The Nursing Undergraduate Retention and Success (NURS) Model (Jeffreys, 2004) was the theoretical framework for a study that examined the predictive value of selected cognitive (cumulative GPA, science GPA, science credits, previous degree, reading comprehension, math skill), noncognitive (stress), and demographic (age, ethnicity) student profile characteristics on the early academic success and on-time program completion of baccalaureate nursing students. The sample consisted of 370 BSN students at a public university in the Southeast. Data were collected from an existing student database. The dependent variable, early academic success, was based on grades in nursing courses during the first two semesters. The dependent variable, program completion, was measured as on-time graduation at the end of six semesters or graduation being delayed or denied. Three of the independent variables (reading comprehension, math skill, and stress) were measures from the Nurse Entrance Test. The results of logistic regression analysis showed that for the model predicting early academic success ($\chi^2 = 57.76, p < .0001$), the significant variables were science GPA (OR = 2.93, $p = .003$), reading comprehension (OR = 2.52, $p = .03$), and math skill (OR = 3.03, $p = .002$). For the model predicting program completion ($\chi^2 = 55.1$, $p < .0001$), the significant variables were reading comprehension (OR = 6.03, $p < .0001$), math skill (OR = 2.38, $p = .04$), and previous degree (OR = .36, $p = .01$). The noncognitive variable of stress and the demographic variables of age and ethnicity were not significant in either model. The findings provide evidence to inform admission policies and to assist
faculty in identifying and assisting students who may be at risk for academic difficulty, delayed graduation, or attrition. The study supports the use of a nursing aptitude examination as an admission screening tool and as a means to identify at-risk students. While the results are most pertinent for the institution that was the setting for study, there are implications for other BSN programs.
Predictors of Early Academic Success and Program Completion
Among Baccalaureate Nursing Students

by
Kathryn Rhodes Alden

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2008

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DEDICATION

I dedicate this dissertation to my husband, Trip, who has provided constant love and support throughout our lives together and especially over the past ten years since I began doctoral study. I could never have done this without him.

This dissertation is also dedicated to the memory of my mother and father, Jack and Geraldine Rhodes, who raised me to believe that all things are possible (Philippians 4:8 – “I can do all things through Christ who gives me strength.”). Although they were not privileged to attend college, they believed in the importance of education and sacrificed so that my brothers and I were able to attend. Dad loved N.C. State and would be especially proud of this project.
Kathryn Rhodes Alden is an experienced clinician and educator. A native of Brevard, North Carolina, she received a baccalaureate of science in nursing degree from the University of North Carolina at Charlotte and a master of science degree in nursing from the University of North Carolina at Chapel Hill. Her nursing career has focused on care of women, infants, and children with a specialization in human lactation. With over 20 years of experience as an educator and over 30 years as a professional nurse, Ms. Alden has taught in the undergraduate baccalaureate nursing programs at both the University of North Carolina at Charlotte and the University of North Carolina at Chapel Hill. Currently, Ms. Alden is a Clinical Associate Professor in the School of Nursing at UNC Chapel Hill where she serves as the coordinator of the undergraduate Maternal/Newborn Nursing course and as an academic counselor for undergraduate nursing students. In addition, she is a certified lactation consultant for Rex Health Care in Raleigh, North Carolina. She has written extensively for maternity textbooks and has conducted numerous workshops for students and professional nurses on breastfeeding and human lactation.
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<td></td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td></td>
</tr>
<tr>
<td>AACN</td>
<td>American Association of Colleges of Nursing</td>
<td></td>
</tr>
<tr>
<td>BSN</td>
<td>Baccalaureate of science in nursing</td>
<td></td>
</tr>
<tr>
<td>GPA</td>
<td>Grade point average</td>
<td></td>
</tr>
<tr>
<td>NCLEX-RN</td>
<td>National Council Licensure Examination for Registered Nurses</td>
<td></td>
</tr>
<tr>
<td>NET</td>
<td>Nurse Entrance Test</td>
<td></td>
</tr>
<tr>
<td>NLN</td>
<td>National League for Nursing</td>
<td></td>
</tr>
<tr>
<td>NURS Model</td>
<td>Nursing Undergraduate Retention and Success Model</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>Odds ratio</td>
<td></td>
</tr>
<tr>
<td>RN</td>
<td>Registered nurse</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>Standard deviation</td>
<td></td>
</tr>
<tr>
<td>URM</td>
<td>Underrepresented minority</td>
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CHAPTER ONE
INTRODUCTION

The academic success and retention of nursing students is gaining increased attention as the nation braces for the most severe nursing shortage in history. The current nursing shortage is forecast to reach crisis levels within the next 10-15 years when a large number of nurses will be retiring from the profession. A recent report suggested that the demand for nurses is increasing at the rate of 2-3% per year and subsequently, the nursing shortage could reach 500,000 by 2025 (Buerhaus, Staiger, & Auerbach, 2008). The decline in the number of working nurses combined with the aging population and increased demands for nursing care are predicted to result in a nursing shortage of greater severity and longer duration than previously experienced in the United States (Buerhaus et al., 2008; Goodin, 2003; Nevidjon & Erickson, 2001).

The critical nature of the current and future nursing shortage in the United States raises societal and institutional expectations of college and university nursing education programs. Schools of nursing are expected to produce increasing numbers of graduates who will soon begin work as professional nurses. According to the Health Resources and Services Administration (HRSA), nursing programs in the United States must graduate approximately 90% more nurses to meet the projected growth in demand for registered nurses (HRSA, 2006). Although BSN programs reported a 7.4% increase in graduations in 2007, nursing schools are falling far short of this goal (AACN, 2008).

While there is a need for greater numbers of registered nurses in general, there is a specific need for more baccalaureate prepared nurses (AACN, 2008). Therefore,
baccalaureate nursing education programs are under considerable pressure to produce the maximum number of graduates each year, and graduates are expected to pass the national licensure exam (NCLEX-RN) so that they may enter practice as soon as possible. Students are expected to complete the nursing program in the time frame dictated by their starting semester and the curriculum sequence of the program. For example, those who enroll full-time in a six semester nursing program are expected to complete course and clinical requirements and graduate on schedule at the end of two years.

