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# Predicting the NCLEX-RN Pass Rate at an Associate Degree Nursing Program

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# Walden University

College of Education

This is to certify that the doctoral study by

Dawne Olbrych

has been found to be complete and satisfactory in all respects,  
and that any and all revisions required by  
the review committee have been made.

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2018

Abstract

Predicting the NCLEX-RN Pass Rate at an Associate Degree Nursing Program

by

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MS, Russell Sage College, 1989

BS, State University New York at Plattsburgh, 1983

Project Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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## Abstract

The National Council Licensure Examination for Registered Nurses (NCLEX-RN) first-time pass rate for an associate degree in nursing (ADN) program was below the national mean, presenting a problem for graduates who failed the NCLEX-RN and could not enter the workforce as registered nurses. Knowles's assumptions of adult learning, Ebbinghaus's forgetting curve, and Zull's neuroscience research served as the theoretical frameworks for this study. The purpose of this study was to identify which academic and time-lapse variables predict the graduate's first-time passage for the NCLEX-RN. Archived academic records and NCLEX-RN results for all 786 graduates from one ADN program who took the NCLEX-RN for the first time in 2015 were reviewed. Binary logistic regression analysis of the data identified multiple academic and one time lag factor as significant predictors for first-time NCLEX-RN passage. Key results included positive relationships between academic variables (prerequisite grade point average [GPA], nursing GPA, cumulative GPA, final course grade in 1 medical surgical course) and NCLEX-RN passage. An inverse relationship was shown between NCLEX-RN pass and the number of nursing component failures and time lag between clinical capstone completion and first NCLEX-RN attempt. Results informed a policy recommendation to provide timely intervention and resources for students at risk, with a goal of promoting success on the first attempt of the NCLEX-RN. Increasing the numbers of graduates who successfully complete the NCLEX-RN on the first attempt and promptly join the nursing workforce will demonstrate positive social change by mitigating the nursing shortage, which promotes safe patient care.

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## Dedication

This project is dedicated to extraordinary people who touched my life and are watching from above: my parents, Ralph and Irene DeVoe, who taught me to work hard and “act like you know something”; my brother Peter, who told me he was pretty sure I was earning this degree because I “always wanted to be the boss of everyone”; and Kathy Heron who helped me start my nursing career with a smile and a friendship that lasted 30+ years. I wish you were here to see I am finally done.

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Thanks for sitting next to me through it all. Perhaps now I will start to cook. I am also grateful to my sons Mike and Dan for technical help with an obstinate computer, lots of laughter to smooth the edges, and your unflagging belief that I can do almost anything. Amazing things are possible when you are willing to work. I love you both very much.

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I am grateful for the work of my study chair, Dr. Janet Reid-Hector, my second member Dr. Richard Hammett, and editor Lydia Lunning for their thorough review and critique of multiple drafts as this project followed the trajectory toward completion.

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## Section 1: The Problem

### **The Local Problem**

The national shortage of registered nurses is projected to worsen as the population continues to age, and this shortage will negatively impact safe patient care (American Association of Colleges of Nursing [AACN], 2017; Institute of Medicine, 2011). Nursing programs have been challenged to increase capacity and develop graduates who are prepared to begin practice as a registered nurse (RN). Before entering the workforce, graduates of nursing programs are required to pass the National Council Licensure Examination for Registered Nurses (NCLEX-RN). The National Council of State Boards of Nursing (NCSBN) creates and administers the NCLEX-RN to ensure all licensed nurses meet state education requirements and are competent to practice nursing safely (NCSBN, 2013). This examination is scored as a pass or fail examination. At the completion of a nursing program, students independently schedule and take the licensure examination created by the NCSBN. Graduates of nursing programs who do not pass the NCLEX-RN contribute to the nursing shortage (Lavandera et al., 2011).

An Associate Degree in Nursing (ADN) program in upstate New York has identified a problem with a low pass rate for graduates' first-time attempt on the state licensure examination. A low NCLEX-RN first-time pass rate negatively impacts the program reputation and may be a precursor to decreased program enrollment (Crow & Bailey, 2015; Pressler & Kenner, 2012; Roa, Shipman, Hooten, & Carter, 2011). NCLEX-RN first-time pass rates below the national mean negatively impact the nursing program's accreditation status. The accrediting agency for this program is the

Accreditation Commission for Education in Nursing (ACEN). ACEN 2013 standards and criteria for associate degree programs require “The program’s three-year mean for the licensure examination pass rate will be at or above the national mean for the same three-year period” (ACEN, 2013a, p. 6). A gap in practice has been identified; this program is not successfully preparing students to pass the NCLEX-RN on the first attempt at the level of the national mean.

The NCLEX-RN first-time pass rate for nursing program graduates is one measurement of an effective program curriculum. Program stakeholders, including students, faculty, administrators for healthcare institutions, and accreditors expect graduates from nursing programs to be prepared to pass the NCLEX-RN on the first attempt. Program pass rates are available to the public on the state board of nursing websites. Nursing program accreditors require programs to maintain an NCLEX-RN first-time pass rate at or above the 3-year national mean for continued accreditation (ACEN, 2013a; National League for Nursing [NLN] Commission for Nursing Education Accreditation, 2016).

Many variables have been studied as possible predictors for student success or failure on the NCLEX-RN. Cumulative GPA, nursing GPA, mathematics and science grades, grades for individual nursing courses, and failures and withdrawals for individual nursing courses are among the academic variables studied related to the NCLEX-RN first-time pass rates of nursing program graduates (Alameida et al., 2011; DeLima, London, & Manieri, 2011; Herrera & Blair, 2015; Lavandera et al., 2011; Romeo, 2013;



Simon, McGinniss, & Krauss, 2013; Trofino, 2013). Conflicting evidence exists regarding the impact of academic factors and the first-time pass rate.

A paucity of evidence exists regarding the effect of time-lapse intervals on the outcome of the first NCLEX-RN attempt. Time-lapse intervals include length of time the student is enrolled in the nursing program, and the length of time between program completion and first NCLEX-RN attempt. Limited researchers have studied the relationship between the length of time enrolled in the nursing program and the NCLEX-RN outcome (McGahee, Gramling, & Reid, 2010). NCSBN researchers have completed two reviews of the time lag between program completion and the first NCLEX-RN attempt to determine the impact on the first-time NCLEX-RN attempt (Eich & O'Neill, 2007; Woo, Wendt, & Liu, 2009).

A gap in knowledge exists regarding which students are at risk for first-time NCLEX-RN failure. An analysis of academic and time-lapse factors predicting NCLEX-RN success will enable implementation of early intervention strategies for students at risk. Academic factors previously studied include grades for mathematics and science prerequisites (Elder, Jacobs, & Fast, 2015; Simon et al., 2013; Trofino, 2013), number of nursing course attempts and all grades in nursing courses (Alameida et al., 2011; Elder et al., 2015; Trofino, 2013), cumulative GPA (Alameida et al., 2011), and nursing GPA (Alameida et al., 2011; Kaddoura, Flint, VanDyke, Yang, & Chiang, 2017; Romeo, 2013; Trofino, 2013). Poor academic performance in prerequisite and nursing courses has been linked with decreased pass rate on the NCLEX-RN (Elder et al., 2015; Herrera & Blair, 2015; Kaddoura et al., 2017; Trofino, 2013). Retention of nursing knowledge may be

negatively impacted by an increased time-lapse between learning and examination (Brown et al., 2015; Woo et al., 2009). Prolonged length of time between program onset and program completion, and increased time lag between program completion and the first NCLEX-RN attempt may affect first-time licensure examination outcome (Eich & O'Neill, 2007; Woo et al., 2009). A study of academic and time-lapse factors to predict students who will successfully pass the NCLEX-RN in an ADN program will provide guidance for the academic nursing community to promote successful licensure of graduates.

## **Rationale**

### **Justification of the Local Problem**

The New York State Office of the Professions (NYSOP) reported the studied ADN program's first-time taker's NCLEX-RN pass rate was 76.2% in 2013, 74.1% in 2014, and 74.5% in 2015, for a 3-year mean of 74.93% (NYSOP, 2016). The national first-time pass rate for ADN programs was 81.4% in 2013, 79.3% in 2014, and 82.0% in 2015 (NYSOP, 2016). The calculated national 3-year mean first-time pass rate for ADN programs, from 2013 to 2015, was 80.9%, and serves as a benchmark for nursing programs. The studied ADN program's student catalog reinforces a commitment to prepare a diverse population of nursing students to graduate, successfully pass the NCLEX-RN, and begin nursing practice. Successful completion of the NCLEX-RN on the graduates' first attempt is essential for this ADN program to maintain accreditation, meet graduate expectations, and meet the needs of the healthcare system.

A gap in knowledge exists regarding which factors impact NCLEX-RN outcome for graduates of the ADN program. An analysis of academic and time-lapse factors predicting NCLEX-RN success will enable implementation of early intervention strategies for students at risk. Identification of students at risk for first-time failure provides an opportunity for planned intervention and provision of services for NCLEX-RN preparation. Admission criteria, program progression, curriculum, and NCLEX-RN preparation may also be evaluated based on the outcome of this study.

The program under study is a nontraditional competency-based ADN program accredited by the ACEN and registered by the New York State Education Department. According to the nursing program's catalog, the NLN has designated this program as a Center of Excellence in Nursing Education every year since 2005. Site study records indicate students complete both general education credits and nursing credits; the nursing credits are completed in four phases. Knowledge gained with the successful completion of each phase serves as the building block for the next phase.

The program is designed for students with previous clinical experience in health care. A criterion-referenced clinical examination is the final nursing component completed before conferral of the nursing degree. At the completion of the program, students are eligible to take the NCLEX-RN. Students are allowed 7 years to complete the program. The science requirements may be completed up to 5 years before enrollment in the nursing program. Students self-schedule and complete the NCLEX-RN after graduation. Study site records denote the student body at this program is largely nontraditional, and the majority of the students are enrolled part-time.

Graduates, healthcare organizations, and the nursing program are major stakeholders impacted by NCLEX-RN failure (Crow & Bailey, 2015; Roa et al., 2011). Graduates who fail the licensure examination incur the financial cost of retaking the examination as well as the financial and emotional consequences associated with failure to enter the workforce. Healthcare organizations are negatively impacted when hired program graduates do not pass the NCLEX-RN and are unable to practice as an RN. An NCLEX-RN first-time pass rate below the 3-year national mean negatively impacts the nursing program in terms of accreditation, program reputation, and future enrollment of students. Program stakeholders equate a program's NCLEX-RN first-time pass rate with the efficacy of the instructional process (Crow & Bailey, 2015; Pressler & Kenner, 2012; Roa et al., 2011; Taylor, Loftin, & Reyes, 2014). NCLEX-RN pass rates are published on the program web page and are also available on the state's board of nursing website. This transparent disclosure of licensure pass rates below the national mean can negatively impact the program reputation and student enrollment.

### **Justification of the Problem from the Literature**

A shortage of nurses exists in the United States. The AACN has projected the RN shortage will increase as the population ages, and nursing schools are unable to expand capacity to graduate more nurses (AACN, 2017). A relationship exists between adequate staffing levels of RNs and safe patient care (AACN, 2017). Nursing program graduates must pass the NCLEX-RN to enter the workforce as RNs. When more individuals pass the NCLEX-RN after graduation from nursing programs, the nursing shortage will be lessened and quality patient care will be maintained.

According to the American Nurses Association (2016) individuals can meet the educational requirements for licensure in one of three ways: by receiving a diploma in nursing from a hospital-based school of nursing (a diploma program), by receiving an associate degree in nursing from a community college or a hospital-based school of nursing (an ADN program), or by receiving a bachelor of science in nursing from a college or university (a BSN or baccalaureate program). In 2015, of the 157,882 candidates who took the NCLEX-RN examination, 84,379 (53.4%) were ADN program graduates (NCSBN, 2016a). The NCLEX-RN first-time pass rate in 2015 for ADN graduates was 82% (NCSBN, 2016a). The first-time pass rate for diploma program graduates was 85.77%, and for BSN program graduates was 87.49% (NCSBN, 2016a). The largest group of graduates who take the RN licensure examination currently have the lowest pass rate for that examination. Therefore, increasing the NCLEX-RN pass rate for associate degree graduates will directly impact the nursing shortage and help to maintain safe patient care.

To maintain accreditation, nursing programs with declining first-time pass rates have developed systems to improve the first-time NCLEX-RN success of graduates. Programs have upgraded admission criteria, revised curriculum to increase rigor, implemented progression policies, and mandated review courses to improve NCLEX-RN pass rates (Chen & Bennett, 2016; Elder et al., 2015; Horton, Polek, & Hardie, 2012; Taylor et al., 2014). Over the past decade, external vendors have developed standardized examinations, which are used as criteria for progression and to identify students at risk for NCLEX-RN failure. Foreman (2017), Giddens (2009), and Spurlock (2006) discussed

the use of standardized examinations developed by external vendors as a primary criterion for progression. High-stakes testing at the end of a program has been used to prevent low scoring students from graduating and may be biased against minority students and students for whom English is a second language (Foreman, 2017; Giddens, 2009; Molsbee & Benton, 2016; Randolph, 2017; Spurlock, 2006).

Carr (2011) described an analysis of a BSN curriculum to identify and address gaps, improve the quality of faculty-created examinations, and to redesign the NCLEX-RN review course to increase the NCLEX-RN first-time pass rate. Gaps in student knowledge were identified by standardized exit examination scores and precipitated the program review (Carr, 2011). Low likelihood of NCLEX-RN passage, as determined by a comprehensive predictor exit examination, initiated a structured remediation program at an Alabama university (Cole & Adams, 2014). Progression testing throughout the program identified students who required remediation. Student-faculty contracts were established, and a required NCLEX-RN review course was implemented to increase the first-time pass rate (Cole & Adams, 2014).

Koester (2015) described a multifaceted strategy to improve NCLEX-RN pass rates for a baccalaureate program in Mississippi with low first-time pass rates. Admission standards were made more rigorous with the inclusion of a standardized entrance examination, higher required scores for the American College Testing (ACT) examination, and increased preadmission GPA. All courses were standardized and peer-reviewed. Students were tracked to identify clinical or examination failures necessitating

remediation, and simulation was introduced into the curriculum. A mandatory NCLEX-RN preparatory course was also initiated as a capstone course (Koester, 2015).

Low NCLEX-RN first-time pass rates are problematic for programs nationally. An analysis of national program pass rates by Foreman (2017) indicated approximately “20% of nursing education programs fell below the state pass rate standard at least once between 2010 and 2014” (p. 9). Stringent admission standards to restrict enrollment, and progression policies resulting in increased attrition, will yield fewer graduates and will contribute to the nursing shortage. Programmatic changes based on the analysis of standardized exit examinations or deficiencies noted in NCLEX-RN content areas occur too late for the graduates who have already failed the NCLEX-RN. Therefore, research to predict students who will be successful is essential to promote data-driven decisions for program improvements.

Positive social change will result from increasing the number of nurses licensed, which will reduce the nursing shortage. The nursing shortage results in decreased RNs at the bedside. Inadequate RN staffing levels negatively impact safe patient care and are associated with poorer patient outcomes (AACN, 2017).

### **Purpose of the Study**

The purpose of this study was to identify which academic and time-lapse factors have a significant relationship with student success on the first attempt of the NCLEX-RN. Independent variables studied included academics: grades for mathematics and science prerequisites, grades in all nursing theory components, failures and withdrawals in all nursing theory components and clinical application courses, cumulative grade point

average (GPA), and nursing GPA. Independent variables also included time-lapse variables: the length of time a student is enrolled in the nursing program, and the time lag between program completion and the first NCLEX-RN attempt. I examined these variables in conjunction with the dependent variable, the result of the graduate's first-time NCLEX-RN attempt, to identify students who are expected to pass the NCLEX-RN. The statistically significant findings for the independent variables related to first-time NCLEX-RN success may be used by the local program to identify and intervene with those students who may be at risk for failing the licensure examination.

### **Definition of Terms**

*Accreditation Commission for Education in Nursing (ACEN):* The ACEN provides accreditation for all types of nursing programs. Accreditation is a voluntary process to validate educational quality (ACEN, 2013b).

*First-time pass rate:* The passage of the NCLEX-RN licensure examination for the first attempt after graduation. This pass rate is a criterion for program accreditation for the ACEN (ACEN, 2013a) and the NLN (National League for Nursing Commission for Nursing Education Accreditation, 2016).

*National Council Licensure Examination for Registered Nurses (NCLEX-RN):* The licensure examination developed by the NCSBN. The passing standard for this examination reflects the nursing knowledge required for entry-level practice as an RN. Passing standards for the licensure examination are reviewed every 3 years when the test plan is reviewed (NCSBN, 2016c). Graduates are required to pass this licensure examination after completion of an approved nursing program to practice as an RN. At



the conclusion of an academic program, students independently schedule and take the licensure examination created by the NCSBN (NCSBN, 2016c).

*NCLEX-RN readiness examinations (ATI Comprehensive Predictor Exam; NLN EPE, RN; NLN Comprehensive Nursing Achievement RN; HESI RN Exit Examination):* Standardized examinations developed by independent vendors to predict NCLEX-RN outcome. ATI has developed the ATI Comprehensive Predictor Exam (ATI, 2016). The NLN has developed two NCLEX-RN readiness examinations, the End of Program Exam, RN (EPE, RN) and the Comprehensive Nursing Achievement RN (NLN, 2015). The HESI RN Exit Examination was initially developed by Health Education Systems Incorporated (HESI) and is administered by Elsevier (Elsevier Education, 2016). These examinations include test items following the NCLEX-RN test plan, and format test questions similar to the NCLEX-RN. These vendors have published reliability and validity information regarding the predictive ability of each examination. Vendors have also developed NCLEX-RN review programs to accompany each predictor examination. (ATI, 2015; Elsevier Education, 2016; NLN, n.d.; NLN, 2015).

*Nursing preadmission standardized examinations (TEAS, PAX-RN, A<sup>2</sup>, NET):* Standardized examinations developed by independent vendors used as part of entrance requirements. Assessment Technologies Institute (ATI) developed the Test of Essential Academic Skills (TEAS) examination. The NLN developed the PAX-RN. Health Education System Incorporated created the Admission Assessment Examination (A<sup>2</sup>), and Kaplan developed the Nursing Entrance Test (NET). These examinations include

English, mathematics, and science components (ATI, 2015; Elsevier Education, 2016; Kaplan Nursing, n.d.; NLN, 2015).

*Time lag:* The time between program completion and first NCLEX-RN attempt (Eich & O'Neill, 2007; Woo et al., 2009).

*Time-lapse factors:* Two time-lapse factors will be studied. The enrollment time, the length of time a student is enrolled in program, and time lag, the period of time between program completion and first NCLEX-RN attempt (Eich & O'Neill, 2007; McGahee et al., 2010; Woo et al., 2009).

### **Significance of the Study**

The studied nursing program delivers a nontraditional competency-based distance-learning program, awarding an associate degree in nursing. Stakeholders expect graduates to pass the NCLEX-RN on the first attempt at a rate equal to the national mean for ADN programs. This study is unique because research regarding students at risk for NCLEX-RN failure has not included associate degree prelicensure students enrolled in an online program. Existing research has been limited to associate degree and baccalaureate degree students in traditional face-to-face or hybrid programs. Information specific to nontraditional ADN programs, multiple academic factors, and time-lapse factors predicting NCLEX-RN outcome is limited.

The NYSOP compiles annual NCLEX-RN first-time pass rates for state registered programs and reports national first-time pass rates for all types of nursing programs. The NCLEX-RN first-time pass rate for the studied ADN program declined from 2008 to 2011, with a slight increase in 2012 (NYSOP, 2013, 2016). NCSBN evaluates the passing

standard for the NCLEX-RN every 3 years. NCSBN raised the passing standard for the NCLEX-RN examination on April 1, 2013, with a change from -0.16 logits to 0.00 logit (NCSBN, 2016b). NCSBN defines a logit as “a unit of measurement to report relative differences between candidate ability estimates and item difficulties” (NCSBN, 2016c, p.1). The change in passing standard resulted in a dramatic decrease nationally for the NCLEX-RN first-time pass rate. National first-time pass rates have begun to rebound, but the pass rates for the study site program have not (Table 1).

Table 1

*2008-2015 NCLEX-RN First Time Pass Rate Percentage for Studied Program, ADN National, and All Programs National*

Program	2008	2009	2010	2011	2012	2013	2014	2015
Studied program	85.7	84.7	81.6	81.5	85.7	76.2	74.1	74.5
ADN national	86.2	87.6	86.5	87.0	89.3	81.4	79.3	82.0
All programs national	86.8	88.4	87.4	87.9	90.3	83.0	81.8	84.5

Study site records indicate programmatic changes have been implemented since 2008 to improve the NCLEX-RN pass score. Changes in admission requirements, progression requirements, and curriculum have been initiated to increase rigor. Additional revisions to the existing optional review program for NCLEX-RN preparation are under consideration. The policy regarding the length of time students are allowed to complete the program is also being discussed.

The data analysis and information obtained from this study have provided multiple opportunities for a project to address the findings. Recommendations for

program curriculum change to effectively prepare students for NCLEX-RN success were considered. Policy recommendations for identification of students at risk for NCLEX-RN failure and subsequent interventions were contemplated, as well as the potential for admission and progression criteria changes. Creation of a program for faculty development to increase faculty-student engagement and enhance NCLEX-RN preparation was also considered.

Limited evidence exists in the nursing literature regarding either the potential impact of the length of time the student is enrolled in a nursing program on the NCLEX-RN first-time pass rate or the time lag between graduation and first NCLEX-RN attempt with the NCLEX-RN first-time pass rate (Eich & O'Neill, 2007; McGahee et al., 2010; Woo et al., 2009). This study contributes to the body of knowledge regarding the effect of time and results of the NCLEX-RN.

Multiple opportunities for positive social change exist as a result of this study. Increasing the NCLEX-RN pass rate for the studied nursing program's graduates is essential for continuing accreditation of the ADN program and will increase the number of practicing RNs in the workforce. Healthcare organizations carry the burden of providing efficient health care to the community when faced with a worsening nursing shortage. Mitigating the nursing shortage will enable healthcare organizations to operate more effectively and provide quality patient care. Increasing the NCLEX-RN pass rate will also benefit students who invest considerable resources completing their nursing education courses.

### **Research Question(s) and Hypotheses**

The purpose of this study was to identify if academic achievement, the length of time spent in the nursing program, and the time-lapse between graduation and the first attempt on the NCLEX-RN predict the students who pass the NCLEX-RN on the first attempt. The research questions for this study are:

Research Question 1: What are the percentages for the academic factors and time-lapse factors for graduates from the studied ADN program who attempted the NCLEX-RN for the first time in 2015?

Research Question 2: Which academic factors predict the first-time success on the NCLEX-RN exam?

*H<sub>0</sub>2*: There is no significant difference between selected academic factors and a student's NCLEX-RN first-time pass rate.

*H<sub>a</sub>2*: There is a significant relationship between selected academic factors and a student's NCLEX-RN first-time pass rate.

Research Question 3: Which time-lapse factors associated with length of time enrolled in the program and time lag between program completion and the first NCLEX-RN attempt predict a first-time pass on the NCLEX-RN?

*H<sub>0</sub>3*: There is no significant difference between the length of time enrolled in the program or the time lag between program completion and the first NCLEX-RN attempt and a student's NCLEX-RN first-time pass rate.

*H<sub>a3</sub>*: There is a significant relationship between the length of time enrolled in the program or the time lag between program completion and the first NCLEX-RN attempt and a student's NCLEX-RN first-time pass rate.

### **Review of the Literature**

The literature review includes the theoretical underpinnings for this study for both the academic and the time-lapse variables. Knowles, Holton, and Swanson's (2012) assumptions about adult learners provide insight into the learning style of students enrolled in ADN programs (Knowles et al., 2012). Ebbinghaus's theory of knowledge retention and the forgetting curve clarify the effect of time on an adult's knowledge retention (Ebbinghaus, as cited in Hu et al., 2013). The inclusion of current research concerning brain function will elucidate cognitive function and the process of learning for the adult population (Zull, 2006, 2011).

An exhaustive review of the nursing literature was completed to provide evidence to support the inclusion of the selected academic and time-lapse variables associated with the NCLEX-RN first-time pass rate. Existing studies provide conflicting information regarding the predictive value of grades in mathematics, science, and individual nursing courses, the number of course failures or withdrawals, cumulative GPA, and nursing GPA on NCLEX-RN outcome (Elder et al., 2015; Herrera & Blair, 2015; Kaddoura et al., 2017; Trofino, 2013). Studies from both ADN and BSN programs were included to provide a thorough review of variables. In contrast, evidence for time-lapse factors and NCLEX-RN outcome is limited (Eich & O'Neill, 2007; McGahee et al., 2010; Woo et al., 2009). Therefore, a healthcare field other than nursing was explored to provide

additional data regarding the effect of time on the end of program examination results (Brown et al., 2015).

To complete the literature review, I searched these databases: EBSCO Host, CINAHL Plus with full text, Ovid Nursing Journals Full-Text, MEDLINE with full text, ProQuest Health and Medical, ERIC, SCOPUS, Cochrane, Google Scholar, and ProQuest Dissertations. I searched these databases for peer-reviewed articles and doctoral projects using the keywords and index/subject terms: NCLEX-RN predictors, NCLEX-RN outcome, high-stakes testing in nursing, effect of time and end of program examinations, end of program examinations in health-related fields, associate degree NCLEX-RN pass factors, retention in associate degree nursing, nursing program success, academic factors and NCLEX result, program length and NCLEX outcome, andragogy and nursing, and effect of time on NCLEX-RN results. Limited articles exist for academic and time-lapse factors related to NCLEX-RN outcomes for ADN programs. Relevant articles within the past 5 years were chosen as primary sources. I expanded the literature search to include a historical viewpoint and to include older articles with an ADN focus for all variables to be studied. This search yielded 121 articles. Doctoral research projects' reference lists and article references provided additional relevant articles. Theoretical literature regarding adult learning theory (Knowles), memory and forgetting (Ebbinghaus), and the neuroscience of learning were included in the literature review to provide an explanation for the academic and time-lapse variables explored in this study.

## **Theoretical Foundation**

The andragogical model and assumptions about adult learning developed by Knowles et al. (2012) serve as one component of the theoretical foundation for this study. The six assumptions of andragogy address the differences in learning processes between adults and children: adults are self-directed individuals whose learning is affected by previous experience, adults demonstrate an individual readiness to learn and desire to have learning be applicable to current life situations, adults are internally motivated and require rationale for learning (Knowles et al., 2012). Teaching strategies can be developed based on the core principles of andragogy.

The andragogical approach to adult learning, using the assumptions developed by Knowles et al. (2012), is pertinent to nursing education. The evolution of nursing care from a nurse-centered to a patient-centered focus initiated a paradigm shift in education from a pedagogical to an andragogical model (Young & Maxwell, 2007). The learner's self-concept as an individual responsible for self-direction necessitates the creation of student-directed learning experience. (Knowles et al., 2012).

The nursing literature supports student-centered teaching and learning within nursing programs (Billings, Allen, Armstrong, & Green, 2012; Kalb, O'Conner-Von, Brockway, Rierson, & Sendelbach, 2015; Valiga, 2012). Wlodkowski (2008) also supported this concept when describing adult motivation to learn as driven by responsibility for actions. Employers and academic programs reward self-direction. Adults in the United States are socialized to be self-directed and independent (Wlodkowski, 2008). All students in the program under study enter with previous



experience in health care and desire to learn the content for career progression. The mission of this program as described in study site records is centered on the andragogical tenet that learners must take responsibility for their learning.

Knowles et al.'s (2012) theory provides insight into the specific learning needs of adults, who are the subjects for this study. The adult's diverse life experiences require individualization of the teaching and learning strategies. Teaching strategies that build upon previous knowledge and expand the learner's thinking to new approaches are essential for adults (Knowles et al., 2012). Learning based on previous knowledge is a core premise of the program under study. Students enrolled in this program are building upon prior knowledge of healthcare. Student experiences with life, death, wellness, and disease pair with didactic content from the nursing theory components.

Adult learning principles are identified in study site documents as the basis for curriculum development and decisions at the studied nursing program. Students progress through the nursing curriculum in a systematic manner. General education courses including English, psychology, mathematics, anatomy and physiology, and microbiology are completed before the nursing courses. Nursing courses are completed in phases, to promote the integration of previous knowledge into the higher-level courses, which is consistent with the assumptions of adult learning. Nursing theory components provide concrete information regarding RN practice. The integration of theory related to RN professional practice is assimilated into the student's existing knowledge base and is then applied to the end of program licensure examination. The student's academic

achievement throughout the program may be a predictor for success on the first attempt of the NCLEX-RN.

The adult's life-centered approach to learning requires a learning environment where content applies to real life (Knowles et al., 2012). Motivation must also be considered when planning adult learning. Internal motivators, such as improving the quality of life, are a compelling force for the adult learner (Knowles et al., 2012). The pragmatic nature of the adult learner who seeks educational opportunity to upgrade skills (Wlodkowski, 2008) is evident in the student population of the program under study; graduates from this program will experience economic benefit when they enter the nursing workforce. Successful completion of the NCLEX-RN is essential for the student to practice as an RN; the program under study must create a system of learning where students are successful on the licensure examination.

Merriam, Caffarella, and Baumgartner (2007) discussed if andragogy is a theory or a set of assumptions that are useful in describing the continuum of learning from teacher-directed to student-centered. Principles of andragogy are "based on observation and experience, rather than logical postulates and/ or empirical research" (Houde, 2006, p. 90) and have been linked to self-determination theory. Taylor and Kroth (2009) posited the need for a testable instrument that will yield empirical data to overcome criticism and support andragogy as a theory. A review of the literature by Chan (2010) included the application of andragogical concepts to criminal justice education, police training, medical register preparation, and physician education. Chan identified the need to expand

the application of andragogical principles to varying social, political, and cultural arenas (Chan, 2010).

Regardless of whether andragogy is considered a theory, Knowles et al.'s (2012) assumptions align closely with the population of adult learners who attend the studied ADN program. Self-direction, motivation to learn, readiness to learn, taking responsibility for own decisions, ability to draw upon life experience, and the desire to have learning apply to real life (characteristics identified by Knowles et al.) are evident in the learner population at the study site. Nursing programs are responsible for creating a learning environment where students can learn the skills necessary to be successful when attempting the NCLEX-RN (Crow & Bailey, 2015).

Neuroscience advances provide insight into how learning can be more effective and how to promote retention of information. Zull (2006, 2011) explored the structure of the adult brain associated with learning. The cortex is associated with cognition, and the neocortex has “separate areas for sensory, association, and motor functions” (Zull, 2006, p. 3). The repeated firing of the neurons involved in learning promotes the growth of the neural branches, “which increases the density of the cellular material and enhances their ability to connect with other neurons—to form more synapses” (Zull, 2006, pp. 4-5). The physical changes in the brain explain Ebbinghaus’s forgetting curve, which described memory loss over time. Ebbinghaus (as cited in Hu et al., 2013) explained how information is forgotten rapidly after initial exposure and identified the role of learning strategies and frequency of review as factors that may slow memory loss. Studies have replicated Ebbinghaus’s original work, and have explored the role of active participation

in learning and review of material to improve recall of information (Custers, 2010; Foster, West, & Bell-Angus, 2016; Hu et al., 2013; Krishnan & Carey, 2013; Murre & Dros, 2015).

According to study site records, most students at the studied ADN program complete the program part-time and are allowed 7 years from the date of enrollment to completion. Anatomy and physiology, microbiology, and mathematics may be taken up to 5 years before the student begins the first nursing component. This prolonged time frame delays the application of prerequisite content to nursing practice and may negatively impact recall of material. Repetition of content to encourage long-term recall may not occur given the length of time between general education classes, completion of the nursing components, and subsequent NCLEX-RN testing.

