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Walden University

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Colleen Bacon Phillips Peace

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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Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2024

Abstract

Relationship Between Health Education Systems Incorporated Admission Assessment Scores and Student Completion of a Baccalaureate Nursing Program

by

Colleen Bacon Phillips Peace

MA, Walden University, 2012

BS, West Texas A&M University, 2008

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Nursing

Walden University

May 2024

Abstract

Math, reading, and vocabulary comprehension are important skills needed to ensure nursing students have a solid foundation on which to develop critical thinking skills to complete a nursing program. One of the common preadmission standardized tests is the Health Education Systems Incorporated Admission Assessment (HESI A2), but little research had been conducted to determine whether there is a correlation between the score on the HESI A2 and readiness to master nursing courses at the bachelor of science in nursing (BSN) level and completion of the BSN program. The purposes of this quantitative retrospective study, guided by Jeffreys's nursing undergraduate retention and success model, were to determine whether there is (a) a relationship between HESI A2 scores of math, reading, and vocabulary scores and completion of the BSN program and (b) a relationship among the math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students when the HESI A2 entrance exam is repeated. In a convenience sample of 513 BSN students, binary logistic regression revealed those with higher math scores remained to finish the RN-BSN program (p = .02), and students who took the HESI A2 more than once did not have a higher incidence of completing the RN-BSN program as compared to students who took the HESI A2 only once (p = .74). Future research should focus on the current admission criteria used for the BSN program, and whether that criteria will help with retention of nursing students, thereby providing needed nurses throughout the United States, which may affect positive social change.

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Dedication

I would like to dedicate this dissertation to my family. To my husband, Freddie Theron Peace, I want to thank you for your love, support, continued guidance, and for always telling me that I can do anything. To my father, William B. Bacon, Jr., for raising me to believe in myself, for sharing your love of reading and learning, and for helping me to break down the learning process when I was very young. I still follow your advice to master the simple, apply the complex. My regret is that you did not live long enough to see me further my education, but your spirit is still very much alive in me. To my uncle, Howard Bartow Bacon, for encouraging me to return to school at the age of 50 to earn my BSN. Neither of us could have imagined back then that I would still be in school to earn my doctorate. In the absence of my father, you provided the support and guidance to help me realize this was a possibility. To my mother, Patsy McFarland Bacon, for encouraging me to follow my heart. To my children, Danny Ray Phillips, Jr., Brandon Lee Phillips, and Michael Shane Peace, for your support and encouragement during this process and for understanding my need to pursue my educational dreams. I hope my example can help you see that you can do and be anything you wish. To my grandchildren, Zachary Phillips, Aspen Phillips, Jaelynn Phillips, Wyatt Peace, Brody Peace, and Spencer Peace, thank you for the laughter and needed distraction that helped me when I needed a break. I hope my achievements will inspire you to accomplish all the hopes and dreams that you desire in your own lives. To my brother, William Bartlett Bacon, III, and my sister, Maria Bacon Harkey, thank you for listening to me during this process and for always encouraging me. And to my brother, Philip Michael Bacon, now

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Chapter 1: Introduction to the Study

Student retention is a well-documented problem for nursing programs (Drennan & Ross, 2019; Goodare, 2017; Hyunbong & Soyoung, 2019; Merkley, 2016; Mooring, 2016). In the United States, the retention of nursing students in the bachelor of science nursing (BSN) program continues to be a challenge. RNs are projected to be one of the top growing occupations in the United States, with an expectation of the nursing workforce to grow 9% from 2020 to 2030. It is projected that the job openings for RNs will be about 194,500 each year throughout 2020 to 2030 (U.S. Bureau of Labor Statistics, 2023). With limited spaces available in BSN programs, improving student retention rates is a critical component in filling the number of projected positions in nursing. The National League for Nursing reported that in the United States, the national dropout rate for nursing programs is 20% (Elkins, 2019). To retain nursing students, many schools are beginning to implement strategies, including the development of proactive advising sessions. These sessions are devised to help identify at-risk students early, find resources to help the student overcome stressors, and help promote a faculty–student relationship (Bumby, 2020; Jeffreys, 2014; Tinnon, 2018).

The site of my study was a university that admits approximately 90 highly qualified students to the nursing program every year (Commission on Collegiate Nursing Education, 2018). This university requires 2 years of prerequisites, which include 41 hours of prenursing courses before the prospective student can begin the BSN program. Admission criteria were in place that should have ensured the selection of students who were most likely to complete the program. However, at the university, the completion

rate of the BSN program (within 3 years of admission to the program) was 81% in 2018 (Commission on Collegiate Nursing Education, 2018).

The Health Education Systems, Inc. Admission Assessment (HESI A2) is used by some BSN programs as a method to evaluate students' ability for success after admission to the BSN program. The HESI A2 consists of comprehensive tests in English language, math, science, and a learner profile (Elsevier, 2017). Faculty members can focus on select areas of the exam that are found to be important in the acceptance of the student into their BSN program.

Few studies were found that explored the role of the HESI A2 in predicting success in the BSN program (Hinderer et al, 2014). Students who had higher HESI A2 scores on all components of the entrance exam had higher grades on course exams and performed better in clinical areas during the first semester of nursing school (Underwood et al., 2013). There was little research that identified the admission criteria that are most likely to predict successful completion of the BSN nursing program (Underwood et al., 2013). Insights gained from investigating admission criteria that are most likely to predict successful completion of the BSN nursing program may aid nursing faculty in the selection of students for admission who have a strong potential to complete the BSN nursing program. In addition, BSN nursing programs may be able to identify students who may need remediation in a timely manner and may affect positive social change. In this introductory chapter, I describe the background of the study, the problem statement, the purpose of the study, and the research questions and hypotheses. In addition, I

describe the theoretical framework, the nature of the study, assumptions, scope and delimitations, limitations, and the significance of the study.

Background

To meet the growing demand for qualified nurses, BSN program faculty must carefully consider who will be admitted into the nursing program and how best to support the students' successful transition through the program (Schmidt & Macwilliams, 2011). An average of 194,500 RNs yearly will be needed to fill the workforce from 2020 to 2030 (U.S. Bureau of Labor Statistics, 2023). The number of RNs in the baby boomer generation (nurses born between 1946 and 1964) who are retiring from the workforce will impact this number. The loss of this generation from the workforce will also decrease the number of qualified experienced nurses available to fill the deficit in the workforce (Al-Alawi et al., 2020). According to Smiley et al. (2021) results of the National Nursing Workforce Study in 2020 stated the median age of an RN in 2020 was 52 years. Therefore, over 50% of the current RN workforce is within 13 years of retirement, with more than one fifth of all nurses reporting they plan to retire from nursing over the next 5 years.

In addition to the projected loss of nurses, there remains a shortage of nursing faculty. According to the American Association of Colleges of Nursing (AACN, 2022), 91,938 qualified applicants from baccalaureate and graduate nursing programs were turned away due in part to the shortage of nursing faculty. The shortage of nursing faculty has been cited as the primary reason qualified applicants were turned away from nursing programs (AACN, 2022). The average faculty age continues to increase, which affects

the number of years that current educators will be available to teach (AACN, 2022). One third of the current nursing faculty in the United States will retire by 2025 (Fang & Kesten, 2017). Therefore, it is crucial that nursing programs retain students they admit.

The primary loss of nursing students occurs during the first year (Knauss & Willson, 2013). Nursing students enrolled in nursing programs had an average graduation rate of 80% to 87% (National League for Nursing, 2016). However, graduation rates are lower for ethic minority students (Sedgwick et al., 2014). Overall, the retention rate for racial and ethnic minority students was only 47% and 38% (Harris et al, 2014).

BSN programs throughout the United States use admission criteria to determine the candidates with the highest probability of completing the nursing program based on history within the nursing program and faculty input (Schmidt & MacWilliams, 2011). The most common admission criteria include the following: college cumulative grade point average (GPA), nursing prerequisite GPA, preadmission standardized tests (such as the American College Testing), Nurse Entrance Test), the HESI A2, volunteerism, service, prior health care experience, admission essays, and personal interviews (Schmidt & MacWilliams, 2011; Twidwell & Records, 2017). My review of the literature did not reveal a specific admission criterion used by colleges that was related to a higher retention rate of the nursing student. Some evidence suggested that prenursing exams are effective in predicting early achievement and graduation (Schmidt & MacWilliams, 2011). However, the ability of one examination to predict student success or failure was not supported in the literature (Schmidt & MacWilliams, 2011). To meet the demands to choose the best qualified candidates to enter the BSN program, many universities are

utilizing entrance exams, such as the HESI A2 or an RN Comprehensive Predictor examination, developed by the Assessment Technologies Institute (Newton & Moore, 2009; Twidwell & Records, 2017). Each BSN program may require different groupings for the entrance exams, and there is no set requirement that the BSN program must follow.

One university in the Southeast region of the United States requires their candidates for the BSN program to take the math, reading comprehension, vocabulary and general knowledge, grammar, and anatomy and physiology components of the HESI A2 as part of their admission requirements (Texas A&M University, 2024). Another university in the Southeast region of the United States requires their candidates for the BSN program to take math, reading comprehension, vocabulary and general knowledge, grammar, anatomy and physiology, learning style, and the personality profile components of the HESI A2 as part of their admission requirements (George Mason University, 2019). A university located in the Pacific region of the United States requires their candidates for the BSN program to take math, reading comprehension, vocabulary and general knowledge, grammar, anatomy and physiology, learning style, and the personality profile components of the HESI A2 as part of their admission requirements (Samuel Merritt University, 2019). To ensure the student can read, comprehend, and critically think, BSN programs frequently tested candidates in the areas of math, reading, and vocabulary, using the HESI A2 (Twidwell & Records, 2017).

Critical thinking and reasoning can be enhanced by the way the student approaches their mathematical skills (Su et al., 2016). Knowledge of math and the ability

to solve complex problems enables the student to analyze, evaluate, reason, and communicate effectively (Su et al., 2016). Critical thinking encourages the student to process information in a logical method, which then prepares the student for self-directed learning (Su et al., 2016). The development of critical thinking skills is important for nursing students to be prepared to investigate scientific facts and implement evidence-based nursing practices (Kaya et al., 2018). For these reasons, students' ability to solve math problems may be key to understanding students' ability to think critically (Kaya et al., 2018; Su et al., 2016).

Nursing is a science in which students must have the ability to read and understand the various concepts that are presented in class (de Sousa et al., 2019). To comprehend the new information, the student needs to have a strong vocabulary (Cohen, 2012). Vocabulary is the foundation of all languages, consisting of all the words in any given language (Bai, 2018). A strong vocabulary enhances the student's ability to critically analyze and evaluate new information (Cohen, 2012). This ability is vital in ensuring the patient receives the best possible care. If a student's vocabulary is limited, the student's scope of thought will be narrow, and they will likely face many difficulties in communication (Bai, 2018).

In addition to math and vocabulary, another important skill that enables a student to think and respond critically is the student's ability to read. In an age of growing technology, the quickest way to obtain information and knowledge is by reading (Zubaodah et al., 2017). Reading promotes intellectual growth and critical thinking, and contributes to an individual's emotional and moral development (Kohtz et al., 2019). In

the field of nursing, a student must be able to read, understand, and connect what they have learned in class and apply that knowledge to clinical practice (Kohtz et al., 2019). The areas of math, reading, and vocabulary comprehension are important skills that are necessary prerequisites to ensure nursing students have a solid foundation to develop the critical thinking skills needed to successfully complete the nursing program (Cohen, 2012; de Sousa et al., 2019; Kaya et al., 2018; Kohtz et al., 2019; Su et al., 2016; Zubaodah et al., 2017). In the current study, I identified the extent to which the measurement in these areas of the HESI A2 are strong predictors of the ability of the nursing student to complete the BSN program.

Problem Statement

The retention of nursing students continues to be a concern for undergraduate nursing programs. The primary loss of nursing students occurs during the first year (Knauss & Willson, 2013). In addition to the shortage of nursing students, there is a shortage of nursing faculty (Underwood et al., 2013). Student attrition and faculty shortage highlight the need to choose candidates for the nursing program who have the greatest potential to complete the program. The nursing shortage is further increased when a student is accepted into the nursing program and then fails or drops out of the program (Underwood, et al., 2013). Resources are best utilized when applicants who are believed to be the most likely to complete the nursing program are carefully selected (Chen & Voyles, 2013).

There was little research published that addressed whether the HESI A2 scores are a good indicator of the student's readiness to master nursing courses at the BSN level and

complete the program. The HESI A2 consists of nine exams that include math, reading comprehension, vocabulary and general knowledge, grammar, biology, chemistry, anatomy and physiology, learning style, and personality profile. A preliminary study indicated that the HESI A2 scores are valid predictors of students' success in the first-semester nursing courses at the associate's degree nursing (ADN) level (Knauss & Willson, 2013). Another study indicated the HESI A2 scores can be used to make evidence-based decisions about which applicants should be considered for admission to the ADN nursing program (Chen & Voyles, 2013). However, based on my literature review, there were no studies that investigated the possible correlation between the score on the HESI A2 and readiness in mastering nursing courses at the BSN level and completion of the BSN program (see Chen & Voyles, 2013; Hinderer at el. 2014; Underwood et al., 2013). I investigated the extent to which math, reading, and vocabulary correlate with completion of the BSN nursing program. The results may provide nurse educators with additional insight as to whether they think the information presented would be beneficial to their program.