Unfortunately, every student who is admitted to a baccalaureate nursing education program will not graduate, most often because of academic problems. For some students, graduation may be delayed as the result of failing grades or withdrawal from nursing courses and the subsequent need to repeat required courses. The need to change from full-time to part-time study or temporarily dropping out of the program can prolong the time until graduation. (Jeffreys, 2004)

Attrition (noncompletion) and delayed graduation of baccalaureate nursing students are major concerns in contemporary times. Placement in nursing education programs is in great demand. Over the past five years, the number of applicants to baccalaureate nursing programs in the United States has increased dramatically (AACN, 2008). Applicants are more qualified than ever before, with many students bringing impressive academic credentials and a wealth of life and work experiences into the nursing education arena. Unfortunately, enrollments in baccalaureate nursing programs have not increased concomitantly with the steep rise in the number of applicants. Although the total enrollment in all baccalaureate nursing programs increased by 4.98% from 2006 to 2007, more than
30,000 qualified applicants were turned away from entry-level baccalaureate nursing programs in 2007. Enrollment is restricted by faculty shortages, financial constraints, and limited availability of clinical sites and classroom space (AACN, 2008).

There is a critical need for more nurses to be prepared at the baccalaureate level. The future of health care in the United States is largely dependent on nurses who are capable of managing care along a continuum, working as members of interdisciplinary health care teams with knowledge of community resources. Baccalaureate education, with its broad foundation in the physical, behavioral, social and management sciences, prepares practitioners who are capable of critical thinking, problem-solving, communicating and analyzing data. There is evidence that BSN graduates bring unique skills to their practice as clinicians and play a vital role in the delivery of competent and effective patient care. Patient outcomes are improved in hospitals with higher proportions of baccalaureate nurses. Fewer medication errors and procedural violations are committed by nurses who were educated in BSN programs (Aiken, Clarke, Cheung, Sloane, & Silber, 2003). Baccalaureate graduates are more likely to assume management and RN specialty positions within health care institutions. Nursing administrators prefer to hire nurses with baccalaureate degrees, recognizing distinct differences in competencies of nurses based on their education. (Goode, Pinkerton, McCausland, Southard, Graham, & Krsek, 2001; National Council of State Boards of Nursing, 2002)

The consequences and implications of nursing student attrition and delayed program completion are far-reaching, beginning with the individual student and extending into society to those who are recipients of nursing care. Students who leave prior to earning a degree
experience financial and occupational loss. Psychological repercussions may be even more devastating in terms of disappointment, decreased self-esteem, and sense of failure. In addition, for the individual student, there is often personal shame and social stigma associated with “dropping out” or extending the program of study (McSherry & Marland, 1999; Tinto, 1993; Yorke & Longden, 2004).

Attrition means loss of revenue to colleges and universities; students who leave the program may receive some reimbursement of tuition costs, depending on when they withdraw inside a semester. Because students are not routinely admitted to the nursing program to replace those who leave, the institution is losing tuition dollars for the remainder of the program. Attrition may directly affect institutional or state allocated funding and financial support by alumni (Yorke & Longden, 2004).

Attrition also impacts students who desire to enroll in a nursing program. For every student who does not complete the program, it means that another qualified student who was denied admission could have had the slot and completed the program. Because of limitations in enrollment capacities, delayed graduation can reduce the number of students who are admitted into the next class.

Delayed graduation and attrition mean that there are fewer nurses entering practice. This has implications for health care agencies who are seeking to hire staff as well as for the public – the recipients of nursing care.

Concerns about attrition, delayed graduation, and the nursing shortage bring attention to the need for examination of factors that are predictive of academic success and retention among nursing students. Research evidence suggests that unique combinations of cognitive,
noncognitive, and demographic factors influence the academic success and retention of students in nursing education programs. Awareness and understanding of these factors can inform admission policies and decisions and enable faculty to identify at-risk students early in the program such that early and ongoing interventions can be implemented to promote academic success and graduation. Such interventions have been shown to dramatically increase student success and retention (Peter, 2005; Higgins, 2004; Tracey, 2003; Lockie & Burke, 1999; Symes, Tart, & Travis, 2005). Early assessment and intervention can enhance students’ chances of achieving success in the nursing education program, completing the program on schedule, and going on to pass NCLEX-RN so that they may enter the nursing workforce.

Statement of the Problem

The literature reflects that nursing researchers have been investigating nursing student success and retention for the last three decades. However, there is an obvious paucity in the number of studies appearing in nursing and higher education journals that have based their findings within a theoretical framework (Aiken, Cervero, & Bailey, 2001; Campbell & Dickson, 1996; Janes, 1997; Jeffreys, 1998, 2001, 2002, 2007; Lockie & Burke, 1999; Manifold & Rambur; 2001; Shelton, 2003).

Only one well-defined model of nursing student retention is reported in the literature, and this model is relatively new (Jeffreys, 2004). The Nursing Undergraduate Retention and Success (NURS) Model developed by Marianne Jeffreys is described in her book, Nursing Student Retention: Understanding the Process and Making a Difference (2004). The model is based on traditional retention theories and the results of extensive research by numerous
authors. There are few studies reported in the literature since the publication of the NURS model that were based on this new model (Horton, 2006; Jeffreys, 2007). The obvious lack of research on this model supports the need for further testing and validation of nursing retention using this theoretical framework.

Assorted dependent variables have been studied in various combinations by researchers who have examined nursing student success and retention. The dependent variables represent an array of time periods in the nursing education program, ranging from first semester to graduation. Academic success has been operationalized in a variety of ways such as grades in specific courses, overall GPA at the end of a particular semester or year in the nursing curriculum, and cumulative GPA for all nursing courses.