Students must apply knowledge of RN practice to all learning activities throughout the nursing theory components at the program under study. As adult learners who build upon previous knowledge to apply information in real-life situations, learning gathered throughout the nursing program must be applied during the NCLEX-RN to pass the examination. Analysis of the academic achievement throughout the program, including grades in all prerequisite mathematics and science courses, grades in all nursing theory components, and the number of repeated courses, should provide information about which courses predict the graduate's outcome on the NCLEX-RN. Identification of the course grades or number of repeated courses associated with first-time NCLEX-RN failure creates an opportunity for student remediation or changes in the progression policy. Knowles et al.'s theory (2012) aligns with this study in the identification of

courses that require strengthening of the learning environment where content applies to the NCLEX-RN, and in evaluation of the efficacy of the curriculum plan currently in place.

While students are actively involved in completing the program requirements, the opportunity for reflection, integration, and generalization of information is provided. However, an extended length of time between prerequisite mathematics and science courses and program completion, and an extended length of time between graduation and the first NCLEX-RN attempt diminishes the opportunity for active experimentation to cement learning. Neurologic changes associated with knowledge retention and Ebbinghaus's (as cited in Hu et al., 2013) forgetting curve are aligned with this study in the discussion of the time-lapse independent variables. Bartle's (2014) discussion of literature from the field of learning and development indicated shifting the Ebbinghaus forgetting curve requires strategies such as frequent practice and creation of relevant connections between new information and memories. These strategies were described to enhance retention and retrieval of information (Bartle, 2014). Custers's (2010) analysis of the long-term retention of basic science knowledge supports the need for reinforcement to cement learning. Retention concerns were not noted when knowledge was used (Custers, 2010). The program under study may use results from this study to implement remediation strategies throughout the program to promote the retention of information. Review of content between graduation and the first NCLEX-RN attempt may be required to slow the memory loss and strengthen the neural pathways associated with the recall of information.

I reviewed alternative theoretical frameworks before I selected Knowles et al.'s (2012) theory of andragogy supplemented with Zull's (2006, 2011) neuroscience approach to adult learning. Bandura (as cited in Merriam et al., 2007) developed a social cognitive learning theory, which combines a behavioral and cognitive approach. Bandura focused the social cognitive learning theory on the social environment where learning occurs and included the concept of self-efficacy (Bandura, as cited in Merriam et al., 2007). Raman (2013) examined student success in an ADN program with a theoretical background based on Bandura's social cognitive learning theory. Raman studied faculty support, student self-efficacy, academic self-concept, commitment to the program, and compared with the first-year GPA (Raman, 2013). I did not collect data regarding the learner's self-perception of competence, nor did I explore the environment where learning takes place. Subsequently, I did not consider Bandura's social cognitive learning theory a good fit as the theoretical framework for my study.

Behavioral learning theories developed by Pavlov, Thorndike, and Skinner (as cited in Merriam et al., 2007) focus on shaping, changing, and rewarding behavior with external reinforcement. The behavioral learning theoretical framework includes a structured learning environment with the instructor determining the learning outcomes and reward system (Pavlov, Thorndike, & Skinner, as cited in Merriam et al., 2007). Behavioral learning may be an effective theoretical framework for a study focused on psychomotor skill development or clinical performance during simulation (Billings & Halstead, 2012). However, the dependent variable for my study is student outcome on the nursing licensure examination, which determines a student's ability to apply learned

knowledge and demonstrate the ability to provide safe nursing care. My research did not include psychomotor or clinical skill analysis. Therefore, I do not consider behavioral learning theories an adequate theoretical framework for my research.

Billings and Halstead (2012) discussed the application of adult learning theory for nursing mobility programs that involve the transition from licensed practical nurse to RN, such as the ADN program I studied with this research. Knowles et al.'s (2012) description of andragogy accurately describes the learner at the studied ADN program as a self-directed, internally motivated individual who demonstrates a readiness to learn relevant information applicable to RN practice. This framework, in conjunction with Zull's (2006, 2011) description of the neurologic pathways associated with learning and retention, and Ebbinghaus's forgetting curve provide the theoretical foundation for this study of academic and time-lapse factors that predict NCLEX-RN success. A review of the current literature surrounding mathematics and science prerequisite grades, achieved grades in individual nursing theory courses, cumulative GPA, nursing GPA, and time-lapse factors, and the impact on NCLEX-RN outcome are described.

### **Academic Variables and NCLEX-RN Pass Rate**

Accrediting agencies require all nursing program types to achieve an NCLEX-RN first-time pass rate at or above the national mean (ACEN, 2013a). Multiple academic factors have been researched as variables that can predict NCLEX-RN outcome. This review includes evidence from both ADN and BSN programs to provide a thorough analysis of current and historical research.

**Mathematics and science prerequisites.** The relationship between student

grades on prerequisite courses and first-time NCLEX-RN success has been studied to determine the efficacy of admission criteria for nursing programs; results have been varied. Although mathematics and science courses have been considered foundational for nursing courses, Trofino (2013) completed a retrospective review of academic transcripts for 85 students enrolled in a private ADN program in Pennsylvania, to examine the potential impact of admission criteria on the NCLEX-RN outcome. Support courses were not found to have a significant effect on passing the NCLEX-RN. The support courses were defined as anatomy and physiology, microbiology, psychology, and human growth and development. A logistic regression found no association between the letter grade earned in these courses and success with the NCLEX-RN. Only three of the 85 students studied repeated a support course. Therefore, conclusions could not be drawn regarding the impact of repeating a prerequisite course on NCLEX-RN outcome (Trofino, 2013).

Despite the lack of significant results linking course grades with NCLEX-RN outcome, preadmission examination results demonstrated the importance of a mathematics foundation in Trofino's (2013) study. Analysis of the preadmission testing results for the TEAS indicated normalized mathematics subscores associated with the standardized tests administered were statistically significant ( $p = .03$ ) for the probability of NCLEX-RN pass (Trofino, 2013). These findings indicate additional research is necessary to determine the link between science and mathematics knowledge and NCLEX-RN outcome.

In a similar study, Shaffer and McCabe (2013) studied 335 ADN students to determine if admission criteria determined the acceptance of students who would be



successful in the nursing program. Grades in anatomy and physiology, microbiology, English composition, introduction to psychology, introduction to sociology, and lifespan development were reviewed to determine which nonnursing courses predicted NCLEX-RN outcome. The mean preadmission GPA was 3.49. A positive correlation ( $p = .000$ ) did exist between preadmission GPA and NCLEX-RN outcome; a higher GPA was linked with increased chance of first-time pass (Shaffer & McCabe, 2013). Although preadmission grades earned in anatomy and physiology and microbiology were not a predictor of a first-time passing score on the NCLEX-RN, repeated attempts on these science courses were correlated significantly with first-time NCLEX-RN failure (Shaffer & McCabe, 2013).

ADN students were also studied by Truman (2012) to determine if admission variables predicted NCLEX-RN success. High school rank, preadmission GPA, preadmission science GPA, and verbal and mathematics scores on the Scholastic Assessment Test (SAT) were analyzed to determine if a relationship existed between these variables and NCLEX-RN outcome. A sample of 188 academic records was reviewed; 138 graduates passed the NCLEX-RN and 50 graduates failed. The profile of graduates who were successful with the first attempt on the NCLEX-RN included graduates with a significantly higher cumulative preadmission GPA ( $p = .011$ ,  $M = 3.22$ ), and a significantly higher SAT verbal score ( $p = .009$ ). High school rank, SAT mathematics score, and preadmission science GPA were not significantly different between the students who passed and the students who did not (Truman, 2012). A logistic regression of the data to identify the variable effect on NCLEX-RN outcome included

admission variables of SAT verbal and mathematics scores, and preadmission science GPA. Of these admission variables, the SAT verbal score was the only significant predictor, “with every 1 point increase in SAT verbal, the chance of passing the NCLEX-RN increases by 1%” (Truman, 2012, p. 43). The lack of a statistically significant relationship between preadmission science GPA and NCLEX-RN outcome found by Truman is consistent with the findings by Trofino (2013) and Shaffer and McCabe (2013).

Yates and Sandiford (2013) also conducted a correlation study using retrospective records to examine admission, progression, and exit data to determine the predictive nature of those variables with NCLEX-RN results. Academic records for 298 diverse ADN students were statistically analyzed using logistic regression. The sample size exceeded the required sample size of 285 for the multiple variables studied. Graduates in the sample had an NCLEX-RN first-time pass rate of 78.5%. Student scores on the NET and TEAS examinations, as well as preadmission GPA, were defined as the preadmission variables. The analysis of data found only the NET score significantly predicted NCLEX-RN success at  $p = .015$  significance (Yates & Sandiford, 2013). The TEAS entrance examination and the preadmission GPA were not significantly linked to NCLEX-RN outcome, which conflicts with studies by Trofino (2013), Truman (2012), and Shaffer and McCabe (2013). However, the lack of a statistically significant relationship with preadmission GPA and NCLEX-RN success is consistent with findings by DeLima et al. (2011).

Preadmission GPA, in general, was not found to be significant in predicting NCLEX-RN results in a small ( $N = 38$ ) retrospective study by DeLima et al. (2011). Nineteen participants who failed the NCLEX-RN were compared with 19 participants who were randomly selected from those who passed the licensure examination after graduation during one calendar year. The prenursing GPA included prerequisites and some co-requisites, which were not specifically identified by the author. Graduates who passed the NCLEX-RN achieved a prenursing GPA of 2.89; participants in this sample who failed the NCLEX-RN achieved a prenursing GPA of 2.95 (DeLima et al., 2011). However, the preadmission examination (PAX-RN) mean score was higher for students who passed the licensure examination and was statistically significant at a  $p = .05$  level (DeLima et al., 2011). The preadmission examination included English, mathematics, and science knowledge and was linked to NCLEX-RN outcome. The small size of this sample from a single institution limits the generalizability of these findings.

In a follow-up study, Manieri, DeLima, and Ghosal (2015) maintained current program admission criteria but evaluated the ability of standardized preadmission examinations to predict program completion. Program completion is essential before individuals are eligible to take the NCLEX-RN. The authors' literature review supported the use of preadmission data to determine which applicants were most likely to complete the program and pass the NCLEX-RN. A gap in the literature was identified regarding which standardized preadmission examination would best predict ADN student program completion. Applicants for an ADN program were ranked based on entrance cumulative GPA, curriculum GPA of required courses taken prior to acceptance, the number of

required courses the student withdrew from or received a grade less than C, the number of required credits earned prior to application, and the scores on a standardized preadmission examination (Manieri et al., 2015).

Two cohorts of accepted students were followed as the sample for Manieri et al.'s (2015) study. The first cohort of students ( $n = 171$ ) took the NLN's PAX-RN examination and HESI's A<sup>2</sup> examination prior to admission. The second cohort of students ( $n = 168$ ) took ATI's TEAS test before admission. No statistical difference was found between the mean entrance cumulative GPA for each cohort ( $p = .085$ ). An analysis of other factors associated with admission were not discussed. A total of 211 students graduated from the program from these two cohorts; each cohort was followed for a 4-year timeframe. The researchers analyzed academic records using logistic regression to determine which preadmission examination had a significant relationship with successful completion of the ADN program. The PAX-RN did not demonstrate a significant relationship with program success. The TEAS examination demonstrated a significant relationship with program success ( $p = .004$ ) and explained 5.9% of the students' successful program completion. The A<sup>2</sup> examination demonstrated a significant relationship ( $p = .000$ ) with successful program completion and explained 15.9% of the variance of successful completion of the ADN program (Manieri et al., 2015).

The mean entrance cumulative GPA for both cohorts was above 3.0, and the program completion rate was 65% (Manieri et al., 2015). One important limitation of this study was the lack of discussion surrounding the acceptable passing score and subscores for each examination considered for admission. The comparison of the cohorts included

preadmission GPA, but multiple other variables were identified as factors for admission. Although the scores on two of the standardized preadmission examinations (TEAS and A<sup>2</sup>) were predictive of program completion, further analysis of NCLEX-RN outcome was not completed.

Second-year ADN students were surveyed by Raman (2013) to determine which factors were significant for successful completion of the first year of the nursing program. This evaluation of first-year success is consistent with the research by Knauss and Willson (2013) who postulated attrition for nursing students is most significant during the first year. Multiple factors with potential influence on first-year success were identified by the author and studied for a sample of 104 participants (Raman, 2013). Students completed a survey instrument and ranked faculty support, general self-efficacy, academic self-concept, goal orientation, mathematics self-concept, and commitment to the nursing program. Faculty support, general self-efficacy, academic self-concept, and mathematics self-concept were all significantly ( $p < .05$ ) related to first-year program success (Raman, 2013). Students self-reported the prenursing GPA and current GPA. The prenursing GPA was significantly linked ( $p < .05$ ) with first-year success.

In the study by Raman (2013), the average current GPA was 3.48. Student perception of general self-efficacy, mathematics self-concept, and prenursing GPA represented the largest percent of variance for the current GPA (Raman, 2013). The average prenursing GPA for this group of students was 3.58, and the “*R* squared revealed that students’ prenursing GPA accounted for 38% of the variance...in current GPA” (Raman, 2013, p. 54). The stepwise regression analysis also found the student’s

mathematics self-concept explained 12.3% of the variance in current GPA. The prenursing GPA reported in Raman's 2013 study ( $M = 3.48$ ) was close to the preadmission GPA ( $M = 3.49$ ) reported by Shaffer and McCabe (2013). Shaffer and McCabe linked preadmission GPA with NCLEX-RN success.

Community college nursing students in California were studied to determine predictors of success as part of a grant to increase the number of graduates from nursing programs in that state. Seago, Keane, Chen, Spetz, and Grumbach (2012) studied 738 students from eight ADN programs to complete program evaluations for the grant. The authors collected data from students in four intervention colleges and four control colleges to determine which factors were related to program completion. All colleges studied had an open access admission policy; the intervention colleges had implemented programs to promote program completion. The interventions included increased financial aid, increased time in the skills laboratory, individual tutoring, and hiring of additional faculty. Nine percent of the students sampled did not graduate, and 2.4% did not graduate on time. On time graduation was defined as within 2 years (Seago et al., 2012).

Preadmission independent variables studied included the science GPA and the prenursing GPA, and the dependent variables were on-time graduation, any-time graduation, and no graduation. The mean prenursing GPA was calculated to be 2.76, and the mean science GPA was 2.66 (Seago et al., 2012). Although the science courses were not detailed in the article, the presence of science courses as a component of the prenursing courses indicates those variables were highly correlated. Logistic regression was performed, and higher prenursing and science GPAs significantly predicted ( $p <$

.001) on-time and any-time graduation. The authors recommended initiatives to improve prenursing grades as a strategy to increase graduation rates (Seago et al., 2012). The mean prenursing student GPA reported by Seago et al. (2012) was lower than the GPAs reported by Raman (2013) and Manieri et al. (2015), which were associated with first year and program completion. The average GPA associated with NCLEX-RN passage in the study by Shaffer and McCabe (2013) was also higher than the GPA reported by Seago et al.

Potential links between preadmission examinations and specific nursing course grades have also been studied. Knauss and Willson (2013) reviewed an admission assessment examination to determine if the assessment scores were correlated with course grades in nursing one and nursing two. One hundred and fifty-seven students completed the HESI A<sup>2</sup> examination as a component of the rubric established to rank students for admission into an ADN program. All data were obtained from a retrospective record review as a part of the program's curriculum revision. A prerequisite course required for this program was anatomy and physiology; a final course grade of C was required for admission. The A<sup>2</sup> examination scores for science were not included in this study (Knauss & Willson, 2013).

The researchers studied the A<sup>2</sup> examination component scores for basic mathematics skills, reading comprehension, vocabulary, and grammar. These four A<sup>2</sup> examination components were significantly correlated with nursing one at a  $p < .01$  level. Correlations with nursing two were also significant in all areas, with basic mathematics skills at a  $p < .05$  level, and reading comprehension, vocabulary, and grammar each at a  $p$

< .01 level. A positive correlation also existed between the A<sup>2</sup> examination scores and the nursing course final grades (Knauss & Willson, 2013).

The researchers postulated the most significant attrition in the nursing program occurred during the first year. The admission criteria were believed to be reliable predictors of student retention. The authors noted multiple curricula and faculty changes were made during this study but did not supply any specific information about the nature of those changes. Overall retention rates did not change as a result of admission changes (Knauss & Willson, 2013). This study provided a link between standardized testing and initial nursing course success. Additional research must be completed to determine a link between admission testing and NCLEX-RN results, and individual course grades and NCLEX-RN results.

A well-designed historical study frequently cited in recent research also identified relationships between prerequisite course grades and NCLEX-RN outcome for the ADN population. A descriptive study of 218 ADN students by Gilmore (2008) focused on admission criteria at two community college ADN programs. The ACT composite score (as well subscores on that test for mathematics, reading, English, and science), anatomy and physiology grades, and prenursing GPA were assessed to determine if those variables predicted program success and passage on the NCLEX-RN. Within the sample, 176 participants completed the nursing program and 91.5% passed the NCLEX-RN on the first attempt (Gilmore, 2008). This study indicated ACT composite scores, ACT mathematics and science subscores, prenursing GPA, and grades in anatomy and physiology were not predictive of nursing program success or NCLEX-RN success. The



small number of students who were unsuccessful on the licensure examination ( $n = 14$ ) limits the generalizability of this information regarding first-time NCLEX-RN outcome. However, the ACT English subscore was a significant predictor of success in the nursing program (Gilmore, 2008). The analysis of academic records indicated students who did not successfully complete the nursing program did have lower grades in the biological sciences. (Gilmore, 2008). As can be seen from the above discussion, the overview of literature for ADN programs evaluating the predictive ability of preadmission variables provides conflicting results.

To expand the literature review regarding the predictive ability of mathematics and science grades on NCLEX-RN outcome, I reviewed evidence at the baccalaureate level. For the BSN graduate, the data regarding science prerequisites differs from ADN data, but conflicting results still exist. Using a case management model, Elder et al. (2015) identified 83 out of 183 BSN students as at risk for failure in nursing courses or failing the NCLEX-RN. Data were analyzed using independent sample  $t$  tests for all prerequisite courses to determine if course grades predicted NCLEX-RN outcome. Students were considered at risk based on achieved scores for the Motivated Scores for Learning Questionnaire and when scores for content examinations fell below the 50th percentile (Elder et al., 2015). Results of this study indicated the science grades for chemistry, anatomy, microbiology, pathophysiology, and pharmacology were all significantly different between students considered at risk for first-time NCLEX-RN failure and those students considered not at risk. The preadmission GPA was also significant ( $p = .018$ ) for the identification of student outcome on the first attempt of the

NCLEX-RN (Elder et al., 2015). This research indicated students with higher-level skills in scientific reasoning, as evidenced by higher grades in science courses, are more prepared to be successful on the NCLEX-RN examination.

Another retrospective study of 187 BSN student records by Elkins (2015) was completed to determine if a relationship existed between admission criteria, program completion, and NCLEX-RN outcome. This convenience sample consisted of 136 students who completed the program and 51 students who did not. One hundred and twenty-one of the students who completed the program passed the NCLEX-RN on the first attempt. The researchers found the preprogram GPA, ACT scores, and the grades for the anatomy course were significant predictors ( $p < .05$ ) of program completion and NCLEX-RN pass (Elkins, 2015). It is interesting to note the grade in physiology was not significantly related to success with the licensure examination, in contrast with the research by Elder et al. (2015).

Lockie, VanLanen, and McGannon (2013) also studied academic variables and NCLEX-RN performance for a group of BSN graduates. The independent variable for this study was the NCLEX-RN pass rate, with 81.2% of the graduates ultimately passing the NCLEX-RN. Data regarding grades for freshman chemistry 108 (organic and biochemistry) and student participation in tutoring sessions were collected for 197 nursing students enrolled in freshman chemistry 108. Eighty-two percent of studied students earned grades of A, B, or C and passed freshman chemistry 108. All students enrolled in freshman chemistry 108 were offered the opportunity to participate in

supplemental instruction sessions. The majority of students (87.8%) attended less than six sessions, and 12.2% of students participated in six or more sessions (Lockie et al., 2013).

A significant relationship was found ( $p = .02$ ) between the freshman chemistry 108 pass and NCLEX-RN success, with 82.5% of the students who passed freshman chemistry 108 passing the NCLEX-RN. Most students who earned an A in freshman chemistry 108 passed the NCLEX-RN (90.2%). Only 60% of students who withdrew from or failed freshman chemistry 108 subsequently passed the NCLEX-RN (Lockie et al., 2013). No relationship was found between attendance at the chemistry tutoring sessions and NCLEX-RN outcome; therefore, a longitudinal influence of the supplemental instruction was not found (Lockie et al., 2013). The relationship between chemistry grades and NCLEX-RN outcome is consistent with the research completed by Elder et al. (2015).

Abele, Penprase, and Ternes (2013) completed a retrospective study of 327 students who were on academic probation or were dismissed from a BSN program. This program experienced a 33% attrition rate and the primary reason for attrition was academic failure. Students in the program under study were placed on academic probation when one undergraduate course was failed and dismissed from the program when two courses were failed. A logistic regression analysis was completed, with the binary dependent variable defined as students who stayed in the program or students who left the program. The independent variables were student outcomes on undergraduate courses, to determine which courses were predictive of student success in the program. The courses most commonly failed included microbiology, pathophysiology, and lifespan

psychology. Student grades in lifespan psychology were significantly related ( $p < .05$ ) to program completion. The odds ratio indicated a higher grade in lifespan psychology increased the odds a student would complete the program (Abele et al., 2013). This study found microbiology and pathophysiology grades were not significantly related to program completion, which contradicts subsequent studies by Elder et al. (2015) and Elkins (2015).

A study of 255 BSN student records was completed by Breckenridge, Wolf, and Roszkowski (2012). The researchers inputted student information into the Risk Assessment Profile, Strategies for Success (RAPSS) instrument to determine if demographic and academic factors could predict NCLEX-RN outcome. Of the sample studied, 133 students ultimately passed the licensure examination, and 122 students failed. The RAPSS is scaled to predict students at risk of failure. The undergraduate science GPA was the strongest predictor of NCLEX-RN failure ( $p = .001$ ). Repeating a science course was also a significant predictor ( $p < .05$ ). Science GPA, family income, and repeated science courses could accurately predict NCLEX-RN failure 63% of the time (Breckenridge et al., 2012). Subsequent studies by Elder et al. (2015), Elkins (2015), and Lockie et al. (2013) validated the relationship between science GPA and NCLEX-RN outcome.

The predictive ability of preadmission examinations and prenursing GPA was demonstrated in a large study of BSN graduates. McCarthy, Harris, and Tracz (2014) completed a retrospective study of the academic records for BSN students from four large universities ( $N = 794$ ) to predict NCLEX-RN pass rate. The preadmission examination

(TEAS) included reading, mathematics, science, and English subscores. Reading, mathematics, and science subscores were significantly correlated with NCLEX-RN outcome at the  $p < .001$  level. All four TEAS subscores were also significantly correlated ( $p < .001$ ) to the prenursing GPA. The prenursing GPA was significantly related to NCLEX-RN outcome (McCarthy et al., 2014). This study validated the use of preadmission testing and admission criteria related to mathematics and science to admit students who would be successful on the end of program licensure examination.

Indirect links between prerequisite grades and NCLEX-RN outcomes have also been demonstrated with the BSN population. Simon et al. (2013) used the NLN readiness examination as a reliable and valid predictor of NCLEX-RN outcome. These authors studied academic transcripts for 171 BSN graduates to determine which academic variables were associated with NLN readiness examination scores. The independent variables included the presence of transfer credits for prerequisite courses, grades in prerequisite courses, and grades in required clinical nursing courses. Chemistry course grades had a linear association with the NLN readiness examination, significantly predicting scores ( $p = .020$ ). Biology course grades were also predictive of scores on the readiness examination at a  $p = .003$  level (Simon et al., 2013). Mathematics and pharmacology scores were not significantly related to the standardized readiness examination outcome. The results of this study also found that students who had transfer credits were noted to have a higher GPA in general and tended to be older than students who entered nursing school without transfer credits. The presence of transfer credits was also found to have a linear association with scores on the readiness examination (Simon

et al., 2013). This study assumed that the NLN readiness examination was predictive of NCLEX-RN success. The linear association of chemistry and biology grades with the NLN readiness examination score supports the need for further research between these grades and NCLEX-RN results.

Herrera and Blair (2015) explored the premise that prerequisite science courses may provide foundational knowledge for nursing theory courses in a descriptive study. This 3-year review of transcripts for 366 BSN students identified a significant relationship ( $p = .000$ ) between grades in human pathophysiology and grades in an upper-level adult health course. Faculty identified more students failed the adult health course than any other upper-level course, and considered success in this course as a marker for program success (Herrera & Blair, 2015). Further research is necessary to determine if success in the human pathophysiology course or the adult health course is significantly linked to NCLEX-RN outcome.

This comprehensive review of the literature surrounding prerequisite mathematics and science grades for both ADN and BSN programs presents variable results. Additional research is necessary to determine if a significant relationship exists between mathematics and science course grades, prerequisite GPA, and NCLEX-RN outcome. My research explored potential links between mathematics and science grades and NCLEX-RN outcome for the ADN graduate.

Examination of preadmission data provides information to inform admission criteria for the studied ADN program. Identification of individuals who are prepared to be successful in the program and pass the NCLEX-RN is essential (Lavin & Rosario-Sim,

2013). However, stringent admission criteria may exclude diverse students with academic risk factors who might complete the program and pass the NCLEX-RN on the first attempt (Taylor et al., 2014). The belief that admission criteria alone should determine student success discounts the influence of faculty and curriculum in preparing graduates for NCLEX-RN success. Progression criteria are another element that must be explored in relation to NCLEX-RN outcome (Custer, 2016).

Program progression criteria include determination of the passing grade for nursing courses. A small study ( $N = 29$ ) of ADN students by Peterson-Graziose, Bryer, and Nikolaidou (2013) found a 29% attrition rate at the end of the first semester of the nursing program. All students who left the program during the first year did so because of academic disqualification secondary to GPA (Peterson-Graziose et al., 2013). Early identification of students at academic risk can impact student attrition. The next section of the literature review will highlight multiple studies that have established a relationship between grades in individual nursing courses and NCLEX-RN success.

**Nursing theory courses.** Literature regarding the impact of individual nursing theory courses for NCLEX-RN outcome is conflicting regarding the predictive ability of individual courses. Information is available for both ADN and BSN programs. Analysis of the relationship between grades in nursing theory courses and NCLEX-RN outcome provides data to inform progression policies within a nursing program.

Trofino's (2013) retrospective analysis of ADN transcripts collected data for nursing course grades in seven courses, including fundamentals, maternal child nursing, psychiatric nursing, nursing pharmacology, nursing leadership, adult medical-surgical

nursing, and advanced adult medical-surgical nursing. Results indicated higher letter grades in the following courses, nursing pharmacology ( $p < .001$ ), adult medical-surgical nursing ( $p < .05$ ), psychiatric nursing ( $p < .001$ ), nursing leadership ( $p < .001$ ), and advanced adult medical-surgical nursing ( $p < .05$ ), were associated with passing the NCLEX-RN on the first attempt. A statistically significant relationship was also found between two courses, nursing pharmacology ( $p < .05$ ) and advanced adult medical-surgical nursing ( $p < .05$ ) and the probability of NCLEX-RN pass (Trofino, 2013).

Data were also collected for students who repeated nursing courses secondary to course failure. Twenty-one students from the total sample ( $n = 85$ ) repeated a nursing course, and 28.6% of those students failed the NCLEX-RN. Calculation of the odds ratio indicated students who never repeated a nursing course were 3.5 times more likely to pass the NCLEX-RN (Trofino, 2013). This study did not indicate the passing score for a nursing theory course or include discussion of course difficulty. Additional research is necessary to provide data for decision-making regarding course rigor and progression policies.

Yates and Sandiford (2013) completed a correlational study of ADN students in Florida. A sample of 298 archived academic records was reviewed to determine if a relationship existed between nursing course theory grades and NCLEX-RN outcome. The logistic regression included data from obstetrical nursing, pediatric nursing, psychiatric nursing, and advanced medical-surgical nursing. The data analysis demonstrated only the advanced medical-surgical nursing course grade was significantly related ( $p = .014$ ) to NCLEX-RN outcome. Students who received a B in the advanced medical-surgical



nursing course were 90% likely to pass the NCLEX-RN, and students who received an A were 100% likely to pass (Yates & Sandiford, 2013). A combination of the NET preadmission examination and the final grade in the advanced medical-surgical nursing course correctly predicted NCLEX-RN pass for 94% of students, and predicted 47% of students who failed the NCLEX-RN (Yates & Sandiford, 2013). Information was not provided regarding the passing scores for the nursing courses or if students could repeat a course to progress in the program.

A correlational study of ADN students was completed by Schrum (2015) to describe academic variables, the use of a retention specialist, and student persistence to graduation. Academic records included in the sample ( $N = 168$ ) were from students admitted between November 2009 and May 2011. In contrast to previous studies by Trofino (2013) and Yates and Sandiford (2013), the analysis of the data found no significant differences between the cohorts regarding prenursing GPA or distribution of final grades in the medical-surgical nursing courses. The retention specialist provided tutoring and weekly application sessions specific to each medical-surgical nursing course. The services of the retention specialist were used by 66.1% of students, either by receiving tutoring or by attending the application classes offered throughout the program, or both. Twenty-two percent ( $n = 37$ ) of the studied sample withdrew from the program, with 43% ( $n = 16$ ) of those students leaving for poor academic performance (Schrum, 2015).

Students who were tutored by the retention specialist received significantly ( $p < .001$ ) higher course grades for medical-surgical nursing I, medical-surgical nursing

II, and medical-surgical nursing III. Also, students who attended the application classes earned significantly higher course grades in medical-surgical nursing I, II, and III at the  $p < .001$  level. Students who attended both the tutoring and the application classes provided by the retention specialist had a significantly higher mean GPA ( $p < .001$ ) than students who did not use the services of the retention specialist (Schrum, 2015). This study provides additional data regarding program completion to supplement previous work by Horton et al. (2012), Jeffreys (2007), and Trofino (2013).

A well-designed historical study by Jeffreys (2007) studied records of 112 nursing students to determine student retention and success. Individual nursing theory grades for the first medical-surgical nursing course ( $p < .05$ ), the pediatric nursing course ( $p < .05$ ), and the maternity nursing course ( $p < .05$ ) were significantly linked to NCLEX-RN passage (Jeffreys, 2007). Students who failed the first medical-surgical nursing course or who achieved the minimally passing grade of C+ in this course had increased attrition rates, increased rates of academic failure, and increased likelihood of NCLEX-RN failure. The impact of course grade in the initial medical-surgical nursing course on NCLEX-RN passage was replicated in other studies (Horton et al., 2012; Trofino, 2013).

Jeffreys's (2007) study found the prerequisite GPA and prerequisite course grades were not linked to NCLEX-RN outcome. However, those prerequisite grades were significantly linked to the outcome for the first medical-surgical nursing course, which was significantly linked to NCLEX-RN outcome. This data spoke to the foundational nature of the prerequisite courses. Ninety-four percent of students with no withdrawals or failures in nursing courses passed the NCLEX-RN on the first attempt, while only 50% of

students with two failures or withdrawals passed on the first attempt. The number of withdrawals and failures in nursing courses was inversely related to first-time NCLEX-RN pass with a  $p = .004$  (Jeffreys, 2007). Trofino's (2013) study replicated the impact of course withdrawal and failure on NCLEX-RN pass rate. Both researchers indicated targeted remediation could be implemented for students identified as at risk as part of progression policy development.

Additional research into nursing course grades and NCLEX-RN outcome for the ADN students has yielded varying results. DeLima et al. (2011) completed a retrospective review of the academic characteristics of 38 graduates. Nineteen of those graduates failed the NCLEX-RN, and 19 passed the NCLEX-RN on the first attempt. Final course grades for five clinical nursing courses including fundamentals, medical-surgical nursing one, parent-child, mental health, and medical-surgical nursing two were analyzed. Final grades for the parent-child and mental health courses were significant predictors of NCLEX-RN success ( $p \leq .05$ ) for this small group of ADN students (DeLima et al., 2011).