Purpose of the Study

The purposes of this quantitative retrospective study were to determine whether there was (a) a difference between HESI A2 individual scores of math, reading, and vocabulary in nurses who complete the BSN program and those who do not and (b) a difference among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once. The independent variables

were completion of the BSN program or lack of completion of the BSN program, and whether it made a significant difference if the student took the HESI A2 more than once. The dependent variables were the HESI A2 scores, which included the students' individual math, reading, and vocabulary scores.

Research Questions and Hypotheses

RQ1: What is the difference between HESI A2 individual scores of math, reading, and vocabulary in students who complete the BSN program and those who do not?

H_o1: There is no difference between HESI A2 individual scores of math, reading, and vocabulary in students who complete the BSN program and those who do not.

H_a1: There is a difference between HESI A2 individual scores of math, reading, and vocabulary in students who complete the BSN program and those who do not.

RQ2: What is the difference among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once?

H_o2: There is no difference among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once.

H_a2: There is a difference among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once.

Measurement of Variables

The independent variables in RQ1 were the students who completed the BSN program and those who did not complete the BSN program. In RQ1, the three dependent variables were the individual math, reading, and vocabulary scores. Each of these scores were interval level, ranging from 0 to 100. The scores were compared to completion of the BSN program by conducting a multivariate analysis, specifically a binary logistic regression model, using the Statistical Package for the Social Sciences (SPSS) Version 29. SPSS is a powerful statistics tool that allows the user to "validate assumptions, analyze past performance, and forecast trends" (IBM, 2022, p. 1.)

For RQ2, the dependent variables were the individual math, reading, and vocabulary scores. The independent variable was nursing students who take the HESI A2 entrance exam once compared to students who take the HESI A2 more than once. For RQ2, these scores were reported as individual scores for math, reading, and vocabulary. As a result, the scores were continuous. I conducted a binary logistic regression to analyze the data using SPSS Version 29. A logistic regression is useful to estimate the relationship between one or more independent variables (predictor) and a binary (dichotomous) outcome variable. The benefit of using logistic regression is the test can be used to estimate the probability (or risk) of an outcome when provided the value(s) of the independent variable(s). The benefit of using a logistic regression model is the test will reveal whether there is a significant difference between the groups of the combined dependent variables. The logistic regression allows for results of each of the dependent variables separately (Schober & Vetter, 2021).

Conceptual Framework for the Study

There have been numerous retention models that have strived to identify factors believed to impact the retention of traditional and nontraditional students (Bean & Metzner, 1985; Cabrerea et al., 1993; Twidwell & Records, 2017). The conceptual framework that has been developed that is applicable to nursing education is the nursing undergraduate retention and success (NURS) model by Jeffreys (2014). Jeffreys supported the belief that quality nurses are needed to help with the growing health care needs of the many populations in the United States. A significant barrier to graduating successful nursing students is the high attrition rate throughout nursing schools in the United States (Jeffreys, 2014). Jeffreys's NURS model was designed to address retention of nursing students rather than attrition. The goal of the NURS model is to attempt to determine why students stay rather than why they leave (Jeffreys, 2014).

Student retention is directly influenced by both academic and psychological outcomes (Jeffreys, 2014). The academic outcomes include the student's grade in the course, the cumulative GPA for nursing courses, and the student's GPA for all courses (Jeffreys, 2014). The NURS model assumes course grades and clinical outcomes are included as factors needed to pass the required nursing courses, which allows the student to progress through the nursing program (Jeffreys 2014). Jeffreys (2014) based the NURS model on the premise that students decide to remain in nursing school or withdraw based on one or a combination of variables. These variables include the profile characteristics of the student, cultural values and beliefs of the student, the student's self-efficacy, the innate motivation of the student, academic factors, environmental factors, professional

integration and socialization factors, academic and psychological outcomes, and outside surrounding factors (Jeffreys, 2014). No single comprehensive approach can be agreed to be the most reliable way to ensure the retention of the student because each nursing school is equipped with its own culture, faculty, administration, and community endorsement (Jeffreys, 2014).

Successful progression through the BSN nursing program may be influenced by the student's abilities when entering the program (Newton & Moore, 2009). Based on the NURS model, this is recognized as a profile characteristic of the student and is represented by the score on the HESI A2. There should be a thorough evaluation of the student's abilities when first entering the program (Newton & Moore, 2009). The intention of my study was to evaluate the extent to which success on the HESI A2 may have impacted the retention of the student in the BSN program. More detail on Jeffreys's model is provided in Chapter 2.

Nature of the Study

Quantitative research methods include statistical analysis to determine a relationship or correlation between one or more independent variables and a dependent variable (Creswell & Creswell, 2018). I conducted a correlational study to determine whether a relationship existed between the student's individual math, reading, and vocabulary score and completion of the BSN nursing program. The same design was used to determine whether a relationship existed between the student's individual math, reading, and vocabulary score on the HESI A2 when students repeated the exam and completion of the BSN program. I collected the data retrospectively from a database of

HESI A2 scores collected over a 5-year period at an undergraduate nursing program in the Midwest United States. Successful completion of the BSN nursing program was recorded as a percentage of the students who passed. The dependent variables were the HESI A2 scores, which included the students' individual math, reading, and vocabulary scores. The independent variables were completion of the BSN program or lack of completion of the BSN program. I investigated whether it made a significant difference if the student took the HESI A2 more than once.

I used logistic regression to analyze the data for RQ1. This method was used to determine each variable's relative contribution and each variable's predictive power. For RQ2, I used three separate binary logistic regression models to model the dependent variable of completed the BSN program (yes/no) as a function of (a) the moderating effect of taking the exam more than once on the relationship between math scores and completed the BSN program (interaction term: taking the exam more than once x math scores), (b) the moderating effect of taking the exam more than once on the relationship between reading scores and completed the BSN program (interaction term: taking the exam more than once x reading scores), and (c) the moderating effect of taking the exam more than once on the relationship between vocabulary scores and completed the BSN program (interaction term: taking the exam more than once x vocabulary scores).

Definitions

Attrition: The proportion of students in a year that neither complete nor return in the subsequent year (Adusei-Asante & Doh, 2016).

Baccalaureate degree nursing (BSN): -A nursing program that requires 4 years of study through an accredited nursing program (American Association of Colleges of Nursing, 2018).

Health Education Systems, Inc. Admission Assessment (HESI A2): A multiple choice test used to screen applicants for admission into nursing programs (Elsevier, 2017).

Nursing student: An individual who is enrolled in an approved program for licensure as an RN (Neumbe, et al., 2023).

Assumptions

Assumptions are statements based on logic and accepted as truth even though there is no scientific proof (Polit & Beck, 2021). One assumption for my study was that nursing students desire to do well on the HESI A2. Another assumption was that the nursing student has a high commitment to completing the BSN program. These assumptions were important because they could affect the inferences that I drew from my study.

Scope and Delimitations

I conducted a quantitative retrospective analysis of HESI A2 scores of nursing students who completed the BSN program. I briefly considered conducting a qualitative study that would have involved having to ask nursing students who had completed the BSN program if they felt the HESI A2 was a good predictor of their ability to complete the BSN program. I did not choose this design because it would have provided only subjective information. I also considered using Swail's geometric model of student

persistence (see Percival et al., 2016). However, this model was multifaceted and did not fit my study. The focus of this model was about the entire student experience in college, including cognitive, social, and institutional factors. The cognitive factors are concerned with the overall academic ability a student brings with them to college. The social factors are concerned with the ability of a student to correctly handle themselves in any given social situation. The institutional factors are concerned with the ability of the institution to provide academic and social support to the student during their time in college.

I chose Jeffreys's (2014) NURS model to guide my understanding of factors that may influence retention of nursing students. This model is also comprehensive and multifaceted. However, the NURS model supports the belief that there is a growing, urgent need for quality nurses to help with the numerous health care needs in the United States (Jeffreys, 2014). The factors included in this model are academic factors, environmental factors, professional integration and socialization factors, academic and psychological outcomes, and outside surrounding factors (Jeffreys, 2014). Jeffreys noted that these factors contribute to the retention of the nursing student.

The scope of my study involved determining whether successful completion of the HESI A2 contributed to the ability of the student to complete the BSN program. I considered only students enrolled in a BSN program, and data were collected from the spring of 2016 through the fall of 2021. I did not include students who were enrolled in an ADN program or an RN-BSN program. It was beyond the scope of this study to analyze the characteristics or reasons why students failed or withdrew from the program.

Delimitations were students who graduated from before the spring of 2016 and after the fall of 2021. I analyzed the data using a logistic regression model. The target population for the study consisted of nursing students at least 18 years of age who were candidates in a BSN program. I did not include candidates in an ADN program or in an RN-BSN program. Students who did not have the required GPA to be considered for admission to the BSN program or who did not pass the HESI A2 were not considered. I ensured the generalizability of this study's results by obtaining an adequate sample size from the population studied.

Limitations

The convenience sample for this study was from one university in the Midwest United States, which limited generalizability to other BSN graduates. The study was also limited to a BSN nursing program that used the HESI A2 standardized entrance exam as part of its admission criteria. The primary objective of this study was to determine whether successful completion of the HESI A2 was a good indicator that the student had the ability to complete the BSN program. In addition, this study addressed whether it made any difference in completion of the BSN program if a student took the HESI A2 more than once.

There was no potential for bias because data were de-identified. I did not know any students who were in the BSN program during the time the data were collected. The results of the data that were collected were shared with the nursing department at the university that supplied the data. I work in the RN-BSN program for the nursing department at the university that supplied the data. The institutional review board (IRB)

at both the university that supplied the data as well as Walden University were notified of this as part of the approval process.

Significance

There is a low rate of retention primarily among first-year nursing students in a BSN program (Underwood et al., 2013). Admission of qualified nursing students who have the ability to complete the nursing program will increase the number of graduates who are able to transition into the work force (Chen & Voyles, 2013). The current study filled the gap in knowledge by providing an understanding of the extent to which the scores on the HESI A2 are predictive of the students' ability to complete the BSN nursing curriculum at each level. Admitting students who are more likely to complete the BSN program will ensure an optimal number of graduate nurses each semester who will be qualified to fill nursing positions (Underwood et al., 2013). Insights gained from this study may aid nursing faculty in the selection of students for admission who have a greater potential to complete the BSN program. In addition, BSN programs may be able to identify students who may need remediation in a timelier manner. Students may benefit from remediation programs geared to their academic deficits, which may increase their potential to complete the nursing program. Recognizing students who have the potential to complete the BSN program has the potential to increase the nursing workforce.

The results of the current study have the potential to effect positive social change for two groups: faculty and students. Nursing programs may use the HESI A2 scores to select groups of students who are most likely to complete the BSN program. In addition,

the scores may inform faculty of students who may require additional remedial support to complete the program. Based on the test results, support strategies may be instituted early in the program. The test results may be used to determine admission criteria and implementation of strategies to support the students' progression and completion of the program, which may increase the number of qualified graduates in the nursing workforce and effect positive social change.

Summary

It is estimated that an additional 438,100 RNs will be needed nationwide by the year 2026 (U.S. Bureau of Labor Statistics, 2023). Nursing schools need to be proactive in choosing candidates who have the potential for success in the nursing program. This will ensure the students have a higher potential to finish the program and enter the nursing workforce. One measure of the candidates' ability to complete the nursing program at the BSN level is the HESI A2 (Elsevier, 2018). The purposes of the current quantitative retrospective study were to determine whether there is (a) a relationship between HESI A2 scores of math, reading, and vocabulary scores and completion of the baccalaureate nursing program and (b) a relationship among the math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students when the HESI A2 was repeated. Research suggested the primary loss of nursing students occurs during the first year of nursing classes (Knauss & Willson, 2013).

The NURS model (Jeffreys, 2014) served as the theoretical framework for this study. The NURS model supports the belief that quality nurses are urgently needed to help with the growing health care needs of the diverse populations in the United States.

There was a need for a better understanding of the extent to which the scores of the HESI A2 are predictive of the student's ability to successfully complete the BSN program. The current study addressed this gap in the literature. In Chapter 2, I provide the literature search strategy, theoretical foundation guiding this study, and the literature review related to the key variables.

Chapter 2: Literature Review

The purposes of this quantitative retrospective study were to determine whether there is (a) a relationship between HESI A2 individual scores of math, reading, and vocabulary in nurses who complete the BSN program and those who do not and (b) a relationship among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once. For this study, the independent variables were completion of the BSN program or not completing the BSN program, and whether it makes a significant difference if the student takes the HESI A2 more than once. The dependent variables were the HESI A2 scores, which included the students' individual math, reading, and vocabulary scores.

