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**Rethinking Admission Criteria in a Tennessee Nursing Program
to Improve Quality Outcomes**

Tina M. Massey

Nursing Outcomes

A Field Study

Presented to

The College of Graduate Studies

Austin Peay State University

In Partial Fulfillment

of the Requirements for the Degree

Educational Specialist

Tina M. Massey

May 4, 2018

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To the College of Graduate Studies:

We are submitting an APA field study written by Tina M. Massey entitled “Rethinking Admission Criteria in a Tennessee Nursing Program to Improve Quality Nursing Outcomes.” We have examined the final copy of this APA field study for form and content. We recommend that it be accepted in partial fulfillment of the requirements for the degree of Educational Specialist.



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DEDICATION

For my late brother, Mark R. Ingraham. It was he who always encouraged me to further my degree and achieve all the education life has to offer. And for my parents, Roger L. Ingraham and Roberta L. Ingraham, who taught me that hard work has its own rewards.

This goal was attained due to the support I received from Rodney Grimsley and Shannon Massey-Rives. They provided me a gentle “push” during the times I believed it was best to rethink my goals.

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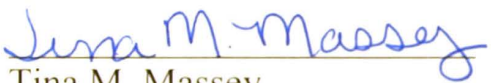
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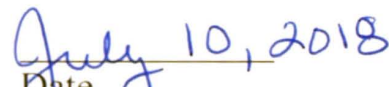
I am indebted to Cindy Jackson and Y'hanna Perez for painstakingly editing my work and to Monica Wirts and Connie Choate for believing that I could accomplish my goal. Additionally, I benefited immensely from Dr. John McConnell's guidance and assistance.

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TINA M. MASSEY. Rethinking Nursing Admission Criteria in a Tennessee Nursing Program to Improve Quality Nursing Outcomes (under the direction of DR. JOHN R. MCCONNELL).

Nursing programs across the globe are facing attrition issues. Adding additional students to nursing cohorts is not necessarily the best solution. Retaining the admitted students to become more successful within the Bachelors of Science in Nursing (BSN) program, thus increasing the graduation rate, is more economically feasible than increasing the cohort size. Success is defined as the ability to remain in the nursing program, passing all nursing courses with a B or better, on the first attempts. Predicting if a student was at-risk prior to being admitted to the nursing program was the primary goal of this study. An evaluation of 325 nursing students, accepted to a Tennessee nursing program from Spring 2011 through Fall 2016 was conducted. The bioscience grades (predictor variables) and the three nursing grades (dependent variable) were used to conduct a logistic regression to determine if a student was at-risk for failure or withdrawing from their first semester of nursing school. Furthermore, a simple linear regression was conducted to determine if the bioscience grades were a prediction of nursing fundamental and/or overall nursing grade point average (GPA). Overall, the findings demonstrated that the admission ranking formula should be redesigned to weigh the bioscience grades in order to select a more qualified pool of candidates. In addition, interviews, essay writing, and additional critical thinking exercises were also examined as a way to improve the selection process.

Keywords: BSN, retention, TEAS, GPA, anatomy, physiology, microbiology

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CHAPTER I

INTRODUCTION

Statement of Problem

Nursing shortages are nationwide, and in order to fulfill the demand, nursing educators need to examine the retention of their programs in order to improve program graduation rates. Determining at-risk students prior to the students being accepted to the nursing program is vital. In Tennessee, as of September 4, 2016, Jobs4tn listed 4,102 registered nurse (RN) positions available on their website. During the same timeframe, only 156 RNs were actively using the website and seeking employment. Nursing shortages, coupled with decreasing retention rates in the nursing programs, are worrisome to nurse educators. Whyte, Madigan, and Drinkwater (2011) concluded that identifying at-risk students by evaluating predictors of academic success is critical to improving degree completions. Nursing students' performances in clinical are highly technical, and a solid foundation of the sciences equips them with the knowledge needed in rapid, critical thinking, decision-making. Building upon their study, an examination of the student's nursing bioscience grades were used as a predictor for success within the students first semester of the nursing program. The current admission formula developed by the faculty, in which this study took place, weighs all courses evenly, which includes the university core courses that have little impact on nursing skills or abilities. The study will include valid reasons for changing the admission ranking from an all-inclusive Grade point Average (GPA) + Test of Essential Academic Skills (TEAS) to a ranking formula that weighs the nursing core bioscience prerequisites more heavily. The TEAS exam is an exam that includes a measure of a student's nursing aptitude and is assigned a value up to

100. Additionally, the use of essay writing and interviews, in regards to retention in nursing programs, was also examined to determine if they are valid predictors of success.

Purpose of the Study

In an effort to curtail attrition within a nursing program, one must examine the at-risk probability of the potential incoming nursing students. As “baby boomers” retire and the life expectancy in the United States increases the nursing shortage will continue to persist unless more nursing students are successful in the nursing program. The concept of successfully graduating students and improving current retention may be more economically feasible than admitting additional nursing cohorts. Although the school of nursing is a GPA competitive program, the current ranking formula consists of calculating an overall admission ranking formula based off a student’s nursing prerequisites and university core prerequisites. Special consideration or weight should be shifted to the nursing science core in order to determine the best qualified candidates, thus reducing the at-risk student nursing population.

During the past few admission cycles, at-risk applicants who received bioscience grades that were not competitive enough for consideration to the nursing program chose to retake the science course within the seven-year allotted timeframe. In doing so, both attempts at the course were averaged together and added to the Test of Essential Academic Skills (TEAS) results, enabling the applicants to boost their admission rankings to a more competitive level. TEAS testing is conducted to predict if a student has the general knowledge needed to become successful and graduate from a nursing program. It should be noted that Newton, Smith, Moore, and Magnan (2007) disagreed with Assessment Technologies Institute (ATI) claims that the TEAS exam helps in

predicting academic success and readiness in preservice nursing students, since at the time of their study, there was no published data or literature regarding TEAS predictive nature. However, in order to predict performance in a nursing program, evaluation of admission policies, which may include the TEAS exam, should be conducted. Knowing if a student is at-risk will benefit nursing faculty since the admission committee can select students that have a deeper understanding and knowledge of context prior to admission. Stronger learning outcomes are possible with the elimination of at-risk students.

The Significance of the Study

While examining existing literature regarding science courses and nursing programs, Wolkowitz and Kelly (2010) suggested that science prerequisites are a statistically significant predictor of success in a nursing program success. Knowing the importance of science courses and their relation to retention, should nursing faculty adjust admission criteria be updated to address the number of times a nursing focus student can repeat a nursing bioscience course within the seven-year timeframe? Would it be viable to rephrase an admission application statement of ineligibility to one that states applicants earning a C or below in any two nursing bioscience courses are ineligible to apply to the nursing program? Changing the criteria for eligibility should increase retention by filtering at-risk students into an alternative degree program. When including a statement of ineligibility clause, better-qualified individuals may be granted entrance into the nursing program; thus, increasing retention and graduation rates within the nursing program is a more likely probability. Whyte et al. (2011) believed today's highly technical professions are in need of knowledgeable individuals with the ability to make competent decisions within the evolving healthcare environment.

Research Questions

Test of Essential Academic Skills (TEAS) test aside, this study is set forth to answer the following questions in an effort to better understand the relationship between the variables and the predictability of nursing success based on bioscience grades:

R1: What impact do bioscience courses have on nursing fundamental GPA and/or the students overall nursing GPA?

R2: How is retention in the first semester of a nursing program (known as nursing fundamentals) impacted by a prerequisite bioscience grades of a C or below?

R3: Should admission ranking consider adding essays or interviews to their admission criteria?

Research Hypothesis

Focusing this study on at-risk students will assist in growing future retention in the nursing program. Addressing academic failures will be useful for future educational research since scant information is published regarding at-risk students and academic failure in nursing programs (Abele, Penprase, & Ternes, 2013). Therefore, examining the reasons behind decreased retention may help ease faculty's concern as to whether or not anything else could have been done to help at-risk students, prior to the students leaving the nursing program. Timer and Clauson (2011) concurred that since nursing courses contain curriculum based on science backgrounds, science GPA is amongst the most valuable predictor of nursing success.

The hypothesis of this study is that a negative relationship currently exists between a student's bioscience grades of a C or below in more than one nursing bioscience prerequisite and the students' ability to successfully complete their first

semester of the nursing program. The research will examine both the effect of Anatomy & Physiology I (API), Anatomy & Physiology II (APII), and Microbiology lecture and lab courses on Nursing Assessment, Nursing Assessment Clinical, and Intro to Nursing. The research will provide evidence-based criteria supporting the need to update the nursing ranking formula and eligibility criteria for a middle-Tennessee nursing program in an effort to curtail the at-risk population. Growing retention and supplying more nurses to the workforce is a vital priority if one wishes to diminish the nursing shortage. According to McNelis, Wellman, Hrisomalos, McElveen, and South (2010) an Indiana university reformulated its ranking formula from an all-inclusive GPA to a formula that included service experience, interviews, nursing GPA, and a weighted 30% for the critical, analytical, and science GPA of the applicant. At this time, there were no additional studies showing if the updated Indiana ranking formula created a more qualified pool of candidates. Furthermore, the review of literature portion of this study will include discussions of essay writing and interviews used as part of the admission criteria.

Delimitations

1. The population of the study is from one mid-sized university in Tennessee.
2. The dependent variable was restricted to the retention rate of a student accepted to the nursing program.
3. The study is a quantitative study without any qualitative surveys or input from the students asking them what outside variables may have occurred in their lives as they underwent the bioscience courses.

4. The study may not be generalized to schools outside of the university since a potential confounder exists pertaining to the demographics of the university. The university is located next to a military base; therefore, there is a larger male and nontraditional population within the nursing program. (This potentially confounding variable is addressed in the Review of Literature).
5. The nursing focus course loads, known as the nursing prerequisites, may have differed between full and part-time students.
6. Students that completed the bioscience courses outside of the home university were not included in the research.

Justification of the Study

The results of this study will assist a Tennessee university nursing admission committee to determine if the admission criteria should remain the same or if, in the interest of retention, the school's nursing admission policies should be updated. The retention rate in the nursing program may be directly related to the formula used for ranking, which includes grades earned from completing three nursing core bioscience courses: Anatomy & Physiology I & II (lecture and lab) and Microbiology (lecture and lab). The ability to excel in the bioscience core classes and its effect of on academic success is worthy of investigation. Therefore, the research focus is an exploration of the students' academic achievement of the nursing core bioscience classes in order to predict if the students are at-risk of remaining in the nursing program, consequently impacting the nursing program's retention. Academic performance records, in regards to the nursing core bioscience courses (completed at the home institution) of all students, accepted to the nursing program ($n = 325$) from Spring 2011 through Fall 2016 were analyzed.

There are multiple justifications for the study. Understanding why a student is potentially “at-risk” of failure, if accepted to the program, will enable the nursing focus advisor to assist a nursing focus student with seeking an alternate career path prior to applying to the nursing program. Students make a more informed decision regarding their academic career path if they understand how prerequisite grades earned in API, APII, and Microbiology impact their ability to remain in the nursing program. Furthermore, the US federal government has the right to demand reimbursement of federal aid (from the university) if aid was granted to students that did not qualify for a particular major. The study will assist nursing admission committees in determining if reforming the nursing ranking formula should be conducted as a way to filter students without a high enough nursing focus GPA into alternative degrees. Cunningham, Manier, Anderson, and Sarnosky (2014) explained that applying a statistical technique to the formula and utilizing the information gained as a predictor should assist admission committees in differentiating between higher and lower potential candidates. Once at-risk students opt for better-suited majors outside of nursing students who are better qualified, due to bioscience grades of a B or better, on the first attempt, will be accepted to the nursing program and have a higher probability of graduating from the program. Each nursing program sets forth its own admission criteria. It is imperative for researchers to examine variables that are causing attrition to increase in their particular nursing program in order to reconfigure possible admission criteria and possibly include an ineligibility statement for applicants wishing to apply to the program.

Definitions of Terms

In order to provide clarity, the succeeding definitions of terms are provided:

1. Academic variables include grades in core bioscience courses (nursing prerequisite biology courses) API, APII, and Microbiology and grades in (nursing fundamental courses) Nursing Assessment, Nursing Assessment clinical, and Introduction to Nursing.
2. At-risk students are defined as students who have a high probability of not successfully completing their first semester of the nursing program due to their previously earned bioscience grades. Students who earned a grade of a C or below in the fundamental courses, or were removed from the nursing programs, are not considered successful.
3. Demographic variables include gender, age, and ethnicity.
4. The nursing admission ranking formula is the student's $\text{GPA} \times 50 + \text{TEAS test results}$. The ranking formula correlates with Schmidt and MacWilliams (2011) findings that using a combination of both PreNursing grade point average (PGPA) and admission examinations may be the best predictors of future success in a nursing program.
5. Seven-year timeframe refers to bioscience courses being completed within seven years of the time of application. Grades in bioscience courses older than seven years are not considered eligible for consideration when applying to the school of nursing.
6. Success is the ability of a student to remain in the nursing program without having to repeat any nursing courses.