Faculty members at the studied program administered NLN content examinations to reflect the student's knowledge of course content, in addition to course grades. The NLN content examination results for fundamentals, parent-child, and the mental health course were also included in the academic variables studied. Those NLN test scores for fundamentals, parent-child, and mental health were significantly linked to NCLEX-RN outcome. The study by DeLima et al. (2011) replicated the findings by Jeffreys (2007) regarding the individual course grades for parent-child/maternity pediatrics nursing and

the impact on NCLEX-RN outcome. The end of course grades in fundamentals ( $p = .19$ ) and medical-surgical nursing ( $p = .74$ ) were not significantly linked to NCLEX-RN outcomes (DeLima et al., 2011), which conflicts with the results published by Trofino (2013). The significant link between NLN content examination results for mental health nursing ( $p = .00$ ) and NCLEX-RN outcome is consistent with the findings linking the course grade for mental health nursing ( $p = .0004$ ) and NCLEX-RN outcome found in the Trofino (2013) study.

Nursing course knowledge can also be evaluated through the use of content-specific examinations. NCLEX-RN pass rates were significantly improved with the implementation of a testing policy, which included course examination and HESI content-specific examinations for ADN students (Schroeder, 2013). The studied sample of 572 students included 304 students whose academic records were studied prior to implementation of the interventions and 268 whose records were studied after curricular changes were implemented. At this ADN program, a retention coordinator was hired to evaluate the ADN program's curriculum and examinations, identify students at risk for course and NCLEX-RN failures, provide student remediation, and act as a faculty resource for test construction. Course examinations were reviewed and revised to incorporate criteria for writing critical thinking test items (Schroeder, 2013).

HESI content-specific examinations were also administered to validate course curriculum and provide students with additional experience with NCLEX-RN style questions (Schroeder, 2013). The authors did not share information regarding a comparison between HESI score and course grade. The HESI RN Exit Exam was

administered to the intervention group, but an analysis of correlation between that examination and NCLEX-RN outcome was not provided. After faculty education and integration of the HESI examinations, policies for testing were developed to maintain standards and consistency. Consequences for failure of HESI specialty examinations were included in the testing manual, but not shared in the article (Schroeder, 2013). The researcher used a *t* test to compare pass rates for the NCLEX-RN both before and after the implementation of the new testing policy to determine efficacy. Of the 304 students who completed the program and took the NCLEX-RN examination prior to implementation of the new testing policy, 89.14% passed the NCLEX-RN on the first attempt. After the implementation of the testing policy, 260 students (97.01%) passed the NCLEX-RN on the first attempt, and the difference between the two groups was significant at  $p < .01$  (Schroeder, 2013). The authors noted 11.84% fewer students graduated from the program after interventions, possibly because of the increased rigor associated with the testing policy (Schroeder, 2013).

Horton et al. (2012) studied the effect of remediation on first-time NCLEX-RN outcome. The impact of course grades and participation in a remediation program was studied to determine the impact on NCLEX-RN outcome. Academic records from a convenience sample of 92 ADN students from two sequential graduating classes were studied. Students from the first graduating class ( $n = 41$ ) were considered the preintervention group. The preintervention group received remediation throughout the program based on course grades. Students were also assigned content tutorials and quizzes developed by an outside vendor, which were specific to each course. The second

cohort of 51 students participated in an enhanced remediation program. This intervention group also received remediation throughout the curriculum based on individual course grades but were assigned additional self-study tutorials with required remediation specific to each course. The amount of required tutorial remediation for students in the intervention cohort was based on the difficulty of the content for each course. In addition, the intervention group completed an NCLEX-RN predictor examination during the senior year, with mandatory remediation based on student scores (Horton et al., 2012).

Logistic regression analysis was used by Horton et al. (2012) to determine the impact of the independent variables on NCLEX-RN outcome. Graduates who participated in the remediation group demonstrated a 13.1% higher NCLEX-RN pass rate, with 93.6% of those graduates passing the NCLEX-RN on the first attempt. The student's first-year medical-surgical nursing grade was a significant predictor ( $p = .003$ ) of NCLEX-RN success, "with increase of 1 point, student will have 2.36 times improvement in odds of passing." (Horton et al., 2012, p. 149). The predictive ability of the initial medical-surgical nursing course grade on NCLEX-RN outcome demonstrated in this study is consistent with studies completed by Trofino (2013) and Jeffreys (2007).

Individual course grades, end of course scores on standardized examinations, and end of program NCLEX-RN predictor examination scores were studied to determine if a predictive relationship existed between student scores and NCLEX-RN outcome (Schooley & Kuhn, 2013). Academic transcripts for 306 ADN students were reviewed for course grades and HESI examination scores and subsequently compared with the students' NCLEX-RN outcome. The researchers used a binary logistic model and

analysis of variance model to explore the relationships between NCLEX-RN outcome and the course-specific HESI examination scores, HESI RN Exit Examination score, grades for general education courses, and grades for nursing courses for the studied students. The authors sought to identify which HESI examination scores predicted NCLEX-RN outcome and which course grades predicted HESI examination scores (Schooley & Kuhn, 2013). The authors collected data for students' first and last NCLEX-RN attempts. The students' cumulative GPA for the program and the high school percentile rank were controlling variables for the ANOVA analysis.

The analysis of data indicated the HESI examination associated with the fundamentals nursing course significantly predicted the NCLEX-RN first-time result in all eight binary logistic models studied at a  $p < .05$  level (Schooley & Kuhn, 2013). The HESI end of course exit examination predicted NCLEX-RN outcome in eight of 16 models including both first and last NCLEX-RN attempt. The HESI examination associated with the maternity course was significantly predictive of the NCLEX-RN outcome for two of the eight models for the outcome on the first attempt of the NCLEX-RN. End of course grades in maternity, pediatric, psychiatric-mental health, and medical-surgical nursing significantly predicted each course's content-specific HESI examination score. Three nursing courses (pediatric nursing, medical-surgical nursing, and maternity nursing) significantly influenced the result of HESI examination scores ( $p < .01$ ). These three course grades were linked to HESI test and NCLEX-RN success and provided core knowledge needed for NCLEX-RN success. The authors concluded scores in the fundamentals HESI exam, the HESI Exit Exam, and the HESI maternity exam, and

course grades in pediatric nursing, medical-surgical nursing, and maternity nursing could provide information for progression policies and early intervention (Schooley & Kuhn, 2013).

This review of the evidence for ADN students indicates frequent positive correlations between medical-surgical nursing course grades and NCLEX-RN outcomes (Horton et al., 2012; Jeffreys, 2007; Schooley & Kuhn, 2013; Trofino, 2013; Yates & Sandiford, 2013). Maternity nursing course grades were found to be statistically significant in studies by Jeffreys (2007), DeLima et al. (2011), and Schooley and Kuhn (2013). Conflicting information was found regarding the impact of mental health, pediatric, and fundamental nursing course grades and the licensure examination results for ADN graduates (DeLima et al., 2011; Schooley & Kuhn, 2013; Yates & Sandiford, 2013). Additional study of the relationship between the end of course grades and NCLEX-RN outcome with a large sample is necessary to add to the body of academic nursing research specific to ADN programs.

Research at the baccalaureate level has identified relationships between a variety of courses and the NCLEX-RN outcomes. End of course grades in the nursing fundamentals course have been identified in several studies as a predictor of NCLEX-RN results. A retrospective record review of 153 BSN students found a relationship between the foundational nursing theory course grade and the NCLEX-RN outcome (McGahee et al., 2010). In this research study, prerequisite science GPA was significantly linked with student performance in nursing fundamentals, health assessment, and pathophysiology. Four first semester nursing course grades were among the independent variables studied,



and included one clinical course (fundamentals of nursing), a simulation course (health assessment), and two theory courses (theoretical foundations and pathophysiology). The minimum score to pass a nursing course for the program where data collection took place was 80%. A passing grade in theoretical foundations had significant effect at the  $p < 0.001$  level for NCLEX-RN success. An end of program exit examination developed by an unnamed independent vendor was also found to be significantly linked to NCLEX-RN success at the  $p = .03$  level (McGahee et al., 2010).

Program changes were implemented during early data collection to address concerns with admission criteria, progression policy, and implementation of a standardized testing program (McGahee et al., 2010). Students with more than one failure in a science course were not eligible for admission to the nursing program. The passing score for a nursing course was increased to 80% with no more than one nursing course failure allowed for a student to continue the program, and medical-surgical content hours were increased and split into two courses. The time allowed for completion of the nursing program was decreased, and standardized testing and remediation were required throughout the program. After these changes, the NCLEX-RN pass rate increased from 83% to 93%. The program changes were included in the database to determine the significant impact on NCLEX-RN results. Two-way interactions were found to be significant between science GPA and the fundamentals course ( $p = .002$ ), science GPA and the health assessment course ( $p = .04$ ), and an RN assessment test and the fundamentals course ( $p = .006$ ). A three-way interaction between science GPA, the RN assessment test, and the health assessment course at the  $p = .006$  level supported thinking

that foundational science and nursing courses are integral to building knowledge necessary for end of program success (McGahee et al., 2010).

Alameida et al. (2011) reviewed the academic records for a large group ( $N = 589$ ) of BSN students. The authors used a retrospective descriptive study design and Statistical Package for the Social Sciences (SPSS) to complete data analysis of academic achievement and NCLEX-RN outcome. The independent variables included course grades for each course in the curriculum, and the dependent variable was first-time outcome on the NCLEX-RN. A chi-square analysis was done to determine which nursing courses were correlated with first-time NCLEX-RN success. Students were split into two study groups. The first group consisted of 367 students. A significant correlation at the level of  $p = .000$  was found between five nursing course grades and first-time NCLEX-RN outcome. The nursing courses found to have significant impact on NCLEX-RN outcome were health assessment, medical-surgical nursing theory, pharmacology, pathophysiology, and community public health nursing theory.

The second group studied by Alameida et al. (2011) consisted of 222 students. For the second group, a significant correlation ( $p = .000$ ) was found between NCLEX-RN first-time pass and the following nursing courses: health assessment, medical-surgical nursing theory, medical-surgical nursing practicum, pathophysiology, foundations, and maternal child nursing theory (Alameida et al., 2011). Consistent findings between McGahee et al. (2010) and Alameida et al. were noted with a significant correlation between NCLEX-RN outcome and the health assessment, foundational theory, and pathophysiology courses.

A significant relationship ( $p = .021$ ) was found between the course grade in medical-surgical nursing and NCLEX-RN outcome in a study by Silvestri, Clark, and Moonie (2013). One hundred and sixty-nine students self-reported academic variables and NCLEX-RN outcome via an electronic survey. Thirteen percent of the sample reported first-time failure on the NCLEX-RN and 87% ( $n = 147$ ) reported NCLEX-RN pass. Logistic regression analysis of the surveys was completed. Course grades in fundamentals ( $p = .957$ ), pharmacology ( $p = .072$ ), and leadership/management ( $p = .226$ ) did not significantly influence NCLEX-RN pass (Silvestri et al., 2013). This study conflicts with previous studies by McGahee et al. (2010) and Alameida et al. (2011) regarding the relationship between foundations and NCLEX-RN outcome.

Penprase and Harris (2013) conducted a descriptive study of 363 accelerated BSN students and found the health assessment course was significantly ( $p < .001$ ) related to NCLEX-RN success. This nursing assessment course was considered the foundation for clinical courses in the program, foundational for the advanced medical-surgical nursing content, and provided experience in critical thinking skills. The health assessment course was taught in a blended didactic and simulation style, similar to the health assessment course described by McGahee et al. (2010). The significant correlation between the health assessment course and the NCLEX-RN outcome is consistent with research results published by McGahee et al. and Alameida et al. (2011).

Students studied also completed the ATI Comprehensive Predictor Exam prior to the first NCLEX-RN attempt in the Penprase and Harris (2013) study. A Pearson correlation was performed, and the predictor examination was significantly correlated

( $p < .001$ ) with NCLEX-RN success (Penprase & Harris, 2013). After calculation of a multiple linear regression, a significant relationship emerged, “the predictor examination alone accounted for 16% of the variance in NCLEX-RN passage.” (Penprase & Harris, 2013, p. 28). Students identified as at risk after completion of the predictor examination were required to attend an NCLEX-RN review course and participate in a remediation program with faculty. Eighty-eight percent of the students in this sample were successful on the first attempt of the NCLEX-RN (Penprase & Harris, 2013). The predictive ability of an end of program NCLEX-RN preparation examination for BSN students was consistent with results for ADN students (Schooley & Kuhn, 2013).

Content-specific standardized examinations have been used to assess a student’s knowledge base for individual nursing theory courses without describing corresponding course grades. Yeom (2013) studied the academic records of 151 baccalaureate students who completed standardized examinations composed by a commercial vendor, to link content mastery with NCLEX-RN success or failure. Students were split into two groups, those who passed the first attempt on the NCLEX-RN ( $n = 118$ ) and 33 who failed the first attempt on the NCLEX-RN. All students took the fundamentals and mental health nursing examinations during the second year of study. Maternal-newborn nursing, nursing care of children, and pharmacology content examinations were administered during the third year. Adult medical-surgical nursing, community health, and leadership-management examinations were taken during the fourth year of the studied BSN program. Student scores on the first attempt of each examination were recorded for the study, and content-specific standardized examinations were taken at the end of the

corresponding course. A *t* test was completed to determine if statistically significant differences existed between student scores on each of the content-specific examinations for both groups (Yeom, 2013).

Logistic regression was used to determine if these content-specific standardized examinations would predict student NCLEX-RN outcome (Yeom, 2013). No statistically significant difference was found between participants who passed or failed the NCLEX-RN for examinations in fundamentals ( $p = .62$ ) and nursing care of children ( $p = .759$ ). The results from this study, regarding the significance of fundamentals examination and NCLEX-RN result, conflicted with results from other studies which examined fundamentals course grades and NCLEX-RN outcome (Alameida et al., 2011; DeLima et al., 2011; McGahee et al., 2010; Schooley & Kuhn, 2013; Trofino, 2013). The lack of a significant relationship between NCLEX-RN outcome and pediatric content examination grade also differs with previous research by Jeffreys (2007).

Yeom (2013) did note significant differences between the NCLEX-RN pass and fail groups for examinations taken in medical-surgical nursing ( $p = .000$ ), pharmacology ( $p = .000$ ), maternal newborn nursing ( $p = .003$ ), mental health nursing ( $p = .002$ ), community health ( $p = .000$ ), and leadership ( $p = .001$ ). Students who were successful on the NCLEX-RN had higher mean scores on the end of course standardized examinations. Researchers found the administered examinations were more accurate in predicting NCLEX-RN success than predicting NCLEX-RN failure (Yeom, 2013). The ability of the content-specific examinations to significantly predict NCLEX-RN outcome in the study by Yeom replicated the findings of significant course grades among BSN students

found by Alameida et al. (2011) for medical-surgical nursing, maternity nursing, community health nursing, and pharmacology.

Standardized content-specific examinations were also studied to determine if a relationship existed between examination outcome and first-time NCLEX-RN outcome in a study by Emory (2013). A convenience sample of 119 BSN student records was analyzed to determine if the scores on ATI content-specific examinations correlated with NCLEX-RN results. All students in the sample completed the fundamentals, pharmacology, and mental health examinations, which were administered during the first two semesters. All students took the NCLEX-RN, with 112 who passed and seven who failed on the first attempt. Initial *t* tests found a significant difference between the mean of the pharmacology examination ( $p = .02$ ) and the fundamentals examination ( $p = .03$ ) for students who passed versus students who failed the licensure examination (Emory, 2013). The subsequent logistic regression analysis with a stepwise procedure indicated only the pharmacology examination score was significant at a  $p = .02$  level. The content-specific examination for pharmacology “predicted NCLEX-RN outcomes of pass or fail accurately 73.7% of the time” (Emory, 2013, p. 68). A significant limitation of this study is the small number of students who failed the NCLEX-RN on the first attempt, which limits the generalizability of these results beyond the sample population. The results for the predictive ability of the pharmacology examination were consistent with the findings in the larger study by Yeom (2013).

Simon et al. (2013) considered the NLN readiness examination as a valid and reliable predictor of student results on the NCLEX-RN for a group of 171 BSN students.

A descriptive correlational study of academic transcripts investigated the relationship between clinical nursing course grades and the score for the readiness examination. The clinical nursing courses were composed of adult health and specialty content areas. Nursing one included adult health and maternity nursing, nursing two consisted of adult health and pediatrics, nursing three contained adult health and mental health nursing, and nursing four incorporated adult health and community health nursing. A linear relationship was found between the grade for the first nursing course (adult health and maternity nursing) and the NCLEX-RN readiness examination. Nursing course grades were significantly correlated ( $p < .01$ ) with each other (Simon et al., 2013).

This review of the literature demonstrates multiple studies have been completed to identify which nursing course grades are predictive of NCLEX-RN outcome. Common nursing courses for an ADN program include medical-surgical nursing, maternity nursing, pediatric nursing, fundamentals in nursing, and mental health nursing. Significant correlations were found in multiple studies between medical-surgical nursing course grades and NCLEX-RN outcome for both ADN and BSN samples (Alameida et al., 2011; Horton et al., 2012; Jeffreys, 2007; Schooley & Kuhn, 2013; Simon et al., 2013; Trofino, 2013; Yates & Sandiford, 2013; Yeom, 2013). Many studies for both types of programs also found significant correlations between maternity nursing and NCLEX-RN outcome (Alameida et al., 2011; DeLima et al., 2011; Jeffreys, 2007; Schooley & Kuhn, 2013; Simon et al., 2013; Yeom, 2013). Conflicting results exist regarding the ability for the pediatric nursing course grade (Jeffreys, 2007; DeLima et al., 2011; Schooley & Kuhn, 2013; Yates & Sandiford, 2013; Yeom, 2013), the fundamentals

course grade, and the mental health course grade (DeLima et al., 2011; Schooley & Kuhn, 2013; Trofino, 2013; Yates & Sandiford, 2013; Yeom, 2013) to predict NCLEX-RN outcome. This variability in the literature identifies a gap in the evidence regarding the predictability of individual nursing course grades on NCLEX-RN outcome. Additional research is necessary.

My study provides additional data from a large sample of ADN students to identify if individual nursing course grades can significantly predict NCLEX-RN outcome for the program under study. The studied ADN program records indicate the existence of consistent rubrics for grading written work, and a curriculum map regarding rigor of course quizzes and examinations, for all eight nursing theory components. The presence of these guidelines provides a leveled base for evaluating the predictive ability of individual courses and NCLEX-RN outcome for this ADN program.

Nationally, grading policies are not consistent within or between institutions and programs of nursing (Merkley, 2016). Educators must review evaluation methods for all courses to establish standards for rigor to prepare students for the NCLEX-RN (Serembus, 2016). Inconsistencies with grading and course rigor may limit the ability of a researcher to establish correlation between individual course grades and NCLEX-RN results. To manage this concern, researchers have evaluated the predictive ability of the nursing GPA. The nursing GPA provides a summative evaluation of students' nursing theoretical foundation. The literature surrounding the nursing GPA and NCLEX-RN outcome is explored next.

**Nursing GPA.** Although evidence identifying significant relationships between



individual nursing course grades and NCLEX-RN outcomes is variable, nursing GPA has been identified as a significant predictor of NCLEX-RN outcome in several studies.

Romeo (2013) studied student scores for a critical thinking assessment, nursing GPA, and the preadmission combined SAT score for 91 students who passed the NCLEX-RN and 91 students who failed the NCLEX-RN in a retrospective study of 182 ADN students' academic records. Students completed the SAT prior to admission, the nursing GPA was calculated based on all nursing courses, and the critical thinking examination was administered during the last semester of the program. Critical thinking examination scores were significantly correlated ( $p < .001$ ) with nursing GPA. Logistic regression analysis identified nursing GPA as the strongest predictor ( $p < .001$ ) of NCLEX-RN success. "The mean nursing GPA was 3.08 among those who passed the NCLEX-RN the first time and 2.49 among those who failed" (Romeo, 2013, p. 250).

Truman (2012) also found ADN students who passed the NCLEX-RN had nursing course GPAs ( $M = 2.65$ ) that were significantly higher ( $p = .000$ ) than the nursing course GPA ( $M = 2.25$ ) for students who failed. Students were required to earn at least a C in each nursing course to continue in the program. A negative correlation was found between the number of C grades earned in nursing courses and NCLEX-RN passage. Students who passed the NCLEX-RN earned a mean of 2.25 C grades and students who failed earned a mean of 3.60 C grades (Truman, 2012). The nursing GPA was identified as a significant predictor through logistic regression, "for every 1.0 increase in nursing didactic GPA, the subject was 35.09 times as likely to pass the NCLEX-RN" (Truman, 2012, p. 43). This descriptive correlational study by Truman involved 188 ADN students,

138 students who were successful on the NCLEX-RN first attempt, and 50 students who failed their first attempt on the NCLEX-RN.

The studies by Romeo (2013) and Truman (2012) replicated the results for nursing GPA from previous studies by Gilmore (2008) and Jeffreys (2007). Gilmore (2008) completed a retrospective study of 218 ADN students to explore the potential link between admission criteria and student success in the nursing program. Nursing GPA and NCLEX-RN passage measured student success. Students were split into two groups, consisting of the 176 who completed the nursing program and the 42 who did not. Of the students who completed the program, 91.5% passed the NCLEX-RN on the first attempt. Nursing GPA was identified as statistically significant ( $p < .05$ ) in predicting first-time NCLEX-RN success among the participants, with a mean nursing GPA 0.3 points higher for students who passed the NCLEX-RN on the first attempt than the mean nursing GPA of students who failed the NCLEX-RN on the first attempt (Gilmore, 2008). The descriptive analysis by Jeffreys (2007) identified students with a nursing GPA of a B or higher passed the NCLEX-RN on the first attempt with a significance level of  $p = .004$  (Jeffreys, 2007). This finding was replicated in the study by Romeo (2013) who also noted a nursing GPA of B (3.08) was associated with NCLEX-RN pass.

In contrast to the other studies regarding nursing GPA and NCLEX-RN outcome, Chen and Bennett (2016) conducted a longitudinal study of 453 ADN students' academic records and created a decision tree to attempt to predict first-time outcome for the NCLEX-RN examination. Data from 5 years of students (2008-2013) were reviewed to include each semester's cumulative GPA for nursing courses, student demographic

information, preadmission GPA, TEAS score, and student score on the ATI Comprehensive Predictor (NCLEX-RN readiness) examination. A CHAID analysis of the data revealed only the ATI Comprehensive Predictor examination was statistically significant in predicting NCLEX-RN success or failure. The GPA for nursing courses did not significantly predict NCLEX-RN outcome at a significance level of  $p < .05$  (Chen & Bennett, 2016). These findings regarding nursing GPA are consistent with an earlier study by Yates and Sandiford (2013).

A logistic regression analysis of 19 predictor variables associated with admission and progression data from academic records of 298 ADN students by Yates and Sandiford (2013) also did not find the nursing GPA or the ATI achievement exit examination to significantly predict student success on the NCLEX-RN. Seventy-eight percent of the sample students in this study passed the NCLEX-RN on the first attempt, and 22% failed in this multicampus study. The nursing GPA was calculated based on the student's first attempt at each course, but the mean GPA and the calculated significance level were not reported (Yates & Sandiford, 2013).

Abele et al. (2013) completed a logistic regression analysis of factors predicting BSN program completion and noted the number of course failures was significantly related ( $p < .001$ ) to student attrition. The odds ratio analysis showed, "for every course failure, the odds that a student will complete the program are more than halved relative to a student with one fewer failure" (Abele et al., 2013, p. 260). Course failures are linked with a program's progression policy and have a negative impact on the student's GPA. The data were relevant in that students who do not persist and successfully graduate from

a nursing program are not eligible to take the NCLEX-RN. Previous research by Jeffreys (2007) linked the number of course failures for ADN students inversely with NCLEX-RN pass, for the students who did complete the program.

Other studies of nursing programs have identified nursing GPA as a significant predictor of NCLEX-RN outcome. Alameida et al. (2011) collected data from 589 BSN students in a prelicensure program. Multiple predictor variables were considered, including demographic data, academic grades, and scores on an end of program predictor examination. Participants were divided into two groups, based on the version of the ATI NCLEX-RN predictor examination the participant took. The nursing GPA was significantly correlated ( $p < 0.001$ ) with first-time NCLEX-RN passage for both groups.

Lavandera et al. (2011) conducted a multiyear study of 240 predominately minority BSN graduates to evaluate HESI test scores, academic performance, and NCLEX-RN outcome. The HESI exit scores significantly predicted success on the licensure examination. Nursing GPA was also significantly correlated with NCLEX-RN outcome, “Increasing the nursing GPA by one standard deviation (+0.30) increased the odds of timely licensure by 1.58 times, and getting at least one D or F grade [in a nursing, science, or mathematics course] decreased the odds of timely licensure by 0.29 times” (Lavandera et al., 2011, p.5).

Nursing GPA reflects a nursing student’s ability over time. My research provides additional data regarding the impact of nursing GPA on NCLEX-RN outcome for the ADN student. Regression analysis of the nursing GPA coupled with the impact of

individual course grades on the students' NCLEX-RN outcome provides information for the studied ADN program to inform progression and remediation policies.

Progression policies establish passing grades for courses, and establish the number of times a student may withdraw from, or fail, a nursing course before a student is dismissed from the program (Crow & Bailey, 2015; Serembus, 2016). The number of nursing course failures or withdrawals secondary to academic performance may not be clear on an academic transcript once a course has been repeated, as the most recent grade is frequently recorded over the previous grade(s). This method of recording course grades can diminish the usefulness of the nursing GPA as a predictor. Capture of the number of times a student fails a nursing theory component provided a more holistic understanding of nursing GPA. The predictive nature of a student's academic performance was explored more fully with the analysis of these additional variables.

In addition to nursing GPA, a student's cumulative GPA reflects academic ability for all courses in the nursing program. Calculation of the cumulative GPA occurs too late in the program for successful student remediation, although participation in a review course at the end of the nursing program has been identified as a strategy for student NCLEX-RN success (Serembus, 2016). The literature provides evidence surrounding the relationship between cumulative GPA and NCLEX-RN outcome.

**Cumulative GPA.** Data describing the relationship between cumulative GPA, program success, and NCLEX-RN results can be found for both ADN and BSN programs. Kaddoura et al. (2017) analyzed the academic records of students ( $N = 235$ ) in an accelerated BSN program to determine if a relationship existed between cumulative

GPA and first-time NCLEX-RN pass. The cumulative GPA was a significant predictor of success ( $p < .0001$ ) on the NCLEX-RN. Data were also collected for the number of course grades less than or equal to C, which also proved to be significantly significant ( $p = .0023$ ) in predicting the NCLEX-RN pass (Kaddoura et al., 2017). This study reinforced the findings of previous studies (Brodersen & Mills, 2014; Simon et al., 2013).

Brodersen and Mills (2014) completed a descriptive correlational study to evaluate the predictive ability of two predictor examinations. Data gathered included the student scores on the exit examinations, ACT scores, demographic information, and cumulative GPA for upper-division BSN students. The students' cumulative GPA ranged from 2.77 to 3.99. The mean cumulative GPA for the sample ( $N = 317$ ) was 3.3. A logistic regression analysis was performed; students who failed the NCLEX-RN had significantly lower cumulative GPA ( $p < .01$ ) than students who were successful (Brodersen & Mills, 2014).

Simon et al. (2013) also studied the academic records for BSN students ( $N = 174$ ) to determine which academic variables were significantly linked to an NLN-developed NCLEX-RN readiness examination. As previously discussed, relationships were found between the readiness examination score and science grades, and the readiness examination and the nursing fundamentals course grade. Transfer students were identified to be older students with higher GPAs. Cumulative GPA was significantly linked with student success ( $p = .001$ ) on the readiness examination when interacted with student transfer status, which supported the "supposition that second-degree

baccalaureate students who already have a science degree can be very successful in passing the NCLEX-RN” (Simon et al., 2013, p. 23).

Previous studies conflict with the results by Brodersen and Mills (2014), Kaddoura et al. (2017), and Simon et al. (2013). Alameida et al. (2011) analyzed the academic records of prelicensure BSN and masters nursing students ( $N = 589$ ) to determine which academic factors were linked to NCLEX-RN first-time passage. The mean GPA of the entire sample was 3.53, with a standard deviation of 0.42. Differences were found between the mean cumulative GPA of students who passed the NCLEX-RN on the first attempt and students who failed the NCLEX-RN on the first attempt. In the final analysis, the cumulative GPA was not significantly related to NCLEX-RN first-time pass (Alameida et al., 2011).

DeLima et al. (2011) compared the academic records of 19 students who passed the NCLEX-RN and 19 students who failed the NCLEX-RN on the first attempt. The cumulative GPA for the students who passed the NCLEX-RN was 2.65, and the cumulative GPA for the students who failed the NCLEX-RN was 2.56. The cumulative GPA was not found to be significant ( $p = .37$ ) in relation to NCLEX-RN outcome for this small sample of ADN students (DeLima et al., 2011).

Yates and Sandiford (2013) replicated this lack of a significant relationship between cumulative GPA and NCLEX-RN outcome in a review of academic records for 298 ADN students. Multiple academic and demographic variables were analyzed using point biserial correlations and chi-square analyses, with logistic regression to predict variables associated with NCLEX-RN success. Although students who passed the

NCLEX-RN had a higher cumulative GPA than students who failed, a significant relationship between cumulative GPA and NCLEX-RN pass rates was not found (Yates & Sandiford, 2013).

Cumulative GPA was not found to predict program completion in a study of ADN students. Seago et al. (2012) completed a summative evaluation to describe the success of interventions initiated for four community colleges in California. This large sample of 738 students had an cumulative GPA of 2.56. When a logistic regression was performed, the cumulative GPA did not significantly predict program graduation, although the prenursing GPA and the science GPA did (Seago et al., 2012).

Cumulative GPA is used as a benchmark for student progression at the program under study. I gathered academic data including the cumulative GPA to determine if the GPA is associated with NCLEX-RN results. The study site may evaluate progression policies related to academic standing and opportunity for student remediation based on the data gathered.

Program progression policies also determine the length of time a student may use to complete a nursing program. These policies accommodate the students' need for flexibility to manage life events and allow for part-time study (Crow & Bailey, 2015). Concerns about the length of time between program enrollment, completion and NCLEX-RN first-time pass rate are a factor in setting progression policies. Literature relevant to time-lapse factors and impact on NCLEX-RN outcome is explored next.



### **Time-Lapse Factors and NCLEX-RN Pass Rate**

Very limited information is available within nursing education research to equate time-lapse factors and NCLEX-RN success or failure. A review of 153 BSN students by McGahee et al. (2010) identified the number of semesters necessary to complete the program as an independent variable. The researchers did not find the number of semesters taken to finish the nursing program to be statistically significantly related to NCLEX-RN outcome. An anecdotal recommendation by Lavin and Rosario-Sim (2013) states, “Students should be encouraged to schedule the NCLEX examination within the first three months of program completion” (p. 198). The recommendation was based upon the “authors’ experience as educators and as test consultants for the National League for Nursing Testing Services” (Lavin & Rosario-Sim, 2013, p. 196). Data to support this recommendation were not provided.

Eich and O’Neill (2007) authored a study for NCSBN looking at the relationship between NCLEX-RN outcome and time lag between the date of eligibility for NCLEX-RN and the first attempt on the licensure examination. Information for individuals who were educated in the United States and took the NCLEX-RN between 2003 and 2005 was analyzed. Time lag was split into four quartiles based on the distribution of the testing population. The 25% quartile was 0–21 days, 50% was 22–33 days, 75% was 34–54 days, and the 100% quartile was 55–365 days (Eich & O’Neill, 2007). Longer time between the date of eligibility and the first attempt on the NCLEX-RN is associated with lower passing rates (Table 2).