To meet the growing demand for qualified nurses, BSN programs must carefully consider who will be admitted into the nursing program, and how best to support the students' successful transition through the program. An increase of 438,100 RNs nationwide will be needed to fill the workforce from 2016 to 2026 (U.S. Bureau of Labor Statistics, 2023). To meet the demands to choose the best qualified candidates to enter the BSN program, many universities are using entrance exams such as the HESI A2. The benefit of the HESI A2 as part of admission to an ADN program has been examined (Chen & Voyles, 2013; Gallagher et al., 2001; Knauss & Willson, 2013; Manieri et al, 2015; Yoho et al., 2007). However, only one article addressed the HESI A2 results and completion of a BSN program (Murray et al., 2008). In this study, the HESI A2 was not used as part of the admission process, but instead was given after admission to measure

the needs of the new nursing student. My study helped to fill the gap in knowledge about whether the selection of a candidate for the BSN program based on their performance of the HESI A2 would help to determine their ability to complete the BSN program.

Chapter 2 includes the literature search strategy, the theoretical framework of the study, and a review of literature related to the key variables of the study. The review includes evidence-based articles that describe the need for the nursing workforce, strategies used to retain nursing students, and information regarding the use of the HESI A2 in the selection process of BSN student candidates. A summary concludes this chapter.

Literature Search Strategy

The purpose of a literature review is to clarify the relationship between a proposed study and any previous work that has been performed on the topic of the proposed study (Rudstram & Newton, 201). The review for my study was conducted through the Walden University Library. The literature search included the following databases: CINAHL, Medline, EBSCO, and Google Scholar. The following keywords were used: *HESI A2*, *BSN students*, *BSN program*, and *retention of students in a BSN program*. The publication date parameters were from 2000 to 2018. Most of the articles were less than 5 years old. Articles that were helpful in explaining the HESI A2 were included even if they were over 5 years old.

The review included over 60 articles on the topic of the HESI A2 and strategies to improve student retention. When reviewing these articles, the strategy was to focus on

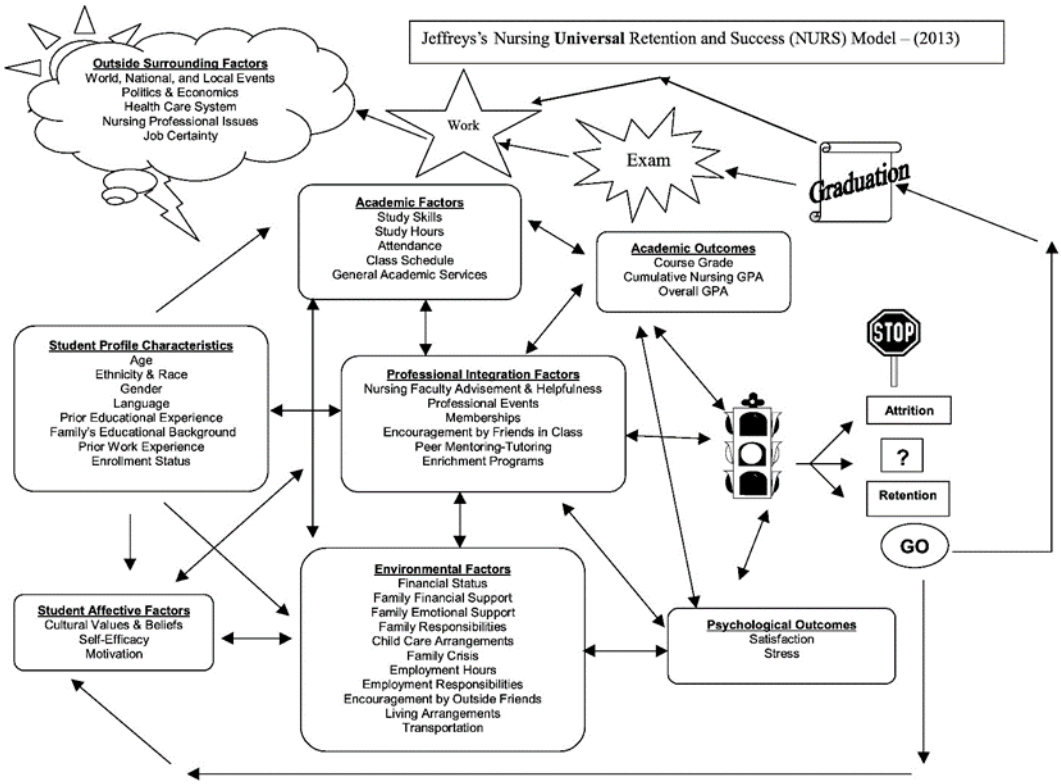
methods to determine what students would complete the BSN program. The search also included articles related to the success or failure of the HESI A2 in a BSN program.

Conceptual Framework

The conceptual framework that guided my study was Jeffreys's (2014) NURS model. The origin of Jeffreys's NURS model is rooted in the traditional retention theories of Tinto's (1975) theory of student retention and Bean and Metzner's (1985) model of nontraditional undergraduate student attrition. The NURS model is thought to be the most comprehensive model for focusing on the many factors that concern nursing student retention and success (Jeffreys, 2014). The model allows educators to identify at-risk students early and provides strategies that promote the success of the student (Jeffreys, 2014). The model focuses on retention rather than attrition and supports the belief that there is a growing, urgent need for quality nurses to help with the numerous health care needs in the United States (Jeffreys, 2014; see Figure 1).

Figure 1

Jeffreys's Nursing Universal Retention and Success (NURS) Model (2013)



Note. Adapted and reprinted from Jeffreys (2014). Reproduced with the permission of Springer Publishing Company, LLC. (see Appendix B).

Graduating successful nursing students is hindered by a low retention rate, which has been reported to be as low as 50% throughout nursing schools in the United States (Jeffreys, 2014; Merkley, 2016). The NURS model was designed to determine why students stay rather than why they leave (Jeffreys, 2014). One premise of the NURS model is that students decide to remain in nursing school or withdraw based on one or a combination of variables. These variables include the profile characteristics of the student, cultural values and beliefs of the student, the student's self-efficacy, the innate

motivation of the student, academic factors, environmental factors, professional integration and socialization factors, academic and psychological outcomes, and outside surrounding factors (Jeffreys, 2014). These variables are defined as either restrictive or supportive of student retention (Peterson-Grazioze et al., 2016). No single comprehensive approach can be agreed to be the most reliable way to ensure the retention of the student because each nursing school is equipped with its own culture, faculty, administration, and community endorsement (Jeffreys, 2014).

Profile Characteristics of the Student

According to Jeffreys (2014), the profile characteristics of the student include gender, ethnicity and race, age, primary language, previous education, the family's educational background, any previous work experience, and current enrollment status in school. Knowledge in these areas allows the nursing educator to evaluate the weaknesses and strengths of each student. This helps to ensure the educator can identify at-risk students early and provide additional help and encouragement to those students. It is also important to note that at-risk students can either be those students who lack motivation or those who are overly confident (Jeffreys, 2014).

Profile characteristics of the student factor, as described by Jeffreys (2014), provide an understanding of how the HESI A2 may relate to the retention of the student in the BSN program. The profile characteristics also help the educator know whether the student is a traditional or a nontraditional student (Jeffreys, 2014). A nontraditional student may be a commuter, a student over 24 years of age, a student who represents an

underrepresented population, a first-generation college student, or a student who attends part-time (Seidman, 2018).

The current study addressed only the academic outcomes of the HESI A2, including the math, reading, and vocabulary scores and their relevance to the ability of the applicant to successfully complete the BSN program. The HESI A2 is required as a prerequisite for entrance into the BSN program at the university where the data for this study were collected. Knowledge of the results of the HESI A2 prior to being admitted may allow the educator to provide remediation and other academic support to the student. The ability of the student to do well on the HESI A2 may be influenced by their previous educational experience (Knauss & Willson, 2013).

Cultural Values and Beliefs of the Student

Culture is developed as one generation teaches the next generation behaviors, beliefs, and values within a group (Jeffreys, 2020). Jeffreys (2012) proposed that each student belongs to a culture (or possibly more than one culture) before entering nursing school. The student brings this culture with them to the academic setting. If there is a high level of cultural similarity, the student will be more satisfied and perform at a higher level. Values are standards that have significance, meaning, and worth in the student's life. These standards guide the behaviors of the student. The student's thinking, decisions, and actions are driven by the cultural values the student possesses (Jeffreys, 2012).

Student's Self-Efficacy

Self-efficacy is the confidence the student believes they possess for learning or completing tasks or skills necessary to accomplish a goal. The student's belief that they

can succeed in learning a task despite any difficulties allows the student to use the amount of energy necessary to accomplish the task (Jeffreys, 2012).

Innate Motivation of the Student

The NURS model describes motivation as the power within the student to generate actions that will result in their success (Jeffreys, 2012). A student who is not highly motivated may not perform well in an academic setting, and a student who is highly motivated will generally perform very well in an academic setting (Jeffreys, 2020). However, if the student begins to perform poorly, the student's motivation may suffer (Jeffreys, 2020).

Academic Factors

Academic factors include personal study skills, study hours, attendance, class schedule, and general academic services such as the college library, college counseling, and the computer lab. These combined factors influence the retention of the student. The personal study skills of the student include reading skills, writing skills, preparation for exams, and note-taking skills. Of the academic factors, personal study skills are most important (Jeffreys, 2012).

Environmental Factors

Environmental factors include financial status, family financial support, family emotional support, family responsibilities, arrangements for childcare, and transportation. Environmental support is believed to compensate for weak academic support; however, the opposite does not hold true (Jeffreys, 2020).

Professional Integration and Socialization Factors

Professional integration factors are those that enhance the students' interactions with the social system of the college environment within the framework of professional socialization and career development. Professional integration factors are central to the NURS model because they influence the student's decision to continue, drop out, or withdraw temporarily (Jeffreys, 2012). Nurse educators can play an active role in professional integration by promoting nursing professional events, professional nursing association memberships, and peer mentoring (Jeffreys 2020).

Academic and Psychological Outcomes

Academic outcomes include the student's nursing course grade, the GPA for nursing courses, and the overall GPA (Jeffreys, 2012). The HESI A2 is required as a prerequisite for entrance into the BSN program at the university where the data for the current study were collected. Good academic outcomes result in the retention of the nursing student when the student also has positive psychological outcomes (Jeffreys, 2012). Positive psychological outcomes include satisfaction and manageable stress. Negative psychological outcomes include dissatisfaction and unmanageable stress (Jeffreys, 2020).

Outside Surrounding Factors

Surrounding factors exist outside of the academic setting and outside of the student's personal environment. These factors include world, national, and local events; politics and economics; the health care system; professional nursing issues; and the confidence students will have a job (Jeffreys, 2012). The outside surrounding factors

intermingle to establish an atmosphere that could influence the student's desire to continue, the student's retention, or the student's success either positively or negatively (Jeffreys, 2020).

How the NURS Model Has Been Used Similarly

Associate's degree nursing programs reported having a significant number of nursing students who do not graduate, with attrition usually occurring within the first two semesters of the program (Fraher, et al., 2010; Jeffreys, 2007; Peterson-Graziose et al., 2013). Murray et al. (2008) used Jeffreys's NURS model to evaluate the effects of an intervention retention program to determine the drive of the nursing student in completing an ADN program. This was a study of 137 students who participated in a grant-funded design that was given the name of Northern Nevada Nursing Retention Program. This program incorporated many retention services that included academic learning plans; peer tutoring; mentoring; and academic, personal, and career counseling. These services are suggested in Jeffreys's NURS model (Fontaine, 2014). Upon graduation, the students answered questions on a Likert scale survey that was developed by the program staff. Results indicated that the ADN program's average retention rate after the Northern Nevada Nursing Retention Program was implemented was 71%. There was a statistically significant difference ($p = 0.048$) from the prior six semesters that showed a 61% retention rate.

In a study by Donnell (2015), Jeffreys's NURS model was used to identify students at risk for attrition. This study included 3,258 nursing students from 27 different universities within the state of Texas. The significant predictors of attrition were (a) older

age (46 years or older), (b) Black or Native Hawaiian/Other Islander, (c) men, or (d) first-generation college student status. The results were consistent with the items listed in the NURS model's student profile characteristics that may affect attrition.

Lundgren (2020) used the NURS model to study which diverse factors affect English as a second language students who are enrolled in an ADN program. Several themes emerged from the data that were collected: (a) barriers experienced by the participants, (b) issues with retaining and learning the information, (c) feelings of being different from the other nursing students as well as being treated differently by both students and faculty, (d) the time needed to study, and (e) the desire to better themselves and to better provide for their family by becoming a nurse.

The studies presented above are in alignment with factors proposed by the NURS model relating to nursing student success in the program. However, each examined different factors that were based on the model may affect students' success; Murray et al. (2008), investigated academic factors, Donnell (2015) investigated Student Profile Characteristics, and Lundgren (2000) investigated Student Affective Behaviors. Like Donnell's study, this current study will examine relationship between student profile characteristics and retention. However, Donnell's study did not examine student profile characteristics related to prior education experiences. This study provided information to fill the gap in the literature by examining the extent to which the HESI A2 (math, reading, and vocabulary; based on the student's prior educational experience) are predictive of the student's ability to complete the BSN program (retention in the program).