CHAPTER II

LITERATURE REVIEW

The research was conducted to assist a Tennessee nursing program with a consideration of reconstructing its current admission ranking formula. With attrition on the rise, every effort to select a more qualified pool of candidates is being examined. An investigation of whether students who earned a C or below in a prerequisite bioscience course (within the seven-year application timeframe) are more likely to academically struggle and earn grades of C or below during their first fundamental semester in the nursing program was conducted. The examination of their three bioscience course grades API, APII, and Microbiology in comparison with the students' success rate in Nursing Assessment, Nursing Assessment Clinical, and Intro to Nursing was examined. Did a strong comprehension of anatomy and physiology and microbiology effect students' success within the nursing major? Furthermore, is selecting students with substandard noncompetitive bioscience grades setting at-risk students up for failure?

In the end, students obtained a higher debt that could have been avoided if more competitive bioscience students were selected for the Tennessee nursing program and at-risk students opted to change their degree major to a degree that worked well with their academic strengths. Based upon historical data retrieved from the Institutional Review Board (IRB), the hypothesis of this study is that students' that receive a C or lower in any of the bioscience core courses, within the seven-year time limit, are more likely to earn a C or below in nursing fundamental courses. IRB approval is needed when researching data that involves human participants.

Admission Variables

Pre-Admission Stage. Stuenkel (2006) determined that it is possible to classify students' success by examining pre-admission entrance test scores in combination with the PGPA. While reviewing the students' progress mid-way through the nursing program, Stuenkel found that 31% of the fail group were identified during the pre-admission stage. His findings reinforce this study's views that nursing focus bioscience grades are a great predictor of retention in the nursing program. Students admitted to a nursing program should have a clear understanding of anatomy and physiology. Simply desiring to be a nurse is not enough. In order to treat patients, it is imperative for nursing students to be able to make critical life-saving decisions. A student's confidence in his or her academics may be negatively impacted if selected for a program that he or she may have difficulty understanding. Repeating courses or failing out of a program may be detrimental to a student's self-esteem. The complex phenomenon of attrition is influenced by multiple variables and it may be impossible for nursing faculty to control other outside variables. However, engaging in appropriate responses and facilitating a nurturing environment may increase the retention (Urwin, Stanley, Jones, Gallagher, Wainwright, & Perkins, 2010).

Cohort Size. University focus is shifting to increasing cohorts' size in an attempt to graduate more nursing students. Smaller cohorts allow faculty to promote more accurate critical care since more attention and resources are available to smaller groups and/or individuals. It is then possible to have higher test scores which lead to an increase in retention. Likewise, in an effort to counteract attrition, quality students need to be

admitted to the nursing program, since graduating more students rather than adding additional students to a cohort is a realistic outcome (Starck, Love, & McPherson, 2008).

Predictors of Success. Identifying predictors of success for potential nursing students is a significant factor in regards to nursing program retention and matriculation within the program itself. When preparing nursing criteria and admission formulas, it is imperative that nursing schools first determine the factors that contribute to attrition rates of at-risk students in an effort to better prepare the upcoming student for a nursing program and/or to advise the student to seek an alternative degree that works well with that student's strengths. Timer and Clauson (2011) provided information that GPA, interviews, and essay writing, during nursing admission cycles to minimize attrition and to predict success, is not the best formula. They concluded that interviews and essay writing have little impact on future nursing success. However, nursing admissions committees need to remember that including essay writing and interviews may have the potential to increase diversity.

Yocom and Scherubel (1985) postulated that prerequisite grades correlate to attrition, retention, and most assuredly, success on nursing boards. Individual prerequisite course grades should be examined prior to admission to the program. Data that needs investigating include individual grades, GPA, and credit hours. Although the Yocom and Scherubel (1985) study included the small number of participants consisting of only 139 students from a single university, the study can easily be generalized to other nursing programs and it provided a foundation for further research questions. On examination of the Tennessee nursing program admissions criteria, factors of major concern are the number of students obtaining prerequisite bioscience grades of a C or below and the

number of students who retake bioscience grades within a seven-year timeframe in order to become better qualified and gain admission to the nursing program. However, once admitted, the students are unable to comprehend the course material and often withdraw or fail out of the nursing program due to their lack of qualifications. Grossbach and Kuncel (2011) stated that predictors of performance include academic performance, Prenursing Grade Point Average (PGPA), and standardized admission tests, with PGPA being a weak predictor. Attempting to educate nursing students, while determining predictors of at-risk students, is an ongoing concern for nursing educators.

The Tennessee nursing program in which this study took place currently evaluates the scores of all nursing focus prerequisite courses and each course is assigned a value depending on the grade received: A = 4 points, B = 3 points, C = 2 points, D = 1 point, and F = 0 points. All courses are weighted the same, regardless of the subject material. If reconfiguring the admission criteria to accept only students that obtain a B or better in all attempts of the bioscience courses is not approved by both the nursing faculty and the departmental Dean, an alternative formula may be to weigh the bioscience grades. It may be best to reconfigure the ranking formula in a way that will weigh certain courses more by assigning them a higher value.

National Council Licensure Examination (NCLEX). Grossbach and Kuncel (2011) performed a meta-analysis in an effort to predict what variables resulted in nursing students being successful on the National Council Licensure Examination (NCLEX) boards. They believed that admission committees are able to forecast success by examining standardized test scores and GPA, with the GPA being the weaker of the two indicators. Examining a nursing program's infrastructure is one way in which programs

can implement methods to expand their growth. In an effort to counteract the limitations of their study, Grossbach and Kuncel (2011) suggested including personal statements and letters of recommendation when selecting their nursing candidates. However, both researchers concurred that including personal statements and letters of recommendation are limited in predicting if a student is at-risk for failure or if the student will be successful if selected into the nursing program.

Symes, Tart, and Travis (2005) proposed that bioscience grades obtained while undergoing nursing prerequisites have a significant correlation with retention and graduation rate. However, Jeffreys (2007) found that bioscience grades have a very little impact on passing the NCLEX boards. It is the basis of this study that success on the NCLEX is a result of the content learned in the nursing program coupled with the ability of nursing faculty to provide the support needed throughout a student's academic nursing career. Limitations to Jeffreys (2007) study included a small sample of only 112 participants who were 83% female. Either way, understanding how admission committees can better serve its students is imperative to growing their program. Success is gauged by determining if a student graduated from the nursing program. However, a critical component to determine nursing success is the ability to successfully pass the NCLEX boards. Predictors for successfully passing the NCLEX boards include grades earned in nursing courses and entrance to the nursing school exam which may include TEAS test scores (Grossback & Kuncel, 2011). Nursing faculty members should realize that retaining highly qualified candidates who are accepted into the nursing program should and can be a priority. In order to overcome nursing shortages, nursing educators should become more active in a student's nursing focus educational experience.

As seen with Jobs4TN (2016), there is a shortage of nurses within the state of Tennessee using their services to apply for RN positions. Retention of the Tennessee nursing programs will counteract the deficit. Graduating more students who are able to pass the NCLEX boards is the main goal of the program. Hospitals sought more than 184,000 RNs during 2002 to 2003. However, from 2003 to 2006, there was a negative growth that rapidly rebounded to 243,000 from 2007-2008. Yearly, RNs are fulfilling more than 3,000 employment opportunities (Buerhaus, Auerbach, & Staiger, 2009). Negative growth is a byproduct of students being unsuccessful in a nursing program. Abele et al. (2013) concluded that students who fail more than one course are only 36% as likely to complete a nursing program in comparison to students who fail only one course. Determining measures of nursing success variables for consideration are first-time pass rates on NCLEX boards, attrition, retention (graduation numbers), GPA, and early academic achievements (Schmidt & MacWilliams, 2011).

Reasons for Withdrawal. Understanding why students withdraw from a nursing program or why nursing students are unable to graduate from the program is imperative to improving the program's graduation rates. Once the factors are investigated, nursing programs can look into their admission process and update their admission criteria in order to promote a more qualified nursing student body. Worthington, Salamonson, Weaver, and Cleary (2013) claimed that nursing retention is related to professional identity. Furthermore, a student's outlooks, morals, understandings, principles, and skills impact graduation rates. Professional development throughout an academic career is crucial to whether or not a student completes the nursing program.

As an advisor for the Tennessee nursing program in which this study took place students withdrawing from the program have mentioned reasons why they decided to withdraw from the nursing program and change majors after beginning nursing courses within the program. The reasons included fear of working with needles, refusal to clean up bodily fluids, the inability of selecting which patients they would care for to include working with the elderly, working with the opposite sex, and/or working with terminally ill children. The participants in the study all had access to peer-mentoring tutoring sessions. Tutoring is provided by tutoring services, a peer mentoring program outside of the nursing program with little faculty intervention. It is unknown what the impact of tutoring has on the nursing retention rates. Similarly, Bowers and McCarthy (1993) reported that clinical and lecture faculty state that students have a difficult time applying content to patient care. Lack of competence during hypothetical clinical patient care situations exist. The ability to contextualize information is vital to nursing care.

Urwin and others (2010) examined nursing attrition and its complexity. Their study of 123 records focused on three contributions: microbiology, institutional, and professional. They believe that discovering if a student is suited for a career in nursing is valuable and can eliminate waste in a program before it is a financial burden. Of the 123 records, only a limited number contained attrition data which resulted in a limitation to their study.

Graduation Formulas

Comprehensive Approach. McNelis et al. (2010) found that a comprehensive approach to nursing admission criteria should be considered when selecting the most qualified candidate. In their study, interviews, writing samples, and service requirements

were used for ranking purposes which may be more costly due to faculty pay. Likewise, Schmidt and MacWilliams (2011) provided a systematic review of 50 previous studies in order to compile a comprehensive approach to nursing admission criteria, in an effort to curtail nursing shortages and increase retention rates. All 50 studies within their analysis contained data pertaining to baccalaureate programs. Limitations of the Schmidt and MacWilliams (2011) study included the literature providing consensus and effectiveness of varying admission criteria. The study did not provide sufficient recommendations for any admission formula. Jeffreys (2007) discussed retention and success of a nursing program is a priority given the escalating nursing shortage. It is suggested that individualized facilitation of instructions are the most beneficial in retaining at-risk students. Academic success is possible for students regardless of their demographics.

This study is written in order to determine if bioscience GPAs are pivotal in predicting a student's at-risk factor. In an effort to determine if retention rates can increase by examining six bioscience grade, this study analyzed the nursing focus bioscience GPAs of each student and focused on grades of a C or below. Are the bioscience grades an academic point in each student's career that determines a student's ability to be successful in the nursing program? Will accepting students with a stronger bioscience grade impact the nursing shortages? Should the Tennessee nursing program reevaluate their nursing admission formula and update it to include essay writing or interviews? What recommendations are made for improving student's critical thinking skills?

Writing-to-Learn. Bowers and McCarthy (1993) reported that nursing focus health courses that have been reconstructed to use writing-to-learn (WTL) strategies to

boost critical thinking skills and enhance student's cognitive thought processes better equip students for success in nursing schools. It also develops a positive relationship between students and teachers. Limitations of the study include assigning additional writing which creates more work for the faculty. Training faculty in WTL must be included when the program committee plans on incorporating WTL assignments.

Calculating Graduation Rates. During their study, Starck et al. (2008) developed a standard definition for calculating graduation and then used their newly developed methodology to calculate graduation rates for new enrollees. Having a precise measurement in which to calculate graduation rates filled a gap in research. The authors offered two versions of their newly founded methodology 1) the technical version and 2) the short-hand version, since the measurement used to calculate potential graduating numbers or successful students, will vary from program to program. The formulas consisted of "the number of new students in the original cohort who have not graduated but are still enrolled in the same institution for the academic term in which the rate is being calculated, divided by the total number in the original student cohort who have not yet graduated and the number of students in the original cohort who have not graduated but are still enrolled, divided by the number of those who have not yet graduated" (Starck et al., 2008).

Nursing admission committees should determine what type of measurement is best for their nursing program. There is not a one size fits all formula for success. Every nursing program has its own cultural makeup, and many are geared toward that specific geographical area. The Tennessee nursing program in which this study was conducted has a large number of military students who contribute to an outlier effect. There are a

large number of nontraditional students, males, and individuals with diverse ethnic backgrounds that live within the community and attend the program in question. Restructuring programs and utilizing graduation formulas that boost graduation rates while disallowing students to apply with repeated performances in the bioscience courses may make a huge difference in retention while saving nursing programs hundreds of dollars since faculty services will be spent educating students who have a higher probability of successfully graduating from the nursing program. Money and time spent towards tutoring at-risk students should diminish. Additionally, the university will save money in regards to recruitment costs since a successful student completes his or her degree program at the home institution whether than switching to another institution in hopes of successfully completing the nursing program elsewhere.

Cost-Benefit-Analysis. Planning on success whether than budgeting for potential failures or withdraws is a much wiser business decision. Nursing programs should perform a cost-benefit analysis to determine the cost of educating students that are repeating nursing courses, failing out of the nursing program, and/or withdrawing from the nursing program. Starck et al. (2008) reported startling results indicating that even when students were given double the time to graduate, only 67% of the students actually graduated with the Bachelors of Science in Nursing, whereas, 55.3% of students earning their Associate's in Nursing graduated when attending double the allotted of time. A limitation of the Starck et al. (2008) study is a lack of participants from more than one academic year. The academic year studied consisted of Fall 2000 and Spring and Summer 2001 data, making a generalization to other geographic locations difficult.

