2012

A Study Investigating the Predictors of Attrition in an Associate Degree Nursing Program

Patricia A. Gagliano

A STUDY INVESTIGATING THE PREDICTORS OF ATTRITION IN AN ASSOCIATE DEGREE NURSING PROGRAM

DISSERTATION

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Patricia A. Gagliano

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A STUDY INVESTIGATING THE PREDICTORS OF ATTRITION IN AN ASSOCIATE DEGREE NURSING PROGRAM

DISSERTATION

By

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Abstract

Background: Attrition of nursing students is a commonly occurring problem in nursing programs within the United States. Unfortunately, a shortage of nurses requires that more nursing students graduate from nursing programs to meet the health care needs of the population.

Purpose: The purpose of this study was to investigate the effectiveness of pre-nursing grade point average, Assessment Technologies Institute's Critical Thinking Entrance scores and sub-scores, age, ethnicity, gender, as predictors of success or attrition rates in the first six nursing courses.

Theoretical Framework: A modified model adapted from Bean and Metzner's Conceptual Model of Nontraditional Undergraduate Student Attrition.

Methods: A retrospective correlation design evaluated a sample of 129 students from the admission cohort from spring and fall of 2010.

Results: Statistical significance was found between academic success rates and two sub-scores from Assessment Technologies Institute's Critical Thinking Entrance exam. The sub-scores for analysis and evaluation were found to be statistically significant within the sample and for students enrolled in two medical-surgical courses. Pre-nursing grade point average was also found to be statistically significant for the sample and for the Psychiatric Nursing course.

Implications: The findings from this study may provide nursing education an alternative method to evaluate potential student applicants for academic success within a nursing program. The findings also extend the current literature regarding the predictability of pre-nursing grade point average as admission criteria for applicants for nursing school.

Conclusion: The research findings in this study may illuminate new alternatives for admission criteria of nursing students. The Critical Thinking Entrance exam from Assessment Technologies Institute may identify qualities of nursing students that will effectively predict academic success. Increasing nursing students academic success will reduce attrition rates and may increase nursing graduates to reduce the nursing shortage.

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DEDICATIONS

This study is dedicated to my husband and two children. The attainment of this degree was only completed through your continuous love, encouragement, and understanding.

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CHAPTER ONE

A growing and aging population in the United States (U.S.) requires more nurses to provide health care to the general population. The nation is predicted to need an additional 1.2 million nurses by 2020 to care for patients (United States Department of Labor Bureau of Labor Statistics, 2012). If nursing does not have enough staffing to provide quality and effective care at the bedside, patient care is in jeopardy. An impending nursing shortage requires creativity and ingenuity to identify new initiatives to expand the discipline of nursing.

Increasing the number of graduates from nursing schools is seen by some as one way to reduce the nursing shortage. Now, more than ever, nurse educators are under pressure to graduate more students. Academic success is central to ensuring more student nurses graduate from nursing school. Unfortunately, each student failure equates to a loss of a potential nurse or, at best, delays entry into practice. The current number of qualified nurses will not meet expected demands of one million additional nurses in health care (Scherzer, Stotts, and Fontaine, 2010). Nursing education needs to discover new approaches to increase program effectiveness, reduce nursing student attrition, and increase nursing graduates.

BACKGROUND OF THE STUDY

It is predicted that by 2016 an additional 30% of nurses will be required to care for patients (Rouse and Rooda, 2010). The Florida Center for Nursing (FCN) reported that by 2025, Florida might need an extra 50,000 nurses to care for patients (Florida Center for Nursing, 2011, February). Currently, the demand for nurses is exceeding the supply and the profession is experiencing a shortage of qualified nurses. Multiple factors

contribute to the current nursing shortage. The aging population in the U.S. is one source that is intensifying the nursing shortage. The health care market is growing with the impending retirement of the baby boomers. As people age, they will require health care. Unfortunately, as the population ages, so does the nursing workforce. A large portion of the nursing workforce, 55%, will retire within the next ten years (Rouse and Rooda; Scherzer, Stotts, and Fontaine, 2010). The discipline of nursing is being challenged in several different ways to overcome the nursing shortage.

Nursing graduates need to increase by 30% to meet health care demands (Rouse and Rooda, 2010). More nurses are needed to care for patients, while at the same time nursing is losing large numbers to retirement. It is clear that the nursing profession is facing significant challenges when it comes to filling nursing positions. Therefore, increasing graduates is one method that may assist in reducing the nursing shortage. If more students graduate, more nurses would be available to meet the growing demands of the health care community.

To further complicate the nursing shortage, Associate Degree Nursing (ADN) programs in 2010 reported 46% of qualified applicants were turned away due to a faculty shortage (Kaufman, 2010). The faculty shortage is significant with the American Association of Colleges of Nursing (AACN) identifying that 56% of schools had nursing faculty vacancies (Fang and Tracy, 2010). Limited nursing faculty restricts nursing education's ability to expand class size and increase enrollment capacities. The most effective admission criteria should be utilized by nursing education when large applicant pools of qualified students are being turned away.

The use of admission criteria by nursing education has been employed as a measuring stick to ensure qualified students enter the program. College grade point average (GPA), nursing course GPA, standardized exam scores, psychological assessments, and interviews have all been used as admission criteria. Unfortunately, Wolkowitz and Kelley (2010); Newton and Moore (2009); and Hopkins (2008) all identified no one standardized assessment used in admission criteria has proven to be reliable and valid for use in predicting attrition. The current literature has found admission criteria are unreliable and may not be sensitive enough to screen for qualified applicants. Newton, Smith, Moore, and Magnan (2007) noted students that meet the minimum admission criteria usually fail a nursing course. Ironically, some view admission criteria as a significant cause of attrition (Newton, Smith, Moore, and Magnan, 2007). When attrition rates are reported to be as high as 17 % in some nursing programs (National League for Nursing, 2006), it is fair to question if admission criteria is effective. Ample numbers of qualified applicants are being turned away annually (National League for Nursing, 2009), however, the formula for admission is not known. Admission criteria should be a benefit and not a hindrance. To find a solution to attrition in nursing education, admission criteria are fairly seen as a quandary that needs to be investigated.

Nursing programs are currently experiencing a large amount of student failures and this can be viewed as contributing to the nursing shortage. Jefferys (2007) reported an attrition rate of 25% and Rogers (2010) reported attrition rates of 20% for Associate Degree Nursing (ADN) programs and Peterson (2009) reported a 30% rate of attrition for a Baccalaureate of Science Nursing (BSN) program. The Florida Center for Nursing

(FCN) conveyed ADN programs in the state of Florida in 2009 had a capacity of 8,518 (Florida Center for Nursing, 2010a, January). The number of ADN graduates for 2009 - 2010 in the state of Florida was 5,701 (Florida Center for Nursing, 2011, Spring). Hundreds of seats for ADN programs are vacant upon graduation. Attrition of nursing students is slowly chipping away at potential nurses. The end result of attrition is fewer nurses caring for patients.

Current research published by Ellis (2006) found increased retention rates with the use of the Nurse Entrance Test (NET) critical thinking scores. Ellis (2006) reported on a diploma nursing program that used the NET critical thinking scores as admission criteria. The researcher found a 19% higher retention rate when a critical thinking score of 50 was used as minimal admission criteria (Ellis). Little research has investigated critical thinking scores as admission criteria for entrance into a nursing program. Understanding that critical thinking is a necessary skill for nurses supports the premise that nursing students also need to think critically. If students are not able to think critically in the beginning of a nursing program, this may contribute to poor academic success and attrition. An investigation into the effect of nursing students' critical thinking abilities may shed light on the type of skills students need in order to be successful in a nursing program.

PROBLEM STATEMENT

Attrition rates in Associate Degree Nursing (ADN) programs contribute to the nursing shortage. Attrition is defined as a student failing or withdrawing from a nursing course or a nursing program for academic reasons. When students fail a nursing course,

they are at risk for not completing or returning to nursing school. If students do not return to school, they do not graduate and thus contribute to the nursing shortage.

PURPOSE STATEMENT

The purpose of this study was to investigate if a relationship exists between pre-nursing GPA, age, ethnicity, gender, Assessment Technologies Institute's (ATI) Critical Thinking Entrance (CTE) exam and attrition in the first six nursing courses at a state school located in the southeastern United States.

RESEARCH HYPOTHESES

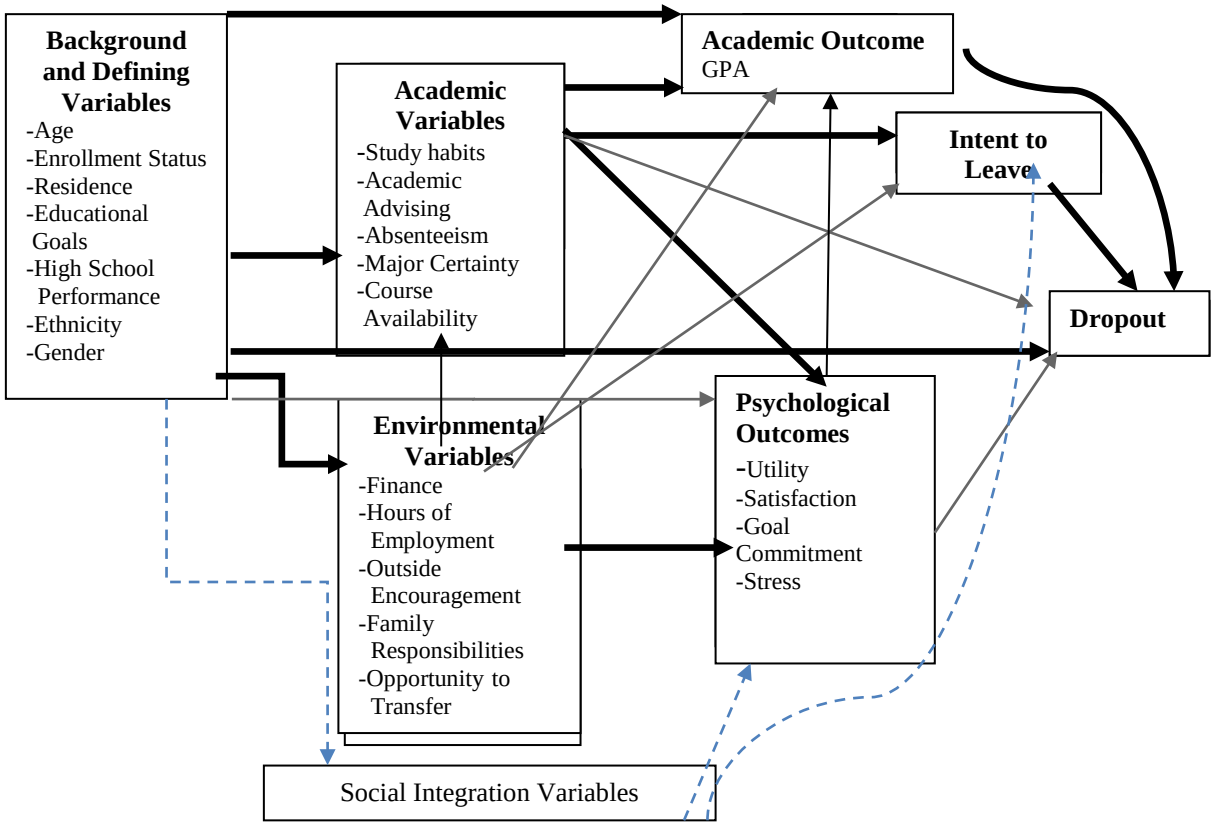
The content of this study will be guided by the following research hypotheses:
Hypothesis 1: A positive relationship will exist between ADN students' critical thinking entrance exam scores and sub-scores and attrition in the first six nursing courses.
Hypothesis 2: There will be a significant correlation between select demographic variables (age, gender, ethnicity), critical thinking entrance exam scores, pre-nursing grade point average, and attrition for ADN students in their first six nursing courses.

THEORETICAL FRAMEWORK

The Conceptual Model of Nontraditional Undergraduate Student Attrition (CMNUSA) published by Bean and Metzner (1985) provided a structure for exploring attrition of college students. High attrition rates occurred in nontraditional students in the 1980s. Earlier published models for attrition incorporated socialization on college campuses as a pivotal variable. Bean and Metzner (1985) recognized that nontraditional students did not participate in on-campus activities and therefore, previously published frameworks are not applicable to predict attrition. According to Bean and Metzner (1985), nontraditional students have one or more of the following qualities: 24 years of

age and older, enrolled part-time, and a commuter student. The nontraditional student population at colleges is estimated to be 75% (Hermida, 2010; Ross-Gordon, 2011). Attrition is defined as students who have not declared a major or left college and/or is registered one semester and does not return the following semester (Bean and Metzner). While this definition is vague, the researchers encourage future uses of the model to articulate a definition of attrition that is specific for the research.

Conceptual Model of Nontraditional Undergraduate Student Attrition



Key:
Direct /Most Important Effects=
Direct Effects =
Compensatory Effects =
Possible Effects =

Fig A. A reprinted copy of the Bean and Metzner (1985) conceptual model. "A Conceptual Model of Nontraditional Undergraduate Student Attrition" by Bean, J., Metzner, B., 1985, *Review of Educational Research*, 55(4), 485 – 540. Copyright 1985 by Sage Publications. Reprinted with permission of Sage Publications.

Major Concepts

The researchers recognized background, academic, and environmental variables have direct and indirect relationships within the CMNUSA model. The social interaction variable is used within the model and assumed to have a possible effect on attrition. All of the variables are thought to impact academic and psychological outcomes and influence the major factors of intent to leave and attrition (Bean and Metzner, 1985).

The researchers also associated compensatory effects, similar to Tinto (1975), within the model. Negative environmental variables may cause attrition even if academic variables are positive (Bean and Metzner, 1985). However, weak academic variables may be positively impacted by environmental variables. Psychological outcomes may also positively impact academic outcomes, but academic outcomes do not positively impact psychological outcomes. The use of compensatory relationships by Bean and Metzner (1985) has illuminated the importance of interrelationships and their impact on attrition (Bean and Metzner).

Background variables. Age, enrollment status, and residence were seen as important factors in a student's background. Educational goals, high school performance, ethnicity, and gender are four other variables that affect how the nontraditional student may relate with the college. Age can impact attrition due to the responsibilities assumed to be held by older students (Bean and Metzner, 1985). Studies cited by Bean and Metzner (1985) have found a positive relationship among students' age and attrition. The researchers recognize age as having an indirect effect on dropout; the older the student, the more chance for dropout. Enrollment status is measured by the amount of credits a student is registered for during a semester. Part-time status is defined as 12 credits or less

per semester. A literature search by the researcher found part-time students had a higher rate of attrition than full-time students. The researchers also believe a relationship exists between nontraditional students, enrollment, and attrition (Bean and Metzner). Residence, for nontraditional students, describes commuter students that live off-campus. Research identified by Bean and Metzner (1985) cited commuter students spend less time on campus, have few friends on campus, and interact less with faculty. Nontraditional students are seen as socializing less on campus, which supports the researchers' use of environmental variables. Qualities exclusive to older, part-time commuter students are key to separating Bean and Metzner's (1985) model from that of Spady (1970), Tinto (1975) and Pascarella (1980).

The researchers predict an indirect relationship exists between educational goals and attrition. Educational goals can be motivational for students and are also used by Tinto (1975) and Pascarella (1980) in their background variables. Bean and Metzner (1985) placed educational goals within the background variable based on previous theoretical models and the need to assess its impact on non-traditional students. High school performance has also been noted as a strong pre-enrollment quality of traditional students (Bean and Metzner, 1985). High school performance is operationalized as high school ranking, standardized test scores, and high school grade point average (GPA). Previous research on high school performance and college attrition is varied in its findings of nontraditional students (Bean and Metzner). Academic abilities in high school are expected by the researchers to be repeated in students' academic performance in college.

Coding methods in prior research pose challenges in attempting to identify a relationship between ethnicity and attrition (Bean and Metzner, 1985). For this model, the researchers recognized a negative indirect effect of ethnicity on persistence (Bean and Metzner, 1985). Bean and Metzner (1985) identified that weak educational preparation for diverse students places them at risk for college attrition. Bean (1980, 1981) and Spady (1971) found in their research findings gender differences existed between men and women relating to college persistence (as cited in Bean and Metzner, 1985). Females are seen to have more family responsibility and are not able to transfer out of their enrolled college as readily as men (Bean and Metzner). In this model, gender is assumed to indirectly impact attrition due to the researchers' assumptions of gender obligations outside of school. Background variables are unique to traditional students. The nontraditional student presents with different background qualities that impact his/her ability to persist in college. It is important to appreciate student qualities in order to effectively evaluate attrition in nontraditional students.

Academic variables. Academic variables, used by Tinto (1975), were also used by Bean and Metzner (1985) due to their effect on academic integration into the college system. Study skills, advising, absenteeism, major certainty, and course availability are included in the academic variables and are seen as having a direct impact on attrition via GPA. Study skills have been adopted by Bean and Metzner (1985) as a part of the academic variables. Bean and Metzner (1985) have discovered in the literature that students who reported weak study skills are at risk for dropping out. Previously published research has been inconclusive regarding academic advising and nontraditional

college students. The researchers did not note a direct or indirect effect of advising on attrition.

Bean and Metzner (1985) found absenteeism, as a marker for attrition, was limited in research on nontraditional students (Bean and Metzner, 1985). Absenteeism was included in the model based on prior research by Bean (1985) linking the occurrence of absenteeism and attrition (as cited in Bean and Metzner). Major certainty has also been cited in the literature as being positively associated with student persistence at four-year colleges (Bean and Metzner). If students are aware of their major, they have a goal, and have a higher probability of obtaining a degree. The researchers did not identify a direct or indirect affect from major certainty onto attrition. Course offerings and course scheduling can have positive and negative bearing on students' perception of course availability (Bean and Metzner). The researchers included course availability in their model, but do not predict a direct or indirect impact on attrition (Bean and Metzner). Individual personal dynamics of nontraditional students are believed to have a different effect on their academic abilities and are seen as impacting issues for attrition.

Environmental variables. Environmental variables, first used by Bean (1982), illuminate the concept that nontraditional students are impacted by their outside world. Personal finances, employment responsibilities, emotional support, inability to transfer, and family represent environmental variables. Lewin's (1935) "Dynamic Theory of Personality" states that behavior is determined by the individual and the current surrounding environment. For Bean and Metzner (1985), Lewin's (1935) theory provided support to exchange social interaction used in older models and replace it with environmental variables in their model (Bean and Metzner). The impact of personal

finances on nontraditional students has been researched with variations in the findings. Finances are included due to its impact on nontraditional students, who characteristically have financial obligations. Bean and Metzner (1985) felt hours of employment could take study time away from students and impact attrition. The researchers did not identify a direct or indirect relationship between hours of employment and attrition. Outside encouragement is similar to normative congruence, which is seen in Spady's (1970) and Tinto's (1975) models. Outside encouragement is defined as support from friends outside of the college, family, and employers (Bean and Metzner). The nontraditional student lives off of campus, is employed, and has family obligations. Bean and Metzner (1985) cite positive research findings indicating family encouragement promotes college persistence. Outside encouragement, hours of employment, and finances appear to be a good fit for the CMNUSA model due to the qualities of nontraditional students.

Family responsibilities describe married or unmarried students with at least one child. Bean and Metzner (1985) did not state a direct or indirect relationship between family responsibilities and attrition. However, previous research regarding the impact of family responsibilities implies a relationship does exist (Bean and Metzner). Opportunity to transfer has been found by Spady (1970) and Bean (1982) as an integral factor in attrition rates. The ability to transfer to another institution is a reason some students leave college. Bean and Metzner (1985) cited numerous studies reflecting reasons why students transfer to other colleges, thus giving credence to the impact of opportunity to transfer. Nontraditional students may have different aspects to their lives that separate them from traditional students. Environmental variables are unique to nontraditional

students, pose different challenges, and are viewed as potential impacting factors in attrition.

Social integration. Variables for social integration include relationships with campus friends and instructors, satisfaction with social life, and involvement with campus activities. Social integration is a central component to models by Spady (1970), Tinto (1975) (Bean and Metzner, 1985). Research investigating nontraditional students' socialization patterns and persistence were not clearly articulated in the literature. Bean and Metzner (1985) decided not to include social integration into the central component of the model.

Academic outcomes. Academic outcomes are measured by college GPA. Research by Spady (1970) and Tinto (1975) found grades encourage students to do well. Bean and Metzner (1985) discovered research where cumulative GPA and course grades present a negative effect for traditional and nontraditional students with attrition. The literature also recognized that GPA, at the time of attrition, was higher for nontraditional students (Bean and Metzner). A less predictive relationship between college GPA and attrition tends to illuminate Bean and Metzner's (1985) thoughts on the impact of the environment for the nontraditional student.

Psychological outcomes. Utility, satisfaction, goal commitment, and stress result in students' attitudes and are considered psychological outcomes. Psychological outcomes, according to Bean and Metzner (1985), are an indirect result of academic and environmental variables. Fishbein and Ajzen (1975) provide support for the use of psychological outcomes via their beliefs on attitudes that impact utility. If students do not believe the college education is useful, they may be at higher risk for leaving. Little

research has investigated utility and the older nontraditional student (Bean and Metzner). Locke (1976) also provides support for psychological variables based on his beliefs regarding emotions and satisfaction. Locke (1976) believes satisfaction is value based, subjective, acquired, and an emotional reaction. Values for satisfaction are developed from past and present experiences (Locke). Satisfaction is the extent to which a nontraditional student enjoys school. A negative relationship between satisfaction and attrition at four-year residential colleges, four-year commuter colleges, and two-year colleges was found in the literature. In addition, research was conducted by Metzner (1984) that identified a negative relationship between satisfaction and intent to leave for full-time and part-time students (as cited in Bean and Metzner, 1985). The CMNUSA model provides an understanding of the impact satisfaction and utility have on nontraditional students. Students' views on utility and satisfaction of their current academic experience are expected to be impacted via Locke's (1976) thoughts on satisfaction and the impact of past and present experiences.

Goal commitment reflects the students' dedication to graduating (Bean and Metzner, 1985). Educational aspirations are tied to goal commitment due to the students' desire to obtain a college degree. Goal commitment and educational aspirations have been evaluated in the research of four-year residential and commuter schools and are found to have a positive effect on persistence (Bean and Metzner, 1985). Stress can be a problem for all students regardless of traditional or nontraditional status. In the literature, stress appears to be tied to personal problems, yet the literature did not tie stress to outside causes. Most students have personal responsibilities that may limit their time and attention to course work. The individual qualities of nontraditional students may place

them at higher risk for stress, which places stress as a significant component of Bean and Metzner's (1985) conceptual model.

