with performance in both pathophysiology and medical-surgical nursing courses as the variables most commonly correlated with NCLEX-RN success (Daley et al., 2003; Seldomridge & DiBartolo, 2004; Trofino, 2013). Similarly, Beeman and Waterhouse (2001) found statistically significant correlations between NCLEX-RN performance and grades in nursing intervention courses ( $r = .37$  to  $.38$ ,  $p < .001$ ); however Vandenhouten (2008) found grades in four nursing course, including pathophysiology and medical-surgical nursing, could be used to predict both NCLEX-RN success and failure. Most significantly, Vandenhouten (2008) discovered students who earned higher grades in medical-surgical nursing were four times more likely to pass the NCLEX-RN on their first attempt.

Correlations between specific nursing course grades and nursing licensure results have also varied between program types. In exploring the relationship of nursing course performance and NCLEX-RN success, Landry et al. (2010) found differences between programs. In their comparison of a traditional BSN, satellite program, and master's entry program within one school of nursing, Landry et al. found correlation between grades in

seven specific nursing courses and NCLEX-RN success; however, these findings did not hold true for the other program types. For the traditional BSN program, only some of the nursing course grades were correlated with success, while only pathophysiology grades were correlated with success for the students on the satellite campus (Landry et al., 2010). On the other hand, Daley et al. (2003) found NCLEX-RN pass rates were significantly higher for students with a higher final grade in medical-surgical courses (3.4+ .4 versus 2.8 + 0.6,  $p < .001$ ).

Although course performance is generally considered an indicator of an individual's academic abilities, the literature does not clearly establish which courses best predict NCLEX-RN success. Although several studies in several BSN programs found correlation between pathophysiology and medical-surgical courses performance and NCLEX-RN success, Penprase and Harris (2013) found health assessment grades were the only nursing grades correlated with NCLEX-RN success for students in an accelerated BSN program. On the other hand, De Lima et al. (2011) found grades in fundamentals, maternal child, and mental health courses were the only courses significantly related to NCLEX-RN success for students in ADN programs. Combined, these findings suggest specific course performance may not a reliable predictor of NCLEX-RN success across different program types.

In addition to specific nursing course grades, researchers have also operationalized nursing by the total number of C's in nursing courses. Considering other studies found a relationship between nursing course grades and NCLEX-RN success, it is not unexpected that several studies found the total number of C's was a useful predictor of NCLEX-RN success. When analyzing 21 predictor variables including nursing

program GPA and nursing course grades, Beeman and Waterhouse (2001) discerned the number of C+'s or lower in nursing courses had the highest correlations with NCLEX-RN success ( $r = -.39, p < .001$ ), with an increase in number of C+'s or lower resulting in an increase in the probability in NCLEX-RN failure. Similarly, Beeson and Kissling (2001) discovered the most significant predictor of NCLEX-RN success was the number of C's, D's, and F's earned in junior year nursing courses, with their analysis revealing a 97% NCLEX-RN pass rate in students with no grades below a B. Pass rates were reduced to 84% when a student earned 1 C or below, with this rate further reduced to 51% with 3 or more grades below this benchmark (Beeson & Kissling, 2001). Both Seldomridge and DiBartolo (2004) and Truman (2012) supported these findings. Truman (2013) found 28.6% of the students who repeated a nursing course failed the NCLEX-RN on the first attempt.

Although the literature does not clearly distinguish which courses most accurately predict NCLEX-RN success, the research links high performance in nursing courses with NCLEX-RN success. While many researchers have found nursing course exam performance is useful in predicting NCLEX-RN performance, there is no consistency in the courses evaluated. Several studies tested all nursing courses, while other selected only a few courses to test, which lead to unclear conclusions. Furthermore, other course assignments may be included in course grade determination, with dilutes the measurement of performance on course examinations.

**Exit exams.** Many nursing programs utilize commercially available testing software, administered prior to graduation, to predict the probability of success on the NCLEX-RN. Over the past two decades, nursing programs have routinely incorporated

the use of predictive exam testing packages as an exit examination (Langford & Young, 2013). As these testing packages have increased in prevalence in nursing programs, researchers have dedicated much time studying the predictive ability of these test scores. Two of the most widely used examinations are the HESI Exit Examination (E<sup>2</sup>) and the ATI Comprehensive Predictor Examination (CPE) (DeBartolo & Seldomridge, 2005). Research on the predictive value of these exit exams is more conclusive than other frequently studied predictors.

The E<sup>2</sup>, a 160 item comprehensive assessment, is designed to assess a student's readiness for the NCLEX-RN (Nibert & Morrison, 2013). The literature is replete with studies on the predictive ability of the E<sup>2</sup>. Since its inception in the 1990's (Nibert & Morrison, 2013), numerous studies have tested the validity of the E<sup>2</sup> (Adamson and Britt, 2009; Langford and Young, 2013; Lauchner, Newman, & Britt, 1999; Newman, Britt, & Lauchner, 2000; Nibert and Young, 2001; Nibert et al., 2002; Young and Wilson, 2012; Zweighaft, 2013). Across a combined sample of 49,115 students, the predictive accuracy of the E<sup>2</sup> ranged from 96.36% to 99.16%, with significantly more E<sup>2</sup> low-scoring students failing the NCLEX-RN (Adamson and Britt, 2009; Langford and Young, 2013; Lauchner et al., 1999; Lewis, 2005; Newman et al., 2000; Nibert and Young, 2001; Nibert et al., 2002; Young and Wilson, 2012; Zweighaft, 2013). These findings were also supported in a large, four-year study conducted by Harding (2010). In this study, Harding found the E<sup>2</sup> was 96.4% to 98.3% accurate in predicting NCLEX-RN success across 17,432 students. Lauchner, Newman, and Britt (2008) confirmed the high predictive ability of the E<sup>2</sup> across multiple program types (associate degree, BSN, and master's entry), with no significant difference across groups ( $\chi^2 = 2.49, p = .01$ ). With data consistently

supporting student success on the E<sup>2</sup> as a predictor of NCLEX-RN success, many programs of nursing rely on this test to identify students who are high risk for failure.

The ATI CPE, a newer alternative to the E<sup>2</sup>, has recently gained popularity. Similar to the E<sup>2</sup>, ATI designed the CPE to assess student readiness for the NCLEX-RN. An individual's score (percentage correct) on the CPE is converted to a numerical probability of passing the NCLEX-RN, ranging from 1% to 99% probability of passing NCLEX-RN (ATI, 2014a).

According to ATI (2013a), over 1,000 institutions utilize the ATI CPE in their nursing programs. Despite the high number of nursing programs administering the CPE, evaluation of predictive ability of the CPE on NCLEX-RN performance is relatively limited. Although not as well tested as the E<sup>2</sup>, early studies of the relationship between the CPE and NCLEX-RN performance have yielded positive results. In their analyses, Sims (2012) and Vandenhouten (2008) found CPE performance was significantly related to NCLEX-RN success, with Sims (2012) reporting a significant difference between the mean CPE probability score of students who passed on the first attempt (94.51) and those who failed (85.83). Similarly, in an analysis of 7,126 nursing students, ATI (2013) reported the CPE was able to reliably distinguish between those who passed NCLEX-RN on the first attempt and those who did not ( $\chi^2 = 826.66; p < .001$ ). In this analysis, ATI (2013) reported an odds ratio indicating a 1.0 point increase on the CPE score increased an individual's odds of passing NCLEX by 1.19. Furthermore, ATI (2013) found 98% of students earned a CPE probability of  $\geq 90\%$  passed the NCLEX-RN on the first attempt.

While researchers frequently studied the predictive ability of the HESI E<sup>2</sup>, studies on the ATI is limited. Early studies on the CPE show promise in predicting NCLEX-RN

performance; however, additional testing is warranted.

**Nursing content exams.** In an attempt to predict NCLEX-RN success during nursing studies, standardized nursing content exams have gained recent popularity. Nursing programs administer standardized nursing content exams, such as the ATI Content Mastery Series (CMS), at the completion of specific courses to assess student knowledge of respective course content. With CMS exams, a student's individual score (percentage correct) is converted to a proficiency level (Below 1, Level 1, Level 2, and Level 3), which indicates if the student exceeds, readily meets, just meets, or does not meet the NCLEX-RN standard in the specific content area (ATI, 2014c).

As nursing content exams increase in popularity, some researchers have explored the usefulness of standardized nursing content exams to predict NCLEX-RN performance. Although the number of studies is limited, early studies yield promise in predicting NCLEX-RN performance. In one of the earliest studies of ATI CMS exams, Vandenhouten (2008) discovered correlation between student performance on eight ATI CMS exams (fundamentals, pharmacology, medical-surgical, mental health, pediatrics, maternal newborn, community, and leadership) and NCLEX-RN outcomes, with higher scores being associated with NCLEX-RN success. Using logistic regression, Vandenhouten (2008) found ATI CMS performance significantly predicted NCLEX-RN success.

Although Vandenhouten (2008) suggested scores on eight ATI CMS exams were associated to NCLEX-RN performance, the literature does not consistently support this finding. In a comparison of the CMS scores for graduates who had passed NCLEX-RN on the first attempt to those who had failed, Yeom (2013) found CMS scores differed on

only six exams: mental health, pharmacology, medical-surgical, maternal newborn, community, and leadership exams ( $t = -3.143$  to  $5.697$ ,  $p < .001$  to  $.003$ ). In a similar analysis of scores on fundamentals, mental health, and pharmacology CMS exams, Emory (2013) found both fundamentals and pharmacology scores were significantly different between the pass and fail groups, yet there was no significant difference in mental health scores between the two groups. Interestingly, while Yeom (2013) found no significant differences in performance on the fundamentals test between the two groups, Emory's (2013) analysis yielded a large difference between the two groups on the same exam ( $d = .87$ ). The inconsistencies in findings between the few studies suggest additional research is needed to determine if CMS exam scores are beneficial predictors of NCLEX-RN performance.

Although the literature has not clearly established a relationship between ATI CMS performance and NCLEX-RN performance, early studies suggest performance on some CMS exams are related to known predictors of NCLEX-RN success, such as course grades and CPE performance. Despite early promise, there are inconclusive findings regarding which CMS exams are associated with NCLEX-RN prediction. These findings suggest a more extensive testing of ATI CMS examination as a predictor is needed.

### **Other Variables**

While most studies on nursing student success have focused on demographic and academic variables, the evidence suggests these variables alone may not fully explain NCLEX-RN performance. Using a discriminant function analysis of 21 demographic and academic variables including gender, age, race, pre-program and nursing GPA, performance in nursing and science courses, and the number of low grades, Beeman and



Waterhouse (2001) revealed demographics and course performance only accounted for 31% of the variance in NCLEX-RN performance. These findings suggest other factors may explain NCLEX-RN performance, such as critical thinking abilities, psychosocial concerns, and post-graduation influences.

The discipline of nursing has long considered critical thinking a central element to nursing practice. Recognizing the importance of critical thinking development in nursing education, the AACN requires BSN programs to include activities designed to facilitate critical thinking development within their curriculum (AACN, 2008). With the emphasis on critical thinking in nursing education and practice, researchers have explored the relationship between the construct of critical thinking and NCLEX-RN outcomes. In an integrative review of literature on critical thinking and NCLEX-RN performance, Romeo (2010) found the link between critical thinking and NCLEX-RN performance was inconsistent. For example, Akerson (2001) and Henriques (2002) found no correlation between NCLEX-RN outcomes and critical thinking. Using the same instrument, Giddens and Glockner (2005) found positive correlations between critical thinking scores and NCLEX-RN success. Although critical thinking is an essential component of nursing education, inconsistencies in defining and measuring the construct of critical thinking poses a challenge in studying the link between critical thinking and NCLEX-RN performance (Romeo, 2010).

Few studies have explored psychosocial and personal variables associated with academic performance and NCLEX-RN performance such as test anxiety, personality, self-esteem/concept, financial status, and family/work responsibilities (Arathurzik & Aber, 1998; Crow et al, 2004; Endres, 1997; Salamonson & Andrew, 2006; Shelton,

2003). One such study by Arathurzik and Aber (1997) found several non-academic factors were significantly correlated with NCLEX-RN success including English as primary language, lack of family demands or responsibilities, and lack of emotional distress.

Post-graduation factors may also influence NCLEX-RN success. While programs of nursing cannot control these factors, the literature suggests post-graduation experiences may influence NCLEX-RN success (Beeman & Waterhouse, 2003). In an exploration of the post-graduation factors of work hours, NCLEX-RN preparation methods and activities, hours studied, time between graduation and sitting for NCLEX-RN, and the exposure to new nursing material, Beeman and Waterhouse (2003) found both study time and exposure to new nursing content were related to NCLEX-RN performance. Not surprising, the number of hours dedicated to NCLEX-RN preparation was positively correlated with success; however, the exposure to new nursing material was negatively correlated with NCLEX-RN success. While post-graduation NCLEX-RN preparation is expected, inconsistencies in available preparatory courses and activities, as well as difficulty in data tracking post-graduation, pose challenges in exploring the relationship between post-graduation activities and NCLEX-RN performance.

### **Accuracy in Prediction**

A review of existing literature yields a wide range in accuracy rates for predictors of NCLEX-RN performance. Although some researchers have found success in using student data to predict NCLEX-RN performance, these results have not always been consistent in predicting passing and failing the NCLEX-RN (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Seldomridge & DiBartolo, 2004; Truman, 2014; Yeom,

2013). Examining a combination of 21 pre-admission and program predictors, Beeman and Waterhouse (2001) correctly classified 94% of the students who were successful on NCLEX-RN. Beeson and Kissling (2001) yielded similarly impressive results using a combination of the number of Cs in junior year nursing courses, standardized nursing assessment scores, and age group (traditional versus non-traditional). Seldomridge and DiBartolo (2004) tested three separate prediction models, one using pre-admission academic performance, one using junior year academic performance, and the final using end-of-program predictors. All three of the models yielded high accuracy rates for NCLEX-RN success, with the pre-admission prediction equation yielding the highest accuracy at 100% and the end-of-program model yielding the lowest accuracy for NCLEX-RN success prediction at 94.7%. Seldomridge and DiBartolo combined these models to create an overall prediction model yielding a 94.9% accuracy rate in predicting NCLEX-RN success. More recently, Truman (2012) and Yeom (2013) found NCLEX-RN success prediction remained high for the 2010 NCLEX-RN test plan. Using a combination of demographic, pre-admission, and program variables, Truman's (2012) prediction model yielded an accuracy of 87.6% for NCLEX-RN success. Utilizing eight ATI CMS exams to create a prediction model, Yeom (2013) yielded a correct classification of 93.2% of the NCLEX-RN success group. Overall, prediction of NCLEX-RN success using a variety of the aforementioned predictors has led to promising results.

By and far, the literature indicates prediction of NCLEX-RN success is much easier than prediction of failure. Despite multiple studies reporting over 85% accuracy in predicting NCLEX-RN success, these same predictors are less likely to identify who is at risk for NCLEX-RN failure. Testing the same model that yielded over 85% accuracy in

classification of NCLEX-RN “passers”, Beeson and Kissling’s (2001) model yielded only a 67% accuracy in predicting failures. The results from other studies demonstrate less accuracy in failure prediction. Truman’s (2012) model only accurately predicted failures 50% of the time, while Yeom (2013) found ATI CMS scores only predicted failures with 33% accuracy. The most profound difference was the findings of Seldomridge and DiBartolo’s (2004)- testing the same pre-admission, junior year, and end-of program models that yielded 95% to 100% accuracy, the researchers were only able to correctly classify failures 3%, 6%, and 25% of the time, respectively.

Despite positive results in predicting NCLEX-RN success, the literature has yet to establish a clear picture of the true predictors of NCLEX-RN failure. Combined, these accuracy findings suggest predictors of NCLEX-RN are not necessarily the same predictors of NCLEX-RN failure. The lack of literature accurately predicting NCLEX-RN failure indicates a need for additional studies focusing on identifying predictors of NCLEX-RN failure, so educators can readily identify students at risk for NCLEX-RN failure.

### **Summary of Literature**

Prediction of students who are likely to achieve success on the NCLEX-RN remains a challenge for educators. The ever-evolving diversity in the nursing student population, combined with the change in passing standard, complicates accurate prediction of NCLEX-RN performance. While the challenges in identifying students likely to pass NCLEX-RN remain, the identification of those at risk for failure presents a greater challenge for researchers. The vast majority of prior studies have focused on predictors of NCLEX-RN success, with very few establishing accurate prediction of

NCLEX-RN failure. Even in studies yielding promising results, recent changes in the NCLEX-RN test plan and passing standard warrants further exploration of predictors for NCLEX-RN performance.