Traditional Care Plan (TCP) and Concept Mapping. Maneval, Filburn, Deringer, and Lum (2011) found that TCP and Concept Mapping exams resulted in 3.11 to 3.28 admissions GPA respectively, whereas the nursing GPA using a TCP was 2.74 compared to 2.57. Limitations of the Maneval and others (2011) study include using a limited choice in measuring the students' critical thinking skills. Furthermore, one has to consider if the faculty has been instructed in teaching conceptual mapping. When determining if a student has the critical thinking skills needed to be successful in clinical, interventions assessing a student's ability to process throughout the academic career should be performed periodically (Grossbach & Kuncel, 2011).

Ranking Formulas. Shulruf, Wang, Zhao, and Baker (2011) stated that in order to boost academic success, admission criteria should include ranking scores, in addition to an alternative score, that rates an applicant's likelihood to succeed. However, limitations to the Shulruf et al. (2011) study are its population of which 93% were females. Their study did not include the ethnicity of its population. Additionally, the participants in their study were accepted to the nursing program prior to the implementation of the predictive model program. Establishing a newly improved ranking formula in order to boost retention and to save university costs, should be investigated every few years. A holistic view that includes standardized test scores, GPAs (both high school and university level), interviews, and critical thinking skills may be beneficial to include in the admission criteria. The current ranking formula, in which this study was conducted, is weak since it allows students who obtain poor bioscience grades to be admitted to the program if their overall nursing prerequisite and university core GPA is competitive. If a student obtains poor bioscience grades of a C or below and they have A's in the remaining of the nursing

prerequisites and university core courses, are they still the best-qualified candidate? Is that particular student able to successfully complete the nursing program?

Motivational Factors. Being accepted into a degree program of one's choice may motivate potential students to excel in their degree choice. Self-motivation in relation to students' willingness to be successful is likely to be consistent when students are selected for a program that will lead to the applicant's "dream" job. Urwin et al. (2010) stated that students not retained in the nursing program felt "devastated" and believed their "hopes" were crushed. If potential students have a better understanding of nursing knowledge and realities, these same students may have changed degree choices prior to being admitted to the program. It is understood that when students are happy with their degree choice, they are more likely to put forth the effort needed to succeed; thus, the supply and demand for nurses will become more balanced. Buerhaus et al. (2009) projected a shortfall of nurses that will amount to a staggering 260,000 RNs by 2025. The employment outlook for registered nurses is favorable. For this reason alone, it is imperative that nursing faculty learn what motivational techniques will assist their students in completing their degree works.

Suffering is focused on more than the patient, due to financial costs. Attrition rates are negatively affecting individuals and universities alike. When selecting nursing students, committees must realize that students who choose to nurse as their first career choice are twice as likely to graduate from the nursing program counteracting the nursing shortfall Salamonson, Everett, Cooper, Lombardo, Weaver, and Davidson (2014). Limitations of the Salamonson et al. (2014) study included only using one item to determine if a student chose to nurse as their first career choice. The participants were

from a local Australian population which contributed to sociodemographic profiles from that geographic location. However, the study may be generalized to other Australian universities.

When determining that students are at-risk by evaluating previous nursing entrance criteria, numbers, and/or ranking formulas, nursing programs can reconfigure their current admission criteria to improve nursing outcomes by incorporating questionnaires focused around motivational factors and explanations of why students choose to nurse as their career choice. Accordingly, nursing programs will focus on the underlying factors of attrition to increase retention. Perhaps investigating a nursing student's emotional intelligence during interviews should be considered (Beauvais, Stewart, DeNisco, & Beauvais, 2013). Limitations of Beauvais et al. (2013) is not reflective of all include participants were all from a private Catholic University making generalization tenuous since it is unknown if spiritual beliefs were confounding variables.

Retention Global Issue

Retaining nursing students is an elusive global challenge. Action ideas for optimizing student outcomes are pivotal. Several pathways leading to retention and attrition should be examined. Nursing educators should determine why students are staying or leaving, (Jeffreys, 2007). Retention in nursing programs is a global issue. Globally, the supply of nurses is dwindling as attrition rates keep increasing. Retaining and graduating competent nursing scholars is an acute situation in need of rectification. Andrew, Salamonson, Weaver, Smith, O'Reilly, and Taylor (2008). Andrew and others (2008) stated to counteract the negative impact of financial losses to Australian universities Australian Federal Government is mandating that the universities perform in

a commercial manner. The Tennessee nursing program in which this study took place takes pride in connecting with their students in a non-businesslike manner. The faculty believes in personalization and in making every student feel important. Changing to a business format to boost a profit may not be the ideal situation to counteracting nursing retention. Losing the personalization that has made the nursing program so successful could result in an even higher attrition rate.

Timer and Clauson (2011) study of 249 students admitted to a Canadian nursing program, reported that GPAs were a good predictor of success. However, age, ethnicity, and a student's minority status is a more reliable predictor of determining if a student is at-risk. Van Rooyen, Dixon, Dixon, and Wells (2006). New Zealand study suggested that although there are several factors (study habits, marital status, employment status), examining bioscience grades is more worthwhile when trying to determine an at-risk student since it influences a student's likeliness for success. Likewise, a qualitative study by Andrews et al. (2008) indicated that when applying to a BSN program, Australian universities calculate a student's University Admission Index (UAI) competitiveness by using the student's high school GPA. They believe a high school GPA is an indicator of a student's overall ambition, drive, and potential.

Lancia, Petrucci, Giorgi, Dante, and Cifone (2013) reported that universities in Italy are also experiencing retention issues within their nursing programs which have led to nursing shortages within their country. The demand for more nurses is prevalent in Italy. In order to counteract the retention and attrition issues, nursing programs need to measure outcomes and determine the viable solutions to retention and attrition. Success in a nursing program is measurable by calculating the nursing program's graduation rate.

The Tennessee nursing faculty studied in this research understands that the program graduation rate is the first measure of having a successful nursing program. The second level of success is the pass rates on the NCLEX boards. Although the NCLEX boards are briefly mentioned in this study, the NCLEX pass rates are not being evaluated.

Nurse educators, both nationally and internationally, should improve their methodologies and practices in order to improve graduation rates. In order to foster program completion, educators must understand how outside factors contribute to retention. Beauvais et al. (2013) stated with stable predictions for nursing shortages forecasted, attrition rates are a concern. Retention is related to academic success, high school GPA, scholastic tests, as well as demographics, finances, critical thinking, and behavior factors. This study will examine factors of a comprehensive overview in an attempt to graduate more students from the Tennessee nursing program. A holistic review of admission processes should be studied by nursing admission committees that are seeing an increase in their attrition rates.

A student's ability to balance outside variables directly relates to a student's concentration level and success while undergoing a nursing program (Beauvais et al., 2013). Likewise, a study by Whyte et al. (2011) of New South Wales and the Australian Capital Territory found that bioscience knowledge is crucial to the development of future nurses and paramedics. Limitations of Whyte et al. (2011) study include that researchers did not include personal data as in the number of dependents, a student's employment status, and/or marital status, all outside factors that relate to a student's ability to concentrate. Successfully passing the bioscience courses with B's or better and having

the critical thinking skills needed to successfully graduate from a health related program, whether it is nursing or paramedics, is vital.

Grades

High School Grades. Stuenkel (2006) noted that when evaluating at-risk students, an examination of both high school science grades and PGPA should be conducted. High school science grades will allow nursing admission committees to better understand if the student can successfully complete a nursing program. Understanding the student's comprehension of the basic high school level biology and chemistry sciences, as well as their motivation to be successful (obtained during interviews), may be the combination needed when determining if the student has a high or low at-risk factor. If high school science GPAs are difficult to obtain, examining the overall high school GPA may help in determining a potential student's at-risk factor. Similarly, van Rooyen, et al. (2006) examined the relationship between the school's entry criteria and the student's academic performance in high school, which included the students' bioscience grades. The study resulted in evidence that a student's first year bioscience grade impacts performance in the first year of nursing courses. Bearing in mind the results of previous studies, review of the bioscience academic outcomes should occur during each admission cycle. Negative impacts on the nursing retention can be avoided if students who are geared towards a nursing program are selected. Students not meeting the eligibility criteria would be required to select an alternative degree.

During the research by Potolsky, Cohen, and Saylor (2003) it was determined that performance in high school significantly impacts a student's first-semester nursing course

grades. Tutoring, including counseling and mentoring the at-risk students, was offered to 37 students. It resulted in raising retention from 64% to 70%.

Bioscience Grades. Whyte et al. (2011) suggested that many nursing students have difficulty comprehending bioscience in spite of its importance to the nursing career. Bioscience courses often cause anxiety amongst nursing students due to the course content and terminology. This study will pinpoint if the bioscience courses correlate with the Whyte and others (2011) study. In observing the ten admission cycles, it will be determined if the students that were not retained in the nursing program struggled with comprehending their bioscience prerequisite content. Potolsky et al. (2003) result supported that prerequisite bioscience courses directly impact the first semester of nursing courses. Students' bioscience grades are often strong indicators of passing nursing pathophysiology or pharmacology courses. Respondents in the Andrews et al. (2008) survey stated the main reason for students withdrawing is being unprepared for the depth and content of the material; they were not prepared for the science components which contributed to poor academic results.

Nursing Focus Grade Point Average (prenursing). Although Sadler (2003) reported that when comparing essay scores of those who were retained and those who dropped out of the program, there were insignificant mean admission GPAs of $t = .22$. Jeffreys (2007) examined science grades separately from other nursing prerequisites which resulted in 30% of the participants earning B's and 33% earning a C, only 75% of the students were retained with a first-semester failure rate of 9%.

In Stuenkel's (2006) study, 80% of the students were classified correctly based on the entrance exam and PGPA. However, the study revealed that a better determination of

success would be a combination of the PGPA and Aptitude Test results. Using the GPA in combination with other factors yields a higher success rate. Programs reliant on a PGPA as the sole determination of admission ranking face a higher attrition rate. Combinations of ranking, or a more holistic ranking formula, may cost more upfront due to implementing interviews; however, the savings will occur with a possibly higher number of graduates. Wharrad, Chapple, and Price's (2003) conclusions paralleled Stuenkel's data (2006) that nursing focus scores are foundations in which predicting retention within a program is possible.

Newton et al. (2007) concluded that successful completion of a student's first semester in the nursing program could be based off the PGPA and TEAS test scores; however, the PGP is a better variable when determining if a student is at-risk. The participants were primarily female with minorities being underrepresented. Therefore, the conclusions of this study are not easily generalized due to its homogenous makeup, although the population of the study coincides with the overall population of the United States with Caucasians being the majority.

Abele et al. (2013) confirmed that grades earned in certain courses are strong predictors of success. The process of evaluating GPA and science grades as predictors of future success of first-time passers on the NCLEX-RN boards will give faculty insight to who is at-risk, (Elder, Jacobs, & Fast, 2015). Furthermore, deciphering why a student decided to take their science courses at a community college rather than at their current university should be investigated. Was the decision to enroll in science courses at the community college done so in an effort to obtain higher grades?

Van Rooyen et al. (2006) concluded that there is mixed literature regarding a student's GPA and success. They found studies indicating high school performance may be a better predictor of success in a nursing program. A limitation of the Van Rooyen et al. (2006) study includes all participants having good academic grades prior to admission to the nursing program. All of the participants had no experience with bioscience courses and they all have comparable nursing prerequisites. Additionally, outside variables which include study habits, having dependents, marital status, and possible employment were not considered. Wolkowitz and Kelley (2010) stated that when determining predictors of success, evaluation of science grades should be conducted since the standardized test and the weighing of science composites are not readily available. Science grades (as independent values) are the strongest predictor of retaining nursing students with a 3% variance. However, when examining the limitation of Wolkowitz and others study (2010), it was found that the study only contained one admission test. As far as admission tests are concerned, the Tennessee nursing program included in this study also administers only one admission test, the TEAS exam.

Furthermore, Salamonson et al. (2014) targeted nursing students attending the bioscience courses in order to survey if nursing was their first career choice. The results of the survey were used as a follow-up to the nursing academic performance when scrutinizing a student's retention and attrition rate in the program. McNelis et al. (2010) postulated that GPA only criterion for admission purposes affects retention, as well the overall diversity of the admitted population. A comprehensive approach that reflects current practices should be embraced by nursing programs throughout the nation. GPA is a predictor of success but only minimally so.

Potolsky et al (2003) claimed that only 32% of U.S. nurses had baccalaureate degrees and only 10% had master's level degrees. With attrition rates on the rise, voluntary tutoring programs were developed to examine the impact on course grades and retention. Age and entry qualification continued to impact GPAs. A limitation of the Potolsky and others (2003) study included not knowing the participant demographics. Additionally, the researchers did not measure a student's self-efficacy and their willingness to attend tutoring sessions. This study is written in order to determine if bioscience GPAs are pivotal in predicting a student's at-risk factor. In an effort to determine if retention rates can increase by examining six bioscience grade, this study analyzed the nursing focus bioscience GPAs of each student and focused on grades of a C or below. Were the bioscience grades an academic point in each student's career that determines a student's ability to be successful in the nursing program? Will accepting students with a stronger bioscience grade impact the nursing shortages? Should the Tennessee nursing program reevaluate their nursing admission formula and update it to include essay writing or interviews? What recommendations are made for improving student's critical thinking skills?