Intent to leave. The intent to leave variable reflects students that are planning on leaving college before graduation. According to Fishbein and Ajzen's (1975) "Theory of Belief, Attitudes, Intentions, and Behavior", attitudes and intentions are thought to be influential of behavior. In Bean and Metzner's (1985) model, attitudes about academics will impact the students' intent to leave. Tinto (1975) used institutional commitment as a predictor of intent to leave. Intent to leave was found by Pascarella et al. (1983) as a strong predictor for attrition (as cited by Bean and Metzner, 1985).

Relationship to Theoretical Framework of the Study

For this study, the concepts were extracted from the CMNUSA model and used as a supportive framework. A modified CMNUSA model was used for this study and included the background variable, academic outcomes, and the major factor of attrition. Background variables include students' pre-nursing GPA, age, ethnicity, gender, and ATI's CTE scores. The variables used in this study are supported by the literature. The CTE by ATI has not been researched as admission criteria or as a measure in regards to attrition occurrences of nursing students. The lack of research on the CTE by ATI can be viewed as a literature gap needing further investigation.

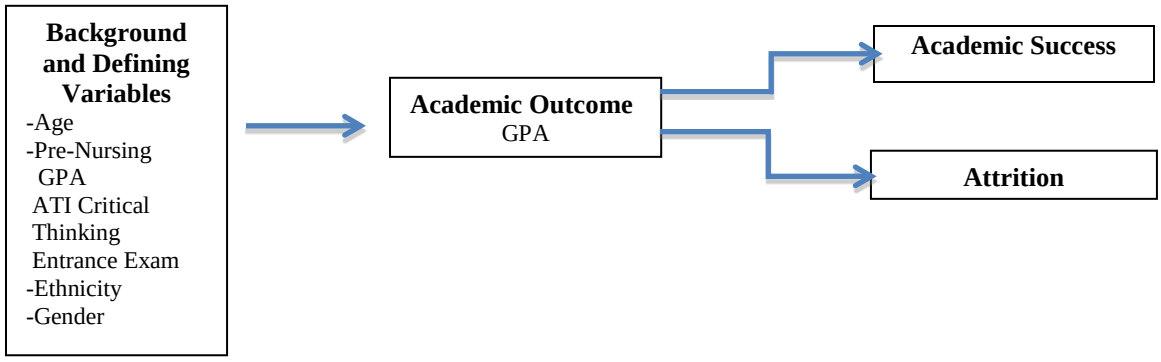
Several concepts in Bean and Metzner's (1985) background variables were not measured. In this study, residence as a variable was not applicable because all of the subjects will be commuter students. The ADN program under investigation was part-time and therefore enrollment status was not an applicable variable ([redacted] State College, 2011). High school performance, which is defined by Bean and Metzner (1985)

as high school GPA, high school rank, and standardized test scores, will not be used in this study. In this study, high school grades were replaced by pre-nursing GPA. The use of high school GPA as admission criteria for nursing programs is not well supported by current literature. The standardized exam, ATI's CTE entrance score, was used as a standardized exam instead of high school standardized exams. Furthermore, educational goals were not included in this study as a variable. All subjects applied to the ADN program and it is believed that the subjects' educational goals are to graduate.

Academic variables reflected GPA from the first six nursing courses. The following conditions will define student attrition: students with a course average equal to or less than a 75 or a "D" upon withdrawing or ending the semester results in failure and/or attrition.

In conclusion, the presenting qualities of nursing students are not only reflective of nontraditional students as defined by Bean and Metzner (1985), but they have characteristics similar to variables present in the CMNUSA model. Similarities exist among variables present in the CMNUSA model and nursing student characteristics. A supportive environment was created for use of the CMNUSA model as a theoretical framework for an investigation into nursing student attrition.

Conceptual Model of Nontraditional Undergraduate Student Attrition



Key:
Direct /Most Important Effects =

Fig B. The Conceptual Model of Nontraditional Undergraduate Student Attrition, adapted by Gagliano (2012), to depict the relationship among variables that may influence academic success and attrition.

DEFINITIONS OF KEY TERMS

In order to understand the variables in this study, conceptual and operational definitions are necessary. They are as follows:

Academic Success

Conceptual Definition. Academic success was operationalized by Hopkins (2008) as achieving an 80 (of 100) or higher as the final grade in the Nursing Fundamentals course, taken during the first semester.

Operational Definition. In this study, a course average of a "C" or 76 or higher at the end of the course will define academic success. Those subjects that experienced academic success will be coded for statistical analysis as "1".

Academic Outcome

Conceptual Definition. Academic outcomes can be defined as the students nursing course grade, cumulative GPA for nursing courses, and overall GPA (Jefferys, 2004).

Operational Definition. In this study, academic outcomes reflected students' nursing course GPA.

Attrition

Conceptual Definition. Attrition can be defined as a reduction in the numbers usually as a result of resignation, retirement, or death (http://www.merriam-webster.com/dictionary/attrition).

Operational Definition. In this study, attrition was defined as a student failing or withdrawing from a nursing course for academic reasons. Students with a course average equal to or less than a 75 or a "D" upon withdrawing or ending the semester results in failure and/or attrition. Attrition will be coded for statistical analysis as the subjects that failed a nursing course as "0".

Critical Thinking

Conceptual Definition. Critical thinking is defined as "a form of analyzing and problem solving that is essential in any practice profession". Concepts included in ATI's definition of critical thinking include interpretation, analysis, inference, explanation, evaluation, and self-reflection (Assessment Technologies, Inc., 2000, p. 1).

Operational Definition. In this study, critical thinking skills were an ordinal variable measured by the ATI's CTE exam (Assessment Technologies, Inc., 2000).

First Six Nursing Courses

Conceptual Definition. The first six nursing courses are required sequenced courses in the ADN program.

Operational Definition. In this study, the first year and a half of nursing school included the following courses: Nursing Fundamentals, Maternal Child Nursing, Psychiatric Nursing, Medication Administration, Adult Health Respiratory/ Gastrointestinal Nursing, and Adult Health Genitourinary/Endocrine Nursing.

ASSUMPTIONS

Assumptions for this study include:

- Nursing students can think critically prior to the admission into the nursing program.
- Critical thinking can be accurately measured by the CTE by ATI.
- Students want to be academically successful.
- Students answered the CTE entrance test by ATI honestly.
- Test scores for the CTE entrance by ATI will only be used if all questions are answered.
- The educational goal of students enrolled in the ADN program is to graduate.

SIGNIFICANCE OF THE STUDY

The significance of this study may reach broad and deep within the discipline of nursing. Findings from this study may enhance nursing research, and nursing education,

and increase of the number of nursing graduates. Increases in nursing graduates may benefit the discipline of nursing and the health care community at the local, state, and national level.

Nursing Education

The findings of this study may have several benefits for nursing education. Identification of effective admission criteria will provide nursing programs the ability to choose applicants that are prepared for the rigor of nursing school. Applicants that are prepared for nursing school will have stronger academic variables such as pre-nursing GPA and scores on the CTE by ATI. Based on previous research by Newton, Smith, and Moore (2007) academic variables such as pre-nursing GPA have proved to be reliable indicators of students' academic success in the first semester of nursing school. In addition, the research findings may also illuminate a benchmark for students at-risk for failing. If nursing faculty is aware prior to admission which students may fail, additional support for at-risk students could be provided. The identification of reliable admission criteria will allow nursing programs to admit qualified students who will persist, resulting in lower attrition and higher graduation rates, (Newton and Moore, 2009) and decreasing the nursing shortage. Higgins (2005), Newton, Moore, and Smith (2007), and Rosenberg, Perraud, Willis (2007) recommend further research focusing on identifying accurate indicators of attrition and academic success.

Findings from this study may assist nurse educators to maintain accreditation standards and to better articulate solutions for retention in nursing education. The Southern Association of Colleges and Schools Commission on Colleges (SACSCOC) and the National League for Nursing Accreditation Commission (NLNAC)

are accreditation agencies for higher education. When a college or university is undergoing accreditation, SACSCOC assesses for compliance with federal guidelines discussed in "Principles for Accreditation: Foundation for Quality Enhancement" (SACSCOC, 2010). The U. S. Department of Education, SACSCOC, and the NLNAC require nursing programs to monitor student success and course completion rates (SACSCOC; National League for Nursing Accrediting Commission, 2008).

The limited number of available nursing faculty places stress on current nursing programs to graduate more nurses. Fox and Abrahamson (2009); Scherzer, Stotts, and Fontaine (2010); and Reinhard and Hassmiller (2011), cite limited faculty as one of the causes for reduced admission rates and a contributing factor to the nursing shortage. The resources are absent to change student-faculty ratios and to increase enrollment in nursing programs (Scherzer, Stotts, and Fontaine). Nurse educators have to identify new and innovative methods to reduce attrition and to increase the number of nursing graduates. Discovery of alternative admission criteria that identifies qualified students may increase retention and provide some relief to the nursing faculty shortage.

Nursing Practice

Findings from this study may improve nursing practice by increasing the quality of care and the number of nurses in the workforce. Nurses that think critically can maneuver through the difficult decisions about how to provide safer patient care and reduce the risk of nursing error (Jones and Morris, 2007). Critical thinking has been identified as a key quality nurses must demonstrate when caring for patients. Investigating students' critical thinking scores at the beginning of a nursing program may provide nursing educators a boost to greatly improving students' abilities. A benchmark

may be identified for critical thinking skills of students entering nursing programs. The establishment of a baseline critical thinking score may allow uniformity of critical thinking abilities of the beginning student. Instructional initiatives may then expand students' critical thinking abilities while enrolled in a nursing program. The end result may be broadened critical thinking abilities of the nursing graduate. Nurse graduates that have improved critical thinking abilities will improve their practice at the bedside. Hence, increased critical thinking abilities of nursing graduates allows for more qualified nurses to provide safe patient care from which the community as a whole benefits.

Students' academic success while enrolled in a nursing program results in an increase of graduates, which may directly impact nursing practice. The need for more qualified nurses to care for patients is well documented in the literature. Patient safety may be in jeopardy if qualified nurses are absent from the bedside due to a shortage. Research conducted by Needleman, Buerhjaus, Pankratz, Leibson, Stevens, and Harris (2011) found low staffing levels of registered nurses increases patient mortality. If nursing education finds the keys to unlock a solution for ineffective admission criteria, more students may graduate. The end result of an increase in nursing graduates should be an increase in qualified nurses in the workplace.

Nursing Research

The results of this study will contribute to the literature base of ADN education. Attrition in nursing is still ongoing and an extension of nursing science may uncover a solution. ADN graduates comprise approximately 60% of the registered nurses. Associate Degree Nursing programs produce the largest number of registered nurses (RN) in the U.S. While ample amounts of literature have been published regarding

attrition of nursing students, the search for effective methods to reduce attrition still remains unresolved. Research studies conducted by Higgins (2005); Rees, (2006); Stuenkel (2006); Newton and Moore (2009); and McNelis, Wellman, Splann-Krothe, Hrisomalos, Mcelveen and South (2010) all identified the lack of a clear indicator for academic success from admission criteria. The National Institute of Nursing Research (NINR) (2011) has identified the need to improve methods for future scientific discoveries as part of their strategic goals. In following the lead set forth by the NINR, additional research is needed to open the door to new methods for improving educational practices to reducing attrition of nursing students in ADN education.

A literature gap exists regarding critical thinking and ADN education. A literature search in Academic Search: EBSCO and CINAHL Plus with Full text electronic databases identified studies by Vaughan-Wrobel, O'Sullivan, and Smith (1997); Myrick (2002); Profetto-McGrath (2003); Todd, Manz, Hawkins, Parsons, and Hersinger (2008); and Vacek (2009) which focus on critical thinking in BSN education. The nursing science regarding ADN students and their critical thinking abilities should be expanded. Nursing education appreciates the importance of critical thinking. Mun (2008) states "one of the ultimate aims of nursing education is to develop students' critical thinking abilities" (p. 1). Therefore, it is necessary to extend the current nursing science regarding critical thinking of nursing students. A broader understanding of ADN student abilities will provide tools for nursing educators to expand students' educational capabilities.

Health/Public Policy

Hospitals, healthcare facilities, and the communities they serve may benefit from this study. A reduction in attrition and an increase in nursing graduates may assist in

reducing the nursing shortage. The population of the U.S. continues to expand and will require more nurses to care for patients. The United States Department of Labor, Bureau of Labor Statistics (2009) predicts new jobs in nursing will expand by 22% during 2008 – 2018. Furthermore, a bill has been introduced into the Congressional session for 2011 – 2012, *RN Safe Staffing Act*, which encourages safe staffing levels for registered nurses across this country (American Nurses Association, 2012). If this bill is passed, the need for more nurses may increase, and nursing education may have to increase its graduates to meet the staffing needs. The looming nursing shortage threatens the discipline of nursing to safely care for patients. Academic success of students is at the core of nursing education and it provides a lifeline to nursing. To overcome the shortage, more nurses are needed to care for patients. The academic success of nursing students is imperative to reduce student attrition and increase nursing graduates.

LIMITATION OF THE STUDY

Limitations for this study include:

- The use of a single setting sets limitations of the findings of this research study.
- Without multiple sites for sampling, the researcher's findings are not generalizable.
- The subjects will be from one geographic area.

VALIDITY

Validity is a necessary component in research that provides the reader a level of confidence with the study. Validity, within a quantitative study, addresses specific

components that can either weaken or strengthen the research findings due to methods used or not used to conduct the study. A deeper investigation into validity requires a discussion of internal and external validity.

Threats to Internal Validity

Several threats to internal validity exist in correlation designs because true causation is not being established within the study design. The lack of random assignment blurs the ability to distinctively tie the independent variables to the dependent variable. Extraneous variables, such as family stressors, financial restrictions, and personal emergencies may deflect the student from studying and successfully completing the course or cause the student to leave the program. The extraneous variables may result in an academic failure and/or program withdrawal.

Threats to External Validity

The use of a convenience sample can pose a threat due to the lack of random assignment. The use of random assignment expands the generalizability of a research study (Houser, 2008). A convenience sample was used from a state college in southeast Florida. Therefore, the generalizability is limited to similar populations reflective of the sample. This is the first time ATI CTE entrance scores have been used to correlate a relationship among admission criteria and attrition. Further replication of this study at several different sites may increase its generalizability and decrease threats to external validity (Polit and Beck, 2011).

CHAPTER SUMMARY

The ever-expanding nursing shortage calls for nurse educators to increase nursing graduates. The ability of nurses to provide quality care is in jeopardy. Attrition of nursing students is slowly chipping away at potential nurses. The nursing shortage, nursing education, and nursing students are all casualties of attrition. The current number of qualified nurses will not meet expected demands in health care. Nursing education needs to discover ways to reduce nursing student attrition and increase nursing graduates.

A wide range of variables for admission criteria have been investigated with sometimes varying and conflicting results. The lack of one clear indicator of attrition of nursing students leaves nursing education in a dilemma regarding which admission criteria to use for admitting students. Effective admission criteria may decrease attrition and increase academic success of nursing students (Newton, Smith, Moore, and Magnan 2007; Stuenkel, 2006; Yoho, Young, Adamson, and Britt, 2007).

Empirical studies may be one way to gain more knowledge regarding factors associated with attrition. This study utilized a correlational research design to investigate whether admission criteria can identify indicators of academic success and/or attrition of associate degree nursing students. A modified version of the Bean and Metzner's CMNUSA model provided a supportive framework for variables that may be predictive and reliable for this study. If predictive academic predictors can be defined, nursing education may graduate more nurses and help reduce the nursing shortage.

CHAPTER TWO

REVIEW AND CRITIQUE OF THE LITERATURE

A search of relevant literature across disciplines was conducted to explore the phenomenon of attrition of nursing students, admission criteria, and critical thinking. Using First Search and ProQuest Direct search engines, the following computerized databases were used for this search: the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Educational Resource Information Center (ERIC), Health Reference Center-Academic and Periodical Abstracts (PerAbs: Covering nursing students, critical thinking, attrition, and admission criteria). Key words used in the search were attrition, admission criteria, and critical thinking. Citations were limited by language to English and by subject exploration of the concepts. A limitation was imposed to find literature published since 2006 with classics sought by reviewing citation in the published works. A random selection process delimited the profusion of theoretical references that were found. Fourteen studies were reviewed in which attrition, critical thinking, and admission criteria were chosen for review. The literature review will be divided by discipline into the major theoretical and research literature addressing admission criteria, attrition, and critical thinking. Synthesis of the literature reveals what is known and not known about admission criteria, attrition, and critical thinking in associate degree nursing programs.

The problem addressed by this research study is nursing student attrition. The use of admission criteria in nursing programs has not reliably predicted attrition rates. The purpose of this study was to identify if a relationship exists between admission criteria and attrition in an ADN program. The Bean and Metzner (1985) CMNUSA framework

guided the research study through the use of its variables. The background variables and academic outcomes supported the study to identify whether a relationship existed with attrition or drop out. High attrition rates are well documented in the literature. The identification of a relationship between admission criteria and attrition may assist in reducing academic failure, increasing nursing school graduates, and decreasing the nursing shortage.

REVIEW AND CRITIQUE OF THE LITERATURE

Admission Criteria and Attrition

Nurse educators struggle to choose the best variables to use as admission criteria to predict academic success. An evaluation of nursing literature by Wolkowitz and Kelley (2010) found variances in use and effectiveness of standardized assessments. The nursing literature has not been able to identify one admission variable that consistently predicts academic success in nursing students. The lack of identified effective admission criteria is a problem for nursing programs because they are not able to consistently admit the most qualified applicants (Wolkowitz and Kelley, 2010). Standardized exams like the Scholastic Aptitude Test (SAT) and the American College Test (ACT) are used for students entering post-secondary institutions. These exams also provide composite scores that are not weighted, thus not identifying strong sub-scales.

The researchers believe that science and reading sub-scores from standardized exams may predict academic success of nursing students. Little empirical research exists on the impact of science sub-scores on a standardized exam. Prior research by Lewis and Lewis (2000) found science course grades to be predictive of academic success in nursing school. Wolkowitz and Kelley (2010) published a study that sought to identify the most

effective indicator(s) to predict students' academic success in nursing programs. The research design was not discussed in the literature. The researchers' independent variables were Assessment Technology Institutes (ATI)'s Test of Essential Academic Skills (TEAS) standardized examination. The TEAS: 1.0 – 4.0 composite scores are weighted and evaluate reading, mathematics, English, and sciences abilities. The TEAS exam has 170 multiple choice questions with four choices for answers. The alpha is 0.62 and a standard error of the mean is 72. The English component of the TEAS is weighted the most, followed by mathematics, reading, and science respectively (Wolkowitz & Kelley). The ATI RN Fundamentals 2.1 is a 60-item exam with a standard error of 68.75 and an alpha of 0.62. This examination assesses nursing students' knowledge of fundamentals of nursing (Wolkowitz & Kelley, 2010). The dependent variables of the researchers' study consisted of the subjects' RN Fundamental examination scores.

The researchers mailed a survey to 314 directors of nursing programs that used both the TEAS and the RN Fundamentals exam between May 1, 2005 - 2008. The convenience sample consisted of 4,105 subjects' first time examination of TEAS and RN Fundamental Test scores. The data was divided into three groups depending on the subjects' educational level of ADN, BSN, and combined ADN and BSN. The researchers did not discuss specific qualities of the sample. Wolkowitz and Kelley (2010) used Statistical Package for the Social Sciences (SPSS) 15.0 to conduct a multiple regression analysis evaluating TEAS sub-scores and the RN Fundamental scores identified $p < 0.01$ and $R^2 = 0.20$ indicating 20% of variance in the scores. The low correlation may be a result of the closeness in the timing of administering both exams. The researchers discovered that science and reading scores were more predictive than

verbal, written, and math scores on the TEAS for all educational levels. Science was the strongest sub-score with a R^2 of 0.15 (Wolkowitz and Kelley, 2010).

The study by Wolkowitz and Kelley (2010) contributes to nursing education by illuminating a potential tie between the TEAS science scores and academic success. Gilmore (2008) and Hopkins (2008) also cited past literature that tied science grades to having a positive impact on NCLEX-RN success. The emergence of science and reading make sense because reading comprehension and sciences are concepts incorporated into nursing curriculum.

Due to the use of multiple variables used as predictors of academic success, the researchers also recommend focusing on science sub-scores and other standardized tests. This research study supports the use of multiple variables for admission criteria. Findings from this study contribute to this literature review by illuminating the ability of admission criteria to predict academic success of nursing students. The researchers believe the use of the RN Fundamentals exam as a limitation in this study and recommend evaluating the TEAS effectiveness with a measurement later in the nursing program.

Newton and Moore (2009) identified a plethora of information discussing the use of standardized aptitude tests as a mechanism to identify predictors of academic success. The researchers feel tougher admission policies may decrease attrition and failure of the state board licensure exam, the National Counsel Licensure Examination for Registered Nursing (NCLEX-RN). A literature review, conducted by the researchers, isolated only a few studies that assessed long-term academic success in nursing students. The

researchers identified that current aptitude tests used for admission criteria only found academic success early in the nursing program (Newton and Moore).

Newton and Moore (2009) set out to describe the relationship among pre-nursing aptitude, nursing aptitude, scores on a pre-NCLEX-RN assessment, and student attrition. Independent variables of scholastic and nursing aptitude were used in the study. Scholastic aptitude was defined as pre-nursing grade point average (GPA) and nursing aptitude was defined as scores from ATI's TEAS test (Newton and Moore, 2009). The TEAS validity and reliability have been previously discussed. The NCLEX-RN reliability is between 0.87 – 0.92 (NCSBN, n.d.). Dependent variables were classified as late attrition and ATI's RN Predictor examination scores. The ATI RN Predictor exam is administered to students at the end of the nursing program and the exam assesses their readiness for the NCLEX-RN exam. Students that did not move forward into the final semester operationalized attrition. Academic failure was defined as a student that received an average of 2.5 or less, on a scale of 0 to 4.0, in a nursing course (Newton and Moore).

An exploratory descriptive research design was used for this research study. A convenience sample of 94 was obtained from a midwestern BSN program in the fall of 2004 (Newton and Moore, 2009). Demographics on the sample were not provided in the literature. The researchers used SPSS version 15.0 to examine the data. A regression analysis used by the researchers found that neither the TEAS nor GPA was an effective predictor of academic success before the final semester. The researchers found pre-nursing GPA was an indicator of NCLEX-RN readiness ($P = .015$). Pre-nursing grades of less than 2.5 were not found to be predictive of long-term attrition or NCLEX

readiness. Newton and Moore (2009) did discover the first semester nursing GPA was a reliable indicator of NCLEX readiness with an r = .275. Earlier work by Newton, Smith, Moore, and Magnan (2007) and Newton, Smith, and Moore (2007) found TEAS scores and pre-nursing GPA scores were indicative of first semester success.