Rationale for the Choice of This Theory

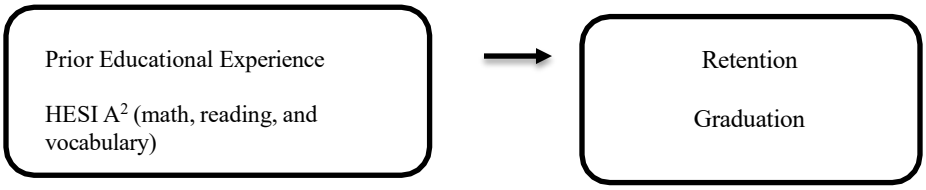
Jeffreys' model is concerned with retention, rather than attrition, of nursing students. Jeffreys (2012) presented a model that can guide educators to identify factors that can influence the students' ability to be successful in the nursing program. With the limited number of positions open for nursing students, it is critical that educators do the best job they can when choosing candidates for nursing school.

The HESI A2 was required as a prerequisite for entrance into the BSN program at the university where the data for this study was collected. This study helped to fill the gap in knowledge about whether the selection of a candidate for the BSN program, based on their performance of the HESI A2, will help to determine their ability to successfully complete the BSN program.

The results of this study helped build on Jeffreys' existing model by further supporting the model's premise that the student's educational background, which is a component of the students' profile characteristics, is an important factor that impacts retention and graduation (see Figure 2). In this study, the student's educational background includes the prior educational experience as measured by the HESI A2 (math, reading, and vocabulary). The score on the HESI A2 exam determines the level of retention, which is more likely to result in graduation (see Figure 2).

Figure 2

Student Profile Characteristics



Literature Review Related to Key Variables and/or Concepts

Shortage of Nurses

According to the Bureau of Labor Statistics (2018), there will be an additional 438,100 RNs nationwide needed to fill positions from 2016 to 2026. The number of RNs in the "Baby Boomer" generation (those nurses born between 1946 and 1964) who are retiring from the workforce influence this number. The loss of this generation from the workforce will also decrease the number of qualified experienced nurses available to fill the deficit in the workforce (Al-Alawi et al., 2020). According to the National Nursing Workforce Study, the median age of an RN in 2017 was 51 years. Therefore, approximately 50% of the current RN workforce is within 15 years of retirement (National Council of State Boards of Nursing [NSCSBN], 2017).

To encourage students to enter the nursing profession, government initiatives at both the federal and state levels have been created to help offset the cost of nursing school. At the federal level, a Public Service Loan Forgiveness Program (Federal Student Aid, 2019) has been created. In addition, many students can qualify for Federal Aid when applying for the Free Application for Federal Student Aid (FAFSA; Federal Student Aid,

2019). One state, located in the southwestern United States, offers assistance programs, such as a loan forgiveness program, to nurses who agree to practice in an under-served state healthcare facility as well as many professional nursing scholarships (Texas Health and Human Services, 2019). Unfortunately, the added incentives have not been enough to keep up with the mass departure of aging nurses. Nursing programs will have to increase the number of new graduates by approximately 30% each year over the next decade to meet the growing demand for RNs (Evans, 2013). Adding to the problem, it is reported that only 59% of nursing students graduate from nursing programs on time (Texas Higher Education Coordinating Board, 2010).

Shortage of Nursing Faculty

The AACN reports nursing schools in the United States turned away 75,029 qualified applicants from baccalaureate and graduate nursing programs in 2018 due to an insufficient number of faculty; too few clinical sites; limited classroom space; too few clinical preceptors; and budget constraints. In addition to the projected increase of nursing faculty retirements, higher compensation in clinical and private sector settings is luring current and potential nurse educators away from teaching (AACN, 2022). The average salary for a master's prepared assistant professor in a school of nursing in the United States was $87,325 (AACN, 2022). This is in contrast to the average salary ($105,903) of a nurse practitioner in the United States (American Association of Nurse Practitioners, 2019).

Retention of Nursing Students

The BSN nursing program includes both pre-licensure nursing students as well as RNs who are seeking to advance their nursing degree (Peterson-Grazioze, et al., 2016). This study will focus only on the pre-licensure BSN nursing student. The retention of nursing students is a primary concern for BSN nursing programs. When nursing students are not successful in their nursing program, there is a loss of valuable resources such as faculty and student time, costs of the nursing program, and missed opportunities for potential candidates for the nursing program. The loss of pre-licensure nursing students directly influences the number of graduating professionals who are available to enter the nursing workforce (Peterson-Grazioze, et al., 2016).

Positive results are achieved when student-centered teaching/learning strategies, writing skills, and additional help with computer skills are included in the program (Perfetto, 2015). The support of family is very important, as well as the support from friends both in and outside of class (Kern, 2014). Aggressive advising is a strategy which has been utilized to help retain nursing students (Mooring, 2016). Regular advising focuses on course scheduling, record keeping, and record review to ensure students fulfilled the requirements for graduation (Mooring, 2016). Aggressive advising is a proactive type of advising which includes frequent face-to-face meetings and focuses on the student's personal and educational stressors (Mooring, 2016). In aggressive advising, the advisor plays a much more active role, functioning as a mentor and providing the student with resources to enhance the student's educational experience (Mooring, 2016). Academic advisors who reach out to students, identify areas of weakness, and develop

meaningful relationships with students can have a positive impact on the success of the nursing student (Jeffreys (2014).

Retention specialists, who are faculty members and serve as instructors for remediation, have had positive outcomes in helping nursing students achieve academic success (Schrum, 2015). Remediation instruction is an effective strategy for improving academic achievement, retention, and graduation of the nursing students (Harding, 2012). This type of supplemental instruction provides the opportunity for nursing students to bond with a mentor who does not evaluate or assign grades. This mentoring relationship is associated with greater rates of retention (Schrum, 2015).

Selection of Students for Admission: Math, Reading, and Vocabulary

The AACN has determined the BSN curriculum must include content areas relating to critical-thinking, evidence-based practice, communication, leadership, and community health nursing (2019). These skills are crucial for BSN graduates who are required to function as skilled practitioners, managers, and coordinators of patient care. The BSN prepared-RN must be able to make instant decisions, recognize changing symptoms in patients, have the ability to coordinate care with other health providers, and be able to guide patients to needed resources in the community. The BSN prepared-RN is also expected to have the ability to master advanced technology and to function in a supervisory position. Lastly, the BSN prepared-RN is expected to have the ability to teach patients how to adopt a healthy lifestyle as the patient learns to comply with their treatment plan (AACN, 2019).

To master these skills, the BSN student needs to have well developed critical thinking skills. Critical thinking is the mental process of identifying and thoroughly exploring a problem, synthesizing what is observed, questioning the information, and making a decision for action (Castledine, 2010; Papathanasiou et al., 2014). Proficiency in math, reading, and vocabulary are three of the areas a candidate for the BSN program need to demonstrate their ability to critically think.

Math

It is well documented that students who are able to master mathematical skills demonstrate increased critical reasoning skills (Kaya et al., 2018; Su et al. 2016). The knowledge of math and the ability to solve complex problems enables the student to analyze, evaluate, reason, and communicate effectively (Su et al., 2016). Critical thinking skills enable the student to process information logically, and this ability enhances self-directed learning (Su et al., 2016). The development of critical thinking skills is important for nursing students to be prepared to investigate scientific facts and implement evidence-based nursing practices (Kaya et al., 2018). Therefore, assessment of the students' ability to solve math problems may be key to understanding the students' ability to think critically (Kaya et al., 2018).

Reading

Reading is one of the basic skills of any language. The ability to read and comprehend what is read is significant in the development of a students' intellect (Akin et al., 2015). To gain the most from the information the student is reading, the student must have the ability to interact with the message the writer is presenting (Murdoch, 2019). To

interact with the material being read means to be able to understand the new information, synthesize it with what the reader already knows, and end with an expanded view of the reader's previous reality (Aloqaili, 2012; Murdoch, 2019). This cognitive process will help the reader think critically as they process the new information being read (Akin et al., 2015).

Vocabulary

Vocabulary is the foundation of all languages, consisting of all the words in any given language (Bai, 2018). Nursing is a science which greatly relies on a students' ability to comprehend new terms and concepts (Cohen, 2012). Students with a strong vocabulary do not treat each word as a single piece of information, but understand the word represents only a part of the concept they are learning (Cohen, 2012). A strong vocabulary is essential to the ability of the student to comprehend new information, and to construct meaningful sentences which will allow their thoughts to be expressed properly (Bai, 2018; Cohen, 2012). A nursing student must know how to articulate what needs to be taught to a patient, what needs to be communicated to the physician or other staff members about a patient. This information must be communicated in both layman and medical terms. A strong vocabulary will facilitate the nursing student's ability to communicate well at all levels (Wernick et al., 2016).

Health Education Systems, Inc. Admissions Assessment

The HESI A2 was developed by Elsevier to use as a tool to help determine the most qualified students to admit in nursing programs (Chen & Voyles, 2013). Nursing schools use the HESI A2 to assess nursing applicants in four main academic areas:

English, language, math, and science, as well as in two personal areas. Nursing schools may choose to use a few or all the available assessments. The complete HESI A2 consists of nine exams that may be selected by nursing programs. These include English language – reading comprehension, vocabulary and general knowledge, and grammar; Math – basic math skills; Science – biology, chemistry, and anatomy and physiology; Learner Profile – learning style and personality profile (Elsevier, 2018).

A major component in identifying qualified student nursing applicants is preadmission testing (Cornelius, 2012; Higgins, 2005). Higgins (2005) cited common reasons for attrition included poor communication abilities, insufficient reading comprehension, and inadequate abilities in math. On the other hand, those students who demonstrated good reading comprehension, competence in their math skills, and a solid vocabulary often resulted in the student's ability to master the contents taught in the nursing program (Higgins, 2005; Swain, 2012; Underwood et al., 2013). Underwood et al. (2013) reported that students who had higher HESI A2 scores (on all components of the entrance exam) had higher grades on course exams and performed better in clinical areas during the first semester of nursing school. These researchers discussed the need for future research to investigate retention rates as related to admission policies that use the HESI A2 scores as a criterion for the selection of student applicants and should include BSN programs as part of the sample.

Studies which have been conducted on the relationship of the HESI A2 to retention have focused on ADN programs. Knauss and Willson (2012) found a positive correlation between student scores on the HESI A2, and their final course grades in the

first two semesters of an ADN nursing program. (In the first semester of nursing school r(157) = .532, p < .01, and in the second semester of nursing school r (157) = .455, *p* < .01.

Several studies reflected that the HESI A2 has a positive relationship to the student's grades in nursing courses (Chen & Voyles, 2013; Knauss & Willson, 2013; Murray et al., 2008; Underwood et al., 2013). Strong correlations were found between the four components of the HESI A2, (reading comprehension, vocabulary and general knowledge, math, and anatomy and physiology), and the three first-semester nursing courses in an ADN program. All relationships were significant with math scores and final course grades in the first semester, r (157) =.370, *p*<.01; math scores and final course grades in second semester, r (157) =.193, *p*<.05; reading comprehension scores and final course grades in the first semester were highly significant, r (157) = .211, *p* <.01; reading comprehension scores and final course grades in second semester, r (157) = .337, *p* <.01; vocabulary/general knowledge scores and final course grades in the first semester, r (157) = .371, *p* <.01; vocabulary/general knowledge scores and final course grades in second semester, r (157) = .359, p <.01; with grammar scores and final course grades in the first semester was moderate and significant, r (157) =.357, *p*<.01; grammar scores and final course grades in second semester, r (157) = .320, *p*<.01 (Underwood et al., (2013).

No studies were found that conducted to examine the relationship between the HESI A2 and retention rates in BSN students. The reason for the low retention rate among the students in the second through fourth semesters of the BSN nursing program remains unknown (Hinderer et al., 2014). This study helped to fill the gap in knowledge

about whether the selection of a candidate for the BSN program, based on their performance of the HESI A2, helped determine their ability to successfully complete the BSN program.

This information aided nursing faculty in the selection of students for admission who have a greater potential to complete the BSN nursing program. In addition, BSN nursing programs were able to identify students who may need remediation in a timely manner.

Summary

There is a growing need for nurses as the "Baby Boomers" continue to age and leave the workforce. The loss of this generation from the workforce will result in a decrease of experienced nurses available to fill the need for nurses (Al-Alawi et al., 2020). The NURS model developed by Jeffreys will guide the investigation on factors related to retaining students in nursing schools. It is critical for BSN programs to select the candidates for nursing school that can demonstrate the knowledge necessary to complete the BSN program (Peterson-Grazioze, et al., 2016). The HESI A2 scores are one measurement of the candidate's intellectual and critical thinking abilities. Three of the most common areas evaluated are math, reading, and vocabulary (Bai, 2018; Cohen, 2012; Kaya et al., 2018; Murdoch, 2019; Wernick et al., 2016). When these combined areas are evaluated, the outcome is the retention of candidates selected for the BSN program who will successfully graduate and effectively add their knowledge to the nursing workforce. The goal of this study was to determine if the scores on the HESI A2 is an effective way to measure the ability of the candidate to complete the BSN program.

In Chapter 3, I present the research design and rationale, methodology, and threats to validity.