It is important to note that fewer studies have examined early academic success as a dependent variable in samples of baccalaureate students (Abdur-Rahman, Femea, & Gaines, 1994; Brennan, Best, & Small, 1996; Femea, Gaines, Braithwaite, & Abdur-Rahman, 1995; Griffiths, Bevil, O’Connor, & Wieland, 1995; Newton, Smith & Moore, 2007; Newton, Smith, Moore & Magnan, 2007; Potolosky, Cohen, & Taylor, 2003). This is a notable gap in the literature because it is recognized that during the first year of study, attrition rates are highest and early intervention is most critical to increase the likelihood of nursing student success (Jeffreys, 2004; Ehrenfield, Rotenberg, Sharon, & Bergman, 1997). The first year of the nursing program represents a period of adjustment and challenges for beginning students. Nursing curricula are unique compared with most other types of educational programs. Students must adjust to the rigors of courses that may include theoretical, as well as skills laboratory and clinical components (Burris, 2001; Jeffreys, 2004). Early courses with a strong science basis such as pathophysiology and pharmacology can be particularly challenging for students. Additionally, it is during the first year of study that students are enrolled in the initial clinical course. Numerous concerns and uncertainties surround the clinical experience as students are placed in a “human lab” where variables are not easily controlled and situations are unpredictable. Students can feel overwhelmed by the demands of assuming responsibility for patient care and safety. Stress associated with the clinical experience can impact academic performance. (Beck, Hackett, Srivastava, McKim, & Rockwell, 1997; Cuthbertson, Lauder, Cleary, & Bradshaw, 2004; Hegge & Larson, 2008; Kirkland, 1998; Lindop, 1999; Mahat, 1998; Steele, Lauder, Caperchione, & Anastasi, 2005; Timmins & Kaliszer, 2002). Recognition of student profile characteristics that are predictive
of academic success during the first year of the program can enable faculty to identify those at risk of poor performance. With early identification of at-risk students, interventions can be designed and implemented to promote their success.

Relatively few researchers have identified nursing program completion or graduation as a dependent variable. (Byrd, Garza, & Nieswiadomy, 1999; Carroll, 2001; Horton, 2006; Jeffreys, 1998; Manifold & Rambur, 2001; Simmons & Haupt, 2003; Simmons, Haupt, & Davis, 2004; Schafer, 2002; Symes, et al., 2005). As nursing education programs are challenged to produce as many graduates as possible in an effort to reduce the nursing shortage, it is critical that research is done to identify factors that predict program completion. Students must complete the nursing program before they can take the national licensure examination (NCLEX-RN) and enter nursing practice. Factors that predict program completion need to be identified as early as possible in the curriculum, even at the time of entry. Students at risk for attrition or delayed completion can then be identified so that appropriate interventions can be implemented to increase the likelihood of completing the program and doing so on time.

A wide range of cognitive, noncognitive, and demographic student characteristics have been examined in relation to BSN nursing student success and retention. Variables have been combined in a variety of predictor models and findings have been inconsistent. For those studies that have included pre-admission variables, the most common were cognitive factors such as cumulative grade point average, grades in science courses or other prerequisite courses, and ACT or SAT scores. Few studies have examined the predictive value of standardized nursing aptitude assessments such as the Nurse Entrance Test in
predicting student success among samples of baccalaureate nursing students (Abdur-Rahman et al., 1994; Femea et al., 1995; Newton, Smith & Moore, 2007; Simmons & Haupt, 2003; Simmons, Haupt, & Davis, 2004; Newton, Smith, Moore & Magnan, 2007).

While most studies have focused on cognitive variables, there are a limited number of studies that have explored the influence of noncognitive student characteristics on student success and retention. Stress appears to be the most common noncognitive factor that has been studied in relation to nursing student retention and success, although the majority of researchers have focused on levels of stress occurring during the nursing program, not at the time of entry (Beck et al., 1997; Cuthbertson et al., 2004; Hegge & Larson, 2008; Lindop, 1999; Mahat, 1998; Steele et al., 2005; Timmins & Kaliszer, 2002). Few studies have examined the impact of stress levels at the time of program entry on academic outcomes. In most of those studies, the dependent variables were measures of academic performance at program end (Abdur-Rahman et al., 1994; Sayles, Shelton, & Powell, 2003; Simmons & Haupt, 2003; Simmons et al., 2004). The relationship between student stress at program entry and academic performance during the first year of the program is unclear. Further research needs to examine the predictive value of early stress levels on academic performance during the first year of the program when attrition rates are highest. It is also important to examine the relationship between student stress at the beginning of the program and its influence on graduation. Individualized assistance and group programs can then be developed to assist students to cope with stressors in their lives as they proceed in the nursing program.

Demographic characteristics of students have been included in various combinations in predictor models of nursing student success and retention. However, demographic factors,
in general, have been found to be weak predictors. Age and ethnicity have been shown to be
the strongest demographic predictors of academic success and retention among nursing
students (Aber & Arathuzik, 1996; Beeson & Kissling, 2001; Campbell & Dickson, 1996;
Crow et al., 2004; Endres, 1997; Lewis & Lewis, 2000; Wong & Wong, 1999).

The role of demographics in predicting nursing student success needs to be re-
examined in light of the evolving profiles of contemporary nursing students (Wells, 2003).
Although success and retention of nursing students has been studied since the 1960’s, the
bulk of research was conducted in the late 1980’s and early 1990’s as schools were faced
with declining enrollments in the midst of a national nursing shortage (Campbell & Dickson,
1996). The nation is again facing a critical shortage in the nursing workforce, yet the
attributes and qualifications of those seeking to enter the profession are distinctly different
(AACN, 2008). Changing times warrant new research to re-examine the relationship between
student success and demographics such as age and ethnicity. Student demographics are
changing dramatically as ethnic and racial diversity are increasing among nursing students.
While it is critical that minority representation in the nursing workforce is increased, it is
recognized that retention rates are often lower for minorities (Childs, Jones, Nugent, & Cook,
2004; Barbee & Gibson, 2001; Bessent, 1997; Tucker-Allen & Long, 1999). Increasing
numbers of nontraditional students are enrolling in nursing education programs. Entering
students are often older; many are changing careers, bringing a variety of college and work
experiences along with more sophisticated expectations of their educational program. Many
students are employed part-time or full-time and raising families while attending nursing
school. (AACN, 2007; Heller, Oros, & Durney-Crowley, 2000) Although there is some
evidence that nontraditional nursing students may be more serious about their studies and demonstrate higher levels of academic performance, there is a concomitant concern about increased risk of attrition due to personal and family obligations (Jeffreys, 2004; Wells, 2003)

The majority of research studies on nursing student success and retention have been descriptive or correlational in design. There is a need for more predictive studies to be conducted, using regression analysis to identify factors that are predictive of early student success and retention. The results of predictive analyses can provide educators with meaningful and useful information as they refine admission criteria to reflect the changing profile of applicants to nursing programs, as they attempt to identify at-risk students, and as they design programs to assist those who may be at risk of academic difficulty during the nursing program. The pragmatic value of study findings can be enhanced using benchmarking to create independent variables that clearly differentiate between students who are most likely to succeed and those who are likely to experience negative outcomes. This methodology has been reported by a minimal number of researchers who studied predictors of nursing student success and retention (Bondmass, 2008).