Table 2

*RN Pass Rates Associated with Time Lag between Eligibility and First NCLEX-RN Attempt*

Days between eligibility and first attempt	Number of first attempts	First-time pass rate
0–21	77,459	90.1%
22–33	80,494	88.1%
34–54	73,151	85.0%
55–365	30,760	77.0%

Eich and O’Neill (2007) did not collect additional data from the graduates who tested, to determine which factors might provoke or delay testing after eligibility is determined.

Woo et al. (2009) subsequently analyzed 176,539 NCLEX-RN examinations taken between 2006 and 2008 to determine if a relationship existed between NCLEX-RN passage and delay in taking the examination. The average time for RN candidates to make the first attempt on the NCLEX-RN was 34.79 days. A moderated logistic regression was completed using statistical analysis software, indicating a significant ( $p < .0001$ ) inverse relationship between time lag and outcome on the NCLEX-RN (Woo et al., 2009). A significant inverse relationship was also found between the number of attempts on the licensure examination and the examination outcome. This information does indicate the graduate’s first-time pass rate decreased when the time lag increased. However, a causative relationship between time lag and NCLEX-RN result cannot be established. Many factors including perceived readiness to take the examination, anxiety, and self-confidence can impact both test scheduling and test result. The authors suggested

graduates who are not actively practicing nursing may suffer a decrease in nursing knowledge and skills during the lag time (Woo et al., 2009). The decrease in first-time NCLEX-RN pass rate with increased time lag noted in the Woo et al. study has prompted nursing faculty to recommend students prepare and test as soon as possible (Serembus, 2016).

Other educational programs involve a certification or licensure examination after a program of study. Literature exists from other health-related fields regarding a link between delays in examination taking and negative examination outcomes. This literature was explored to broaden the understanding of the effect of time on end of program, standardized examinations. An example from health care is particularly relevant because science and mathematics form the foundation for other courses, which build upon each other in a way similar to nursing education.

Brown et al. (2015) explored the impact of time lag between program completion and taking the board certification, and board certification scores for laboratory professionals. Medical laboratory scientists (MLS) and medical laboratory technicians (MLT) are required to complete a certification examination to be licensed in 13 states (Brown et al., 2015). These medical laboratory students complete their educational program and self-schedule the computerized examination much like nursing students. The American Society for Clinical Pathology Board of Certification creates the cumulative exam; students are not eligible to take the examination until the educational program is complete. This system is similar to the process for RN licensure. Brown et al. (2015) reviewed the results of the first-time attempt on the end of program certification

examination for 6037 MLS graduates and 3920 MLT graduates in relation to the time between graduation and initial certification attempt. All MLS and MLT first-time test takers between April 2013 and December 2014 were included in this study (Brown et al., 2015).

Graduates self-reported their graduation date on the application form and the school's director verified individual graduation dates prior to individual testing. Brown et al. (2015) defined time between graduation and certification examination in three-month intervals. The statistical method used was analysis of variance. The researchers found pass rates decreased with increased time after program completion for both groups. During the first quarter, 80.2% of the MLS graduates took the examination with a 91.1% pass rate, and 57.6% of the MLT graduates took the examination with an 88.5% pass rate (Table 3). The decreased examination pass rate was significant across quarters at a  $p < .01$  level for both those who took the MLS certification examination and those who took the MLT certification examination (Brown et al., 2015).

Table 3

*MLS and MLT Pass Rates Associated with Time Lag between Eligibility and First Certification Attempt*

Quarter(s) between eligibility and first attempt	Number of MLS test takers	MLS pass rate	Number of MLT test takers	MLT pass rate
1	4843	91.1%	2258	88.5%
2	845	73.6%	1154	74.5%
3	214	69.6%	321	69.2%
4	135	68.1%	187	72.2%

The process for MLS and MLT certification mirrors the process for RN licensure. Applicants must successfully complete their educational program before they are eligible for the examination, which is developed by a national organization with a commitment to safe practice. Programs are science based, with a theoretical and clinical component. Applicants self-schedule the computer-administered examination, which is comprehensive for content covered during the educational program. The impact of time lag on certification test outcome for program graduates may be similar between medical laboratory professionals and RNs.

### **Implications**

Nursing program admission criteria include core mathematics and science prerequisites, and these courses are believed to be foundational for nursing theory. This strategy for curriculum development is consistent with the principles of andragogy (Knowles et al., 2012). Existing evidence for the ADN student does not clearly indicate a

link between grades in these prerequisite courses and eventual outcome on the NCLEX-RN (DeLima et al., 2011; Gilmore, 2008; Jeffreys, 2007; Shaffer & McCabe, 2013; Trofino, 2013). Research among the BSN population demonstrates a significant relationship between prerequisite course grades, nursing program success, and NCLEX-RN results (Elder et al., 2015; McCarthy et al., 2014; Simon et al., 2013). Forging a link between prerequisite course grades, nursing theory course grades, and NCLEX-RN examination success is consistent with the need of an adult learner to have learning apply to life (Knowles et al., 2012). Additional information is necessary to formulate data-driven admission policies for the studied ADN program. The analysis of my research regarding prerequisite course grades and NCLEX-RN passage provided data for review of admission criteria by the study site. Administrators may consider strengthening admission standards to admit those students most likely to succeed. Admitted students identified as at-risk could also be targeted for early remediation, which may improve future NCLEX-RN first-time pass rates.

Early identification of students at risk creates remediation opportunities (Horton et al., 2012; Peterson-Graziose et al., 2013). A significant relationship between individual nursing theory course grades and NCLEX-RN outcome, and between nursing GPA and NCLEX-RN outcome, create an opportunity for the development of progression policies within the nursing program to promote student success (Romeo, 2013; Truman, 2012). Course withdrawal and course failure may be indicative of student academic ability or life circumstances, which impact overall student success (Abele et al., 2013; Silvestri et al., 2013; Trofino, 2013). Cumulative GPA provides additional insight into the student's

academic abilities. If significantly linked with NCLEX-RN outcome, this information informs progression policies for the studied ADN program (Brodersen & Mills, 2014). The evaluation of progression policies may promote the student's ability to be self-directed within the program curriculum, which is an essential component of adult motivation (Wlodkowski, 2008).

Although multiple factors can impact a student's outcome for an end of program examination, the effect of time lapse factors on a student's retention of information and ability to test effectively has been studied (Brown et al., 2015; Eich & O'Neill, 2007; Woo et al., 2009). Course withdrawal and course failure will extend the time a student remains in the nursing program and may impact end of program examination results (Abele et al., 2013; Trofino, 2013). Evidence from the scientific community outlining advances in neuroscience indicated learning could be more effective if strategies are used to promote retention (Zull, 2006, 2011). A significant link between time lag and NCLEX-RN success may necessitate implementation of a systematic review to slow memory loss (Foster et al., 2016; Hu et al., 2013; Krishnan & Carey, 2013; Murre & Dros, 2015).

The data analysis and results of this study created an opportunity for several project directions. A recommendation for ADN program curriculum change to prepare graduates more effectively for NCLEX-RN success is an option. Policy recommendations for admission, progression, identification of students at risk for NCLEX-RN failure, and interventions to promote student success was also considered. Creation of a professional development program for faculty to promote student-faculty engagement and enhance NCLEX-RN preparation may also be warranted.

## Summary

The shortage of nurses in the United States is real, and evidence indicates this shortage will continue to worsen (AACN, 2017; Institute of Medicine, 2011). Colleges of nursing must expand enrollment and create learning environments where students complete the program and pass the NCLEX-RN on the first attempt. In 2015, the ADN-prepared graduates who failed the NCLEX-RN on the first attempt represented 15,188 individuals nationally who were unable to work as RNs (NCSBN, 2016a). An analysis of the relationship between academic and time-lapse variables and graduate outcome for the NCLEX-RN examination for a large sample of ADN graduates provided valuable information for the program under study. The summary provided to program administrators can be used to evaluate admission and progression policies based on data. Increasing the number of graduates who are successfully licensed will assist in the mitigation of the nursing shortage, and promote safe patient care.

In Section 2, I will describe the methodology used to conduct the study, including research design and rationale. I will also describe the sample population, data collection and statistical analysis.



## Section 2: The Methodology

### **Research Design and Approach**

My purpose in this quantitative study was to identify academic and time-lapse factors that predict ADN students who will successfully pass the NCLEX-RN on the first attempt after program completion. The evidence surrounding academic variables as predictors for NCLEX-RN outcome is conflicting. An ADN sample is represented in only a limited number of studies completed in the last 5 years. A paucity of research also exists regarding either the effect of the length of time a student is enrolled in a program, or the time lag between program completion and first NCLEX-RN attempt, and the outcome of the licensure examination. A gap of knowledge exists regarding the identification of ADN students at risk for NCLEX-RN failure. Information gathered from this study added to the existing body of nursing research and was provided to the program where data was collected to promote student success.

Knowles et al.'s (2012) andragogical model and assumptions about adult learning, Zull's (2006, 2011) neuroscience research regarding learning and retention, and Ebbinghaus's forgetting curve (as cited in Hu et al., 2013), serve as the theoretical background for this study. The assumptions of adult learning theory provide insight into the teaching and learning strategies associated with the academic variables to be examined (Knowles et al., 2012). The curriculum at the program under study was developed to build upon previous learning, with the application of previously learned knowledge tested on the NCLEX-RN examination. Adult learners build upon previous knowledge and apply learning to life circumstances (Knowles et al., 2012). The

independent variables in this study include multiple academic factors: grades for mathematics, microbiology, and anatomy and physiology prerequisites; grades for eight nursing theory components; number of failures and number of withdrawals for eight nursing theory components and three clinical application courses; the overall GPA while enrolled in the ADN program; and the nursing GPA while enrolled in the ADN program.

My review of the research by Zull and Ebbinghaus stimulated a desire to understand if elapsed time impacted the student's outcome on the NCLEX-RN examination. Current neuroscience research has identified brain changes associated with repetition of content and learning (Zull, 2006, 2011). This neuroscience research supports Ebbinghaus's forgetting curve and subsequent memory research, which explored timely remediation to improve recall (Foster et al., 2016; Hu et al., 2013; Krishnan & Carey, 2013; Murre & Dros, 2015). The link between elapsed time, review of content, and knowledge retention was studied. Additional independent variables included two time-lapse factors: the length of time in the ADN program from enrollment to program completion, and the time lag between completion of the program and first NCLEX-RN attempt. I measured elapsed time in months. The dependent variable is dichotomous, to reflect the graduate's first-time passage or failure on the NCLEX-RN.

In this section, I explain the methodology used to conduct the study, including research design and rationale. I describe the sample population, the data collection from archived data, and the statistical analysis used for quantitative analysis. The description of independent and dependent variables addressed the research questions. Study limitations and assumptions are delineated.

I used a quantitative approach and secondary analysis of archived data to complete this study. A quantitative study is consistent with the analysis of the identified variables associated with the first-time outcome on the NCLEX-RN. Both the independent and dependent variables consisted of factual, numeric, individual data, as recommended by Creswell (2012). I selected a convenience sample of student records for all graduates from the program under study who took the NCLEX-RN in 2015 to gather this historical data. My goal was to find if statistically significant relationships exist between the dependent variable (NCLEX-RN passage) and the previously occurring independent variables of academic achievement and elapsed time using a retrospective design as described by Creswell (2009) and Polit and Beck (2012). This study design was nonexperimental, as the independent and dependent variables have already occurred (Creswell, 2009; Polit & Beck, 2012).

According to Creswell (2009) a retrospective review of archived records is the most effective strategy to determine if the independent variables have predictive ability for the end of program licensure examination result. A quantitative study design is best aligned with the independent and dependent variables to be studied; numeric data are collected from a large group of participants (Creswell, 2012). My statistical analysis of data related the academic and time-lapse variables for students who pass and students who fail the NCLEX-RN on the first attempt. My interpretation of results occurred in comparison with previous research as recommended by Creswell (2012). Data collection of numerical data is not consistent with a qualitative approach. Qualitative methodology

involves “collecting data based on words from a small number of individuals so that the participants’ views are obtained” (Creswell, 2012, p. 16).

My quantitative study analysis provided information to inform policies for admission, progression, and remediation. Results from this study allowed for the consideration of effective strategies to promote student engagement and learning. Increasing the number of graduates who pass the NCLEX-RN will assist in the management of accreditation concerns (related to NCLEX-RN pass rate) for the program under study. The introduction of additional RNs into the workforce will demonstrate a positive social outcome.

### **Setting and Sample**

The setting for this study is a large ADN program in upstate New York. Study site records indicate students enrolled in this program reside in all 50 states and represent culturally diverse adult learners. Site records indicate accepted students must have previous experience in health care, and must have completed mathematics and science prerequisites before beginning the nursing theory components. Although an ideal population sample according to Creswell (2012) could include all graduates who took the NCLEX-RN nationally, I collected data exclusively from this ADN program.

According to study site records, NYSOP provided a quarterly report of graduates who attempted the NCLEX-RN for the first time. The population sample for this study included the academic records for all program graduates who took the NCLEX-RN for the first time between January 1, 2015, and December 31, 2015. Reports provided the date for the NCLEX-RN test quarter (e.g., 4/1/2015-6/30/2015) to indicate when the

individual took the examination. The sample for this study included records for 786 graduates who took the examination for the first time during 2015. Of those graduates, 74.5% passed ( $n = 586$ ) and 25.4% ( $n = 200$ ) failed. Study site records indicate 897 students graduated from this ADN program in 2015. Only the 786 graduates who were included in the NYSOP report of first-time test takers for the NCLEX-RN in 2015 were studied. Students self-schedule for the NCLEX-RN. Individuals who graduated before January 1, 2015 may be among the cohort of graduates who took the examination in 2015, and students who graduated during 2015 may not have attempted the licensure examination before December 31, 2015.

I chose the dates of selection for the archived records for two reasons. First, the most recent major revision of the NCLEX-RN blueprint and passing score occurred in 2013 (NCSBN, 2016c). A sample of participants who have tested with this new blueprint provided timely and relevant information for the studied ADN program and the nursing profession overall. Second, the NCSBN reported data for the NCLEX-RN outcome on a quarterly or semiannual basis to each state; 2015 was the most recent year where 12 months of examination outcome data were available for the program under study.

I analyzed archived data from the study site's student information system. This data included all academic and time-lapse variables, as well as the first-time NCLEX-RN outcome. With rare exceptions, students completed nursing credits at the ADN program. This convenience sample included all student records from the program under study for the studied period. Therefore, randomization was not a concern. This nonprobability sample represented the academic and time-lapse characteristics and the NCLEX-RN

outcome for students who graduated from this program and who took the most recent version of the licensure examination. I calculated descriptive statistics from this sample to allow comparison with the larger population of ADN graduates who took the NCLEX-RN, as recommended by Creswell (2012).

I chose this convenience sample to include a large group of graduates for whom academic records and NCLEX-RN outcomes were readily available. This census population of all 2015 NCLEX-RN test takers provided a high degree of internal validity for the program under study. A drawback of a convenience sample, as identified by Creswell (2012) and Lodico, Spaulding, and Voegtler (2010), is the inability to confidently say this sample represented the general population of graduates who took the NCLEX-RN.

Necessary information for a power analysis to estimate sample size includes the “effect size, number of predictors, desired power, and the significance criterion” (Polit & Beck, 2012, p. 442). G\*Power 3.1 included power procedures for logistic regression (Faul, Erdfelder, Buchner, & Lang, 2009). I used the methodology of linear multiple regression, fixed model, with  $R^2$  deviation from zero as the basis for the calculations. The a priori sample size was calculated using G\*Power 3.1 with an anticipated effect size of 0.15, desired statistical power level of 0.80, 17 predictors, and a probability level of 0.05, resulting in a minimum required sample size of 146 (Faul et al., 2009).

Data gathered from the academic records for all graduates from the program under study who took the NCLEX-RN in 2015 ( $N = 786$ ) exceeded the calculated minimum required sample size. The selection of the largest sample available was desired

(Creswell, 2012), and the archived records were readily available. The power of the analysis increases with sample size (Tabachnick & Fidell, 2014). Trofino (2013) analyzed preadmission and nursing course grades as academic factors associated with NCLEX-RN passage in an ADN population, using a methodology similar to that in my research. A  $p$  value of 0.05 was determined to be statistically significant in Trofino's (2013) study, which led to my decision to set the probability level to 0.05 for my study. Trofino (2013) used logistic regression for analysis and sampled entire cohorts of graduating students for analysis. Power effect information is not available for the time-lapse studies completed by NCSBN psychometricians (Eich & O'Neill, 2007; Woo et al., 2009). Woo et al. (2009) studied data from a large sample size ( $N = 176,539$ ) and obtained a significance level of  $p < .0001$  in the analysis of RN data regarding time lag and NCLEX-RN outcome.

### **Instrumentation and Materials**

Academic records were stored electronically at the study site program. Participants did not participate in data collection or complete survey instruments. The academic records included dates and grades for prerequisite science and mathematics courses, and dates and grades for all nursing theory credits. Students were assigned grades after each term and were required to earn a grade of A, B, or C to receive credit for a course; final grades of D or F were considered failing and no credit was earned. No plus or minus grades were assigned (e.g., A+, B-). All GPAs were calculated and recorded using the 0 to 4.0 academic grading scale. Academic transcripts contained grades for all courses taken at the studied college, including all course failures earned in

multiple attempts for the same course. Therefore, an accurate count was obtained for the number of failures for nursing components. The data for numbers of course withdrawals were not able to be retrieved from the student information system. The prerequisite GPA was calculated for three prerequisite courses (mathematics, microbiology and anatomy and physiology) when these courses were completed at the study site. Transfer courses were not calculated in the prerequisite GPA. I calculated the nursing GPA from the nursing theory grades, which included all attempts for each nursing theory component. The program under study does not remove a failing grade value from the GPA even if a student repeats a course.

Each student's cumulative GPA was calculated after each term and recorded using the 0 to 4.0 academic grading scale. Transfer courses are not calculated into the cumulative GPA. After the clinical capstone was completed the cumulative GPA was recorded for each student. The cumulative GPA included all attempts for each course; a failing grade value was calculated into the cumulative GPA even when a student repeated a previously failed course. The collection of this information was consistent with the retrospective study by Trofino (2013) who analyzed independent variables of preadmission grades, nursing course grades, and the number of nursing course failures and compared to the dependent variable of NCLEX-RN outcome.

Date of enrollment in the nursing program was recorded in the student information system and I used this date to calculate the time elapsed between enrollment and program completion. In this program, students did not graduate in cohorts. Clinical capstones were completed by different students every week. Students became eligible to



take the licensure examination after the successful completion of the clinical capstone. The student information system contained the date of successful clinical capstone completion for each student. For this research, the date of the successful clinical capstone completion was considered the end of program. NCSBN reports the NCLEX-RN student results quarterly. The use of the clinical capstone completion date and NCLEX-RN test quarter provided an accurate measure of time lag and was consistent with previous studies regarding time lag and NCLEX-RN outcome (Eich & O'Neill, 2007; Woo et al., 2009).

Eich and O'Neill (2007) published a psychometric research brief through NCSBN and used date of licensure eligibility and date of NCLEX-RN to calculate time lag. The researchers used the date of eligibility for licensure because date of graduation was self-reported to NCSBN by applicants and might not be accurate. Woo et al. (2009) published a second study investigating time lag and NCLEX-RN pass rates, and completed a logistic regression to analyze participant data for 176,539 graduates who took the NCLEX-RN between July 1, 2006, and June 30, 2008. The researchers calculated time lag as the number of days between eligibility date and test date. An inverse relationship was found between pass rate and time lag at a  $p < .0001$  level (Woo et al., 2009).

I matched student records to a single year of the NCLEX-RN licensure examination to ensure a consistent test blueprint. The pass or fail outcome on the NCLEX-RN was the dependent variable for this study. The NCLEX-RN is a criterion-referenced examination for RNs; "passing or failing depends solely on the candidate's level of performance in relation to the established point that represents safe entry-level

competence” (NCSBN, 2016b, p. 6). A panel of judges completed the standard setting to address content validity, using a “modified Angoff procedure with additional statistical compromise procedures” (NCSBN, 2016b, p. 6). The percentage of graduates who pass or fail the licensing examination was not predetermined. RN employers and educators generate the data for standard setting.

NCSBN raised the passing standard for the NCLEX-RN examination on April 1, 2013, with a change from -0.16 logits to 0.00 logit (NCSBN, 2016b). NCSBN defined a logit as “a unit of measurement to report relative differences between candidate ability estimates and item difficulties” (NCSBN, 2016c, p. 1). The logit range for the NCLEX-RN is from -2.00 for less difficult items or low-performing individuals to 2.00 for difficult items or high-performing individuals (NCSBN, 2016b, p. 9). The increase in the passing standard was implemented to ensure that all individuals who are successful on the licensure examination meet the “minimum qualifications for a new nurse and can function in today’s changing health care environment” (Lavin & Rosario-Sim, 2013, p. 196). After the 2013 increase in examination difficulty, the first-time NCLEX-RN pass rate for United States educated candidates for all program types dropped from 90.34% in 2012 (NCSBN, 2012b), to 83.04% in 2013 (NCSBN, 2013), and to 81.78% in 2014 (NCSBN, 2014). The NCLEX-RN pass rate at the program under study decreased from 85.7% in 2012 to 74.1% in 2014 (NYSOP, 2013, 2016). This dramatic decrease in the first-time pass rate below the national average is a concern for program stakeholders.

The NCLEX-RN is administered via a computerized adaptive testing (CAT) process to create an individualized licensure examination for each candidate. The CAT

process determines the content area for the next question based on the test blueprint after each question is answered. The test plan requirements are met throughout the entire test. The CAT process also calculates the individual's ability level based on previous answers. The degree of difficulty is calculated for each question to allow a 50% chance of selecting a correct answer. When the submitted answers indicate with a 95% certainty the individual's ability is above or below the passing standard the pass/fail decision is made (NCSBN, 2016b).

Candidates complete between 75 and 265 questions (NCSBN, 2012a). Individuals pass the NCLEX-RN when the CAT process indicates a 95% confidence the candidate is above the passing standard. The candidate will pass when the maximum number of questions has been answered and the CAT final ability estimate for the candidate is above the passing standard. Candidates will also pass when the time for the examination runs out, the CAT ability estimate has been found to be consistently above the passing standard for the last 60 questions, and at least 75 questions have been completed. NCSBN reports only the pass or fail decision (NCSBN, 2016b). The estimated decision consistency of the NCLEX-RN result is an indicator of reliability and was calculated by NCSBN as 0.90 for January through December of 2015 (NCSBN, 2016b, p. 9).

A director of assessment at the program under study created a data set with the information I identified as necessary for this research. This data set was created within the college's password-protected secure server. I received a limited data set with no student identifiers and I will maintain data from this study for a minimum of 5 years. If any challenges regarding the research emerge, I will preserve the data until the issues are

resolved. I do not have hard copies or electronic files of the data with any student identifier information.

### **Data Collection and Analysis**

Before data collection was begun, I received approval from Walden University's Institutional Review Board (IRB) and from the IRB at the program where data collection took place. The Walden IRB approval number is 10-11-17-0311938. The dean of the nursing program for the study site approved the completion of this study and I obtained a signed data use agreement from the studied college. The IRB for the program identified Walden University's IRB as the primary IRB of record and granted exempt approval for the study before I accessed student-related information. The study site's IRB number is 2017-05. Per the limited data use agreement, the program's director of assessment moved data specific to the chosen sample from the student information system and the learning management system into an SPSS file for my use.

NCSBN generates the NCLEX-RN first-time attempt results for all graduates of the program by student state of residence; they send this report electronically to the program under study quarterly. The director of assessment matched the NCLEX-RN outcome to student name, state of residence, and graduation date, and then merged this information into a limited data set specific to this study. The spreadsheet used for this project was maintained on the college's internal server to ensure confidentiality of student information. The director of assessment then removed all student identifiers and assigned a number to each participant record to create a limited data set before I received access to the information.

The director of assessment reviewed the limited data set for completeness and potential for inclusion into the study. Missing information was coded as such to improve internal validity as outlined in Creswell (2012). Course letter grades for prerequisite courses and nursing theory components were converted using the following numerical code: A = 4, B = 3, C = 2, D = 1, and F = 0. Prerequisite GPA was calculated from prerequisite courses (mathematics, microbiology, and anatomy and physiology) taken at the study site. Nursing GPA was calculated from grades in all attempts in the eight nursing theory components. The three nursing components that are graded pass/fail (two clinical assessments and the clinical capstone) were awarded no value on the transcript for a pass and a 0 was calculated in the GPA for a fail per study site records. Cumulative GPA was recorded in the student information system using the college's 0 to 4.0 academic grading scale. The number of failures for all 11 nursing components throughout the program was counted for each student, for a cumulative program total. The director of assessment was not able to generate a count of course withdrawals for each student studied, therefore these data were not able to be collected or counted. The date of enrollment in the nursing program and the date of clinical capstone completion were used to calculate the length of time enrolled in program in months. The date of clinical capstone completion and the quarter of the NCLEX-RN attempt were used to calculate the time lag in 3-month quarters.

The dependent variable, NCLEX-RN outcome, was coded *pass* = 1, *fail* = 0. This outcome coding was chosen to allow the software program to solve for dichotomous outcome of 1, which impacts the direction of the odds ratio (Tabachnick & Fidell, 2014).

I did not collect demographic data in this study. I completed data analysis using SPSS version 19.

### **Operationalization of Variables**

Independent variables for this study included academic and time-lapse factors (Table 4). Academic grades were collected for three prerequisite courses (if those courses were taken at the site under study): mathematics, anatomy and physiology, and microbiology. Earned grades for these courses were scored as A, B, C, D, or F and were entered as A = 4, B = 3, C = 2, D = 1, and F = 0. Academic data were also collected for student grades in the nursing portion of the program. This program included eight nursing theory components, two clinical assessments, and a clinical capstone, for a total of 11 nursing components. All nursing theory components were graded as A, B, C, D, or F, and were entered as A = 4, B = 3, C = 2, D = 1, and F = 0. The nursing GPA was calculated based on the numeric grades for all attempts in the eight nursing theory components.

Table 4

*Description of Variables Related to Research Question*

Research Question	Description of Variable	Variable Type	Variable Measure
1, 2 and 3	First-time NCLEX-RN outcome	Dependent	Dichotomous
Academic Factors			
1 and 2	Grades for prerequisite courses: mathematics, microbiology, anatomy and physiology	Independent	Categorical
1 and 2	Prerequisite GPA calculated based on 3 prerequisite courses (mathematics, microbiology, anatomy and physiology)	Independent	Continuous
1 and 2	Grades for each of the 8 nursing theory components (Phase 1 and 2: NUR 104, NUR 105, NUR 108, NUR 109, NUR 209, NUR 211, NUR 212, NUR 213)	Independent	Categorical
1 and 2	Nursing GPA calculated based on the 8 nursing theory components	Independent	Continuous
1 and 2	Number of failures for all 11 nursing components (Phase 1, 2, 3, 4)	Independent	Discrete
1 and 2	Cumulative GPA calculated based on all courses in the ADN curriculum	Independent	Continuous
Time-lapse Factors			
1 and 3	Length of time enrolled in the nursing program, between date of enrollment and completion of capstone clinical	Independent	Continuous
1 and 3	Time lag between completion of the clinical capstone and first NCLEX-RN attempt	Independent	Continuous

The number of failures a student received over the course of the nursing curriculum at this ADN program was considered as an additional academic factor that may impact NCLEX-RN outcome. For the eight nursing theory courses, failure was defined as achieving a letter grade of D or F. For the two clinical assessments and the clinical capstone, failure was defined as receiving a grade of fail, as these three components are graded pass/fail. The total number of times each student received a failing grade for any of the 11 nursing components was counted. I was not able to collect the number of withdrawals during the program for each student.

The final academic factor studied was the cumulative GPA earned during enrollment in the ADN program. This cumulative GPA was calculated based on the numeric grades for all courses in the ADN curriculum taken at the studied college and may include prerequisites and social sciences courses. Transfer courses do not transfer a grade that is calculated in the cumulative GPA. The cumulative GPA for each graduate was calculated after the clinical capstone was completed, and was based on the 0 to 4.0 academic grading scale.

Two time-lapse factors were also included as independent variables in this study. The first, enrollment time, I defined as the length of time between the date of enrollment in the nursing program and the date of completion of the clinical capstone, in months. The second, time lag, I defined as the time between clinical capstone completion and the first NCLEX-RN attempt, in months.



Graduates self-schedule the NCLEX-RN examination and are eligible to take the examination after clinical capstone completion. The program under study receives a quarterly report of NCLEX-RN results. For each of the graduates in this study, the director of assessment assigned a quarter value to the date of the final attempt on the clinical capstone; the first attempt on the NCLEX-RN was also assigned a quarter value. The difference between these two values for each graduate was calculated by the director of assessment to establish a time value (in quarters) between the final clinical capstone and the first attempt on the NCLEX-RN. Graduates whose first attempt on the NCLEX-RN was within the same quarter as their clinical capstone completion were entered as 0, those who attempted the NCLEX-RN during the first 3-month quarter after their clinical capstone completion were entered as 1, those within the second 3-month quarter after clinical capstone completion were entered as 2; and with each additional quarter the value entered for the graduate increased by 1. The director of assessment assigned the corresponding time value, in quarters, to the data file for each graduate's first-time NCLEX-RN attempt.

The dependent variable for this study was the NCLEX-RN outcome. The ADN program graduate either passed the NCLEX-RN on the first attempt or failed the NCLEX-RN on the first attempt. NCLEX-RN results are reported as pass or fail, not by earned score on the actual examination (NCSBN, 2016b). Only two categories are possible for this variable, which defines a dichotomous variable (Polit & Beck, 2012).

## **Data Analysis**

I used a binary logistic regression analysis of the independent variables (academic and elapsed time) to predict the dichotomous dependent variable of first-time pass for the NCLEX-RN as described by Creswell (2009) and Polit and Beck (2012). The predictor variables used for logistic regression can be continuous or categorical (Polit & Beck, 2012; Tabachnick & Fidell, 2014). The independent variables I identified, such as course grades, GPAs, number of course failures, number of months enrolled in the program, and number of 3-month quarters between program completion and first NCLEX-RN attempt, meet the criteria for logistic regression analysis. I was not able to obtain the proposed variable of number of course withdrawals from the student information system, and did not include it in analysis. The academic records were unique to each participant for my study and met the criteria for logistic regression in that each case was independent from the others. If the cases were not independent, the regression analysis could result in increased Type 1 error (Tabachnick & Fidell, 2014). My primary research question involved prediction of group membership, with a dichotomous dependent variable, multiple continuous and discrete variables, and no covariates. Logistic regression allowed me to calculate the odds ratio (as described by Tabachnick & Fidell, 2014) associated with belonging in the NCLEX-RN passage group.

Researchers have used logistic regression frequently in retrospective studies to determine NCLEX-RN predictors (Alameida et al., 2011; Horton et al., 2012; Kaddoura et al., 2017; Lavandera et al., 2011; Raman, 2013; Trofino, 2013; Yeom, 2013). In addition, Horton et al. (2012), Kaddoura et al. (2017), and Trofino (2013) found no

correlation between the independent academic variables; the order entry of the independent predictors was not demonstrated to be important. Furthermore, simultaneous entry of all predictors is the preferred method for predictor entry, to evaluate the contribution of each predictor while controlling the other predictors (Tabachnick & Fidell, 2014).

Multicollinearity exists for some of the independent predictor variables for academic factors in this study. This intercorrelation compromises the analysis of the regression (Polit & Beck, 2012; Tabachnick & Fidell, 2014). Nursing GPA is calculated from all attempts in all nursing theory components; cumulative GPA reflects all grades for all courses taken in the ADN program at the studied college and is related to individual grades for prerequisite and requisite courses. Therefore, I entered the independent variables in models to delete redundant variables from each model as described by Tabachnick and Fidell (2014). I determined the models for logistic regression analysis by defining the relationship among independent variables and establishing a stepwise approach, as described by Tabachnick and Fidell.