Chapter 3: Research Method

The purposes of this quantitative retrospective study were to determine whether there is (a) a relationship between HESI A2 individual scores of math, reading, and vocabulary in nurses who complete the BSN program and those who do not and (b) a relationship among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once. The independent variables were completion of the BSN program or not completing the BSN program, and whether it makes a significant difference if the student takes the HESI A2 more than once. The dependent variables were the HESI A2 scores, which included the students' individual math, reading, and vocabulary scores.

In Chapter 3, I describe the research design including the research variables, constraints of the design, and rationale for the design. In addition, the chapter contains information regarding the study methodology, specifically the procedures used. In addition, I address the data analysis plan, including statistical tests that were used to test the hypotheses. Lastly, I address the threats to validity as well as the ethical procedures for this study.

Research Design and Rationale

My study was nonexperimental and retrospective because the predictor (independent) variables were not manipulated and the sample was not randomly assigned to groups (see Cooper & Schindler, 2014; Johnson, 2001; Lodico et al., 2010). This approach allowed me to retrieve and analyze the data that had already been collected by

the university to determine the relational outcome of the variables (see Reio, 2016). Data were retrieved from one university in the Southwest region of the United States.

My study was a quantitative, nonexperimental, retrospective study, which included convenience sampling. The variables did not change over time, so time-related constraints did not diminish the usefulness of my study. I planned for method- related constraints, such as the time it would take to process the data, so I could effectively present what I found. However, using a convenience sample in my retrospective study put constraints on the scope of the data I was able to collect. The data I used were retrieved from one university in the Southwest region of the United States. Although the scope of my study was relatively small, I was able to examine and report findings that other researchers can further explore with additional studies.

Methodology

Population, Sampling, and Sampling Procedures

The population of interest included students in the United States who were required to pass the HESI A2 as part of the admission criteria to be admitted to a traditional BSN program and who graduated on time. The convenience sample for this quantitative, nonexperimental, retrospective study was students from a university nursing school located in the Southwest region of the United States. I used the Power and Precision software to determine the sample size. For RQ1 and RQ2, the Power and Precision software program indicated that a medium effect size effect ($OR = 3.34$) would be detected between a dichotomous independent and dependent variable (with a projected event rate of .26 and .54 among the two groups) using a binary logistic regression model

with power set at .80 and alpha set at .05 using a sample size of 100 participants. The completed records for the HESI A2 were available for 513 students enrolled in the traditional BSN program from January 2016 (spring semester of 2016) through December 2021 (fall semester of 2021). This convenience sample included 100% of the students who graduated during that time. The sample of 513 participants provided sufficient statistical power for the current analysis. The inclusion criteria of my sampling frame were applicants to the BSN program who took the HESI A2 as part of the admission criteria and were admitted to the BSN program and graduated. The exclusion criteria were applicants who were not accepted to the BSN program due to a low HESI A2 score.

Procedures for Recruitment, Participation, and Data Collection

I met with the department head of the undergraduate nursing program and explained the purpose of the study, the research questions, and the requested information from the students' records (see Appendix A). The department head agreed to provide me with an Excel file containing de-identified HESI A2 data for traditional BSN students from January 2016 through December 2021. Students entering the BSN program take the HESI A2, and these scores are kept by the university for each student. The data included codes used to replace the students' names; the HESI A2 individual math, reading, and vocabulary scores; and the date when the student began and when they completed the BSN program. In addition, the list included the scores of any student who took the HESI A2 more than once. The list also provided the date the student started the program and the date the student left the program, either by completing the program or failing the program. No other information was collected about the students. The data were

maintained in the Testing Center in a locked area accessible only to the director of educational services and the secretary. Access to the files requires a signature of the person making the request and the director's permission. The department head of the undergraduate nursing program had full access to the data. Before data were collected from the undergraduate nursing program, IRB approval was obtained from Walden University IRB and from the target university IRB.

Instrumentation and Operationalization of Constructs

I designed an Excel document to record student data, which was the instrument used in this study (see Appendix B). All predictor variables were interval level. The dependent variables were the student's individual math, reading, and vocabulary scores. These data were continuous and interval/ratio. The Excel file had headings that included the student ID (de-identified), date started NURS 3550 (first nursing class taken), HESI A2 exam score (math, reading, vocabulary), and graduated (yes/no). If the student repeated the HESI A2, their information was entered the same way the initial data were entered, but the information was highlighted in yellow to indicate these were data from an additional attempt on the HESI A2.

The operationalization of constructs included the HESI A2 math, reading, and vocabulary scores. These scores could range from 0 to 100 and were reported as a percentage (Riley & Gouveia, 2023). The operationalization of the math, reading, and vocabulary variables was designated as a 1 to reflect a passing score as determined by the university on the HESI A2 math, reading, and vocabulary exam. I recorded the passing

score as a percentage of each group. Detailed diagnostic reports are provided for the prospective students and for the school who requires the exam (Riley & Gouveia, 2023).

Data Analysis Plan

I used SPSS Version 29.0 to examine the relationship between the predictor variables and the probability that a student completed the BSN program. The de-identified scores obtained from the BSN school were placed in an Excel spreadsheet and imported to SPSS. The data contained HESI A2 scores for math, reading, and vocabulary; how many times the student took the HESI A2; and whether the student completed the BSN program.

The BSN program at the university where my data were gathered is a 4-year program. However, for the first 2 years, the students complete their core requirements as well as two prenursing courses (Nursing Skills and Elementary Biostatistics). The BSN nursing classes are four semesters in length. The students who were included in my study were the students who graduated in the four semesters after beginning the BSN nursing classes. These data were found on the class information for NURS 3550, the first BSN class that is taken, as well as NURS 4390, which is the last BSN class in which the students are enrolled.

All data analysis was performed using the latest SPSS version 29.0. The data analysis was conducted in four phases. First, all study variables were presented using descriptive statistics, such as, means, standard deviations, and minimum/maximum values for continuous variables (interval/ratio level) and frequencies and percentages for categorical variables (nominal/ratio level). Second, bivariate tests were used to produce

inferential findings regarding which independent variables, including took the exam more than once (yes/no), math scores, reading scores, and vocabulary scores, were related to each dependent variable, completed the BSN program (yes/no), at a statistically significant level ($p < .05$). A chi-square analysis was used to examine the relationship between the two categorical study variables: took the exam more than once (yes/no) and completed the BSN program (yes/no). Additionally, an independent samples *t* test was used to examine whether mean math scores, reading scores, and vocabulary scores differed significantly by categories of the dichotomous variable completed the BSN program (yes/no). All explanatory variables related to the dependent variable at a statistically significant level were included in the third phase of analysis: multivariate analysis.

The multivariate analysis was a binary logistic regression model used to model the dependent variable, completed the BSN program (yes/no), as a function of the independent variables significantly related to that dependent variable in the bivariate analysis. The model was assessed in terms of overall statistical significance, chi-square value, the percentage of cases categorized correctly, the significance of individual predictors, and the odds ratio effect size values along with the 95% confidence interval for each odds ratio value. The logistic regression model was used to address RQ1.

The fourth phase of data analysis involved testing for moderating effects to address RQ2. Here three separate binary logistic regression models were used to model the dependent variable, completed the BSN program (yes/no), as a function of (a) the moderating effect of taking the exam more than once on the relationship between math

scores and completed the BSN program (interaction term: taking the exam more than once x math scores), (b) the moderating effect of taking the exam more than once on the relationship between reading scores and completed the BSN program (interaction term: taking the exam more than once x reading scores), and (c) the moderating effect of taking the exam more than once on the relationship between vocabulary scores and completed the BSN program (interaction term: taking the exam more than once x vocabulary scores).

RQ1: What is the difference between HESI A2 individual scores of math, reading, and vocabulary in students who complete the BSN program and those who do not?

H_o1: There is no difference between HESI A2 individual scores of math, reading, and vocabulary in students who complete the BSN program and those who do not.

H_a1: There is a difference between HESI A2 individual scores of math, reading, and vocabulary in students who complete the BSN program and those who do not.

RQ2: What is the difference among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once?

H_o2: There is no difference among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once.

H_a2: There is a difference among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once.

In both research questions, the outcome variable was completion of the BSN nursing program. In RQ1, the three independent (predictor) variables were the individual math, reading, and vocabulary scores. In RQ2, the predictor variables were the individual math, reading, and vocabulary scores when the student was allowed to take the exam more than once. At the university where the data were obtained, the student is allowed to take the HESI A2 entrance exam as many times as they wish. For both RQ1 and RQ2, I addressed the assumptions of logistic regression, which were the following: The response variable is binary, the observations are independent, there is no multicollinearity among explanatory variables, there are no extreme outliers, there is a linear relationship between explanatory variables and the logit of the response variable, and the sample size is sufficiently large. I tested these assumptions. If any assumptions were violated, I analyzed what other statistical nonparametric tests could be used in lieu of logistic regression.

Threats to Validity

It is vital that the researcher determine the accuracy and consistency of all instruments included in the study. Validity reflects the accuracy of measurement of a concept that is being investigated (Heale & Twycross, 2015). Reliability measures consistency with repeated tests of the same measures (Heale & Twycross, 2015). The following is a review of threats to validity in my study.

External Validity

External validity referred to the ability to generalize information obtained from this study to future graduates of the BSN program under study or to BSN graduates

nationally (see Polit & Beck, 2021; Creswell & Guetterman, 2019). The most serious risk would be that the findings only applied to the sample being studied. I used a convenience sample of students who took the HESI A2 for admission to a BSN program in the Midwest region of the United States. Even though the HESI A2 is used by nursing programs all over the United States, the results of my study may not be generalizable to other nursing students due to the time frame the data were collected and the area of the United States the university that furnished the data is located. For this study, there were no threats to external validity due to testing reactivity, interaction effects of selection and experimental variables, specificity of variables, reactive effects of experimental arrangements, or multiple-treatment interference.

Internal Validity

The accuracy and strength of the evidence is assessed through examination of the internal validity (Bolarinwa, 2015). Using a nonexperimental design weakens internal validity because random assignment is not possible. I used convenience sampling, which was a threat to selection validity (see Frankfort-Nachmias et al., 2015). To decrease Type I and Type II errors, I set my sample size to an adequate power of 0.80. There were no threats to internal validity due to history, maturation, testing, instrumentation, experimental mortality, and selection-maturation interaction.

Construct Validity

Construct validity is the extent to which a research instrument (or tool) measures the intended construct so the researcher can draw inferences based on the results of the study (Bolarinwa, 2015; Heale & Twycross 2015; Salkind & Frey, 2019). Construct

validity for the HESI A2 was established Hinderer et al. (2014) who found the HESI A2 scores had moderate, significant correlations with both nursing GPA (r = .31, p = .007) and NCLEX-RN success (r = .301, p = .010). Another study found the HESI A2 was positively correlated (r = 0.241–0.374; p = .05–.01) with 50% of the nursing course grades in the total BSN curriculum (Murray et al., 2008). In the sophomore year, 80% of course grades were positively correlated with HESI A2 scores; 55.56% of course grades were positively correlated with the HESI A2 scores in the junior year; and 16.67% of course grades were positively correlated with HESI A2 scores in the senior year (Murray et al., 2008).

Additionally, in another study, the HESI A2 scores in an ADN program was positively correlated with three first-semester nursing courses, which included Nursing Practice 1 (health promotion therapeutic communication, hygiene safety, asepsis, and medication administration), Nursing Practice 2 (fluid and electrolytes, legal/ethical issues, wound care, patient comfort, and spirituality) and pharmacology (Chen & Voyles, 2013).

Ethical Procedures

I have identified four potential ethical concerns for my study. The primary ethical concern was that the student's information remained confidential. Confidentiality was accomplished by de-identifying the student's name in the Excel file before I had access to the data. I received IRB approval from the university where I obtained the data and from Walden University (IRB # 03-29-23-0164851).

Another ethical concern was that I am employed at the university where the data for my study were collected. However, the data were from the traditional BSN program, and I work in the RN-BSN online program. I did not work with any of the students from which the HESI A2 data were collected.

An additional ethical concern was that the data were already collected and I was not able to validate the procedure used in collecting the data. However, the data were stored in a locked filing cabinet, only accessible to the director of educational services and his secretary. Anyone who needed access to the data was required to sign a form kept by the educational services.

Lastly, there was an ethical concern that the results of my study must be published in a way that no student identification is possible. No individual information was reported or published, and the published information will not identify the name of the school but will refer to the region where the school is located.

Summary

In this chapter, I discussed the research design as a non-experimental, quantitative, retrospective study. I conducted a retrospective study because this allowed me to retrieve and analyze the data that had already been collected by the university to determine the relational outcome of the variables.

I also presented the methodology. I used the Power and Precision software program which indicated that a medium effect size effect (OR=3.34) would be detected between a dichotomous independent and dependent variable (with a projected event rate of .26 and .54 among the 2 groups) using a binary logistic regression model with power

set at .80 and alpha set at .05, using a sample size of 100 study participants. Thus, the current convenience sample of 513 study participants provided sufficient statistical power for the current analysis.

I explained how I accessed the archival data. The list also provided the date the student started the program and the date the student left the program, either by completion of the program or quitting the program.