Although some researchers have found a link between student profile characteristics, such as age, gender, and race, and NCLEX-RN performance (Beeson & Kissling, 2001; Briscoe & Anema, 2999; Daley et. al, 2003; Trofino, 2013; Vanderhouten, 2008), the literature does not consistently support these findings (Beeman & Waterhouse, 2003; Giddens & Gloeckner, 2005; Landry et al., 2010; Ostrye, 2001; Sayles et al., 2003; Truman, 2012; Yin & Burger, 2003). Researchers have linked academic factors, most specifically pre-requisite program GPA and re-requisite science GPA, to NCLEX-RN prediction; however, the literature is inconsistent in which courses are considered as predictors (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Daley et al., 2003; Trofino, 2013; Truman, 2012).

As previously discussed, academic outcomes such as nursing program GPA, course performance, and standardized testing scores, are the most tested predictors of NCLEX-RN performance. While numerous researchers have linked nursing program GPA, nursing course performance, and performance on standardized testing with NCLEX-RN performance, no studies have considered the predictive nature of academic outcomes when controlling for student profile characteristics and/or academic factors (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Daley et al., 2003; DeLima et al., 2011; Gilmore, 2008; Haas et al., 2003; Landry et al., 2010; Penprase & Harris, 2013; Salyes et al., 2003; Seldomridge & DiBartolo, 2004; Sims, 2013; Tipton et al. , 2008; Trofino, 2013; Truman, 2012; Vandenhouten, 2008; Yeom, 2013), Furthermore, none of

the above listed studies considered interactions between student profile characteristics (i.e., gender and race) and academic outcomes (i.e., standardized testing performance).

## CHAPTER III

### METHOD

This chapter provides a review of the research questions for the study and describes the methodology used to answer the research questions. To provide the reader with a comprehensive understanding of the research methods, this chapter describes the research design, variables and instrumentation, study participants, study setting, procedures, and statistical analysis.

#### **Research Questions**

The purpose of this study was to determine if nursing students' academic outcomes predict NCLEX-RN performance. Four research questions guided the study:

*Question 1:* Do nursing course exam scores predict NCLEX-RN performance, when controlling for student demographics and academic factors?

*Question 2:* Does nursing program cumulative grade point average predict NCLEX-RN performance, when controlling for student demographics and academic factors?

*Question 3:* Does performance on nursing standardized testing predict NCLEX-RN performance, when controlling for student demographics and academic factors?

*Question 4:* Is Comprehensive Predictor Exam (CPE) prediction of NCLEX-RN performance moderated by race?

#### **Research Design**

The current study is quantitative in nature and employed a retrospective, correlational

design using a nonrandom sample of existing student data. The study was considered non-experimental as the researcher used an existing data set and no manipulation of the variables occurred (Creswell, 2012).

### Major Variables and Instruments

As described in the study purpose, the primary objective of the study was to identify the predictors of NCLEX-RN performance for BSN graduates. Using the NURS model as the conceptual framework, the current study tested: 1) student profile characteristics, 2) academic factors, and 3) academic outcomes as predictors of NCLEX-RN performance. As previously presented in Chapter 2, Figure 4 visually depicts the empirical model for the study.

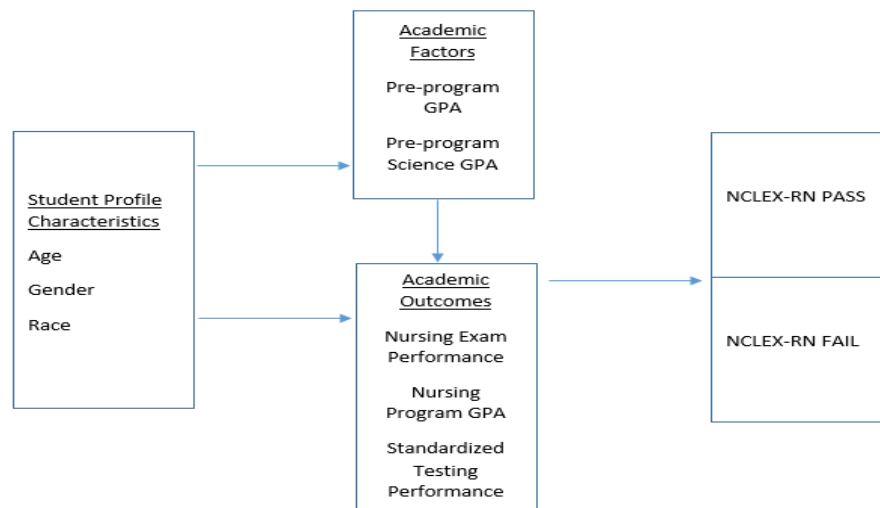


Figure 4. *Empirical model*

Consistent with Jeffrey's NURS model, student profile characteristics included the student's age, gender, and race. Academic factors include both pre-requisite program GPA and pre-requisite science GPA. The primary predictors of interest, academic outcomes, include nursing program GPA, nursing course exam scores in six nurse



courses, and student performance on three standardized exams. Table 2 presents full descriptions of the variables in the empirical model.

Table 2

*Variables included in the empirical model*

<b>Variable</b>	<b>Definition</b>
<b><i>Outcome Variable</i></b>	
NCLEX-RN performance	Results of an individual's NCLEX-RN on first-attempt. Calculated by the NCSBN and reported as either pass or fail. (Pass = 0, Fail = 1)
<b><i>Predictor Variables</i></b>	
<i>Student Profile Characteristics</i>	
Age	A student's age, in years, at time of graduation from the pre-licensure BSN program. The graduate's age at graduation was transformed from the date of birth, as documented in university records.
Gender	A student's reported gender, as documented in the university records through self-report on admissions application. (Female = 0, Male = 1)
Race	A student's self-identified race, as documented in the university records. Due to the disproportionate number of students who identify as White, in comparison to other individual racial groups, race was coded as Non-minority (= 0) and Minority (= 2). Non-minority students included individuals classified as White, Non-Hispanic in university records. Minority students included all individuals self-identified as Black, Asian, Hispanic, Native American, or Other race in university records.
<i>Academic Factors</i>	
Pre-requisite program GPA	Student's general academic performance in required pre-requisite course, prior to admission into upper division. Calculated through multiplying quality points by number of credit hours, then dividing by total hours attempted. This value was calculated as a continuous value ranging from 0.00 to 4.00.
Pre-requisite science GPA	A student's academic performance in lower division science-based courses prior to admission into the Upper Division Nursing Program, as reported on university records. Calculated through multiplying quality points by number of credit hours, then dividing by total hours attempted. This value was calculated as a continuous value ranging from 0.00 to 4.00.
<i>Academic Outcomes</i>	
Cumulative nursing GPA	A student's final cumulative grade point average in all required

lower division and upper division courses. Calculated from grades reported in university records, through multiplying quality points by number of credit hours, then dividing by total hours attempted. Recorded as a continuous value ranging from 0.00 to 4.00.

### *Exam Averages*

Fundamentals exam average	A student's overall exam performance in fundamentals of nursing. The average of all exam scores throughout the course, as reported by course faculty. Calculated as a continuous variable, with possible score range of 0 to 100. A higher score indicated the more questions answered correctly, on average.
Adult health exam average	A student's overall exam performance in adult health nursing. The average of all exam scores throughout the course, as reported by course faculty. Calculated as a continuous variable, with possible score range of 0 to 100. A higher score indicated the more questions answered correctly, on average.
Mental health exam average	A student's overall exam performance in mental health nursing. The average of all exam scores throughout the course, as reported by course faculty. Calculated as a continuous variable, with possible score range of 0 to 100. A higher score indicated the more questions answered correctly, on average.
Child health exam average	A student's overall exam performance in child health nursing. The average of all exam scores throughout the course, as reported by course faculty. Calculated as a continuous variable, with possible score range of 0 to 100. A higher score indicated the more questions answered correctly, on average.
Maternal health exam average	A student's overall exam performance in maternal health nursing. The average of all exam scores throughout the course, as reported by course faculty. Calculated as a continuous variable, with possible score range of 0 to 100. A higher score indicated the more questions answered correctly, on average.
Complex health exam average	A student's overall exam performance in complex health nursing. The average of all exam scores throughout the course, as reported by course faculty. Calculated as a continuous variable, with possible score range of 0 to 100. A higher score indicated the more questions answered correctly, on average.

### *Standardized Testing*

Adult Health CMS score	A student's percentage correct on their first attempt of the ATI Adult Health CMS exam, as calculated and reported by ATI. Recorded as a continuous score, with possible score range of 0 to 100. A higher score indicated the more questions answered correctly.
Child Health CMS score	A student's percentage correct on their first attempt of the ATI Care of Children CMS exam, as calculated and reported by ATI. Recorded as a continuous score, with possible score range of 0 to 100. A higher score indicated the more questions answered correctly.

CPE Score

A student's percentage correct on their first attempt of the ATI CPE, as calculated and reported by ATI. Recorded as a continuous score, with possible score range of 0 to 100. A higher score indicated the more questions answered correctly.

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A detailed discussion of measurement for NCLEX-RN performance, nursing course exam averages, and standardized testing follows. Appendices B and C provide additional details for calculation of quality points and exam averages.

### **NCLEX-RN Performance Measurement**

The NCLEX-RN is the instrument used by the nursing licensing body to measure entry-level nursing competence of the examinee (NCSBN, n.d.). The considerations for validity and reliability of the NCLEX-RN are two-fold: the ability of the exam to measure safe and effective nursing practice and the ability to distinguish between examinees who possess essential competencies and those who do not (NCSBN, 2011). The NCSBN routinely examines the validity of the examination and the reliability of scores, and report it as a psychometrically sound instrument to measure entry-level nursing competency with reliable results (NCSBN, n.d.; Woo & Dragan, 2012; NCSBN, 2011).

**Validity.** Validity concerns the “matter of degree to which accumulated evidence supports the intended interpretation of test scores for the proposed purpose” (Urbina, 2004, p. 151). The NCSBN utilizes a test plan to define the domains covered by the examination and each exam item is constructed to assess minimal competence within a specified domain. To establish the domains of the NCLEX-RN, the NCSBN conducts a practice analysis every three years and revises the test plans to reflect changes in current nursing practice.

The NCSBN establish content validity of the NCLEX-RN through use of nursing

experts to develop items for each domain and evaluate items for the examination (NCSBN, n.d.). Through the utilization of a diverse panel of experts to develop and evaluate items, the NCSBN constructs the examination to cover the entire domain of entry-level nursing practice (NCSBN, n.d.).

Construct validity, which indicates the extent to which an instrument measures the latent construct (minimum nursing competence), is established using Rasch measurement theory to develop the examination scale. According to the NCSBN (n.d.), the literature documents the effectiveness of Rasch theory in producing valid measures of a latent construct. To ensure the NCLEX-RN measures only the intended construct of minimal nursing competency, the NCSBN also performs a differential item functioning analysis on each item to ensure there are no potential biases related to gender and ethnicity (Woo & Dragan, 2012).

**Reliability.** Reliability is the consistency in scores produced by an instrument. The NCSBN evaluates the reliability of the NCLEX-RN examination scores using a decision consistency statistic. A decision consistency statistic is an alternate to traditional internal consistency reliability statistics, such as Cronbach's alpha, for criterion-referenced test such as the NCLEX-RN (Traub, 1980). According to Linn (1979), examination of score variability and traditional assessments of validity are unsuitable for criterion-referenced tests.

The NCSBN utilizes the decision consistency reliability statistic to indicate the probability of a consistent decision over two NCLEX-RN attempts. The NCSBN (n.d.) reports good decision consistency reliability, with a calculated value of .87 to .92. This value indicates the NCLEX-RN would consistently classify 87% to 92% of examinees as

minimally competent or not, if two equivalent tests were administered. According to Subkoviak (1988), a decision consistency reliability of .90 is desired on high stakes testing.

### **Nursing Course Exam Averages**

Similar to the NCLEX-RN, the validity of nursing course exams is established by content validity. Experienced course faculty, considered experts in their content area, developed the nursing course exams utilized in determining nursing course exam averages. Each faculty member possesses either a master's or doctoral degree in nursing and is experienced in test item construction. Using an exam blueprint for exam specification, the course faculty develops exam items to assess minimum competence in the respective content area. Furthermore, faculty conduct an item analysis following each exam administration and items evaluated for difficulty and discrimination.

Exams consisted of five possible question type: multiple choice, multiple response, hot spot, fill in the blank, or ordering. Exam developers scored the exams based on the number of correct items. Faculty administered exams in either a computerized or pencil-paper format in a proctored, classroom setting.

### **Standardized Nursing Exams**

For the purpose of this study, the research considered student performance on three standardized tests. The first two exams are part of Assessment Technology Institute's (ATI) Content Mastery Series (CMS), designed to assess a student's proficiency in concepts with specific nursing content areas (ATI, 2013b). The two CMS exams used in this study included Adult Medical-Surgical (Adult Health) Form B and Nursing Care of Children (Child Health) Form B. The third standardized assessment used

in this study was the ATI Comprehensive Predictor Examination (CPE) Form B.

According to ATI (2012), the purpose of the CPE is to assess an individual's current level of readiness for the NCLEX-RN. Table 3 presents an overview of the number of items, length of exam, and reliability coefficients for each standardized examination.

Table 3

*ATI Standardized Tests, CMS Exams and CPE*

Exam	Number Of Items*	Exam Length (min)*	Cronbach Alpha
Adult Health	90	90	.70
Child Health	60	60	.65
CPE	150	150	.81

\*excludes try-out questions and additional 1 minute per try-out item (ATI, 2013b; ATI, 2012)

Each CMS exam and the CPE consist of a specified number multiple choice, multiple response, fill in the blank, hot spot, chart/exhibit, and drag and drop ordering type questions. The two CMS exams and CPE include “try-out” questions, not calculated in the score. ATI scores assessments questions as either correct or incorrect, with no partial credit awarded (ATI, 2013b). Standardized assessment reports include an individual percentage correct, student proficiency level, and national percentile.

The SON administered each standardized examination in a proctored, computerized format. Faculty administered the CMS exams during the last week of each corresponding nursing course and the CPE within a month prior to graduation. At the time of admission into Upper Division, students were provided textbooks created by ATI to assist their studies; however, no resources were available for use during the examinations.

To ensure the CMS and CPE exams measures what they are purported to measure, ATI utilized a panel of expert nurse educators in respective content areas to develop

exam questions, establishing content validity. After a question was developed, a group of nursing experts screened each item for appropriateness to measuring the mastery of specified content (ATI, 2013b). Furthermore, items were evaluated for gender and ethnicity testing bias through bias panel review and analysis of differential item functioning (ATI, 2013b; ATI, 2012).

The reported reliabilities for each of the CMS exams and CPE are located in Table 7. ATI reported Cronbach's alpha reliabilities ranging from .65 to .81, which are considered minimally acceptable to very good (ATI, 2013b; ATI, 2012). According to DeVellis (2003), a Cronbach alpha of .65 to .70 is minimally acceptable, .70 to .80 is respectable, .80-.90 is very good, and greater than .90 is too high. Nine CMS exams are available from ATI; however, only exams with at least minimally acceptable reliability coefficients were included in this study. DeVellis' (2003) recommendations indicated a reliability coefficient of less than .60 is unacceptable and .60 to .65 is undesirable. Other CMS exams have reported reliability coefficients ranging from .58 to .62 and, thus, the researcher excluded these from this study (ATI, 2013b).

### **Participants**

The target population for this study was graduates of US-based pre-licensure BSN programs, who completed the NCLEX-RN following the 2013 NCLEX test plan revisions. A convenience sample was collected from graduates at a single Southeastern university. Sample selection began with a listing of all graduates of the pre-licensure BSN program between May 2013 and May 2015. All program graduates, meeting inclusion criteria, were included in the sample. Inclusion criteria included: 1) completion of the university's pre-licensure BSN program after the April 2013 NCLEX-RN

revisions; 2) completion of the first-attempt on NCLEX-RN under the April 2013 test plan; 3) completion of standardized testing while enrolled at the university; 4) completion of all Upper Division nursing program requirements at the specified university; and 5) completion of Upper Division coursework on the Health Science Campus (HSC) of the university. Using the aforementioned inclusion criteria ensured only students who completed their nursing specific courses at the designated university were included in the sample. Most specifically, students who transferred in nursing courses from other institutions or completed nursing courses outside of the health science campus (i.e., the remote campus site) were excluded from the study.