The relationship between each independent variable and the dependent variable was initially described through correlation. A Spearman's correlation was calculated to describe the relationship between each independent variable and the dependent variable (Creswell, 2012; Polit & Beck, 2012). An initial logistic regression analysis of the final grades for each prerequisite course (mathematics, microbiology, and anatomy and physiology), final grades for each nursing theory component (NUR 104, NUR 105, NUR 108, NUR 109, NUR 209, NUR 211, NUR 212, NUR 213), total number of nursing

component failures, time enrolled in the nursing program, and the time lag between completion of the clinical capstone and the first NCLEX-RN attempt was completed. All cases with missing data ( $n = 763$ ) were deleted, which severely restricted the sample size below the minimum required (Faul et al., 2009; Tabachnick & Fidell, 2014). The missing data for students who transferred prerequisite courses (mathematics, microbiology and anatomy and physiology) to the studied college restricted the sample size drastically. Therefore, I calculated prerequisite GPA for the students who took any combination of prerequisite courses, and entered prerequisite GPA in subsequent analyses.

Models were developed using logistic regression to determine which independent variables predict NCLEX-RN success. I used this prediction design to identify variables associated with NCLEX-RN outcome (Creswell, 2012). Correlations were identified, with subsequent logistic regression, to enable prediction of NCLEX-RN pass (Creswell, 2012). The analysis of multicollinearity, statistical significance ( $p < .05$ ) for included variables, as well as the Hosmer and Lemeshow goodness of fit and Nagelkerke  $R^2$  for the model informed the development of each subsequent model (Tabachnick & Fidell, 2014). Model 1 included the cumulative GPA, the time enrolled in the nursing program, and the time lag between completion of the clinical capstone and the first NCLEX-RN attempt. Model 2 clarified components of the cumulative GPA to provide additional information and included the prerequisite GPA, the nursing GPA, the time enrolled in the nursing program, and the time lag between completion of the clinical capstone and the first NCLEX-RN attempt. Model 3 included prerequisite GPA, and further differentiated nursing GPA with final grades in each of the eight nursing theory components, number of

failures in all 11 nursing components, the time enrolled in the nursing program, and the time lag between completion of the clinical capstone and the first NCLEX-RN attempt. The Hosmer and Lemeshow goodness of fit identified that each of these models was correctly specified, and Nagelkerke  $R^2$  increased with each model. Model 4 included the significant ( $p < .05$ ) academic and time-lapse variables identified in the previous analyses, and included prerequisite GPA, final grade in NUR 211, number of failures in all 11 nursing components, and the time lag between completion of the clinical capstone and the first NCLEX-RN attempt.

I considered three research questions for this study:

Research Question 1: What are the percentages for the academic factors and time-lapse factors for graduates from the studied ADN program who attempted the NCLEX-RN for the first-time in 2015?

Research Question 2: Which academic factors predict first-time success on the NCLEX-RN exam?

Research Question 3: Which time-lapse factors associated with length of time enrolled in the program and time lag between program completion and the first NCLEX-RN attempt predict a first-time pass on the NCLEX-RN?

For the methodology research questions, the null hypothesis stated there was no significant difference between first-time NCLEX-RN outcomes based on the independent variables of academic factors or elapsed time.

Descriptive data analyses, including frequency percentages, describe characteristics of the sample population (Creswell, 2009). The data in my descriptive

analysis included the mean, standard deviation, maximum and minimum counts, and frequency distributions as appropriate for the variable. This information was generated for increased understanding of the data and subsequent analysis.

Logistic regression is the statistical analysis technique I used to generate information regarding the probability of the independent variables predicting the outcome of NCLEX-RN pass through a calculation of the odds ratio as described by Polit and Beck (2012). Calculation of the odds ratio allows the researcher to evaluate the likelihood of NCLEX-RN pass “based on a combination of values of the predictor variables” (Tabachnick & Fidell, 2014, p. 56). A calculation of the odds ratio for each of the academic factors determined which of the factors (such as individual grades, cumulative GPA, or number of nursing component failures) had a significant impact on NCLEX-RN passage. The odds ratio calculation for time-lapse factors, both time enrolled in the program and time lag between clinical capstone completion and first NCLEX-RN attempt, determined if elapsed time had a direct or inverse relationship to NCLEX-RN success (Woo et al., 2009).

Confidence intervals were established for the odds estimate to identify the likelihood of NCLEX-RN pass based on the analysis of the predictors. I described both the Wald chi-square statistic and the Hosmer-Lemeshow test in my analysis. I used the Wald chi-square statistic to determine the effect of each predictor variable on the dependent variable (Polit & Beck, 2012; Tabachnick & Fidell, 2014). The Hosmer-Lemeshow test is a test of a good fit and compares the prediction model to the perfect model. When a nonsignificant chi-square occurred, I inferred that my model duplicated

the observed frequencies and was correct, as described by Polit and Beck (2012). Data analysis was completed with SPSS version 19. Identification of a prediction model with statistically significant differences provided information that can be used to promote success on the NCLEX-RN examination.

I reviewed and rejected other methods of analysis for my data. If I considered the dichotomous dependent variable as categorical, a *t* test could have been done to compare the differences between the means of the graduates who pass the NCLEX-RN and those who fail. The *t* test analysis would only portray the differences between the two groups (Polit & Beck, 2012). Use of ANOVA and MANCOVA analytics could also have been performed, to depict the significance of group differences. However, these analytics are used with a continuous dependent variable (Tabachnick & Fidell, 2014), which is not consistent with my study. The aforementioned data analysis techniques would be incomplete for the development of my project; I would not be able to predict which students would pass the NCLEX-RN, nor would I be able to ascertain if a combination of the academic or time-lapse factors would have predictive ability.

Discriminant multiple logistic regression analysis could be used to predict the participant's membership in a group (Polit & Beck, 2012; Tabachnick & Fidell, 2014). For this study, the group is known, as each graduate's outcome on the first attempt of the NCLEX-RN has already occurred. The discriminant analysis would produce a Wilks' lambda, to indicate the "proportion of variance unaccounted for by predictors" (Polit & Beck, 2012, p. 447). This statistical analysis could provide information regarding which independent variables are important in predicting first-time NCLEX-RN outcome.

However, discriminate analysis would not allow me to calculate the odds ratio to determine the degree of association between the independent variables and the dependent variables, as described by Tabachnick and Fidell (2014).

### **Assumptions, Limitations, Scope, and Delimitations**

#### **Assumptions**

One assumption inherent to this study was the belief that the nursing curriculum prepared students to pass the NCLEX-RN examination on the first attempt. I based this assumption on the program's reported 2015 pass rate of 74.5%. Sample selection of the 2015 first-time test takers assumed that choosing a sample of recent graduates reflected the graduates' outcome for the current version of the NCLEX-RN blueprint. This assumption was made to allow generalization of study results to this program's future graduates who test with the current NCLEX-RN blueprint.

#### **Limitations**

Researchers identify limitations as "potential weaknesses or problems with the study" (Creswell, 2012, p. 199). This study included academic and time-lapse variables for graduates of an ADN program in upstate New York. Participants for this study were a convenience sample, which limited generalizability to students and graduates from other programs. Sample selection was not randomized, which poses a threat to external validity (Lodico et al., 2010). Information was not collected about participant abilities regarding critical thinking, anxiety level associated with high-stakes testing, or post-graduation preparation for the first attempt of the NCLEX-RN. These additional variables could



impact the participant's outcome on the examination in addition to the independent variables studied (Lavin & Rosario-Sim, 2013).

**Internal validity.** Problems with internal validity disrupt the researcher's ability to identify a predictive relationship between the academic and time-lapse factors identified and the NCLEX-RN outcome, as described by Creswell (2012) and Polit and Beck (2012). The use of archived data eliminated internal validity concerns related to participants, such as history and the passage of time, maturation of the participants, regression of scores, selection of participants, mortality and drop out, and interactions with selection (Creswell, 2012), as long as the information was transcribed correctly into the SPSS data table. The timing of the NCLEX-RN examination after the ADN program minimizes concerns regarding which variable occurs first, as the academic factors, the enrollment time, and the clinical capstone completion have already occurred (Polit & Beck, 2012). The selection of a sample of graduates who took the same version of the NCLEX-RN was made to improve internal validity related to instrumentation. A concern documented in the literature involves other factors that might cause NCLEX-RN passage or failure, such as test anxiety, critical thinking, preparation for the examination, or limited proficiency in English (Carr, 2011; Cole & Adams, 2014; Hansen & Beaver, 2012; Lavin & Rosario-Sim, 2013; Lujan & Little, 2010; Mee & Schreiner, 2016).

**External validity.** External validity refers to the ability to generalize information obtained from this study to future graduates of the ADN program under study or to ADN graduates nationally (Creswell, 2012; Polit & Beck, 2012). The sample of archived records for this study, including all graduates who tested in a calendar year, was selected

to minimize concerns with external validity in the generalization to future graduates of this program. The NCLEX-RN test blueprint is in place until at least 2019; future graduates will complete essentially the same licensure examination as the 2015 test takers. Demographic information was not collected. It will not be possible to tell if graduates who took the NCLEX-RN in 2015 are representative of future graduates of the program regarding age, gender, or race. Research indicates these factors can influence NCLEX-RN outcome (Hyland, 2012; Murray, Pole, Ciarlo, & Holmes, 2016; Staykova, 2012; Trofino, 2013). The convenience sample of academic records from a single ADN program limits the generalizability of these results to other programs nationally (Creswell, 2012; Polit & Beck, 2012).

### **Scope and Delimitations**

The scope of the study was to determine which academic and time-lapse factors affect the outcome on the nursing licensure examination. Delimitations for the study included that all data was from an ADN program in upstate New York, and also that data gathered was limited to archived records and NCLEX-RN results from one year. Changes in admission, progression, and remediation policies could impact the academic and time-lapse factors associated with this study. Other variables could influence the individual's first-time outcome on the NCLEX-RN.

### **Protection of Participants' Rights**

#### **Researcher Role**

I began employment at the study site in 2015. All academic records used for this study are for graduates who completed the NCLEX-RN in 2015. Data collection for this

study did not begin until 2017 and included only archived information. The graduates linked to the academic records associated with this study are no longer students with the associate degree program; successful completion of the program is a precursor to eligibility to sit for the NCLEX-RN. The college provided me with a limited data set; I did not receive any student identifying information.

### **Participant Protection**

I used a limited data set with no student identifiers and maintained the confidentiality of data to ensure that the participants within this study were protected (Lodico et al., 2010). Informed consent from the student was not required because this study involved archived data, stored on the college's password-protected internal servers. Minimal risk to the individual is evident (Creswell, 2012; Polit & Beck, 2012). The director of assessment accessed the college's password-protected student information system to obtain academic records, date of enrollment, date of clinical capstone completion, quarter of first NCLEX-RN attempt and result of the licensure examination. The college's internal password-protected server houses the spreadsheet with the raw data. Student names were not disclosed to anyone outside the studied college or to me; information with student identifiers will not be removed from college's servers. Graduates associated with the academic records will not be interacted with or observed.

The Walden IRB was the primary IRB for this study. I also received permission to conduct the study from the IRB of the college to be studied, as recommended by Creswell (2012). In addition, at the college where data was collected, I received permission from the college's legal counsel to use the limited data set, approval from the dean of the ADN

program to conduct the study, and exempt approval from the institutional IRB. The program under study was not identified in this document.

The college's secure server maintains the student information system and stores the compilation of archived records used for this study. I will store the limited data set for a minimum of 5 years as recommended by Creswell (2009). If any challenges regarding the research emerge, I will preserve the data until those issues are resolved. I do not have hard copies or electronic files of any data linked with any student names. After 5 years or after any issues are resolved (whichever is longer), I will delete any associated study data from electronic files and recycling bins. I will share the analysis of the data with the administrative team of the studied ADN program via an executive summary.

### **Data Analysis Results**

The director of assessment and I reviewed the limited data file for outliers. The data for all variables were reviewed for completeness and accuracy. Missing data was coded as missing. All final grades were recorded as 2, 3, or 4; all GPAs were recorded between 0 and 4; dates for enrollment and clinical capstone completion were recorded including month, day, and year; dates of NCLEX first attempt were recorded including number of quarters between clinical capstone completion and first NCLEX-RN attempt; and NCLEX-RN examination results were recorded as *pass* = 1, *fail* = 0. No records were eliminated as outliers.

### **Descriptive Statistics**

**First-time NCLEX-RN outcome.** The following information is provided for RQ1. Graduates from the program under study who took the NCLEX-RN for the first

time between January 1, 2015 and December 31, 2015 were included in the sample for this study ( $N = 786$ ). Of the 786 graduates, the majority passed ( $n = 586$ , 74.5%). Two hundred graduates failed (25.4%). This first-time pass rate is below the national mean (82%) for ADN programs in 2015 (NYSOP, 2016). Nursing programs participating in research for NCLEX-RN pass rates tend to have pass rates below the national mean, which precipitated the research at those programs (Breckenridge et al., 2012; Chen & Bennett, 2016; DeLima et al., 2011; Elder et al., 2015; Foreman, 2017; Horton et al., 2012; Kaddoura et al., 2017; Taylor et al., 2014; Truman, 2012; Yates & Sandiford, 2013). The first-time NCLEX-RN pass rate for graduates at the program where data were collected is consistent with the pass rates described by several researchers included in the review of the literature.

**Academic variables.** Descriptive statistics for academic variables of prerequisite courses and nursing theory components were calculated to address RQ1, and provide a basis for RQ2. These statistics include the percentage of students who received an A, B, or C as a final grade, the mean, and the standard deviation for the final grade in each course. Many students who attend the program transfer in prerequisite courses. Prerequisite credits are transferred into the student's academic record, but transfer grades are not calculated within the GPA for the program under study. Only ten percent of the students took a prerequisite mathematics course at the study site ( $n = 80$ ). It was more common for students to take prerequisite microbiology ( $n = 345$ ) and anatomy and physiology ( $n = 294$ ) at the program under study.

Table 5 presents the percent of students with a final grade of A, B, or C in the prerequisite and requisite courses. I completed an analysis of the mode for course grades. The grades occurring most often for the three prerequisite courses were A for mathematics, and B for both microbiology and anatomy and physiology. For mathematics, 40% of all students earned an A ( $n = 32$ ). Concern for grade inflation and rigor arise for the mathematics prerequisite, especially when compared to the rate of As given in the other two prerequisites, which were only 28% in microbiology and 22% in anatomy and physiology.

Table 5

*Descriptive Statistics for Prerequisite and Requisite Components*

Component	<i>N</i>	Percent of Students with C	Percent of Students with B	Percent of Students with A	Mean	Standard Deviation
Mathematics	80	30.0	22.5	40.0	2.88	1.17
Microbiology	345	27.8	42.3	28.4	2.96	0.8
Anatomy and Physiology	294	34.7	42.2	22.4	2.87	0.77
NUR 104	775	51.5	31.7	16.8	2.65	0.75
NUR 105	312	58.7	31.4	9.9	2.51	0.67
NUR 108	780	62.8	32.8	4.4	2.42	0.58
NUR 109	785	66.4	28.0	5.6	2.39	0.59
NUR 209	753	47.4	23.4	29.2	2.82	0.86
NUR 211	781	36.2	47.0	16.8	2.81	0.70
NUR 212	784	61.2	34.3	4.5	2.43	0.58
NUR 213	784	75.4	21.4	3.2	2.28	0.52

Table 5 also describes the grade distribution for the nursing theory components. The most common grade for seven of the eight nursing theory components (NUR 104, NUR 105, NUR 108, NUR 109, NUR 209, NUR 212, & NUR 213) was a C (2.0), earned by 48% to 75% of all students. Although the final grade in NUR 209 (Phase 2 reproductive health nursing component) is most frequently a C, 29.2% of students earned an A; this component demonstrated a standard deviation of .86 Final grades are also

dispersed for NUR 211, a Phase 2 medical surgical nursing component, with 283 (36.2%) students who earned C for the final grade, 367 (47%) students who earned a B for the final grade, and 131 (16.8%) students who earned an A for the final grade. Of note, students who meet eligibility criteria set by the program may choose to waive NUR 105.

Study site records indicated Phase 1 nursing components included foundational concepts for the RN practice of nursing care within each content area. Phase 2 nursing components built upon that knowledge and included RN care of patients with health differences across the lifespan within each content area. A description of the content covered in each of the eight nursing theory components is shown in Table 6.



Table 6

*Nursing Theory Component Content Description*

Phase	Component	Content Areas and Associated Nursing Care
1	NUR 104	Nursing process, nursing judgment, patient-centered care, environmental safety, biological threats, therapeutic communication, patient teaching, safe medication administration
1	NUR 105	Nutrition, elimination, oxygenation, fluid and electrolyte balance, rest and activity
1	NUR 108	Role and scope of practice for the RN, delegation and supervision, collaboration with interprofessional team, legal, ethical issues
1	NUR 109	Cultural diversity, pain, sensory impairment, growth and development, chronic illness, end of life care
2	NUR 209	Human sexuality, childbearing, congenital anomalies, genetic disorders, male/female reproductive disorders
2	NUR 211	Cardiovascular, respiratory, impaired blood cell formation, abnormal cell growth
2	NUR 212	Mental health disorders, cognitive impairment, diabetes mellitus, endocrine, hepatic, biliary, renal and pancreatic disorders
2	NUR 213	Infectious/communicable diseases, tissue trauma, neurological dysfunction, musculoskeletal disorders, perioperative nursing

A student's academic progress throughout the program is illustrated in part by the distribution of grades that student received for the prerequisite and requisite courses. The descriptive statistics for the total number of student failures for all 11 nursing components are provided in Table 7. Study site records indicate students may fail any one nursing component up to three times before dismissal from the program; failing grades were not removed from the transcript even after repeat of a course. Students may earn a

cumulative number of seven failures among the 11 nursing components before dismissal, and total failures may be higher still if the appeal process indicates extenuating circumstances existed for that student. For the study period, a total of 13 students were permitted to accumulate an excess of seven failures, the highest number failures being 16 for one student. The number of earned failures, the frequency count, and the percentage of students within each category are identified in Table 7.

Table 7

*Descriptive Statistics for Total Failures in all 11 Nursing Components (N = 786)*

Number of Failures	N	Percent of Students
0	233	29.6
1	181	23.0
2	130	16.5
3	90	11.5
4	60	7.6
5	45	5.7
6	19	2.4
7	15	1.9
8	6	0.8
9	2	0.3
10	3	0.4
14	1	0.1
16	1	0.1

The percentage of students who did not earn a failing end of course grade in any of the nursing components was 29.6% ( $n = 233$ ). Fifty-one percent of the students ( $n = 401$ ) earned between one and three failing grades in nursing components during their enrollment. Approximately 70% of students failed and repeated at least one nursing component.

Table 8 describes the statistics for prerequisite GPA, nursing GPA and cumulative GPA, which are recorded on a 0 to 4.0 scale. These numbers reflect the individual's academic achievement over time (i.e., cumulative). Most students (62%) earned above a 3.0 prerequisite GPA, and the prerequisite mean was 2.86.

Table 8

*Descriptive Statistics for Prerequisite, Nursing, and Cumulative GPAs*

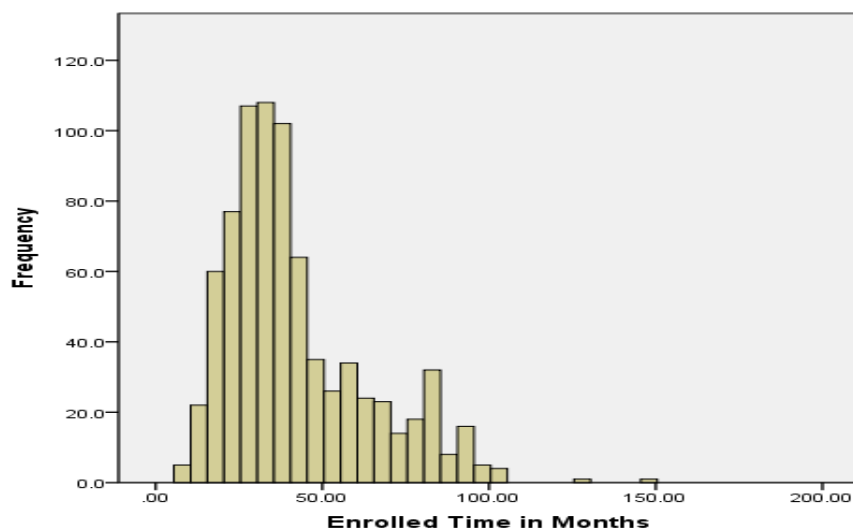
GPA	<i>N</i>	Percent of Students with GPA Below 2.0	Percent of Students with GPA Between 2.0 – 2.99	Percent of Students with GPA 3.0 – 4.0	Mean	Standard Deviation
Prerequisite GPA	420	6.7	38.1	61.9	2.86	.83
Nursing GPA	786	33.5	50.2	16.3	2.28	.62
Cumulative GPA	786	0	65.3	34.7	2.86	.35

For the records included in this study, 33.5% ( $n = 263$ ) of students earned a nursing GPA (which includes grades for all attempts on nursing theory components)

below 2.0 ( $M = 2.28$ ,  $SD = .62$ ). Fifty percent of students ( $n = 395$ ) earned between a 2.0 and 2.99, and 16.3% ( $n = 128$ ) of students achieved a 3.0 or greater nursing GPA.

The cumulative GPA for students in this sample ranged from a minimum of 2.06 to a maximum of 3.95 ( $M = 2.86$ ,  $SD = 0.35$ ). Most students whose records were included in this study (65%,  $n = 513$ ) earned a cumulative GPA between 2.06 and 2.99. Almost 35% ( $n = 273$ ) of the studied sample achieved a cumulative GPA over 3.0.

**Time-lapse variables.** Descriptive statistics for time-lapse variables were explored to address RQ1, and provide a basis for RQ3. Students are typically enrolled part time in the program under study. For the studied sample, the length of enrollment in the program ranged from a minimum of 8 months to a maximum of 150 months ( $M = 41.94$ ,  $SD = 21.22$ ). Nineteen percent of students ( $n = 146$ ) completed the program in 24 months or less. Thirty-three percent of students ( $n = 257$ ) required between 24 and 36 months to complete the program. Students enrolled for more than 36 months comprised 48.7% of the sample population. Six percent of students ( $n = 47$ ) were enrolled in the program for 84 or more months (Figure 1).



*Figure 1.* Number of months enrolled in program.

Table 9 includes the descriptive statistics for the time lag variable, previously defined as the calculated time between the clinical capstone completion and the first-time NCLEX-RN attempt. This variable was calculated in quarters, the student's last attempt on the clinical capstone was assigned a quarter value, and the first attempt on the NCLEX-RN was assigned a quarter value. The difference between the two quarters was considered the time lag between clinical capstone completion and first NCLEX-RN attempt. Of the 786 graduates in the sample population, 33 graduates (4.2%) attempted the NCLEX-RN for the first time within the same 3-month quarter as their clinical capstone completion; the time lag variable for these graduates was recorded as 0. Fifty-one percent attempted the NCLEX-RN for the first time within the next quarter following clinical capstone completion; the time lag variable for these graduates was recorded as 1. The maximum value of lapsed 3-month quarters was 23, with a mean value for the

sample of 1.89 ( $SD = 2.159$ ). Most of the program graduates (83.5%) took the NCLEX-RN for the first time within two quarters of passing the clinical capstone ( $n = 623$ ).

Table 9

*Descriptive Statistics for Time Lag Between Capstone Completion and NCLEX-RN*

Time Lag Variable	0 Quarter Difference	1 Quarter Difference	2 Quarters Difference	3 Quarters Difference	4 Quarters Difference	5 or more Quarters Difference
Frequency	33	403	220	59	35	36
Percent of graduates	4.2	51.3	28.0	7.5	4.5	4.7

### **Inferential Statistics**

The null hypothesis for the methodological research questions was that there was no significant difference between selected academic factors and a student's NCLEX-RN first-time pass rate (RQ2), and there was no significant difference between the length of time enrolled in the program or the time lag between program completion and the first NCLEX-RN attempt and a student's NCLEX-RN first-time pass rate (RQ3). I performed a Spearman's correlation to assess the relationship between first-time NCLEX-RN passage and selected academic variables (final grades in prerequisite mathematics, microbiology, anatomy and physiology courses; final grades for each of eight nursing theory components; nursing GPA based on all attempts in eight nursing theory components; cumulative GPA for all courses in the ADN curriculum; and number of failures for all 11 nursing components). The correlation also assessed the relationship

between time-lapse variables (length of time enrolled in the nursing program, and time lag between completion of the clinical capstone) and the result on the first NCLEX-RN attempt. Spearman's correlations are identified with strength and direction. Correlations between .20 and .35 demonstrate a slight relationship, and correlations between .35 and .65 allow for limited prediction as described by Creswell (2012).

Table 10 displays the Spearman's correlation between the NCLEX-RN outcome and the academic and time-lapse predictor variables. The table shows two-tailed significance ( $p < .05$ ) for final grades in microbiology, anatomy and physiology, prerequisite GPA, final grades in seven of the individual nursing theory components (NUR 104, NUR 108, NUR 109, NUR 209, NUR 211, NUR 212, & NUR 213), number of failures in 11 nursing components, nursing GPA, cumulative GPA, and length of program enrollment in months. Therefore, I rejected the null hypothesis and accepted the alternative hypothesis for RQ2 and RQ3. Of those significant ( $p < .05$ ) independent variables, two predictor variables (nursing GPA and number of failures in 11 nursing components) demonstrated a correlation above .35 and, according to Creswell (2012), allow for limited prediction. It is important to note the negative correlation (-.368) between number of failures in 11 nursing components and NCLEX-RN passage. Also, from those significant ( $p < .05$ ) independent variables, a slight correlational relationship between .20 and .35 existed for nine predictor variables (prerequisite GPA; final grade in anatomy and physiology; final grade in microbiology; final grades in NUR 104, NUR 109, NUR 108, NUR 211, and NUR 212; and cumulative GPA). Final grade in NUR 209, and length of program enrollment in months demonstrated a correlation below .20. Final

grade in mathematics, final grade in NUR 105, and the time lag between clinical capstone completion and first attempt for NCLEX-RN were not significant ( $p > .05$ ) in this correlation.



Table 10

*Spearman's Correlation for Academic and Time-lapse Variables: High to Low*

Variable	NCLEX result	Nursing GPA	Number of failures	NUR211 final grade	Prerequisite GPA	A&P final grade	NUR104 final grade	Cumulative GPA	Micro. final grade	NUR212 final grade	NUR109 final grade	NUR108 final grade	NUR209 final grade	Program enrollment	NUR213 final grade	Time lag	NUR105 final grade	Math. final grade
NCLEX result	1.000	.396**	(-.368)**	.342**	.328**	.315**	.301**	.292**	.287**	.246**	.232**	.212**	.176**	(-.105)**	.086*	(-.057)	.058	.020
Nursing GPA	.396**	1.000	(-.779)**	.624**	.568**	.573**	.655**	.673**	.562**	.581**	.559**	.568**	.581**	(-.202)**	.402**	.027	.402**	.109
Number of failures	(-.368)**	(-.779)**	1.000	(-.419)**	(-.456)**	(-.416)**	(-.440)**	(-.449)**	(-.448)**	(-.363)**	(-.395)**	(-.332)**	(-.325)**	.320**	(-.211)**	.040	(-.155)**	(-.166)
NUR211 final grade	.342**	.624**	(-.419)**	1.000	.443**	.470**	.365**	.494**	.439**	.393**	.314**	.357**	.315**	(-.052)	.313**	.010	.290**	(-.120)
Prerequisite GPA	.328**	.568**	(-.456)**	.443**	1.000	.862**	.369**	.664**	.851**	.404**	.340**	.419**	.307**	(-.146)**	.244**	.017	.276**	.672**
A&P final grade	.315**	.573**	(-.416)**	.470**	.862**	1.000	.388**	.675**	.561**	.414**	.351**	.405**	.306**	(-.098)	.295**	(-.013)	.327**	.075
NUR104 final grade	.301**	.655**	(-.440)**	.365**	.369**	.388**	1.000	.525**	.393**	.372**	.382**	.365**	.319**	(-.150)**	.261**	(-.021)	.251**	(-.014)
Cumulative GPA	.292**	.673**	(-.449)**	.494**	.664**	.675**	.525**	1.000	.629**	.516**	.429**	.496**	.447**	(-.128)**	.363**	(-.019)	.381**	.205
Micro. final grade	.287**	.562**	(-.448)**	.439**	.851**	.561**	.393**	.629**	1.000	.390**	.357**	.400**	.287**	(-.103)	.217**	(-.005)	.295**	.027
NUR212 final grade	.246**	.581**	(-.363)**	.393**	.404**	.414**	.372**	.516**	.390**	1.000	.347**	.349**	.304**	(-.143)**	.377**	(-.038)	.306**	.267*
NUR109 final grade	.232**	.559**	(-.395)**	.314**	.340**	.351**	.382**	.429**	.357**	.347**	1.000	.342**	.298**	(-.048)	.299**	(-.004)	.173**	.033
NUR108 final grade	.212**	.568**	(-.332)**	.357**	.419**	.405**	.365**	.496**	.400**	.349**	.342**	1.000	.328**	(-.030)	.290**	.068	.226**	.163
NUR209 final grade	.176**	.581**	(-.325)**	.315**	.307**	.306**	.319**	.447**	.287**	.304**	.298**	.328**	1.000	(-.101)**	.198**	.049	.245**	.191
Program enrollment	(-.105)**	(-.202)**	.320**	(-.052)	(-.146)**	(-.098)	(-.150)**	(-.128)**	(-.103)	(-.143)**	(-.048)	(-.030)	(-.101)**	1.000	.009	.187**	.158**	(-.151)
NUR213 final grade	.086*	.402**	(-.211)**	.313**	.244**	.295**	.261**	.363**	.217**	.377**	.299**	.290**	.198**	.009	1.000	(-.005)	.238**	.215
Time lag	(-.057)	.027	.040	.010	.017	(-.013)	(-.021)	(-.019)	(-.005)	(-.038)	(-.004)	.068	.049	.187**	(-.005)	1.000	.074	(-.005)
NUR105 final grade	.058	.402**	(-.155)**	.290**	.276**	.327**	.251**	.381**	.295**	.306**	.173**	.226**	.245**	.158**	.238**	.074	1.000	(-.187)
Math. final grade	.020	.109	(-.166)	(-.120)	.672**	.075	(-.014)	.205	.027	.267*	.033	.163	.191	(-.151)	.215	(-.005)	(-.187)	1.000

Note. Number of failures = number of failures among 11 nursing components; Program enrollment = program enrollment in months; Time lag = time lag between capstone completion and NCLEX-RN attempt.

\* correlation is significant at the 0.05 level (2-tailed). \*\* correlation is significant at the 0.01 level (2-tailed).

I conducted an initial binary logistic regression analysis to determine the effect of academic and time-lapse variables on the NCLEX-RN outcome. The outcome of interest was passage of NCLEX-RN on the first attempt. The possible predictor variables were as follows: final grades in each prerequisite course (mathematics, microbiology, and anatomy and physiology), final grades in each nursing theory component, number of failures in all 11 nursing components, length of program enrollment in months, and time lag between clinical capstone completion and first NCLEX-RN attempt. Missing cases for students who transferred prerequisite courses (mathematics [ $n = 706$ ], microbiology [ $n = 441$ ], and anatomy and physiology [ $n = 492$ ]) to the studied college or for students who waived NUR 105 ( $n = 474$ ), restricted the sample size drastically. The number of cases included in this analysis was 23, with 763 missing cases. This regression does not meet the minimum required sample size of 146 as identified by Faul et al. (2009). No conclusions could be drawn from this model analysis. I used the academic variable prerequisite GPA in subsequent analyses to gather information regarding prerequisite academic achievement. For each model, the independent variables were entered simultaneously.