Critical Thinking (CT)

Other options to eliminating nursing shortages were examined by Kaddoura, Van-Dyke, and Yang (2016). They concluded that improving retention is possible by instructing students to think critically. Nursing students analyze and interpret patient care. Critical thinking promotes understanding while assisting students with drawing connections. Students using their knowledge to connect ideas are more likely to be successful. Limitations of the Kaddoura et al. (2016) study include a 17-week timeframe,

which did not allow for adequate research in regards to students' maturation. Drawing conclusions concerning a student's critical thinking skill should be conducted over multiple semesters. The 17-week timeframe is simply not enough time to predict the success of a student.

Shin, Jung, and Kim (2015) created a Clinical Critical Thinking Test (CCTS) to assist with validating nursing students critical thinking (CT) performances since nursing students must grasp the meaning of content, concepts, and methods of healing. Critical thinking skills assists students with objective analysis and the evaluations of issues. The CCTS was both reliable and valid with its representation of CT abilities. Nurses are part of the cutting edge of medical technology which feeds into a patient's belief that optimal patient care will be provided to them. From initial analysis to nursing intervention, CT is imperative in the decision-making process. Nursing students are required to use their CT skills when learning to develop care policies. The effort put forth will assist students during their clinical when CT is vital to the life of a patient. Often, nursing students must select from multiple answers that contain correct processes; however, they must select the answer that is most correct. Prior to graduating from nursing programs, students must be comfortable using their CT skills. In order to predict successful nursing candidates, perhaps admission committees need to determine a measurement of CT.

Kaddoura et al. (2016) indicated that CT skills are improved with the use of concept mapping when used during intervention groups of at-risk students. Standardized testing scores of students using concept mapping were 84.5. Once a nursing admission committee determines which nursing candidates best utilize a comprehensive critical process, the faculty can develop programs to enhance the skills. Understanding the

thought process of each student should be an essential part of the admission criteria and processes. After all, CT skills are vital to successfully completing nursing clinical and passing the NCLEX boards. Newton and Moore (2009) exploratory descriptive study measured CT skills of students between 19 and 26 years of age. Students were required to interpret, understand, and evaluate problems. Results indicated that CT skills differed between BSN and ASD students.

CT is reliant on specific conditions. Developing a CCTS that considered geographical, cultural, and clinical contexts was developed using cognitive interviews conducted by two scholars, two professors of philosophy, and two education professors (Shin, Jung, & Kim, 2015). Determining the relationship between a student's CT skill and the content of courses being taught is a foundation for improving retention and reducing attrition. Promoting and developing a curriculum that includes CT skills in the nursing focus stage is imperative if programs wish to graduate more students. As nursing students encounter complex diseases and the aging baby-boomers in a medical field that continuously looks for cost-effective treatments, the educated students will be asked to do more for less and as a result will be more reliant on their CT skills. When making rapid, life-saving decisions, the practicing students are dependent on their own knowledge and critical thinking abilities.

Elder et al. (2015) reported that philosophy with its CT component significantly increases the NCLEX-RN pass rate. Students with sophisticated knowledge of bioscience have the ability to think critically and make rational decisions while performing in their clinicals (Whyte, Madigan, & Drinkwater, 2011). Maneval et al. (2011) agreed that critical thinking is imperative to nursing students since nurses collect, interpret, analyze,

synthesize, and evaluate data. Nursing students that use cognitive skills as part of their logical reasoning abilities are better prepared for examinations. Brunt (2005) declared that in order to solve complex ideas, it is essential for healthcare professionals to use their CT skills to apply, predict, reason, and transform their knowledge. Nursing educators should implement context-dependent situations that help influence CT skills. One limitation of Brunt's study is it is not discipline specific.

Maneval and others (2011) investigated the idea of nursing programs embracing concept mapping (CM) as an instruction method for improving the critical thinking skills of students. Their study indicated that students taught with a combination of TCP and concept mapping score 95.93 compared to 92.12 from TCP respectively. The way students are taught does make a difference in critical thinking skills. Developing independent thinkers capable of efficiently caring for patients, while being accountable for the decisions, is imperative to the nursing practice. To measure a student's critical thinking skills, nursing faculty must develop methods that enhance the critical thinking abilities and improve the way cognitive ideas relate (Brunt, 2005). Likewise, university faculty members should encourage students to become involved in scholarly activities that will make them successful in their nursing career.

Bowers and McCarthy (1993) reported that analytic skills are pivotal to a student being able to perform complex clinical decisions. Educators need to provide students with opportunities that reinforce CT and develop cognitive skills. It is their responsibility to facilitate scenarios that emphasize CT. Hernandez (2009) recommended that nursing students compose a personal philosophical statement regarding their views on patient care and clinical. The assignment will assist with students developing CT skills since

students will be engaged in the theoretical conceptual content. It was determined that the research does not have any limitations. Assigning philosophical coursework that promotes the students' reflections can be generalized amongst nursing programs.

Test of Essential Academic Skills (TEAS)

Yocom and Scherubel (1985) found that standardized testing performance is a key indicator of future academic success. Admission committees have depended on standardized test scores when selecting potential students due to their predictive nature. Committees should know that the TEAS exam is unable to measure a student's motivation or character. According to ATI testing, the TEAS exam was written with content applicability in mind, the exam comprises four areas of study: English, math, reading, and science. The science section contains portions that examine science reasoning and knowledge to include Anatomy & Physiology and Microbiology.

Stuenkel (2006) determined that it is possible to classify students' success on the NCLEX by examining TEAS results and the PGPA. Similarly, Shulruf et al. (2011) believe nursing schools should use two components when developing ranking formulas (1) admission criteria scores and (2) an applicant's likelihood to succeed score. Whereas Newton et al. (2007) concluded that both TEAS and PGPA are measures of aptitudes and prospectively they account for a 4.8% and 15.4% variance of being successful in the 1st semester of a nursing program. Recruiting potential nursing students based on TEAS examinations may increase retention rates.

Wolkowitz and Kelley (2010) concurred that the TEAS exam has a more focused audience and is intended for nursing specific programs. However, when ranking potential nursing students, focus on science and reading composites should be conducted since

students with strong science abilities are usually retained in the program. Grossbach and Kuncel (2011) also concluded that standardized test scores are strong indicators of the students' potential ability to successfully complete a nursing program and obtaining their nursing license by passing the NCLEX boards.

Faculty and admission committees have access to the TEAS results including an applicant's individual composite score, program means, and nationwide percentiles. The figures should assist with ranking and select students that have a higher probability of graduating from the nursing program. However, additional studies conducted by Newton and Moore (2009) determined that the TEAS does not assist in predicting success later in the nursing program or with successfully passing the NCLEX boards. Schmidt and MacWilliams (2011) noted that when considering the TEAS exam for admission, it is best to couple it with another variable. They found that TEAS exam in conjunction with a student's PGPA was a useful predictor of passing or failing the NCLEX boards.

Similarly, Wolkowitz and Kelley's (2010) study used the TEAS results of 46,865 students along with RN fundamentals grade results from 25,933 students to determine between subscores and success in a nursing program. Their study resulted in science being the strongest predictor of future academic success in a nursing program. Newton et al. (2007) stated that both the TEAS exam and PGPA were measures of aptitude since the TEAS measures nursing aptitude; whereas, the PGP measure scholastic aptitude. Additionally, students that achieve higher PGPA's may possess similar features that enable them to undergo demanding nursing programs without succoring to failure. Further examination of the students' should be conducted to determine if such factors do exist.

Interviews

Just as interviews may be costly to employers, including interviews as part of the program's admission criteria can be rather costly since interviewers must be trained and knowledgeable of key categories or terms and situational and non-situational situations (McNelis et al., 2010). Throughout the interview process, the admission committee can include questions regarding outside influences on the student. However, remaining objective and maintaining consistency during the interviews may prove to be difficult. Questions regarding variables such as feeling alone, not enough study time while completing the nursing prerequisites, and financial responsibilities may be part of the interview. Including the aforementioned factors may help in identifying at-risk students. McNelis et al. (2010) found the opinion on whether or not interviews should be used in the admission criteria rather controversial. If a nursing program is trying to increase diversity within its program, interviews may be beneficial. However, once accepted to the program, attrition rates still occur.

Shin and others (2015) interviewed students in qualitative 'think-alouds' sessions. Upon completion of the 'think-alouds,' each student received a code. Once analyzed, low to high CT skills were assigned and found lacking and the researchers determined additional exploration in difficulty and discrimination are needed. Timer and Clauson (2011) concluded that interviews did not have a positive impact on determining a student's potential status. They found that a student's prerequisite and high school GPA was a much stronger indicator of success. Likewise, implementing interviews in hopes of determining a potential student's critical thinking skills may result in a higher graduation rate. Interviews will also assist in determining if a nursing career is in the best interest of

the candidate as well as being in the best interest of future patients. There is a difference between students withdrawing from programs due to realizing that a nursing career is not suitable and students failing from a program due to lack of critical thinking skills or inability to complete the required coursework.

Essay Writing

Hernandez (2009) recommended that students write a philosophical reflection of nursing care. This written statement gave insight into students' beliefs while reinforcing their cognitive skills provided insight on whether or not a nursing career is a match for that particular student. Timer and Clauson (2011) stated that supplemental application materials provide little value in determining if a student is at-risk. A student's GPA was the more reliable predictor of success within a healthcare program. However, further examination of how student's demographics and character impacted their GPA needed to be conducted.

Worthington et al. (2013) set out to determine if a student had a strong professional identity. It was concluded that those with a poor professional identity were more likely to withdraw from the program. Including questions pertaining to professional identity during the essay portion of entrance criteria, may result in a higher graduation rate. Students that do not have a full understanding of the role of nurses will have the opportunity to further explain their essay during interviews. Once nursing roles are understood, students not suitable for nursing will have the opportunity to withdraw their application. Withdrawing their application prior to entrance to the program will save the student and the university money. Sadler (2003) reported that when selecting the best and the brightest candidates, GPAs and standardized testing alone will not necessarily reduce

attrition. Incorporating essay writings will make an identifiable difference and use of essays require carefully written questions.

Marketing oneself with a persuasive essay is easier than ever with the numerous essay writing websites available to students. Some students are able to pay for an essay that will impress a college admission board. In the end, there is no way of knowing if the student stands out among applicants because of their own writing skills. However, Van Rooyen et al. (2006) explained that if a student majors in careers that work with that student's academic strengths, they will have less stress and likely be more successful. Essay writing will allow the interviewers to determine if nursing is the students' first career choice.

Demographics

Age. Van Rooyen et al. (2006) study determined that a student's age could be used to predict success since they found older students performed higher in the biosciences than the younger students. However, younger students usually improve their performance while undergoing the second year of nursing school. Salamonson and others (2014) study concluded that nontraditional students, first degree, were more likely to have selected nursing as their first-degree major when compared to traditional age students. Maneval et al. (2011) found that a student's age was a strong predictor of future success since age impacts their critical thinking skills and that older students perform academically better than younger students. In 2007, Jeffreys reported that educators must systematically assess their program's situation and profile its characteristics if they wish to reduce attrition and improve retention rates. Each program has its own unique needs. Age was a key factor in determining an individual approach to mentor an at-risk student.

Shepherd (2008) stated that traditional-age students are less likely to complete a Nursing Degree. When examining the traditional age students in Shepherd's study, 13% from 2002-2003, 18% from 2003-2004, and 25% from 2004-2005 did not graduate from the nursing program. Timer and Clauson (2011) declared that age had no bearing on interview scores; although, age did have a bearing on a student's ability to successfully complete the nursing program once accepted. Graduating students from a Tennessee nursing program in order to meet the local and national demands of the nursing workforce is crucial to the healthcare environment. As baby-boomers age, there will need to be enough healthcare providers to meet their needs. Urwin et al. (2010) reported figures obtained from National Nursing Research Unit. During 2005, 28% of the nurses working in the United Kingdom were 50 years or older and by 2011, the United Kingdom was facing a nursing deficit of 11,000. Increased attrition rates in nursing programs are a common occurrence that needs to be counteracted before the global community suffers from a health care crisis.

Gender. As indicated below, studies from previous programs indicate that only a very small percentage of nursing students are male. This number contrasts University of L'Aquila findings were 35.1% of the nursing students' population in their study were male. The sample included in this study consisted of a 14.5% male population. Of L'Aquila's population of 64.9% female students, 66.8% were able to graduate according to their degree plan; whereas, 51% of the males stayed on track (Lancia et al., 2013). The researched university may want to further this study and track the completion rate of males vs. females.

Interestingly, a two-decade trend came to a halt when female nurses age 23 - 25, entered the workforce increasing female RNs by 130,000 during 2008. At that time, males only represent 9% of the nursing workforce or 218,000 positions (Buerhaus et al., 2009). Salamonson et al. (2014) concluded that male students who did not select nursing as their first-degree option are more than twice more likely to withdraw than males who selected nursing as their first-degree option prior to the maximum enrollment period. In 2011, Maneval et al. reported that male students have higher test scores than female. Whereas, Timer and Clauson (2011) reported that males and minority nursing students have lower mean grades in comparison to counterparts.

A Worthington et al. (2013) research included 540 participants of which 82% were female and only 44% of the students spoke only English at home. Their study found students who affiliated with low professional identity were 1.06 times more likely to withdraw from the nursing program since professional identities vary among geographic locations.