The findings of this study are weak and do not build on prior research conducted by Newton, Smith, Moore, and Magnan (2007) and Wolkowitz and Kelley (2010) that found early academic success to be determined by TEAS composite scores or sub-scores, and pre-nursing GPA. Furthermore, Wolkowitz and Kelley (2010) found success with the TEAS science and reading sub-scores, whereas Newton, et al (2007) found success with the TEAS composite score. The uncertainty regarding the TEAS and its ability to predict success past the first semester supports the need for this study to examine other standardized exams for admission criteria. Additional research may be needed to further clarify the effectiveness of the TEAS (Newton and Moore, 2009). The researchers encourage additional investigations into "core" variables related to attrition. It is believed by the researchers that the impact from demographics and psychosocial variables may not directly relate to attrition, but in specific situations may have a potential impact on student success (Newton and Moore). The researchers recommend more of a focus on using admission criteria that can predict long-term attrition.

The nursing shortage has placed a necessary urgency on nursing faculty to graduate more qualified nurses. It is common practice for admission criteria to be used as a predictor of academic success or to identify students at risk for failure. Hopkins (2008) identified numerous research studies that identified academic and demographic variables that successfully and unsuccessfully predicted academic success. Hopkins (2008) felt

one method to encourage academic success may be to identify a method to predict academic success in the first semester. In 2008, Hopkins published a study to identify a model for detecting success in nursing students.

Academic variables used in this study included the ACT, SAT, high school GPA, college cumulative GPA, and math and reading scores on the Nurse Entrance Test (NET) by Educational Resources Institute (ERI) exam. Hopkins (2008) transformed the ACT scores to be equivalent to the SAT scores and reported on them together. The researcher did not discuss how this process was conducted or how the ACT sub-scores and SAT correlated. The NET is a diagnostic instrument used by nursing programs to identify at risk students prior to admission. The NET evaluated students' math, reading comprehension, reading rate, critical thinking, test taking, learning styles, stress levels, and social interaction. The researcher also included critical thinking scores, five stress levels, two learning styles scores, and one testing score identified on the NET. The NET has an internal reliability coefficient of 0.92 (Hopkins). The researcher did not provide discussion of the reliability or validity of the SAT or the ACT. Academic success was operationalized as a course average of 80 in nursing fundamentals. Non-academic variables included gender, race, and age. Independent variables used by Hopkins (2008) consist of the ACT, SAT, high school GPA, college cumulative GPA, and math and reading scores on the NET, age, gender, and race. The dependent variable is academic success as operationalized by a course average of 80 in nursing fundamentals (Hopkins).

The researcher did not articulate what research design was used for this study. Hopkins (2008) obtained a convenience sample from 383 ADN students at a college in the southeastern United States. Final grades in nursing fundamentals were obtained from

the nursing department. The researcher inputted data into an SPSS 12.0 program. Hopkins (2008) used a regression analysis and was successful at predicting academic success X^2 (9,N=383) – 33.10, $p < 0.01$). Data revealed 89.6% of subjects were females and 62.1 % were white. The mean SAT score was 1014, mean age 28.2, mean college cum GPA 2.89, mean high school GPA 3.06, mean college GPA was 2.89, and the average Fundamentals grades was 84.7%. The researcher's findings indicated an 82.5% rate of predicting academic success with the use of SAT scores, high school GPA, and NET scores. However, the data only correctly categorized 5.9% of student failure. A model did emerge from the data that included SAT scores, NET reading and math scores, and high school GPA for academic success (Hopkins). The researcher found the model was not predictive of academic failure.

Data identified by Hopkins (2008) does expand the knowledge base regarding ADN students' admission criteria. Hopkins (2008) found the NET, along with SAT scores and high school GPA, to be a predictor of academic success in the first semester. Since the publication of this study, the NET is no longer available for use. The research findings are still useful in the fact that math and reading scores were found to be predictive of academic success in the first semester. Students' reading ability has been cited in Wolkowitz and Kelley (2010) and in other studies as being predictive of academic success. Sayles, Shelton, and Powell (2003) correlated positive results on the NET reading score to higher nursing GPA and NCLEX success. The researcher recommends more research attempting to predict attrition past the first semester into the second year and for NCLEX-RN success.

Large numbers of qualified BSN applicants are turned away annually from nursing programs and at the same time large numbers of students are failing nursing school. The nursing shortage is calling for more nursing graduates, but nursing education struggles to meet the demands. Attrition of nursing students is indirectly impacting the nursing shortage (Peterson, 2009). Past research investigating attrition found numerous variables have been used with conflicting results. This researcher believes improving prediction of nursing students abilities may increase graduates.

Peterson (2009) was interested in pursuing key points in Bean and Metzner's CMNUSA framework. Specifically, the researcher felt self-perception, self- esteem, and past academic performance may impact academic success. Prior research on self-esteem and self-efficacy found positive and negative relationships relating to GPA and attrition. In an attempt to better predict student attrition, Peterson (2009) directed a study investigating if a relationship exists between pre-nursing GPA, self-esteem, self-efficacy, and academic success in the first semester of nursing school. Psychological variables in Bean and Metzner's (1985) CMNUSA supported the use of self-esteem and self-efficacy (Peterson). If researchers can identify a system of predictors for at-risk students, more nursing students might be able to graduate.

Peterson (2009) conducted a correlational research study with 66 students from a convenience sample at a BSN program located at a four-year residential university in the northeastern United States. Students were enrolled full-time in their first nursing course. Independent variables were age, gender, ethnicity, pre-nursing GPA, the Rosenberg Self-Esteem Scale, and the General Self-Efficacy Scale. The Rosenberg Self-Esteem Scale has been found to be effective in assessing self-esteem, stress, and adaptation in prior

research of adults over 25 years of age. A four-point Likert scale measures self-esteem for a ten-item questionnaire. A score ranges from 0 – 30 representing answers regarding subjects' responses from strongly agree to strongly disagree. The Rosenberg Self-Esteem scale has test-retest correlation ranges from 0.82 – 0.88. The General Self-Efficacy Scale also has positive findings in previously published research in 26 different languages in 23 different nations. A four-point Likert scale measures subjects' responses ranging from exactly true to not at all true. A Cronbach's alpha for the General Self-Efficacy Scale ranges from 0.76 - 0.90. Dependent variables included first semester grade point average operationalized as 2.5 or above (Peterson, 2009).

Demographic data revealed 34.8% African-American, 18.2 % Asian, 15.2% Hispanic, 13.6% Caucasian, and 18.2% identified "other" as ethnicity. Females comprised 89.4% of the sample. A Power analysis found a minimum of 50 subjects were needed or $\alpha = 0.05$. one-tailed, and $\alpha = 0.10$, two tailed. The sample reported 72% felt they had a high level of self-esteem and 62% identified a high level of self-efficacy. No relationship was found between self-esteem ($r = -0.022$), self-efficacy ($r = -0.025$), and academic success. Academic success was not related to age, ethnicity, or gender. Past academics were positively correlated to first semester subjects' ability, which was identified by a $r = 0.514$, $p < .01$. Peterson (2009) also stated 29% of the sample did not proceed on to the second semester due to poor academic success.

The researcher's findings are significant for this literature review and extend nursing science due to the repeated connection between past academic performances predicting future student performance. Pre-nursing GPA predicting academic success also is reflective of the premise for the background variables in Bean and Metzners'

(1985) model. Furthermore, Peterson's (2009) findings support the continued use of academic indicators for predicting student attrition. The researchers findings also mirror Newton, Moore, Smith, Magnan (2007) and Hopkins' (2008) previous research correlating past academic performance of pre-nursing GPA to be reflective in first semester success. The researcher does recommend future investigations using multivariate predictors for attrition.

Attrition of nursing students in Great Britain is widespread, causing many to question the effectiveness of their nursing education programs. In Great Britain, attrition rates ranged between 6 – 26% during 1994 – 2001. Attrition of nursing students affects more than just nursing education. Nursing students have a unique and individual experience with attrition. O'Donnell (2009) wished to understand better the reasons and emotional experience of students as they voluntarily withdrew from nursing and midwifery school. The researcher used a case study design with semi-structured interviews. A purposeful sample of students that left nursing school from 2004 – 2007 was mailed a letter regarding their participation in the study (O'Donnell). A sample was obtained from 15 participants that withdrew from a nursing program. The interviews lasted one hour and were conducted at a site that was chosen by the participant. The author completed all of the interviews to reduce bias. Semi-structured interviews were conducted. Two pilot interviews were completed prior to the study with two participants that withdrew voluntarily from a nursing program. Data was analyzed using the Cyclical or Interactive Model of qualitative data analysis (O'Donnell).

Themes identified by the researcher included distress and relief. While enrolled, the participants expressed stress and experienced health problems. Once participants left

the program, feelings of shame, failure, and relief emerged (O'Donnell, 2009). Participants described, "my sleep was disturbed", "feeling sick", and "I thought I was headed for a nervous breakdown" (O'Donnell, 2009, p. 750). Participants reported experiences centered on feeling ill and emotional while academically struggling and deciding to withdraw. Some participants reported relief, "I felt relief" and "It was the right decision" (O'Donnell, 2009, p. 750). Support, as stated by the participants, prior to and after withdrawal came from friends. Findings were reflective of previous research that identified stress on the part of the student that is withdrawing. The researcher also identified attendance is tied to poor academic performance.

The use of friends, and not formal mechanisms, for support during and after the process of withdrawal (O'Donnell, 2009), reinforces previous research and environmental variables in Bean and Metzner's (1985) CMNUSA framework. Implications from this study contribute to the nursing science and can assist nurse educators to be more sensitive to absences and signs of stress in students. It may also be beneficial for nurse educators to implement initiatives reflective of Bean and Metzner's (1985) environmental variables for additional student support. The results of this study contribute to the literature review by clarifying the personal challenges students undergo as they academically fail and leave nursing school. A better understanding of students' experiences underscores the importance of identifying more effective mechanisms to ensure students admitted to nursing programs are successful.

Murray, Merriman, and Adamson (2008) conducted a study investigating the ability of Health Education Systems, Inc (HESI) Admission Assessment (A^2) to predict academic success in ADN and BSN programs. A nursing shortage demands more nurses,

yet nursing education is restricted with limited faculty. Large applicant pools require nursing programs to identify the most qualified applicants. The researchers noted that high school and pre-nursing grade point average might not be a reliable indicator for academic success in nursing education (Murray et al, 2008). Variations in grading scales and grade inflation have reduced the reliability of grade point average as an indicator or predictor for academics. Therefore, the researchers chose to seek alternative predictors for academic success.

The researchers elected to define academic success as a student's ability to pass the NCLEX-RN exam. The HESI A^2 evaluates students' learning styles, personal attributes, and behavioral inventory, math, English, vocabulary, science, biology, anatomy and physiology abilities. The independent variable was the A^2 exam and the dependent variables included nursing course grades, program completion, and passing the NCLEX-RN exam.

Murray et al., (2008) conducted a longitudinal descriptive research study examining 217 ADN and 69 BSN students' academic success and program completion. Characteristics of the sample were not provided by the researchers. The HESI A^2 was administered to subjects after admission to the ADN and BSN programs. A computerized version of the HESI A^2 was used for the study. The HESI test items had a reliability coefficient, Kuder-Richardson formula 20.17, between 0.9783 – 0.9900. The exam was offered electronically via a secured Internet. Multiple-choice questions with four to five choice answers are used on the exam. Course grades were obtained from the nursing program's database. The NCLEX-RN reliability is between 0.87 – 0.92 (NCSBN, n.d.). The researcher conducted a regression analysis to assess if the HESI A^2

could predict academic success. Data from the BSN subjects revealed a 50% positive correlation with course grades 88.9%, r = 0.241 – 0.374 for BSN graduates. All 69 BSN subjects were successful and passed the NCLEX-RN (Murray et al., 2008).

Of the 217 ADN subjects who took the HESI Admission Assessment, 37.2% were unsuccessful in the nursing program. It is important to note that after the A^2 scores were obtained, subjects with low scores were referred for additional support. The average score for unsuccessful subjects on the A^2 was 70.4 compared to 75.98 (two-tailed t test = 4.48) scored by ADN subjects who were successful in the nursing program. Yoho, Young, Adamson, and Britt (2007) also used the HESI A^2 math and reading scores as academic predictors and experienced a 55% long-term attrition rate. It is interesting to note that Murray et al (2008) found A^2 scores positively correlated with eight of the nine course grades with r = 0.253 – 0.442.

This study expands nursing science regarding standardized exams and admission criteria. A significant difference in academic success was found between ADN and BSN subjects. A five-point difference on the A^2 existed among ADN subjects that failed or passed. Unfortunately, high attrition rates associated with A^2 scores and ADN students presents a weakness in the literature regarding the HESI A^2, admission criteria, and attrition. The findings from this study support the literature review by making clear the need for alternative standardized exams used as admission criteria for ADN programs.

Population growth and advances in health care have produced a need for more nurses. Within the next ten years, 29.4% additional graduates will be required to help reduce a shortage of qualified nurses. Nursing education can help suppress the nursing shortage by reducing failure rates and increasing graduates. Gilmore (2008) found a lack

of knowledge regarding the ACT reading scores and academic success in nursing programs. Prior research by Gallagher, Bomba, and Crane (2001) found a relationship with academic success and nursing students' reading ability. The ACT's reading and English sub-scores were found by Taraban, Rynearson, and Kerr (2000) to be correlated with students' comprehension (as cited in Gilmore, 2008). Therefore, the researcher wished to extend the knowledge regarding the ACT and its predictability as admission criteria for nursing programs.

The researcher conducted a retrospective correlational study examining admission criteria, academic success, and NCLEX success. Independent variables included ACT composite scores, ACT reading, math, English, pre-nursing GPA, along with course grades in anatomy and physiology I and II. Dependent variables included nursing GPA and passing the NCLEX-RN exam (Gilmore, 2008). The reliability for the NCLEX-RN is between 0.87 – 0.92 (NCSBN, n.d.). The researcher did not discuss the reliability of the ACT (Gilmore).

Gilmore's (2008) sample consisted of 218 ADN students from two different ADN programs in the southeastern U.S. between the dates of 2001 – 2003. Any students that withdrew or failed out of the program were excluded from the study. The sample was divided into two groups. One group with n = 178 subjects that successfully completed their ADN program and a second group with n = 42 that did not complete. Characteristics of the sample were not provided in the literature. Gilmore (2008) conducted a logistic regression analysis to investigate the independent variables' effect on nursing GPA. The data revealed the group that completed the program had an average composite score on the ACT of 19.70, and the students lost to attrition scored 18.85. The

students that completed the nursing program also had higher ACT reading and English sub-scores than the group of students that did not complete. The ACT science sub-score was not significantly different between the two sample groups. It is important to note that subjects that were successful on the first attempt on the NCLEX-RN had a 0.3 higher mean for a nursing GPA (Gilmore).

Independently, nursing GPA is predictive of success on the NCLEX-RN and the ACT English sub-score was predictive of academic success. The model identified by Gilmore (2008) is predictive of academic success with $F = 6.59$ and $p < 0.001$, and $R^2 = 0.196$. The ACT English sub-scores were found to be related to 20% of the variance for predictors of academic success (Gilmore, 2008). The researcher believes the positive findings are due to reading comprehension and its relationship to synthesis and critical thinking, which are reflective of nursing skills. The findings from Gilmores' (2008) research support the premise of this study and extend nursing science by correlating critical thinking skills, reading comprehension, and academic success. The researcher encourages future pursuit of the best predictors of academic success to assist in reducing attrition (Gilmore).

In summary, the literature that examines attrition of nursing students focuses on admission criteria. What is known in the literature regarding admission criteria predicting attrition revolves around the use of a standardized exam and pre-nursing grade point average. The need for additional research detecting effective admission criteria is repeated in the literature review. What is not known is what specific standardized exam is most effective at identifying students at risk for failing a nursing course. Conflicting results evaluating standardized exams used as admission criteria is a weakness in the

literature. Not only are the results on the standardized exams conflicting, the sub-scores measured by standardized exams are inconsistent with predicting attrition. Wolkowitz and Kelley (2010) did find that science and reading scores on the TEAS were predictors of early academic success, whereas Newton and Moore (2009) found that the TEAS composite score was not predictive of first semester or long-term attrition.

Gilmore (2008) found ACT English sub-scores were responsible for 20% of the variance; unlike Wolkowitz and Kelley's (2010) that found success stemming from TEAS science sub-scores. Hopkins (2008) did not discuss the ACT sub-scores in the results. Nevertheless, the multiple variables used to predict academic success require further research to strengthen their evidence.

Demographic Variables

Nursing education programs need to foster a rich diverse student population to ensure the workforce reflects the current population. Therefore, nurse educators should be aware of demographic variables that may challenge nursing students. Unfortunately, this literature review did not identify non-academic variables such as age, ethnicity, and gender that impact students' academic success. Peterson (2009) was the only study reviewed to report on non-academic variables and did not identify an impact from age, ethnicity, and gender on academic success. Hopkins (2008) did include age, gender, and ethnicity in the study, but did not discuss a relationship between the selected demographics and attrition. Schmidt and MacWilliams (2011) published a systematic review of undergraduate nursing programs' admission criteria. In the researchers' review of the literature, they failed to mention age, gender, and ethnicity as variables related to admission criteria. A study conducted by Yin and Burger (2003) evaluated age, gender,

and ethnicity, along with other academic variables, to predict NCLEX-RN success. However, Yin and Burger (2003) were not able to identify a relationship between age, ethnicity, and gender when predicting NCLEX-RN success. Pence (2011) conducted a study to evaluate students enrolled in Illinois ADN program's motivation, emotional intelligence, and retention. The data found age was a factor in retention with older students with a mean age of 29 having a lower retention rate during the first semester. Pence (2011) also tied ethnicity to attrition in certain ADN schools. Earlier literature by Evans (2006) and Bean and Metzner (1985) noted that poor academic preparation of ethnically diverse students poses challenges for their success in higher education.

It was interesting to note that Newton and Moore (2007) recommend further research to focus on "core" values and recommend focusing on academic variables to seek effective admission criteria. The research showed conflicting findings regarding the impact of age, gender, and ethnicity, which weaken the relationship between student demographics and academic success. Further research is needed to attempt to clarify if a relationship does exist between demographics and attrition of nursing students enrolled in an ADN program.

Theoretical Framework

Bean and Metzner's Conceptual Model for Nontraditional Undergraduate Student Attrition will provide a supporting framework for this study. The use of Bean and Metzner's model in research has been documented as being an effective tool to support research investigating attrition of college students.

Chartrand (1992) published a study to examine relationships between concepts of Bean and Metzner's (1985) Conceptual Model for Non-traditional Undergraduate Student

Attrition (CMNUSA). Chartrand's (1992) area of interest was on the lack of an understanding of non-traditional students (NTS) in higher education. Nontraditional students encompass almost half of the U.S. college student population and very little is known about their characteristics. The researcher describes NTS as students older than 24 years of age, with families and work responsibilities, enrolled part-time or full-time, live off campus, and have completed fewer than 60 college credits. In order to understand attrition of nontraditional students, Chartrand (1992) felt a framework that appreciated the unique characteristics and challenges of NTS should be utilized. Chartrand (1992) used a modified form of Bean and Metzner's (1985) CMNUSA framework.

The background variables used in Chartrand's (1992) study include age, educational goals, and high school GPA. Certainty of major, course and college satisfaction, and study skills encompassed the academic variable (Chartrand). The environmental variable consisted of family and friend support, finances, hours of employment, and family responsibility. Social variables were included in Chartrand's (1992) study but were not discussed in length. Psychological outcomes used by the researcher included institutional commitment, academic adjustment, and stress. Chartrand's (1992) psychological outcomes are modified from the original outcomes identified by Bean and Metzner's (1985). However, the researcher believes institutional commitment, academic adjustment, and stress is more closely correlated to the NTS and their stressors.

The researchers' sampling frame was 679 freshmen enrolled in a large southeastern university. Chartrand (1992) used a correlational research methodology.

The researcher used a correlation analysis, regression analysis, and a Goodness of Fit statistical analysis to evaluate the data collected (Chartrand). Data for background and academic variables were collected by the researcher and included on a questionnaire. Questions were ranked with a Likert scale. The environmental and social variables, along with psychological outcomes and intent to continue were all collected from 90 questions on the Student Transition Questionnaire (STQ). Major certainty was measured with four questions using a seven-point scale. Satisfaction with advising measured subjects' responses with four questions with a scale ranging from 4 to 20.

The environmental variables of friends and family support were measured by 11 questions with an internal consistency ranging from 0.84 - 0.93 on the STQ. Subjects' difficulty with finances was measured with one question that ranged from (1) inadequate to (5) representing difficult. Subjects reported weekly work hours with responses for one question ranging from 0 – 5 = 1 hour, and 9 = over 40 hours. The number of children for whom the subject was responsible for was measured on a scale between 1, representing one child over the age of 18 to 5, representing subjects with one or more children less than 3 years-of-age (Chartrand).

The subjects' social integration was assessed on the STQ with 20 questions, r = 0.90, with a range of items from 20 – 80 with the higher numbers reflecting more social integration of the subject (Chartrand, 1992). Seven questions on the STQ addressed the psychological outcomes, r – 0.79, with items ranging from 7 – 28 with the higher numbers representing more commitment and satisfaction with the college. Academic adjustment, on the STQ, represented 16 questions, with a responses ranging from 20 – 80

and an internal consistency of r = 0.92). Subjects answered 20 questions focused on psychological distress, responses ranged from 20 – 80, and an internal consistency of 0.91 (Chartrand, 1992). Intent to continue was measured by two questions on the STQ with responses ranging from 2 – 8. The responses reflected the subject's intent to remain or stay enrolled. Chartrand (1992) did not discuss an internal consistency with the intent to continue measurement.

The sample consisted of 28.2% freshman, 49% sophomores, and 17.6 % juniors. The mean age of the population was 32 with 83% White, 12.4% Black, 1.4% other, 1.2 % Puerto Rico/Latin American, 0.9% Native American, and 0.6% Asian American. Married subjects comprised 39.9%, 37.5 % were single, 21.1% were divorced or separated, and 1.4% were widowed. Of the sample, 12.1% had at least one child, 84.7% worked, and 98.3% were commuter students (Chartrand, 1992).