During the designated timeframe, a total of 386 students completed the pre-licensure nursing program at the university. After removing all cases not meeting inclusion criteria, the sample was reduced to 382 students. Using Peduzzi, Concato, Kamper, Holdford, and Feinstein's (1996) and Vittinghoff and McCulloch's (2006) recommendations of events per variable (EPV), the researcher determined the sample size was adequate for the planned analysis, with approximately 25 cases per variable. Peduzzi et. al. (1996) recommended 10 EPV to minimize biased estimates; however, Vittinghoff and McCulloch (2006) assert 10 EPV is too conservative and suggest 5-9 EPV may be adequate for logistic regression. Courvoiser, Combeseure, Agoritsas, Gayet-Ageron, and Perneger (2011) argued EPV alone does not guarantee accurate estimation and, therefore, recommend researchers consider EPV, number of predictors, and the size of correlations between predictors when evaluating the adequacy of sample size. To address the concerns presented by Courvoiser et al. (2011) the researcher also cautiously evaluated the predictors during model specification to ensure none were highly correlated.



## Setting

The researcher conducted the study at a large, public university located in an urban setting within the Southeast region of the US. The institution is considered a research-intensive university, with a basic Carnegie designation of RU/VH (very high research activity). The Carnegie undergraduate profile for the university is full-time, four-year, selective, with a higher transfer in rate (FT4/S/HTI).

The university enrolls approximately 20,000 students annually and offers associate, baccalaureate, graduate, and professional degrees. The School of Nursing (SON) is 1 of 12 schools and colleges within the university. The SON offers a variety of nursing degrees as a part of the undergraduate and graduate programs. The undergraduate program offers both pre-licensure BSN entry and RN-BSN entry, with the pre-licensure program offering courses on two campuses: the Health Science Campus (HSC) and a distance location campus. The SON on the HSC admits students into the pre-licensure BSN program three times a year, with approximately 200 degrees conferred per academic year. The pre-licensure BSN program accreditation is through the Commission on Collegiate Nursing Education and program approval is through the state Board of Nursing. Upon graduation, pre-licensure BSN graduates are eligible to sit for the NCLEX-RN.

The SON is 1 of 13 pre-licensure BSN programs within the state and is the largest in the state. While the SON grants 20% of all pre-licensure BSN degrees in the state, the 2013-2015 NCLEX-RN pass rates of the institution are among the lowest in the state for BSN programs (KBN, 2014). Among the BSN programs in the state graduating at least 100 students, the SON pass rates are closest to the national NCLEX-RN pass rates

following the 2013 revisions. Table 4 presents an overview of the enrollment data and NCLEX-RN pass rates for the SON, in comparison to national BSN program values.

Table 4

*Comparison of School of Nursing (SON) Student Enrollment to National BSN Nursing Enrollment*

	SON BSN Program*	National BSN Programs**
Age < 30	84.8%	84%
Female	86.6%	86%
Non-minority	85.3%	66%
Graduation rate	96%	81%
2014 NCLEX-RN pass rates	89%	85%***

\* From current data set (April 2013-May 2015)

\*\* NLN, 2013a

\*\*\* NCSBN, 2014b

Using the largest pre-licensure BSN program in the state allowed the researcher to conduct an in-depth exploration at the predictors of NCLEX-RN performance at a large, BSN program with a diverse study body. Given the IOM’s (2010) call to increase the number of baccalaureate prepared nurses and the steady increase of BSN enrollment over the past decade (AACN, 2014b), the number of BSN programs admitting large student numbers are continuing to rise; however, the national NCLEX-RN pass rates of BSN programs remain low. These findings are consistent with the recent experiences at the SON. Although the current study examined NCLEX-RN performance at a single institution, the decline in NCLEX-RN pass rates at the university over the past 2 years have similarities to the national BSN pass rate decline (Table 4).

### **Procedures**

The researcher compiled the data set from merging existing university records, standardized testing results available through an ATI database, and NCLEX-RN results reported by the state Board of Nursing. First, an official from the nursing program’s Office of Student Services (OSS) compiled a list of each pre-licensure BSN graduate

between May 2013 and May 2015, along with selected background and academic variables including the demographic variables of interest, grade point averages, and exam scores. The OSS official removed student names and only included participant identification by date of birth, student identification number, and semester of graduation, to allow for matching with the Board of Nursing data and ATI data. The OSS official provided the data to the researcher, who compiled the records into a single spreadsheet. Next, the researcher retrieved the standardized testing data from an existing ATI database and matched to the existing spreadsheet through student identification number. Finally, an official from the SON provided NCLEX-RN results from the Board of Nursing, with students identified only by date of birth and semester of graduation, to assist with matching to data provided by OSS.

After data were compiled into a single data set, the remaining identifiers, including student identification number and semester of graduation, were deleted and discarded from all devices. The researcher transformed date of birth into age at graduation. The researcher secured the de-identified data file in a password-protected file and maintained the file in a locked system in electronic format.

### **Statistical Analysis**

Data were analyzed using the statistical software package SPSS 22. The significance level for statistical decisions was set at .05. The researcher selected this level of significance to limit the Type I error rate to five percent, while maintaining adequate power to detect a significant effect when one exists.

To answer the research questions of this study, the researcher selected binary logistic regression to analyze the data. Since NCLEX-RN failure was a rare occurrence

event within the dataset (10.9%), the researcher adjusted the classification cutoff in SPSS for the logistic regression analysis. Prior to analysis, the researcher performed data cleaning and verified assumptions of statistical tests, as presented below.

### **Data Cleaning**

First, the researcher explored the data for missing cases and none were identified. Second, the researcher performed data cleaning through univariate and multivariate analysis. Univariate analysis included visual inspection of histograms of the continuous variables for outliers and skewness with no outliers noted. Multivariate analysis included visual inspection of the standardized residual scatterplot for potentially influential cases. The standardized residuals ranged from -3.987 to 2.393. Inspection of standardized residuals revealed potentially influential cases at  $< -2.5$  and  $>2.0$ . Following Osborne’s (2015) recommendations, the researcher removed cases with a standardized residual  $< -2.5$  or  $>2.0$  and the model fit was analyzed. As presented in Table 5, removal of the influential cases yielded a desirable improvement in the model fit with a decreased -2 log likelihood (-2 LL) and increased Wald statistic. Furthermore, removal of the influential cases improved overall correct classification from 89.5% to 95.7%

Table 5

*Model Fit Comparison of Untrimmed Model and Trimmed Model using Based on Standardized Residuals*

	<i>N</i>	-2 LL	Wald
Untrimmed Model	382	93.04	156.86*
Trimmed Model	375	48.22	158.15*

\* $p < .001$

Following inspection of the standardized residuals, the researcher analyzed histograms of the DfBetas for each parameter to identify extreme cases. A histogram of the DfBetas for the standardized pre-requisite science GPA revealed some extreme cases

outside of the normal distribution curve. A scatterplot of the DfBetas for NCLEX pass and NCLEX fail groups also yielded similar results, with some extreme scores falling  $<-.40$  and  $>.40$  for the NCLEX fail group. Using Osborne's (2015) recommendations, the researcher removed cases above the 99<sup>th</sup> percentile ( $>.275$ ) and below the 1<sup>st</sup> percentile ( $<-.229$ ), which captured the previously identified outliers. The removal of the extreme values in both directions resulted in a reduction of the sample size by 7 cases ( $n = 368$ ). Cleaning the DfBetas for the standardized pre-admission science GPA resulted in a desirable improvement in the model fit (see Table 6). Furthermore, the overall classification accuracy improved from 95.7% to 97.6%.

Table 6

*Model Fit Comparison of Untrimmed Model and Trimmed Model Based on DfBetas (Pre-requisite Science)*

	<i>N</i>	-2 LL	Wald
Untrimmed Model	375	48.22	158.15*
Trimmed Model	368	20.35	158.4*

\* $p < .001$

### **Model Assumptions**

After the data were cleaned, assumptions of logistic regression were verified. The five assumptions of logistic regression include perfect measurement, correct specification of the model, no multicollinearity, and no sparse data matrix (Osborne, 2015).

First, the researcher considered the assumption of perfect measurement.

Violations of this assumption would reduce accuracy of estimates and subsequently attenuate effects (Osborne, 2015). While the researcher cannot fully ascertain perfect measurement, measurement error was minimized through utilization of reliable and valid instruments to measure study variables. The researcher recognized self-report of any variables has the potential for error; however, the use of self-reported demographic data

is common and acceptable practice in social science research. Although human error in reporting and coding poses a risk, use of accepted definitions and valid and reliable methods for measurement minimize this threat.

Similar to perfect measurement, the researcher cannot definitively assure correct model specification; however, a priori variable selection minimized model misspecification. To reduce misspecification, the researcher selected all variables based on a prior theoretical model. Furthermore, the researcher followed the recommendations of Hosmer and Lemeshow (1989) in specifying the model to ensure only meaningful or statistically significant predictors were included.

Multicollinearity would prevent the researcher from identifying which predictors individually contributed to the outcome (Osborne, 2015). The researcher evaluated the assumption of no multicollinearity through testing of inter-correlations between predictors. Osborne (2015) recommends eliminating or combining variables with correlations  $> .90$ ; however, the research found no inter-correlations  $> .81$ .

Finally, the researcher inspected of the descriptive statistics and the contingency table for a sparse data matrix. Inclusion of variables with zero cells create undesirable outcomes and any variables with zero cells should be collapsed, removed, or modeled as a continuous variables, if appropriate (Hosmer & Lemeshow, 1989). No zero cells were identified in the data set.

### **Data Analysis**

The researcher performed initial descriptive analysis of the data to identify basic summary information about the variables of interest. Following an analysis of descriptives, the continuous predictor variables (age, nursing course exam scores, GPAs,

and standardized test scores) were converted into z-scores. According to Osborne (2015), the use of z-scores for continuous variables enhances interpretability in logistic regression, in comparison to non-standardized values, while maintaining the predicted probabilities. More specifically, the standardized values provided the researcher a meaningful intercept for the continuous predictors (mean values) and predicted probability of NCLEX-RN failure were easily calculated for an individual at, below, and above the mean for each continuous variable (Osborne, 2015).

### **Model Specification**

Equation 1 presents the general form of the model. Using a logit link function, Logit ( $\hat{Y}$ ) represents the dependent variable after transformation from the natural form or the probability of the event/characteristic of interest, whereas  $b_0$  is the intercept, and  $b_1$  through  $b_{10}$  represent the slope coefficients for the primary predictors (academic outcomes), which represent the effect of each predictor on the outcome of interest (NCLEX-RN performance).

Equation 1. General form of the Logistic Regression Model

$$\text{Logit } (\hat{Y}) = b_0 + b_1 X_1 + b_2 X_2 + b_3 X_3 \dots b_{10} X_{10} + e$$

To ensure appropriate model specification, the researcher utilized Jeffreys' NURS model, combined with Hosmer and Lemeshow's (1989) four-step process, to aid in the selection of variables for the model. The proceeding section presents the four-step process used for model specification.

**Univariate analysis.** First, the researcher conducted a univariate analysis of each predictor, including primary predictors of interest (academic outcomes) and control variables (student profile characteristics and academic factors). For the categorical

predictors (gender and race/ethnicity), the researcher inspected a contingency table for zero cells and tested each level of the predictors versus the outcome using a chi-square test (Hosmer & Lemeshow, 1989). There were no zero cells in the race/ethnicity contingency table and the chi-square test was statistically significant ( $\chi^2 = 4.37; p < .04$ ), therefore, the researcher retained race/ethnicity in the prediction model at this step. The contingency table for gender also had no zero cells; however, the chi-square for gender was non-significant ( $\chi^2 = 0.01; p < .91$ ). The researcher planned to use gender as a control variable, the researcher elected to retain the gender variable for subsequent model testing.

For the 13 continuous predictors, the researcher performed a univariate logistic regression for each predictor and evaluated a Wald statistic for each univariate test. Hosmer and Lemeshow (1989) recommend using a .25 significance level during this stage as use of a traditional .05 significance level would potentially eliminate important predictors. The univariate analyses of the 13 continuous predictors were statistically significant ( $p < .001$  to  $p = .09$ ), therefore, all continuous predictors were retained at this step.

**Multivariate analysis.** Second, the researcher evaluated the fit of the multivariate model. To ensure the predictors contributed to explaining NCLEX-RN performance, the researcher verified the appropriateness of each predictor using the Wald statistic for each predictor and comparison of the estimated coefficient to the respective univariate model coefficient (Hosmer & Lemeshow, 1989). Hosmer and Lemeshow (1989) recommend removal of any variables with a non-significant Wald statistic ( $p > .05$ ) or not of specific interest for the study. Following the removal of any variable, Hosmer and Lemeshow (1989) recommends re-running the model and evaluating the model fit statistics (-2 LL



and Wald statistic) for model improvement. According to Hosmer and Lemeshow (1989), “the process of deleting, refitting, and verifying continues until it appears all important predictors are included in the model and those excluded are biologically or statistically unimportant” (p. 88).

To conduct the multivariate analysis and answer the sub-questions of the study, the researcher tested four separate models: 1) exam average model; 2) standardized test model; 3) cumulative nursing GPA model; and 4) overall NCLEX-RN prediction model. A discussion of the multivariate model specification follows.

***Exam average model.*** The researcher selected a blockwise entry method for variable entry. The first block consisted of student profile characteristics including age, race, gender, pre-requisite program GPA, and pre-requisite science GPA (student profile characteristics and academic factors). This step allowed the researcher to control for student profile characteristics and academic factors. Block two consisted of student exam averages for the six nursing courses.

The model fit statistics for block one ( $-2LL = 187.12$ ;  $\chi^2 = 65.90$ ,  $p < .001$ ) indicated the inclusion of the control variables improved model fit, in comparison to the null model ( $-2LL = 253.02$ ). While the overall classification accuracy reduced from 89.1% (null model) to 74.2% (block one), the correct classification of NCLEX-RN failures improved from 0% to 73.5%.

When the six exam averages were added into the model in block two, the model fit statistics yielded an improved model fit ( $-2LL = 112.71$ ;  $\chi^2 = 74.42$ ,  $p < .001$ ) from block 1, with an improvement in overall correct classification to 87.0%. Additionally, the classification of NCLEX-RN failures improved to 86.6%. Correct classification of

NCLEX-RN passers remained high at 90.0%. Table 7 presents the multivariate statistics for the exam average variables.

Table 7

*Multivariate Statistics for Exam Averages*

	<i>B (SE)</i>	<i>OR</i>	Wald ( <i>df</i> =1)	<i>p</i> -value
Fundamentals	0.37 (0.27)	1.44	1.79	.18
Adult Health	2.13 (0.44)	8.41	23.02	.001
Mental Health	0.04 (0.34)	1.03	0.01	.92
Maternal Health	0.43 (0.32)	1.54	1.89	.17
Child Health	0.16 (0.31)	1.17	0.27	.61
Complex Health	-0.10 (0.35)	0.91	0.08	.78

As shown in Table 7, the statistics for the following exam average were non-significant: Mental Health ( $B = 0.04, p = .92$ ), Complex Health ( $B = - 0.10, p = .78$ ), Child Health ( $B = 0.16, p = .61$ ), Fundamentals ( $B = 0.37, p = .18$ ), and Maternal Health ( $B = 0.43, p = .17$ ). The Adult Health exam average was the only exam average significant in the multivariate analysis ( $B = 2.13, p < .001$ ). The non-significant findings suggested the above-mentioned exam average were not good predictors of NCLEX-RN performance. As a result, the researcher re-specified the model by individually removing each variable from the model and tested the model fit. The re-evaluation of model fit statistics guided the researcher in determination of whether to exclude the respective variable from the model.

In re-evaluating the model fit, the researcher first removed the Mental Health exam average from the model, yielding no significant change in the -2LL (112.72) from the previous model (112.71). Since the removal of Mental Health exam average did not improve the -2 LL, the researcher concluded the exam average did not contribute to the

prediction model and subsequently removed the non-significant Mental Health variable from the model. The researcher continued the above presented process for the remaining non-significant exam averages, in the following order: Complex Health, Child Health, Fundamentals, and Maternal Health. After the researcher removed each variable, the model was re-estimated and the model fit statistics were compared to the initial model.