Researchers have studied student success and retention in nursing programs with varying enrollments and curricular designs, located in public and private institutions. Convenience sampling is the norm, with samples most often confined to a single institution. Because of the variations in philosophy, curriculum, and student profiles among individual nursing programs, generalizability of research findings is limited. It is essential that individual institutions examine their own student populations in relation to success and
retention. In addition, it is important that increasing numbers of institutions conduct investigations of student success and retention such that patterns and trends might be recognized across similar institutions.

While the literature contains articles that describe programs designed to assist at-risk students, there is little information related to selection criteria for student participation in these programs (Higgins, 2004; Peter, 2005; Lockie & Burke, 1999; Symes et al., 2005; Tracey, 2003). There is a need for research findings that identify the most appropriate criteria for identifying at-risk students within and across BSN programs. Results of predictive studies can provide evidence toward that end.

The University of North Carolina at Chapel Hill School of Nursing offers an opportune setting to study student success and retention among a population of a baccalaureate nursing students at a large public university. Consistent with national trends, increasing numbers of applicants are seeking admission to the undergraduate nursing program. This surge in applications creates workload issues for administrative personnel and for faculty who serve on the Admissions Committee. Based on the number of applicants and the changing characteristics and qualifications of applicants, in 2004, the committee initiated a process of refining admission criteria to be more selective. To that end, a pilot study on predictors of student success was conducted by an experienced researcher on the School of Nursing faculty. Results of multiple regression analysis indicated that the best predictor of student success in terms of cumulative GPA at program end was science GPA, based on grades in required prerequisite science courses (Lynn, 2005). The study did not examine predictors of early academic success or program completion. This study will extend the scope
of findings of this initial investigation and will provide the Admissions Committee with further evidence to possibly refine admission criteria.

Retention of nursing students in the six semester pre-licensure BSN program at UNC Chapel Hill is an ongoing concern for faculty and administrators. On-time graduation rates ranged from a low of 80% in 2006 to a high of 90% in 2003 (Cronenwett, 2006). Graduation rates are displayed in Table 1.1.

As the national nursing shortage worsens, it is more important than ever that the School of Nursing contributes the maximum number of new graduates each year to the nursing workforce and that graduation rates increase and do not show further decline. Toward that end, this study will help identify the unique cognitive, noncognitive, and demographic factors that are predictive of early success and program completion among students enrolled in the six semester prelicensure BSN program at UNC Chapel Hill.

Table 1.1

*On-Time Graduation Rates for the Prelicensure Six Semester BSN Program at UNC-CH*

<table>
<thead>
<tr>
<th>Year of Admission</th>
<th>Year of Graduation</th>
<th>Graduation Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>2001</td>
<td>86%</td>
</tr>
<tr>
<td>2000</td>
<td>2002</td>
<td>88%</td>
</tr>
<tr>
<td>2001</td>
<td>2003</td>
<td>90%</td>
</tr>
<tr>
<td>2002</td>
<td>2004</td>
<td>84%</td>
</tr>
<tr>
<td>2003</td>
<td>2005</td>
<td>88%</td>
</tr>
<tr>
<td>2004</td>
<td>2006</td>
<td>80%</td>
</tr>
</tbody>
</table>

The results of the study will inform admission policies and decisions, providing data regarding the student profile characteristics that are most predictive of success and retention.
The findings will provide faculty with information they can use to identify students who are likely to encounter difficulty during the program and those who are at risk of delayed graduation or attrition from the program. Early identification of at-risk students will enable faculty to design and implement interventions to promote academic success and timely graduation. The findings are also pertinent for other BSN programs as they determine the student profile characteristics that are predictive of success and retention among their student populations.

Conceptual Framework

Nursing student success and retention are complex, dynamic, multidimensional phenomena influenced by the interaction of personal, academic, and environmental factors (Jeffreys, 2004). Traditional retention models have attempted to explain the longitudinal process that leads students to persist in educational programs until graduation (Astin, 1970, 1984, 1985; Bean, 1980; Bean & Eaton, 2000; Bean & Metzner, 1985; Cabrera, Nora, & Castanada, 1992; Metzner & Bean, 1987; Pascarella, 1980, 1985; Spady, 1970; Tinto, 1975, 1987, 1993, 1998), and while these models have relevance to nursing education, it is most pertinent to employ a nursing theory as the theoretical framework for this study. Therefore, the conceptual framework for this study is based on the Nursing Undergraduate Student Retention (NURS) model developed by Marianne Jeffreys (2004). The NURS model, with its foundation in traditional retention theories, presents an organizing framework to examine the multidimensional factors that affect the retention of undergraduate nursing students (See Figure 1.1). Jeffreys posits that retention decisions are based on the interaction of student
profile characteristics, student affective factors, academic factors, environmental factors, professional integration factors, academic outcomes, psychological outcomes, and outside surrounding factors (Jeffreys, 2004).

While many models of student retention emphasize the role of social integration in student adjustment, persistence, and success, Jeffreys introduces the additional concept of
professional integration factors. Within the context of professional socialization and career development, the professional integration factors enhance students’ interaction with the college environment and are instrumental in persistence and retention decisions (Jeffreys, 2004).

While it is not within the scope of this study to test the entire NURS model, the conceptual models for this research study (Figure 1.2 and Figure 1.3) are based on Jeffreys’ model of Nursing Undergraduate Student Retention and illustrate the predictive relationship of selected factors from the model that have been shown to have an effect on academic success and retention. This study represents a unique combination of variables that have not been studied as such by previous researchers.