Chartrand (1992) used a correlation analysis, regression analysis, and a Goodness of Fit statistical analysis to evaluate the data collected (Chartrand). The researcher did not identify statistical differences among the modified model employed in this study and the original model by Bean and Metzner (1985). The subjects described themselves as having moderate financial problems, moderately high level of degree certainty, and having a strong intent to remain at the college (Chartrand, 1992). A large amount of variance stems from the background, academic, and environmental variables represented by a coefficient of determination = 0.89. The model also positively correlated relationships among academic adjustment (R^2 – 0.65), institutional commitment (R^2 – 0.61), and absence of psychological stress (R^2 = 0.5). Unfortunately, the model was not effective at predicting intent (R^2 = 0.31). Study skills (r = 0.78) and academic adjustment

(r = 0 .69) were highly correlated with institutional commitment. The data indicated a relationship might exist between career planning, academic advisement, and institutional commitment (B = 0.80). Chartrand (1992) found the environmental variable of friends and families had a positive impact on intent to stay in college (B = 0.16), a decrease in absenteeism, and a decrease in psychological stress (B = -.18). The subjects' responses did not indicate any other environmental variables to be reflective of intent to stay.

The findings from Chartrand's (1992) study are relevant for higher education because it indicated more of a focus may be needed on career planning, level of commitment, study skills, motivation, and academic advisement. For the scientific community, Chartrand (1992) encourages future research to validate the model, implementation programs assisting students, and to measure academic achievement or academic outcomes. Based on the positive results from this study, the CMNUSA framework is well supported for use in future research. Limitations to Chartrand's (1992) findings include the use of one sample site and one tool. The researcher did recommend future research be conducted using a different tool for additional verification of research findings.

In 2001, Jefferys published a study investigating the use of enrichment programs to enhance retention in an associate degree-nursing (ADN) program. Jefferys (2001) believed that nontraditional students have a higher attrition rate than traditional students. The researcher wished to investigate if the use of an undergraduate enrichment program (EP) would increase retention rates in nontraditional nursing students enrolled in ADN programs. The researcher recognized literature that supported the use of mentoring to promote socialization, professional development, and knowledge attainment.

Jefferys (2001) used Bean and Metzner's (1985) CMNUSA as a framework for this study. A descriptive exploratory research design was used to investigate if students that were enrolled in an enrichment program would have higher pass rates and lower attrition rates. Jefferys (2001) used a convenience sample of 1,100 ADN students enrolled in a commuter public university in the northeastern United States. Jefferys (2001) identified 257 subjects for the experimental group and 851 subjects for the control group. Independent variables include background, academic, and environmental variables of Bean and Metzner's CMNUSA and the EP. The dependent variables include academic outcomes, psychological outcomes, intent, and attrition.

The EP provided free tutoring, study groups, mentoring, orientation, workshops, and networking opportunities. The goal of the EP program is to increase academic success, increase students' psychological outcomes, and decrease attrition. The mentoring/tutoring was provided by upper-level nursing students and/or registered nurse baccalaureate student nurses (RN-BSN) (Jefferys, 2001). In the Bean and Metzner (1985) model, psychological and academic outcomes are impacted by background, academic, and environmental variables. The impact on psychological and academic outcomes prompted the researcher to provide student support via mentoring, advisement, tutoring, and orientation. Therefore, the researcher provided interventions for the students participating in EP that focused on students, friends, faculty, and maneuvers to increase academic success. Students that participated in the EP were considered part of the intervention group. The EP students were required to participate in all scheduled EP activities and remain actively enrolled in nursing courses. Students considered in the control group were enrolled in the nursing program.

The Student Perception Appraisal- 1(SPA) data collection tool has 22 questions and used a six-point Likert scale to evaluate academic and environmental variables reflective of retention (Jefferys, 2001). The SPA-1 is a modified tool created by Jefferys (2001) for earlier research. The modified tool, SPA-1, has one additional qualitative question that assesses the enrichment program and its effectiveness. Twenty-one questions are in a survey form with answers ranging from 1, which represents does not apply to 6, which represents greatly supportive. The second tool, the Satisfaction Questionnaire, assessed the subject's psychological outcomes, satisfaction with his/her career choice, course work, and satisfaction with the enrichment program. The Satisfaction Questionnaire was created by the researcher. The tool was a survey that used eight questions and a five-point Likert-type scale. The answers range from 1, for strongly agree, to 5, or unable to evaluate. The tool also provided one qualitative comment section. A 13 member expert panel reviewed the tools for content validity. The SPA-1 had an alpha coefficient of 0.79 and the Student Questionnaire's alpha coefficient was 0.87 (Jefferys). Jefferys (2001) provided further support for the theoretical constructs of the Bean and Metzner's (1985) model by incorporating an intervention, the EP, to directly address the weaknesses of students' college experience.

Of the students enrolled in the EP, only 67 % completed the SPA and 40% completed the Student Questionnaire. The mean age of subjects in the EP program was 32 and 30 for the control group. All subjects were commuter students and considered nontraditional. Only 6% of males participated in the EP group and 16% of males were in the control group (Jefferys, 2001). Ethnicity of the EP group included 47% white, 26.7% black, 9.3% Puerto Rican, 6.2% other Hispanic, 8.5% Asian, and 2.3 % other. The

control group reported 66.4% were white, 16.6% black, 2.4% Puerto Rican, 3% reported Hispanic, 8.4% Asian, 0.8% American Indian, and 2.4% other (Jefferys). Demographic data was only reported on by 84% of the EP subjects and 90% of the control group subjects. Relevant findings by Jefferys (2001) for academic outcomes indicated that subjects enrolled in the enrichment program experienced higher academic success, a decrease in course failures, and an increase in psychological outcomes. The subjects' psychological outcomes indicated a satisfaction with nursing as a career (97%), the college (97%), faculty advising (87%), peer mentoring (96%), and the EP (97%) (Jefferys).

Results reflecting retention in the subjects found family crisis (14.6%), finances (13.5%), employment (10.5%), and family responsibilities (9.9%) as severely restrictive (Jefferys, 2001). Family responsibilities, (29%), employment hours (21%), employment responsibilities, (19%), study hours (15%), and child care (14%) are moderately restrictive. Items characterized as greatly supportive by 30% of subjects include friends, transportation, college tutoring, and family emotional support.

Significant meaning for the scientific community was found by Jefferys (2001) research. The EP was effective at reducing attrition and increasing retention in ADN students at Jefferys (2001) research site. The demographics revealed more females utilized EP. Nurse educators may need to make more of an attempt to recruit male participants. The increase in academic and psychological outcomes can be seen as a positive response from the enrichment program. Jefferys (2001) believes the positive psychological outcomes assist with promoting retention and are supportive of Bean and Metzner's (1985) model and the EP.

The nontraditional students have many roles to manage. The personal responsibilities as defined under "Severely Restrictive" variables may interfere in the students' ability to study and prepare for class. The researcher recommends further investigation of the environmental variables affecting nontraditional students. The subjects' responses provided encouraging support for the framework for this study and the EP. The positive findings identified by Jefferys (2001) expand nursing science and support the use of the CMNUSA framework to guide research focused on student attrition in the college setting.

In conclusion, nontraditional student enrollment in nursing has increased (Colalillo, 2007). Hermida (2010) stated that 73% of college students in the U.S. are nontraditional. The large component of nontraditional students enrolled in college supports the use of a theoretical model that is sensitive to characteristics reflective of nontraditional students. Characteristics of nursing students include diverse ethnicity, older, commuter student, married, increased stressors, and a part-time enrollment status (Jefferys, 2004, 2007; Goff, 2011). Prior research by Jefferys, 2004, identified that family responsibilities and finances contribute to stress in students and limit their academic abilities. The CMNUSA framework, published by Bean and Metzner (1985) was used effectively in guiding research investigating attrition of college students. Chartrand (1992) and Jefferys (2001) both utilized the CMNUSA framework and both found positive results with their research. It is interesting to note that both research studies focused on different disciplines within education. Even though Chartrand (1992) modified the CMNUSA model, the researcher was still able to identify positive findings with her research. Thus, the positive findings in the literature supporting the

effectiveness of Bean and Metzners (1985) CMNUSA model support the use of the CMNUSA model in this research study.

Measuring Critical Thinking

The importance of critical thinking in nursing underscores the need for a better understanding of students' critical thinking abilities. Assessing critical thinking abilities of students provides nursing education a stronger platform for instructional initiatives. A sizeable amount of literature is published discussing the measurement of nursing students' critical thinking abilities after a learning initiative or at the end of the nursing program. However, little is known about critical thinking abilities of nursing students as they enter the program. Critical thinking skills of student applicants entering the nursing program may illuminate a benchmark for academic success. The following research studies evaluate the effectiveness of critical thinking measurement tools.

Critical thinking is well documented as a skill necessary for nurses and therefore is an important concept for nursing curriculum. Critical thinking is also assumed to be a concept necessary to possess in order to be successful with patient care and on the NCLEX-RN. The use of admission criteria as prediction of academic success is a common practice in nursing education. Research by Facione and Facione (1997), Hall (1996), and Morris (1999) found critical thinking scores of students who passed and failed the NCLEX-RN statistically significant (as cited in Giddens and Gloeckner, 2005). Therefore, Giddens and Gloeckner (2005) set out to investigate if a relationship existed between critical thinking and NCLEX-RN performance, changes in critical thinking over time, and demographics. This study is important to nursing science because the researchers measured critical thinking abilities of students at the beginning and the end of

the program. Very few research studies investigated nursing students' critical thinking abilities in the beginning of the nursing program.

In 1998 – 2001, data was gathered from a BSN program in the southwest U.S. A sample of 281 BSN students was obtained and used by Giddens and Gloeckner (2005) for a nonexperimental ex post-facto design. The sample was divided into two groups by classifying subjects that passed (n = 202) and failed (n = 16) the NCLEX-RN. Independent variables used in this study included age, gender, nursing GPA, and pre and post scores from the California Critical Thinking Skills Test (CCTST) and the California Critical Thinking Dispositions Inventory (CCTDI) scores.

The CCTST evaluates critical thinking abilities of college students. The exam measures students' abilities of analysis, evaluation, inference, inductive reasoning, and deductive reasoning. The CCTST provides five sub-scores and a total score. The CCTDI measures critical thinking dispositions of students. The CCTDI measures truth-seeking, inquisitiveness, open-mindedness, confidence, analyticity, systematicity, and maturity. The CCTST has 34 multiple-choice questions (Stone, Davidson, Evans, and Hansen, 2001). An internal consistency for the CCTST is reported as a KR-20 range of 0.68 – 0.719 (Ravert, 2008). The CCTDI is a 75-question exam that uses a six point Likert scale to evaluate critical thinking dispositions. The CCTDI is reported to have a Cronbach's alpha of 0.91 (Ravert). The dependent variable was NCLEX-RN performance (Giddens and Gloeckner, 2005). The NCLEX-RN reliability is between 0.87 – 0.92 (NCSBN, n.d.).

Data collected by Giddens and Gloeckner (2005) was evaluated by an independent t-test and a discriminate analysis. Age and gender were not found to be

contributing factors to success and/or attrition. Men comprised 22% of the sample and the mean age was 30.3 (Giddens and Gloeckner, 2005). Nursing GPA was higher for the pass group than the failed group of subjects at the time of graduation with a t-test identifying $t(209) = 5.3$, $p < 0.001$, $d = 1.38$. Higher means were statistically significant on the CCTST entry and exit exams for those subjects that passed the NCLEX-RN. The t-test for CCTST entrance score and NLCEX-RN passing with large effects size was $t(101) = 2.5$, $p = 0.015$, $d = 1.0$. Exit CCTST scores for the passing group were also significant noted by $t(191) = 3.0$, $p = 003$, $d = 0.81$ with medium to large effects size (Giddens and Gloeckner). The researchers also found a relationship between CCTST and CCTDI scores, nursing GPA, and NCLEX-RN passing. Using the previously listed variables, subjects were predicted to pass the NCLEX-RN at a rate of 98%. It is interesting to note that the subjects that passed the NCLEX-RN did have higher critical thinking scores on the CCTDI entrance and exit exams; yet independent t-tests of both tests means did not identify a statistical difference. The model incorrectly classified 79% of NCLEX-RN failures (Giddens and Gloeckner). The small group of subjects that failed the NCLEX-RN may have limited the ability of the t-test to evaluate for significance. A larger sample size may have produced different results.

The results identified by Giddens and Gloeckner (2005) expanded the nursing science with a potential model for predicting NCLEX-RN success. Furthermore, positive results were found by the CCTST entrance and exit scores and nursing GPA in predicting NCLEX-RN success. Giddens and Gloeckner's (2005) results are conflicting with Stone, Davidson, Evans, and Hansen (2001) who did not find the CCTST to predict NCLEX-RN

success. Stone et al. (2001) administered the CCTST to 108 graduating BSN seniors and was unable to identify statistical significance from CCTST scores and NCLEX-RN success. Unfortunately, measuring critical thinking abilities of nursing students remains unclear. True advances of the critical thinking abilities of students remain either un-measureable or advances are non-existent.

The lack of consistent statistical significance for the CCTST and the CCTDI weakens the literature regarding effective tools to measure critical thinking in nursing students. Standardized exams have yet to consistently capture critical thinking. The usefulness of the CCTST and CCTDI is still in question due to the lack of statistical significance of this research study findings. Giddens and Gloeckner (2005) also question the necessity of the CCTDI due to its measurement of subjects' attitudes and its connection with critical thinking skills. The researchers strongly support the idea of critical thinking measurement and its potential predictive abilities. Further research is needed to examine the predictability of critical thinking standardized exams in nursing education.

In 2000, in the U.S, the National Council for Licensure Examination (NCLEX) pass rates decreased by 20% (Ellis, 2006). With the nursing shortage looming, nurse educators have been prompted to investigate ways to increase retention rates of nursing students (Ellis). Previous research using the Nurse Entrance Exam (NET) found a correlation between reading, critical thinking, and NET composite scores. The researcher wished to evaluate the use of critical thinking scores from the Educational Resources Incorporated (ERI) Nurse Entrance Test (NET) as admission criteria from a diploma

school in Baton Rouge, Louisiana (Ellis, 2006). The reliability coefficient for the NET is 0.92 (Hopkins, 2008).

The sampling method used by Ellis (2006) involved a convenience sample of two groups. The first sample group consisted of subjects admitted to the nursing program with a composite NET score of 50 or above. The second group comprised of subjects admitted to the program with a NET composite score of 50 or above and a critical thinking score of 50 or above. The sample population has 137 subjects admitted to a diploma school from 2003 – 2005 (Ellis). The sample was divided into two groups, n = 82, representing subjects admitted with a NET composite of 50. The second group, n = 55, was admitted with a NET composite of 50 or above and a critical thinking score on the NET of 50 or above. The researcher identified the dependent variable as academic success operationalized as retention in the first level of nursing courses. Independent variables included NET composite scores above 50, NET critical thinking scores above 50, age, gender, marital status, inferential reading, predicting outcomes, and main idea scores on the NET exam (Ellis).

Data collected by the researcher was inputted into an SPSS program. The researcher did not discuss the design implemented in this study nor were the demographics presented in the literature. Ellis' (2006) data analysis revealed that students admitted to the nursing program with a NET composite score of 50 or above had a 70.7% rate of academic success. Subjects admitted to the nursing program with the additional criteria of a 50 or above score on the critical thinking component of the NET had an 89.1% rate of academic success. The researcher used a Chi square analysis to evaluate the data. Ellis (2006) findings from the sample data identified one degree of

freedom was equivalent to 6.466 chi-square. The researcher chose a prior p level at a 0.5 and the data yielded p at 0.011, df = 1. The researcher did not present any other statistical analysis used in this study. Ellis' (2006) study is significant to nursing science because the data found a higher retention rate for subjects admitted with a minimum of 50 on the NET critical thinking component. Ellis' (2006) study was the first to look at critical thinking scores on the NET and within a diploma program. The use of a diploma program as a setting limits the generalizability of the research findings. Furthermore, an additional limitation to this study is that the NET is no longer available for use as admission criteria. However, Ellis' (2006) findings do expand the knowledge base of nursing and raise the question of the importance of students' critical thinking abilities at the beginning of a nursing program. This research study contributes to the literature review due to its successful use of a standardized exam to evaluate student nurses' critical thinking abilities in the beginning of the nursing program. Ellis' (2006) research findings are significant and may have opened up a new avenue for potentially predicting academic success of nursing students.

In 2008, Ravert conducted a study to evaluate the effectiveness of human patient simulators in promoting critical thinking in nursing students enrolled in a BSN program. A literature search conducted by Ravert (2008) identified the successful use of the human patient, high fidelity simulator, and advancing critical thinking skills.

Nursing care, medication administration, and numerous treatments can be administered to the high-fidelity simulator and nursing faculty can evaluate the students' abilities to be an effective providers of care. The use of the human simulator also provides an avenue of learning for students whose preferred learning style is experiential (Ravert).

A convenience sample was created from 64 undergraduate BSN students. A pretest-posttest design was used to evaluate three groups of subjects. The first group, non-human-patient simulation, n = 13, was an experimental group that attended scheduled course work and five one-hour enrichment sessions discussing the assigned patient simulation. A second group, human patient simulator, n = 12, was an experimental group with regular course work, and five enrichment sessions that used a human patient simulation. The third group, n = 15, only attended regularly scheduled course work. The California Critical Thinking Dispositions Inventory (CCTDI) and the California Critical Thinking Skills Test (CCTST) were used to measure critical thinking abilities of the subjects (Ravert).

The CCTDI is a 75-question exam that uses a six point Likert scale to assess for open-mindedness, truth seeking, analyticity, systematicity, critical thinking, self-confidence, inquisitiveness, and cognitive maturity. The CCTDI is reported to have a Cronbach's alpha of 0.91 (Ravert). The CCTST is a 34 item questionnaire with multiple-choice questions. The CCTST measures analysis, evaluation, inference, deductive reasoning, and inductive reasoning. An internal consistency for the CCTST is reported as a KR-20 range of 0.68 – 0.719. The Learning Style Inventory was used by Ravert (2008) to assess the subjects learning style. The learning styles include diverging, assimilating, converging, and accommodating. The Learning Style Inventory was created to assess for Kolb's (1999) definition of learning styles. The tool has a Cronbach's alpha noted between 0.73 – 0.88. Independent variables for this study included gender, student's academic year in school, learning style, high fidelity simulation, five enrichment

sessions, and discussion sessions. The dependent variables were the scores on the CCTDI and CCTST scores (Ravert).

The researcher compiled the data into an SPSS 11.5 program. The critical thinking exams were administered at the beginning and at the end of the study. The sample consisted of 69 females and one male with a mean age of 22.03. Fourteen subjects were juniors and 26 were seniors. The mean GPA for the three groups ranged from 3.61 – 3.71. Group one increased its mean CCTDI score by 5.33 and its CCTST mean score by 9.29. Group two increased its mean CCTDI score by 9.84 and its CCTST score to 7.40. Group three increased it mean CCTDI score by 14.90 and its CCTST score by 1.84 (Ravert, 2008). While an increase occurred with all of the mean scores for the two critical thinking exams, statistical significance did not emerge from the data (Ravert, 2008).

Simulation, as a method to improve critical thinking abilities of students, still requires further research. The small sample size may have restricted the researcher's ability to find true statistical significance. However, Ravert (2008) stated that the CCTST and the CCTDI may not evaluate skills necessary for thinking critically in nursing. Stone, Davidson, Evans, and Hanson's (2001) research identified that nursing faculty found skills reflecting critical thinking in nursing were not evaluated for on the CCTST and the CCTDI. It was interesting to note that Ravert (2008) found the CCTDI sub-score was poorly correlated with the CCTST sub-score with ($r = 0.09$) which supports the idea that critical thinking dispositions are not reflective of critical thinking skills (Stone et al, 2001). The lack of statistical significance from the research findings further contributes to the weakness in literature surrounding the CCTST and the CCTDI's

effectiveness at measuring critical thinking abilities. Ravert's (2008) study is different in the respect that it utilized an instructional method to evaluate changes in students' critical thinking abilities. The commonality of Ravert's (2008) study with others in the literature review is the use of a standardized assessment to measure critical thinking of nursing students. Ravert (2008) recommends the development of tools for nursing education to measure critical thinking abilities of students.

Critical thinking has emerged as a necessary concept for nurses and nursing students. Complex patient care requires nurses to think critically to ensure safe and quality patient care is delivered. Therefore, it is necessary for nurse educators to incorporate critical thinking into nursing curriculum. In the literature, little discussion was focused on critical thinking and academic success. Academic success of nursing students is just as important as critical thinking in nursing education. Successful completion of nursing programs and NCLEX-RN success is not always attainable for all students selected for nursing programs. Shirrell (2008) believes indicators exist that may, at admission, help predict academic success of nursing students.

Shirrell (2008) wished to link critical thinking abilities of ADN students to academic success. The researcher operationalized academic success as passing the NCLEX-RN exam on the first attempt. The critical thinking exam used by the researcher was the Collegiate Assessment of Academic Proficiency (CAAP) (Shirrell). No discussion was provided by the researcher regarding the reliability and validity of the CAAP and whether the exam is discipline specific. Twibell, Ryan, and Hermiz (2005) believe a critical thinking exam that is specific to the discipline of nursing would be beneficial. Prior research evaluating critical thinking used the CCTST, CCTDI, and the

Watson-Glaser Critical Thinking Test (WGCTA) (Shirrell). These critical thinking exams are not specific for nursing and their findings have been varied.

Shirrell (2008) used data from a nursing program database to complete a retrospective correlational research study. A sample of 173 graduating student records was obtained from a private midwestern ADN program from 2001 - 2006. Independent variables included CAAP scores, nursing GPA, and science GPA. The CAAP exam was provided to the graduating senior students. Science courses included anatomy and physiology, chemistry, and microbiology. Research published by Yin and Burger (2003) and Griffith, Bevil, O'Conner, and Weiland (1995) identified pre-nursing science courses as predicting academic success in ADN and BSN programs. The dependent variable used by Shirrell (2008) was passing the NCLEX-RN on the first attempt. Data was inputted into the SPSS for Windows Version 12.0. Shirrell (2008) used a retrospective quantitative research design. Characteristics, or demographics, of the subjects were not provided.