Table 8 presents the model fit statistics (-2LL,  $\chi^2$ , and correct classification) following removal of the respective exam average. The Cox and Snell  $R^2$  and Nagelkerke  $R^2$  are included in the model fit statistics in Table 8; however, they were not interpreted within this study. The use of calculated  $R^2$  values in logistic regression is disputed within the literature. Osborne (2015) asserts estimations of explained variance ( $R^2$ ) in logistic regression are frequently volatile and often inconsistent among calculated values. These inconsistencies were found within this step (Cox and Snell  $R^2 = .31$ ; Nagelkerke  $R^2 = .63$ ), therefore, the researcher elected to omit calculated  $R^2$  values in evaluating model fit. Alternatively, the researcher elected to utilize a combination of model fit statistics, including -2LL,  $\chi^2$ , and correct classification, to determine model fit in subsequent steps (Osborne, 2015).

Table 8

*Model Fit Statistics after Removal of Exam Averages*

	-2 LL	Model $\chi^2$	Nagelkerke $R^2$	Cox and Snell $R^2$	Overall Correct Classification
All Averages Included	112.71	140.31*	.63	.31	87%
Mental Health	112.72	140.30*	.63	.31	87%
Complex Health	112.79	140.22*	.63	.31	87%
Child Health	113.13	139.90*	.63	.31	87%
Fundamentals	115.25	137.77*	.62	.31	87%
Maternal Health	118.36	134.67*	.63	.31	86%

\* $p < .001$

Removal of each of the exam averages had no deleterious effect on the model fit

statistics. Comparing the new model fit statistics to the initial model (all exam averages included), there were no substantial change in the -2LL, the chi-square statistic, nor the overall correct classification. Given the lack of change in the overall model fit statistics, the researcher determined the non-significant exam averages did not contribute to the prediction model. Consequently, the researcher elected to remove the aforementioned variables to achieve the most parsimonious model.

***Standardized test model.*** The researcher followed the same process for testing the standardized test model, using student profile characteristics and academic factors as control variables in block one. Block two included the three standardized testing variables: Adult Health CMS exam, Child Health CMS exam score, and CPE score. Comparing the model fit statistics of block two (-2LL = 49.33;  $\chi^2 = 137.79$ ,  $p < .001$ ) to block 1 (-2LL = 187.12), there was significant model improvement when adding the three standardized testing variables. In addition, inclusion of the standardized exams increased the overall correct classification from 74.2% (control only model) to 95.4%. All three standardized testing variables were statistically significant ( $p < .001$  to  $.002$ ); therefore, the research retained the three variables.

***Cumulative nursing GPA.*** To test graduation GPA in the model, the above presented process was followed, using the nursing cumulative GPA variable in block 2. The model fit statistics for block two (-2LL = 133.37;  $\chi^2 = 53.75$ ,  $p < .001$ ) indicated cumulative nursing GPA significantly improved model fit from the control variable model (-2LL = 187.12). The cumulative nursing GPA was statistically significant ( $p < .001$ ); therefore, it was retained for the overall model.

***Overall prediction model.*** Following multivariate analysis for each sub-question,

the researcher tested the overall prediction model. The researcher selected a blockwise order entry to allow for testing the theoretical model, while controlling for student profile characteristics and academic factors. The researcher entered student profile characteristics (age, race, and gender) as block one, followed by academic factors (pre-nursing GPA and pre-science GPA) in block two. Block three consisted of previously retained academic outcomes, the primary predictor set of interest. The set of academic outcomes included the Adult Health exam average, three standardized test scores (Adult Health, Child Health, and CPE), and graduation GPA.

The model fit statistics for blockwise entry are presented in Table 9. The -2LL of the final overall model suggests the model fit the data well.

Table 9

*Model Fit Statistics for Student Profile Characteristics, Academic Factors, and Academic Outcomes Models*

	-2 LL	$\chi^2$	Overall Correct Classification
Null model (constant)	253.02	-	89%
Student profile characteristics (block one)	224.32	8.71*	55%
Academic factors (block two)	187.12	57.19**	74%
Academic outcomes (block three)	29.49	157.63**	96%

\* $p < .05$

\*\*  $p < .001$

**Curvilinear effects.** As the third step in model specification, the researcher examined the functional form of the model. Using the primary predictors of interest (academic outcomes), the linear and non-linear terms (squared and cubed) of each retained predictor was entered into the model as separate blocks and model fit statistics (-2LL and chi-square) were evaluated separately for model improvement, which would indicate a curvilinear effect (Osborne, 2015).

Examination of the model fit statistics after entry of the non-linear terms yielded no significant improvement of the model, indicating there were no curvilinear effects.

Table 10 presents the model fit statistic when the non-linear form of each retained predictor was tested.

Table 10

*Model Fit Statistics for Non-linear Terms of the Retained Predictors*

	-2 LL	$\chi^2$	p-value
Linear model (Comparison)	32.62	-	-
Graduation GPA			
Squared	32.61	0.004	.95
Cubed	32.14	0.47	.49
Adult Health Exam			
Squared	31.91	0.71	.40
Cubed	29.82	2.09	.15
Adult Health CMS			
Squared	32.44	0.17	.68
Cubed	30.18	2.26	.13
Child Health CMS			
Squared	29.39	3.22	.07
Cubed	25.83	3.56	.06
CPE			
Squared	32.09	0.53	.47
Cubed	31.84	0.25	.62

**Interactions.** To conclude model specification, the researcher tested research question 4, which focused on the interaction between race and CPE score in predicting NCLEX-RN performance. To test this interaction, the researcher created a cross-product interaction term by multiplying race and CPE performance. Using the hierarchical omnibus test, the researcher entered the race and CPE variables (simple effects) in the first block and interaction term in separate block. After the interaction term was entered into block two, the researcher evaluated the change in the -2 LL to test for any significant interactions (Jaccard, 2001; Osborne, 2015). When the interaction term of race and CPE

were entered into block two, there was no significant improvement in model fit ( $p = .66$ ).

### **Model Specification Summary**

As presented above, the researcher utilized Hosmer and Lemeshow's (1989) four-step process to specify the model. Only predictors that were statistically significant or theoretically important were retained, to allow for the most parsimonious prediction model. Following model specification, five nursing exam averages were excluded from subsequent model testing, as they were non-significant at the multivariate level.

As presented in the preceding sections, the following predictor variables were retained for subsequent analysis: the Adult Health exam average, the three standardized test scores (Adult Health CMS, Child Health CMS, and CPE), and the cumulative nursing GPA. The researcher elected to retain all student profile characteristic variables and academic factors to provide control for confounding variables that occur prior to entrance into nursing courses. Chapter 4 utilizes the retained variables to answer the study questions.

### **Limitations**

There are several limitations to the study. First, the wide confidence interval in the statistical analysis limits the findings of the study. The wide confidence intervals indicate low precision of the point estimates. As Osborne (2015) notes, small sample sizes can lead to a widened confidence interval. In this case, the wide confidence interval is likely attributed to the small number of failures included in this study. Using Peduzzi et. al. (1996) recommendation of 10 EPV to minimize biased estimates, the researcher anticipated a sufficient number of cases per variable studied (30). Once students were divided into the NCLEX-RN outcome variable, there were approximately 5.7 failure

events for each variable in the overall prediction model. While Vittinghoff and McCulloch (2006) assert 5-9 EPV may be adequate for logistic regression, the study findings must be interpreted cautiously, as the widened confidence interval creates a challenge in pinpointing the size of the effect in this model. Despite this, the overall conclusion that the Adult Health exam average, standardized exam scores, and cumulative nursing GPA have a positive relationship with exam passage holds. When looking at passage rates by each of the variables, bivariate correlations, and in the overall regression model, the evidence supports this conclusion.

Second, the current study included only graduates from a BSN program. Findings from this study may not hold true for graduates of other types of pre-licensure education, such as ADN or diploma programs. Students seeking a baccalaureate degree may differ from individuals who choose to pursue associate degrees or diplomas. In addition, the pre-requisite and programmatic requirements may differ between different program types. While only one-third of the nursing programs in the US currently confer baccalaureate degrees, the number of BSN programs is on the rise. With the IOM's (2010) call to increase baccalaureate education in nursing, BSN programs are becoming an increasingly popular choice for nursing education. Over the previous decade, BSN enrollment has steadily increased and BSN program growth is outpacing ADN growth (NLN, 2013b). As the number of BSN programs increase and enrollment numbers rise, the study findings provide important information to these large growing BSN programs.

Third, this study explored predictors of NCLEX-RN failure under the passing standards implemented in April 2013. Additional revisions to the passing standard are expected in April 2016; therefore, the findings may not apply to examination attempts



following subsequent revisions. Although potential revisions limit these findings, this study provides educators important information under the existing test plan. All RN program graduates will complete the NCLEX-RN under the existing standard until the NCSBN implements a revised standard. At this time, it is not certain what changes, if any, NCSBN will initiate during the scheduled review.

Fourth, the study was limited to a single institution, which reduced the generalizability of the findings. Study findings are limited to nursing programs with similar curricular structure and student enrollment as the program studied. Use of findings by institutions with differing student enrollment, pre-requisite courses, or standardized assessments could prove problematic. Nonetheless, the findings can speak to similar types of institutions, including large, research-intensive, public universities, as this study was conducted at a large, four-year, research-intensive institution. Furthermore, the sample demographics and NCLEX-RN pass rates were similar to the national data for BSN programs during the same timeframe (Table 4).

Finally, the study was limited to prediction of first attempt performance on the NCLEX-RN. This study did not consider factors or events occurring after initial failure, so findings would not apply to subsequent NCLEX-RN attempts. With the current first time pass rate for BSN programs near 85% (NCSBN, 2014b), the number of second attempts is limited, minimizing this limitation.

## CHAPTER IV

### RESULTS

This study focused on the relationship among student background characteristics, prior academic performance, nursing exam scores, and standardized tests scores as predictors of NCLEX-RN outcomes. Using a combination of the aforementioned variables, the researcher sought to develop a model to predict NCLEX-RN performance. This chapter presents the findings from statistical analyses used to answer the research questions. A description of the sample is presented, followed by findings related to each research question.

#### **Descriptive Findings**

Following a screening of inclusion criteria and conducting data cleaning, the final sample consisted of 368 graduates. The proceeding section presents the descriptive statistics for the sample in regards to student demographics (profile characteristics), academic factors, academic outcomes, and NCLEX-RN outcomes.

##### *Student Demographics*

With respect to the demographic characteristics, the majority of the sample was female (87.0%) and White (85.9%). Ages for the sample ranged from 20 to 58 years, with an average age of 25.6 ( $SD = 6.2$ ). Table 11 provides detailed demographic characteristics of the sample.

Table 11

*Sample Demographics*

	<i>N</i>	Percentage
Gender		
Female	320	87.0%
Male	48	13.0%
Race/Ethnicity		
White	316	85.9%
Black	30	8.2%
Asian	14	3.8%
Hispanic	5	1.4%
Other	3	0.8%

**Academic Performance**

The pre-requisite program GPA of the sample ( $M = 3.57$ ,  $SD = 0.24$ ) was slightly higher than the pre-requisite science GPA ( $M = 3.42$ ,  $SD = 0.38$ ). The sample's cumulative nursing GPA ranged from 2.9 to 4.0, with an average of 3.52 ( $SD = 0.25$ ).

Table 12

*Academic Performance of Sample*

Variable	Minimum	Maximum	<i>M</i>	<i>SD</i>
GPA				
Pre-program	2.75	4.00	3.57	0.24
Science	2.41	4.00	3.42	0.38
Cumulative	2.90	4.00	3.52	0.25
Exam Averages				
Fundamentals	69.75	96.50	85.21	4.33
Adult Health	69.97	98.78	86.86	5.16
Mental Health	76.00	98.00	89.75	4.58
Maternal Health	73.00	97.00	87.11	4.40
Child Health	75.00	98.92	90.32	4.10
Complex Health	73.32	97.00	85.62	5.15
Standardized Tests				
Adult Health CMS	33.30	92.20	65.69	8.31
Child Health CMS	36.70	88.30	67.07	8.94
CPE	42.00	90.00	72.25	7.26

The nursing course exam averages of the sample ranged from 69.75 to 98.92 for all courses. The Child Health course ( $M = 90.32$ ,  $SD = 4.10$ ) was the sample's highest course average and the lowest was the Fundamentals course ( $M = 85.21$ ,  $SD = 4.33$ ). The

ranges for the three standardized tests were wider, with the largest range in the Adult Health CPE (33.30 to 92.20). Table 12 presents the descriptive statistics for the sample's academic performance.

### **NCLEX-RN Performance**

Within the sample, 328 of the graduates passed the NCLEX-RN on their first attempt (89.1%). Male graduates had a pass rate of 89.5%. Similarly, 89.1% of the females passed on their first attempt.

While first time pass rates among male and female graduates were similar, the first time pass rates of non-minorities (90.51%) exceeded the first time pass rates of minority students (80.77%). Within the minority groupings, Black graduates, which made up the highest number of minority graduates, had a pass rate of 76.7% on first attempt. Hispanic graduates had the lowest first time pass rate (60%) of all minority groups (60%). Table 13 provides a descriptive comparison of NCLEX-RN performance among all graduates and between groups.

Table 13

*Overall and Group Comparison of NCLEX Performance of Sample, First Attempt*

	Pass (%)	Fail (%)	Total Students
All graduates	328 (89.1)	40 (10.9)	368
Gender			
Female	285 (89.1)	35 (10.9)	320
Male	43 (89.6)	5 (10.4)	48
Race/Ethnicity			
White	286 (90.5)	30 (9.5)	316
Black	23 (76.7)	7 (23.3)	30
Asian	13 (92.9)	1 (7.1)	14
Hispanic	3 (60.0)	2 (40.0)	5
Other	3 (100)	0 (0)	3

### **Binary Logistic Regression Results**

The primary purpose of the study was to identify the predictors on NCLEX-RN

performances for graduates of BSN programs. The overall research question focused on the use of academic outcomes to predict NCLEX-RN performance. To answer this question, the researcher developed four sub-questions to assist with the development of an overall prediction model for NCLEX-RN performance utilizing a student's academic outcomes. The following sections presents the results of statistical testing for each of the following research sub-questions, concluding in an overall model for NCLEX-RN prediction.

*Question 1:* Do nursing course exam scores predict NCLEX-RN performance, controlling for student demographics and academic factors?

*Question 2:* Does nursing program cumulative grade point average predict NCLEX-RN performance, controlling for student demographics and academic factors?

*Question 3:* Does performance on nursing standardized testing predict NCLEX-RN performance, controlling for student demographics and academic factors?

*Question 4:* Is performance on the Comprehensive Predictor Exam (CPE) moderated by race?

The researcher performed binary logistic regression to test each research question. The verification of assumptions of logistic regression and model specification steps are detailed in Chapter 3.

### **Nursing Course Exam Scores**

Research question 1 explored whether nursing course exam scores predict NCLEX-RN, when controlling for student demographics and prior academic performance. To test this question, the researcher blockwise entered the student profile characteristics (age, race, and gender), academic factors (pre-requisite program GPA and

pre-requisite science GPA), and the Adult Health exam average into the model. The remaining five exam averages (Fundamentals, Mental Health, Maternal Health, Child Health, and Complex Health) were excluded from the model, as they were non-significant predictors of NCLEX-RN performance during model specification (Chapter 3).

The model fit statistics indicated student demographics, prior academic performance, and the Adult Health exam average yielded a statistically significant model (null -2LL = 253.02, final -2 LL = 118.36;  $\chi^2 = 134.67$ ,  $p < .001$ ). Furthermore, the combination of the aforementioned variables was 86.1% accurate in classifying NCLEX-RN performance, with 87.5% of NCLEX-RN failures and 86.0% of NCLEX-RN passers correctly classified.