Ethnicity. Diversity is a concern for nurse educators and because of this, nursing faculty should oversee retention efforts for students from all ethnic backgrounds. As seen in the review of the literature, in order to increase diversity, nursing programs across the globe are incorporating interviews and essay writing as part of the nursing admission formula. Buerhaus et al. (2009) stated, when considering the overall workforce population, African Americans represent 11% which is equivalent to the 11% of African Americans that are working as Registered Nurses. In order to know if 11% is an indicator of African Americans being successful in the nursing programs, there should be a value

assigned as to the number of African Americans that entered the nursing programs during the same timeframe.

Similarly, focusing recruitment efforts on Hispanics would help to counterbalance the current nursing deficit. Stuenkel (2006) reported that pass rates and ethnicity were related. Nursing programs with higher NCLEX pass rates consisted of a greater number of Caucasian students. The Tennessee nursing program minority demographics consists of 5.5% African American, 3.4% Asian, 7.7% Hispanic, and 0.6% Native American (table 1). Of the 112 participants in Jeffreys (2007) study, 53% were Caucasian. Jeffreys' study determined that the ethnicity had no bearing on the first time NCLEX testers. Approximately 80% of the students passed their exams regardless of their ethnicity. Yocom and Scherubel (1985) found race contributed significantly to a student's ability to pass NCLEX boards.

Buerhaus et al. (2009) discovered that of the total RN workforce, foreign-born RNs increased from 9% in 1994 to 16.3% by 2008. The foreign-born RNs admitted to migrating to the United States within five years of the study, adding diversity to the workforce. Successful academic achievement in both prerequisites and nursing courses for students from every diverse population is vital in order to provide diversity in the workforce. Students from diverse backgrounds that are aspiring to become accepted to a nursing program, as their first-degree major, often times are more motivated to successfully complete the program. Targeting these students is key to understanding a student's at-risk factors (Salamonson et al., 2014).

McNelis et al. (2010) briefly touched on the disparities amongst minority nurses. The lack of minorities in the health field was concerning and may be a result of

standardized tests which includes the TEAS exam, a concern for programs that are attempting to increase diversity within their programs. Jeffreys and others (2015) stated that first-generation students believed that during their first six weeks of post-educational experience they faced additional challenges such as mismatched expectations or belief of college experiences, feelings of not belonging, and self-efficacy which all factored into their retention. Tennessee nurse educators should include a questionnaire, if approved by the IRB, asking students if they are first-generation students. For those students that are first-generation, mentoring them and assisting them with a feeling of belonging, and fostering professional identity may help with attrition and retention issues.

Jeffreys et al. (2015) suggested enhancing a student's cultural congruence, nursing educators should actively include “topics, activities, and teaching-learning strategies,” that extend beyond the patient care. Positively influencing a student’s belief in their professional career choice should counteract attrition issues. First-generation students in this study were offered to attend TRIO Student Support Services (SSS), a program that enhances first generation student’s educational experiences. TRIO provides students with opportunities such as one-to-one peer tutoring, academic coaching, and cultural and academic enrichment activities.

Gaps in Literature

It should be noted that throughout the literature review, a common limitation included sample size, time-frames selected and using data from only one university. Future researchers should note that generalization of their studies is difficult given the limitations.

Although there is research available pertaining to attrition and retention in nursing programs, there were little findings that indicate how a bioscience course impacts a particular nursing course. This study proved there is a difference in evaluating how a bioscience course impacts nursing GPA compared to how a bioscience grade impacts success in a nursing course. Nursing programs need to have a comprehensive picture on whether or not admitting students that obtained a C in any of the bioscience courses is creating a “false” pretense of future success.

Finding literature that proved essay writing and/or interviews created a better pool of candidates was lacking. There needs to be more evidence-based literature on whether or not either of these methods resulted in the retention of students throughout their academic nursing career. How was attrition impacted due to implantation of essay writing or interviews? Findings studies that have before and after figures of success rates was difficult. Therefore, this study was conducted in an effort to find answers to the following research questions. Is the retention in the first semester of the nursing program impacted by the first attempt of the prerequisite bioscience grades of a C or below, if so, should weight be placed into the nursing bioscience grades rather than considering all the university and nursing core equally, would adding essays or interviews be beneficial in determining the most qualified candidates, is the nursing fundamental GPAs and/or the overall nursing GPA predictable when evaluating the bioscience grades?

Due to the work of Timer and Clauson (2011), combined with the findings from Whyte et al. (2011), it is hypothesized that early academic achievements have a significant impact on determining the success of nursing students which is reflected in both nursing GPAs and an increase in graduation rates. Therefore nursing entrance

formulas should consider variables that led to higher retention. Negative growth can be curtailed with the admission of better-qualified candidates into the nursing programs. Entrance formulas are complex and the correct method will help to weed out at-risk students prior to the admission process. It should be noted that after reconstructing the nursing admission formula, there should be follow-up studies proving or disproving if the reconfiguration has a positive impact on student performance.

Identification of Variables

This study was designed to investigate whether students who earn a C or below and students who retook bioscience courses within the seven-year application time frame are more likely to academically struggle and earn grades of C or below during their first fundamental semester in the nursing program. The examination of their three bioscience course grades Anatomy & Physiology I & II (lecture and lab) and Microbiology lecture and lab in comparison with the students' success rate in Nursing Assessment, Nursing Assessment Clinical, and Introduction to Nursing was examined. Did a strong comprehension of anatomy and physiology and microbiology effect students' success within the nursing major? Furthermore, is selecting students with substandard noncompetitive bioscience grades setting at-risk students up for failure?

In the end, students have obtained a higher debt that could have been avoided if more competitive bioscience students were selected for the Tennessee nursing program, in this study, and at-risk students opted to change their degree major to a degree that worked well with their academic strengths. Based upon historical data retrieved from the IRE, the hypothesis of this study is that students' that receive a C or lower in any of the

CHAPTER III

METHODOLOGY

This study intended to understand the effects and relative importance of bioscience grades and student success in the nursing program using data from Spring 2011 through Fall 2016. Both linear and logistic regressions were used to estimate the predictive probability of students' being successful within the program. This chapter clarifies the systematic investigation of the study, including the commonly adopted research procedures for analyzing the data, a detailed description of the data set, how and which variables were chosen for applicability in the study, research hypotheses, and the methodological strategy for evaluating the data. A logistic regression model is ideal since success is defined by the students' ability to successfully pass all nursing courses with a grade of a B or better, on the first attempt.

Methodological Considerations for Examining the Records on the Retention of Nursing Students in a Tennessee nursing program.

While concern over nursing students retention has prompted research regarding potential nursing shortages, the impact of biology grades on student GPA, and the possibility of using interviews or essay writing as part of the nursing admission formula, this research struggled with methodological limitations. Limitations included small sample sizes, lack of follow-up information proving that the changes made in admission criteria (found in the research articles) led to a higher qualified pool of candidates, and the studies contained predominantly females with males being under-represented which resulted in problems of generalizability.

Origin of the Data

Prior to the research being conducted, permission to study the student records was obtained from the Institutional Review Board (IRB) of the institution in which this study took place. The IRB required a Collaborative Institutional Training Initiative (CITI) training process to be completed before granting their permission to retrieve the historical data. The records were retrieved from the home institution's Institutional Research & Effectiveness (IRE) department. The historical data included nursing focus bioscience grades, gender, age, ethnicity, and nursing fundamental grades. In order to protect a student's rights and maintain confidentiality, no personally identifiable information were used throughout the research. Information pertaining to the students were monitored via a non-identifiable number. It should be noted that since all the material was historical data retrieved from the university database, no surveys/questionnaire and compensation were included. Permission from the participants was not necessary and compensation was not necessary or offered. If a student was a transfer student, his or her biology grades were not included in the data obtained from IRE.

Selection of Items

Prior to the study being conducted, careful consideration was made as to the home institution's nursing success rate. The nursing faculty were concerned with students' success during their first semester of the nursing school known as the nursing fundamentals. A report that included all grades for the first semester of nursing school. Nursing Assessment, Nursing Assessment Clinical, and Introduction to Nursing had the largest number of students earning grades of a C or below. Therefore, dependent variables chosen included the three areas of study where students struggled the most.

Description of Participants

Data collection for this study included 542 nursing students admitted to the program within from Spring 2011 through Fall 2016. Of the 542 students, 325 students were selected for the study since they completed all three nursing bioscience prerequisites at the home institution of which this study was based. Only the first attempt for all three bioscience nursing core API, APII, and Microbiology was examined. The sampled students were all undergoing nursing courses at a baccalaureate level. The population included 12 admission cycles, 6 Spring, and 6 Fall terms. Knowing the results of the study will help to reinforce Elder, Jacobs, and Fast's (2015) findings that science course grades impact at-risk student's ability to pass the NCLEX-RN boards. The research findings in this study will determine if the bioscience grades earned by the target students impact the students' ability to successfully complete their first semester of the nursing school known as nursing fundamentals. The demographic characteristics are presented in Table 1. Females comprised of 86% of the sample.

Table 1

Demographic Characteristics of the Participants

Demographic	Frequency	Percentage
Gender		
Male	47	14.5
Female	278	85.5
Ethnicity		
Black (not Hispanic)	18	5.5

Caucasian (not Hispanic)	249	76.6
Hispanic Origin	25	7.7
American Indian	2	0.6
Multiracial	13	4.0
Not Specified	5	1.5
Asian	11	3.4
Native Hawaiian or Other Pacific Islander	1	0.3
Alaskan Native	1	0.3
Age Group		
Traditional	189	58.15
Nontraditional	136	41.85

Of the targeted students, 278 were female and 47 were male. Upon examination of the 325 participants, it should be noted that two dichotomous variables were selected, gender and traditional vs. nontraditional. In 2003, Hinkle, Wiersma, & Jurs, stated that “a discrete variable contains only two classifications.” There were 189 ($n = 189$) traditional age participants (under the age of 24) and 136 ($n = 136$) nontraditional (24 or older) at the time they started nursing courses. Not surprisingly, 77.3% or 116 ($n = 116$) were Caucasian.

The mean overall admission age for the Tennessee nursing program students entering the nursing program was $M = 25.48$ years which was broken down by gender, please see Histogram 1. The mean age for males admitted to the program was $M = 27.7$ with females having a mean age of $M = 25.09$. Overall, the nursing program is

academically diverse with its gender, ethnicity, and age. The numbers may contrast the age demographics of other universities since the nearby military post provides a larger span of nontraditional students to the home university. For instance, the University of L'Aquila study that found 21 years was the median age for males and 20 years the median age for females within their population. However, Lancia et al. (2013) stated that the workforce is seeing a change in the age of RN's, possibly due to baby-boomers. Likewise, RN's in their fifties are entering the nursing workforce, accounting for 77% of the total increase between 2001-2008 (Buerhaus et al., 2009).

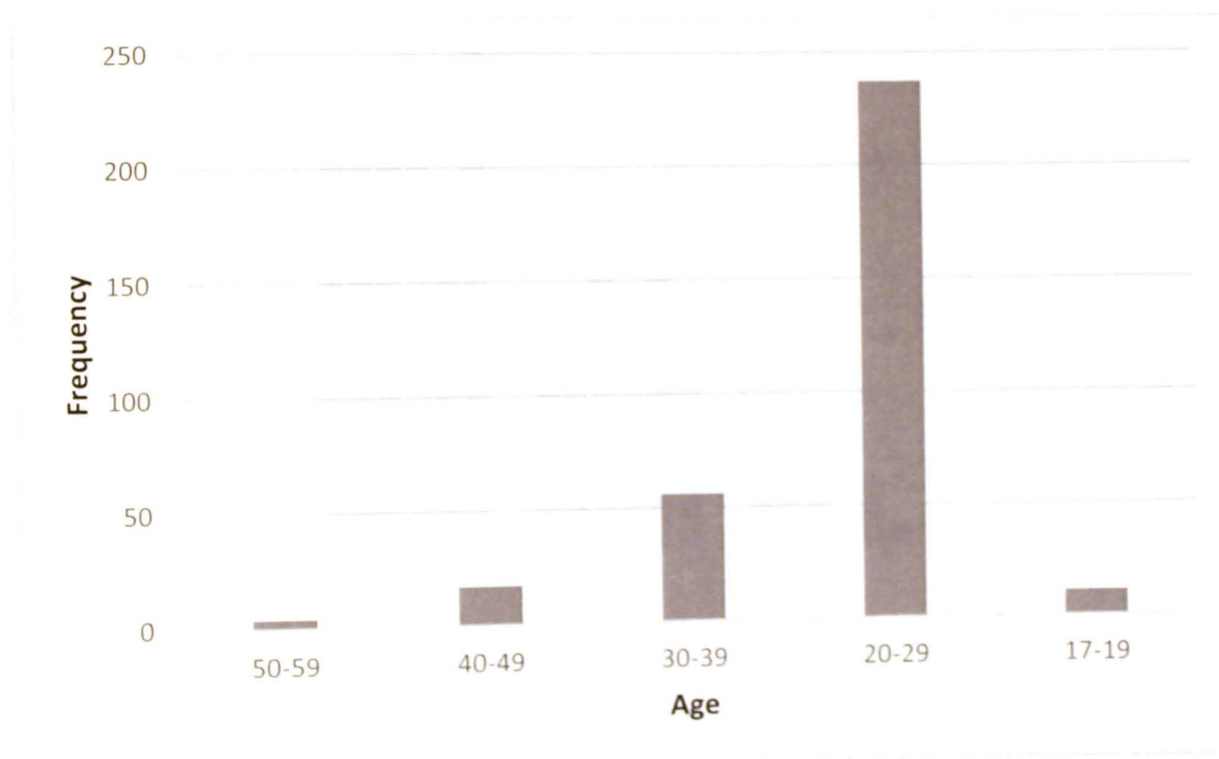


Figure 1. Age of Nursing Students upon Entry to the Nursing Program.