Two dependent variables have been selected for this study. Because the dependent variables represent two distinct points in time, there are two conceptual models. The dependent variable in the first conceptual model for this study is early academic success, categorized by Jeffreys (2004) as an “academic outcome”. The dependent variable for the second model is program completion, labeled in Jeffreys’ model as “retention”. The independent variables in the conceptual models are categorized for the purposes of this study as cognitive, noncognitive, and demographic. The cognitive variables include cumulative GPA, science GPA, number of science credits, previous degree, reading comprehension, and math skill. These are consistent with Jeffreys’ category of “prior educational experience” which is a subset of “student profile characteristics” at the beginning of the NURS model. The single noncognitive independent variable in this research study is stress, which is reflective of Jeffreys’ category of “environmental factors” in the NURS model. As
Figure 1.2 Conceptual model A - predictors of early academic success

Figure 1.3 Conceptual model B - predictors of program completion
conceptualized in this study, stress relates to five important areas of personal coping: family life, social life, money/time commitments, academic stress, and stress in the workplace. Demographic variables in the conceptual models are age and ethnicity, which are consistent with “student profile characteristics” in the NURS model.

Purpose of the Study

The purpose of this study was to examine the predictive value of selected cognitive, noncognitive, and demographic characteristics of prelicensure baccalaureate nursing students on their early academic success and on-time program completion.

Research Questions

1. What is the predictive value of selected cognitive (cumulative GPA, science GPA, number of science credits, previous degree, reading comprehension, math skill), noncognitive (stress), and demographic (age, ethnicity) student profile characteristics on the early academic success of students enrolled in a prelicensure baccalaureate nursing education program?
2. What is the predictive value of selected cognitive (cumulative GPA, science GPA, number of science credits, previous degree, reading comprehension, math skill), noncognitive (stress), and demographic (age, ethnicity) student profile characteristics on BSN program completion?

Significance of the Study

The results of this research study will provide a broader understanding of student success and retention in baccalaureate nursing education programs. While the findings may
be most pertinent and significant for the baccalaureate nursing education program that is the setting for the study, there are also important personal, institutional, and societal implications. Those who are likely to benefit from the study include students, faculty, administrators, future employers, and the public who will become the recipients of nursing care.

The study findings should be of particular interest to the faculty at the UNC Chapel Hill School of Nursing. Faculty who are serving on the Admissions Committee will benefit from the findings of this study in terms of identifying student attributes that are predictive of success and retention in the nursing program. Admission policies can be evaluated and revised as needed to incorporate student characteristics that are associated with success and timely graduation.

Through the identification of factors that are predictive of early student success and program completion, it is possible to determine which students may be at risk of academic difficulty in the first two semesters of the nursing program and those who may be at risk of delayed graduation or attrition. Because these factors are known either on admission or within the first few days of the nursing program, at-risk students can be identified early. They can be counseled and supported to promote academic success and to increase the likelihood that they will graduate at the end of six semesters with their admitting class.

It is important to determine if the same student profile characteristics that predict early academic success are also predictive of program completion. Findings of the study have implications for the design of interventions to promote student success and retention.
The findings of the study will provide administrators with a greater understanding of variables that are associated with academic success and retention in the nursing program. This information can be utilized in evaluating and revising the nursing curriculum and educational practices to more effectively meet student needs.

Although the investigation is confined to the nursing program of a large public university and the findings are institution-specific, other nursing programs with similar characteristics may find the results to be useful. Factors that are identified as indicative of academic success and program completion are likely to be similar and applicable in other similar baccalaureate programs. Additionally, the findings of this study may prompt other nursing programs to examine the factors that are predictive of academic success and program completion. As more studies are conducted across other university baccalaureate programs, findings can be compared and possible trends identified. This may result in sharing of ideas and strategies to enhance student success in nursing education programs.

There is significance of the study for potential employers, and to the public, in general, related to concerns about the nursing shortage and nursing competence. Students who are at risk of having academic difficulty can be identified and counseled early so that they are more likely to complete the program within two years, graduate, and enter the practice arena, thus, contributing to the nursing workforce.

**Definition of Terms**

At-risk: the likelihood that a student will experience difficulty in achievement during the nursing education program; having earned two or more grades of C, or any grade of
less than C in nursing courses during the first two semesters, as well withdrawal from any course

Attrition: noncompletion of the nursing program; withdrawal from the nursing program, either voluntarily or involuntarily, prior to graduation

Cognitive student profile characteristics: variables that are evidence of a student’s academic ability and educational background; cumulative grade point average, science grade point average, number of science credits, previous degree, reading comprehension, math skill

Cumulative GPA: grade point average on admission to the School of Nursing, based on all courses completed by the student after high school

Early academic success: academic performance at the end of the first semester of the six semester prelicensure nursing program; having earned grades of C or above in all nursing courses, with no more than one grade of C, and having no course withdrawals

Ethnicity: a student’s self-reported ethnic origin

Math skill: ability to perform basic operations in math and algebra that are deemed essential for success in health care professions (Frost, 2004)

NCLEX-RN: National Licensure Examination for Registered Nurses

NCLEX-RN success: passing the National Licensure Examination for Registered Nurses on the first attempt

Noncognitive student profile characteristics: stress related to personal and environmental factors (family, social, money/time, academics, and work)
Nursing: “The protection, promotion, and optimization of health and abilities, prevention of illness and injury, alleviation of suffering through the diagnosis and treatment of human response, and advocacy in the care of individuals, families, communities, and populations.” (American Nurses’ Association, 2003, p. 6)

Previous degree: earned baccalaureate, master’s, or doctoral degree in any area

Program completion: graduating from the nursing program on schedule at the end of the six semester curriculum

Reading comprehension: the ability to read and understand science related materials at the inferential level (Frost, 2004)

Retention: continuous enrollment in the nursing program resulting in graduation

Science GPA: grade point average in required science courses including anatomy and physiology, physiology, microbiology, psychology, and statistics

Stress: “a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being.” (Lazarus & Folkman, 1984, p. 19)

Summary

This study examined the predictive value of selected cognitive, noncognitive, and demographic student profile characteristics on early academic success and on-time program completion among students enrolled in a six semester pre-licensure baccalaureate nursing education program. The study findings are most important for the nursing program that is the setting for the study. Results of the study will be used by faculty to evaluate admission policies and to identify at-risk students early in the program, as soon as the first few weeks,
so that prompt and ongoing intervention plans can be implemented. This increases the
likelihood that every student who is admitted can be successful in completing the program on
time, proceeding to pass NCLEX-RN, and entering the profession as a practicing nurse.
CHAPTER II
LITERATURE REVIEW

The primary focus of this literature review is on studies that have investigated the academic success and retention of baccalaureate nursing students. The majority of studies in the review were conducted by nursing researchers in the United States and published in nursing and education journals during the last ten years. The review also includes relevant studies from the dissertation literature.