The Adult Health score ( $p < .001$ ) was a statistically significant predictor of NCLEX-RN performance. As presented in Table 14, the probability of passing the NCLEX-RN substantially increased with an increase in the Adult Health exam average [OR = 10.01 (95% CI =4.74 to 21.12)], controlling for the student profile characteristics and prior academic factors. Because the researcher standardized the exam averages, the odds ratio represented the increase in odds in NCLEX-RN passage with every one standard deviation increase in exam average. In other words, the likelihood of a student with a mean Adult Health exam average passing the NCLEX-RN was 10 times that of a student whose exam average was 1 standard deviation below the mean. Although the confidence interval for the odds ratio was wide, indicating poor precision, Osborne (2015) posits smaller sample sizes yield wider confidence intervals.

Table 14

*Predictors of NCLEX-RN Performance: Exam Scores, Controlling for Student Demographics and Pre-Nursing Academic Performance*

	<i>B (SE)</i>	Wald ( <i>df</i> =1)	<i>Exp(B)</i>	Odds Ratio (95% CI)	
				Lower	Upper
Age	-0.01 (0.39)	0.01	0.99	0.47	2.14
Race	-0.01 (0.60)	0.01	0.99	0.31	3.19
Gender	0.96 (0.73)	1.75	2.62	0.63	10.94
Pre-program GPA	0.40 (0.40)	1.00	1.49	0.68	3.22
Pre-science GPA	1.16 (0.42)	7.72*	3.17	1.41	7.17
Adult Health	2.21 (0.38)	36.54**	10.01	4.74	21.12
Constant	3.53 (0.97)	13.14	33.97		

\*  $p < .05$ ; \*\*  $p < .001$

Equation 2 represents the regression equation for predicting NCLEX-RN performance, using an individual's Adult Health exam average. To calculate the predicted logit, the researcher controlled for student demographics and pre-nursing academic performance by inserting a "0" into the respective portions of the equation. Each "0" indicated the individual had a mean score for the continuous predictors (age, pre-program GPA, pre-science GPA) and were within the group majority for the categorical predictors (non-minority and female).

*Equation 2.*  $\text{Logit}(\hat{Y}) = 3.53 - 0.01(\text{age}) - 0.01(\text{race}) + 0.96(\text{gender}) + 0.40(\text{pre-program GPA}) + 1.16(\text{pre-science GPA}) + 2.21(\text{adult health})$

Using equation 2 to calculate the predicted logit and subsequent conditional probability, the researcher found students with an Adult Health exam average at the mean (86.86) had a predicted logit of 3.52 and a conditional probability of .97, which corresponds with a 97% chance of passing the NCLEX-RN, assuming the student was at the average for the control variables (age, race, gender, pre-program GPA, and pre-science GPA). Students with an Adult Health exam average two standard deviations below the mean (76.54) had a predicted logit of 0.2, which equates to a 55% chance of

passing the NCLEX-RN, when controlling for student profile characteristics and prior academic factors.

### **Nursing Program Cumulative GPA**

Research question 2 examined whether the cumulative nursing GPA predicted NCLEX-RN, when controlling for student demographics and prior academic performance. To test this question, the researcher blockwise entered the retained student profile characteristics and academic factors from the prior model specification, along with the cumulative nursing GPA.

The model fit statistics indicated the combination of student demographics, prior academic performance, and cumulative nursing GPA produced a statistically significant model (null -2LL = 253.03, final -2 LL = 133.37;  $\chi^2 = 119.65, p < .001$ ). Furthermore, the combination of the aforementioned variables yielded an 86.7% accuracy in overall classification of NCLEX-RN performance, with 90% of NCLEX-RN failures and 86% of NCLEX-RN passers correctly classified.

Table 15

*Predictors of NCLEX-RN Performance: Cumulative Nursing GPA, Controlling for Student Demographics and Pre-Nursing Academic Performance*

	<i>B (SE)</i>	Wald ( <i>df</i> =1)	<i>Exp(B)</i>	Odds Ratio (95% CI)	
				Lower	Upper
Age	-0.07 (0.34)	0.04	0.94	0.48	1.81
Race	-0.12 (0.56)	0.04	0.84	0.30	2.66
Gender	0.36 (0.62)	0.35	1.44	0.43	4.83
Pre-program GPA	-0.82 (0.43)	3.70*	0.44	0.19	1.01
Pre-science GPA	0.58 (0.37)	2.46	1.79	0.87	3.70
Cumulative GPA	3.07 (0.53)	34.39**	21.91	7.81	61.46
Constant	3.80 (0.91)	17.54	44.68		

\* $p \leq .05$ ; \*\*  $p < .001$

The model indicated cumulative nursing GPA was a significant, unique predictor



of NCLEX-RN performance (Table 15). After controlling for student profile characteristics and academic factors, an increase in the cumulative nursing GPA was associated with an increase in passing the NCLEX-RN ( $B = 3.09$ ,  $SE = 0.53$ , Wald = 34.39,  $p < .001$ ).

Equation 3 yielded a predicted logit of 0.71 for students with a cumulative nursing GPA one standard deviation below the mean (3.27), which corresponds to a 67% chance of passing the NCLEX-RN. Inversely, students with a cumulative nursing GPA one standard deviation above the average (3.77) had a predicted logit of 6.89, which translates to a 99% chance of passing the NCLEX-RN.

*Equation 3.*  $\text{Logit}(\hat{Y}) = 4.25 - 0.07(\text{age}) - 0.12(\text{race}) + 0.36(\text{gender}) - 0.82(\text{pre-program GPA}) + 0.58(\text{pre-science GPA}) + .3.07(\text{cumulative nursing GPA})$

### **Nursing Standardized Exam Performance**

Research question 3 examined whether performance on three standardized (ATI) nursing exams predicted NCLEX-RN, when controlling for student demographics and prior academic performance. To test this question, the researcher entered the retained student profile characteristics and academic factors from the prior model specification, along with the three ATI variables.

The model fit statistics indicated the combination of student demographics, prior academic performance, and ATI scores produced a statistically significant model (null - 2LL = 253.03, final -2 LL = 49.34;  $\chi^2 = 203.69$ ,  $p < .001$ ). Furthermore, the combination of the control variables and ATI test variables yielded the highest rate of accuracy in classification, when compared to the previously tested exam average and cumulative GPA models. The standardized exam model was 95.4% accurate in overall classifying

NCLEX-RN performance, with a 95.0% accuracy rate in predicting NCLEX-RN failures and 95.4% accuracy for NCLEX-RN passers.

As presented in Table 16, all three ATI averages were significant predictors of NCLEX-RN performance. Since the researcher standardized the ATI values, the researcher utilized the coefficient estimates for the three exams to determine the CPE ( $B = 3.31, p = .001$ ) was the strongest predictor on NCLEX-RN performance.

Table 16

*Predictors of NCLEX-RN Performance: Standardized Nursing Exams, Controlling for Student Demographics and Pre-Nursing Academic Performance*

	<i>B (SE)</i>	Wald ( <i>df</i> )	<i>Exp(B)</i>	Odds Ratio (95% CI)	
				Lower	Upper
Age	-0.64 (0.81)	0.62 (1)	0.53	0.11	2.59
Race	-0.49 (0.88)	0.31 (1)	0.61	0.11	3.43
Gender	2.29 (1.14)	4.03 (1)*	9.84	1.05	91.81
Pre-program GPA	1.20 (0.71)	2.87 (1)	3.32	0.83	13.35
Pre-science GPA	-0.70 (0.81)	0.75 (1)	0.50	0.10	2.43
Adult Health CMS	2.96 (0.80)	13.64 (1)**	19.27	4.01	92.67
Child Health CMS	2.81 (0.82)	11.80 (1)**	16.62	3.34	82.61
CPE	3.31 (1.00)	10.87 (1)**	27.39	3.83	196.01
Constant	7.07 (1.74)	25.08 (1)	6192.55		

\*\*  $p \leq .001$

Using equation 4 to calculate the predicted logit and conditional probabilities, students with a CPE score two standard deviations above the mean (86.77) had a 99% chance of passing the NCLEX-RN, holding all other variables in the model constant at the group average. In comparison, students with a CPE score two standard deviations below the mean (57.73) had a 62% chance of passing the NCLEX-RN, when controlling for demographics and prior academic performance.

*Equation 4.*  $\text{Logit}(\hat{Y}) = 7.07 - 0.64(\text{age}) - 0.49(\text{race}) + 2.29(\text{gender}) + 1.20(\text{pre-program GPA}) - 0.70(\text{pre-science GPA}) + 2.96(\text{Adult Health CMS}) + 2.81(\text{Child Health CMS}) + 3.31(\text{CPE})$

### **Interaction between Race and CPE Performance**

The fourth research question addressed the interaction between race and CPE performance, when predicting NCLEX-RN performance. To test this question, the researcher entered the race and CPE variables into the block one, followed by an interaction term between race and CPE as block two. A significant improvement in model fit after entry of the interaction term would indicate a significant interaction between race and CPE.

Following entry of the race and CPE variables, the model fit improved from the null model (null  $-2LL = 253.03$ , block 1  $-2LL = 110.22$ ,  $\chi^2 = 199.23$ ,  $p < .001$ ), with both race (OR = 0.25,  $p = .02$ ) and CPE score (OR = 34.93,  $p < .001$ ) as significant predictors of NCLEX-RN performance. However, the model fit statistics showed no improvement in model fit (block 1  $-2LL = 110.22$ , block 2  $-2LL = 110.03$ ,  $\chi^2 = .19$ ,  $p = .67$ ) when the interaction term was entered. Therefore, the researcher concluded there was no significant interaction between race and CPE score in predicting NCLEX-RN performance.

### **Overall NCLEX-RN Prediction Model**

After the researcher addressed the four study sub-questions, the researcher tested an overall prediction model using academic outcomes to predict NCLEX-RN performance. To test the final prediction model, the researcher grouped the previously retained student profile characteristics (age, race, and gender) and entered these variables into block one of the model. Block two consisted of the retained academic factors (pre-requisite program GPA and pre-requisite science GPA). The retained academic outcomes were grouped into block three, which consisted of one exam average (Adult Health),

cumulative nursing GPA, and the three standardized exam variables (Adult Health CMS, Child Health CMS, and CPE). The use of blockwise entry allowed the researcher to both test the theoretical model of the study and control for the student profile characteristics and academic factors. Controlling of student profile characteristics and academic factors enabled the researcher to determine the unique contribution of academic outcomes in predicting NCLEX-RN performance, beyond profile characteristics and pre-requisite academic factors.

**Student Profile Characteristics (Block One).** The entry of student profile characteristics (age, race, and gender) significantly improved the model fit from the null model (null -2LL = 253.03, block 1 -2LL = 244.32,  $\chi^2 = 8.71$ ,  $p = .03$ ), which suggested the use of the combination of student profile characteristics predicts NCLEX-RN performance. Although age ( $p = .06$ ) and gender ( $p = .62$ ) did not predict NCLEX-RN performance, race was a significant predictor ( $OR = .40$ , Wald = 4.92,  $p = .03$ ). Since gender and age were not significant, the research individually removed both variables from block one and the model was re-run. Removal of gender and age improved overall classification accuracy from 55% to 80%, with no negative effects on the -2LL. To create the most parsimonious prediction model, the researcher elected to remove age and gender from the overall prediction model. The revision of the model yielded a statistically significant prediction model (null -2LL = 253.03, block 1 -2LL = 249.24,  $\chi^2 = 3.78$ ,  $p = .05$ ).

**Academic Factors (Block Two).** After the researcher re-specified block one, the academic factor variables were entered as block two. The entry of academic factors revealed significant model improvement from both the null model and block one (null -

2LL = 253.03, block 1 -2LL = 249.24, block 2 -2LL = 187.59,  $\chi^2 = 61.65$ ,  $p < .001$ ), suggesting the combination of race and academic factors predicted NCLEX-RN performance. The coefficient estimate indicated pre-requisite science GPA predicted NCLEX-RN performance ( $OR = 3.14$ , Wald = 15.88,  $p < .001$ ); however, pre-requisite program GPA was nonsignificant (Wald = 3.20,  $p = .07$ ). Therefore, the researcher removed pre-requisite program GPA from block two. Following the removal of pre-requisite program GPA, no significant change in the -2LL was noted (190.72) and the overall model remained statistically significant ( $p < .001$ ). The researcher excluded the non-significant pre-requisite program GPA variable from block two of the overall prediction model. The coefficient estimate for pre-requisite science GPA ( $B = 1.47$ ,  $p < .001$ ) indicated a student's pre-requisite GPA predicted NCLEX-RN performance, when controlling for race.

**Academic Outcomes.** Following re-specification of block two, the researcher entered the final block of variables (academic outcomes). Entry of the Adult Health exam average variable, three standardized test variables, and cumulative nursing GPA significantly improved model fit from the null model, block one, and block two (null -2LL = 253.03, block 1 -2LL = 249.24, block 2 -2LL = 190.72, block 3 -2LL = 35.02,  $\chi^2 = 218.00$ ,  $p < .001$ ). The model fit statistics indicated the block of academic outcomes significantly predicted NCLEX-RN performance, after controlling for race and pre-requisite science GPA. The three standardized tests were statistically significant ( $p = .02$  to  $.03$ ), as was the cumulative nursing GPA ( $p = .04$ ) and the Adult Health exam average ( $p = .05$ ).

After final re-specification, the final prediction model included race and pre-

requisite science GPA as the control variables, and the Adult Health exam average, Adult Health CMS score, Child Health CMS score, CPE score, and cumulative program GPA as the academic outcomes. The final model correctly classified 96.0% of the students who passed NCLEX-RN and 97.5% of NCLEX-RN failures.

Table 17 presents the coefficient estimates for the final prediction model.

Equation 5 represents the mathematical equation for predicting NCLEX-RN performance, using a combination of the respective student profile characteristics, academic factors, and academic outcomes.

Table 17

*Overall Prediction of NCLEX-RN Performance: Student Profile Characteristics, Academic Factors, and Academic Outcomes*

	<i>B (SE)</i>	Wald ( <i>df</i> )	<i>Exp(B)</i>	Odds Ratio (95% CI)	
				Lower	Upper
Race	0.26 (1.18)	0.05 (1)	1.29	0.13	13.14
Pre-science GPA	-0.68 (1.01)	0.45 (1)	0.51	0.07	3.70
Adult Health Exam	1.62 (0.76)	4.59 (1)*	5.05	1.15	22.20
Adult Health CMS	3.53 (1.10)	34.01 (1)**	34.01	3.94	293.89
Child Health CMS	3.32 (1.00)	11.00 (1)**	27.59	3.89	195.91
CPE	2.19 (1.08)	4.13 (1)*	8.89	1.08	73.23
Cumulative GPA	3.01 (1.41)	4.57 (1)*	20.26	1.28	319.98
Constant	12.82 (3.16)	16.51 (1)			

\*  $p < .05$ ; \*\*  $p = .001$

*Equation 5.*  $\text{Logit}(\hat{Y}) = 12.82 + 0.26(\text{race}) - 0.68(\text{pre-science GPA}) + 1.62(\text{Adult Health exam average}) + 3.53(\text{Adult Health CMS}) + 3.32(\text{Child Health CMS}) + 2.19(\text{CPE}) + 3.01(\text{cumulative nursing GPA})$

Since the variables were in standardized values, the researcher directly compared each significant predictor variables to determine the strongest predictor of NCLEX-RN performance. As presented in Table 17, when controlling for race, pre-science GPA, Adult Health exam average, the cumulative nursing GPA, and the other two standardized

nursing tests, the Adult Health CMS score was the strongest predictor of NCLEX-RN performance ( $B = 3.53, p = .001$ ). The odds ratio for the Adult Health CMS exam ( $OR = 34.01$ ) represents the increase in odds in NCLEX-RN passage with every one standard deviation increase in exam score. In other words, the likelihood of a student with a mean Adult Health CMS score passing the NCLEX-RN is 34 times that of a student whose exam average was 1 standard deviation below the mean, assuming all of the other variables in the model were at the group average. In addition, the analysis indicated the remaining standardized testing variables (Child Health CMS and CPE), Adult Health course exam average, and cumulative nursing GPA were also significant predictors of NCLEX-RN performance, controlling for race and pre-science GPA.

### **Summary of Results**

Chapter 4 presented the findings for the four research sub-questions and the overall focal research question for the study. Table 18 summarizes the key findings for each question.

As presented in Table 18, a combination of academic outcomes are significantly associated with NCLEX-RN performance, when controlling for certain student profile characteristics and academic factors. Using nursing course exam averages, standardized nursing exams, and cumulative nursing GPA can assist with prediction of both NCLEX-RN passage and failure. Using the above results, Chapter 5 presents a discussion of the findings, implications, and recommendations for further study.