I presented the data analysis plan and the threats to validity (external validity, internal validity, and construct validity) were reviewed for transparency. Lastly, I addressed ethical concerns stressing the need to maintain confidentiality of any student information. Nothing will be included in the Excel document which would identify any student's records. In Chapter 4, I presented the results of the study and a summary of the answers to the research questions.

Chapter 4: Results

The purposes of my study were to determine whether there was (a) a relationship between HESI A2 individual scores of math, reading, and vocabulary in nurses who complete the BSN program and those who do not and (b) a relationship among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who took the HESI A2 once compared to students who took the HESI A2 more than once. The independent variables were completion of the BSN program or not completing the BSN program, and whether it made a significant difference if the student took the HESI A2 more than once. The dependent variables were the HESI A2 scores, which included the students' individual math, reading, and vocabulary scores. The research questions for my study were as follows:

RQ1

RQ1: What is the difference between HESI A2 individual scores of math, reading, and vocabulary in students who complete the BSN program and those who do not?

H_o1: There is no difference between HESI A2 individual scores of math, reading, and vocabulary in students who complete the BSN program and those who do not.

H_a1: There is a difference between HESI A2 individual scores of math, reading, and vocabulary in students who complete the BSN program and those who do not.

The statistical test that was used to analyze RQ1 was a multivariate model. A binary logistic regression model was used to model the dependent variable, completed the BSN program (yes/no), as a function of the independent variables significantly related to

that dependent variable in bivariate analysis. The model was assessed in terms of overall statistical significance, chi-square value, the percentage of cases categorized correctly, the significance of individual predictors, and the odds ratio effect size values along with the 95% confidence interval for each odds ratio value.

The assumptions included the sample size. A descriptive statistics test was run to ensure the categories of math, reading, and vocabulary had an adequate number of cases. An additional assumption was multicollinearity. A collinearity diagnostics test was run to ensure the predictor variables were not strongly related to one another. Lastly, the outliers that were found were appropriately adjusted.

RQ2

RQ2: What is the difference among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once?

H_o2: There is no difference among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 Entrance Exam once compared to students who take the HESI A2 more than once.

H_a2: There is a difference among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once.

For RQ2, I conducted three separate binary logistic regression models to model the dependent variable, completed the BSN program (yes/no), as a function of (a) the moderating effect of taking the exam more than once on the relationship between math scores and completed the BSN program (interaction term: taking the exam more than once x math scores), (b) the moderating effect of taking the exam more than once on the relationship between reading scores and completed the BSN program (interaction term: taking the exam more than once x reading scores), and (c) the moderating effect of taking the exam more than once on the relationship between vocabulary scores and completed the BSN program (interaction term: taking the exam more than once x vocabulary scores).

Data Collection

Data were collected retrospectively from a database of HESI A2 scores collected over a 7-year period at an undergraduate nursing program in the Midwest region of the United States. I was provided with an Excel file containing de-identified HESI A2 data for traditional BSN students from August 2014 through December 2021 (see Appendix B). Students entering the BSN program take the HESI A2, and these scores are kept by the university for each student. The data included codes used to replace the students' names; the HESI A2 individual math, reading, and vocabulary scores; and the date when the student began and when they successfully completed the BSN program. In addition, the data included the scores of any student who took the HESI A2 more than once. The data also provided the date the student started the program and the date the student left

the program, either by completing the program or failing the program. No other information was collected about the students. The total sample size was 513.

Results

I analyzed my data analysis using SPSS Version 29.0 in four phases. First, all study variables were presented using descriptive statistics, such as means, standard deviations, and minimum/maximum values for continuous variables (interval/ratio level) and frequencies and percentages for categorical variables (nominal/ratio level). Second, bivariate tests were used to produce inferential findings regarding which independent variables, including took the exam more than once (yes/no), math scores, reading scores, and vocabulary scores, were related to each dependent variable, completed the BSN program (yes/no), at a statistically significant level ($p < .05$). I used a chi-square analysis to examine the relationship between the two categorical study variables: took the exam more than once (yes/no) and completed the BSN program (yes/no). Additionally, an independent samples *t* test was used to examine whether mean math scores, reading scores, and vocabulary scores differed significantly by categories of the dichotomous variable, completed the BSN program (yes/no). All explanatory variables related to the dependent variable at a statistically significant level were included in the third phase of analysis: multivariate analysis.

The multivariate analysis was a binary logistic regression model used to model the dependent variable, completed the BSN program (yes/no), as a function of the independent variables significantly related to that dependent variable in bivariate analysis. The model was assessed in terms of overall statistical significance, chi-square

value, the percentage of cases categorized correctly, the significance of individual predictors, and the odds ratio effect size values along with the 95% confidence interval for each odds ratio value. The multivariate model was used to address RQ1.

The fourth phase of data analysis involved testing for moderating effects to address RQ2. I conducted three separate binary logistic regression models to model the dependent variable, completed the BSN program (yes/no), as a function of (a) the moderating effect of taking the exam more than once on the relationship between math scores and completed the BSN program (interaction term: taking the exam more than once x math scores), (b) the moderating effect of taking the exam more than once on the relationship between reading scores and completed the BSN program (interaction term: taking the exam more than once x reading scores), and (c) the moderating effect of taking the exam more than once on the relationship between vocabulary scores and completed the BSN program (interaction term: taking the exam more than once x vocabulary scores). Within the final inferential analysis presented, all necessary test assumptions were examined and revealed no test violations, including normality (values in Table 2 indicate that for continuous variables the skewness and kurtosis were not greater than 3 times the standard error of each value), multicollinearity (where VIF values are ≤ 2.0), and linearity (where the Box-Tidwell test for continuous explanatory variables with the dichotomous dependent variable evidenced a logit interaction term of $p > .05$).

There were several outlier scores (cases two standard deviations from the mean or more) that evidenced an undue effect on the inferential analysis and needed to be treated. For example, the findings in Table 5 indicate that when the outlier scores were included

in the analysis, the relationship between reading scores and completion of the BSN program was statistically significant, but the relationship between vocabulary scores and completion of the BSN program was not statistically significant. However, when the outlier scores were treated (through changing each outlier score to the adjacent value that was not an outlier), the relationship between reading scores and completion of the BSN program was not statistically significant, but the relationship between vocabulary scores and completion of the BSN program was statistically significant. This indicates that the outlier scores were driving the findings, which violated the assumption of no undue influence of outlier scores.

This necessitated treating the outlier scores in the three continuous distributions of scores. To treat the outlier scores, I changed each outlier value to the adjacent value that was not an outlier. According to Pallant (2020), outlying scores can either be deleted or assigned a score that is the approximate value of the remainder of the other scores. For the math score distribution, 7.2% (n = 37) of scores were outlier scores to the low side of the distribution (ranging from scores from 0% to 66%) that were changed to the next score that was not an outlier, which was a score of 70.0%. For the reading score distribution, 5.5% (n = 28) of scores were outlier scores, with two scores of 100% to the high side of the distribution and 26 scores to the low side of the distribution (ranging from 22% to 74%) that were changed to the next score that was not an outlier, which was 76.0%. For the vocabulary score distribution, 3.7% (n = 19) of scores were outlier scores, with two scores of 100% to the high side of the distribution and 17 scores to the low side

of the distribution (ranging from 0% to 64%) that were changed to the next score that was not an outlier, which was 66.0%.

There were no missing data values in the data set, which facilitated a complete case analysis. In terms of statistical power regarding the dependent variable, completion of the BSN program (yes/no), the Power and Precision software program indicated that a medium effect size effect (*OR* = 3.34) would be detected between a dichotomous independent and dependent variable (with a projected event rate of .26 and .54 among the two groups) using a binary logistic regression model with power set at .80 and alpha set at .05, using a sample size of 100 participants. Thus, the sample of 513 participants provided sufficient statistical power for the current analysis.

Descriptive Analysis

Table 1 presents a descriptive analysis of categorical study variables. Data indicated that 15.4% (*n* = 79) of the participants did not complete the BSN program. Additionally, about one third of the sample (*n* = 187, 36.5%) took the exam more than once.

Table 1

*Descriptive Analysis of Categorical Study Variables (*N = *513)*

Variable	Category	Number	Percentage
Completed the BSN program	Yes	434	84.6%
	No	79	15.4%
Took the exam more than once	Yes	187	36.5%
	No	326	63.5%

Table 2 presents a descriptive analysis of the continuous study variables. Results indicated that the average study participant scored 88.07% (*SD* = 8.26, MIN/MAX = 70.00–100.00) for math scores, 86.59% (*SD* = 5.54, MIN/MAX = 76.00–98.00) for reading scores, and 84.54% (*SD* = 8.41, MIN/MAX = 66.00–100.00) for vocabulary scores. The distribution of scores was approximately normal as the skewness and kurtosis were not approximately 3 times the respective standard error of each value (see Figures 3–5 to view the distribution of scores). Table 3 presents the descriptive analysis of the continuous study variables with the outlier scores untreated (see Figures 6–8 to view the distribution of scores).

Table 2

*Descriptive Continuous Study Variables (*N = *513)*

Variable	*M* (*SD*)	Minimum/Maximum	Skew (*SE*)	Kurtosis (*SE*)
Math scores	88.07 (8.26)	70.00-100.00	-.83 (.11)	-.16 (.22)
Reading scores	86.59 (5.54)	76.00-98.00	-.22 (.11)	-.58 (.22)
Vocabulary scores	84.54 (8.41)	66.00-100.00	-.59 (.11)	-.42 (.22)

Table 3

*Outliers Scores Included: Descriptive Analysis of Math, Reading, and Vocabulary Scores (*N = *513)*

Variable	*M* (*SD*)	Minimum/Maximum	Skew (*SE*)	Kurtosis (*SE*)
Math scores	88.22 (11.22)	0.00-100.00	-2.83 (.11)	-14.86 (.22)
Reading scores	86.22 (7.15)	22.00-100.00	-3.06 (.11)	-24.18 (.22)
Vocabulary scores	84.06 (10.50)	0.00-100.00	-2.76 (.11)	-16.59 (.22)

Bivariate Analysis

Table 4 presents a single predictor logistic regression analysis of the variables took the exam more than once (yes/no) and completion of the BSN program (yes/no). Bivariate analysis indicated that the participants who took the exam more than once were 88% less likely to complete the BSN program, *OR* = .53 (95% CI =.33–.86), 1.00/.531 = 1.88, B = .63, *SE* = .25, Wald $X^2 = 6.59$, $p < .01$; 87.7% ($n = 286$) of participants who took the exam once finished the BSN program; and 79.1% ($n = 148$) of participants who took the exam more than once completed the BSN program.

Table 4

Single Predictor Logistic Regression Analysis of Took the Exam More Than Once (Yes/No) by Completion of the BSN Program (Yes/No; N = *513)*

	Completed the Program					
	Yes (n=434)	No (n=79)				
Variable	n (%)	n (%)	*B(SE)*	*Wald* X^2	*OR (95% CI)*	*p*
Took the exam more than once			-.63 (.25)	6.59	.53[1] (.33-.86)	.01
Yes	148 (79.1)	39 (20.9)				
No	286 (87.7)	40 (12.3)				

[1]1.00/.531=1.88 (88% less likely to complete the program)

Table 5 presents an independent samples t-test analysis of mean math, reading, and vocabulary scores by completion of the BSN program (yes/no). Analysis revealed significantly higher math scores among study participants that completed the BSN program (*M*=88.62, *SD*=7.99), relative to those that did not complete the program (*M*=85.09, *SD*=9.07), *t*(511)=3.54, *p*<.001. Likewise, analysis revealed significantly higher vocabulary scores among study participants that completed the BSN program (*M*=84.91, *SD*=8.20), relative to those that did not complete the program (*M*=82.56, *SD*=9.30), *t*(5101.23)=2.11, *p*<.05. Mean vocabulary scores did not vary significantly by categories of the dependent variable, *t*(511)=1.80, *p*=.07. Table 5 presents an independent samples t-test analysis of mean math, reading, and vocabulary scores by completion of the BSN program (yes/no) with the outlier scores included in the distribution of scores.