This chapter begins with an overview of the major theories of student retention that are foundational to the Nursing Undergraduate Retention Model (Jeffreys, 2004), the theoretical framework on which this study is based. This is followed by descriptions of the limited number of nursing research studies on student success and retention that have based the findings within the context of a theoretical framework. Subsequently, nursing studies of academic success and retention are described based on operational definitions of dependent variables and the various cognitive and noncognitive factors that have been examined in relation to both academic success and retention.

Review of Retention Theories

The conceptual model for this study is based on the Nursing Undergraduate Student Retention (NURS) model developed by Marianne Jeffreys (2004). This model of student retention reflects the distinctiveness of nursing education programs, presenting an organizing framework to examine the multidimensional factors that affect the retention of undergraduate nursing students. Although Jeffreys’ model is new and warrants further testing, its foundations are firmly based in classic theories of student retention. To provide a greater
understanding of student retention, it is important to review some of the major theoretical models of student retention developed by experts in higher education.

Braxton (2000) notes that interest in student retention and persistence at the university level has been in existence for over fifty years. Review of the literature on retention reveals an array of theoretical constructs proposed by experts who have drawn inspiration from a variety of disciplines. While none of the theories are monodisciplinary in nature, there is evidence of influence from psychology, sociology, and organizational theory (Yorke & Longden, 2004).

One of the first theoretical models of student departure, or “drop-out” was developed by Spady (1970). This model was based on Durkheim’s (1951) theory of suicide which postulated that suicide is inversely related to the individual’s degree of social integration. Spady likened dropping out to suicide in that both are directly affected by social conditions: a lack of consistent, intimate interactions with others, having values and orientations that are different from the general social collective, and incompatibility with the immediate social system. Spady proposed that adjustment to college is a longitudinal process involving interaction between the student and the academic and social systems of the institution. The degree of integration into these systems, in combination with background characteristics, directly influences the student’s decision to persist or withdraw. (Spady, 1970)

The interactionalist theory of student departure developed by Tinto (1975, 1987, 1993, 1998) “enjoys near paradigmatic stature in the study of college student departure” (Braxton, 2000, p.2). Tinto proposed a multivariate longitudinal model to explain attrition from colleges and universities prior to graduation. The theory posits that student retention is
a function of student pre-entry characteristics and the interaction between the academic and social systems of the campus environment. Pre-entry characteristics include family and community backgrounds, personal attributes such as age, sex, skills (intellectual and social), as well as precollege educational experiences and achievements (SAT and achievement test scores, and high school grade point average). These pre-entry characteristics have a direct influence on student departure decisions, student commitment to the institution, and commitment to the goal of graduation. Academic variables focus on academic performance in college and interactions with faculty/staff. Social system variables include such things as involvement in peer group interactions and extracurricular activities. Tinto theorized that the greater the interaction with the academic and social systems of the institution, the greater the probability of persisting through to graduation. The likelihood of withdrawal is increased when there is limited social integration into the campus environment. This is related to a lack of commitment to the institution and holds true even when academic performance is satisfactory (Tinto, 1975, 1987). Later work by Tinto led to further development of the model of student departure. To the original model, he added adjustment, difficulty, incongruence, isolation, finances, learning, and external obligations or commitments as factors influencing persistence. Tinto recognized that different types of students (e.g. at-risk, adult, transfer) and various types of postsecondary institutions (residential, nonresidential two-year, urban, and large public universities) require different types of retention programs and policies. (Tinto, 1993, 1998)

The relationship between persistence and student involvement in the academic and social aspects of the institution were also described by Astin in his theory of student
involvement (1970, 1984, 1985). This theory was first proposed as an “input-process-output" model that placed the student in a passive role, being developed by faculty and university programs. Astin later presented a talent development model suggesting that student involvement in higher education resulted in the development of talents inherent to the student and to the system. He posited that the student plays an integral role in determining the degree of involvement in college classes, as well as extracurricular and social activities. The level of student involvement is directly related to the student’s potential and willingness to persist. (Astin, 1970, 1984, 1985)

Building on the theories of Spady, Astin, and Tinto, Pascarella (1980, 1985) developed a retention model known as the general causal model of student development. Pascarella proposed that student persistence is a function of five major sets of variables: student background and pre-university characteristics, structural and organizational characteristics of the institution, the institutional environment, interactions with socializing agents, and the quality of student effort. (Pascarella, 1980, 1985)