Table 18

*Summary of Key Findings*

Research Question	Variables	Summary
1	<i>Predictors:</i> Nursing Exam Averages <i>Control:</i> Age, Race, Pre-program GPA, Pre-science GPA	Of the six nursing exam averages tested, the Adult Health exam average was the only average to significantly predict NCLEX-RN performance. As a student's exam average in the Adult Health course increased, the chances of passing the NCLEX-RN increased, when controlling for student profile characteristics and academic factors.
2	<i>Predictor:</i> Cumulative Nursing GPA <i>Control:</i> Age, Race, Pre-program GPA, Pre-science GPA	The cumulative nursing GPA was significantly associated with NCLEX-RN performance. Students with higher cumulative nursing GPAs were more likely to pass the NCLEX-RN on first attempt.
3	<i>Predictors:</i> Standardized Nursing Exam Scores <i>Control:</i> Age, Race, Pre-program GPA, Pre-science GPA	The two CMS exams (Adult Health and Child Health) and the CPE scores was significantly associated with NCLEX-RN performance. As a student's score on the respective standardized exam increased, the chances of passing the NCLEX-RN increased, when controlling for student profile characteristics and academic factors. The CPE was the strongest predictor of NCLEX-RN performance in the standardized test model.
4	Race, CPE Score	There was no significant interaction between race and CPE score in predicting NCLEX-RN performance.
Overall Prediction Model	<i>Predictors:</i> Adult Health Exam Average, Adult Health CMS, Child Health CMS, CPE Score, Cumulative Nursing GPA <i>Control:</i> Race, Pre-science GPA	All five predictors were significantly associated with NCLEX-RN performance. The combination of Adult Health exam average, Adult Health and Child Health CMS scores, CPE score, and Cumulative Nursing GPA significantly predicted NCLEX-RN performance, when controlling for race and pre-science GPA. The Adult Health CMS score was the greatest predictor of NCLEX-RN performance in the overall model.



## CHAPTER V

### DISCUSSION

Using logistic regression, this study examined the use of nursing course performance and standardized test scores to predict NCLEX-RN outcomes, when controlling for select student background characteristics and prior academic outcomes. To answer the questions posed in this study, the researcher estimated four separate models to predict NCLEX-RN performance: 1) nursing exam model, 2) cumulative nursing GPA model, 3) standardized test model, and 4) overall prediction model. This chapter explores the relevant conclusions drawn from the statistical analysis presented in Chapter 4. The chapter presents the key findings of the study and explores these findings within the context of the conceptual model. The presentation of findings is followed by a discussion of the implications for practice and recommendations for future research.

#### **Key Findings**

##### **Nursing Program Performance Models**

As presented in the review of literature, nursing program factors are the most frequently studied predictor of NCLEX-RN performance. Program factors include performance in nursing courses and standardized exams, as well as nursing GPA. These factors capture a student's academic achievements during nursing studies and may reflect NCLEX-RN preparedness. Multiple studies have found relationships among nursing program performance and NCLEX-RN outcomes (Beeman & Waterhouse, 2001; Daley

et al., 2003; De Lima et al., 2011; Emory, 2013; Gilmore, 2008; Haas et al., 2003; Penprase & Harris, 2013; Salyes et al., 2003; Seldomridge & DiBartolo, 2004; Tipton, et al., 2008; Trofino, 2013; Truman, 2012; Vandenhouten, 2008; Yeom, 2013). The following section discusses the findings of this study, in relation to the previous literature.

**Nursing Course Exam Average Model.** Research question one focused on the use of nursing course exam averages in predicting NCLEX-RN performance. In the current study, the exam averages in six clinical nursing courses were examined: Fundamentals, Adult Health, Mental Health, Maternal Health, Child Health, and Complex Health. Often used as formative assessments, one would expect nursing exam score to reflect an individual's general nursing knowledge in broad content areas and test taking abilities. With the NCLEX-RN covering a broad range of content areas spanning across nursing curriculum, it is reasonable to anticipate a relationship between nursing course scores and NCLEX-RN performance.

After controlling for an individual's demographics and prior academic performance, only one course exam average predicted NCLEX-RN success. The study results indicated there was a significant association between a student's exam average in the Adult Health and their NCLEX-RN performance, when controlling for age, race, gender, pre-requisite program GPA, and pre-requisite science GPA. As expected, the chances of passing the NCLEX-RN on first attempt were greater for students with higher exam averages in the Adult Health course than students with lower exam averages. This finding is consistent with some earlier studies on NCLEX-RN prediction and performance (Daley et al., 2003; Seldomridge & DiBartolo, 2004; Trofino, 2013;

Vandenhouten, 2008). While the literature presents a mixed picture of courses associated with NCLEX-RN outcomes, performance in medical-surgical related nursing courses was the most consistently supported nursing course correlated with NCLEX-RN success (Daley et al., 2003; Seldomridge & DiBartolo, 2004; Trofino, 2013).

In the nursing program used for this study, the Adult Health course focuses on the management of care of an adult health patient with acute and chronic medical-surgical needs. Although the NCLEX-RN covers nursing care across the lifespan, the content in the course encompasses the vast majority of the areas of the NCLEX-RN test plan including management of care, safety, basic care and comfort, pharmacology, risk reduction, and physiological adaptation. With the principles of the course covering a broad range of foundational topics, it is not surprising that performance in the Adult Health course is strongly associated with NCLEX-RN performance.

While the exam average in the Adult Health course was significantly associated with NCLEX-RN performance, this study found exam averages in the other clinical courses were not predictive of NCLEX-RN performance. As previously mentioned, the literature does not clearly establish which courses best predict NCLEX-RN success, with mixed results across multiple studies. Some researchers found courses such as fundamentals, mental health, and maternal health (Beeman & Waterhouse, 2001; De Lima, 2011; Landry, 2010); however, these findings were not consistently supported in the literature or by the current study. The regression analysis showed the remaining clinical course exam averages were not significant predictors of NCLEX-RN performance, although each exam average significantly predicted NCLEX-RN performance at the univariate level. These findings indicate the remaining nursing course

exam averages are not unique predictors of NCLEX-RN performance. However, the exam averages were positively correlated with performance on the Adult Health exams ( $r = .50$  to  $.76$ ,  $p < .001$ ), suggesting exam performance in other clinical courses may indirectly relate to NCLEX-RN outcomes.

**Nursing Program Grade Point Average Model.** The second research question focused on the nursing program GPA. A regression analysis showed nursing program GPA significantly predicted NCLEX-RN performance, when controlling for select demographics and pre-program academic performance. Consistent with prior studies (Gilmore, 2008; Daley et al., 2003; Haas et al., 2003; Salyes et al., 2003; Tipton, Pulliam, Beckworth, Illich, Griffin, & Tibbitt, 2008; Truman, 2012; Vandenhouten, 2008), this study found students who earned a higher cumulative nursing program GPA were more likely to pass the NCLEX-RN, comparing to students with lower GPAs.

Within the study setting, nursing specific courses comprise nearly one-half of the cumulative program GPA (60 hours). The remaining portion consists of one-fourth general education requirements (39 hours) and one-fourth pre-requisite science courses (34 hours). Although general education courses complement and support student preparation for nursing studies, the pre-requisite science and nursing specific course work forms the foundation for nursing specific knowledge. Since the compilation of both nursing specific courses and pre-requisite science courses form nearly three-fourths of the cumulative GPA, one would expect a strong relationship between the cumulative GPA and NCLEX-RN performance. The study findings indicate the overall program curriculum performance reflects a student's NCLEX-RN readiness. This is not surprising, as pre-requisite science and nursing specific course grades should indicate a student's

competency in both the art and science of nursing.

These findings suggest a student's GPA at time of graduation can be a valid indicator of an individual's preparedness for the NCLEX-RN. The GPA at program completion can provide a meaningful reflection of the graduate's overall knowledge within the discipline of nursing and may be a beneficial indicator of students who are high risk for NCLEX-RN failure following graduation. While it is ideal to identify high risk students prior to graduation, the use of the cumulative GPA can provide important information for students in determining their own level of preparedness at program completion. Furthermore, nursing educators can counsel students with GPAs below an established benchmark on the need for additional NCLEX-RN preparation.

**Standardized Test Score Model.** The third research question focused on the use of standardized test scores to predict NCLEX-RN performance, when controlling for demographics and prior academic performance. Three ATI standardized nursing exams were used in this study: Adult Health CMS, Child Health CMS, and the CPE. Regression analysis indicated the three standardized exam scores were significant predictors of NCLEX-RN performance, when controlling for an individual's race, gender, age, pre-requisite program GPA, and pre-requisite science GPA.

These findings support earlier research, which associated success on the NCLEX-RN with higher scores on select ATI CMS exams (Vandenhouten, 2008; Yeom, 2013) and the CPE (Sims, 2012; Vandenhouten, 2008). Consistent with the findings of the current study, both Vandenhouten (2008) and Yeom (2013) found the Adult Health CMS score was a significant predictor of NCLEX-RN performance. Likewise, the findings are congruent with earlier studies linking CPE scores and NCLEX-RN performance (Sims,

2012; Vandenhouten, 2008).

While the literature consistently supports the predictive ability of Adult Health score and CPE score on NCLEX-RN outcomes, the use of the Child Health CMS is not consistently supported in the literature. Between the two previous studies on CMS exams, only Vandenhouten (2008) supported the current findings that the Child Health CMS score was positively associated with NCLEX-RN success.

Within the current study, the combination of the three standardized tests accurately classified 95.0% of the NCLEX-RN failures and 95.4% of the students who subsequently passed the NCLEX-RN, when controlling for demographics and prior academic performance. This finding suggests these standardized tests can accurately distinguish students who are likely to pass the NCLEX-RN from those at risk for failure. As previously discussed, nursing programs often administer standardized tests at the completion of related courses throughout the program to provide an indication of student mastery in selected content areas. These findings suggest the results from these examinations can offer crucial evidence for educators to assist with identification of students at risk for NCLEX-RN through key points in the nursing curriculum. Although the literature recommends against utilizing standardized testing results to determine progression and graduation decisions (NLN, 2012), these scores can be useful in selecting students for remediation and support programs, as well as provide information in guiding remediation activities.

### **Moderation Effect of Race on CPE Score**

Research question four addressed the moderation of race on CPE performance, when predicting NCLEX-RN performance. Within this study, the mean CPE score for

non-minority students was 72.53 ( $SD = 7.39$ ), compared to a mean score of 70.57 ( $SD = 6.17$ ). In testing the interaction between race and CPE performance, there was no significant interaction found. The absence of significant interaction between the race and CPE predictors indicates the relationship between CPE performance and NCLEX-RN outcomes do not differ between racial groups. Although the literature suggests there are consistent and substantial differences in standardized tests scores between minority and non-minorities on exams outside of nursing (Jencks & Phillips, 1998; Sacks, 1997), the current study indicates this may not hold true within the discipline of nursing.

### **Overall Prediction Model**

The study sought to conduct empirical testing of a portion of Jeffreys' NURS model (2012), using NCLEX-RN passage as an indicator of student success. According to Jeffreys (2012), an interaction of student profile characteristics, student affective factors, academic factors, environmental factors, professional integration factors, academic outcomes, and psychological outcomes influence student success. Within the study, the researcher narrowed in on the use of student profile characteristics, academic factors, and academic outcomes to predict nursing student success on the NCLEX-RN. As presented in Chapter 4, the overall prediction model included a blend of demographic, academic factors, and nursing program factors. The following section will discuss the findings in relation to each set of predictors, followed by the final model results.

**Demographics.** Demographics collected for analysis included age, race, and gender. While these demographics were utilized as control variables and were not intended as variables for determining a significant relationship to NCLEX-RN outcomes, the data were analyzed as part of the overall prediction model. Within this study, 87% of

the participants were female, which is consistent with the 2013 enrollment rates for BSN programs across the country (NLN, 2013). While the number of male students enrolling in nursing program is on the rise, males remain underrepresented within BSN programs. Likewise, the number of non-traditional students pursuing BSN degrees is slowly rising; however, these individuals remain as a minority in BSN programs. Consistent with national statistics for BSN enrollment, 85% of the students within the study were under the age of 30 (NLN, 2013).

When examining the student demographics, neither gender nor age were significant predictors of NCLEX-RN performance. Furthermore, male and female graduates had essentially identical NCLEX-RN pass rates with 89% of female and 90% male students passing on their first attempt. These results are consistent with earlier studies on NCLEX-RN prediction, where neither age nor gender were related to NCLEX-RN performance (Alamedia et al., 2011; Beeman & Waterhouse, 2001; Beeson & Kissing, 2001; Daley et al., 2003; Giddens & Glockner, 2005; Trofino, 2013; Truman, 2012; Vandenhouten, 2008; Yin & Burger, 2003).

Unlike gender and age, race was a significant predictor of NCLEX-RN performance when entered as a single demographic control variable during model specification. The analysis indicated the odds of a non-minority student passing the NCLEX-RN was 4.18 times that of a minority student, without considering other predictors. Once prior academic performance and nursing program factors were entered into the model, race became nonsignificant. This suggests, while race may play a role in NCLEX-RN performance, the variance is partially shared with other important predictors, such as exam averages and standardized tests.



Examining the differences in NCLEX-RN pass rates between racial groups were outside of the scope of this study; however, the descriptive statistics yielded interesting findings. Within this sample, the first time pass rates of non-minorities (90.51%) exceeded the first time pass rates of minority students (80.77%). When looking within the minority groupings, 90.51% of the White graduates were successful on first attempt, whereas Black graduates had a first-attempt pass rate of 76.7%. Hispanic graduates had the lowest first time pass rate (60%) of all minority groups (60%).

**Academic Factors.** Similar to demographics, the researcher utilized pre-requisite program GPA and pre-requisite science GPA as control variables within the study. While these variables were not the focus of the study, these variables were analyzed as part of the overall prediction model. A test of Spearman's rho indicated there was a moderate positive correlation between NCLEX-RN performance and pre-requisite program GPA ( $r_s = .33, p < .001$ ), as well as NCLEX-RN performance and pre-requisite science GPA ( $r_s = .33, p < .001$ ). Furthermore, both pre-requisite program and pre-requisite science GPA were moderately correlated with nursing exam averages and standardized test scores ( $r_s = .34$  to  $.59, p < .001$ ).

During model building, both the pre-requisite program and pre-requisite science GPA were tested as predictors of NCLEX-RN performance as part as the overall prediction model. Neither pre-requisite GPAs were significant predictors of NCLEX-RN performance when combined with the nursing program variables, indicating the pre-requisite GPA variance overlaps with some of the nursing program variables and does not uniquely predict NCLEX-RN performance. These findings suggest that while a student's pre-admission GPA is positively associated with their performance in subsequent nursing

courses, neither program nor science GPA are directly predictive of NCLEX-RN performance. While pre-admission GPAs in general pre-requisite coursework and science courses moderately correlated with how a student performs on nursing exams, they are not necessarily strong predictors of whether a student will be successful on the NCLEX-RN. This suggests using pre-program GPAs in admission decisions can be helpful in determining students who are likely to be successful in nursing course work, but does not necessarily predict who will be successful on the NCLEX-RN.

**Nursing Program Factors.** Five nursing program variables were tested in the overall prediction model: Adult Health exam average, Adult Health CMS, Child Health CMS, CPE, and cumulative nursing GPA. All five nursing program variables were positively correlated with NCLEX-RN performance ( $r_s = .46$  to  $.50$ ,  $p < .001$ ), as well as each other ( $r_s = .33$  to  $.76$ ,  $p < .001$ ). When combined with race and pre-requisite GPA as control variables, the aforementioned nursing program factors accurately classified 95.7% of the NCLEX-RN attempts, with 95.7% passers and 95% failures correctly classified.

Within the overall prediction model, performance on the Adult Health ATI was the greatest predictor of NCLEX-RN performance. Although the CPE is designed to assess a student's competency across the nursing curriculum and is administered at the completion of nursing studies, it was less predictive than the other standardized exams within the overall model. Interestingly, when tested in the standardized test model, the CPE was more predictive than the Adult Health CMS; however, when combined with the Adult Health exam average and cumulative nursing GPA in the overall the coefficient estimate for the CPE decreased. Given the correlation between the CPE and Adult Health

exam average ( $r_s = .76, p < .001$ ), and the CPE and cumulative nursing GPA ( $r_s = .67, p < .001$ ), the CPE variance likely overlaps with the Adult Health exam average and/or the cumulative nursing GPA. Since the cumulative nursing GPA reflects performance in courses across the curriculum, one would expect the CPE and cumulative nursing GPA would overlap. Furthermore, the Adult Health course provides the foundation for management of care for individuals with acute and chronic needs, so the covariation is easily explained.