The mean nursing GPA was 2.7, the mean science GPA was 2.89, and the mean critical thinking score was 62.23. The subjects' demographics were not reported (Shirrell, 2008). A multiple linear regression and binary logistic regression was conducted to answer question one and the data revealed no relationship was evident among critical thinking and passing the NCLEX-RN (Shirrell). Questions two and three used a Pearson correlation for the data analysis and found the model of critical thinking test scores, GPA in science courses, and final nursing GPA were predictive of NCLEX-RN success, Cox and Snell $R^2 = .136$, Nageikerke $R^2 = 0.245$, $p < 0.0001$. Nursing GPA

was the strongest predictor of NCLEX success being responsible for 13 – 24% of the variance (Shirrell).

While the CAAP was not responsible for predicting NCLEX-RN success, nursing GPA was found to be very predictive. Therefore, students' grades in their nursing courses can be viewed as indicators of academic success. The researcher did receive positive results from correlations among critical thinking, nursing GPA ($r = 0.372$), and science GPA ($r = 0.314$). It is interesting how the critical thinking scores correlated with GPA, but not with the NCLEX-RN (Shirrell, 2008).

Research by Shirrell (2008) contributes to nursing science by further evaluating standardized exams measuring critical thinking of nursing students. The lack of the CAAP's ability to correlate critical thinking abilities with NCLEX-RN mirrors previous research conducted on the CCTST, CCTDI, and the Watson Glaser Critical thinking Assessment (WGCTA) (Shirrell). The correlation between GPA as a predictor of success in a nursing program continues to be a strength within the literature. The inability of a critical thinking exam to have a correlation to NCLEX-RN success can be seen as a weakness in the literature. The NCLEX-RN presents students with situations that require nursing students to think critically. The researcher did not discuss what the CAAP measures and therefore the CAAP may not measure the same components of critical thinking that is required by nursing. Shirrell's (2008) research findings contribute to the literature review for this study by evaluating a different type of standardized assessment for measuring critical thinking used by nursing programs. The lack of an effective measure for critical thinking of nursing students is an additional weakness in the

literature. Shirrell (2008) recommends more research identifying a tool to measure critical thinking for nursing students.

To ensure safe and effective patient care, research has identified critical thinking as an essential skill. Nursing education understands the student's need for critical thinking skills. Educational initiatives have been implemented by nurse educators to increase students' critical thinking abilities. Past research supports this premise by connecting clinical ability with critical thinking skills. Jones and Morris (2007) set out to investigate if changes in ADN students' critical thinking exists and if a correlation can be found between critical thinking and academic success.

Jones and Morris (2007) did not discuss a design, but sought to identify if a relationship exists between critical thinking and academic success. The researchers used a convenience sample that included 104 nursing students enrolled in an ADN program at a small university in the southeastern U.S. in the fall of 2002. Demographics of the subjects were not discussed in the literature. Assessment Technologies Institute (ATI) Critical Thinking Assessment (CTE) entrance and exit exams for nursing were used as independent variables. ATI's CTE has previously established content and construct validity and the researchers felt confident in its ability to assess critical thinking abilities of nursing students. The CTE is specific for the discipline of nursing and has a 40- item test with multiple-choice questions. The CTE has an alpha of 0.70 for all subjects' first time examination (Jones and Morris, 2007). The CTE assesses for analysis, evaluation, explanation, inference, interpretation, and self-regulation. The dependent variables were licensure rates, subjects' completion rates, and the subjects' GPA.

The researchers did not identify significant findings for research questions one, two, and five. No statistical significance was found regarding changes in pre and post critical thinking scores or sub-scores, critical thinking pre/post test, and end of the program GPA (Jones and Morris, 2007). Research by Lyons (2008) also utilized ATI's CTE entrance and exit exams to evaluate problem based learning initiatives on senior nursing students enrolled in an NCLEX-RN course. Both CTE exams were given during an NCLEX-RN course and the data revealed no significant difference between ATI's CTE entrance and exit exams. Jones and Morris (2007) did identify a $r^2 = 0.24$, for the fourth question, stating one-fourth of the variance in nursing course GPA is tied to critical thinking scores. This finding is similar to Shirrell (2008) that a correlation exists between nursing GPA and the CAAP a with a $r = 0.372$ for BSN senior students.

For the third research question, the sample's critical thinking entrance scores were divided by those subjects that were academically successful ($n = 60$) and those who either failed a nursing course or left the program ($n = 44$). The sample that remained in the program continued without failures, graduated on time, and had an entrance critical thinking score with a mean difference of 9.58, $t = 3.30$, $SD = 2.04$, with $p < 0.01$. The mean CTE entrance score for the pass group was 71.63 and the mean CTE entrance score for the failed group was 62.05. The researchers also found a positive relationship between critical thinking entrance scores and academic success (Jones and Morris, 2008). The subjects that had higher CTE entrance scores had higher academic success.

The findings of this study contribute to the science of nursing and may assist nursing programs to utilize critical thinking indicators as admission criteria. Jones and Morris (2008) recommend further research investigating entrance CTE scores for

potential ties to academic success. The lack of identifying a change in critical thinking scores raises many questions. The researchers suggest the subjects may not be motivated to do well on this exam and therefore do not put forth effort. An additional reason for a lack of significant change in CTE exit scores may be uncontrollable variables like instructional abilities. Nurse educators may not be as effective, as once thought, in implementing critical thinking initiatives to increase nursing students' critical thinking abilities.

This is the first study that uses ATI's CTE exams predictability of academic success of ADN students. Jones and Morris' (2008) research findings echo Ellis' (2006) findings indicating an increase in nursing student retention with the use of a critical thinking score as admission criteria. The use of ATI's CTE entrance scores and academic success positively contribute to the literature review for this study. If nursing education can identify reliable selective admission criteria, more students may be academically successful, nursing may increase graduates, and assist in decreasing the nursing shortage.

In conclusion, what is known about critical thinking in nursing education is also conflicting. The ability to measure students' critical thinking abilities is not well supported and is a weakness in the literature. Inconsistent results were found from the CCTST and CCTDI. The CAAP used by Shirrell (2008) also was not able to effectively evaluate critical thinking of nursing students. A literature gap regarding critical thinking measurement and ADN students is also present. Of the five critical studies presented, only one study by Jones and Morris (2008) evaluated ADN students. Some support for critical thinking abilities evaluated at entry into the nursing program has emerged in the

literature. Achievement is shown by Ellis' (2006) retention rate of students at 89.1% and by Jones and Morris' (2008) research finding that the ATI CTE entrance exam predicts academic success in a nursing program. All of the studies presented recommend further research using a tool that is discipline specific to measure critical thinking of nursing and nursing students.

CHAPTER SUMMARY

The critical nursing shortage in the U.S. has challenged nursing to utilize new and creative venues to reduce the shortage. Many cite nursing education as the key to decreasing the shortage. Therefore, attrition of nursing students has received more of a focus. What is known in the literature indicates the use of admission criteria to predict student attrition is a well respected and well researched method used by nursing programs. Strong evidence supports the use of a standardized exam and pre-nursing GPA as admission criteria, along with the use of critical thinking exams as admission criteria. The use of the CMNUSA framework, by Bean and Metzner (1985), in the literature provided support for research examining attrition in college students. What is not known is which standardized exam best identifies students at risk for failure along with which critical thinking standardized exam best measures students' critical thinking abilities. This research study builds on what is known and not known in the literature regarding admission criteria, critical thinking ability, and attrition of nursing students. This study sought to identify if the use of ATI's CTE entrance exams can effectively identify students at risk for attrition in an ADN program.

CHAPTER THREE

METHODS

Purpose of this Study

The purpose of this study was to investigate if a relationship exists between pre-nursing GPA, age, ethnicity, gender, Assessment Technology Institute's (ATI) Critical Thinking Entrance (CTE) exam composite scores and sub-scores, and attrition in the first six nursing courses at a state school located in the southeastern United States.

Attrition rates in Associate Degree Nursing (ADN) programs contribute to the nursing shortage. Attrition is defined as a student failing or withdrawing from a nursing course or a nursing program for academic reasons. When students fail a nursing course, they are at risk for not completing or returning to nursing school. If students do not return to school, they do not graduate and contribute to the nursing shortage. The purpose and the research questions for this study address if a relationship exists between select admission criteria and attrition.

OVERVIEW OF DESIGN

This retrospective study utilized a correlational research design. Correlational research is one form of quantitative research methodologies used to gather empirical evidence for data analysis (Polit and Beck, 2008). Quantitative methods are used for research that seeks to investigate a phenomenon using an objective lens, deductive reasoning, scientific methods, and formal measurement. Research questions that seek to measure, control, predict, or provide an intervention usually fall under the umbrella of quantitative methods. Seeking if a relationship exists between variables that are measurable qualifies this study as quantitative (Burns and Grove, 2007).

When a nurse researcher is looking to identify if a relationship exists between two or more variables, correlational research methodologies will assist in uncovering this data. Correlational methodologies can test the existence of a relationship and answer or deny the truth to the hypothesis under question (Houser, 2008). Correlational design may also identify many interrelationships in a situation. Usually the situation has already occurred and cannot be manipulated. In correlational studies, little or no effort is made to control factors in the situation. Instead, the purpose is to examine the situation as it exists (Houser).

A retrospective correlational research design allows for an examination of secondary data that already exists. Variables used for this study include data that was already collected and existing. The nursing program used for the setting of this study was an ADN program on the southeastern coast of Florida. The nursing department admits students for their program twice a year. Each applicant must complete the required admission criteria. Therefore, the nursing program had each applicant's data stored in a College database. The current admission criteria used by the ADN program includes transcripts of each applicant to evaluate pre-nursing GPA, residence, and scores on the National League for Nursing Pre-Admission Examination (NLNPAX) exam. The NLNPAX is used to assess students' abilities prior to entering the nursing program. In the past five years, the effectiveness of the NLNPAX has been in question due to high rates of attrition and academic withdrawals. Therefore, an alternative solution was examined. Data used for this study includes pre-nursing GPA, age (at time of admission), gender, ethnicity, critical thinking entrance composite and sub-scores, and nursing course averages to evaluate attrition.

The ADN program is currently requiring admitted students to complete the ATI CTE exam. The ADN program is evaluating critical thinking scores of students as part of their program evaluation plan. Recommendations for evaluating critical thinking stem from the National League for Nursing student learning outcomes that are discussed in "Outcomes and Competencies for Graduates of Practical/Vocational, Diploma, Associate Degree, Baccalaureate, Master's, Practice Doctorate, and Research Doctorate Programs in Nursing" (National League for Nursing, 2010). The purpose of this research study was to identify if a relationship exists between variables. The variables under evaluation exist as secondary data. The variables were not manipulated or controlled. Therefore, the methodology chosen for this research study is an appropriate fit for the purpose, question, and design of the research study.

Variables

Selected demographics. Age, gender, and ethnicity were selected as demographics. The demographics function as independent variables to assess their impact on attrition for ADN subjects in the first six semesters.

Critical thinking entrance scores. The ATI CTE exams were created for nursing by experts in critical thinking. The CTE was used as an independent variable. The CTE entrance exam is a 40 question, multiple-choice exam. ATI established test validity in 2000 by conducting beta testing. The beta testing revealed a global alpha of 0.692, a standard deviation of 11.24 and a standard error of the mean at 2.441. ATI established construct validity with an extensive literature review of critical thinking theories and operational definition of critical thinking (Assessment Technologies Institutes, LLC, 2001). Concepts, measured on the CTE as sub-scores, include

interpretation, analysis, explanation, inference, evaluation, and self-regulation. The CTE provided composite scores and sub-scores. The CTE was administered as a paper/pencil exam to admitted subjects during their first course, Nursing Fundamentals.

Pre-nursing GPA. Pre-nursing GPA encompasses the subjects' average of all course work completed prior to entering the nursing program. In this study, pre-nursing GPA was evaluated as an independent variable and includes course averages from English I, English II, biology, anatomy and physiology I, anatomy and physiology II, human growth and development, diet and nutrition, psychology, sociology, chemistry, and microbiology. Applicants for the ADN program do not have to complete all of the course work prior to entering the program.

Attrition in the first six nursing courses. The first six nursing courses are required sequenced courses in the nursing program. Attrition rates were evaluated as a dependent variable. In this study, the first six nursing courses included the following courses: Nursing Fundamentals, Maternal Child Nursing, Medication Administration, Psychiatric Nursing, Adult Health Respiratory/Gastrointestinal Nursing, and Adult Health Genitourinary/Endocrine Nursing. Historically, attrition, via academic failure, primarily occurs in the first six of the nine nursing courses. Student failure occurring in the last three courses in the ADN is primarily related to clinical failures, not academic. Attrition was operationalized as: students with a course average equal to or less than a 75 or a "D" upon withdrawing or ending the semester results in failure and/or attrition.

Hypotheses

Hypothesis 1: A positive relationship will exist between ADN students' critical thinking entrance exam composite scores and sub-scores and attrition in the first six nursing courses.

Hypothesis 2: There will be a significant correlation between select demographic variables (age, gender, ethnicity), critical thinking entrance exam scores, pre-nursing grade point average, and attrition for ADN students in their first six nursing courses.

SETTING

The nursing program was located on the southeast coast of Florida. The setting was a nursing program accredited by the National League for Nursing Accrediting Commission (NLNAC). The use of an academic setting that is an NLNAC accredited program ensures equal access, equity, and quality within the program. The ADN program was established in 1965. The ADN program was part of a nursing department that offers a licensed practical nursing program, certified nursing assistant program, patient care technician program, surgical technician program, and an RN-BSN program. The ADN program has an estimated 200 students enrolled annually.

SAMPLE

The target population consisted of ADN students. A convenience sampling method was used in this study. A convenience sample is also referred to as a nonprobability sample (Houser, 2008). Upon IRB approval from Barry University and the IRB at the sample site, permission to conduct the study was requested and granted from the Assistant Dean/Administrator of the nursing program (see Appendix A). The subjects' data was extracted from the Colleges databases, nursing department database

and health science database, student transcripts, course reports/minutes, and admission applications from spring and fall 2010.

The subjects were students admitted during 2010. A priori analysis was conducted using G* Power 3.1 power calculating software (Faul, Erdfelder, Lang, and Buchner, 2007) and was used for a power analysis to determine an acceptable sample size for a logistic regression analysis. G* Power is used to determine appropriate sample sizes for given effect sizes, alpha levels, and power level. An adequate level of statistical significance ($\alpha = 0.05$) was used for the research to avoid Type I errors with only a 5% chance of being wrong, and the amount of power determined to avoid Type II errors ($1 - B = 0.8$). The effect size input for logistic regression requires an estimate of p^1, the probability that a student with an average score on the entrance exam will pass the course and p^2, the probability that a student who scores one standard deviation above the mean would pass the course. Inputs of $p^1 = 0.80$ and $p^2 = 0.85$ were used.

Therefore, this study provided the highest sensitivity that effect on the outcome is actually due to the experiment and not due to change (Creswell, 2009). After careful input into the G* Power 3.1 calculator, $p_1 = 0.80$ and $p_2 = 0.85$, $1 - B = 0.8$ for dependent variables ($n = 6$), the total sample size is $n = 127$. In order to account for errors, missing data, and mislabeled or blank information on any tests or databases, this researcher used a sample size of 142.

Inclusion Criteria

For the purposes of this research, inclusion criteria included:

- Data from students that were accepted into the ADN program in 2010.

Exclusion Criteria

For the purposes of this research, exclusion criteria included:

- Data was not used from students that transferred into the program after the first nursing course, Nursing Fundamentals, and those that withdrew for personal reasons, and students that failed clinical.

ETHICAL CONSIDERATION/PROTECTION OF HUMAN SUBJECTS

The Institutional Review Board (IRB) at Barry University and at the sample site was contacted for approval for this study. Once approval was obtained from both IRB's (see Appendix A), a letter was sent to the Assistant Dean/Administrator of the ADN program for permission to access the data. The Assistant Dean/Administrator of the nursing program at the sample site granted the PI access (see Appendix B). This study did not involve subject participation. The subjects were not exposed to any harmful or emotional experiences. Data used in this study already existed within the College databases. The data was secondary and was not manipulated. Therefore, the risk to subjects is minimal.

The primary investigator (PI) for this study is employed as a faculty member for the ADN program. The PI did not use data from subjects enrolled in courses in which the researcher is the instructor. Subjects' anonymity was protected in this study. Student identification numbers were used by the Assistant Dean/Administrator of the program to extract data and compile a Microsoft Excel © spreadsheet. The data was provided to the PI in an Excel spreadsheet with student identification numbers. Once data was verified, the student identification numbers were removed from the Microsoft Excel © spreadsheet. The Microsoft Excel © spreadsheet was kept on the PI's thumb drive. Any

paper documents obtained from the setting were stored, along with the PI's thumb drive, in a locked file cabinet at the PI's residence. All data obtained from this study will be destroyed no later than five years after this study is completed.

PROCEDURES

This study proceeded once approval was obtained from the IRBs at Barry University, the sample site, and from the Assistant Dean/Administrator of the nursing program. Data was extracted from the College's databases, which included a nursing department database and health science database, student transcripts, course reports/minutes, and admission applications, by the Assistant Dean/Administrator. The subjects' pre-nursing GPA, gender, age, ethnicity, and nursing course averages, and critical thinking entrance composite and sub-scores were utilized for this study.

Individual course reports/minutes, subject's transcripts, and admissions application will provide validation, if necessary, for uncertainty or conflicting data regarding student withdrawal, failure, and academic success. The data was entered into a Microsoft Excel © Program for Windows. The data was provided to the PI in Microsoft Excel © spreadsheet with student identification numbers. Thirty percent of the data was randomly selected and verified by the Assistant Dean/Administrator. The student identifiers were removed once data verification was performed by the Assistant Dean/Administrator.

Data Management and Storage

The PI was provided the data from the nursing department on a Microsoft Excel © spreadsheet. The file holding the Microsoft Excel © spreadsheet was kept on a thumb drive owned by the PI. The PI's personal laptop was used for examining and analyzing

the data. Any paper documents obtained from the setting were stored, along with the PI's thumb drive and laptop, in a locked file cabinet at the PI's residence.

INSTRUMENTS/MEASURES

The nursing department at the sample site holds all student data within the College's database. The students' data that was extracted included pre-nursing GPA, gender, age, ethnicity, and nursing course averages, and critical thinking entrance composite and sub-scores. Students' demographics were also stored within the College's database on a Microsoft Excel © spreadsheet. Once IRB approval was received from Barry University and the sample site, access was granted from the Assistant Dean/Director of the nursing program. The subjects' data was transferred from the nursing department's database onto a new Microsoft Excel © spreadsheet. The Microsoft Excel © spreadsheet, provided to the PI, was saved onto the PI's thumb drive.

Instruments used in this study include the Assessment Technologies Institute (ATI) Critical Thinking Entrance (CTE) examination. Nurse educators developed the CTE from ATI in 2000. The CTE is a 40-item examination that assesses nursing students' critical thinking ability. The CTE is offered either via computer testing and/or paper/pencil modalities (Assessment Technologies Institute, 2000). For this research study, the paper/pencil form of the exam was used. The CTE measures interpretation, analysis, evaluation, inference, explanation, and self-regulation (Assessment Technologies Institute, 2000).

The CTE has been tested for validity and is designed to assess critical thinking skills in nursing (Whitehead, 2006). ATI utilized experts in critical thinking to conduct a literature review and create a test matrix. In 2000, beta testing was conducted to establish

validity. Data was evaluated by psychometricians from the University of Kansas. A sample of 2688 nursing students utilized a Guttmann split-half coefficient and produced a global alpha of 0.692, with a *SD* = 11.24, and a *SEM* = 2.441. ATI established construct validity for the CTE with an extensive literature review of critical thinking theories and operational definition of critical thinking (Assessment Technology Institutes, LLC, 2001).

DATA ANALYSIS PLAN

Correlational designs provide nurse researchers the ability to investigate the existence of potential relationships (Polit and Beck, 2010). A logistic regression analysis is a type of correlational design that will seek to identify if a relationship exists between variables. However, the logistic regression allows for multiple independent variables. This study utilizes multiple variables and two dependent variables. Thus, a logistic regression analysis is an appropriate statistical analysis for this study.

Hypothesis 1: A positive relationship will exist between ADN students' critical thinking entrance exam composite scores and sub-scores and attrition in the first six nursing courses. Critical thinking entrance exam composite scores and sub-scores are quantitative variables. The First Six Nursing Courses (Nursing Fundamentals, Maternal-Newborn Nursing, Medication Administration, Psych-Mental Health Nursing, Adult Health Gastrointestinal/Respiratory Nursing, and Genitourinary/Endocrine Adult Health Nursing) will be quantified as 1 = Academic Success and 0 = Attrition. A logistic regression analysis was be used to identify if a relationship exists between critical thinking entrance exam composite scores and sub-scores.

Hypothesis 2: There will be a significant correlation between select demographic variables (age, gender, ethnicity), critical thinking entrance exam scores, pre-nursing grade point average, and attrition for ADN students in their first six nursing courses. The variables of age, pre-nursing GPA, age, gender, ethnicity, and critical thinking composite scores are quantitative categorical variables and will be evaluated by a logistic regression analysis to identify if a relationship exists between critical thinking entrance exam composite scores. The First Six Nursing Courses (Nursing Fundamentals, Maternal-Newborn Nursing, Medication Administration, Psych-Mental Health Nursing, Adult Health Gastrointestinal Nursing, and Adult Health Nursing) will be quantified as 1 = Academic Success and 2 = Attrition. A logistic regression analysis was used to identify if a relationship exists between critical thinking entrance exam composite scores and sub-scores.

SUMMARY

This study sought to identify a relationship between multiple variables and two categorical dependent variables. This chapter addressed the research methodology for this study. The methodology included a description of the sample size, setting, inclusion and exclusion criteria, power analysis, data collection procedures, protection of human subjects, instrumentation, and data analysis plans.

CHAPTER FOUR

FINDINGS OF THE STUDY

The purpose of this study was to investigate if a relationship exists between pre-nursing GPA, age, gender, ethnicity, Assessment Technologies Institute's (ATI) Critical Thinking Entrance (CTE) exam and attrition in the first six nursing courses at a state school located in the south eastern United States.

Problem

Attrition rates in Associate Degree Nursing (ADN) programs contribute to the nursing shortage. Attrition is defined as a student failing or withdrawing from a nursing course or a nursing program for academic reasons. When students fail a nursing course, they are at risk for not completing or returning to nursing school. If students do not return to school, they do not graduate and thus contribute to the nursing shortage.

A logistic regression analysis was used to analyze the research findings. Variables for this study include pre-nursing GPA, age (at time of admission), gender, ethnicity, critical thinking entrance composite and sub-scores, and attrition in the first six nursing courses in the nursing program. The critical thinking scores were obtained from Assessment Technologies Institute (ATI), Critical Thinking Entrance (CTE) exam. The CTE from ATI provided one composite score and six sub-scores. Descriptive statistics were used to evaluate the demographic data. The XLSTAT program for Microsoft Office Excel © was used to for inferential statistical analysis.