**Model 1.** A binary logistic regression analysis was performed to investigate which academic and time-lapse factors had an effect on the NCLEX-RN outcome. A sample size of 786 is represented, which meets the required sample size as identified by Faul et al. (2009). The outcome of interest was passage of NCLEX-RN on the first attempt. The possible predictor variables were cumulative GPA, length of program enrollment in months, and time lag between clinical capstone completion and first

NCLEX-RN attempt. The Hosmer-Lemeshow goodness of fit was not significant ( $p > .05$ ) indicating the model was correctly specified. The model describes the measure of error with a -2 log Likelihood of 808.522 resulting in a calculated Nagelkerke  $R^2$  of .148; and accurately predicted the graduate's outcome on the NCLEX-RN 74.9% of the time. The model resulted with the independent variable length of program enrollment in months as not significant ( $p > .05$ ), however, the independent variables cumulative GPA and time lag between clinical capstone completion and NCLEX-RN attempt were found to be significant ( $p < .05$ ) (Table 11).

Table 11

*Model 1 Regression Analysis for Selected Academic and Time-lapse Variables (N = 786)*

Independent Variable	B	S.E.	Wald	df	Sig.	Exp (B)	95% C.I. for EXP (B)	
							Lower	Upper
Cumulative GPA	2.165	.281	59.519	1	.000	8.718	5.029	15.113
Length of program enrollment (months)	(-.007)	.004	3.085	1	.079	.993	.985	1.001
Time lag between capstone and NCLEX-RN attempt (quarters)	(-.089)	.038	5.546	1	.019	.915	.849	.985
Constant	(-4.506)	.801	31.676	1	.000	.011		

Controlling for length of program enrollment in months and time lag between clinical capstone completion and first NCLEX-RN attempt, the predictor variable cumulative GPA was found to contribute to the model [ $B = 2.165$ ,  $SE = .281$ ,  $Wald = 59.519$ ,  $p < .001$ ]. The estimated odds ratio favored an increase of nearly 800% [ $Exp (B)$

= 8.718, 95% *CI* (5.029, 15.113)] for first-time NCLEX-RN passage for each 1.0 increase of the cumulative GPA.

Controlling for length of program enrollment in months and the cumulative GPA, the predictor variable time lag between clinical capstone completion and first NCLEX-RN attempt was found to contribute to the model [ $B = (-.089)$ ,  $SE = .038$ ,  $Wald = 5.546$ ,  $p < .05$ ]. The estimated odds ratio favored a decrease of 8.5% [ $Exp(B) = .915$ , 95% *CI* (.849, .985)] for first-time NCLEX-RN passage for every one 3-month quarter increase of the time lag between clinical capstone completion and first NCLEX-RN attempt.

In the analysis of Model 1, the null hypothesis was rejected for RQ2 and RQ3. A significant relationship existed between NCLEX-RN passage or failure for the academic variable of cumulative GPA and the time-lapse variable of time lag between clinical capstone completion and first attempt on NCLEX-RN.

**Model 2.** The second model analyzed individual components of the cumulative GPA to provide greater detail regarding academic factors and address concerns about multicollinearity. The prerequisite GPA (comprised of final grades in microbiology, mathematics, and anatomy and physiology), and the nursing GPA (calculated from all attempts in all eight nursing theory components) were analyzed in lieu of the cumulative GPA. Both time-lapse variables were also included in this model. A sample size of 420 is represented. According to Faul et al. (2009) this sample size is sufficient for analysis.

A binary logistic regression analysis was conducted to investigate which of these academic and time-lapse factors would predict first-time pass of NCLEX-RN. The outcome of interest was passage of NCLEX-RN on the first attempt. The possible

predictor variables were as follows: prerequisite GPA, nursing GPA, length of program enrollment in months, and time lag between clinical capstone completion and first NCLEX-RN attempt. The Hosmer-Lemeshow goodness of fit was not significant ( $p > .05$ ) indicating the model was correctly specified. The model described the measure of error with a -2 log Likelihood of 359.695, resulting in a calculated Nagelkerke  $R^2$  of .265; and accurately predicted the graduate's outcome on first attempt of the NCLEX-RN 79.8% of the time. The model resulted with the independent variable length of program enrollment in months as not significant ( $p > .05$ ). The independent variables prerequisite GPA, nursing GPA, and time lag between clinical capstone completion and NCLEX-RN attempt were found to be significant ( $p < .05$ ) (Table 12).

Table 12

*Model 2 Regression Analysis for Selected Academic and Time-lapse Variables (n = 420)*

Independent Variable	B	S.E.	Wald	df	Sig.	Exp (B)	95% C.I. for EXP (B)	
							Lower	Upper
Prerequisite GPA	.575	.177	10.512	1	.001	1.777	1.225	2.516
Nursing GPA	1.424	.286	24.808	1	.000	4.155	2.372	7.276
Length of program enrollment (months)	.001	.007	.014	1	.905	1.001	.988	1.014
Time lag between capstone and NCLEX-RN attempt (quarters)	(-.138)	.054	6.515	1	.011	.871	.783	.968
Constant	(-3.093)	.699	19.565	1	.000	.045		

Controlling for nursing GPA, length of program enrollment in months, and time lag between clinical capstone completion and first NCLEX-RN attempt, the predictor variable prerequisite GPA was found to contribute to the model [ $B = .575$ ,  $SE = .177$ ,  $Wald = 10.512$ ,  $p < .05$ ]. The estimated odds ratio favored an increase of 77% [ $\text{Exp}(B) = 1.777$ , 95%  $CI(1.255, 2.516)$ ] in first-time NCLEX-RN passage for each 1.0 increase of the prerequisite GPA.

Controlling for prerequisite GPA, length of program enrollment in months, and time lag between clinical capstone completion and first NCLEX-RN attempt, the predictor variable nursing GPA was found to contribute to the model [ $B = 1.424$ ,  $SE = .286$ ,  $Wald = 24.808$ ,  $p < .001$ ]. The estimated odds ratio favored an increase of 300% [ $\text{Exp}(B) = 4.155$ , 95%  $CI(2.372, 7.276)$ ] in first-time NCLEX-RN passage for each 1.0 increase of the nursing GPA.

Controlling for prerequisite GPA, nursing GPA, and length of program enrollment in months the predictor variable of time lag between clinical capstone completion and first NCLEX-RN attempt was found to contribute to the model [ $B = (-.138)$ ,  $SE = .054$ ,  $Wald = 6.515$ ,  $p < .05$ ]. The estimated odds ratio favored a decrease of 12% [ $\text{Exp}(B) = .871$ , 95%  $CI(.783, .968)$ ] for first-time NCLEX-RN passage for every one 3-month quarter increase of the time lag between clinical capstone completion and first NCLEX-RN attempt.

In the analysis of Model 2, I rejected the null hypothesis for RQ2 and RQ3. A significant relationship existed between NCLEX-RN outcome for the academic variables

of prerequisite GPA and nursing GPA, and for the time-lapse variable of time lag between clinical capstone completion and first attempt on NCLEX-RN.

**Model 3.** Model 3 further differentiated nursing GPA by including the final grades in each of the eight nursing theory components. According to Faul et al. (2009) the sample size ( $n = 179$ ) is sufficient for analysis. A binary logistic regression analysis was conducted to investigate which academic and time-lapse factors predict first-time passage of NCLEX-RN. The outcome of interest was passage of NCLEX-RN on the first attempt. The possible predictor variables were as follows: prerequisite GPA, final grades in each nursing theory component (NUR 104, NUR 105, NUR 108, NUR 109, NUR 209, NUR 211, NUR 212, & NUR 213), total number of failures in all 11 nursing components, length of program enrollment in months, and time lag between clinical capstone completion and first NCLEX-RN attempt. The Hosmer-Lemeshow goodness of fit was not significant ( $p > .05$ ) indicating the model was correctly specified. The model describes the measure of error with a -2 log Likelihood of 122.399 resulting in a calculated Nagelkerke  $R^2$  of .332; and accurately predicted the graduate's outcome on the first attempt for the NCLEX-RN 83.2% of the time (Table 13).

Table 13

*Model 3 Regression Analysis for Selected Academic and Time-lapse Variables (n = 179)*

Independent Variable	B	S.E.	Wald	Df	Sig.	Exp (B)	95% C.I. for EXP (B)	
							Lower	Upper
Prerequisite GPA	.639	.315	4.114	1	.043	1.895	1.022	3.513
NUR 104 final grade	.458	.414	1.229	1	.268	1.582	.703	3.558
NUR 105 final grade	(-.382)	.493	.600	1	.439	.682	.259	1.795
NUR 108 final grade	(-.417)	.521	.639	1	.424	.659	.237	1.831
NUR 109 final grade	.952	.640	2.214	1	.137	2.590	.739	9.075
NUR 209 final grade	.331	.317	1.089	1	.297	1.393	.748	2.595
NUR 211 final grade	1.252	.471	7.059	1	.008	3.498	1.389	8.811
NUR 212 final grade	.040	.650	.004	1	.950	1.041	.291	3.723
NUR 213 final grade	(-1.051)	.562	3.492	1	.062	.350	.116	1.053
Number of failures in 11 nursing components	.001	.146	.000	1	.993	1.001	.752	1.333
Length of program enrollment (months)	(-.005)	.019	.066	1	.797	.995	.959	1.032
Time lag between capstone and NCLEX attempt (quarters)	(-.125)	.206	.367	1	.545	.882	.589	1.323
Constant	(-3.229)	2.044	2.496	1	.114	.040		



The model indicated the independent variables of final grades in seven of the eight individual nursing theory components, total number of failures in 11 nursing components, length of program enrollment in months, and time lag between clinical capstone completion and first NCLEX-RN attempt were not significant ( $p > .05$ ). The independent variables of prerequisite GPA and final grade in nursing theory component NUR 211 were found to be significant ( $p < .05$ ).

Controlling for final grades in nursing theory components, total number of failures in 11 nursing components, length of program enrollment in months, and time lag between clinical capstone completion and first NCLEX-RN attempt, the predictor variable prerequisite GPA was found to contribute to the model [ $B = .639$ ,  $SE = .315$ ,  $Wald = 4.114$ ,  $p < .05$ ]. The estimated odds ratio favored an increase of 90% [ $\text{Exp}(B) = 1.895$ , 95%  $CI(1.022, 3.513)$ ] in first-time NCLEX-RN passage for each 1.0 increase of the prerequisite GPA.

Controlling for prerequisite GPA, final grades in nursing theory components, total number of failures in 11 nursing components, length of program enrollment in months, and time lag between clinical capstone completion and first NCLEX-RN attempt, the predictor variable final grade NUR 211 was found to contribute to the model [ $B = 1.252$ ,  $SE = .471$ ,  $Wald = 7.059$ ,  $p < .05$ ]. The estimated odds ratio favored an increase of 250% [ $\text{Exp}(B) = 3.498$ , 95%  $CI(1.389, 8.811)$ ] in first-time NCLEX-RN passage for each 1.0 increase of the final grade in NUR 211.

In the analysis of Model 3, I rejected the null hypothesis and accepted the alternate hypothesis for RQ2 (academic factors predicting first-time success on the

NCLEX-RN) for prerequisite GPA and final grade in NUR 211. I failed to reject the null hypothesis for RQ3, as there was no significant difference between first-time NCLEX-RN pass or fail outcome based on the independent time-lapse variables for this model.

**Model 4.** For Model 4, I included the independent variables that demonstrated significance ( $p < .05$ ) in the previous models. A sample size of 418 was represented, which was sufficient according to Faul et al. (2009). A binary logistic regression analysis was conducted to investigate which academic and time-lapse factors predict first-time pass of NCLEX-RN. The outcome of interest was passage of NCLEX-RN on the first attempt. The possible predictor variables were as follows: prerequisite GPA, final grade in NUR 211, number of failures in 11 nursing components, and time lag between clinical capstone completion and first NCLEX-RN attempt. The Hosmer-Lemeshow goodness of fit was not significant ( $p > .05$ ) indicating the model was correctly specified. The model describes the measure of error with a -2 log Likelihood of 356.046 resulting in a calculated Nagelkerke  $R^2$  of .267; and accurately predicted the graduate's outcome on the first attempt for the NCLEX-RN 79.4% of the time. The model indicated that the independent variables of prerequisite GPA, final grade in NUR 211, number of failures in 11 nursing components, and time lag between clinical capstone completion and first NCLEX-RN attempt were all found to be significant ( $p < .05$ ) (Table 14).

Table 14

*Model 4 Regression Analysis for Selected Academic and Time-lapse Variables (n = 415)*

Independent Variable	B	S.E.	Wald	df	Sig.	Exp (B)	95% C.I. for EXP (B)	
							Lower	Upper
Prerequisite GPA	.587	.177	10.983	1	.001	1.799	1.271	2.545
NUR 211 final grade	.850	.230	13.644	1	.000	2.339	1.490	3.672
Number of failures in 11 nursing components	(-.220)	.076	8.476	1	.004	.802	.692	.931
Time lag between capstone and NCLEX-RN attempt (quarters)	(-.132)	.053	6.152	1	.013	.876	.784	.973
Constant	(-1.861)	.756	6.060	1	.014	.156		

Controlling for final grade in NUR 211, number of failures in 11 nursing components, and time lag between clinical capstone completion and first NCLEX-RN attempt, the predictor variable prerequisite GPA was found to contribute to the model [ $B = .587$ ,  $SE = .177$ ,  $Wald = 10.983$ ,  $p < .05$ ]. The estimated odds ratio favored an increase of 80% [ $Exp(B) = 1.799$ , 95%  $CI(1.271, 2.545)$ ] in first-time NCLEX-RN passage for each 1.0 increase of the prerequisite GPA.

Controlling for prerequisite GPA, number of failures in 11 nursing components, and time lag between clinical capstone completion and first NCLEX-RN attempt, the predictor variable final grade in NUR 211 was found to contribute to the model [ $B = .850$ ,  $SE = .230$ ,  $Wald = 13.644$ ,  $p < .001$ ]. The estimated odds ratio favored an increase of

130% [ $Exp(B) = 2.339$ , 95%  $CI(1.490, 3.672)$ ] in first-time NCLEX-RN passage for each 1.0 increase of the final grade in NUR 211.

Controlling for prerequisite GPA, final grade in NUR 211, and time lag between clinical capstone completion and first NCLEX-RN attempt, the predictor variable number of failures in 11 nursing components, was found to contribute to the model [ $B = (-.220)$ ,  $SE = .076$ ,  $Wald = 8.476$ ,  $p < .05$ ]. The estimated odds ratio favored a decrease of nearly 20% [ $Exp(B) = .802$ , 95%  $CI(.692, .931)$ ] in first-time NCLEX-RN passage for each one unit increase of the number of failures in 11 nursing components.

Controlling for prerequisite GPA, final grade in NUR 211, and number of failures in 11 nursing components, the predictor variable time lag between clinical capstone completion and first NCLEX-RN attempt was found to contribute to the model [ $B = (-.132)$ ,  $SE = .053$ ,  $Wald = 6.152$ ,  $p < .05$ ]. The estimated odds ratio favored a decrease of 12% [ $Exp(B) = .876$ , 95%  $CI(.789, .973)$ ] for first-time NCLEX-RN passage for every one 3-month quarter increase of the time lag between clinical capstone completion and first NCLEX-RN attempt.

In the analysis of Model 4, the null hypothesis was rejected for both methodology research questions. There is a significant relationship between NCLEX-RN pass or fail outcome for the academic variables of prerequisite GPA, final grade in NUR 211, number of failures in 11 nursing components, and for the time-lapse variable of time lag between clinical capstone completion and first attempt on NCLEX-RN.

### Summary of Outcomes

The null hypothesis was rejected for both methodological research questions posed for this study. A significant ( $p < .05$ ) relationship was found between selected academic factors (cumulative GPA, prerequisite GPA, nursing GPA, final grade in NUR 211, and number of failures in all 11 nursing components) and an individual's NCLEX-RN first-time pass rate. A significant ( $p < .05$ ) relationship was also found for the time lag between program completion and the first NCLEX-RN attempt and the NCLEX-RN first-time pass rate. Although a greater odds ratio was found in predicting NCLEX-RN success within models for the following independent variables (nursing GPA greater than prerequisite GPA in Model 2; final grade in NUR211 greater than prerequisite GPA in Model 3 and 4; the time lag between clinical capstone completion and first NCLEX-RN attempt greater than number of failures in 11 nursing components in Model 4) the confidence intervals for the odds ratio overlapped. I cannot identify that one is a stronger predictor than the other for that model. Table 15 provides a summary of the results of this study.

Table 15

*Summary of Study Results*

Independent Variable	Mean	Unit of Measure	Impact on NCLEX-RN Passage
Cumulative GPA	2.86	Increase of 1.0 on the 0 to 4.0 scale	800% increase in NCLEX-RN passage
Nursing GPA	2.28	Increase of 1.0 on the 0 to 4.0 scale	300% increase in NCLEX-RN passage
Prerequisite GPA	2.86	Increase of 1.0 on the 0 to 4.0 scale	80% increase in NCLEX-RN passage
Final grade in NUR 211	2.81	Increase of 1.0 on the 0 to 4.0 scale	130% increase in NCLEX-RN passage
Number of failures in nursing components	1.94	Increase in number of failures by 1	20% decrease in NCLEX-RN passage
Time lag between capstone completion and NCLEX-RN	1.89	Increase in time lag by 1 quarter	12% decrease in NCLEX-RN passage

**Summary of Descriptive Statistics Findings**

Descriptive statistics provided information about the sample and allowed comparisons between the sample for this study and those for previous research studies evaluating academic and time-lapse factors associated with NCLEX-RN outcome. These academic and time-lapse factors may impact the graduate's ability to build upon previous knowledge (Knowles et al., 2012) and to create the neural pathways associated with retention of information (Zull, 2006, 2011). The analysis of descriptive statistics, in conjunction with inferential statistics, provided the basis for the project described in Section 3.

**Prerequisite GPA.** The majority of students in the sample transferred in some prerequisite credits; including mathematics ( $n = 80$ ), microbiology ( $n = 345$ ), and anatomy and physiology ( $n = 294$ ). Fifty-three percent ( $n = 420$ ) of graduates did complete one or more prerequisites at the program under study. The range for prerequisite GPA was from 0 to 4.0, with a mean prerequisite GPA of 2.86 (see Table 8). The high number of students who transfer prerequisite courses into the ADN program may be unique to the program under study. Other research studies did not identify the number of transferred prerequisite courses or how these courses were handled in data analyses (Shaffer & McCabe, 2013; Trofino, 2013; Truman, 2012; Yates & Sandiford, 2013). The mean prerequisite GPA for students at the program under study was below the prerequisite GPA described in several other research studies (Elder et al., 2015; Manieri et al., 2015; Raman, 2013; Shaffer & McCabe, 2013; Trofino, 2013).

**Nursing academics.** Students in the study sample earned a C as the most common final grade for seven of the eight nursing theory components (NUR 104, NUR 105, NUR 108, NUR 109, NUR 209, NUR 212, & NUR 213). A greater distribution of grades was noted for NUR 211 ( $M = 2.81$ ,  $SD 0.70$ ) and NUR 209 ( $M = 2.82$ ,  $SD 0.86$ ). (see Table 5). Administrators at each ADN program establish progression criteria, which vary between institutions (Merkley, 2016). At the program under study, students must earn a 2.0 to pass a course. Schooley and Kuhn (2013), and Truman (2012) also reported the need to maintain a 2.0 to successfully progress. Peterson-Graziose et al. (2013) observed a 29% attrition rate after the first semester for students who did not maintain a GPA of 2.5.

Study site records indicate the progression policies described student dismissal from the program after three failures in any one nursing component or seven failures among the 11 nursing components. The number of cumulative failures counted for the 11 nursing components ranged from 0 to 16, with approximately 70% of students failing at least once. (see Table 7). The progression policy was not followed for students who were allowed to continue in the program after accumulating seven or more failures ( $n = 28$ ). The high number of failures allowed before dismissal from the program is likely unique to the program where data was collected. Existing literature does not describe students with multiple failures during the nursing program. Trofino (2013) described a program where 24.7% of students repeated a nursing course and completed the program. Progression policies were identified where failure in one nursing course resulted in dismissal and required reapplication to the program. (Abele et al., 2013; Jeffreys, 2007; Peterson-Graziose et al., 2013; Schooley & Kuhn, 2013). Other researchers of ADN programs did not identify the number of nursing course failures allowed prior to program dismissal (Chen & Bennett, 2016; Gilmore, 2008; Romeo, 2013; Trofino, 2013; Truman, 2012; Yates & Sandiford, 2013).

Half of the study sample earned a nursing GPA between 2.0 and 2.99, with 33% below a 2.0 (see Table 8). The range for the nursing GPA was between .76 and 4.0. The mean nursing GPA ( 2.28) for students at the program under study is lower than nursing GPAs reported in some previous studies (Alameida et al., 2011; Kaddoura et al., 2017; McGahee et al., 2010; Truman, 2012). Of note, Romeo (2013), Truman (2012), and



Jeffreys (2007) described mean nursing GPAs for graduates who failed the NCLEX-RN that are comparable with the mean nursing GPA for students at the program under study.

**Cumulative GPA.** The range for the cumulative GPA was from 2.06 to 3.95, with a mean of 2.86. Most students in the sample earned a cumulative GPA in the C range (2.00 - 2.99). This description of students' academic ability throughout the program provided a comparison when evaluating results against other research (Alameida et al., 2011; Brodersen & Mills, 2014; DeLima et al., 2011; Kaddoura et al., 2017; Seago et al., 2012; Simon et al., 2013; Yates & Sandiford, 2013). Cumulative GPA at the program where data was collected was lower than the reported cumulative GPA for studies by Alameida et al. (2011), Brodersen and Mills (2014), and Simon et al. (2013).

**Time enrolled.** According to study site records, most students are enrolled part time while they complete the ADN program. The length of enrollment ranged from 8 months to 150 months, with a mean of 41.94 months (Figure 1). Almost half of the students required more than 36 months to complete the program. The prolonged enrollment time at the studied program demonstrated a deviation from conventional ADN programs where students must complete the program in 2 to 3 years (Chen & Bennett, 2016; Horton et al., 2012; Knauss & Willson, 2013; McGahee et al., 2010; Raman, 2013; Shaffer & McCabe, 2013; Trofino, 2013). Information gleaned about part time study, length of enrollment and NCLEX-RN outcome is unique to the program under study.

**Time lag.** Report of time lag between completion of clinical capstone and the first attempt on the NCLEX-RN was calculated in quarters due to the format of the report generated by NCSBN to the program under study. The minimum value for number of

quarters elapsed between completion of capstone and first attempt was 0 (graduate attempted NCLEX-RN during the same quarter as completing the capstone), and the maximum value of lapsed 3-month quarters was 23 ( $M = 1.89$ ,  $SD = 2.159$ ). Eighty-three percent of graduates attempted the NCLEX-RN for the first time within two quarters of completing the clinical capstone (see Table 9). The time lag at the program under study between program completion and first attempt on the licensure examination is not consistent with the time lag identified in previous studies: Eich and O'Neill (2007) found 88% of graduates took the NLCEX-RN within 54 days; Woo et al. (2009) found a mean time lag between program completion and first attempt on the NCLEX-RN of 34.79 days; and Brown et al. (2015) found 80% of medical laboratory scientists took the certification examination within one 3-month quarter.

### **Summary of Inferential Statistics Findings**

**Academic variables.** The null hypothesis was rejected for Research Question 2. A significant ( $p < .05$ ) relationship was found between selected academic factors (prerequisite GPA, nursing GPA, final grade in NUR 211, number of failures in all 11 nursing components, cumulative GPA) and NCLEX-RN first-time pass rate.

My study confirmed the significant ( $p < .05$ ) impact of increased prerequisite GPA on a graduate's first time NCLEX-RN outcome found in multiple studies (Breckenridge et al., 2012; Elder et al., 2015; Elkins, 2015; Gilmore, 2008; McCarthy et al., 2014; McGahee et al., 2010; Raman, 2013; Romeo, 2013; Seago et al., 2012; Shaffer & McCabe, 2013; Schooley & Kuhn, 2013; Trofino, 2013; Truman, 2012). Raising the admission criteria for student admission to increase NCLEX-RN pass rates was also

recommended (Hooper & Ayars, 2017; Libner & Kubala, 2017). These findings supported the foundational nature of prerequisite mathematics and science courses in nursing education, and are supported in theory by the assumptions of adult learning as described by Knowles et al. (2012).

The positive relationship between nursing GPA and NCLEX-RN passage found in my study was consistent with previous significant ( $p < .05$ ) findings by other researchers (Alameida et al., 2011; Gilmore, 2008; Jeffreys, 2007; Lavandera et al., 2011; Romeo, 2013; Trofino, 2013; Truman, 2012). The test blueprint for the NCLEX-RN is based on nursing knowledge, therefore, demonstration of knowledge in nursing theory components should relate to graduate outcome on the licensure examination. In addition, my review of the evidence for ADN students indicated frequent positive, significant relationships ( $p < .05$ ) between medical surgical nursing course grades and NCLEX-RN outcomes (Alameida et al., 2011; Horton et al., 2012; Jeffreys, 2007; Schooley & Kuhn, 2013; Simon et al., 2013; Trofino, 2013; Yates & Sandiford, 2013; Yeom, 2013). At the studied program, NUR 211 includes concepts of cardiovascular, respiratory, and hematology and oncology nursing. As a long-term ADN nurse educator, it was intuitive to me that understanding of the core nursing knowledge in NUR 211 would translate to NCLEX-RN success. The lack of grade distribution for all other nursing theory components at the studied program, with limited numbers of students who achieve a B or an A grade, may explain the lack of a statistically significant relationship between those nursing components and NCLEX-RN passage. The early identification of at risk students and

provision of student support and remediation to increase NCLEX-RN pass rates was also described (Hooper & Ayars, 2017; Libner & Kubala, 2017; McLain et al., 2017).

The inverse relationship between the number of course failures and NCLEX-RN passage was consistent between my study and other previous work (Abele et al., 2013; Lavandera et al., 2011). This relationship was also intuitive to me as an educator. Repeated failure of nursing components demonstrates an inability of the student to build upon previous knowledge and apply that knowledge to the current circumstances, as described by Knowles et al. (2012). With repeated failures, students may be unable to establish the neural pathways necessary to retain information (Zull, 2006, 2011) and apply nursing knowledge when attempting the NCLEX-RN. At the program under study, students were allowed to continue in the program with seven or more nursing component failures, which conflicts with the progression policy in place. Hooper and Ayars (2017) discussed the importance of enforcing progression policies to increase NCLEX-RN pass rates.

Cumulative GPA was found to be significant ( $p = .000$ ) in my study and in previous research by Brodersen and Mills (2014), Kaddoura et al. (2017), and Simon et al. (2013). Knowles et al. (2012) described the adult learner as self-directed and internally motivated, with a readiness to learn relevant information. These traits may be reflected in the ability of a student to achieve a higher cumulative GPA and demonstrate “minimum qualifications for a new nurse” (Lavin & Rosario-Sim, 2013, p.196) to successfully pass the NCLEX-RN.

**Time-lapse variables.** The null hypothesis was rejected for Research Question 3. A significant ( $p < .05$ ) relationship was found for the time lag between program completion and the first NCLEX-RN attempt and the NCLEX-RN first-time pass rate. This finding replicated previous research (Brown et al., 2015; Eich & O'Neill, 2007; Woo et al., 2009). Zull's (2006, 2011) neuroscience research described increases in the efficacy of learning when strategies were implemented to promote retention. In the program under study graduates were not required to complete a post-graduation review of nursing content prior to attempting the NCLEX-RN in 2015. A review course might have interrupted Ebbinghaus's forgetting curve (Custers, 2010; Foster et al., 2016; Hu et al., 2013; Krishnan & Carey, 2013; Murre & Dros, 2015; Quinn, Smolinski, & Peters, 2018). The graduate's limited initial understanding of information, compounded by elapsed time between program completion and first attempt on the licensure examination, may explain the decrease in NCLEX-RN pass rate over time. It was interesting to note the length of enrollment in the ADN program was not significantly ( $p > .05$ ) related to first-time NCLEX-RN outcome. Data analysis suggested prolonged enrollment, as is associated with part-time study, does not put the student at risk for NCLEX-RN failure.

The information from this research identified key academic and time lag variables that demonstrate a relationship with first-time NCLEX-RN passage. From this data, opportunities to reach out to students and provide support were identified. Students with prerequisite GPA, nursing GPA, and/or cumulative GPA below 2.5, students who fail one or more nursing component, and students who do not attempt the NCLEX-RN within one 3-month quarter after capstone completion are at risk for NCLEX-RN failure. I

recommended the implementation of early intervention policies to meet the needs of students at risk.

In Section 3, I describe the project that resulted from this study. The section includes the rationale for the policy recommendation, review of the literature, project description, evaluation plan, and implications for social change.

## Section 3: The Project

### **Introduction**

#### **Background of Existing Problem**

The low NCLEX-RN first-time pass rate is a problem for the ADN program under study. A pass rate below the national mean jeopardizes program accreditation and is a concern for program stakeholders. Failure to complete the program and pass the licensure examination prohibits the graduate from entering the workforce as an RN, wastes valuable resources, exacerbates the nursing shortage, and negatively impacts patient safety.

#### **Summary of Policy Analysis**

The program under study has many systems in place to promote student success. All students are assigned an academic advisor, and students may contact that advisor via phone or electronic messaging. All students also complete a virtual student orientation, which includes information regarding college resources, policies, study skills, and academic planning. College policy defines satisfactory academic progress, which includes a GPA requirement. Students are placed on academic probation for a GPA below 2.0. Students on academic probation are contacted quarterly by academic advisors; these advisors discuss college resources and strategies to help the student return to good academic standing. A policy is also in place whereby students must contact an academic advisor if they withdraw from a nursing component three times prior to registration for another nursing component. Despite these systems, the NCLEX-RN pass rate for the ADN graduate remains below the national mean.

Based on my research and review of the literature, I identified critical points during enrollment where students are at risk academically, and an intervention that could promote student success. The program under study does not have an advising policy in place directing academic advisors and faculty members to contact students at key intervals to promote ongoing academic and subsequent NCLEX-RN success. Additionally, a system of structured outreach and support does not currently exist for the period of time between clinical capstone completion and the first NCLEX-RN attempt. The addition of student outreach policies targeted toward students and graduates at risk will provide student support and resources necessary for NCLEX-RN success. I recommended an early identification system for students at risk for academic difficulties and first-time NCLEX-RN failure, integrated with student support.

### **Project Description and Goals**

I identified academic and time-lapse factors that demonstrate a statistically significant relationship with first-time NCLEX-RN passage. Extrapolating from that data, I identified multiple key points in a student's academic progression where the student should be considered at academic risk. Interventions can be implemented to address those situations of academic risk, and may prevent the student from continuing on a trajectory toward first-time NCLEX-RN failure. I developed a policy recommendation for structured outreach and the implementation of early intervention strategies to meet the student needs, based on the statistically significant ( $p < .05$ ) relationship found between first-time NCLEX-RN passage and selected academic factors (cumulative GPA, prerequisite GPA, nursing theory GPA, number of failures in all 11 nursing components),



and the time lag between completion of clinical capstone and the first NCLEX-RN attempt.

This policy recommendation was supported by current literature surrounding academic advisement, factors affecting NCLEX-RN success, and strategies to promote academic success, all of which are identified in the review of the literature. The resources and barriers associated with the project, evaluation plan, and a summary of the possible social change implications are explained. The policy recommendation included timely identification of students at risk for NCLEX-RN failure and structured contact with those students to provide support. The goal of this recommendation was to improve the first-time NCLEX-RN pass rate for graduates. Appendix A includes details of the policy recommendation, which will be shared with the leadership team for the program under study. The leadership team is accountable to program stakeholders and has the authority to act on recommendations and change policy if desired.