Criterion Variable

The bioscience grades, IV, are the first measure of success and were readily available for all students taught at the home university that entered the nursing program, please see Figure 1. The grades earned in nursing fundamental courses, the nursing fundamental GPAs, and overall nursing GPAs are the dependent variables, please see

Figure 2. The nursing course grades, the second measure, were available for all students that completed any of the major nursing courses. Both logistic regression and linear regression analysis were conducted. The logistic regression was conducted to predict success in individual nursing fundamental courses; whereas, a linear regression was conducted to predict the nursing fundamental and the overall nursing GPAs based on the bioscience grades.

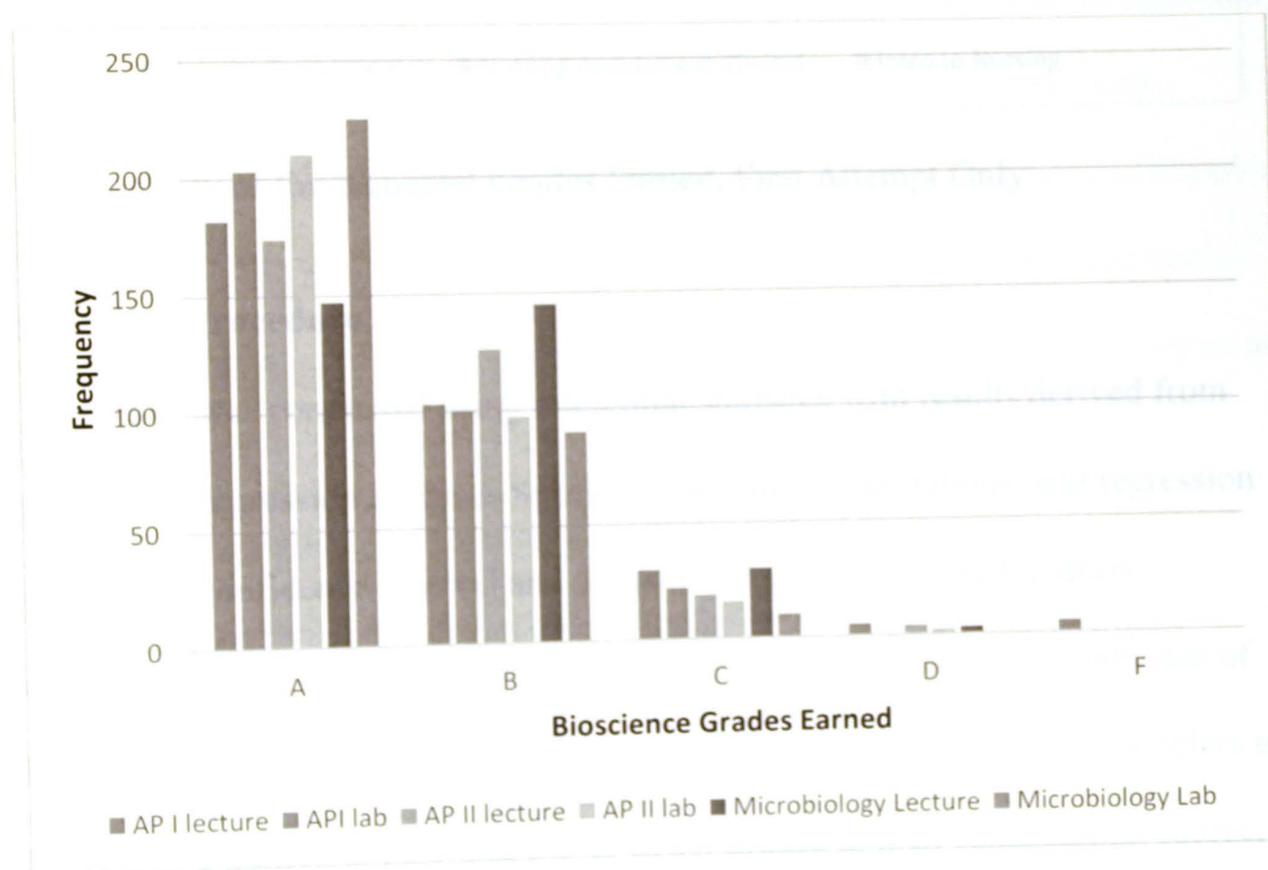


Figure 2. Frequency of Anatomy & Physiology Lecture & Lab Grades Earned, First Attempt Only

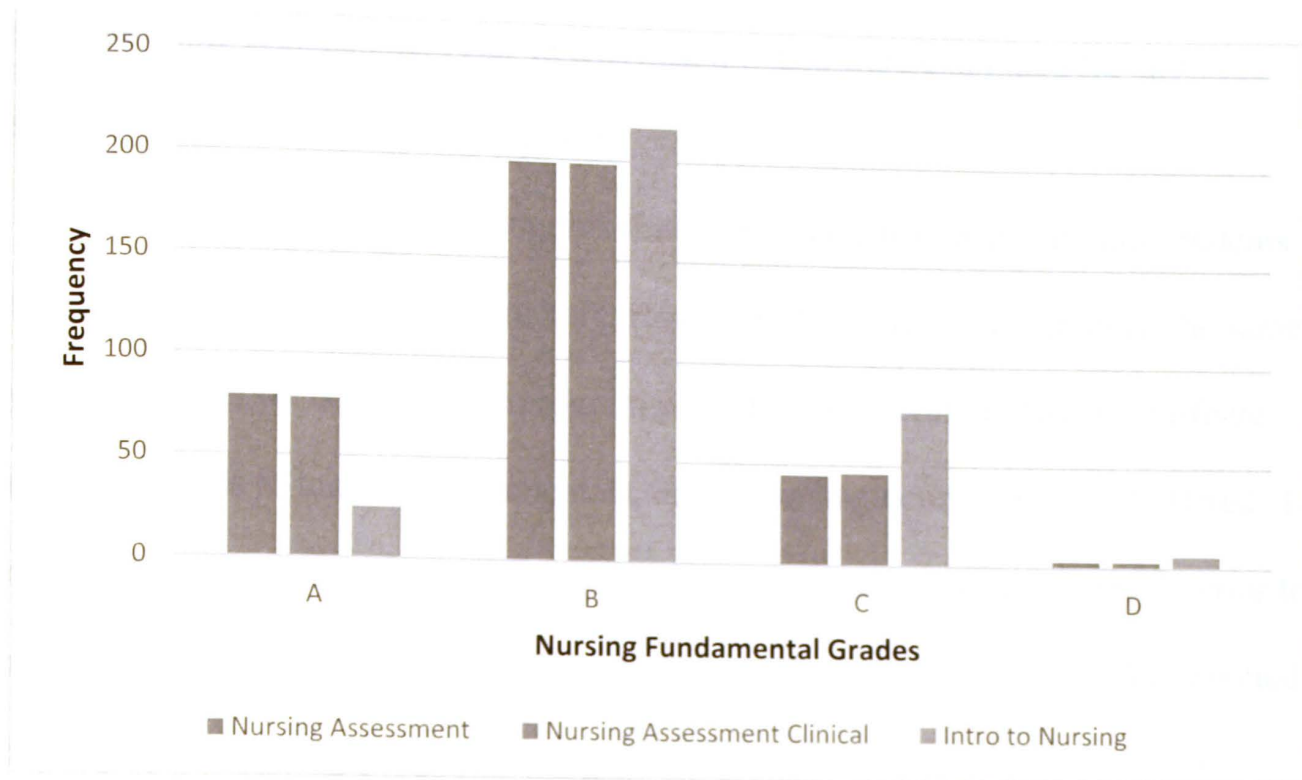


Figure 3. Frequency of Fundamental Grades Earned, First Attempt Only

Instrumentation Procedure

This study was conducted using inferential statistics with results derived from linear and logistic regression analyses. Specific procedures, correlations, and regression analyses at a 95% confidence interval and alpha of .05 were completed to draw inferences from the data collected. Throughout the study, the *p*-value is an indicator of the probability or likelihood of an event occurring. In this study, the *p*-value refers to the probability of a participant earning a B or better grades in their fundamental course, DV, based on the IV. In determining the degrees of freedom, the number of coefficients minus one was calculated, $N - 1$. The coefficients of this research study included API lecture and lab, APII lecture and lab, Microbiology lecture and lab, Nursing Assessment, Nursing Assessment clinical, Intro to Nursing, and Intro to Nursing clinical. Knowing how the science prerequisites grades influence nursing fundamental grades will help in determining if admission formulas should be reconfigured. Furthermore, predictions

were made using regressions. Prior to analysis, the data were examined for any missingness and violation of assumptions.

It should be noted that during this timeframe, the participants/nursing students were under the guidance of two directors. However, the curriculum remained the same. The nursing program is a full-time program provided in a lecture format with offsite clinics. In regards to nursing fundamentals, online nursing courses were not offered. The nursing prerequisite courses, including the bioscience courses, were completed prior to starting the school of nursing fundamental courses. The traditional age student applied for admission to the nursing program during the second half of their sophomore year. Nontraditional students applied for admission during various times. The nontraditional student consisted of first-time students, second-degree students, and/or students that started courses and took a leave from school before returning to complete their degree at later date.

The hypotheses used in this study include the following:

H1: Prerequisite bioscience grades of B or better had a positive effect on nursing fundamental and overall nursing GPAs.

H2: Prerequisite bioscience grades of B or better had a positive effect on first year student retention in the program, i.e., a passing grade in nursing fundamental courses.

H3: Written essays and interviews should/should not (pick one) be included as admission criteria for nursing applicants.

Predictor Variables

Simple linear and logistic regression analyses were conducted were conducted as a way to predict the probability of obtaining higher GPAs by earning grades of B or

better. The study set forth to prove the predictor variables did a good job in predicting outcomes. The effects of the relationships are explained in the result section.

“Variance findings of r include -1, a perfect negative linear relationship between x and y , 1, a perfect positive linear relationship between x and y , and 0 no linear relationship between x and y . All other values of r tell us that the relationship between x and y is not perfect. The closer r is to 0, the weaker the linear relationship, the closer r is to -1 the stronger the linear relationship, the closer r is to 1 the stronger the positive linear relationship. As is true for the R^2 value, what is deemed a large correlation coefficient r value depends on the research area,” (PennState, 2018).

The sample ($n = 325$) comprised undergraduate students whose ages ranged from 17 – 57 ($M = 25.48$, $SD = 7.289$) at the time the students were admitted to the nursing program, please see Histogram 4. Overall nursing GPAs ranged from 1.714 to 4.00 ($M = 3.179$, $SD = .357$). Nursing fundamental GPAs ranged from 1.833 to 4.00 ($M = 3.271$, $SD = .382$), all were continuous in nature. Females nursing GPAs consisted of ($M = 3.205$, $SD = .328$) with their fundamental GPAs of ($M = 3.282$, $SD = .380$). Males nursing GPAs consisted of ($M = 3.027$, $SD = .472$) with their fundamental GPAs ($M = 3.202$, $SD = .386$).

There was a disproportionate number of females to males and non-minorities to minorities; therefore, these variables were not useful for modeling purposes. Logistic regression models are unable to compute the same R^2 statistic as a linear regression analysis. For this study, Pseudo R-Square tables were formulated using the Statistical Package for the Social Sciences (SPSS), version 25. The Nagelkerke value was used to determine the effect size.