MEASUREMENT TOOL RELIABILITY AND VALIDITY

The ATI CTE examination was the only diagnostic tool utilized in this study. The CTE by ATI was designed to evaluate critical thinking measures in nursing students. The

CTE was adopted by the sample site in 2010 and administered routinely to students enrolled in Nursing Fundamentals. Six concepts were measured on the CTE that evaluated the subject's abilities for interpretation, analysis, explanation, inference, evaluation, and self-regulation. The scores for the CTE include six equally weighted sub-scores and one composite score. The CTE composite score is a representation of the six sub-scores. The seven CTE scores range between 0 – 100. The CTE is a timed test (40 minutes) with 40 multiple-choice questions.

ATI published a statistical report in 2000 that discussed the CTE's beta testing and validity. Psychometricians from the University of Kansas evaluated the data from the beta test. Data was collected from ADN, BSN, practical nursing, and diploma nursing programs. The four types of nursing programs provided ATI with N = 2688 test results for beta testing. The internal consistency of the CTE was assessed using a coefficient of Cronbach alpha, Guttman split-half coefficient for analysis. The CTE exam produced global $\alpha = 0.6942$, $SEM = 2.4$, and a standardized item $\alpha = 0.7012$. The CTE composite scores produced a $M = 67.66$ and a $SD = 11.24\%$. ATI established construct validity with an extensive literature review of critical thinking theories and operational definition of critical thinking (Assessment Technologies Institutes, LLC, 2001).

SAMPLE DESCRIPTION

The sample consisted of 142 subjects. Thirteen subjects were excluded from this study leaving 91 % ($N = 129$) of the sample's data for the study. The excluded subjects ($n = 13$) included four that failed clinical ($n = 0.028$ %), four that left for personal reasons

(0.028 %), and five that had incomplete critical thinking scores (0.035 %). The remaining sample consisted of 129 subjects.

Gender

The gender of the subjects was primarily composed of females. Of the subjects (*n* = 129), 87.5 % (*n* = 113) were females and 12.5 % (*n* = 16) were males (Table 1).

Table 1

Gender Characteristics of the Sample

Gender	n = 129	%
Males	16	12.5
Females	113	87.5

Age

Concerning the subject's ages in this sample, the range of ages spanned 37 years. The ages of the subjects (*N* = 129) ranged from 21 – 58 years of age. The mean age of the sample was 32.6 years of age, with a standard deviation of 9.7 (Table 2).

Table 2

Age Characteristics of the Sample Subjects

Subjects Ages	n = 129	%
19 – 24 Years of Age	33	26
25 – 34 Years of Age	45	36
35 – 44 Years of Age	33	26
45 – 54 Years of Age	13	9
55 – 64 Years of Age	5	3

Ethnicity

The sample was comprised of seven major ethnic groups (Table 3). The sample's ethnicity was mildly diverse with 76 % of the sample White (*n* = 98), 9 % Haitian (*n* = 12), Black (*n* = 9) 7 %, Other (*n* = 4) 3 %, Asian (*n* = 3) 2 %, Indian (*n* = 2) 2 %, and Pacific Islander (*n* = 1) 1 %.

Table 3

Ethnicity Characteristics of the Sample

Characteristics	n	%
White	98	76
Haitian	12	9
Black	9	7
Other	4	3
Asian	3	2
Indian	2	2
Pacific Island	1	1

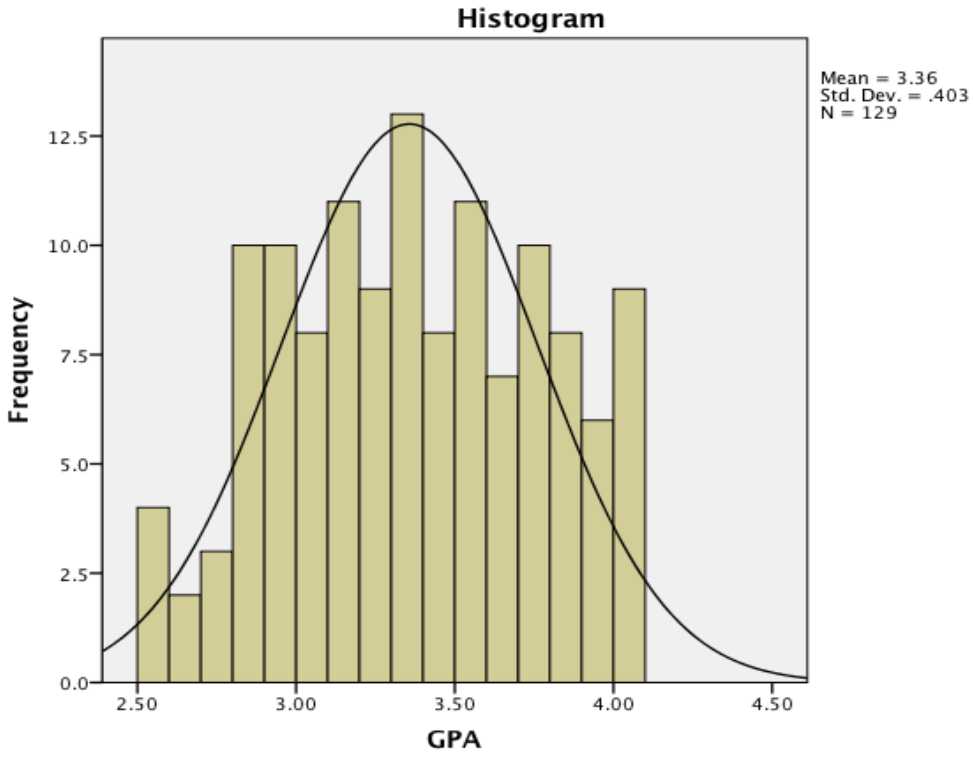
[a] *N= 129*

Pre-Nursing GPA

Descriptive statistics found the subject's (n = 129) pre-nursing GPA to reflect a M = 3.36, SD = 0.406 (Figure 1). Those subjects that experienced academic success, or passed all six nursing courses, were found to have a pre-nursing GPA M = 3.426, SD = 0.404. The subjects that experienced attrition, or failed one nursing course, had a pre-nursing GPA M = 3.139, SD = 0.329. Figure 1, listed below, provides a visualization of the distribution and mean of the subjects pre-nursing GPA upon admission.

Figure 1

Pre-Nursing Grade Point Average



Academic Success and Attrition

Academic success and attrition can be described within the sample and also within each nursing course. The sample consisted of 129 subjects (*n* = 129) with 77.5% of the subjects experienced academic success by passing all six of the nursing courses and 22.5% of the subjects experienced attrition or failed at least one nursing course.

Academic success and attrition rates for the six nursing courses are listed in Table 4. The Nursing Fundamentals course had a sample size of 129, with 95.4 % (*n* = 123) passing and 4.6% (*n* = 6) failing. The Maternal Child nursing course had a sample size of 120, with 99% (*n* = 119) passing and 1 % (*n* = 1) failing. The Psychiatric nursing course had a sample size of 121, with 94.3 % (*n* = 114) passing, and 5.7 % (*n* = 7) failing. The Medication Administration nursing course had a sample size of 121, with a passing rate

of 97.5% (*n* = 118) and a failure rate of 2.5 % (*n* = 3). The Adult Health Gastrointestinal/Respiratory (GI) nursing course had a sample size of 112, with 91.9 % passing (*n* = 103) and 8.1 % (*n* = 9) failing. The Adult Health Genitourinary/Endocrine (GU) nursing course had a sample size of *n* = 112 with 90.2 % (*n* = 101) passing and 9.8 % failing (*n* = 11).

Table 4

Academic Success and Attrition Rates within the Six Nursing Courses

Nursing Course	N	Rates of Academic Success		Rates of Attrition	
		n	%	n	%
Nursing Fundamentals	129	123	95.4	6	4.6
Maternal Child Nursing	120	119	99	1	1
Psychiatric Nursing	121	114	94.3	7	5.7
Medication Administration	121	118	97.5	3	2.5
Adult Health Gastrointestinal/ Respiratory Nursing	112	103	91.9	9	8.1
Adult Health Genitourinary/Endocrine Nursing	112	101	90.2	11	9.8

ATI CTE Exam Scores

The subject's Assessment Technologies Institute's (ATI) Critical Thinking Entrance (CTE) exam (Table 5) scores revealed one composite score and six sub-scores equaling seven scores in all. The composite score is an equally weighted average of the six sub-scores reflecting interpretation, analysis, explanation, inference, evaluation, and self-regulation. Mean scores for the CTE (Table 5) were assessed for the sample (n = 129). The CTE mean scores were also grouped and calculated according to the subjects' academic success (n = 100) and attrition (n = 29).

Table 5

Characteristics of the Subject's Assessment Technologies Institute's Critical Thinking Entrance Scores

ATI CTE Scores	M (n = 129)	SD	Mean Score of Subjects with Academic Success (n = 100)	Mean Score of Subjects with Attrition (n = 29)
Composite	70.7	12.3	71.9	66.6
Interpretation	69.2	20.8	70.6	65.2
Analysis	77.1	20.0	80	67.8
Explanation	77.3	13.9	77.9	74.3
Inference	54.7	17.9	54.7	53.6
Evaluation	70.7	18.1	72.5	65.5
Self-Regulation	87.4	7.7	88.7	82.7

HYPOTHESES TESTING

The purpose of this study was to investigate if a relationship exists between pre-nursing GPA, age, ethnicity, gender, Assessment Technologies Institute's (ATI) Critical Thinking Entrance (CTE) exam and attrition in the first six nursing courses at a state school located in the south eastern United States.

This study utilized a binary logistic regression analysis. A binary logistic regression analysis identifies whether the independent variable predicts the dependent variable. The Wald test is a test of significance for binary logistic regression analysis (Bewick, Cheek, & Ball, 2005). For this study, the level of statistical significance = 0.05. The dependent variable in this study is academic success. To measure academic success, the subjects that failed a nursing course were coded as zero (0 = failure of a nursing course or attrition) and subjects that passed a nursing course were coded as one (1 = passing a nursing course or academic success). The results for the Wald logistic regression are discussed in the tables below (Tables 6 – 15).

The McFadden's R^2 test supports the statistical findings by assessing the model produced from the logistic regression analysis. If the independent variable is found to predict the dependent variable, the fit of the model is successful. The McFadden's R^2 values must be between 0 – 1 (Newsom, 2005).

Two independent variables, gender and ethnicity, were found to have small sub-groups within their sample. The Hosmer Lemeshow R^2 test is used for logistic regressions and is appropriate for samples with this unique quality. The Hosmer Lemeshow R^2 is similar to McFadden's R^2 and provides an assessment of the accuracy of statistical findings were due to the data collected and not randomness. This test assesses the independent variable's impact on the dependent variable by evaluating the expected and observed values in data. The Hosmer Lemeshow produces values between 0 – 1 with values closer to one indicating a strong fit of the independent and dependent variables (LaValley, 2008).

Hypothesis 1:

A positive relationship will exist between ADN students' critical thinking entrance exam composite scores and sub-scores and attrition in the first six nursing courses. Critical thinking entrance exam composite scores and sub-scores are quantitative variables. The first six nursing courses (Nursing Fundamentals, Maternal-Child (MC) Nursing, Medication Administration (Med Adm), Psychiatric (PSY) Nursing, Adult Health Gastrointestinal/Respiratory Nursing (Adult Health GI), and Adult Health Genitourinary/Endocrine (Adult Health GU) Nursing will be quantified as 1 = academic success (subject that passed a nursing course) and 0 = attrition (subject that failed a nursing course).

A statistical analysis was conducted by comparing the subject's academic success rates and the seven CTE scores: composite, interpretation, analysis, explanation, inference, evaluation, and self-regulation (Tables 6 - 12). The first hypothesis was accepted due to positive statistical findings.

Academic success rates within the sample. The Critical Thinking Entrance (CTE) exam scores and sub-scores were compared to academic success rates within the entire sample (n = 129). The CTE analysis sub-score and academic success (Table 6) showed statistical significance with the $p = 0.010$, McFadden's $R^2 = 0.05$, $SD = 20.00$, $M = 77.129$, and a range of 16.7 – 100. The subjects (n = 100) who experienced academic success produced an analysis sub- score $M = 80$, $SD = 17.9$. Those subjects who experienced attrition ($n = 29$) had an analysis sub-score $M = 67.8$, $SD = 23.5$. Based on the coefficient of the regression model, an increase in the sub-score of analysis by one

point would predict a 3 % increase in the odds of the subjects passing all six nursing courses.

The evaluation sub-score and academic success (Table 6) statistical analysis showed significant findings: $p = 0.032$, McFadden's $R^2 = 0.034$, $M = 70.7$, and a range of 12.5 – 100. When the subjects were separated by academic success/attrition, the subjects evaluation sub-score for those with academic success showed $M = 72.250$, $SD = 16.04$ and the attrition group equaled $M = 65.5$, $SD = 23.7$. Based on the coefficient of the regression model an increase in the sub-score of evaluation of one point would predict a 3 % increase in the odds of the subjects passing all six nursing courses.

Table 6

Academic Success Rates of the Sample and Scores from ATI CTE Composite and Sub-Scores

ATI CTE Scores	p value	McFadden's R^2	M (n = 129)	SD	Mean Score of Subjects with Academic Success (n = 100)	Mean Score of Subjects with Attrition (n = 29)
Composite	0.058	0.026	70.7	12.3	71.9	66.6
Interpretation	0.208	0.012	69.2	20.8	70.6	65.2
Analysis	0.010	0.050	77.1	20.0	80	67.8
Explanation	0.495	0.003	77	13.9	77.9	74.3
Inference	0.893	0.000	54.7	17.9	54.7	53.6
Evaluation	0.032	0.034	70.7	10.1	72.5	65.5
Self-Regulation	0.165	0.014	84.4	19.7	88.7	82.7

Notes. The p value for this study was measured by a Wald logistic regression test with $p < 0.05$

Academic success rates within each nursing course. A statistical analysis was conducted to evaluate academic success rates within each of the six nursing courses and the Critical Thinking Entrance (CTE) composite and sub-scores (Tables 7 – 12). Statistical significance was found among the Adult Health Gastrointestinal/Respiratory (Table 11) nursing course and the Adult Health Genitourinary/Endocrine (Table 12) nursing course academic success rates and the CTE sub-scores of analysis and evaluation.

Table 7

Nursing Fundamentals Rates of Academic Success and ATI's CTE Composite and Sub-scores

ATI CTE Scores	McFadden's R^2	p value
Composite Score	0.032	0.191
Interpretation	0.035	0.195
Analysis	0.001	0.791
Explanation	0.009	0.515
Inference	0.003	0.683
Evaluation	0.037	0.163
Self Regulation	0.040	0.133

Notes. The p value for this study was determined by the Wald test with $p < 0.05$.
[a] n = 129

Table 8

Maternal Child Nursing Rates of Academic Success and ATI's CTE Composite and Sub-scores

ATI CTE Scores	McFadden's R^2	p value
Composite Score	0.256	0.205
Interpretation	0.323	0.991
Analysis	0.215	0.994
Explanation	0.332	0.992
Inference	0.000	0.969
Evaluation	0.109	0.345
Self Regulation	0.077	0.992

Notes. The p value for this study was determined by the Wald test with $p < 0.05$
$_a$ $n = 120$

Table 9

Psychiatric Nursing Rates of Academic Success and ATI's CTE Composite and Sub-scores

ATI CTE Scores	McFadden's R^2	p value
Composite Score	0.018	0.349
Interpretation	0.006	0.571
Analysis	0.011	0.432
Explanation	0.013	0.420
Inference	0.036	0.183
Evaluation	0.015	0.391
Self Regulation	0.012	0.475

Notes. The p value for this study was determined by the Wald test with $p < 0.05$
[a] $n = 121$

Table 10

Medication Administration Rates of Academic Success and ATI's CTE Composite and Sub-scores

ATI CTE Scores	McFadden's R^2	p value
Composite Score	0.057	0.183
Interpretation	0.050	0.234
Analysis	0.031	0.339
Explanation	0.006	0.673
Inference	0.003	0.760
Evaluation	0.084	0.108
Self Regulation	0.091	0.078

Notes. The p value for this study was determined by the Wald test with $p < 0.05$
[a] $n = 121$

Statistical significance was found between the Adult Health Gastrointestinal/Respiratory nursing course (n = 112) (Table 11) rates of academic success and the CTE sub-score for analysis. The binary logistic regression analysis produced p = 0.010, McFadden's R^2 = 0.118, M = 77.9, SD = 18.8, and score ranges from 12 – 100. Based on the coefficient of the regression model, an increase in the sub-score for analysis of one point would predict a 5 % increase in the odds of the student passing the nursing course.

Table 11
Adult Health Gastrointestinal/Respiratory Academic Success Rates and ATI CTE Scores

ATI CTE Scores	McFadden's R^2	p value
Composite Score	0.023	0.222
Interpretation	0.001	0.780
Analysis	0.118	0.010
Explanation	0.001	0.765
Inference	0.005	0.579
Evaluation	0.033	0.139
Self Regulation	0.012	0.376

Notes. The p value for this study was determined by the Wald test with $p < 0.05$.
[a] n = 112

Statistical significance was found between the Adult Health Genitourinary/Endocrine nursing course (n = 112) (Table 12) rates of academic success and the evaluation sub-score. Significant findings were uncovered indicating a $p = 0.030$, McFadden's $R^2 = 0.064$, $M = 71.4$, $SD = 17.1$, with a range of 12 – 100. Based on the coefficient of the regression model an increase in the sub-score for evaluation of one point would predict a 3 % increase in the odds of the student passing the nursing course.

Table 12

Adult Health Genitourinary/Endocrine Nursing Rates of Academic Success and ATI's CTE Composite and Sub-scores

ATE CTE Scores	McFadden's R^2	p value
Composite Score	0.045	0.068
Interpretation	0.034	0.118
Analysis	0.053	0.050
Explanation	0.009	0.419
Inference	0.000	0.884
Evaluation	0.064	0.030
Self Regulation	0.002	0.689

Notes. The p value for this study was determined by the Wald test with $p < 0.05$
[a] $n = 112$

Hypothesis 2:

There will be a significant correlation between select demographic variables (age, gender, ethnicity), critical thinking entrance exam scores, pre-nursing grade point average, and academic success for ADN students in their first six nursing courses. The independent variable consisted of the Critical Thinking Entrance exam scores (Table 6), age (Table 14), gender (Table 16), ethnicity (Table 15), and pre-nursing GPA (Table 13). The first six nursing courses (Nursing Fundamentals, Maternal-Newborn Nursing, Medication Administration, Psychiatric Health Nursing, Adult Health Gastrointestinal/Respiratory Nursing, and Genitourinary/Endocrine Adult Health Nursing) was coded as 1 = passing the course or academic success and 0 = course failure or attrition. The second hypothesis was accepted due to positive statistical findings.

Academic success within the sample. Statistical significance was discovered when the subject's (n = 129) pre-nursing GPA was evaluated against academic success and attrition within the sample. The subject's pre-nursing GPA showed a M = 3.36, SD = 0.403, p = 0.001, McFadden's R^2 = 0.088, and the score ranged from 2.5 – 4.0. Based on the coefficient of the regression model an increase in pre-nursing GPA by 0.1 would predict a 21 % increase in in the odds for passing all six nursing courses.

Academic success within each nursing course. Additional statistical tests were conducted to evaluate the academic success rates within each of the six nursing courses with subjec'ts pre-nursing GPA. The Psychiatric Nursing (n = 121) (Table 13) academic success rates and pre-nursing GPA found statistical significance of p = 0.032, McFadden's R^2 = 0.049, M = 3.382, SD = 0.398, and a range from 2.5 – 4.0. Based on

the coefficient of the regression mode, an increase in pre-nursing GPA by 0.1 would predict a 25 % increase in in the odds for passing the course.

The data did not identify statistical significance between the select demographic variables age (Table 14), gender (Table 16), or ethnicity (Table 15). Descriptions of the select demographics of age, gender, and ethnicity were discussed in the beginning of this chapter.

Table 13

Pre-Nursing GPA and Academic Success in Six Nursing Courses

Nursing Course	n	Mean Pre-Nursing GPA	Standard Deviation	McFadden's R^2	p value
Nursing Fundamentals	129	3.357	0.403	0.087	0.057
Maternal Child Nursing	120	3.375	0.408	0.049	0.472
Psychiatric Nursing	121	3.382	0.398	0.101	0.032
Med Adm	121	3.375	0.406	0.007	0.661
Adult Health GI	112	3.396	0.411	0.033	0.153
Adult Health GU	112	3.40	0.404	0.056	0.051

Notes. The p value for this study was measured by a Wald logistic regression test with $p < 0.05$

[a] Medication Administration (Med Adm); Adult Health Gastrointestinal/Respiratory Nursing (Adult Health GI); Adult Health Genitourinary/Endocrine Nursing (Adult Health GU).

Table 14

Age and Academic Success in Six Nursing Courses

Nursing Course	n	Age	Standard Deviation	McFadden's R^2	p value
Nursing Fundamentals	129	32	9.70	0.038	0.232
Maternal Child Nursing	120	33	9.90	0.060	0.520
Psychiatric Nursing	121	33	9.94	0.008	0.532
Med Adm	121	33	9.88	0.004	0.757
Adult Health GI	112	32	9.75	0.003	0.654
Adult Health GU	112	33	10.08	0.030	0.140

Notes. The p value for this study was measured by a Wald logistic regression test with $p < 0.05$.

[a] Medication Administration (Med Adm); Adult Health Gastrointestinal/Respiratory Nursing (Adult Health GI); Adult Health Genitourinary/Endocrine Nursing (Adult Health GU).

Table 15

Ethnicity and Academic Success in Six Nursing Courses

Nursing Course	n	Hosmer Lemeshow R^2	p value
Nursing Fundamentals	129	0.516	0.757
Maternal Child Nursing	120	-8.47	0.204
Psychiatric Nursing	121	.199	0.570
Med Adm	121	-2.35	0.549
Adult Health GI	112	0.188	0.865
Adult Health GU	112	0.230	0.526

Notes. LOS, Level of significance for this study was determined by the Wald test with $p < 0.05$

[a] Medication Administration (Med Adm); Adult Health Gastrointestinal/Respiratory Nursing (Adult Health GI); Adult Health Geniturinary/Endocrine Nursing (Adult Health GU).