### **Rationale**

My data analysis identified multiple academic factors and one time lapse factor which were associated with NCLEX-RN passage. For every one-point increase in prerequisite GPA, nursing GPA, and cumulative GPA (on the 0 to 4.0 scale) data analysis suggested an increase in the chance to pass the NCLEX-RN on the first attempt. Also, for each additional failure in a nursing component, and each additional 3-month quarter increase in the time lag between completion of clinical capstone and the first NCLEX-RN attempt, the data analysis suggested a decreased likelihood of NCLEX-RN passage. These results point to many critical pathway opportunities during the education process to

intervene with students, and improve their chances for NCLEX-RN success. The program under study has multiple resources to facilitate intervention (i.e., electronic student information system with the ability to correspond electronically, academic advisors, and faculty). My research provided information to inform a policy recommendation to address the current problem of a low NCLEX-RN first-time pass rate by graduates of the program under study.

I recommended early intervention with at risk students at critical points in their academic progression. I considered the impact of cognitive and noncognitive factors that influence a student's success as described by Jeffreys (2014, 2015) in the determination of when to reach out to students. Communication with the student promotes identification of causative factors associated with lack of success, and allows for system development to provide early intervention (Elder et al., 2015; Jeffreys, 2014, 2015; Murray et al., 2016; Shellenbarger & Hoffman, 2016). Electronic or telephone communication initiated per my recommendation was focused to generate conversation with students about concerns and identify strategies for success. The research indicated grades in core courses can inform progression within the nursing program (Schooley & Kuhn, 2013; Taylor et al., 2014) as well as NCLEX-RN success, which supports the need to improve student success throughout the program. Remediation has been shown to improve pass rates, therefore connecting the student with resources for success will improve student outcomes (Horton et al., 2012; Jeffreys, 2014; Jeffreys, 2015; Murray et al., 2016).

The time lag between program completion and the NCLEX-RN attempt presents another opportunity to promote graduate engagement and remediation and therefore

promote NCLEX-RN success. Graduates who delay attempting the NCLEX-RN may feel unprepared, have test anxiety, or lack confidence in their ability to pass (Serembus, 2016; Taylor et al., 2014; Woo et al., 2009). At the program under study, most graduates attempted the NCLEX-RN for the first time within two 3-month quarters of clinical capstone completion. Graduates self-schedule for the NCLEX-RN; a systematic program of communication with the graduate during their NCLEX-RN preparation is not currently in place. I recommended ongoing interaction with program graduates as they prepare to take the NCLEX-RN.

A policy recommendation is the most appropriate genre to present research findings and present solutions based on these findings. My recommendation includes policies for reach-out to students at key intervals, with identification of student needs and subsequent provision of relevant support.

### **Review of the Literature**

I reviewed the literature to discover relevant studies surrounding policy development, strategies to promote academic success, and a theoretical model to serve as a basis for the policy recommendation. Initially, I examined policy analysis and development of policy briefs to enhance my knowledge of this project genre. I also researched frameworks for academic advising, to inform interventions for the policy recommendation. The theoretical framework for my policy recommendation was based on Jeffreys's (2015) Nursing Universal Retention and Success (NURS) Model. Jeffreys described the impact of various factors which influence a student's success in a nursing program: academics; professional integration; environmental support or concerns; student

profile and affective characteristics; and outside surrounding forces. I incorporated the findings for academic and time-lapse variables from my study and the NURS model factors and outcomes into the policy recommendation. The interaction of the factors identified by Jeffreys (2014, 2015) provided a basis for progression policies, student intervention, and optimal outcomes for the program under study.

To review the literature for this project, I searched the following databases for documents and peer-reviewed articles published between 2013 and 2018: Google Scholar, CINAHL Plus with Full Text, ProQuest Health and Medical Collection, Ovid Nursing Journals, Health Source: Nursing/Academic Edition, and ScienceDirect. Search terms used included: *policy development, policy change, barriers to academic policy change, academic policy development, higher education policy development, academic advising, NCLEX success, academic achievement and nursing, nursing retention, counseling in higher education, learning styles for student nurses, remediation in nursing, and interventions for academic success.*

### **Project Genre: Policy Recommendation**

The identification of a problem may spur policy analysis and initiate the development of a policy recommendation. Bardach and Patashnik (2016) identified a stepwise approach for policy analysis, the steps of which included define the problem, assemble the evidence, identify options, select evaluative criteria, envisage outcome and impact, clarify tradeoffs with alternative policy options, complete focused analysis of the best alternative, choose, and communicate policy recommendation. Wong, Green, Bazemore, and Miller (2017), described similar steps specific to health care policy

development. Healthcare practitioners transform clinical or scientific knowledge into a policy brief through definition of the problem, articulation of the policy actions, description of the recommendations, and discussion of the impact of the policy (Wong et al., 2017). Additionally, Herman (2013) addressed the steps in policy analysis when describing a logical approach for writing a policy paper beginning with a definition of the problem, followed by analysis of the data, policy recommendations, feasibility of the approach, implementation details, and wrapping up with a strong conclusion. I conducted the policy analysis for the program under study using a stepwise approach. I identified the problem as a first-time NCLEX-RN pass rate below the national mean, with insufficient systems in place for the identification of students at risk and provision of support.

The policy recommendation I developed to address the identified problem of the low first-time NCLEX-RN pass rate, was based on the analysis of data from my research, progression policies at the program under study, and a review of the literature. I considered the existing structure and workforce for academic advising; the student information system and communication opportunities; the existing policies, as well as the ability of the institution to implement recommendations.

The implementation of the policy recommendation at the program under study is contingent upon leadership review and approval. I will share the policy recommendation with the leadership for the school of nursing, which will include the deans and faculty. Communication with nurse executives and leadership must include the link between the identified problem, potential solutions, theoretical background, and strategies for

evaluation of the recommendation, all in a concise format (Porter-O'Grady, 2017). The policy recommendation (Appendix A) provides rationales and proposed interventions in a logical and succinct format for the leadership team's review.

### **Policy Recommendation: Factors Contributing to Academic Success**

Multiple factors are associated with academic success. My data analysis showed that increased GPAs (prerequisite, nursing, and cumulative) suggest an increased pass rate on the NCLEX-RN. Additionally, my analysis indicated that an increased number of nursing component failures suggests a decreased pass rate on the NCLEX-RN. Therefore, optimizing academic achievement throughout enrollment may promote subsequent NCLEX-RN success. The NURS model (Jeffreys, 2015) provided the theoretical basis for my policy recommendation, by addressing student success throughout enrollment until passage of the licensure examination. The NURS model promotes engagement, support, and remediation for all students (Jeffreys, 2014, 2015). Jeffreys (2015) explored interrelated factors associated with nursing student retention and academic success, with the purpose of identifying students at risk for academic difficulty, developing strategies for success, guiding innovative teaching and educational research, and evaluating strategy effectiveness. The factors associated with student success as identified in the NURS model, included student profile characteristics (e.g. age, gender, language, prior work experience), student affective factors (e.g. cultural values, self-efficacy, motivation), academic factors (e.g. study skills, study hours, academic services), environmental factors (e.g. financial status, family emotional and financial support, family and employment responsibilities, transportation), professional integration factors (e.g. nursing

faculty advisement and helpfulness, encouragement by friends in class, peer mentoring-tutoring), and outside surrounding factors such as local, national, and world events, politics and economics (Jeffreys, 2015, p. 426).

The factors described in the NURS model (Jeffreys, 2015) impact student outcomes, both academic and psychological. Academic outcomes include course grades, nursing GPA, and cumulative GPA; the psychological outcomes include levels of stress and satisfaction. Jeffreys (2015) challenged nursing faculty to design, implement, and evaluate strategies to optimize student outcomes. Program goals included retention, graduation, successful completion of the NCLEX-RN, and integration into the workforce (Jeffreys, 2014, 2015).

The concept of multiple academic and nonacademic factors that impact student success is well represented in the literature. Sportsman (n.d.) described financial, personal, and academic situations that place students at risk for attrition from a nursing program. Shellenbarger and Hoffman (2016) also identified enrolled student concerns associated with finances; the need to work while attending school; time management conflicts between family, school and work; increased stress and anxiety; and a lack of foundational math, science, and English skills. Student-identified barriers included multiple competing demands between childcare, finances, social support, transportation, computer access, and school, as well as a lack of academic skills to prepare for the rigor of nursing school, such as learning and study skills, time management, note-taking, and critical thinking (Custer, 2016; Karsten & DiCicco-Bloom, 2014; Lewis, 2018). Hooper

and Ayars (2017) also described multifaceted reasons for student NCLEX-RN failure that required a programmatic evaluation to promote NCLEX-RN passage.

Ethnically diverse nursing students shared their perspective for educational experiences and strategies for success in a study by Dapremont (2014). This group of students cited a need for help to develop a daily routine of study, strategies to prepare for class participation and examinations, and faculty assistance to establish peer study groups. Murray (2015) echoed these concerns in a study of African American nursing students who identified themes surrounding attrition, financial concerns, lack of social integration, and lack of faculty support. Murray (2015) described the need to help students obtain necessary emotional and financial support from family, provide academic support by faculty, and initiate social activities to promote student integration. An effective action plan to promote student success in the program and NCLEX-RN passage must address multiple academic and personal factors.

Jeffreys (2015) described the student's affective characteristics as personal factors that influence academic outcomes (enrolled GPA, success on the NCLEX-RN), and the psychological outcomes of stress and satisfaction. Fiske (2017) identified the impact of test anxiety, stress, and self-efficacy for both the graduate's success on the NCLEX-RN and the enrolled student's academic and clinical success. Increased self-efficacy (a student's belief of his or her capability to succeed) and mindfulness activities to minimize the negative impact of test anxiety and stress, were found to increase student success while enrolled and graduates who continued those activities during NCLEX-RN review also demonstrated a 10% increase on NCLEX-RN passage (Fiske, 2017). These results



were consistent with Khalaila (2015) who explored the relationship between academic achievement and academic self-concept, intrinsic academic motivation, and test anxiety. Academic self-concept (the student's beliefs and perceptions of own academic ability) was measured using the Academic Self-Concept Scale (Khalaila, 2015). Test anxiety was described as situational anxiety, and demonstrated an inverse relationship with earned GPA. Data analysis found students with high academic self-concept demonstrated higher intrinsic motivation and less test anxiety, which manifested in higher GPA (Khalaila, 2015). In a related study, Beauvais, Stewart, DeNisco, and Beauvais (2014) researched the relationship between academic success (as measured by GPA) and emotional intelligence (measured by the Mayer-Salovey-Carouso Emotional Intelligence Test), psychological empowerment (measured by Sprietzer's Psychological Empowerment Scale), resilience (measured by the Wagnild and Young Resukuebce Scale), and spiritual well-being (measured by the Spiritual Well-Being Scale). Beauvais et al.'s findings differed from Fiske and Khalaila, in that overall emotional intelligence, psychological empowerment, resilience, and spiritual well-being were not correlated with academic success for the undergraduate student. One subset of emotional intelligence (the ability to perceive emotions) was positively linked with academic success; the authors postulated those students were able to manage life situations and study effectively which led to academic success (Beauvais et al., 2014). Pence (2011) surveyed students after completion of their first nursing course and reported results consistent with Beauvais et al. in that emotional intelligence was not significantly related to student retention, but increased extrinsic motivation and decreased test anxiety were. The multiple factors

associated with academic and psychological outcomes are a challenge for program administrators and faculty.

Jeffreys (2014, 2015) recommended early implementation of a program to address factors associated with success and to establish meaningful relationships between students, faculty, and advisors. Davis (2016) described a similar system for student success that started with student orientation and continued throughout the program until NCLEX-RN passage. Student orientation provided an opportunity to demonstrate faculty behaviors associated with caring, have students complete a learning style inventory, identify student needs, recognize academic and personal barriers, describe institutional resources, and provide targeted support. Quinn et al. (2018), and Serembus (2016), described similar approaches to provide academic and psychosocial support to all students beginning early in the program. The meta-analysis by Quinn et al. did not provide a clear indication of the timing associated with interventions for NCLEX-RN success, but the authors concluded that starting success policies early in the program would promote NCLEX-RN success. Donaldson, McKinney, Lee, and Pino (2016) studied an intrusive advising model throughout enrollment for all students, which included registration, learning inventory, study strategies and institutional resources. Students shared an increased likelihood of help-seeking behaviors, with increased program retention and academic success (Donaldson et al., 2016). The program under study has an established orientation program and an assigned academic advisor for each student. I included the recognition of multifaceted student factors and outcomes, and the

use of resources to address these factors, in the policy recommendation, based on the results of my study and this theoretical framework.

### **Policy Recommendation: Strategies to Promote Academic Success**

**At-risk student identification.** Early identification of at risk students was frequently cited in the literature as an important consideration for promoting academic success. Jeffreys (2014) described the importance of early identification of students at risk, and of educating students to seek help for resources at key transition points during enrollment. Hooper and Ayars (2017) recommended identification of students at risk for NCLEX-RN failure with a review of assignments, test scores, and standardized examination scores to provide early assistance. Koester (2015) also monitored student grades in each course, implemented standardized examinations, and provided counseling and remediation after each examination to increase the NCLEX-RN pass rate. Taylor et al. (2014) considered all students who had trouble academically, students with increased course failures, and students who delayed taking NCLEX-RN to be at risk for NCLEX-RN failure. Corrigan-Magaldi, Colalillo, and Molloy (2014) reviewed previous nursing course grades to identify students at risk for course failure in their final semester as well as at risk for NCLEX-RN failure, and initiated remediation to promote success. In a similar study, students were identified as at risk for NCLEX-RN failure when they successfully completed the final nursing theory course with a C+ (Cherkis & Rosciano, 2015). Kolenovic, Linderman, and Karp (2013) considered associate degree students as at risk based on scores from the assessment tests for college readiness, or if they completed developmental education coursework. Custer (2016) identified the need for remedial

courses as a problem for the ADN student in community colleges. Academic risk was associated with study habits, reading skills, time management, and/or classroom participation (Custer, 2016).

In an alternative approach to grade analysis to determine students at risk, Pence (2011) considered all first semester nursing students to be at academic risk, and Ryan (2013) considered all students taking the freshman seminar to be students who required additional academic support. Students who attended the freshman seminar had increased GPAs and indicated satisfaction with the seminar, which included course planning, an overview of campus services, and an assessment of learning style (Ryan, 2013). The administration of a self-assessment tool has also been used to identify students at risk for academic difficulty. McLain et al. (2017) determined academic risk through the use of a self-assessment tool to evaluate the study habits of nursing students. Faculty advisors reviewed the completed tool to determine academic needs, and identify students with personal issues that required referral.

Nursing education programs are constructed with each course building upon the knowledge gained in previous courses. Subsequently, students who fail a course are also considered at risk for NCLEX-RN failure (Taylor et al., 2014). Karsten and DiCiccio-Bloom (2014), and Lewis (2018) also recognized that students who failed a course, then returned to repeat that course, needed academic and psychological support to repeat the course successfully. This review of the literature informed my policy recommendation in terms of the criteria to identify students at risk for academic problems (those with

prerequisite, nursing and cumulative GPAs below 2.5, those who have failed a nursing component), and interventions to promote academic success.

**Changes in academic advising.** Academic advising has been validated as a strategy to promote nursing students' success and retention. Hooper and Ayars (2017) identified individual coaching as a role for student services that promotes academic and NCLEX-RN success for nursing students. Additionally, Custer (2016) described the relationship students develop with an academic advisor, and the need for academic advisor support to link students with institutional resources related to study skills, note taking, time management, and learning styles. Sportsman (n.d.) and Murray et al. (2016) also described retention programs, which addressed the student need for academic resources but also identified other information that an academic advisor could provide, such as information about scholarships and financial resources, and referrals for personal issues. Students who failed and repeated courses also described connecting with academic advisors for emotional support, referral to other professionals, and connection with academic resources (Karsten & DiCicco-Bloom, 2014; Lewis, 2018). These students also shared a need to learn how to manage extenuating circumstances, such as asking for additional time, to promote academic success (Lewis, 2018). Additionally, a literature review by Mooring (2016) identified that nontraditional students required assistance with coping skills, stress management, test anxiety, academic confidence, and relationship building with both peers and faculty. Intrusive advising was recommended to assist students with management of both academic and personal stressors (Mooring, 2016).

A review of studies specific to academic advising provided information about intrusive advising. Donaldson et al. (2016), Kolenovic et al. (2013), and Ryan (2013) implemented intrusive advising programs that featured proactive reach out to students. Donaldson et al. included tasks such as registration, planning the trajectory for education, discussing the academic calendar, and completing a learning study strategies inventory. Kolenovic et al. also studied at risk associate degree students who were assigned an academic advisor and who were involved in an intrusive advising program. The goal of the advising program was for students to achieve and maintain academic momentum, feel integrated with the college, and have access to relevant college support services. After three years, students enrolled in the intrusive advising program were twice as likely to achieve a degree than students in a comparison group (Kolenovic et al., 2013). An improvement in student's overall GPA and retention occurred when academic advisors provided instruction during a freshmen seminar in an experimental study completed by Ryan. Advisors met with students individually and in groups to create course plans for degree completion (Ryan, 2013). Students reported satisfaction with the intrusive advising programs, showed increased knowledge of college resources, and met program goals for academic success (Donaldson et al., 2016; Kolenovic et al., 2013; Ryan, 2013). An academic advisor is assigned for each student at the program under study. My policy recommendation includes proactive outreach to the student with provision of academic and personal support.

Shellenbarger and Hoffman (2016) expanded on the concept of intrusive advising to recommend a system for nursing students, with a centralized advising design to

provide nursing students with comprehensive guidance and support for academic success. The role of the advisor included exploration of cause when a student had academic difficulty. The advisor then advocated for student services (e.g., disability services or financial aid), and collaborated with other departments to build a plan for successful program completion. Mandatory advising points were established, and records of all communication were maintained. Communication with students was maintained with mandatory face-to-face meetings, telephone conversations, or electronically (Shellenbarger & Hoffman, 2016). Boath et al., (2016) also implemented an electronic communication system for students via mobile texting. Students received messages once or twice a week; the focus was providing students with information and support. Communication was asynchronous and a response was not always required (Boath et al., 2016). Specific strategies for stress and anxiety management were sent, including location of support services (e.g., writing center), reminders to see tutors, and socialization opportunities. Student evaluation indicated the messages triggered access of academic services and generated a sense of support (Boath et al., 2016). Electronic messaging is a viable strategy to provide students with information that is accessible at the students' convenience. Academic advisors create a link between students and services for both personal and academic concerns. The implementation of a proactive advising system including electronic communication increases the frequency of advisor-student interaction, and has demonstrated success in connecting students with resources. Based on the results of my research and literature findings, I have included a recommendation to

increase the frequency of outreach by the academic advisor, with assessment of student needs and link to resources.

**Changes in faculty interaction.** Students at risk for academic failure require faculty interaction to provide discipline-specific guidance. Shellenbarger and Hoffman (2016), Sportsman (n.d.), and Jeffreys (2014) described quality student-faculty interactions that included remediation for nursing content, professional integration, support, and mentoring. To enhance student success, faculty served as advocates, who educated and remediated with student-focused retention strategies such as case studies, timely test review, and critical thinking strategies (Sportsman, n.d.). Serembus (2016) implemented remediation strategies for all enrolled students to promote academic and NCLEX-RN success. Digital learning resources associated with program textbooks, mobile applications, and simulations were described as strategies for student success (Serembus, 2016). Custer (2016) confirmed the aforementioned aspects of the faculty role in remediation, but also noted the impact of student participation to manage the stigma associated with participating in remediation programs. The integration of remediation into the curriculum, with group and individual sessions and the use of student contracts, may promote student participation (Mee & Schreiner, 2016).

Student participation in faculty-led remediation activities as a component of program progression improved student performance. Koester (2015) studied student outcomes after program changes were implemented to improve NCLEX-RN pass rate. One of the changes implemented included faculty identification of students at risk for academic failure, through monitoring of grades after each exam in all courses throughout



the program. Faculty provided remediation for low performance (Koester, 2015). Karsten and DiCicco-Bloom (2014) investigated the experience of students who failed a nursing course and described faculty interaction. Students who successfully repeated the course sought help from faculty members for emotional and academic support. Faculty recommended participation in examination review, peer tutoring, and study groups.

Corrigan-Magaldi et al. (2014) studied ADN students who were at risk for failure in a senior level course and created a unique remediation program. Nursing faculty created learning resources and provided adaptive quizzing and review to be completed during the semester break, in order to preview course content and promote success in the subsequent course. Electronic communication with the study group combined mentoring and educational resources. Students demonstrated success with the second-semester senior level course and were also successful with NCLEX-RN (Corrigan-Magaldi, et al., 2014). Khalaila (2015) also discussed the provision of academic and emotional support and identified a positive relationship between academic achievement, self-concept and motivation. Test anxiety was found to have a negative relationship with academic achievement. Khalaila identified important faculty roles as the inclusion of motivational strategies to engage students in academic activities, teaching strategies to decrease test anxiety, and optimizing examination preparation.

An exploration of faculty support for ethnically diverse students provided additional insight. Murray et al. (2016) implemented a retention program that assigned students a faculty mentor in tandem with an academic advisor. Student support from the faculty-advisor team included tutoring, note taking, examination preparation, reading

comprehension, and advice on connecting with an instructor and building a study group. A GPA of 2.5 or below initiated weekly meetings. Participation in the program resulted in increased GPAs, increased retention, and increased NCLEX-RN pass rates (Murray et al., 2016). In another study by the same author, African American students in particular described the need for academic support and the presence of faculty mentors to promote success (Murray, 2015). A study of culturally and linguistically diverse nursing students described the lack of relationships with faculty as a primary impediment to success (Fuller & Mott-Smith, 2017). In contrast, faculty members believed language proficiency was the key obstacle to success. To best meet the needs of students, faculty must build positive relationships with students, recognize cultural differences, and explicitly teach the language of nursing (Fuller & Mott-Smith, 2017). These findings are consistent with the study of ethnically diverse students by Dapremont (2014), who described the need for faculty to assist with strategies to organize content and pass exams. McLain et al. (2017) also studied retention for diverse nursing students. Students completed a survey to identify potential strengths and barriers related to academic performance and collaborated with faculty advisors to develop a plan for academic success. Faculty members used the survey to assess study habits and identify reading, writing, and critical thinking deficits prior to counseling students.

Faculty members serve as teaching-learning and content experts, as well as mentors to promote academic success. Faculty-student interactions provide an opportunity for personal, academic, and professional support. Increasing the supportive

interactions with faculty members is validated in the literature to promote academic success, and is included in my policy recommendation.

**Increased support during NCLEX-RN review.** Although increased time lag between end of program and first attempt on the NCLEX-RN has been associated with decreased NCLEX-RN passage (Woo et al., 2009), students self schedule for the NCLEX-RN after completion of their nursing program. Students who delay taking the licensure examination may feel unprepared or lack confidence in their ability to pass (Woo et al., 2009). Serembus (2016) agreed that lack of confidence in ability may delay students scheduling of the NCLEX-RN, but advocated that faculty encourage graduates to take the examination as soon as possible to prevent loss of knowledge. Libner and Kubala (2017) suggested the delay between graduation and NCLEX-RN attempt may be related to graduate anxiety, but also indicated a lack of review and preparation for the NCLEX-RN may contribute to low first-time NCLEX-RN passage. The NCLEX-RN is a high stakes exam; incorporation of standardized examinations throughout the program and mandated review courses have been identified as part of the multifaceted strategies to promote student success (Hooper & Ayars, 2017; Koester, 2015; Quinn et al., 2018; Serembus, 2016). Academic support and preparation for the NCLEX-RN was recommended as part of the plan for student success (Libner & Kubala, 2017). However, the sole use of NCLEX-RN preparation at the end of program may increase student anxiety and diminish self-confidence (Serembus, 2016). Faculty interaction with the NCLEX-RN review and the timing of a review program varies in the literature.

Davis (2016) described NCLEX-RN review in phases, with the first phase beginning at program orientation. Preparation for the licensure examination was continued throughout enrollment until NCLEX-RN pass. Faculty members encouraged daily activities for preparation, created a preparation plan with students, and provided resources for success. Students were counseled regarding test-taking anxiety and test-taking strategies, and a structured NCLEX-RN review program was recommended. The creation of a caring atmosphere based on Peplau's Interpersonal Relations in Nursing theory included identification of academic and personal barriers to build a system of support which lasted beyond graduation until NCLEX-RN passage (Davis, 2016). In a similar format, Puskar, Rudolph and Shi (2017) also created connections for NCLEX-RN review, which started during the program's first semester and resulted in increased NCLEX-RN pass rates. Seminars with targeted test-taking strategies and learning resources for NCLEX-RN success were introduced throughout the program. Students signed a contract to complete 3000 NCLEX-RN style questions during enrollment (Puskar et al., 2017). The review of NCLEX-RN resources throughout enrollment heightens student awareness and preparation prior to graduation.

End of program preparation for the NCLEX-RN provides a review of content immediately prior to the examination to prevent memory loss over time. Faculty members facilitate student review using a variety of strategies. Sportsman (n.d.) recommended the development of an individualized NCLEX-RN study plan, with prescribed self-study for students at risk of NCLEX-RN failure. Cherkis and Rosciano (2015) identified at risk students as those who passed a final nursing theory course with a

C+, demonstrating minimal achievement of course outcomes. Students who received a grade of C+ were invited to attend a 5-week review course with online and face-to-face components. Students agreed to participate in all sessions and complete all learning activities. Faculty provided theory review and reinforced concepts identified as problematic during learning activities. The program resulted in a nearly 20% increase in the NCLEX-RN pass rate (Cherkis & Rosciano, 2015). Fiske (2017) also provided an end of program review course, but faculty included contemplative activities with the content review. Graduates engaged in weekly mindfulness activities to decrease anxiety and stress (i.e., meditation, imagery, biofeedback) during the 15-week course. Student response was positive, with a 10% increase in NCLEX-RN passage (Fiske, 2017). Lutter, Thompson, and Condon (2017) studied the effect of emotional and academic support during a tutoring system, for students who had previously failed the NCLEX-RN. The review course included content review and a stepwise approach to question analysis, which validated the graduate's core knowledge and taught test-taking strategies. Faculty provided emotional support during tutoring interactions to manage test anxiety. The tutoring system increased the graduate's pass rate on the subsequent NCLEX-RN attempt (Lutter et al., 2017). The NCLEX-RN is a high stakes examination that serves as a gateway to entering the workforce as an RN. The provision of emotional as well as academic support to students who are preparing for the NCLEX-RN was recommended in the literature.

Graduates from the program under study have an opportunity to participate in an NCLEX-RN review course at no charge, according to study site records. A policy that

includes faculty and advisor outreach during post-graduation examination preparation does not currently exist, but would provide an opportunity to learn about personal situations that occur near time of testing and manage the effect of these situations on student's outcome. My policy recommendation includes student contact between clinical capstone completion and first NCLEX-RN attempt, by faculty and advisors who are equipped to identify the concerns of test takers, promote engagement, and provide resources.

### **Project Description**

I developed a policy recommendation as a project, with a goal of proposing strategies that may increase the NCLEX-RN pass rate for the program under study. The recommendations consisted of identification of students who might be at risk academically throughout enrollment, and a change in the frequency of student contact initiated by academic advisors and faculty members. Structured student outreach was recommended, with suggestions for student support and resources, development of an NCLEX-RN preparation plan after clinical capstone completion, and continued student contact and support until NCLEX-RN passage. No recommendation was made to change admission standards or progression criteria, or to restrict length of enrollment.

### **Resources and Supports**

No additional space resources are necessary to implement the recommended policy. Human resources (nursing faculty members and academic advisors) and time for structured student outreach will be required to implement the recommendations.

Numerous supports exist to implement and sustain the policy recommendation. Study site

records indicate consideration of multiple strategies to increase the first-time NCLEX-RN pass rate. Nursing program administrators, faculty members for the ADN program, and academic advisors are committed to the student-centered mission of the college. Students are assigned an academic advisor upon enrollment, and an open referral process exists between nursing faculty and academic advisors. The presence of an electronic student record, and electronic documentation of all student communication, facilitates retrieval of student information to allow faculty and advisors to explore resource utilization and identify opportunities for additional support.

### **Potential Barriers**

One barrier for the implementation of the policy recommendation may be resistance to change by the academic advisors or faculty members. Resistance to change is expected, and may be initiated by the stress associated with new activities (Mitchell, 2013). Resistance may be mitigated through open communication and provision of the rationale for planned change, and through responding to the identified concerns (Mitchell, 2013). Serembus (2016) also described the need to establish faculty and advisor commitment to support programmatic changes to increase NCLEX-RN pass rates. Changes in workload for the faculty members and academic advisors associated with increased student contact may also be barriers in terms of cost of faculty time (Custer, 2016).

### **Implementation**

The policy recommendation (Appendix A) includes the background of the problem, my research findings, and the detailed proposal with evidence from the

literature. Initially, this policy recommendation will be submitted to the dean for the school of nursing for review and consideration. After review by the dean, my research results and the policy recommendation will be shared with the remainder of the leadership team and faculty members for the ADN program under study, at a team meeting. The inclusion of academic advising personnel as well as nursing faculty in the policy recommendation, and the resultant changes in workload and student contact across departments for the college, necessitates review by the executive staff of the college. I anticipate the review by the dean and presentation of information to involved decision-makers will take one to two months. If approved, implementation of recommendations would require another six months.

### **Roles and Responsibilities**

I was responsible for the research and development of the policy recommendation. I will present the recommendation to the college's executive staff, dean for the school of nursing, ADN leadership, and ADN faculty members. During the ADN team meeting where initial review and decision making will take place, I will respond to questions and explain the policy recommendation. The dean for the school of nursing, ADN leadership, and nursing faculty will be responsible for reviewing the policy recommendation to determine feasibility and efficacy. The ADN team and the dean for the school of nursing will make the decision to endorse all or part of the policy recommendation and submit to the executive staff of the college for approval to implement. The executive staff will complete the cost-benefit analysis and is the final decision-making body for policy acceptance and implementation.



### **Project Evaluation Plan**

This project was designed to increase the first-time NCLEX-RN pass rate for program graduates. The policy recommendation is composed of three components: identification of enrolled students who are academically at risk; increasing the faculty and advisor contact with students during enrollment; and increasing graduate support between capstone completion and the first NCLEX-RN attempt. Enrolled students are considered at risk academically when their prerequisite, nursing, or cumulative GPA fall below 2.5, and after failure of one nursing theory component. Monthly student contact by academic advisors and faculty members, with support and referral for resources, is recommended. Graduate support will be provided through the development of an NCLEX-RN preparation plan which is to occur after clinical capstone completion, and through bi-weekly student contact until NCLEX-RN passage. Graduates who do not attempt the NCLEX-RN within one 3-month quarter after capstone completion are also considered at risk, and weekly contact with these graduates will be initiated to discuss resources and provide support.

If implemented, this project will be evaluated based on measurable outcomes. Bardach and Patashnik (2016) discussed the necessity of projecting policy outcomes against a reference point to evaluate efficacy. The goal of this policy recommendation is to increase the first-time NCLEX-RN pass rate for program graduates. The following outcomes will be used to determine effectiveness of the policy recommendation:

1. Increase in first-time NCLEX-RN pass rate for graduates of the program under study after policy implementation.

2. Increase in nursing and cumulative GPA after policy implementation.
3. Decrease in lag time between clinical capstone completion and first NCLEX-RN attempt after policy implementation.

I anticipate the implementation of this policy recommendation will increase student academic performance and increase the NCLEX-RN pass rate.

### **Project Implications**

Implementation of a policy to promote academic success for enrolled students and increase the first-time NCLEX-RN pass rate will demonstrate positive social change by increasing the number of program graduates who enter the health care system as registered nurses. The nursing shortage is manifested by fewer RNs at the bedside, which is linked with increased patient mortality and infection rates (AACN, 2017).