Based on the work of Spady, Astin, and Tinto, a causal model of student attrition was developed by Bean (1980). In his model of student departure, a psychological processes model, Bean applied organizational behavior theory to student persistence and attrition as he suggested that reasons for employee departure could be applied to student departure from higher education. In his model, Bean proposed that student attrition was affected by student background variables, interaction within the institution, environmental variables (family support, finances), attitudinal variables (perceived quality and self-satisfaction with the institution), and student intention (transfer or degree attainment). (Bean, 1980)
Recognizing that previous theoretical models of student retention did not acknowledge the significance of external factors on attrition, Bean and Metzner (1985) proposed a model of nontraditional student attrition. They described the nontraditional student as older than 24 years, a commuter, or a part-time student. Bean and Metzner proposed that a student’s decisions about persisting in college are related to background and defining variables, academic variables, and environmental variables. The background and defining variables are concerned with entry characteristics such as age, ethnicity, gender, educational goals, high school performance, and number of hours enrolled; the most influential are expected to be high school performance and educational goals. Academic variables describe student involvement with the academic process at the institution; these include study skills, study hours, class attendance, academic advising, major and job certainty, and course availability. Environmental variables are external to the college environment. Examples include family responsibilities, employment, outside encouragement, and opportunity to transfer to other colleges or programs. Bean and Metzner theorized that these sets of variables interact and result in a range of academic and psychological outcomes, which then influence persistence in school and retention. Environmental variables are directly related to the decision to drop out of school. This prediction is based on two basic assumptions. The first is that the interaction of nontraditional students with the college environment is focused primarily on academic programs due to minimal opportunities for integration or socialization into extracurricular activities. Secondly, nontraditional students have more interaction with the environment that is external to the educational setting. (Bean & Metzner, 1985; Metzner & Bean, 1987)
Cabrera, Nora, and Castenada (1992) recognized the importance of financial factors in their model of student retention. They proposed a causal model influenced by Tinto and other major theorists. Cabrera and associates asserted that financial aid equalizes the opportunities between affluent and low-income students and helps students assimilate into the academic and social communities of the college; this, in turn, influences the decision to remain in college. (Cabrera, Nora, & Castaneda, 1992)

The role of psychological processes in academic and social integration is emphasized in the retention model developed by Bean and Eaton (2000). Their theory is based on four psychological theories: attitude-behavior theory, coping behavioral (approach-avoidance) theory, self-efficacy theory, and attribution (locus of control) theory. According to Bean and Eaton (2000), students enter institutions with psychological attributes resulting from particular experiences, abilities, and self-assessments. As students interact with the institution and its representatives in the academic, social, and bureaucratic realms, aspects of their psychological state undergo change. If the changes are positive, students experience a greater sense of self-efficacy, decreased stress, increased self-confidence, and an improved sense of personal control. This leads to academic and social integration, commitment to the institution, and therefore, to persistence. (Bean and Eaton, 2000)

While the major theories of student retention have relevance for nursing education, it is important to acknowledge that they are based on research that was conducted primarily with traditional college students, most often during their first year of study (Braxton & Hirschy, 2004). Tinto suggested that the important issues for first year students may not be important for students at other stages of their college career (Tinto, 1993). Variables that
have been recognized as significant in predicting retention of college students may differ from those shown to influence success and retention in nursing because nursing students enter programs of study at a later age than traditional college freshmen, having already earned at least the equivalent of two years of general college courses. Pre-entry variables such as high school GPA and standardized test scores (SAT, ACT) that have been associated with retention in the initial college program may have little, if any, influence on the educational experience in a nursing program (Jeffreys, 2004).

Theoretical Frameworks of Nursing Studies

Although the literature reflects that nursing researchers have been investigating student success and retention for the last three decades, there is a scarceness in the number of studies published in nursing and education journals that have based their findings within a theoretical framework. In recent years, most of the researchers who have cited theory as the basis for their studies have reported the use of an integrated theoretical framework; that is, more than one theory was used as the basis for the research. Studies that have indicated the use of a theoretical framework are described in the following paragraphs.

Lockie and Burke (1999) utilized integrated Tinto’s (1975, 1987, 1993, 1998) theory of student departure with Bean and Metzner’s (1985) theory of nontraditional student attrition as the framework for their quasi-experimental study in which they evaluated a retention program for at-risk nursing students. Results showed that students who participated in the retention program were more successful in terms of cumulative GPA and graduation rates than those who did not participate (Lockie & Burke, 1999).
In a study concerning faculty support and student retention, Shelton (2003) utilized Tinto’s theory of student departure and Bandura’s (1977) self-efficacy theory as the foundation for her own model of student retention. Shelton’s Model of Student Retention proposes that students who are at risk for attrition based on their backgrounds (gender, past course work, preadmission test scores, past GPA, financial resources, family educational level, family responsibilities, and employment status) may achieve a satisfactory GPA and persist to graduation provided they have internal resources and if they use the external supports available to them. In this correlational study, Shelton administered a perceived faculty support scale that she had developed to three groups of associate degree nursing students. Group one consisted of 300 students who persisted until graduation; group two included 83 students who had voluntarily withdrawn from the program and group three consisted of 75 students who were dismissed from the program. Results of the study showed that students who persisted in the program perceived greater functional and psychological support from faculty than those who withdrew voluntarily or because of academic failure. Shelton indicated that a limitation of her study was related to a low response rate among non-completers as compared with those who persisted (Shelton, 2003). (It is interesting to note that this is the only reference related to Shelton’s model that was found in the review of literature for this study.)

Using Bandura’s (1977) self-efficacy theory as the framework, Aber and Arathuzik (1996) conducted a descriptive correlational study to identify the factors associated with student performance in a sample of 79 generic students and 44 RN students in a baccalaureate nursing program. Students completed the Clinical Self-Efficacy Scale and the
Study Skills Self-Efficacy Instrument. Scores on the two instruments were correlated with theory and clinical course grades, as well as GPA. Significant correlations were found between overall GPA and grades in the synthesis course, plans to attend graduate school, sense of self-efficacy, self-confidence, lack of financial difficulties, motivation and perseverance to succeed, sense of competency in study skills, and physical assessment skills. Students reported stress related to family responsibilities, childcare, financial difficulties, and fatigue, as well as emotional stress associated with combining family, work, and school. (Aber & Arathuzik, 1996)

In a qualitative study, Janes (1997) examined the baccalaureate nursing school experiences of eight African-American nursing students using Tinto’s theory of student departure (Tinto, 1975, 1987, 1993) and Astin’s Student Involvement Theory (Astin, 1984, 1985). Analysis of student interviews revealed that the major factor in student success was commitment to goal completion. (Janes, 1997)

Aiken, Cervero, and Johnson-Bailey (2001) studied issues affecting participation of Black women in nursing education completion programs, using Black feminist theory as the theoretical framework for their investigation. Analysis of interviews with ten Black women in nursing completion programs showed that these women are constantly aware of being the “other” in class and in practice; individual and institutional racism were cited as barriers to program completion. (Aiken et al., 2001)

Three studies by Marianne Jeffreys (1998, 2001, 2002) cited Bean and Metzner’s theory of nontraditional student attrition (Bean & Metzner, 1985; Metzner & Bean, 1987) as the theoretical framework. One of the studies was also based on Bandura’s (1977) self-
efficacy theory (Jeffreys, 1998). These studies were foundational to the development of the NURS model (Jeffreys, 2004).