Table 16

Gender and Academic Success in Six Nursing Courses

Nursing Course	n	Females	Males	Hosmer Lemeshow R^2	p value
Nursing Fundamental	129	87.5 %	12.5 %	0.725	0.169
Maternal Child Nursing	120	89 %	11 %	0.648	0.323
Psychiatric Nursing	121	89 %	11 %	0.895	0.822
Med Adm	121	89 %	11 %	0.665	0.119
Adult Health GI	112	90 %	10 %	0.467	0.295
Adult Health GU	112	91 %	9 %	0.208	0.208

Notes. The p value for this study was measured at $p < 0.05$ using a Hosmer-Lemeshow logistic regression analysis.
[a] Medication Administration (Med Adm); Adult Health Gastrointestinal/Respiratory Nursing (Adult Health GI); Adult Health Genitourinary/Endocrine Nursing (Adult Health GU).

DISCUSSION OF FINDINGS

The findings of this study will be discussed. The characteristics of the demographics, hypothesis testing, and the relationships among variables will be presented.

Demographic and Background Characteristics

The sample for this study was from a state college located on the southeastern U.S. The sample (n = 129) consisted of admitted students during the 2010 academic year. The gender of the subjects (n = 129) consisted of 87.5% (n = 113) females and 12.5% (n = 16) males. The sample site's gender characteristics are similar to national assessments made by the NLN in 2010, which estimated 87.5 % of ADN students were female and 12.5 % were male (National League for Nursing, 2011b). The subjects' ages (N = 129) ranged from 21 – 58 years of age (M = 32.6, SD = 9.7). The sample had 39% of the subjects over 35 years of age and these findings are similar to the NLN in which the 44% of ADN students are 30 and older (National League for Nursing, 2011c).

The subjects' (n = 129) ethnicity consisted of 76 % (n = 98) White, 9 % (n = 12) Haitian, 7 % (n = 9) Black, 3 % (n = 4) Other, 2 % (n = 2) Asian, 2 % (n = 2) Indian, and 1 % (n = 1) Pacific Islander (Table 1). Ethnic diversity at the sample site is consistent with national findings. In 2011, the National League for Nursing reported 25% of the ADN student population was ethnically diverse (National League for Nursing, 2011d). While it is supportive of this study to have demographic characteristics similar to national findings, nursing still needs to strive to broaden the diversity of its workforce. Nursing faculty should support the initiatives put forth the by the NLN to incorporate ideas to diversify the workforce, which starts with diversifying the student nurse population (National League for Nursing, 2011a).

Relationship Among the Variables

Hypothesis 1. Hypothesis one stated: A positive relationship will exist between ADN students' critical thinking entrance exam composite scores and sub-scores and

attrition in the first six nursing courses. Critical thinking entrance exam composite scores and sub-scores are quantitative variables. The first six nursing courses (Nursing Fundamentals, Maternal-Child (MC) Nursing, Medication Administration (Med Adm), Psychiatric (PSY) Nursing, The Adult Health Gastrointestinal/Respiratory Nursing (Adult Health GI), and Adult Health Genitourinary/Endocrine (Adult Health GU) Nursing will be quantified as 1 = Academic Success and 0 = Attrition. The first hypothesis was accepted due positive statistical findings in the data.

Academic success rates within the sample. Academic success rates were assessed against the CTE scores and sub-scores. A data analysis found the subjects (n = 129) analysis sub-scores and academic success rates (Table 6) showed statistical significance with p = 0.010, McFadden's R^2 = 0.05, SD = 20.09, M = 77.129, and a range of 16.7 – 100. Based on the coefficient of the regression model, a one point increase in the analysis sub-score would predict a 3% increase in the odds of the student passing all six nursing courses.

The p value and the McFadden's R^2 indicate the fit of the model for the CTE sub-score and academic success rates is moderately significant. The model can be further supported by the difference in sub-scores between those subjects who experienced academic success and attrition. The data analysis for those who experienced academic success (n = 100) had an analysis sub-score M = 80 and the attrition group (n = 29) M = 67.8. A 12.2 point difference defines impressive boundaries between academic success and attrition. The broad boundaries between academic success and attrition and the statistical support for the model fit may illuminate potential tools for nursing education to

improve academic success rates by using the CTE sub-scores for analysis as admission criteria.

The subjects' (n = 129) CTE evaluation sub-score and academic success (Table 6) rates were also found to be statistically significant. The CTE sub-score for evaluation and academic success rates showed p = 0.032, McFadden's R^2 = 0.034, M = 70.7, and a range of 12.5 – 100. Based on the coefficient of the regression model, an increase in the evaluation sub-score by one point would predict a 3 % increase in the odds of the student passing all six nursing courses. When the subjects were separated by academic success and attrition, the passing subjects' (n = 100) evaluation sub-score M = 72.250, SD = 16.04 compared to the attrition group (n = 29) M = 65.5, SD = 23.7.

The data analysis, p value of 0.032 and McFadden's R^2 of 0.034, signify the fit of the model for the CTE sub-score evaluation and academic success rates is moderately significant. While a higher R^2 and a lower p value would point to highly significant findings and a stronger model fit, the findings of this analysis indicate a moderately well fitting model. Additional support for the use of the CTE sub-score for analysis as an indicator for academic success is found by a 6.7 point difference is the CTE sub-score analysis means of those with academic success and attrition. The distinctive difference between the means for those with academic success and attrition may provide guidance for nurse educators to create guidelines for admission criteria using the CTE sub-score for evaluation.

Academic success rates within each course. The CTE scores and sub-scores were also evaluated against academic success within each course. Again, the sub-scores for analysis and evaluation were found to be significant with academic success rates in

two nursing courses. The subjects' (n = 112) data had significant statistical findings when the CTE sub-scores for evaluation were compared to academic success rates in the Adult Health Genitourinary/Endocrine (GU) nursing course (Table 12). The data analysis showed $p = 0.030$, McFadden's $R^2 = 0.064$, $M = 71.4$, $SD = 17.1$ and moderately supported the fit of the model. Based on the coefficient of the regression model, an increase in the evaluation sub-score by one point would predict a 3 % increase in the odds of the subject passing the course. No prior research on the use of the CTE sub-scores to predict academic success within a nursing program exists. Further research using the CTE sub-scores may prove to be beneficial and support the model within this study.

ATI defines evaluation as "to assess the credibility, significance, and relevance of information necessary to support the conclusions; and to assess the information for biases, stereotypes, and clichés, or inappropriateness" (Assessment Technologies Inc, 2000, p. 1). Evaluation is an additional cognitive skill that is part of the nursing process and essential in its execution. Patients' status needs to be evaluated, conclusions need to be drawn, and the evidence at hand can determine the patients' current status (Chabeli, 2007; Chabeli 2010). Nursing students must evaluate the patients' status to assess the current interventions and then decide the next step in care. Nursing students need to evaluate patient care. Similar to the Adult Health Gastrointestinal/Respiratory nursing course, Adult Health Genitourinary/Endocrine is in the middle of the nursing program at the sample site. Students are expected in this class to be able to create a nursing care plan and evaluate the care provided to patients. Academic assignments, quizzes, exams, and care plans at this level will have an evaluative component to ensure nursing students can effectively execute the nursing process. Nursing students that struggle with evaluating

patient care and status will struggle academically while enrolled in a nursing program. Therefore, it is a likely assumption that students with weak scores on evaluation struggle and are at risk for attrition within a nursing program.

Statistical significance was found between the Adult Health Gastrointestinal/Respiratory (GI) (n = 112) (Table 6) nursing course academic success rates and the CTE sub-score for analysis. The model of Adult Health GI academic success rates and the CTE sub-score for analysis was considered to be moderately significant with the binary logistic regression indicating a p = 0.010, McFadden's R^2 = 0.118, M = 77.9, SD = 18.8, and the scores ranged from 12 – 100. Based on the coefficient of the regression model, an increase in the sub-score for analysis by one point would predict a 5 % increase in the odds of the student passing the nursing course. No prior research exists that used the CTE sub-scores for prediction of academic success. Further research may be beneficial to establish reliability for the predictive model.

ATI defines analysis as "to examine ideas; analyze arguments; make comparisons; and categorize, organize, and prioritize variables" (Assessment Technologies Inc, 2000, p. 1). It is well supported in the literature that the ability to analyze data is a component of critical thinking (Wangsteen, Johansson, Bjorkstrom, and Nordstrom, 2010; Chabeli, M, 2010). Analysis is also seen as a type of cognitive ability students demonstrate by looking at a patient situation and investigating aspects affecting the patient (Lunney, 2010). Nursing students use analysis as a key component to expedite the nursing process. It involves discovery, scrutiny, and observing interrelationships (Chabeli, 2010). The Adult Health Genitourinary/Endocrine nursing course is in the middle of the program at the sample site. At this stage of nursing

education, the students are expected to care for complex patients on a medical/surgical unit. During the nursing process, analysis allows the nurse to look at the data collected, compares and contrast normal to abnormal findings, organize all of the data, and attempt to connect presenting signs and symptoms with pathophysiology and pharmocokinetics. Understanding the role analysis plays in the nursing process, it is easy to see how imperative it is that nursing students have the ability to analyze. It is reasonable to expect students that are academically weak to struggle with the cognitive ability to analyze. Without the ability to analyze patient data, students will struggle in the academic setting with exams and course related material.

Critical thinking composite scores. The CTE composite score is reflective of an average of the six equally weighted sub-scores. When the subjects were separated into two groups (Table 6), academic success (n = 100) and attrition (n = 29), those that passed all six nursing courses had a CTE composite M = 71.9, SD = 11.7 and those lost to attrition (n = 29) were found to have a composite CTE score M = 66.6, SD = 15.7. A 5.3 point difference existed between the composite scores of those subjects who experienced academic success and those that experienced attrition. The p value was not found to be significant for the CTE composite score and academic success rates within the sample (n = 129). The data analysis showed p = 0.058, McFadden's R^2 = 0.02 and was therefore not statistically significant. The 5.3 difference between success and failure may be enough to guarantee academic success for nursing students. However, further testing with larger samples may indicate statistical significance between the CTE composite score and academic success.

Only one other study, by Jones and Morris (2007) evaluated the effectiveness of ATI's CTE exam composite scores (N = 104) with academic success. Jones and Morris (2007) found that subjects that experienced academic success (n = 60) had a CTE M = 71.63, SD = 1.75, and those lost to failure (n = 44), had a M = 62.05, SD = 2.04. The subjects who experienced academic success in this study and in Jones and Morris (2007) study had similar CTE composite means scores to the sample in this study. Nurse educators may decide to use the CTE composite scores to predict academic success based on current research.

Attrition rates within the sample. At first glance, the attrition rates within the sample site appeared to be low. Attrition rates within each course ranged from 0.833% (n = 1) (Maternal Child nursing) to 9.8 % failing (n = 11) (Adult Health GU). Of the subjects that experienced attrition (n = 29), 21% (n = 6) occurred in the first nursing course, Nursing Fundamentals. Subjects that failed Fundamentals are required to withdraw from the nursing program and are not permitted to re-take the course. Thirty-five percent (n = 10) of subjects lost to attrition had one course failure and chose not to return due to academic difficulty. Subjects with two failures (n = 8), 27%, were dismissed from the program. The subjects that remained in the program with one academic failure equated to 17% (n = 5).

These findings are unique and have a limited generalizability due to one sample site. However, the findings are rather significant due to the fact that 35% of subjects that failed a nursing course chose not to return due to academic difficulty. Students today sacrifice a lot to pursue their education. It is unfortunate after years of hard work, one course failure causes subjects not to persist in nursing school. The applicant pool for

nursing programs is vast and nursing education should be able to identify those students who have the highest potential for academic success. A significant number of students who apply to nursing programs are rejected. The admission process should be more effective to help reduce attrition and increase nursing graduates.

To compare the findings at the sample site, the National League for Nursing in 2006 reported attrition rates for ADN programs to be at 17%. Published nursing literature by Peterson (2008) found BSN attrition rates at 30%, and Rogers (2010) reported attrition rates for ADN programs at 20%. The Office of Program Policy Analysis & Government Accountability (OPPAGA) for Florida reported in January of 2012 that as of 2011, retention rates in ADN programs for students that entered the program in 2010 to be at 85%. Historically, Florida's ADN programs retained between 81 % - 85% of enrolled students from 2008 – 2009 (OPPAGA, 2012).

The Florida Center for Nursing (2011a, January) projects Florida will need an additional 50,000 nurses by 2025. In order to meet this demand, nursing programs must increase graduates by 5% annually. In 2010 - 2011, OPPAGA (2012, January) reported that ADN programs in the state graduated 5,011, and all nursing programs (license granting) graduated 13,444. Academic success of students is at the core of nursing education and it provides a lifeline to nursing. The potential predictive ability of the CTE sub-scores is promising. If the CTE can predict academic success of nursing applicants, academic success will increase and so may the nursing graduates. An increase in the number of graduates may assist the state of Florida to reduce the impending nursing shortage and provide nurses to care for patients in our community, state, and nation.

Hypothesis 2. Statistical analysis were conducted to evaluate if pre-nursing GPA, age, gender, and ethnicity were correlated with attrition rates within six nursing courses at the sample site. The second hypothesis was accepted due to positive statistical findings.

Academic success within the sample. The model of pre-nursing GPA and academic success within the sample found statistical significance with $p = 0.001$, McFadden's $R^2 = 0.088$, M = 3.36, $SD = 0.403$, and the scores ranged from 2.5 – 4.0. The model has strong statistical significance due to the low p value of 0.001 and $R^2 = 0.088$. Based on the coefficient of the regression model an increase in pre-nursing GPA by 0.1 would predict a 21% increase in the odds of the student passing all six nursing courses. Prior research by Newton, Smith, Moore, and Magnan (2007); Newton, Smith, and Moore (2007); and Peterson (2009) found pre-nursing GPA to be predictive of success in Nursing Fundamentals. The research findings in this study support previous findings and extend them by showing pre-nursing GPA predicting academic success midway into a nursing program.

Academic success rates within each course. The Psychiatric Nursing (n = 121) (Table 8) course showed $p = 0.032$, McFadden's $R^2 = 0.049$, $M = 3.382$, $SD = 0.398$. Based on the coefficient of the regression model an increase in the pre-nursing GPA by 0.1 would predict a 25 % increase in the odds of the student passing the nursing course. The model of psychiatric nursing academic success rates and pre-nursing GPA is moderately significant as indicated by a p = 0.032 and $R^2 = 0.049$. The research findings in this study extend the current nursing science, which has predicted academic success using pre-nursing GPA only in the first semester (Newton, Smith, Moore, and Magnan,

2007; Newton, Smith, and Moore, 2007; Peterson, 2009). The significant findings related to pre-nursing GPA predictability past the first semester are important. However, as discussed in the literature review in Chapter Two, conflicting findings have been reported in past research discussing pre-nursing GPA's role in admission criteria. The findings in this study regarding pre-nursing GPA and its role as admission criteria predicting success are positive and further research is needed to solidify pre-nursing GPA's role in admission criteria.

CHAPTER SUMMARY

This research study utilized 129 subjects from an Associate Degree Nursing (ADN) program in the southeastern United States. This research study sought to identify a relationship between select student characteristics and academic success of subjects enrolled in a nursing program. The independent variables of age, gender, ethnicity, pre-nursing GPA, and scores on the Assessment Technologies Institute Critical Thinking Entrance exam were evaluated against the rates of academic success and attrition of nursing subjects. Two hypotheses were examined using a binary logistic regression analysis. The results presented in this chapter represent the statistical analysis that evaluated the independent and dependent variables used in this study. The findings in this chapter will be discussed in Chapter 5 along with limitations, implications, and recommendations stemming from this study.

CHAPTER FIVE

SUMMARY AND DISCUSSION

The purpose of this study was to investigate if a relationship exists between pre-nursing GPA, age, gender, ethnicity, Assessment Technologies Institute's (ATI) Critical Thinking Entrance (CTE) exam and attrition in the first six nursing course at a state school located in the south eastern United States.

SUMMARY OF THE STUDY

Findings from this study may enhance admission policies of nursing programs within the U.S and allow for admittance of the most qualified applicants. Qualified applicants should experience academic success and avoid attrition (Newton, Moore, and Smith, 2007). If more nursing students can be academically successful while enrolled in a nursing program, more students will graduate. An increase in nursing graduates will assist in reducing the nursing shortage.

Bean and Metzner's Conceptual Model of Nontraditional Undergraduate Student Attrition (CMNUSA) is a theoretical framework addressing attrition of undergraduate students. Two hypotheses were tested:

Hypothesis 1: A positive relationship will exist between ADN students' critical thinking entrance exam composite scores and sub-scores and attrition in the first six nursing courses.

Hypothesis 2: There will be a significant correlation between select demographic variables (age, gender, ethnicity), critical thinking entrance exam scores, pre-nursing grade point average, and attrition for ADN students in their first six nursing courses.

A retrospective correlational research design was used to guide this study. The correlational design provided for an investigation into the relationship between the independent variables of age, gender, ethnicity, pre-nursing GPA, critical thinking exam (CTE) composite and sub-scores and the dependent variables of attrition rates of nursing students in the first six courses of the sample site. The variables used for this study were found in data that was collected upon the subjects' admission to the program and existed as secondary data.

The sample data consisted of students admitted during the 2010 academic year. Upon IRB approval from Barry University and the sample site, access was sought and obtained from the Associate Dean/Administrator of the nursing program at the sample site. The Associate Dean/Administrator provided the PI with subjects' data.

Scores from the Assessment Technologies Institutes' (ATI) Critical Thinking Entrance (CTE) exam were used in this study. The CTE, by ATI, was designed to evaluate critical thinking measures of nursing students. The CTE was created by ATI in 2000 to assess critical thinking abilities of nursing students. The CTE was adopted by the sample site in 2010 and administered routinely to students enrolled in Nursing Fundamentals. Concepts measured in the CTE include interpretation, analysis, explanation, inference, evaluation, and self-regulation. The CTE composite score is a representation of the six equally weighted sub-scores. The seven CTE scores range between 0 – 100.

The data was evaluated using a binary logistic regression analysis. For this study, the level of statistical significance was a $p < 0.05$. Two dependent variables were evaluated for this study. Subjects that failed a nursing course equaled zero (0 = failure of

a nursing course or attrition) and subjects that passed a nursing course equaled one (1 = passing a nursing course or academic success).

The subjects (n = 129) (Table 3) ethnicity consisted of 76 % (*n* = 98) White, 9 % (*n* = 12) Haitian, 7 % (*n* = 9) Black, 3 % (*n* = 4) Other, 2 % (*n* = 2) Asian, 2 % (*n* = 2) Indian, and 1 % (*n* = 1) Pacific Islander. Females (Table 1) comprised 87.5 %(*n* = 113) of the sample and males comprised 12.5 % (*n* = 16) of the sample. The mean age (Table 2) of the subjects was (*n* = 129) 32.6, *SD* = 9.7 with a range of 21 - 58 years of age.

Academic success rates (Table 4) were evaluated within the sample (n = 129). The subjects (n = 129) that experienced academic success and passed all six nursing courses equaled 77. 5 % (*n* = 100). Academic success rates within each of the six nursing courses were also evaluated. Academic success rates in the Nursing Fundamentals course (*n* = 129) equaled 95.4% of the subjects (*n* = 123) passed and 4.6% (*n* = 6) of subjects failed. The Maternal Child nursing course (n = 120) academic success rates were 99% (*n* = 119) of the subjects passed and 1 % (*n* = 1) failed. The Psychiatric nursing course (n = 121) academic success rates were 94.3 % (*n* = 114) of subjects passed and 5.7 % (*n* = 7) failed. The Medication Administration nursing course (*n* = 121) academic success rates were 97.5 % (*n* = 118) of subjects passed and 2.5 % (*n* = 3) of subjects failed. The Adult Health Gastrointestinal/Respiratory (GI) nursing course (*n* = 112) academic success rates were 91.9 % of the subjects passed (*n* = 103) and 8.1 % (*n* = 9) of the subjects failed. The Adult Health Genitourinary/Endocrine (GU) nursing course (*n* = 112) academic success rates were 90.2 % (*n* = 101) passed and 9.8 % failed (*n* = 11).

Hypothesis 1

Academic success rates within the sample were compared to the CTE composite and sub-scores. The first hypothesis was accepted due to positive statistical findings.

Academic success rates within the sample. The subjects' scores on the CTE exam were evaluated against the academic success rates within the sample. Two scores on the CTE, the sub-scores for analysis and evaluation, were found to be statistically significant with academic success rates within the sample. The analysis sub-score and academic success rates (Table 8) showed statistical significance with the $p = 0.010$, McFadden's $R^2 = 0.05$, $SD = 20.09$, $M = 77.129$, and a range of 16.7 – 100. If the subjects were separated by academic success and attrition, those subjects who experienced academic success had an analysis sub-score $M = 80$, $SD = 17.9$ and the group lost to attrition analysis sub-score $M = 67.8$, $SD = 23.5$. Based on the coefficient of the regression model, a one point increase in the analysis sub-score would predict a 3% increase the subjects odds of passing all six nursing courses.

The evaluation sub-score and academic success rates within the sample (Table 8) showed significant findings with $p = 0.032$, McFadden's $R^2 = 0.034$, $M = 70.7$, and a range of 12.5 – 100. When the subjects were separated by academic success and attrition, those who experienced academic success had an evaluation sub-score $M = 72.250$, $SD = 16.04$ and the attrition group $M = 65.5$, $SD = 23.7$. Based on the coefficient of the regression model, a one point increase in the sub-score evaluation would predict a 3 % increase in the subject's odds of passing all six nursing courses.

Academic success rates within each course. The CTE exam scores were evaluated against each nursing course's academic success rates. Two courses were found

to be statistically significant with two of the CTE sub-scores. Statistical significance was found between the Adult Health Gastrointestinal/Respiratory (n = 112) (Table 12) nursing course academic success rates and the CTE sub-score for analysis. The binary logistic regression indicated a p = 0.010, McFadden's R^2 = 0.118, M = 77.9, SD = 18.8, and the scores ranged from 12 – 100. Based on the coefficient of the regression mode, an increase in the analysis sub-score by one point would predict a 5 % increase in the odds of the subject's passing the course.

The sub-score evaluation showed statistical significance with the Adult Health Genitourinary/Endocrine (n = 112) nursing course (Table 11) rates of academic success and attrition. The findings showed p = 0.030, McFadden's R^2 = 0.064, M = 71.4, SD = 17.1, with a range of 12 – 100. Based on the coefficient of the regression model, an increase in the sub-score of evaluation would predict a 3 % increase in the odds of the student passing the course.