Program stakeholders will experience benefits associated with increased NCLEX-RN pass rate. Students who successfully complete the program and promptly pass the NCLEX-RN on the first attempt will be able to benefit from their education, experience personal satisfaction, and achieve economic stability. Nursing faculty at the program under study will experience professional satisfaction, knowing they have prepared students adequately for nursing practice. For the local program, an increase in the NCLEX-RN pass rate is necessary to meet accreditation criteria for licensure pass rate above the national mean. An increase in the NCLEX-RN pass rate may also have a positive impact on the program's reputation. Nationally, healthcare organizations are burdened by the nursing shortage, which restricts the ability to provide quality patient care. Additionally, healthcare institutions suffer financial loss when program graduates

are hired and then fail the NCLEX-RN. An increase in the number of graduates who pass the NCLEX-RN with the first attempt and enter the workforce as RNs will have a positive social impact for national healthcare institutions.

Section 4 will describe the project strengths and limitations, recommendations for alternative approaches, and my growth throughout this journey. A reflection of the importance of developing a plan for graduate success on the NCLEX-RN, and implications for future research are also included.

## Section 4: Reflections and Conclusions

### **Project Strengths and Limitations**

I initiated this study and the associated policy recommendation to address an identified problem at an ADN program with a first-time pass rate for the NCLEX-RN below the national average. The project described in Section 3 was developed based on the study findings detailed in Section 2 and a review of the literature. This section will discuss the project strengths and limitations, as well as identify recommendations for alternative approaches. I include a discussion of my personal growth as a scholar, practitioner, and project developer, as well as a reflection of the importance of this work to me as a nurse educator in an ADN program. This section concludes with the potential impact for positive social change and recommendations for practice and future research.

The strength of this project is the identification of academic and time-lapse factors that suggest success on the first attempt of the NCLEX-RN. Interventions can then be implemented with the students who are at risk for failing the NCLEX-RN on the first attempt. The policy recommendation detailed a systematic approach to student outreach and included specific strategies for student support, which may promote academic success for ADN students. Hooper and Ayars (2017), and Jeffreys (2014, 2015) identified the importance of implementing a multifaceted approach to student support to promote academic success.

This project is based on results from a convenience study completed at one academic institution and a review of the literature. The research findings cannot be generalized beyond the studied program, but may guide faculty to identify students at risk

for academic difficulty and implement a system for support. The proposed policy recommendation identifies critical points during a student's enrollment where strategies can be implemented to promote academic success. An evaluation of the project study will provide additional information regarding efficacy. Other project genres could be implemented as projects based on this research.

### **Recommendations for Alternative Approaches**

Preparing nursing students to successfully pass the NCLEX-RN on the first attempt requires a multifaceted approach. An alternative approach for a project based on my research might have included a policy recommendation for the initiation of more stringent admission requirements. The implementation of more rigorous admission standards restricts student enrollment and may limit enrollment of diverse students (Taylor et al., 2014) which would exacerbate the nursing shortage. A moderate correlation with NCLEX-RN outcome was found for grades in microbiology ( $r = .278$ ) and anatomy and physiology ( $r = .315$ ), and the prerequisite GPA ( $M = 2.86$ ) was positively linked to first-time NCLEX-RN outcome ( $p < .05$ ) in the regression analysis. My data analysis suggested an increase of the required prerequisite GPA by one point (i.e., from 2.0 to 3.0) was associated with increased likelihood of first-time NCLEX-RN passage. I recommended identification of students at risk as those with a prerequisite GPA of 2.5, with subsequent intervention to promote academic success.

In contrast to my recommendation, Hooper and Ayars (2017) recommended implementation of more stringent admission requirements to improve NCLEX-RN pass rates. Knauss and Willson (2013) also implemented changes in admission criteria, which

restricted admission but did not demonstrate improved student retention or program completion. Denial of admission to students who may not be successful on the NCLEX-RN may increase the first-time NCLEX-RN pass rate for program graduates but may decrease the overall number of nurses who enter the profession (Serembus, 2016; Taylor et al., 2014).

Creation of a policy recommendation supporting the creation of progression policies that are more rigorous may also increase the first-time NCLEX-RN pass rate at the program under study. My data analysis indicated that nursing GPA ( $M = 2.28$ ) was positively ( $p < .001$ ) related to first-time NCLEX-RN pass rate. Increasing the needed passing score for nursing components by one point (i.e., from a 2.0 to a 3.0) may increase the likelihood that students who are at risk for NCLEX-RN failure will be academically dismissed from the program. Additionally, the number of failures in nursing components was inversely related to NCLEX-RN passage. Nineteen percent of students at the program under study failed four or more attempts in the nursing components. Dismissing at risk students from the program after only three nursing component failures could be implemented as a progression policy change. Hooper and Ayars (2017) recommended review of readmission, progression, graduation, and grading policies for programs with first-time NCLEX-RN pass rates below 80%; Libner and Kubala (2017) recommended the same for NCLEX-RN pass rates below 75%. If the students who are at risk for NCLEX-RN failure do not persist in the program, the first-time NCLEX-RN pass rate may increase. However, these alternative policy recommendations potentially exacerbate the nursing shortage, by decreasing the number of individuals who are eligible for RN

licensure. Therefore, I rejected an approach that may increase student attrition in favor of policy development for early intervention and remediation.

Another alternative project genre could be development of a curriculum for a targeted NCLEX-RN review course, available to graduates prior to their first attempt on the NCLEX-RN (Cherkis & Rosciano, 2015; Puskar et al., 2017). Numerous NCLEX-RN review courses currently exist with multiple delivery formats (face-to-face, virtual, synchronous, and asynchronous). Curriculum development for an NCLEX-RN review would require faculty resources to create and implement. My recommendation includes follow up with program graduates to enhance their participation in a review program and an emphasis on test taking skills as described by Davis (2016). The completion of this research study and the resultant project development has served to trigger my interest in additional research and avenues to enhance student success.

### **Scholarship, Project Development and Evaluation, and Leadership and Change**

The completion of this doctoral degree has been a learning and growth opportunity for me. My role as a faculty member has evolved during my time in the EdD program and throughout this research and subsequent project development. I have expanded my experience in scholarship activities, drafted a project to manage an educational issue, and developed additional skills as a leader and change agent.

### **Scholarship**

The definition of scholarship in academics encompasses the scholarship of discovery, integration, application, and teaching (Boyer, 1990). This research project has enhanced the scholarship of discovery for me as I reviewed the current evidence

surrounding NCLEX-RN pass rates and designed a research study (Billings & Halstead, 2012). A key area of growth for me was the use of resources to complete an extensive literature search for both the study and the project. I developed additional skills in the identification of search terms and a comprehensive review of current research. I gained expertise in my analysis of the methodology and results for this research through identifying themes within both the significant and not significant findings.

The iterative process of writing the proposal and final project taught me patience and humility as I navigated the review process. I refined my ability to create a personal timeline to focus my work and study, clarified my writing for a nonnursing audience, and navigated challenges associated with not taking feedback personally. I also developed questioning skills as I reached out to experts in the research field, working with the Walden University writing center, editors, and statistics tutors. As I developed this study and project I reaffirmed how important data analysis is. This study provided an opportunity to explore the facts. The IRB process reminded me about the essential nature of developing a study that protects the rights of the participants and maintains minimal risk for all. The use of a limited data set as required by the IRB made sure the lines between my professional responsibilities and my personal research did not blend. As a lifelong learner, completion of this research and the associated project has allowed me to create new knowledge for the profession and expand my knowledge of the literature surrounding NCLEX-RN success.

As a scholar practitioner, I have grown in the scholarship of integration and application as described by Boyer (1990), by seeking data-driven answers to a pervasive



problem in nursing education and developing a project to address the NCLEX-RN pass rate. I am a skilled nurse educator and practitioner, working as a part of a team to benefit students and graduates in an ADN program. The Walden's Doctor of Education program has enabled me to become a scholar practitioner and integrate scholarly research with my expertise (Walden University, 2013, p. 2).

The completion of this research study and associated project has challenged me to unearth data regarding common assumptions in nursing education. Widely held beliefs that strong mathematics and science scores predict nursing program and NCLEX-RN success or that students who take the NCLEX-RN within three months of graduation are most likely to be successful were not well grounded in the available literature. I have broadened my perspective as I have become immersed in the literature. This growth as a nurse educator will allow me to participate more fully in the development of curriculum and the creation of policies.

### **Project Development**

Data from my research provided a larger picture of the ADN graduate who is successful on the first attempt of the NCLEX-RN, with the goal of creating a system for success for all graduates. This project was developed to meet the needs of the students and the program. The experience of assimilating multiple data points to develop a practical project to address my findings has augmented my skills as a project developer. This research and subsequent project development have honed my skills for articulating a need within a discipline, establishing a database, and developing a solution. The application of research to a current practice setting has allowed me to expand my thinking

beyond my current position. Collaboration with my research chairperson to determine the best approach for a project to address my research findings and explore future implications for my area of research provided valuable insight. As my career progresses, I will be able to apply this approach to other problems to function as a high-level problem solver.

### **Leadership and Change**

I have witnessed many changes during my decades as a nurse. The evolution of technology, emergence of new diseases, and increased healthcare needs of the patients who are acutely ill necessitate innovative approaches for the RN to manage patient care. As a nurse educator, I am challenged to participate in the transformation of prelicensure RN education. Leaders in nursing education must develop and implement curricula that promote critical thinking and establish problem-solving skills (Institute of Medicine, 2011). Nursing programs of study must include the essential support and remediation to allow students to successfully progress through the program with the ability to pass the licensure examination (Taylor et al., 2014). Graduates are required to demonstrate their ability to care for acutely ill patients by successfully completing the application style questions of the NCLEX-RN. My roles as faculty member and course creator include understanding the changing landscape of patient care to prepare students for success with both the NCLEX-RN and with their nursing practice.

Completion of this study and the subsequent development of a policy recommendation have prepared me to function as a leader in an educational program. Educational leaders in nursing programs have a responsibility to develop an evidenced-

based curriculum with appropriate rigor to prepare graduates to successfully enter the nursing workforce (Institute of Medicine, 2011). The program administration and faculty must acknowledge the diverse learning styles and backgrounds of enrolled students, and establish admission and progression policies to meet student needs. This project has illustrated for me that early identification of students at risk and development of an effective strategy for education and remediation are essential components for a program's success. As a leader, I am committed to increase both the number of students graduating and the number of graduates who successfully pass the NCLEX-RN.

The Institute of Medicine (2011) challenged nurses to achieve higher levels of education and develop leadership competencies. The process of completing research and developing a project has helped me to mature as a leader in an academic setting. I am prepared to partner with colleagues in the identification of problems and the generating of solutions (Institute of Medicine, 2011). The development of this project has reinforced for me a multifaceted approach to problem solving. I have developed strategies for meeting the needs of all program stakeholders, including students, faculty members, and healthcare organizations. I am inspired to look at the analysis of data to meet the needs of students throughout enrollment. Data are available to determine what the successful student looks like, and how to develop a system to promote that success.

### **Reflection on Importance of the Work**

Patients who require nursing care exhibit increasingly complex medical needs and multifaceted treatment. The passing standard for the NCLEX-RN has increased, to raise the minimum competency required for individuals to enter the nursing profession

(NCSBN, 2016c). Nursing programs must respond to the resultant drop in NCLEX-RN passing rates with sound systems for student success. Educating individuals who provide safe patient care for individuals with acute and chronic disease is the focus of academic faculty and programs of nursing. Academic institutions are compelled to meet the needs of multiple stakeholders, including prospective patients, healthcare institutions, students, and accreditors. This study provided essential data for decision-making. The resultant policy recommendation offered one approach to meeting the needs of students, enabling those students to become RNs.

The pursuit of my doctorate degree began as an individual goal, to complete my education and participate more fully in academia. As this research study and the resultant project evolved, I was motivated by this opportunity to create social change for the enrolled students and graduates of ADN programs who finish their program and must pass the licensure examination. In my mind's eye, I see the individuals who sought a degree in nursing to enhance their lives as they care for others. I recognize the needs of patients who require competent nursing care and are at risk because of the nursing shortage. I am passionate about the work I do to educate future nurses.

### **Implications, Applications, and Directions for Future Research**

#### **Potential Impact for Social Change**

Nationally, the nursing shortage is projected to worsen, resulting in inadequate RN staffing levels which compromise safe patient care, as evidenced by higher hospital readmissions, higher patient mortality rates, and higher infection rates (AACN, 2017). The identification of academic and time-lapse factors predicting success on the first

attempt of the NCLEX-RN and my subsequent policy recommendation will potentially increase the number of graduates who pass the licensure examination, at the program where data was collected. An increase in the first-time passage will increase the number of RNs entering the workforce and help to mitigate the nursing shortage, demonstrating positive social change.

At the local program, an increase in the first-time NCLEX-RN examination pass rate will manage accreditation concerns related to an NCLEX-RN first time pass rate below the national mean. ADN faculty and administrators are charged with creating and implementing a curriculum that prepares graduates to demonstrate competence on the licensure examination (Lutter et al., 2017; Pressler & Kenner, 2012; Roa et al., 2011). Identification of students at risk for failure, and provision of the necessary support essential for student success, are the responsibility of the ADN program. Implementation of the policy recommendation described in this project may enable students to demonstrate academic success and be prepared for NCLEX-RN passage. For the local program, positive social change will be achieved by meeting stakeholder needs through the provision of resources that support academic and NCLEX-RN success.

Graduates who do not pass the NCLEX-RN experience financial and emotional stress and are unable to enter the workforce (Lutter et al., 2017; Roa et al., 2011). Individuals may experience psychosocial distress, grief, guilt, loss of self-esteem, and anxiety upon failure of the licensure examination (Karsten & DiCicco-Bloom, 2014; Roa et al., 2011). Individuals who fail the NCLEX-RN may also experience financial difficulty, as the financial outlay associated with education did not result in the

anticipated monetary benefit. Students who experienced academic failure during enrollment articulated similar emotional and financial concerns (Crow & Bailey, 2015; Karsten & DiCicco-Bloom, 2014; Lewis, 2018). If the policy recommendation is implemented, students will be more likely to experience academic success, and will realize positive social change as they graduate, pass the licensure examination, and achieve their professional goal of becoming an RN.

### **Implications and Applications**

My study's findings contribute to the existing body of knowledge regarding academic and time-lapse factors that predict NCLEX-RN outcome. This combination of independent variables was a unique approach to gather more comprehensive data about the ADN student. A commonly held belief among nursing faculty is that increased grades throughout the nursing program translate into increased likelihood of NCLEX-RN success. This concept was supported by my research, which suggests that increased prerequisite GPA, nursing theory GPA, and cumulative GPA have a positive impact on a graduate's NCLEX-RN passage, and an increased number of course failures have a negative impact. These findings may stimulate discussion of current admission and progression policies as faculty members and administrators are challenged to manage admission standards, course rigor, progression policies, and student support to create a curriculum that allows students to benefit from the program. As strategies are implemented to promote student success, data must be trended to determine their effect on NCLEX-RN pass rate.

The impact of length of enrollment on the graduate's first-time NCLEX-RN pass rate was not found to be statistically significant in my data analysis. This finding supports the existing policy for a 7-year enrollment period at the program under study. Additional research in other nursing programs is necessary to determine if part-time study impacts a graduate's NCLEX-RN outcome. Additionally, the increased time lag between clinical capstone completion and the first NCLEX-RN attempt was inversely related to NCLEX-RN passage. An exploration of factors associated with a graduate delaying the first NCLEX-RN attempt is required. An investigation of how graduates utilize the time lag to prepare for the NCLEX-RN may identify additional opportunities for intervention.

A policy that identifies students at academic risk and provides resources to promote student success may benefit the program under study by increasing the first-time NCLEX-RN pass rates. If the policy recommendation is implemented, an evaluation of student outcomes is necessary. An analysis of the student experience may identify other critical times where faculty and advisor support is imperative, may suggest ways to promote student engagement, or may suggest revisions to student orientation. The analysis of secondary data for both academic and time-lapse variables needs to be replicated at other nursing schools to determine if consistent results are obtained. Future research should include a qualitative component with students to clarify factors associated with academic difficulty and to identify strategies that may positively impact academic outcome.

### **Directions for Future Research**

Additional research with a mixed methods approach could be considered to supplement the quantitative data reviewed with qualitative information. An analysis of students' test taking strategies, critical thinking ability, degree of test anxiety, and post-graduation preparation for the NCLEX-RN examination would provide data to address student success from an alternative perspective. First-time NCLEX-RN takers could identify their primary concerns related to NCLEX-RN preparation, and a resultant project could address those needs. Graduates could describe their perceptions of factors that limit their ability to pass NCLEX-RN. After graduation from a prelicensure program, individuals self-schedule the NCLEX-RN, and develop an individual approach for NCLEX-RN preparation. Support from the academic institution regarding effective preparation methods, anxiety management, and faculty support during the review process may increase the graduate's ability to be successful.

This study did not collect any information about students' current job title in health care, the number of years working in the current role, social support, or demographics (e.g., age, ethnicity, primary language). Identification of additional risk factors for failure of the licensure examination could inform the nursing program's ability to provide support for the student throughout the program. The development of a course to build English language skills associated with health care might emerge from a study collecting additional data. Unique strategies for student support related to time management, building social support, and managing competing demands might be indicated when demographic data are studied.



## **Conclusion**

A quantitative study with a logistic regression analysis was completed to provide information regarding academic and time-lapse factors, and their relationship with first-time NCLEX-RN success. The ADN program where data was collected will be able to make evidence-based decisions about admission, progression, and remediation policies based on my data analysis. Based on the outcome of this study, I developed a policy recommendation for student outreach and support to improve the first-time NCLEX-RN pass rate. Student success on the NCLEX-RN results from the combined efforts of the student, the faculty, and the resources provided by the academic institution. Systems must be created to support the student for success. In 2015, 200 graduates from the ADN program under study failed the NCLEX-RN on the first attempt and were not able to immediately enter the workforce as RNs. An increased first-time NCLEX-RN pass rate will minimize concerns from the program's accrediting agencies, promote program satisfaction for graduates, and mitigate the nursing shortage, allowing for the provision of safe patient care.

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## Appendix A: Policy Recommendation

**To:** Dean, School of Nursing

**From:** Dawne DeVoe Olbrych MS, RN, CNE, Faculty Program Director

### **Executive Summary**

#### **Problem**

The first-time National Council Licensure Examination for Registered Nurses (NCLEX-RN) pass rate has been below the national mean for program graduates.

#### **Recommendation**

A policy recommendation was developed with suggestions to increase the NCLEX-RN first-time pass rate for the Associate Degree in Nursing (ADN) program. The recommendations are based on a comprehensive review of the literature and the data analysis of a binary logistic regression analysis study conducted at the college.

Statistically significant relationships were found between the NCLEX-RN first-time pass rate and selected academic factors (cumulative grade point average [GPA], prerequisite GPA, nursing GPA, and number of failures in nursing components), as well as the time lag between program completion and the first NCLEX-RN attempt. A policy recommendation was developed to identify enrolled students who are academically at risk, increase the faculty and advisor contact with at risk students during enrollment, and increase contact and support for all graduates between capstone completion and first NCLEX-RN attempt.

## **Implications**

Implementation of policies to promote academic success for enrolled students and increase the first-time NCLEX-RN pass rate will demonstrate positive social change by increasing the number of program graduates who enter the health care system as registered nurses. Students who successfully complete the program and promptly pass the NCLEX-RN will benefit from their education. Nursing faculty for the ADN program will experience personal satisfaction, knowing they have prepared students adequately for nursing practice. Increasing the number of graduates who pass the NCLEX-RN on the first attempt will have a positive impact on program stakeholders and program reputation.

## **Background of Existing Problem**

The low pass rate for graduate's first-time attempt on the NCLEX-RN is a problem for this ADN program. The 2015 first-time pass rate was 74.5% for this program, compared to the national ADN first-time pass rate of 82% (New York State Office of the Professions, 2016). A pass rate below the national mean jeopardizes program accreditation and is a concern for program stakeholders. Failure to complete the program and pass the licensure examination prohibits the graduate from entering the workforce as a registered nurse (RN), wastes valuable resources, and exacerbates the nursing shortage, which negatively impacts patient safety. This policy recommendation was developed to increase the first-time NCLEX-RN pass rate for program graduates.

## **Summary of Findings**

A binary logistic regression analysis of data from graduates who attempted the NCLEX-RN for the first time in 2015 ( $N = 786$ ) was completed to identify which

academic and time-lapse factors predict ADN students who will pass the NCLEX-RN on the first attempt. Academic factors examined included grades for mathematics and science prerequisites, grades in eight nursing theory components, the number of failures in all 11 nursing components, prerequisite GPA, nursing GPA, and cumulative GPA. The time-lapse factors studied included the length of time enrolled in the nursing program in months, and the time lag between clinical capstone completion and first NCLEX-RN attempt.

A statistically significant ( $p < .05$ ) relationship was found between selected academic factors (cumulative GPA, prerequisite GPA, nursing GPA, final grade in NUR 211, number of failures in all 11 nursing components), and the time lag between program completion and the first NCLEX-RN attempt, and the NCLEX-RN first-time pass rate. Data analysis found the distribution of final grades for seven of the nursing theory components (NUR 104, NUR 105, NUR 108, NUR 109, NUR 209, NUR 212, & NUR 213) were limited, with a C as the most common final grade. Analysis of the final grades in those seven courses did not demonstrate a significant relationship with NCLEX-RN success. Data analysis also did not suggest the length of enrollment in the ADN program had an impact on NCLEX-RN success. Therefore, final grades in the individual nursing components and the length of enrollment in the ADN program were omitted from the policy recommendation. To summarize the results of the study pertinent to the policy recommendation:

- Cumulative GPA ( $M = 2.86$ ), for every one point increase on the 0 to 4.0 scale, current data analysis suggests an increase of almost 800% in the chance of first-time NCLEX-RN passage.
- Nursing GPA ( $M = 2.28$ ), for every one point increase on the 0 to 4.0 scale, current data analysis suggests an increase of 300% in the chance of first-time NCLEX-RN passage. Nearly 34% of the program's 2015 first-time NCLEX-RN takers earned a nursing GPA below 2.0.
- Prerequisite GPA ( $M = 2.86$ ), for every one point increase on the 0 to 4.0 scale, current data analysis suggests an increase of 80% in the chance of first-time NCLEX-RN passage.
- Number of failures in nursing components ( $M = 1.94$ ), for every one additional failure, current data analysis suggests a decrease of 20% in the chance of first-time NCLEX-RN passage. Approximately 70% of the program's 2015 first-time NCLEX-RN takers failed and repeated at least one nursing component.
- Time lag between capstone completion and first NCLEX-RN attempt ( $M = 1.89$  quarters), for every one quarter increase of time lag, current data analysis suggests a decrease of 12% in the chance of first-time NCLEX-RN passage. The majority of graduates from this ADN program (83%) attempted the NCLEX-RN for the first time within two 3-month quarters of completing the clinical capstone; almost 17% of graduates delayed the first NCLEX-RN attempt for three or more 3-month quarters.



The policy recommendation includes an early identification system for students at risk for academic difficulty and first-time NCLEX-RN failure, integrated with student support.

### **Outline of Recommendations and Supporting Evidence**

#### **Identification of Enrolled Students at Academic Risk**

**Analysis of existing policy.** Students currently must receive a C or better in prerequisite mathematics and science courses prior to enrollment, and must also receive a C or better to successfully pass nursing components. College policy defines satisfactory academic progress; students are placed on academic probation with a GPA below 2.0.

**Policy recommendation 1.** Early identification of students at academic risk is recommended. Enrolled students are considered at academic risk when any of the following criteria are met:

- Prerequisite GPA at or below 2.5
- Nursing GPA at or below 2.5
- Cumulative GPA at or below 2.5
- Failure of one or more nursing component

**Evidence.** Early identification of at risk students was frequently cited in the literature as an important consideration for promoting academic success. Jeffreys (2014, 2015) described the importance of early identification of students at risk, to allow for implementation of a program to address factors associated with success and to establish meaningful relationships between students, faculty, and academic advisors. The early identification of at risk students allows for the provision of student support and remediation to increase NCLEX-RN pass rates (Hooper & Ayars, 2017; Libner &

Kubala, 2017; Koester, 2015; McLain et al., 2017). Additionally, Taylor, Loftin and Reyes (2014) considered all students who had trouble academically and students with increased course failures, to be at risk for NCLEX-RN failure. Grades in core courses inform progression within the nursing program (Schooley & Kuhn, 2013), which supports the need to improve student success throughout the program. Murray, Pole, Ciarlo, and Holmes (2016) identified a GPA of 2.5 or below as the point at which interaction with the student was initiated. Cherkis and Rosciano (2015) also identified students at risk for NCLEX-RN failure if they achieved a C+ in the final nursing theory course. Early identification of students academically at risk and subsequent provision of support may optimize academic achievement throughout enrollment.

### **Faculty and Advisor Contact with Students at Academic Risk**

**Analysis of existing policy.** All students at the college complete a virtual student orientation, which includes information regarding college resources, policies, study skills, and academic planning. All students are also assigned an academic advisor, and students may contact that advisor via phone or electronic messaging. Students in the ADN program may also schedule weekly telephone appointments with faculty members. Students on academic probation are contacted quarterly by an academic advisor, who discusses resources and strategies to help the student return to good academic standing.

**Policy recommendation 2.** Monthly contact with students at academic risk is recommended. Academic advisors or faculty members can reach out to students electronically or via the telephone to provide support and referral for resources.

**Evidence.** Academic advising has been validated as a strategy to promote nursing students' success and retention. Hooper and Ayars (2017) identified individual coaching as a role for student services that promotes academic and NCLEX-RN success for nursing students. Additionally, Custer (2016) described the relationship students develop with an academic advisor, and the need for academic advisor support to link students with institutional resources for study skills, note taking, time management, and learning styles. Communication with the student promotes identification of causative factors associated with lack of success, and allows for system development to provide early intervention (Elder, Jacobs, & Fast, 2015; Jeffreys, 2014; Jeffreys, 2015; Murray et al., 2016; Shellenbarger & Hoffman, 2016). Intrusive advising, where the academic advisor contacts the student proactively, was recommended to assist students with management of both academic and personal stressors (Mooring, 2016). Students who failed and repeated courses also described connecting with academic advisors for emotional support, referral to other professionals, and connection with academic resources (Karsten & DiCicco-Bloom, 2014; Lewis, 2018). Students also shared a need to learn how to manage extenuating circumstances, such as asking for additional time, to promote academic success (Lewis, 2018). Monthly electronic or telephone communication with at risk students will generate conversation about academic and personal concerns. Academic advisors are then able to create a link between students and services. The implementation of a proactive advising system for the ADN student, with increased frequency of advisor-student interaction, has demonstrated success in connecting students with resources.

Students at risk for academic failure also require faculty interaction to provide discipline-specific guidance. Shellenbarger and Hoffman (2016), Sportsman (n.d.), and Jeffreys (2014) described quality student-faculty interactions that included remediation for nursing content, professional integration, support, and mentoring. Remediation has been shown to improve pass rates (Horton et al., 2012; Jeffreys, 2014; Jeffreys, 2015; Koester, 2015; Murray et al., 2016) therefore connecting the student with resources for success will improve student outcome. Karsten and DiCicco-Bloom (2014) studied students who failed a nursing course and found students who successfully repeated the course sought help from faculty members for emotional and academic support. An exploration of faculty support for ethnically diverse students provides additional insight. Murray et al. (2016) implemented a retention program that assigned students a faculty mentor in tandem with an academic advisor. Student support from the faculty-advisor team included tutoring, note taking, examination preparation, reading comprehension, and advice on connecting with an instructor and building a study group. A GPA of 2.5 or below initiated weekly meetings. Participation in the program resulted in increased GPAs, increased retention, and increased NCLEX-RN pass rates (Murray et al., 2016). In another study by the same author, African American students described the need for academic support and the presence of faculty mentors to promote success (Murray, 2015). Culturally and linguistically diverse nursing students described the lack of relationships with faculty as a primary impediment to success (Fuller & Mott-Smith, 2017). The literature supports the development of early intervention policies within an academic program. Identification of cause for lack of success allows for system

development to provide early intervention (Elder et al., 2015). Faculty members serve as teaching-learning and content experts, as well as mentors to promote academic success. Faculty-student interactions provide an opportunity for personal, academic, and professional support. Increased frequency of contact between the academically at risk student, academic advisor, and faculty member will connect the student with resources for success and improve student outcome.

### **Graduate Support Prior to First NCLEX-RN Attempt**

**Analysis of existing policy.** Upon successful completion of the clinical capstone, students receive messaging and a link for a comprehensive online NCLEX-RN review program, which is provided at no charge to the graduate. Students self schedule for the NCLEX-RN after completion of their nursing program. A system of structured outreach and support from academic advisors or the ADN faculty does not currently exist for the period of time between clinical capstone completion and the first NCLEX-RN attempt.

**Policy recommendation 3.** Increased contact with graduates of the ADN program between clinical capstone completion and first NCLEX-RN attempt is recommended. It is recommended that this contact include:

- The development of an NCLEX-RN preparation plan with a faculty member and the graduate, after clinical capstone completion.
- Twice-monthly contact for 3 months or until NCLEX-RN passage. The graduate and faculty member/academic advisor will discuss progress with preparation, available resources, and provide support.

- Weekly student contact after 3 months until NCLEX-RN passage. The graduate and faculty member/academic advisor will discuss progress with preparation, available resources, and provide support.

**Evidence.** The time lag between clinical capstone completion and first attempt on the licensure examination for program graduates is prolonged in comparison to previous studies. Eich and O'Neill (2007) indicated 88% of graduates took the NLCEX-RN for the first time within 54 days; Woo, Wendt, and Liu (2009) described a mean time lag of 34.79 days. Taylor et al. (2014) considered all students who delayed taking NCLEX-RN to be at risk for NCLEX-RN failure. Students who delay taking the licensure examination may feel unprepared or lack confidence in their ability to pass (Woo et al., 2009). Serembus (2016) agreed that lack of confidence in ability may delay students scheduling of the NCLEX-RN, and advocated that faculty encourage graduates to take the examination as soon as possible to prevent loss of knowledge. Libner and Kubala (2017) suggested the delay between graduation and NCLEX-RN attempt may be related to graduate anxiety, but also indicated a lack of review and preparation for the NCLEX-RN may contribute to low first-time NCLEX-RN pass rate. Academic support and preparation for the NCLEX-RN was recommended as part of the plan for the graduate's success (Libner & Kubala, 2017). End of program preparation for the NCLEX-RN provides a review of content immediately prior to the examination to prevent memory loss over time. Faculty members facilitate the graduate's review using a variety of strategies; recommendations included the development of an individualized NCLEX-RN study plan, strategies to manage test-anxiety, and test-taking strategies (Davis, 2016;

Fiske, 2017; Lutter, Thompson, & Condon, 2017; Puskar, Rudolph & Shi, 2017; Sportsman, n.d.). Faculty and advisor outreach during the post graduation examination preparation provides an opportunity to identify the concerns of test takers, promote engagement, and provide resources.

### **Implementation**

Implementation of policy change between college departments will require several steps. The dean for the school of nursing and the ADN team will be given the opportunity to review the recommendations and evidence, and provide feedback. The policy recommendation and evidence will also be shared with the academic advising team for review and comment. If the ADN team and the academic advising team accept the proposed recommendations, the policy recommendation and evidence will be presented to the executive staff at the college for final approval. The development of a repository of resources (e.g., learning style inventory, test-taking strategies, time management strategies) may be helpful for faculty and academic advisors.

### **Summary**

This policy recommendation was designed to increase the first-time NCLEX-RN pass rate for the ADN program graduates. The policy recommendation is based on a logistic regression analysis conducted at the college and a review of the literature. Structured student outreach is recommended for enrolled students who are academically at risk with suggestions for multifaceted student support and link with college resources. Contact with program graduates after clinical capstone completion is recommended with ongoing communication and support until NCLEX-RN passage. No recommendation was

made to change admission standards, change progression criteria, or restrict length of enrollment. The effectiveness of the proposed recommendation could be measured post implementation by data analysis of the nursing GPA, cumulative GPA, and the time lag between clinical capstone completion and first NCLEX-RN attempt. Monitoring the NCLEX-RN pass rate for program graduates could also provide information about the effectiveness of the policy.



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