Table 5

Independent Samples t-Test Analysis of Mean Math, Reading, and Vocabulary Scores by Completion of the BSN Program (Yes/No; N = *513)*

	Completed the Program			
	Yes (*n*=434)	No (*n*=79)		
Variable	*M(SD)*	*M(SD)*	*T(df)*	*p*
Math Scores	88.62 (7.99)	85.09 (9.07)	3.54 (511)	.001
Reading Scores	86.78 (5.50)	85.56 (5.63)	1.80 (511)	.07
Vocabulary Scores	84.91 (8.20)	82.56 (9.30)	2.10 (101.23)	.04

Figure 3

Distribution of Math Scores with the Outlier Scores Treated

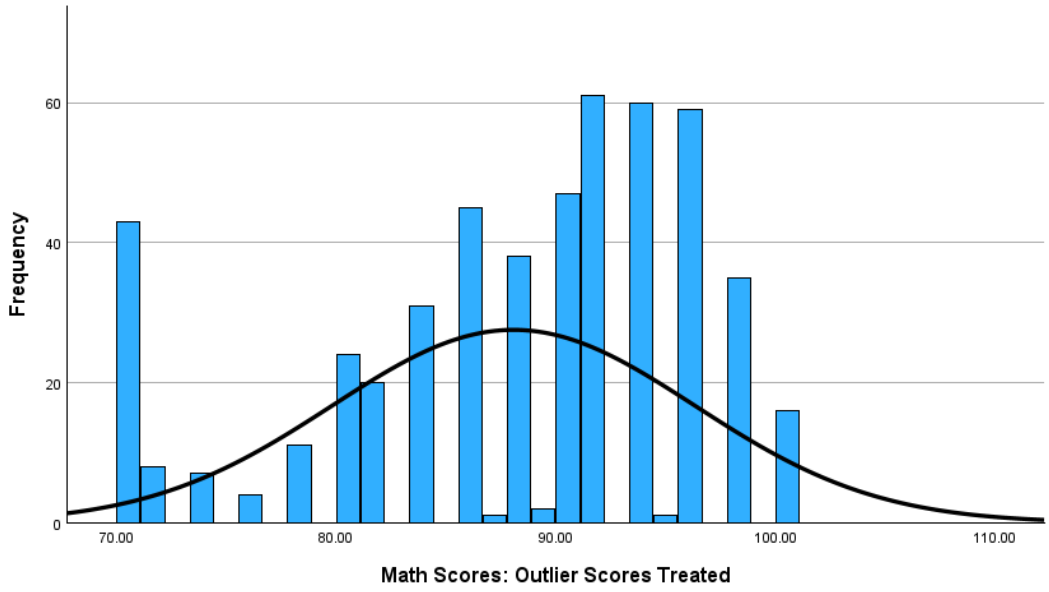


Figure 4

Distribution of Reading Scores with the Outlier Scores Treated

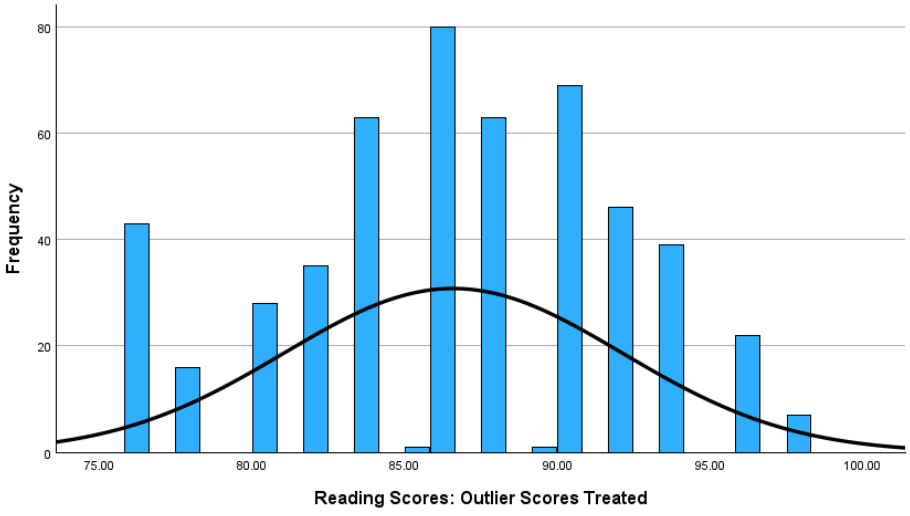


Figure 5

Distribution of Vocabulary Scores with the Outlier Scores Treated

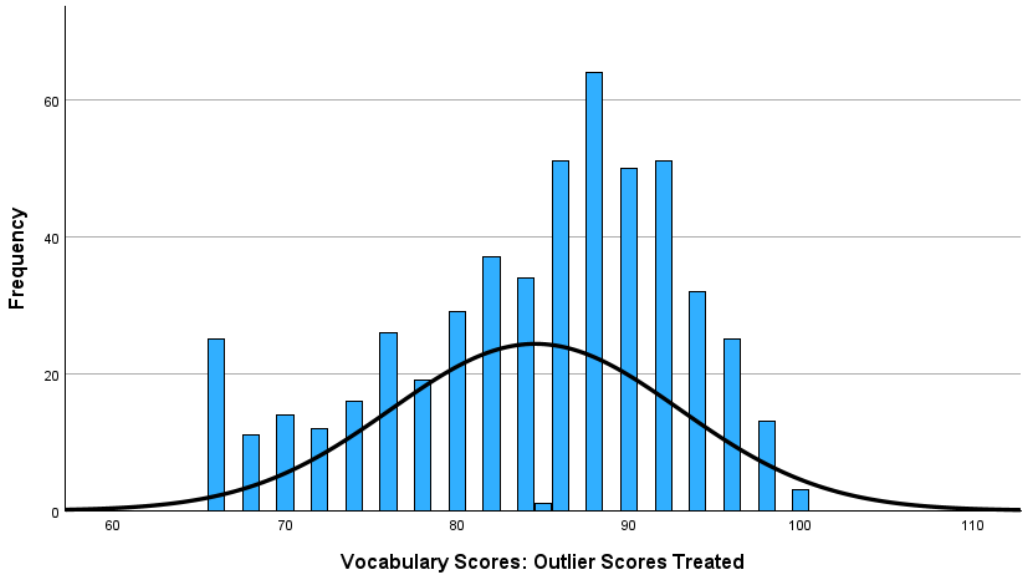


Table 6

Outliers Scores Included: Independent Samples T-Test Analysis of Mean Math, Reading, and Vocabulary Scores by Completion of the BSN Program (Yes/No; N = 513

	Completed the Program			
	Yes (*n*=434)	No (*n*=79)		
Variable	*M(SD)*	*M(SD)*	*T(df)*	*p*
Math Scores	87.84 (11.05)	83.84 (11.60)	2.94 (511)	.01
Reading Scores	86.48 (6.67)	84.75 (9.27)	1.80 (511)	.05
Vocabulary Scores	84.37 (10.61)	82.35 (9.71)	1.58 (101.23)	.12

See Figures 6-8 for a graphic of math, reading, and vocabulary scores with the outlier scores included.

Figure 6

Distribution of Math Scores with the Outlier Scores Included

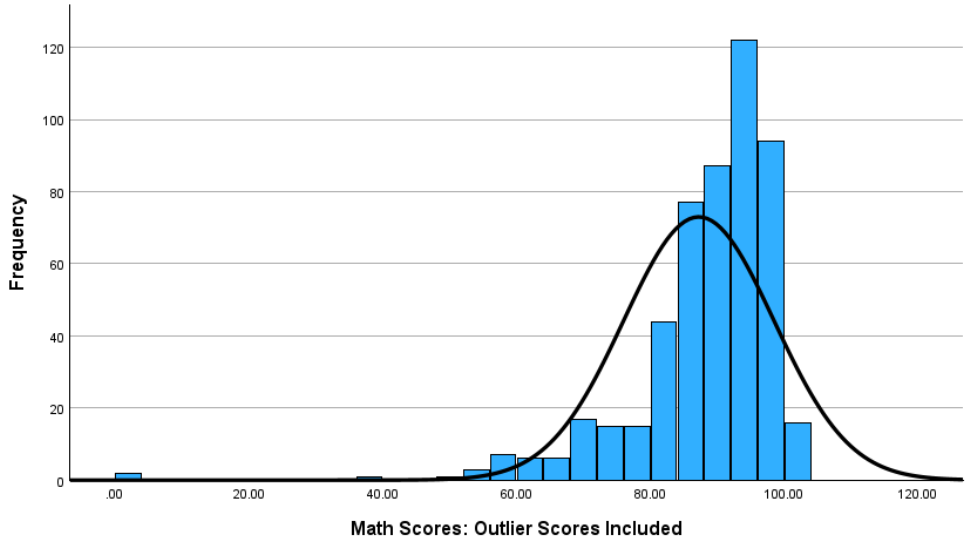


Figure 7

Distribution of Reading Scores with the Outlier Scores Included

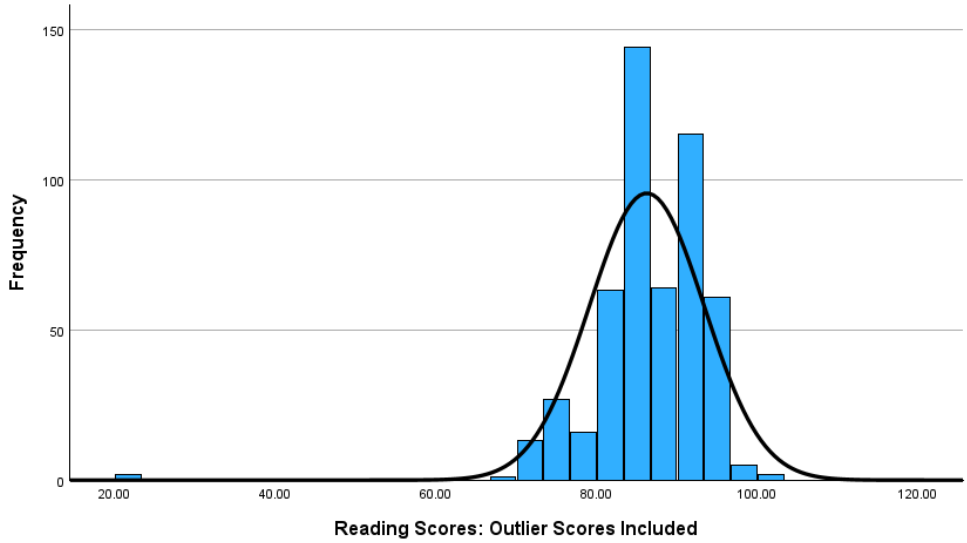
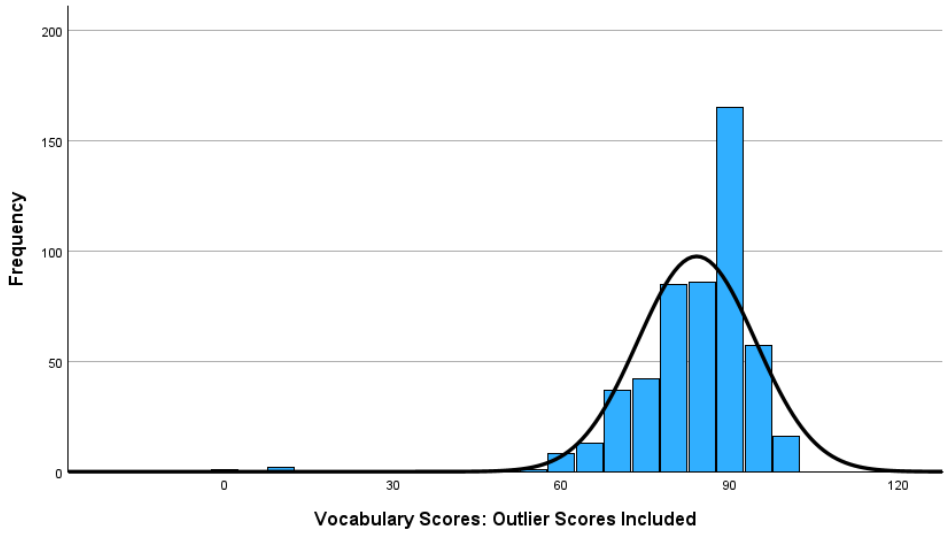


Figure 8

Distribution of Vocabulary Scores with the Outlier Scores Included



Multivariate Analysis

Table 7 presents binary logistic regression analysis examining completion of the BSN program (yes/no) by independent variable scores. Analysis indicated that the overall model was statistically significant, $X^2(3)=12.99$, $p<.01$, with 84.6% of cases being categorized correctly. Regarding the individual predictors, at the multivariate level the dependent variable was not significantly related to the variables took the exam more than once, *B*=-.16, *SE*=.34, *Wald* X^2=.23, *p*=.63), and Vocabulary Scores, *B*=.01, *SE*=.02, *Wald* X^2=.52, *p*=.47. However, higher math scores were associated with a greater likelihood (*OR*=1.04, *95% CI*=1.01-1.07) of competing the BSN program, *B*=.04, *SE*=.02, *Wald* X^2=5.65, *p*<.05.

Table 7

*Binary Logistic Regression Analysis Examining Completion of the BSN Program (Yes/No) by Independent Variable Scores (*N = *513)*

Variable	B(*SE*)	Wald X^2	*OR* (95% CI)	*p*
Took the exam more than once	-.16 (.34)	.23	.85 (.44-1.64)	.63
Math scores	.04 (.02)	5.65	1.04 (1.01-1.07)	.02
Vocabulary scores	.01 (.02)	.52	1.01 (.98-1.05)	.47

Note. $X^2(3) = 12.99$, $p < .01$; 84.6% of cases were categorized correctly.

Analysis of Moderating Effects

Table 8 presents binary logistic regression analysis examining the moderating effect of taking the exam more than once (yes/no) on the relationship between math scores and completing the program (yes/no). Analysis revealed that the variable taking the exam more than once (yes/no) did not moderate the relationship between math scores and completing the program at a statistically significant level, *B*=-.01, *SE*=.03, *Wald* X^2=.18, *p*=.67.