Hypothesis 2

Academic success rates were evaluated against the subjects' pre-nursing GPA. The second hypothesis was accepted due positive statistical findings.

Academic success within the sample. Pre-nursing GPA was evaluated against the subjects' academic success rates of the subject in the sample. The subjects' pre-nursing GPA (Table 13) and academic success rates showed statistical significance with p = 0.001, McFadden's R^2 = 0.088, M = 3.36, SD = 0.403, and the scores ranged from 2.5 – 4.0. Based on the coefficient of the regression model, an increase in the pre-nursing GPA by 0.1 would predict a 21 % increase in the odds of the subject passing all six nursing

courses. The data did not identify statistical significance between the select demographic variables age (Table 14), gender (Table 16), or ethnicity (Table 15).

Academic success within each nursing course. The subjects' pre-nursing GPA and the academic success rates in the six nursing courses were evaluated for statistical significance. The academic success rates of subjects enrolled in the Psychiatric Nursing (Table 13) (n = 121) course were found to be statistically significant with pre-nursing GPA. The statistical analysis showed with $p = 0.032$, McFadden's $R^2 = 0.049$, $M = 3.382$, $SD = 0.398$, and a range from 2.5 – 4.0. Based on the coefficient of the regression model an increase in pre-nursing GPA by 0.1 would predict a 25 % increase in the odds of the subject passing the course.

IMPLICATIONS OF THE STUDY

The implications of this study suggest scores on the CTE exam, from ATI, and pre-nursing GPA may have some predictive value in identifying students that will be successful in nursing programs past the first semester. Few studies have been able to predict academic success past the first semester (Newton and Moore, 2009). Furthermore, little research has focused on the use of critical thinking entrance scores as admission criteria to predict academic success and/or attrition. The research findings of this study extend the nursing science that found critical thinking scores and pre-nursing GPA correlated with academic success (Ellis, 2006; Shirrell, 2008; Jones and Morris, 2007). The predictive value pre-nursing GPA presented in this study surpassed the first semester of nursing which was not a common finding among previous studies.

The idea that critical thinking abilities of nursing students are important is not new. The utilization of critical thinking scores as a predictive component of nursing

admission criteria is beginning to expand from previously published work by Ellis (2006), Jones and Morris (2007) and Shirrell (2008). Implications from these studies' findings impact nursing education, nursing practice, nursing research, and health care policy.

SIGNIFICANCE OF THE STUDY

As the economy slowly strengthens, it is expected that nurses eligible for retirement will leave the profession and those wishing to work only part-time will be able to do so economically (Florida Center for Nursing, 2010b, January). At the same time, the health care sector will see an increase in demand from more patients seeking health care. More nurses will be needed to care for the aging baby boomers and the influx of new patients via the impact of the *Patient Protection and Affordable Care Act*. The Bureau of Labor Statistics (2012) noted registered nurse positions to be one of the largest projected job growths until 2020. Nursing literature has consistently discussed the need for more nurses (Rouse and Rooda, 2010; Florida Center for Nursing, 2011, February). The nursing shortage appears as if it is only going to expand. The findings of this study indicate the CTE exam sub-scores and pre-nursing GPA may have some predictability as admission criteria forecasting academic success. The potential ability of the CTE exam sub-scores and pre-nursing GPA to effectively identify qualified applicants for nursing programs is promising and warrants more research.

Nursing Education

The findings of this study may have several benefits for nursing education. Identification of effective admission criteria will provide nursing programs the ability to choose applicants that are prepared for the rigor of nursing school. Increases in the subjects' pre-nursing GPA or sub-scores on CTE exam may greatly enhance applicants' academic success within nursing programs. The CTE sub-scores of analysis and evaluation had far reaching effects of predictability within the program. The Adult Health Gastrointestinal/Respiratory and Genitourinary/Endocrine nursing courses are midway in the nursing program. Predicting success midway into the nursing program is a new and noteworthy research finding for nurse educators whom usually only see predictability within the first nursing course. Based on previous research by Newton, Smith, and Moore (2007), academic variables such as pre-nursing GPA have proved to be reliable indicators of students' academic success in the first semester of nursing school. In addition, the research findings may also illuminate a benchmark for students at-risk for failing. If nursing faculty is aware prior to admission, which students may fail, additional support for at-risk students could be provided.

Due to the limited number of qualified nursing faculty, nursing programs are restricted when it comes to increasing admission numbers and increasing course limits (Fox and Abrahamson, 2009; Scherzer, Stotts, and Fontaine, 2010; and Reinhard and Hassmiller, 2011). Therefore, it is imperative for those students accepted into a nursing program to be successful and avoid failing and not returning.

The benefits to nursing education from the findings of this study are dynamic. Nurse educators may have new and innovative methods to reduce attrition and to increase

the number of nursing graduates. Effective admission criteria provide nursing educators the tools to identify those applicants successful within the nursing program. Higher rates of academic success will decrease attrition rates within nursing programs and graduate more nurses. Nursing programs that use rates of attritions as benchmarks for accreditation may be able meet their set criteria for attrition and academic success.

Nursing Practice

Now, more than ever, the need for more nursing graduates is imperative. To further stress the need for more nurses, Florida is experiencing a nursing shortage. In Florida, 17.3 % of the population is over 65 years-of-age, which is 4.3% higher than the national average. Florida is known as a welcoming place for retirement and the population over 65 years-of-age, however, this age group also requires more health care. The Florida Center for Nursing (FCN)' in 2012, published *The Demand for Nurses in Florida: The 2011 Survey of Florida's Nurse Employers*, which discusses 483 returned surveys from health care agencies in Florida. The FCN reported a projected 15,740 unfilled registered nurse positions for 2012 (Florida Center for Nursing, 2012, January). It is apparent more nurses are needed to care for patients. Findings from this study may have illuminated critical thinking entrance scores as effective admission criteria to identify qualified applicants. Nursing programs acceptance of qualified applicants may lead to an increase in nursing graduates, which may assist in reducing the shortage here in Florida and in the U.S.

The current literature has supported nurses' beliefs that nurse-patient ratios matter in patient safety and quality of care. Research has successfully indicated patient safety improves, as do patient outcomes, with more registered nurses caring for patients

(Ausserhofer, et. al, 2012; Needleman, Buehaus, Pankratz, Leibson, Stevens, Harris, 2011; Twigg, Duffield, Bremmer, Rapley, and Finn, 2011). To ensure ample numbers of qualified nurses are available to provide patient care, new initiatives are needed to improve graduation rates of nursing students. Improvements in admission criteria will advance nurse educators' ability to identify the most qualified applicants for nursing programs. Fortunately for nursing education, the applicant pool is vast. Selecting the strongest candidates will assist nurse educators to ensure that academic success of students is achievable. The findings of this study may unlock new initiatives to identify the most qualified students to admit into nursing programs.

Nursing Research

The research findings of this study extend the nursing science in multiple ways. The science investigating issues related to admission criteria and its predictability is unclear (Higgins, 2005; Rees, 2006; Stuenkel, 2006; Newton and Moore, 2009; McNelis, Wellman, Splann-Krothe, Hrisomalos, Mcelveen and South, 2010; Wolkowitz and Kelley, 2010). The findings from this study build on Ellis' (2006) research that benchmarked critical thinking scores for admission criteria and found success. This research study also supports findings from Jones and Morris's (2007) study investigating ATI's CTE exam scores predicting academic success within a nursing program. The continuance of research focusing on admission criteria will ensure admission practices within nursing education are grounded in evidence-based practice.

This research study may expand the literature focusing on ADN programs. Romeo's (2010) integrative review of critical thinking's predictability in nursing education included only three studies from ADN programs. Jones and Morris (2007) also

noted the lack of research investigating critical thinking and ADN programs. This study examined admission criteria of an ADN program differently by incorporating critical thinking skills. The research findings in this study might open the door to new methods to evaluate applicants for nursing programs. A broader understanding of ADN student abilities will provide tools for nursing educators to effectively choose the most qualified applicants to enter nursing programs. The better academic qualifications students' possess entering a nursing program, the lower the chance for attrition, which in the end increases nursing graduates.

Health/Public Policy

Current public policies within the U.S. are focusing on health care access and quality. At the center of these policies are registered nurses and their positive impact on patient outcomes. The *Patient Protection and Affordable Care Act* will open access to 32 million uninsured citizens in this country by 2014 (Cleary and Wilmoth, 2011). The *U.S. Bill H.R. 876/S.58, RN Safe Staffing Act*, is currently being evaluated by the House committee. If this bill passes, the staffing ratios of registered nurse to patients across this country may increase (American Nurses Association, 2012). The discipline of nursing is proactive and is stepping up initiatives to ensure the workforce is ready to care for the influx of new patients. Leading these initiatives is the *NLN's Public Policy Agenda* (National League for Nursing, n.d.) where its focus includes initiatives to enhance nursing's workforce development. This study's finding mirrors the NLN's initiatives focusing on increasing the health care workforce. More nurses are needed in order to care for the influx of patients expected by 2014.

One way to ensure the discipline of nursing is vast with enough qualified nurses is to increase the nursing graduates. At the heart of producing more nurses lies nursing education. Academic success of students reduces attrition, increases graduates, and is the lifeline to nursing. The use of effective admission criteria is one important step to ensuring students entering the nursing program are successful. The use of ATI's CTE as admission criteria is relatively new to nursing education and may provide an additional lens to identify applicants with academic characteristics necessary for academic success. This study's findings may assist nursing education's ability to increase the accuracy of choosing the most qualified applicant to enter nursing school.

Future Research

The findings of this study extend the science from previous studies investigating admission criteria and predictability of academic success of nursing students. This study also tested Assessment Technologies Institute's CTE composite and sub-scores for predictability of academic success within an ADN program and identified statistically significant findings with the CTE sub-scores for analysis and evaluation. Future studies evaluating the predictability of the CTE composite and sub-scores would continue to test the validity of this study's findings. Replication of this study with a larger sample size may also find additional significant findings. The statistical analysis did not find statistical significance when evaluating the CTE composite scores, age, gender or ethnicity with attrition in this study. A larger sample size with a more diverse ethnicity may identify significant findings.

STRENGTHS OF THE STUDY

The use of a power analysis to ensure adequate sample size contributes to the strength of this study and supports the validity of the research findings. A level of significance was set at < 0.05. The research findings within this study have illuminated new methods to identify student applicants that may have a high rate of academic success within a nursing program. Higher rates of academic success of nursing students may increase nursing graduates and assist in reducing the nursing shortage.

LIMITATIONS OF THE STUDY

The limitations of the study include:

- The use of correlational design does not require a control group or an intervention, which would strengthen the evidence of statistical findings.
- The use of a convenience sample reduces the generalizability of the findings.
- The use of one sample site limits the generalizability of the findings.
- Limited diversity within the ethnicity limited the ability to find statistical significance.
- The use of only one Associate Degree Nursing program limits the generalizability of the research findings to other types of nursing programs.

CHAPTER CONCLUSIONS

Chapter five provided a summarization and discussion of findings related to this study focusing on attrition of ADN students. Background issues related to nursing

student attrition, samples characteristics, associations between study variables, and descriptive and inferential statistical findings will be presented.

Attrition rates in Associate Degree Nursing (ADN) programs contribute to the nursing shortage. Attrition is defined as a student failing or withdrawing from a nursing course or a nursing program for academic reasons. When students fail a nursing course, they are at risk for not completing or returning to nursing school. If students do not return to school, they do not graduate and thus contribute to the nursing shortage.

When students admitted to nursing programs are not academically prepared, they usually experience attrition (Newton, Moore, and Smith, 2007), which equates to a delay of a graduate and/or a potential loss of a future nurse. Current applicant pools for nursing programs are large, providing nurse educators ample students from which to choose. Unfortunately, nurse educators may not be choosing the most accurate predictors when attrition rates range up to 30% (Peterson, 2009).

This study used a retrospective correlational research design to evaluate the effectiveness of admission criteria from students admitted in 2010 from a state college on the southeastern coast of Florida. The independent variables reflected age, gender, ethnicity, pre-nursing GPA, and ATI CTE composite and sub-scores. The dependent variables included academic success and attrition within six nursing courses. A logistic regression analysis found six statistical analyses with significant findings ($p < 0.05$) supporting the ATI CTE sub-scores (analysis and evaluation) and pre-nursing GPA to be predictive for academic success. The discovery of CTE and sub-scores predicting academic success may provide alternative admission criteria to identify qualified students. The potential predictability of the CTE may have a substantial impact on

academic success, graduation rates of nursing programs, and the size of the nursing workforce.

The looming nursing shortage threatens the discipline of nursing to safely care for patients. If the CTE can predict academic success, many nursing programs will have the ability to choose stronger applicant pools for nursing education. The research findings are also valuable findings for extending previous literature that found predictive ability from the use of pre-nursing GPA and critical thinking scores (Ellis, 2006; Jones and Morris, 2007; Newton, Moore, Smith, Magnan, 2007; Hopkins, 2008; Shirrell, 2008; Peterson, 2009). Admitting qualified applicants to the nursing program may increase nursing graduates.

The nursing shortage, nursing education, and nursing students are all casualties of attrition. The current number of qualified nurses will not meet expected demands in health care. The demographic changes in our nation forecast a need for an expansion of the capacity of the nursing workforce. Nurses are needed at the bedside to care for patients. The ever-expanding nursing shortage calls for nurse educators to increase nursing graduates. The future of nursing is in jeopardy. The findings of this study unveiled a potential new way of viewing qualified applicants for nursing programs. Future research is needed to support the findings within this study. The untapped potential of the CTE exam from ATI is a new venue of testing for nursing education. The CTE exam may be in tune with identifying qualified applicants to reduce attrition within nursing programs and to graduate more nurses. This study may contribute to innovative admission practices to increase graduates and reduce attrition in nursing programs. If nursing education can use more effective admission criteria, they may be able to reduce

the attrition rate of nursing students, and numbers of nursing graduates may increase. Increasing nursing graduates is an imperative task to ensure that the nursing workforce can care for the influx of patients in the years to come.

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Appendix A
IRB Documents

May 16, 2012

Ms. Patricia Gagliano
[redacted]

Dear Researcher:

The Human Subjects Review Panel at [redacted] has reviewed the protocols and consent forms for the research project entitled "*Predictors of Attrition of Associate Degree Nursing Students"* and finds it exempt under Title 34 of the Code of Federal Regulations, Subpart A, §46.101(b)(1). Basic Department of Health and Human Services Federal Policy for the Protection of Human Subjects states:

> Research conducted in established or commonly accepted educational settings involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

The regulations require that subjects be told the extent to which their personally identifiable, private information will be held in confidence.

The investigator is approved to proceed with the research.

Approved by:

[redacted]
Chair
Human Subjects Committee

BARRY UNIVERSITY

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OFFICE OF THE PROVOST
INSTITUTIONAL REVIEW BOARD

Research with Human Subjects
Protocol Review

Date:	May 16, 2012
Protocol Number:	120503
Title:	Predictors of Attrition of Associate Degree Nursing Students
Approval Date:	5/14/12
Name:	Ms. Patricia Gagliano
Address:	3209 Virginia Ave. Fort Pierce, FL 34981
Sponsor:	Dr. Claudette Spalding

Dear Ms. Gagliano:

On behalf of the Barry University Institutional Review Board (IRB), I have verified that the specific changes requested by the IRB have been made. Therefore, I have granted final approval for this study as exempt from further review.

As principal investigator of this protocol, it is your responsibility to make sure that this study is conducted as approved by the IRB. Any modifications to the protocol or consent form, initiated by you or by the sponsor, will require prior approval, which you may request by completing a protocol modification form.

It is a condition of this approval that you report promptly to the IRB any serious, unanticipated adverse events experienced by participants in the course of this research, whether or not they are directly related to the study protocol. These adverse events include, but may not be limited to, any experience that is fatal or immediately life-threatening, is permanently disabling, requires (or prolongs) inpatient hospitalization, or is a congenital anomaly cancer or overdose.

The approval granted expires on May 1, 2013. Should you wish to maintain this protocol in an active status beyond that date, you will need to provide the IRB with and IRB Application for Continuing Review (Progress Report) summarizing study results to date.

If you have questions about these procedures, or need any additional assistance from the IRB, please call the IRB point of contact, Mrs. Barbara Cook at (305)899-3020 or send an e-mail to dparkhurst@mail.barry.edu . Finally, please review your professional liability insurance to make sure your coverage includes the activities in this study.

Sincerely,

Doreen C Parkhurst

Doreen C. Parkhurst, M.D., FACEP
Chair Institutional Review Board
Associate Dean, SGMS &
Program Director, PA Program
Barry University
Box SGMS
11300 NE 2nd Avenue
Miami Shores, FL 33161

Cc: Dr. Claudette Spalding

Note: The investigator will be solely responsible and strictly accountable for any deviation from or failure to follow the research protocol as approved and will

Appendix B

Request for Access

[redacted]

May 20, 2012

Patricia Gagliano
Student, Barry University
College of Health Sciences, Division of Nursing
11300 NE 2"' Avenue
Miami Shores, FL 33161

Dear Ms. Gagliano,

I have received your request to conduct a study on predictors of success in the Associate Degree Nursing Program. Upon review of the description of the doctoral study you provided, I will provide you with the following data from the 2010 Associate Degree Nursing Program admissions: student identification numbers, age, gender, ethnicity, pre-nursing grade point average, grades for the first six nursing courses, and the Assessment Technology Institute critical thinking entrance scores and sub-scores.

I request that student's personal identifiers are not disclosed within your study. I also request that at the completion of this study, you please share your results with the me and Nursing Department faculty.

I wish you much success as you move forward with your

[redacted]

Appendix C
Data Collection Tool

SUBID	NFUND	MATE	PSYCH	MDADM	ALT RGA	AD ULT -GU

Codes:
Subject Identification = SUBID
Age = AGE
Gender = GDR
Ethnicity = ETHN
Pre-Nursing GPA = PNGPA
CTE Composite = CTEC
CTE Sub-scores: Interpretation = INTER
CTE Sub-scores: Analysis = ANAL
CTE Sub-scores: Explanation = EXPLAIN
CTE Sub-scores: Inference = INFER
CTE Sub-score: Evaluation = EVALU
CTE Sub-score: Self-Regulation = SELREG
Nursing Course Grades:
Nursing Fundamentals: NFUND
Maternity Nursing: MATE
Psych Mental Health = PSYCH
Medication Administration = MDADM
Adult Respiratory/Gastrointestinal = GI
Adult Genitourinary/Endocrine = GU

SUBID	AGE	GDR	ETHN	PNGPA	CTEC	INTER	ANAL	EXPLAIN	INFER	EVALU	SELFREG

Appendix D
Hypothesis Table

Research Hypothesis	Instrument	Statistical Test	Results
A positive relationship will exist between ADN students' critical thinking entrance exam scores and sub-scores and attrition in the first six nursing courses.	Data Collection Tool	Logistic Regression Analysis	Accepted Hypothesis Statistical significance was found between the Adult Health Gastrointestinal/Respiratory nursing course academic success rates and the CTE sub-score for analysis: $p = 0.010$, McFadden's $R^2 = 0.118$. A one point increase in subjects' analysis sub-score would predict a 5% increase in the odds of the subjects passing the course. The CTE sub-score evaluation found Adult Health Genitourinary/Endocrine nursing course rates of academic success and attrition were statistically significant: $p = 0.030$, McFadden's $R^2 = 0.064$, $M = 71.4$, $SD = 17.1$. A one-point increase in the sub-score of evaluation would predict a 3 % in the odds of the student passing the course. The analysis sub-score was found to be statistically significant with academic success in first six nursing courses: p = 0.010, McFadden's $R^2 = 0.05$, SD = 20.09. A one point increase in the analysis sub-score would predict a 3 % increase in the odds of the students passing all six nursing course. The evaluation sub-score was found to be statistically significant with academic success in the first six nursing courses: $p = 0.032$, McFadden's $R^2 = 0.34$, $M = 70.7$, $SD = 16.04$. A one point increase in the evaluation sub-score would predict a 3 % increase in the odds of passing all six nursing courses.

Research Hypothesis	Instrument	Statistical Test	Results
There will be a significant correlation between select demographic variables (age, gender, ethnicity), critical thinking entrance exam scores, pre-nursing grade point average, and attrition for ADN students in their first six nursing course.	Data Collection Tool.	Logistic Regression Analysis	Hypothesis Accepted The subject's pre-nursing GPA course and academic success rates were statistically significant: $p = 0.001$, McFadden's $R^2 = 0.088$. A one point increase in the pre-nursing GPA by 0.1 would predict a 21 % increase in the odds the subjects would pass all six nursing courses. The subject's pre-nursing GPA and the Psychiatric Nursing course showed statistical significance: $p = 0.032$, McFadden's $R^2 = 0.049$. A one point increase in pre-nursing GPA by 0.1 would predict a 25 % increase in the odds of the students passing the course.

Appendix E
Patricia A Gagliano, MSN, RN

Experience as an Educator

January 2001 – Present
[redacted], Florida
Associate Professor. Associate Degree & Bachelor Degree Nursing Program and Bachelor of Allied Science, Health Care Management.

Didactic and clinical instruction, committee chair responsibilities

September 1998 – December 2000
[redacted]
Campus. Master Instructor, Practical Nursing Program. Coordinated program, didactic and clinical instruction

Experience as a Nurse

September 1997 – October 2000
[redacted], Florida. Emergency Department, Staff Nursing

April 1996 – September 1997
[redacted], Florida. Clinical Coordinator. Supervisor responsibilities, staffing, education, quality improvement

May 1995 – April 1996
[redacted], Florida. Staff Nurse

Education

December 1998
Masters of Science in Nursing. Focus: Administration, Barry University, Miami, Florida

May 1995
Bachelor of Science in Nursing, Barry University, Miami, Florida

Membership in Professional Organizations

March 2012
Sigma Theta Tau, Lamba Chi Chapter, Barry University, Florida

March 2012
Nursing Honors Society[redacted], Florida

January 2009 – 2010
Florida Association of Community College, *President,* [redacted] State College Chapter

January – December 2006
Florida Association of Community College, *Social Chair,* [redacted] State College Chapter

2002 – 2010	Florida Nurses Association. *Treasurer,*
2002 – Current	National Organization for Associate Degree Nursing
2001 - Current	National League of Nursing
1998 – Current	Florida Association of Community Colleges

Honors

2011	*December Faculty of the Month,* [redacted] Florida
2008	[redacted] Endowed Teaching Chair Award, [redacted] Foundation, [redacted], Florida
2008	*Instructional Innovation Award*, [redacted], Florida
2008	*Chapter of the Year, Florida* Association of Community Colleges, President, [redacted] College Chapter