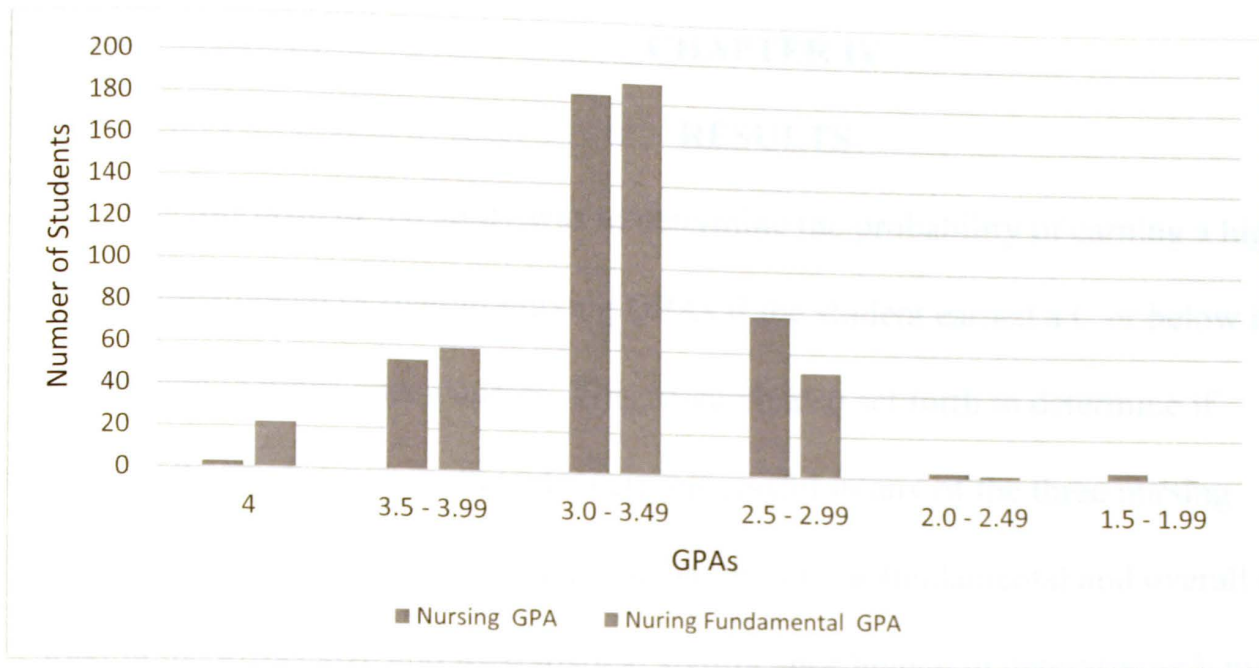


Figure 4. Nursing GPA and Nursing Fundamental GPA Based on Nursing Courses Only

Analysis

A linear regression was used to predict a student's nursing fundamental GPA and overall nursing GPA based on a prerequisite bioscience course. This type of study provides a 'b' coefficient which indicates the independent variable's influence on the dependent variable. Furthermore, the strengths amongst the variables are examined with this type of analysis. Knowing the probability of success and strengths of the relationships will assist the nursing program personnel in making the needed formula reconfigurations. In this research, the students' GPA is considered an interval and numerical measurement. After examining the independent variable, known as the predictor variable, or grades earned in the prerequisite bioscience courses (A, B, C, D, F), it should be noted that the following questions were answered due to the results from the regression analysis. Was it possible to predict a student's nursing fundamental GPA or overall nursing GPA based on the grade earned in a prerequisite bioscience course? How significant is the measurement?

CHAPTER IV

RESULTS

One purpose of the study was to determine the probability of earning a high nursing fundamental or overall nursing GPAs if the student earned a C or below in any of the prerequisite bioscience courses. This research also set forth to determine if academically weak nursing students were successful in any of the three nursing fundamentals courses researched. How strong was their fundamental and overall GPAs? Knowing the effect size and its statistical significance helped in determining how the nursing program admission criteria needed to be reconstructed.

In this study, multiple variables were researched to determine if an effect presented itself. The effect is the percentage of the total variance in the criterion variable described by the set of predictor variables. Any remaining variance is considered “error” variance since it is unexplained. In an attempt to understand the impact of biology courses and its effectiveness, Nagelkerke’s pseudo R^2 was calculated in the logistic regression analysis. Nagelkerke’s pseudo is analogous to and is indicative of the degree to which the set of predictor variables improves upon the prediction of the null model of logistic regression.

Research Question One. What are the impact bioscience courses have on nursing fundamental GPA and/or the students overall nursing GPA? “Since R^2 is a proportion, it is always a number between 0 and 1. If $R^2 = 1$, all of the data points fall perfectly on the regression line. The predictor x accounts for all the variation in y . If $R^2 = 0$ the estimated regression line is perfectly horizontal. The predictor accounts for none of the variation in y , When the number value falls between 1 and 0, $R^2 \times 100$ is the percentage of variation

in y is accounted for by the variation in x or $R^2 \times 100$ is the percentage of variation in y that is explained by the variation in predictor x " (PennState, 2018). The outcomes of the simple linear regression indicate that a significant percentage of the aggregate variation in the nursing fundamental GPA and overall nursing GPA was predicted by the bioscience course grades. In other words, a student's score on the bioscience course is a good indicator of their nursing fundamental and overall nursing GPA's being a 3.0 or higher. As seen in Table 1, the prerequisite bioscience courses have a significant relationship on a student's GPA. Likewise, as shown in Table 3, the bioscience courses significantly impact the grades earned in the nursing fundamental courses.

Preliminary analyses indicate a significant total variability when using the adjusted R^2 square for Anatomy and Physiology II and Microbiology lecture as the predictors for the nursing fundamental GPAs. Whereas, as Anatomy and Physiology I and Microbiology lab are moderate predictors for higher nursing fundamental GPAs. However, all of the bioscience courses resulted in significant p values. The very strong results give way to the rejection of the null hypothesis. These results are significant since its P -value is less than the $\alpha.05$. The P value for this study is $<.005$. Generally speaking, values over .05 are not statistically significant.

$$r = \pm \sqrt{r^2}$$

$$r = \frac{\sum_{i=1}^n (x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^n (x_i - \bar{x})^2 \sum_{i=1}^n (y_i - \bar{y})^2}}$$

Table 2

Bioscience courses as a predictor of Nursing Fundamental GPAs and Overall Nursing GPAs

	Nursing Fundamental GPA		Overall Nursing GPA	
	R^2	Sig.	R^2	Sig.
Anatomy & Physiology I lecture	.050	.000	.034	.001
Anatomy & Physiology I lab	.054	.000	.036	.001
Anatomy & Physiology II lecture	.103	.000	.057	.000
Anatomy & Physiology II lab	.081	.000	.076	.000
Microbiology lecture	.135	.000	.149	.000
Microbiology lab	.065	.000	.055	.000

Research Question Two. How is retention in the first semester of a nursing program (known as nursing fundamentals) impacted by the prerequisite bioscience grades of a C or below? Since the hypothesis consists of determining the relationship between two categorical variables, a logistic regression model, with a Nagelkerke's R-squared, was conducted. The research assessed the odds of student successfully completing (earning a B or better) the nursing fundamental courses based on the categorical grade earned from the bioscience course. The results from this question did not follow a linear trend and the scatterplots were neither normally distributed nor continual across the all-inclusive range

of statistics. With a logistic regression, the prediction of Y from X is calculated. The direction of the relationship between X and Y was determined by the coefficient β .

The regression model consisted of three independent variables and how any or all of the grades affected or predicted success within the nursing fundamental courses. Since more than one independent variable exists, a factorial design study was conducted and the main effect was discovered. To test the set of predictor variables' impact on nursing courses, in regards to each individual science course, 18 logistic regressions were conducted. SPSS produced a Pseudo R-Square table featuring all the data captured by the logistic regression model which measured the prediction of Y from X with Y being the DV and X being the DV. The output results were broken down into files containing the prediction and the probability of the outcomes. The summary of the observed distributions implied that of the data used ($N = 325$), Anatomy & Physiology I lecture and lab and microbiology lab had a moderate impact on nursing grades. Anatomy & Physiology II lecture and lab and microbiology had a statistically significant impact on the criterion variable. As for the overall nursing GPA, the outcomes indicate that Microbiology lecture affect the total variability. As seen with the nursing fundamental GPAs, the overall nursing GPAs were significantly impacted by the bioscience grades. Again, the null hypothesis was rejected and the alternative hypothesis was accepted.

Table 3

Bioscience courses as a predictor for Nursing Fundamental Course

	Nursing Assessment	Nursing Assessment Clinical	Intro to Nursing
Anatomy & Physiology I lecture	6.1%	7.7%	7.7%

Anatomy & Physiology I lab	5.0%	4.4%	4.2%
Anatomy & Physiology II lecture	14.5%	13.7%	14.1%
Anatomy & Physiology II lab	10.6%	10.7%	9.8%
Microbiology lecture	11.5%	10.8%	8.5%
Microbiology lab	4.5%	4.2%	3.2%

Nagelkerke R-Square

Research Question Three. Should admission ranking consider adding essays or interviews to their admission criteria? After reading studies in regards implementing essay writing and interviews into admission formulas, it was determined that neither essay writing nor interviews produce a better pool of candidates. Using formulas based on mathematical calculations is best for admission rankings. A number of studies indicated that bioscience grades, high school grades, and entrance exams are ideal for admission ranking criteria since a precise measurement for entrance ranking produced candidates that were more likely to be successful within a nursing program (Abele et al., 2013; Newton et al., 2007; Van Rooyen et al., 2006). In 2014, Hendricks and Krothe studied the outcomes of interviews used during nursing admission stated that the gain of using interviews related to ethnic and gender diversity not success within the nursing program. It is their recommendation that interviews not be used for admission purposes. They believed interviews themselves create unforeseen difficulties. Likewise, in 2011, Timer and Clauson reported that supplemental application materials were not justifiable as measurements of success since supplemental material offered no predictably of

success. They concluded that GPA was the most significant variable in predicting success since non-cognitive supplemental materials did not facilitate success in the program.

There are other solutions to incorporating essay writing or interviews into the admission process. Bowers and McCarthy (1993) suggested implementing critical thinking strategies such as writing-to-learn into the nursing courses. Likewise, Maneval and others (2011) suggested incorporating concept mapping as part of the nursing curriculum. A study by Elder (2015) recommended executing a case management system for all incoming nursing students to counteract attrition. Specific needs of the student (family obligations, work-life, dependents and other factors) would be addressed prior to the course-load beginning. Furthermore, potential nursing students should be informed about the complexity of nursing before entering the nursing program.

Based on the findings in this study, it is conceivable for the admission committee to differentiate successful from unsuccessful nursing applicants. It was possible to determine if an applicant is an at-risk student prior to starting nursing courses. Since the study indicated that a grade of a C and below or repeating the bioscience prerequisites within a seven-year timeframe is causing a detrimental impact on nursing fundamental grades and GPA as well as the overall nursing GPA, the nursing admission formula should be reconfigured to enhance nursing outcomes.

CHAPTER V

DISCUSSION

Throughout this study, attrition is a concern for nursing programs since lack of qualified nurses has become a global issue. In 2009, Buerhaus, Auerbach, and Staiger projected a staggering amount that consisted of 260,000 RN shortages by 2025. Qualified nurses are in high demand and retention issues within nursing programs are problematic. There are quite a few studies that have tried to pinpoint how individual nursing programs could improve their admission ranking formula in an attempt to admit a better pool of candidates and to convince at-risk students to declare an alternative major. Critical thinking skills coupled with knowledge in which to act upon during life crisis situations must be in possession of all nursing candidates prior to entering the nursing program. The discussions below will focus on the examination of the bioscience prerequisites course grades, nursing fundamental course grades, nursing GPA, nursing fundamental GPA, and supplemental admission criteria were examined.

Research Questions

Research Question One. What are the impact bioscience courses have on nursing fundamental GPA and/or the students overall nursing GPA? As reported in this study, when examining the adjusted R^2 square for Anatomy and Physiology II lecture and lab and Microbiology lecture bioscience courses are good indicators of success with both the overall nursing GPA and the fundamental GPA. The results of this study corroborate with findings from Stuenkel's (2006), Symes et al. (2005), and Whyte et al. (2011) studies. In an effort to reconfigure nursing admission entrance formulas, it was vital for the nursing programs in which this study took place to determine the impact of bioscience of a C or

below on nursing students GPAs. The significant impact of the bioscience grades reinforced the need to place more weight on the bioscience courses rather than treating all nursing prerequisites equally.

Research Question Two. How is retention in the first semester of a nursing program (known as nursing fundamentals) impacted by the prerequisite bioscience grades of a C or below? Similar to research question one, the bioscience grades of a C or below have a negative effect on nursing fundamental grades. Success within the nursing and graduation rates from the program have a relationship based on the bioscience foundation. In 2003, Potolsky and others confirmed confirmed that the first semester of nursing courses are directly impacted by the bioscience grades. Furthermore, Andrews et al. (2008) concluded that being prepared for the content material greatly relates to success within the program; whereas, being unprepared contributed to poor academic performance.

Research Question Three. Should admission ranking consider adding essays or interviews to their admission criteria? Neither essay writing nor interviews provide a more qualified pool of candidates during admission cycles. A quantitative formula based upon its precise measurement is far more likely to yield successful students and reduce attrition than its counterpart a qualitative study. Providing interviews and evaluating essay writing is more time consuming and according to Hendricks and Krothe (2014), the only gains were an increase in ethnicity and gender.

Limitations of the Study

This study had multiple limitations. Limitations included lack bioscience grades from students attending a community college. It would be beneficial to know if

bioscience grades from community colleges have the same effect on the nursing fundamental or overall nursing GPAs. Additionally, the student's full or part-time statuses were unknown. Did outside obligations such as work-life and family-life distract from the amount of time the students were able to commit to the bioscience or nursing courses? Were the students accepted into the program of their choice or was the nursing program an alternative plan. Were the students prepared for the commitment required to become successful (earning Bs or greater) within the nursing program? Did nursing candidates have a clear understanding of nursing job responsibilities and patient loads?

Consideration for Future Studies

Future studies could easily be centered on the points listed in the limitations section. Previous studies mentioned in the review of literature touched briefly upon the topics listed in the limitation of the study section. However, since each university has its own culture it is best to investigate how the topics above impacted the nursing program in which this study was focused.