While the Adult Health CMS exam was the strongest overall predictor of NCLEX-RN performance in the final model, the exam averaged in the complimentary course- Adult Health, was the only exam average that significantly predicted NCLEX-RN performance. Within the study setting, the Adult Health course is situated in the second semester of the Upper Division program. Given immediately prior to the completion of the Adult Health course, the Adult CMS marks the half-way point for Upper Division courses. These findings provide the support for utilizing the Adult Health variables as mid-program benchmarks for identifying students who need additional support to maximize NCLEX-RN success.

The findings from the overall prediction model can assist nursing educators in developing critical milestones for assessment of high-risk students. Table 19 presents the timing of the predictors in relation to program sequencing. As demonstrated in this table, key milestones are positioned throughout the Upper Division nursing curriculum, which allows for ongoing student assessment.

Table 19

*NCLEX-RN Predictors and Program Sequencing*

Predictor	Sequencing
Pre-admission Science GPA	Admission to Upper Division
Adult Health Exam	Throughout 2 <sup>nd</sup> semester of Upper Division
Adult Health CMS	Completion of 2 <sup>nd</sup> semester of Upper Division*
Child Health CMS	Completion of 3 <sup>rd</sup> semester of Upper Division
CPE	Completion of 4 <sup>th</sup> semester of Upper Division**
Cumulative Nursing GPA	Program Completion

\* end of Junior year; \*\* end of Senior year

**Implications for Practice**

With the increased demand for RNs, it is vital for nursing programs to ensure graduates are adequately prepared for the NCLEX-RN. The first-attempt NCLEX-RN failure rate exacerbates the existing shortage of qualified RNs, creates a financial burden for students and employers, and threatens the viability of nursing programs. With the continued increase in passing standards, combined with the impact of NCLEX-RN failure, it is imperative for educators and administrators to recognize the factors associated with NCLEX-RN performance to aid in identification and intervention for at-risk individuals. The findings from this study can assist in informing faculty and administrators of indicators of NCLEX-RN prediction encompassing program admission through graduation.

The findings can aid nursing programs in identifying existing students at-risk for NCLEX-RN failure. While many nursing programs require a minimum grade in nursing courses and utilize standardized testing, it is prudent for educators and administrators to evaluate these outcomes in terms of their ability to discern between students who are likely to pass the NCLEX-RN and individuals at risk for failure. Guided by the findings in this study, nursing programs can develop benchmarks throughout the nursing curriculum that may be useful in early identification of at-risk students. As an alternative

of using a single indicator at graduation, such as the CPE, the study findings provide multiple indicators throughout the program that can help identify individuals that may benefit from additional academic support.

Once identified, at-risk students can participate in interventional programs designed to remediate on deficiencies and participate in academic support opportunities. Earlier identification and intervention is essential for students to address deficiencies and receive support before they struggle in nursing studies. Through early identification and thoughtfully planned intervention programs, nursing programs can minimize student attrition and potential NCLEX-RN failures.

While early identification of at-risk students is ideal, end-of-program assessments can also provide valuable information for nursing programs. Using benchmarks at program completion, including cumulative nursing GPA and comprehensive standardized tests (i.e., CPE), can be beneficial in assessing preparedness for the NCLEX-RN. In using end-of-these indicators, educators can assist students in gauging their readiness for licensure and counsel students in next steps in preparing for the examination. Furthermore, nursing graduates can benefit from an accurate assessment of their relative risk of failure to guide their post-graduation study activities and decisions.

An interesting finding was the lack of consistency in nursing exam averages in predicting NCLEX-RN performance. The vast majority of nursing programs require benchmark exam averages, typically a minimum of a C, to determine student progression within the nursing program. However, this study revealed only the Adult Health exam average predicted NCLEX-RN performance. If the NCLEX-RN is designed to determine an individual's minimal competency in nursing, it is concerning that exam averages are

not more predictive of NCLEX-RN performance. This raises questions to whether course exams are consistently aligned with the expectations on the NCLEX-RN and whether exam averages are appropriate for determining student progression. Given the lack of prediction with the majority of the nursing exam averages, educators must ensure exams appropriately aligned with the NCLEX-RN.

In addition to ensuring exams are aligned with NCLEX-RN criteria, it is essential for nursing faculty to have the education and experiences necessary to develop questions that reflect NCLEX-RN expectations. Faculty development in item development and exam construction is paramount. Since nursing content exams should inform faculty of students who have failed to master essential nursing content and are at risk for NCLEX-RN failure, faculty must possess the knowledge of item writing and exam specification in order to construct an exam that is reflective of current nursing knowledge and NCLEX-RN expectations.

### **Implications for Research**

As discussed above, research on NCLEX-RN prediction is valuable for nurse educators to address the nursing shortage. While this study provides contributes to the existing knowledge on predicting NCLEX-RN performance, additional research is warranted. The following recommendations are aimed at addressing the gaps in NCLEX-RN prediction:

1. Replication of the study, with a larger sample size. With the wide confidence intervals within this study, a larger sample size is needed to test the stability of the predictive model. Cross validation with a larger sample size could estimate how accurately the model will perform in predicting NCLEX-RN

performance.

2. This study empirically tested a portion of Jeffreys' NURS model as a framework for understanding NCLEX-RN performance. The findings partially supported the use of selected student profile characteristics, academic factors, and academic outcomes to predict NCLEX-RN performance. Testing of other components of student profile characteristics and academic factors within the NURS model, which may confound academic outcomes, can provide a more comprehensive look at nursing student performance. Additional factors include: language, educational background, and study habits. Exploration of these factors can also assist educators in developing admission selection criteria to ensure admitted candidates are those most likely to be successful. In addition, studies exploring the impact of student affective factors, environmental factors, professional integration factors, and psychological outcomes could provide a more comprehensive understanding of the complexities of nursing student success.
3. Due to the small number of Black, Asian, and Hispanic students in the sample, the study grouped individuals as non-minority (White) and minority (other racial groups). Since White and Asian students experiences NCLEX-RN pass rates above 90% and Hispanic and Black students yielded NCLEX-RN pass rates below 80%, further studies exploring how prediction models may vary based on race would be prudent.
4. The current study focused on predictors of NCLEX-RN performance with the most recent test plan. While the current study provides a baseline for

understanding NCLEX-RN prediction, more work is needed with future iterations of the examination. With frequent revisions of the NCLEX-RN test plan and the passing standard, predicting NCLEX-RN performance is a moving target. Further studies should explore whether NCLEX-RN prediction remains consistent over subsequent iterations of the examination.

5. The study was limited to BSN programs and included both accelerated and traditional BSN graduates. A study should be conducted to determine if similar predictors can consistently be utilized for ADN programs. Furthermore, an in-depth comparison of program types (i.e., accelerated versus traditional, BSN versus ADN) could provide useful information in understanding the diverse needs across program types.
6. The study revealed race is associated with NCLEX-RN performance. With the growing number of minority students entering nursing programs, an in-depth exploration of differences between minority and non-minority students is recommended. With a larger sample of minority students, a new study exploring group differences in academic factors and academic outcomes could provide meaningful evidence to develop interventional programs. Additionally, an exploration of the interactions between race and other potential predictors, including professional integration factors and environmental factors, is suggested.
7. Replicate the study with a larger sample size, extending the population to other types of BSN settings. This approach would make the findings more generalizable to BSN programs and provide better implications for practice.



8. A longitudinal study of multiple student cohorts is recommended to examine additional factors that may influence NCLEX-RN performance, such as methods of post-graduation NCLEX-RN preparation, post-graduation work, and environmental stressors.
9. Findings from this study target early identification of at-risk students. Research should be conducted regarding the effects of remediation based on specified predictors. Students identified at high risk for failure need to participate in a structured interventional program. Following program development and implementation, additional studies are needed to evaluate program outcomes and determine the effectiveness of interventional activities.

### **Conclusion**

As the largest profession within U.S. health care, nurses play a pivotal role in the health of the nation. According to the Robert Wood Johnson Foundation (RWJF, 2011), with their numbers and adaptive capacity, the profession of nursing has wide-reaching effects on the U.S. health care system. Prepared to manage the care of individuals across the lifespan and in a variety of settings, nurses utilize critical thinking, problem-solving, and research skills to address the health needs of diverse individuals. Often the front line and constant presence in health care, it is impossible to envision without large numbers of nurses (Robert Wood Johnson Foundation, 2011). Following the passage of the Affordable Care Act in 2010, Carnevale et al. (2015) estimates 1.6 million job opening in the nursing field by 2020. Amid this need, Carnevale et al. project a 200,000 shortfall of qualified nurses by 2020.

As a result of the increased need for nurses, educational programs are facing

pressure to increase the number of graduates prepared for nursing licensure. However, nursing programs are currently experiencing a decline in NCLEX-RN pass rates among their graduates. Researchers have attempted to identify predictors of student performance on the NCLEX-RN (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Trofino, 2013; Truman, 2012; Vandenhouten, 2008; Yeom, 2013) though identification of NCLEX-RN performance predictors remains elusive. Through empirical testing of Jeffreys' NURS model, this study attempted to fill gaps in the existing NCLEX-RN prediction literature.

The focus of the study was to explore the predictors of first attempt NCLEX-RN performance for BSN graduates. The researcher employed a retrospective, correlational design to explore a combination predictors. Ten academic outcomes in nursing studies were examined as the primary set of predictors, including nursing course exam averages, standardized test scores, and cumulative program GPA. To control for confounding variables, a combination of student demographics and variables related to prior academic performance were included in the analysis. The outcome of interest, NCLEX-RN pass or fail, was dichotomous in nature; therefore, data were analyzed using binary logistic.

The study results revealed several academic outcomes are significantly associated with NCLEX-RN performance, when controlling for student profile characteristics and academic factors. One nursing course exam average, Adult Health, was predictive of NCLEX-RN performance. In addition, three ATI standardized exams and the cumulative nursing GPA were significant predictors. When arranged in an overall predictive model, the aforementioned predictors, combined with race and pre-requisite science GPA, accurately classified 95% of the examinees. While prior studies found 85-100% accuracy

is predicting success (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Seldomridge & DiBartolo, 2004; Truman, 2014; Yeom, 2013), failure was difficult to predict. Although earlier research yielded a wide range of accuracy in predicting NCLEX-RN failures, the rates were relatively low at 3% to 67%. The study offers promise in predicting both passers and failures at equal accuracy.

While identifying students who are likely to pass NCLEX-RN on their first attempt is useful, recognizing at-risk students is of greater importance. The findings from this study can assist educators in moving towards establishing benchmarks throughout the nursing curriculum, for enrollment in early intervention programs. Although the study was limited to a large, BSN program in a metropolitan setting, the findings can provide the initial framework for understanding NCLEX-RN across program types. Utilizing the recommendations for future research can assist researchers in exploring how these findings may apply to others outside of the scope of this study.

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## APPENDICES

A: Definition of Terms

B: 2013 NCLEX-RN Test Plan

C: Quality Scale and Courses Included GPA Calculations

D: Calculation of Nursing Course Exam Average

E: Intercorrelations of Continuous Predictors

F: Univariate Logistic Regression for Continuous Variables

## Appendix A

### Definitions of Terms

***Age of graduate:*** The age of a nursing student on the date the BSN degree is conferred by the institution, as indicated by the student on the nursing admissions application.

***Baccalaureate nursing graduate:*** A student graduating from a board approved, pre-licensure RN program. Upon completion of the program, Baccalaureate nursing graduates are conferred baccalaureate degrees by their respective institution and are eligible to sit for the NCLEX-RN.

***Computer Adapted Testing (CAT):*** The method for administration of the NCLEX-RN, using computer technology and measurement theory to structure and individualize the examination for each examinee (NCSBN, 2015). According to the NCSBN (2015), CAT is the method used to administer the NCLEX-RN. The CAT improves precision of measurement of the examinee's entry-level nursing knowledge through reduction of items that may skew results. With each item presented, the CAT format re-estimates the examinee's knowledge and adjusts the questions accordingly (NCSBN, 2015).

***Comprehensive Predictor Examination (CPE):*** A commercially prepared, standardized nursing examination, designed to assess a student's current level of readiness for the NCLEX-RN (ATI, 2014a). The CPE assesses the student's comprehension and mastery of basic nursing concepts and provides a numeric indication of the student's likelihood of passing the NCLEX-RN on first attempt (ATI, 2014a; ATI 2014b). Results are presented as an individual percentage correct, national percentile, and predicted probability of passing NCLEX-RN.

***Content Mastery Series Examinations (CMS):*** A series of commercially prepared,

standardized nursing examinations, designed to assess a student's comprehension and mastery of basic nursing concepts in specified content areas (ATI, 2014c). Content exams are available in nine areas: adult medical-surgical nursing (adult health), community health, fundamentals, leadership, maternal newborn nursing (maternal health), mental health, nutrition, pharmacology, and pediatric nursing (child health). Results are presented as percent correct, national percentile, and calculated proficiency level (Below Level 1 to Level 3). Proficiency levels are determined from an individual's percent correct and indicate if the student exceeds, readily meets, just meets, or does not meet the NCLEX-RN standard in the specific content area (ATI, 2014c).

***Gender of graduate:*** The biologic sex of the nursing graduate, as self-reported by the student on the nursing admissions application.

***Lower division nursing program:*** The first two years of pre-nursing curriculum, prior to official admission into a nursing program for completion of nursing specific courses. Students enrolled in the lower division program complete pre-requisite courses required for admission into the upper division nursing program.

***National Council Licensure Examination for Registered Nurses (NCLEX-RN):*** The examination used by the State Boards of Nursing to evaluate the entry level competence of graduates seeking licensure as a Registered Nurse (NCSBN, 2015). The examination estimates the examinee's ability as either above the passing standard or below the passing standard with 95% confidence (NCSCN, 2015).

***National Council of State Boards of Nursing:*** The national organization comprised of representatives from the State Boards of Nursing in the 50 states, the District of Columbia, and four U.S. territories. This organization is responsible for the development

of the NCLEX-RN licensure examination and establishing passing standards for the NCLEX-RN (NCSBN, 2015).

***NCLEX-RN success:*** Completion of the NCLEX-RN on first attempt with a “pass”, determined by a calculated logit  $\geq -0.00$  and reported by the NCSBN. This result indicates the examinee’s nursing knowledge, skill, and abilities are above the established passing standard (NCSBN, 2015).

***NCLEX-RN failure:*** Completion of the NCLEX-RN on first attempt with a “fail”, determined by a calculated logit  $< -0.00$  and reported by the NCSBN. This result indicates the examinee’s nursing knowledge, skill, and abilities are below the established passing standard (NCSBN, 2015).

***Nursing course exam grades-*** A nursing student’s examination average in respective nursing courses. Calculated by percentage of items corrected on each exam, averaged over the number of examinations in the course.

***Nursing program cumulative grade point average-*** A nursing student’s cumulative grade point average in all required pre-requisite and nursing program courses, at the time of program completion. Calculated by combining quality points earned in all required pre-requisite and nursing program courses.

***Nursing program standardized testing performance-*** A student’s individual score (percent correct) on the proctored Content Mastery Series (CMS) examinations and Comprehensive Predictor Examination (CPE), on first administration.

***Pre-requisite program grade point average:*** A numerical representation of all grades earned in required pre-requisite courses. This is a nursing student’s cumulative grade point average in all required pre-requisite courses, at time of admission into the nursing

program. Calculated by combining quality points earned in all required pre-requisite courses.

***Pre-requisite science grade point average:*** A numerical representation of grades earned in all pre-requisite science courses. This is a nursing student's grade point average in all pre-requisite science courses, including only pre-requisite courses with either biology, chemistry, or psychology course numbers. Calculated by combining quality points earned in all applicable courses.

***Race of graduate:*** The race of the nursing student, as self-identified on the nursing admissions application.

***Registered Nurse (RN):*** An individual who has successfully met all of the requirements to practice nursing in their respective state and issued a RN license following successful completion of the NCLEX-RN.