Table 8

Moderating Effect of Taking the Exam More Than Once (Yes/No) on the Relationship Between Math Scores and Completing the Program (Yes/No; N = *513)*

Variable	B(*SE*)	Wald X^2	*OR* (95% CI)	*p*
Took the exam more than once (TEMO)	94(2.87)	.11	2.55(.01-706.57)	.74
Math scores	.05 (.03)	3.50	1.05 (1.00-1.10)	.06
TEMO X math scores	-.01 (.03)	.18	.99(.92-1.05)	.67

Note. $X^2(3) = 12.66$, $p < .01$; 84.6% of cases were categorized correctly.

Table 9 presents binary logistic regression analysis examining the moderating effect of taking the exam more than once (yes/no) on the relationship between reading scores and completing the program (yes/no). Analysis revealed that the variable taking the exam more than once (yes/no) did not moderate the relationship between reading scores and completing the program at a statistically significant level, *B*=.00, *SE*=.05, *Wald X*²=.00, *p*=.98.

Table 9

Moderating Effect of Taking the Exam More Than Once (Yes/No) on the Relationship Between Reading Scores and Completing the Program (Yes/No; N = *513)*

Variable	B(*SE*)	Wald X^2	*OR* (95% CI)	*p*
Took the exam more than once (TEMO)	-.64(4.24)	.02	.53 (.00-2,130.50)	.74
Reading scores	.02 (.04)	.23	1.02 (.95-1.09)	.63
TEMO X math scores	.00 (.05)	.00	1.00 (.91-1.10)	.98

Note. $X^2(3) = 12.66$, $p < .01$; 84.6% of cases were categorized correctly.

Table 10 presents binary logistic regression analysis examining the moderating effect of taking the exam more than once (yes/no) on the relationship between vocabulary scores and completing the program (yes/no). Analysis revealed that the variable taking the exam more than once (yes/no) did not moderate the relationship between vocabulary scores and completing the program at a statistically significant level, *B*=.05, *SE*=.04, *Wald X*²=1.56, *p*=.21.

Table 10

Moderating Effect of Taking the Exam More Than Once (Yes/No) on the Relationship Between Vocabulary Scores and Completing the Program (Yes/No; N = *513)*

Variable	B(*SE*)	Wald X^2	*OR* (95% CI)	*p*
Took the exam more than once (TEMO)	-4.37 (3.15)	1.93	.01 (.00-6.05)	.17
Vocabulary scores	.01 (.03)	.17	.99 (.93-1.05)	.68
TEMO X vocabulary scores	.05 (.04)	1.56	1.05 (.97-1.13)	.21

Note. $X^2(3) = 8.97$, $p < .05$; 84.6% of cases were categorized correctly.

Summary

Based on the statistical analysis, taking the exam more than once (yes/no) did not moderate the relationship between math scores and completing the program at a statistically significant level; taking the exam more than once (yes/no) did not moderate the relationship between reading scores and completing the program at a statistically significant level; and taking the exam more than once (yes/no) did not moderate the relationship between vocabulary scores and completing the program at a statistically significant level. Regarding the individual predictors, at the multivariate level, results showed that higher math scores were associated with a greater likelihood of completing the BSN program. In addition, my study also revealed that taking the HESI A2 more than once was not a statistically significant predictor of whether the student would have a greater likelihood of completing the BSN program. In Chapter 5, I present the interpretation of findings, limitations, and implications of my research study. I also present recommendations for future research.

Chapter 5: Discussion, Conclusions, and Recommendations

The purposes of this quantitative retrospective study were to determine whether there was (a) a relationship between HESI A2 individual scores of math, reading, and vocabulary in nursing students who complete the BSN program and those who do not and (b) a relationship among the individual math, reading, and vocabulary scores of the HESI A2 and completion of the BSN program in nursing students who take the HESI A2 once compared to students who take the HESI A2 more than once. The literature review revealed that studies that had included the HESI A2 primarily focused on ADN programs (Knauss & Willson, 2012). The HESI A2 has shown a positive relationship to the student's grades in nursing courses (Chen & Voyles, 2013; Knauss & Willson, 2013; Murray et al., 2008; Underwood et al., 2013). No studies were found that examined the relationship between the HESI A2 and retention rates in BSN students. The reason for the low retention rate among the students in the second through fourth semesters of the BSN nursing program was unknown (Hinderer et al., 2014).

Analysis using binary logistic regression was conducted to examine completion of the BSN program (yes/no) by independent variable scores. My analysis indicated that the overall model was statistically significant, with 84.6% of cases being categorized correctly. Analysis revealed that higher math scores were associated with a greater likelihood of completing the BSN program. Binary logistic regression analysis examining the moderating effect of taking the exam more than once (yes/no) on the relationship between math scores and completing the BSN program (yes/no), on the relationship between reading scores and completing the BSN program (yes/no), and on the

relationship between vocabulary scores and completing the BSN program (yes/no) revealed that the variable taking the exam more than once (yes/no) did not moderate the relationship between math scores, reading scores, or math scores and completing the BSN program at a statistically significant level.

Interpretation of the Findings

Previous studies indicated that the HESI A2 has a positive relationship to the student's grades in ADN programs (Chen & Voyles, 2013; Knauss & Willson, 2013; Murray et al., 2008; Underwood et al., 2013). According to Peterson-Grazioze et al. (2016), it is essential for BSN programs to select candidates who can demonstrate the knowledge necessary to complete the BSN program. The HESI A2 scores are one measurement of the candidate's intellectual and critical thinking abilities. Three of the most common areas evaluated are math, reading, and vocabulary (Bai, 2018; Cohen, 2012; Kaya et al., 2018; Murdoch, 2019; Wernick et al., 2016). I was not able to find any studies that addressed whether the prospective nursing student's results on the HESI A2 were related to the student's ability to complete a BSN program. However, the benefit of the HESI A2 as part of admission to an ADN program had been examined (Chen & Voyles, 2013; Gallagher et al., 2001; Knauss & Willson, 2013; Manieri et al, 2015; Yoho et al., 2007). One study addressed the HESI A2 results and completion of a BSN program (Murray et al., 2008). In this study, the HESI A2 was not used as part of the admission process, but instead was given after admission to measure the needs of the new nursing student. My results added new information to the body of knowledge by revealing that higher math scores were associated with a greater likelihood of completing the BSN

program. Many of the participants in my study took the HESI A2 more than once in an attempt to obtain a higher grade. However, my study revealed that taking the HESI A2 more than once was not a statistically significant predictor of whether the student would have a greater likelihood of completing the BSN program.

Jeffreys's (2012) NURS model is concerned with retention rather than attrition of nursing students. Jeffreys (2012) presented a model that can guide educators to identify factors that can influence students' ability to be successful in the nursing program. With the limited number of positions open for nursing students, it is essential that educators do the best job they can when choosing candidates for nursing school. The results of the current study may build on Jeffreys's existing model by supporting the model's premise that the student's educational background, which is a component of the student's profile characteristics, is an important factor that impacts retention and graduation. My results revealed that higher math scores were associated with a greater likelihood of completing the BSN program. My study also revealed that taking the HESI A2 more than once in an effort to obtain a higher grade was not a statistically significant predictor of whether the potential nursing student would have a greater likelihood of completing the BSN program.

Limitations of the Study

My study was limited to three variables from the HESI A2, which included reading scores, math scores, and vocabulary scores. These scores do not include all the possible variables that might impact a student's ability to complete a BSN program. An additional limitation was the data was from one university in the Southwest region of the

United States. Data from other universities throughout the United States could yield different results.

Recommendations

Further research should be conducted to identify additional factors to predict whether a potential nursing student can complete a BSN program. Researchers may want to use HESI A2 data from many universities across the United States. Although the results of my study revealed that the reading and vocabulary scores were not associated with a greater likelihood of completing the BSN program, additional research is needed using the HESI A2 math, reading, and vocabulary scores to learn more about how these scores may impact the student's ability to complete a BSN program.

Implications

The implications of completing a BSN include the individual, family, nursing as an organization, and societal/policies levels. Understanding how the HESI A2 math, reading, and vocabulary scores translate to the ability of a prospective nursing student to complete the BSN program could result in positive social change. By making certain the most qualified prospective nursing students are admitted to the program may help ensure there are qualified BSN-prepared nurses to work in the many areas of health care. The current study provides a foundation for additional research.

Implications for the Individual Level

Two implications for individuals completing a BSN program are personal satisfaction and the ability to advance in one's career. Duffy et al. (2014) reported that a feeling of personal achievement was a perceived benefit of obtaining a BSN degree.

According to Thielmann et al. (2019), two of the most important factors in earning a BSN are degree attainment and career advancement. Other reasons that students work to earn a BSN are the money a BSN-prepared nurse can make and that a higher level of education transfers to better patient care.

Implications for the Family Level

Two implications that apply to the family level of individuals completing a BSN program are the ability to have a better balance between work and life and the ability to make more money with a BSN. According to the U.S. Bureau of Labor Statistics (2023), the median pay for an RN-BSN is $81,220 per year. The typical entry-level education is a bachelor's degree. The work environment includes hospitals, ambulatory health care services, nursing homes, government facilities, and educational services (U.S. Bureau of Labor Statistics, 2023). The BSN-prepared RN has many options of where to work, which will allow for a better work–life balance.

Implications for the Organizational Level (Nursing as an Organization)

Two implications at the organizational level are professional development and quality of patient care. Asiimwe et al. (2019) reported that improved patient outcomes, lower patient mortality rates, and increased access to health care have a direct correlation with nurses who choose to advance their degree to at least a BSN level.

Implications for the Society/Policies Level

Two implications at the society/policies level are the public health impact and policy considerations. According to Brown et al. (2023), there will be a 17% increase in the need for community health workers by 2030. The BSN nurse has been educated with

a foundation for public health nursing. According to Brown et al. (2023), the BSN student demonstrated competency in four areas of public health practice: (a) assessment of the population, (b) population-based planning, (c) implementing interventions, and (d) evaluation of process and outcomes. Downs and Fiore-Lopez (2022) stated it is the responsibility of nurses to educate themselves on the problems that affect nursing practice and the nursing profession. A nurse can draw attention to issues they know are affecting patients and use their position to enhance the care that is given to the patient.

Conclusion

Due to the shortage of nurses, it is important that prospective nursing students be chosen based on their ability to complete the BSN program (Al-Alawi et al., 2020). Although the HESI A2 is only one form of measurement, it is an area of focus educators should be looking at closely. If universities are allowing the prospective nursing student to take the HESI A2 exam more than once, that practice may need to be examined closer based on the results of my current study. Nurse educators have the responsibility to recruit and train the most qualified candidates so they can enter the workforce fully prepared to function as confident, professional nurses.

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Appendix A: Letter From the Assistant Department Head Concerning File With Student De-identifying Information

12/31/2021

I have agreed to provide Colleen Peace with an Excel file that will provide the de-identified HESI A2 information for the traditional Bachelor of Science in Nursing (BSN) students. The dates for these files will be from January 2015 through December 2020. The data in the file will be used as retrospective information to complete Mrs. Peace's study for her Dissertation.

Colletta Lozton PhD RN

Assistant Department Head of the Undergraduate Nursing Program

Appendix B: Email Granting Permission to Use Graph of Jeffreys' NURS Model

On Sep 16, 2021, at 7:25 AM, info@copyright.com wrote:

Good morning Colleen Peace,

Thank you for contacting us at Copyright Clearance Center (CCC). We work on helping customers obtain permissions for copyrighted work on behalf of copyright owners. My name is Abdel and it is a pleasure to help you.

Based on the information that you provided, I understand that you'd like to use a graph published in the article "Nursing Universal Retention and Success (NURS) Model: A Holistic, Discipline-Focused Framework" by SAGE. I have checked and according to SAGE's permissions terms and conditions, you are free to use the model in your thesis/dissertation provided that:

Permission is granted at no cost for use of content in a Master's Thesis and/or Doctoral Dissertation, subject to the following limitations. You may use a single excerpt or up to 3 figures tables. If you use more than those limits, or intend to distribute or sell your Master's Thesis/Doctoral Dissertation to the general public through print or website publication then you will need permission.

If you have any further questions please don't hesitate to contact a Customer Account Specialist at 855-239-3415 Monday-Friday, 24 hours/day.

Sincerely,
Abdel

Abdelrahman E.
Customer Account Specialist
Copyright Clearance Center
222 Rosewood Drive
Danvers, MA 01923
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Toll Free US +1.855.239.3415
International +1.978-646-2600
Facebook - Twitter - LinkedIn

Appendix C: Example of Excel Spreadsheet With De-identified Information

Appendix B: Example of Excel Spreadsheet with De-identified Information

Date Took HESI A2	Student ID	Started NURS 3550 Fall 2015		HESI A2 Exam Score	Math	Reading	Vocabulary	Overall Score for Math, Reading, and Vocabulary	Graduated	
									Yes	No
01/24/15	aa	08/25	2014	80.00	84.00	84.00	90.00	86.00	X	
01/10/15	ab	08/25	2014	87.85	89.80	87.75	85.00	87.85	X	
01/31/15	ac	08/25	2014	81.43	94.00	90.00	88.00	97.33	X	
01/31/15	ad	08/25	2014	88.86	94.00	82.00	90.00	88.67		X