Bioscience Courses Completed at a Community College. Further investigation should be made to determine whether or not completing the bioscience courses at a community college has a significant impact on the student's ability to earn Bs or better in the nursing courses; thus, earning higher nursing fundamentals and overall nursing GPAs. This portion of the study can be broken down even further into two categories: online vs. lecture format bioscience courses. A validation of the relationship will help in reconfiguring the nursing formula so that nursing outcomes reflect a higher graduation rate.

Qualitative Study. Future research should also include a qualitative portion of the study. Certain questions would help to determine a student's balance between work-life, academic-obligations, and family commitment at the time the student entered the nursing program and completed the first semester of nursing courses. Additionally, the questionnaire could have a section that focused on if nursing was a student's first choice for a career and if the student had an accurate understanding of nursing prior to starting the nursing program, if not is the student second degree and what was their first degree. Lastly, there should be a portion of the questionnaire that inquires as to why the student chooses to withdraw from the nursing program. Once the data are collected and number values are assigned a report showing a significant difference can be run. Increasing attrition will also help with nursing outcomes. Andrews et al. (2008) stated that students will withdraw during their first semester due to being unprepared. Whereas those who leave after the first semester withdraw because of financial or family pressures. Emphasis should be placed on retaining these students to counteract the financial drain on the university (Hendricks & Krothe, 2014).

Nursing Competitiveness and Financial Aid Issues. Understanding the importance of determining which student is at-risk and filtering the said student into an alternative program is more important than ever. In January 2018 news reporter Scott Travis published an article titled, "Financial Aid Errors Cost Broward College \$5.6 Million". The article clarifies the importance of determining at-risk students prior to the potential students being admitted to a nursing program. Federal aid reviews during 2016-2017 resulted in penalties and pay back issues due to students that did not meet the minimum GPA requirement for the nursing program being granted financial aid regardless of the

student's ineligibility to the nursing program status (Travis, 2018). Simply declaring oneself a nursing student is not enough reason to be granted aid, the student should meet the minimum requirement for acceptance to the nursing program in question. Practices need to be edited so that students not meeting the GPA admission criteria are filtered into alternative degree programs long before applying for entrance to the program. Likewise, transfer students entering the university should be filtered into alternative degrees if they do not meet the minimum nursing program GPA requirement.

The university in which this study was conducted currently allows any student wishing to declare nursing as a major to do so, regardless of the student's nursing focus GPA. Students at the university must have a minimum nursing focus GPA of a 3.0 in order to apply for entrance into the nursing program. Hundreds of students fall well below the 3.0 minimum GPA requirement and refuse to change their major. Please understand that a 3.0 is not a competitive GPA. Perhaps, a protocol for declaring specific majors should be changed in order to avoid potential payback issues. Changing the protocol for declaring specific majors is worthy of further investigation.

TEAS Testing. Perhaps a stipulation regarding the TEAS exam score should be incorporated into the admission criteria. The program in which this study took place does not have any type of score requirement. Since ranking is based off a student's overall GPA * 50 + the TEAS score, students with a 4.0 GPA and a 50 on the TEAS have gained entrance to the program. Placing a minimum requirement on the TEAS may filter out the at-risk student. Research regarding the TEAS scores and this sample of 325 students should be conducted to determine if the TEAS score made a significant difference in nursing outcomes. Depending upon the results, the nursing admission committee may

consider adding a clause that requires all testers to achieve an overall composite score equal to the national percentile rank.

Mentoring Possibilities. If the admission formula remains the same, should the Tennessee nursing program establish mentoring opportunities for the at-risk nursing student? If the student has a dedicated individual invested in his or her education, it may result in a more effective outcome. Encouraging the relationship between faculty and student while guiding the student professionally as well as personally has the possibility of promoting a more positive learning opportunity. A mentor will provide the assistance needed as the student learns new critical skills and adopts to clinical settings that are outside the student's everyday realm. Self-images could be boosted and realities meet while the nursing student emerges from their limited persona and self-beliefs. As with any pilot program, there may be drawbacks to the mentoring process; however, it is worthy of investigating.

Larger cohorts may not be the most cost-effective way to increase retention. Retaining the admitted students is much more feasible. This study will provide insight into the Tennessee nursing program and has proven results that bioscience grades have a significant impact on a nursing student's success. With this in mind, additional research on how its admission criteria may be reconfigured should be conducted so nursing outcomes are further improved.

REFERENCES

- Abele, C., Penprase, B., & Ternes, R. (2013). A closer look at academic probation and attrition: What courses are predictive of nursing student success? *Nurse Education Today*, 33(3), 258-261.
- Andrew, S., Salamonson, Y., Weaver, R., Smith, A., O'Reilly, R., & Taylor, C. (2008). Hate the course or hate to go: Semester differences in first year nursing attrition. *Nurse Education Today*, 28(7), 865-872.
- Beauvais, A. M., Stewart, J. G., DeNisco, S., & Beauvais, J. E. (2013). Factors related to academic success among nursing students: A descriptive correlational research study. *Nurse Education Today*, 34(6), 918-923.
- Bowers, B., & McCarthy, D. (1993). Developing analytic thinking skills in early undergraduate education. *Journal of Nursing Education*, 32(3), 107-114.
- Brunt, B. A. (2005). Models, measurement, and strategies in developing critical-thinking skills. *Journal of Continuing Education in Nursing*, 36(6), 255-276.
- Buerhaus, P. I., Auerbach, D. I., & Staiger, D. O. (2009). The recent surge in nurse employment: Causes and implications. *Health Affairs*, 28(4), 657.
- Cunningham, C. J. L., Manier, A., Anderson, A., & Sarnosky, K. (2014). Rational versus empirical prediction of nursing student success. *Journal of Professional Nursing*, 30(6), 486-492.
- Elder, B. L., Jacobs, P., & Fast, Y. J. (2015). Identification and support of at-risk students using a case management model. *Journal of Professional Nursing*, 31(3), 247-253.

- Grossbach, A., & Kuncel, N. R. (2011). The predictive validity of nursing admission measures for performance on the national council licensure examination: A Meta-analysis. *Journal of Professional Nursing*, 27(2), 124-128.
- Hendricks, S. & Krothe J. (2014). Outcomes and lessons learned regarding the use of interviewing for baccalaureate nursing school admission. *Journal of Professional Nursing*, 392-398.
- Hernandez, C. A. (2009). Educational innovations. Student articulation of a nursing philosophical statement: An assignment to enhance critical thinking skills and promote learning. *Journal of Nursing Education*, 48(6), 343-349.
- Hinkle DE, Wiersma W, Jurs SG (2003). *Applied statistics for the behavioral sciences*. Boston: Houghton Mifflin.
- Jeffreys, M. R. (2007). Tracking students through program entry, progression, graduation, and licensure: Assessing undergraduate nursing student retention and success. *Nurse Education Today*, 27(5), 406-419.
- Jeffreys, M. R. (2015). Jeffrey's nursing universal retention and success model: Overview and action ideas for optimizing outcomes A-Z. *Nurse Education Today*, 35(3), 425-431
- Jobs4TN.gov. (2016, November 2).
<https://www.jobs4tn.gov/vosnet/lmi/occ/occsummary.aspx?enc=e7AKr7bjUGRBEdrMte14UcGASDLPK35sJJ/TkTJAEXGQKTTeOafnKvNkixKfDLOW7iWARP6mFzHR7BWRXYSJj6X7IVDrxnYpBT3zhfsYh/JcwDLH1UhJzJHRE+QUd6fH>

- Kaddoura, M., Van-Dyke, O., & Yang, Q. (2016). Impact of a concept map teaching approach on nursing students' critical thinking skills. *Nursing & Health Sciences*, 18(3), 350-354.
- Lancia, L., Petrucci, C., Giorgi, F., Dante, A., & Cifone, M. G. (2013). Academic success or failure in nursing students: Results of a retrospective observational study. *Nurse Education Today*, 33(12), 1501-1505.
- Maneval, R. E., Filburn, M. J., Deringer, S. O., & Lum, G. D. (2011). CONCEPT MAPPING: Does it improve critical thinking ability in practical nursing students? *Nursing Education Perspectives (National League for Nursing)*, 32(4), 229-233.
- McNelis, A. M., Wellman, D. S., Krothe, J. S., Hrisomalos, D. D., McElveen, J. L., & South, R. J. (2010). Revision and evaluation of the Indiana University school of nursing baccalaureate admission process. *Journal of Professional Nursing*, 26(3), 188-195.
- Newton, S. E., Moore G. (2009). Use of aptitude to understand bachelor of science in nursing student attrition and readiness for the National Council Licensure Examination - Registered Nurse. *Journal of Professional Nursing*, 25(5), 273-278.
- Newton, S. E., Smith, L. H., Moore, G., & Magnan, M. (2007). Predicting early academic achievement in a baccalaureate nursing program. *Journal of Professional Nursing*, 23(3), 144-149.
- PennState. (2018, March 5). *The Coefficient of Determination, r-squared*. Retrieved from STAT 501 Regression Methods:
<https://onlinecourses.science.psu.edu/stat501/node/255>

- Potolsky, A., Cohen, J., & Saylor, C. (2003). Academic performance of nursing students: Do prerequisite grades and tutoring make a difference? *Nursing Education Perspectives*, 24(5), 246-250.
- Sadler, J. (2003). Effectiveness of student admission essays in identifying attrition. *Nurse Education Today*, 23(8), 620-627.
- Salamonson, Y., Everett, B., Cooper, M., Lombardo, L., Weaver, R., & Davidson, P. M. (2014). Nursing as first choice predicts nursing program completion. *Nurse Education Today*, 34(1), 127-131.
- Schmidt, B., & MacWilliams, B. (2011). Admission criteria for undergraduate nursing programs. *Nurse Educator*, 36(4), 171-174.
- Shepherd, J. (2008). Adolescent student nurses: Implications for retention. *Pediatric Nursing* 20 (3), 42-45.
- Shin, S., Jung, D., & Kim, S. (2015). Validation of a clinical critical thinking skills test in nursing. *Journal of Educational Evaluation for Health Professions*, 12, 1-6.
- Shulruf, B., Wang, Y. G., Zhao, Y. J., & Baker, H. (2011). Rethinking the admission criteria to nursing school. *Nurse Education Today*, 31(8), 727-732.
- Starck, P. L., Love, K., & McPherson, R. (2008). Calculating graduation rates. *Journal of Professional Nursing*, 24(4), 197-204.
- Stuenkel, D. L. (2006). At-risk students: Do theory grades + standardized examinations = success? *Nurse Educator*, 31(5), 207-212.
- Symes, L., Tart, K., & Travis, L. (2005). An evaluation of the nursing success program: Reading comprehension, graduation rates, and diversity. *Nurse Educator*, 30(5), 217-220.

- Timer, J. E., & Clauson, M. I. (2011). The use of selective admissions tools to predict students success in an advanced standing baccalaureate nursing program. *Nurse Education Today*, 31(6), 601-606.
- Travis, S. (2018, January 12). Financial Aid Errors Cost Browrd College \$5.6 Million.
- Urwin, S., Stanley, R., Jones, M., Gallagher, A., Wainwright, P., & Perkins, A. (2010). Understanding student nurse attrition: Learning from the literature. *Nurse Education Today*, 30(2), 202-207.
- van Rooyen, P., Dixon, A., Dixon, G., & Wells, C. (2006). Entry criteria as predictor of performance in an undergraduate nursing degree programme. *Nurse Education Today*, 26(7), 593-600.
- Wharrad H. Chapple M., Price N. (2003). Predictors of academic success in a bachelor of nursing course. *Nurse Education Today*, 23, 246-254.
- Whyte, D. G., Madigan, V., & Drinkwater, E. J. (2011). Predictors of academic performance of nursing and paramedic students in first year bioscience. *Nurse Education Today*, 31(8), 849-854.
- Wolkowitz, A. A., & Kelley, J. A. (2010). Academic predictors of success in a nursing program. *Journal of Nursing Education*, 49(9), 498-503.
- Worthington, M., Salamonson, Y., Weaver, R., & Cleary, M. (2013). Predictive validity of the Macleod Clark professional identity scale for undergraduate nursing students. *Nurse Education Today*, 33(3), 187-191.
- Yocom, C. J., & Scherubel, J. C. (1985). Selected pre-admission and academic correlates of success on state board examinations. *Journal of Nursing Education*, 24(6), 244-249.

APPENDICES

APPENDIX A

INSTITUTIONAL REVIEW BOARD LETTER OF APPROVAL



AUSTIN PEAY STATE UNIVERSITY
INSTITUTIONAL REVIEW BOARD

Date: 11/30/2016

RE 16-044: Rethinking School of Nursing Admission Criteria

Dear Ms. Massey and Dr. Stewart,

We appreciate your cooperation with the human research review process. This letter is to inform you that study 16-044 has been reviewed on an expedited level. It is my pleasure to inform you that your study has been approved.

This approval is subject to APSU Policies and Procedures governing human subject research. The IRB reserves the right to withdraw approval if unresolved issues are raised during the review period. Any changes or deviations from the approved protocol must be submitted in writing to the IRB for further review and approval before continuing.

This approval is for one calendar year and a closed study report or request for continuing review is required on or before the expiration date, 11/30/2017. If you have any questions or require further information, you can contact me by phone (931-221-7506) or email butterfieldj@apsu.edu.

Sincerely,

Jonniann Butterfield, Ph. D. Chair, APIRB