***State Boards of Nursing:*** The governmental agency responsible for regulating nursing practice. This is the regulating board responsible for approving nursing education programs, granting licensure to practice in the respective state, and developing/overseeing nursing practice standards for the state (American Nurses Association, 2012).

***Upper division nursing program-*** The last two years of the nursing program curriculum. After admission into the upper division nursing program, students complete required nursing program courses to fulfill the requirements for their pre-licensure degree.

## Appendix B

### 2013 NCLEX-RN Test Plan

Domain	Percentage
Management of Care	17-23%
Safety and Infection Control	9-15%
Health Promotion and Maintenance	6-12%
Psychosocial Integrity	6-12%
Basic Care and Comfort	6-12%
Pharmacological and Parenteral Therapies	12-18%
Reduction of Risk Potential	9-15%
Physiological Adaptation	11-17%

(NCSBN, 2015)

## Appendix C

### Quality Scale and Courses Included GPA Calculations

#### ***Quality Scale Calculations***

Grade	Quality Points
A	4
B	3
C	2
D	1
F	0

#### ***Courses Included in Pre-requisite Program GPA and Pre-requisite Science GPA Calculations***

Pre-requisite Program Courses*	Pre-Requisite Science Courses*
General Ed. Arts (3 hrs)	Anatomy & Physiology (7hrs)
General Ed. Humanities (3hrs)	Chemistry (4hrs)
Ethics (3hrs)	Human Nutrition (3hrs)
College Algebra (3hrs)	Intro to Biology (3hrs)
Oral Communication (3hrs)	Intro into Psychology (3hrs)
Reasoning (3hrs)	Lifespan Development (3hrs)
Sociology (3hrs)	Microbiology (4hrs)
Statistics (3hrs)	Pathophysiology (4hrs)
History (3hrs)	Pharmacology (3hrs)
English (6hrs)	
Cultural Diversity (3hrs)	
All Pre-requisite Science Courses (34hrs)	

\*Or course equivalent(s) as determined by official university evaluation and indicated on transcript

#### ***Upper Division Nursing Courses for GPA Calculation***

Course	Credit Hours
Community Health Nursing*	6 hours
Health Assessment	3 hours
Therapeutic Nursing Interventions*	5 hours
Foundations for Nursing Practice	1 hour
Adult Health Nursing*	8 hours
Mental Health Nursing*	6 hours
Nursing Research	2 hours
Childbearing Nursing* (Maternal Health)	4 hours
Leadership and Management	3 hours
Child Health Nursing*	5 hours
Global Health	2 hours
Synthesis of Complex Needs	5 hours
Transitions to Practice	2 hours
Community Leadership Practicum**	2 hours
Capstone Practicum**	5 hours

\*includes clinical component

\*\* graded as pass/fail



## Appendix D

### Calculation of Nursing Course Exam Average

#### ***Upper Division Grading Scale***

Grade	Course Average
A	92.5-100%
B	83.5-92.4%
C	74.5-83.4%
D	65.5-74.4%
F	Below 65.5%

#### ***Nursing Courses Included in Exam Averages***

Course	Number Of Exams	Number Of Items per Exam
Fundamental	4	50
Adult Health	5	50/ 100 on final exam
Mental Health	4	50
Child Health	4	50
Maternal Health	5	50
Synthesis/Critical Care	5	50/ 85 on final exam

Appendix E

Intercorrelations of Continuous Predictor Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	-	.18**	.25**	.16**	.05**	.09**	.13**	.06**	-.12**	.12**	.28**	.26**	.14**
2. Pre-req. GPA		-	.59**	.35**	.45**	.40**	.40**	.34**	.34**	.33**	.40**	.45**	.79**
3. Pre-Science GPA			-	.44**	.50**	.47**	.43**	.43**	.36**	.46**	.50**	.57**	.81**
4. Fund. Exam				-	.45**	.42**	.35**	.33**	.37**	.40**	.34**	.47**	.57**
5. Adult Health Exam					-	.52**	.55**	.58**	.68**	.55**	.50**	.63**	.76**
6. Mental Health Exam						-	.45**	.47**	.41**	.31**	.42**	.50**	.61**
7. Child Health Exam							-	.55**	.37**	.33**	.45**	.46**	.62**
8. Maternal Health Exam								-	.45**	.34**	.48**	.54**	.60**
9. Complex Health Exam									-	.39**	.38**	.48**	.60**
10. Adult Health CMS										-	.43**	.58**	.55**
11. Child Health CMS											-	.67**	.56**
12. CPE												-	.67**
13. Grad GPA													-

\*\*  $p < .001$

## Appendix F

### Univariate Logistic Regression for Continuous Variables (Standardized)

	<i>B (SE)</i>	Wald	<i>p</i> -value
Race	-.04 (.61)	.003	.95
Age	.21	.	.085
Pre-nursing GPA	1.25	34.17	< .001
Science GPA	1.49	42.34	< .001
Grad GPA	2.83	48.63	< .001
Fund. Exam	.85	23.09	< .001
Adult Health Exam	2.34	52.27	< .001
Mental Health Exam	1.14	33.68	< .001
Maternal Health Exam	1.18	36.30	< .001
Child Health Exam	1.15	34.87	< .001
Complex Exam	1.23	30.60	< .001
Adult Health CMS	2.74	48.96	< .001
Child Health CMS	2.33	48.32	< .001
CPE	3.38	45.38	< .001

(Outcome- NCLEX-RN performance)

## CURRICULUM VITA

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### EDUCATION:

University of Louisville Louisville, KY 40292	Doctor of Philosophy Educational Leadership and Organizational Development (Post-secondary Education Track)	5/2016
University of Louisville Louisville, KY 40292	Health Profession Educators Post-Master's Certificate	5/2011
University of So. Indiana Evansville, IN 47712	Master of Science Nursing (Education Track)	6/2004
Spalding University Louisville, KY 40203	Bachelor of Science Nursing	5/2000

### ACADEMIC APPOINTMENTS:

Assistant Professor of Nursing Undergraduate Program University of Louisville Louisville, KY 40292	7/2010-present
Instructor of Nursing Undergraduate Program University of Louisville Louisville, KY 40292	8/2006-6/2010

OTHER PROFESSIONAL EXPERIENCE:

Staff Nurse, Cardiac Cath Lab Kosair Children's & Norton Hospital Louisville, KY 40202	7/01-8/2007
Staff Nurse, Intensive Care Unit Murray-Calloway Hospital Murray, KY 42071	11/00-7/2001
Staff Nurse, Cardiac Intensive Care Norton Hospital Louisville, KY 40202	6/00-11/2000

CERTIFICATIONS AND LICENSURES:

Registered Nurse, Kentucky	2000-present
Advanced Cardiac Life Support	2001-2009
Pediatric Advanced Life Support	2002-2006

PROFESSIONAL MEMBERSHIPS AND ACTIVITIES:

Preventative Cardiovascular Nurses Association, Member Kentuckiana Chapter, President	2007-present 2015-2017
American Nurses Association, Member	2010-2015
American Association of Critical-Care Nurses, Member	2001-2014
Society of Invasive Cardiac Professionals, Member	2002-2009
Golden Key Honors Society	since 2009
Sigma Theta Tau, Member	since 1999

HONORS AND AWARDS:

UofL Faculty Favorite, Top 4 University of Louisville, Delphi Center for Teaching and Learning	Fall 2015
Outstanding BSN Faculty Award from August Cohort University of Louisville, School of Nursing	Summer 2015

Outstanding BSN Faculty Award from May Cohort University of Louisville, School of Nursing	Spring 2015
Selected as “Faculty Mentor” by student athlete Red and Black Athletic Scholar Banquet	Spring 2015
Outstanding BSN Faculty Award from December Cohort University of Louisville, School of Nursing	Fall 2014
Outstanding BSN Faculty Award from August Cohort University of Louisville, School of Nursing	Summer 2014
Outstanding BSN Faculty Award from May Cohort University of Louisville, School of Nursing	Spring 2014
Selected as “Faculty Mentor” by student athlete Red and Black Athletic Scholar Banquet	Spring 2014
Outstanding BSN Faculty Award from December Cohort University of Louisville, School of Nursing	Fall 2013
Outstanding BSN Faculty Award from August Cohort University of Louisville, School of Nursing	Summer 2013
Outstanding BSN Faculty Award from May Cohort University of Louisville, School of Nursing	Spring 2013
Outstanding BSN Faculty Award from December Cohort University of Louisville, School of Nursing	Fall 2012
Outstanding BSN Faculty Award from August Cohort University of Louisville, School of Nursing	Summer 2012
Outstanding BSN Faculty Award from May Cohort University of Louisville, School of Nursing	Spring 2012
Faculty Favorite Nominee 2011 University of Louisville, Delphi Center for Teaching and Learning	Fall 2011
Outstanding BSN Faculty Award from August Cohort University of Louisville, School of Nursing	Summer 2011
Outstanding BSN Faculty Award from May Cohort University of Louisville, School of Nursing	Spring 2011

Selected as "Faculty Mentor" by student athlete Red and White Banquet	Spring 2011
Outstanding BSN Faculty Award from December Cohort University of Louisville, School of Nursing	Fall 2010
Faculty Favorite Nominee 2010 University of Louisville, Delphi Center for Teaching and Learning	Fall 2010
Outstanding BSN Faculty Award from August Cohort University of Louisville, School of Nursing	Summer 2010
Outstanding BSN Faculty Award from December Cohort University of Louisville, School of Nursing	Fall 2009
Faculty Favorite Nominee 2009 (Top 11) University of Louisville, Delphi Center for Teaching and Learning	Fall 2009
Outstanding BSN Faculty Award from August Cohort University of Louisville, School of Nursing	Summer 2009
Ruth R. Voignier Excellence in Teaching Award University of Louisville, School of Nursing	Spring 2009
Outstanding BSN Faculty Award from May Cohort University of Louisville, School of Nursing	Spring 2009
Faculty Favorite Nominee, 2008 University of Louisville, Delphi Center for Teaching and Learning	Fall 2008
Outstanding BSN Faculty Award from December Cohort University of Louisville, School of Nursing	Fall 2008
Outstanding BSN Faculty Award from August Cohort University of Louisville, School of Nursing	Summer 2008
Selected as "Faculty Mentor" by student athlete Red and White Banquet	Spring 2008

COMMITTEES AND SERVICE:

University

Board of Overseers Faculty Mentor Student: McKenzie Grace	Fall 2015-present
Undergraduate Council	Fall 2015-present

Distinguished Teaching Award Screening Committee	Spring 2015
Blackboard Advisory Group	Fall 2011-present
Board of Overseers Faculty Mentor Student: Ruthie Wooten	Fall 2013-Sp 2014
Celebration of Teaching and Learning Planning Committee	Fall 2011-Sp 2012
Distinguished Service Award Screening Committee	Spring 2008
 <i>School of Nursing</i>	
BSN/MSN Academic Affairs Committee Chair	Fall 2015-present Fall 2015-present
Faculty Advisor to Nursing Student Council	Fall 2008-present
School of Nursing Student Grievance Committee, Chair	Fall 2012-Sp 2015
School of Nursing Diversity Committee	Fall 2012-Sp 2015
School of Nursing Student Affairs Subcommittee Chair	Fall 2011-Sp 2015 Fall 2013-Sp 2014
Undergraduate Program Committee	Fall 2008-present
Course Coordinators Committee	Spring 2010-present
ATI Workgroup	Fall 2013-present
Cardinal Confidence, Coordinator	Spring 2014-present
Faculty Organization Secretary	Fall 2011-Sp 2012
School of Nursing Curriculum Subcommittee	Fall 2010-Fall 2013
School of Nursing Nominations Committee	Fall 2010-Fall 2011
Undergraduate Academic Affair Committee	Fall 2007-2010
School of Nursing I2A Committee	Spring – Fall 2010
BSN Curriculum Redesign Committee	2007-2008
 <i>Community Service since 2009</i>	
Boy Scouts of America Lincoln Heritage Council Pack 776 Assistant Cub Master Committee Member Advancement Chair Den Leader First Aid Training Camp Volunteer	2010-present
Pleasant Grove Elementary Reading and Classroom Volunteer	2010-present
DEU Planning Committee, University Hospital, Member	2011-2014
Nursing Student Education & Practice Committee, University Hospital, Member	2011-2014
Humana Flu Shot Clinic, Healthcare Volunteer	2008-2010
H1N1 Mass Immunization Clinic, Volunteer	Fall 2009



## PRESENTATIONS:

### Oral Presentations: National

Velasquez, C., Hern, M., Elzy, P., Mitchell, H., Burchett, M., Smith, M., & Perkins, N. (2014). *Interprofessional collaboration: The future of nursing student clinical education*. Abstract Presentation. Nursing Management Congress 2014. Las Vegas, NV. (Competitively Selected).

Velasquez, C., Hern, M., Elzy, P., Mitchell, H., Burchett, M., Smith, M., & Perkins, N. (2014). *Interprofessional collaboration: The future of nursing student clinical education*. Abstract Presentation. Portland DEU Model Conference. Portland, OR. (Competitively Selected).

Owens, H. & Mitchell, H. (2010). *Improving critical thinking and decision making in tech savvy students through the use of virtual simulation in the classroom*. Abstract Presentation. American Association of Colleges of Nursing Baccalaureate Conference. Orlando, FL. (Competitively Selected)

Owens, H. & Mitchell, H. (2009). *Designing a learning lab for tomorrow's baccalaureate nurse in times of budget cuts, faculty shortages and H1N1 fears*. Abstract Presentation. American Association of Colleges of Nursing Baccalaureate Conference. Chicago, IL. (Competitively Selected)

### Oral Presentations: State

Mitchell, H. & Perkins, N. (2015). *The DEU Journey: Changing the Face of Clinical Education through Collaboration*. Abstract Presentation. 10<sup>th</sup> Annual Nurse Educator Conference. Lexington, KY (Competitively Selected)

Mitchell, H. & Owens, H. (2011). *Improving critical thinking and decision making in tech savvy students through the use of virtual simulation in the classroom*. Abstract Presentation. 7<sup>th</sup> Annual Nurse Educator Conference. Lexington, KY (Competitively Selected)

### Oral Presentations: Local

Owens, H. & Mitchell, H. (2012). *Developing critical thinking and decision making skills through the effective use of simulation technology*. Celebration for Teaching and Learning. University of Louisville (Invited)

Mitchell, H. (2011). *Motivating the hesitant student in the clinical setting*. Essentials of Clinical Instruction (Faculty Development Workshop). University of Louisville (Invited)

Mitchell, H. (2010). *Making the connection: Strategies for engaging the multi-generational classroom*. Medical Education Grand Round. University of Louisville (Invited)

Mitchell, H. (2007). *Do You Have What it Takes: Critical Care Nursing*. Podium Presentation- Kentucky Association of Nursing Students 55<sup>th</sup> Annual State Conference. Louisville, KY (Invited)

### Poster Presentations

Mitchell, H., Perkins, N., Smith, M., & Perkins, N. Velasquez, C., & Burchett, M., (2014). *The DEU Journey: Changing the Face of Clinical Education through Collaboration*. Poster Presentation. American Association of Colleges of Nursing Baccalaureate Conference. Baltimore, MD. (Competitively Selected)

Wall, M. P., Black, K., Chlebowy, D., Hines-Martin, V., Martin, P., Mitchell, H., & Singleton, K. (2011). *Critical analysis in nursing case management*. Poster presented at i2a Institute: Developing Critical Thinkers. University of Louisville.

### GRANT FUNDING

Marianne Hutti, PhD, ARNP (Chair), Ermalynn Kiehl, PhD, ARNP, CNS (facilitator), Pat Martin, MSN, RN (facilitator), Said Abusalem, PhD, Glenda Adams, MSN, ARNP, Karen P. Black, MSN, PhDc, RN, Diane Chlebowy, PhD, RN, Peggy El-Mallakh, PhD, RN, Sandra Harshfield, MSN, ARNP, Carlee Lehna, PhD, RN, Heather Mitchell, MSN, RN, Heather Owens, MSN, RN, Diane Riff, MS, RN, Virginia Seno, PhD, RN, Karen Singleton, MSN, RN, Mary Pat Wall, PhD, RN, RN, Internal Grant for Implementation of I2A Critical Thinking Initiative, University of Louisville for \$15,000