Using Bean and Metzner’s theory on nontraditional student attrition and Bandura’s theory of self-efficacy as the theoretical framework, Jeffreys (1998) examined the predictive value of self-efficacy and selected academic and environmental variables on academic achievement and retention in a sample of 97 nontraditional nursing students enrolled in the first semester nursing course of an associate degree program. Data were collected using two researcher-developed survey tools specifically designed for students in the first semester nursing course: a self-efficacy questionnaire and a student perception appraisal (SPA) questionnaire focused on academic and environmental variables as related to retention and academic achievement. Two independent variables were created from subscales of the self-efficacy tool: nursing skills subscale and educational requirements subscale. From the SPA, two independent variables were created: academic variable strength and environmental variable strength. Linear regression analysis revealed that the four variables accounted for only 38% of the variance in academic achievement and only 25% of the variance in retention. Only one variable (academic variable strength) was significant in predicting academic achievement and retention. Students who were highly efficacious and perceived academic factors as highly supportive had lower course grades, suggesting that many students did not have accurate perceptions of the academic skills necessary to be successful in nursing education. Descriptive results from the sample showed that students perceived environmental variables as having more influence on academic achievement and retention than academic variables. (Jeffreys, 1998)
The Bean and Metzner (1985) model of nontraditional student attrition provided the framework for a descriptive exploratory study by Jeffreys (2001) in which she examined academic and psychological outcomes of student participation in an enrichment program consisting of peer mentor/tutor led study groups. Jeffreys also explored the variables perceived by students to be restrictive or supportive of retention in nursing courses. All students in the convenience sample were nontraditional. Students were assigned to an intervention or control group based on their participation in the enrichment program. Data were collected over four semesters, resulting in 257 cases in the intervention group and 851 cases in the control group. Students completed the student perception appraisal-one (SPA-1) tool revised from the previous study (Jeffreys, 1998) and a satisfaction questionnaire related to the nursing program and the enrichment program. Data analysis indicated that overall the intervention group had higher pass rates, lower failure rates, and lower withdrawal rates. Students in the intervention group reported positive psychological outcomes in terms of satisfaction with the enrichment program, nursing as a career, the college, as well as nursing and non-nursing required courses. Variables perceived as severely restrictive of retention were environmental: family responsibilities and crises, finances, and employment responsibilities. Students reported the enrichment program and faculty advisement as greatly supportive of retention in nursing courses. (Jeffreys, 2001).

In a follow-up study based on Bean and Metzner’s model, Jeffreys (2002) explored student perceptions regarding the restrictiveness or supportiveness of variables influencing retention at the beginning and end of the semester. The sample (N = 80) included students who consistently participated in enrichment program study groups. Students completed the
SPA-1 at the first and last meeting of the enrichment program during the semester; however, only 28 students completed both the pre- and post-semester questionnaires and were included in the data analysis. Descriptive analysis showed that students perceived environmental variables as having greater influence on retention than academic variables. Environmental variables rated as severely restrictive were related to family and finances. Highly supportive variables were academic and included study skills, study hours, faculty advisement, friends in class, and the enrichment program. Comparison of pretest and posttest ratings showed that the “severely restrictive” ratings were initially more conservative. Students tended to overestimate the influence of their study skills and study hours on retention at the beginning of the semester as compared with their end of semester ratings. (Jeffreys, 2002)

The NURS model, published by Jeffreys in 2004, provided the theoretical framework for a later study. Jeffreys (2007) conducted a multisite investigation of factors that supported or restricted student retention. A sample of 1156 nontraditional nursing students completed the Student Perception Appraisal, developed and refined by the researcher. The variables most frequently cited as “greatly supportive” were nonacademic and related to emotional support from family and friends. Moderately supportive variables cited by the students were academic in nature and included faculty advisement and helpfulness, institutional facilities (library, skills lab, computer lab), and academic performance. Environmental factors were most frequently identified as moderately or severely restrictive; these included family responsibilities, family crisis, financial status, and hours of employment. Factor analysis revealed five significant factors: environmental, institutional and integration factors, personal academic factors, college academic facilities, and friend support. In further analysis, Jeffreys
examined the impact of demographic variables on factor scores using multiple regression analysis. None of the demographic variables (age, gender, ethnicity, and marital status) were statistically significant. (Jeffreys, 2007)

Only one study was found in the literature that had used Jeffreys’ NURS model as part of the theoretical framework. In a dissertation research study, Horton (2006) studied the predictors of graduation and NCLEX success among a sample 351 students who attended a small midwestern BSN program from 1994-2005. Independent variables included prenursing science course grades, grades in junior and senior nursing courses, and grade point averages at various points in the nursing program. Using hierarchical logistic regression analysis, Horton examined three models to predict graduation and three models to predict NCLEX success. The first model predicting graduation that included prenursing course grades and grades in junior and senior level nursing courses was significant ($\chi^2 = 72.65$, df = 7, $p < .001$). The significant variables were grades in Mental Health (OR = 20.64, $p < .001$), Research in Nursing (OR = 4.59, $p < .05$), and Pathopharmacology (OR = 39.58, $p < .01$). The second model predicting graduation included two admission science GPA’s, and GPA at the end of the junior year of the nursing program. The overall model was significant ($\chi^2 = 196.72$, df = 3, $p < .001$) although the only significant independent variable was junior level GPA (OR = 667.71, $p < .001$). Independent variables in the third model represented GPA’s at the time of admission and at the conclusion of the nursing program; the model was significant ($\chi^2 = 233.88$, df = 2, $p < .001$). The significant predictors were admission college GPA (OR = 4.92, $p < .001$) and nursing GPA (OR = 23489.47, $p < .001$). The first model predicting NCLEX success included senior nursing course grades and combined scores on
two exit exams (Mosby’s RN Assess Test and the RN Comprehensive Predictor). The model was significant in predicting NCLEX success ($\chi^2 = 97.95, \text{df} = 16, p < .001$) and the significant independent variables included scores on exit exams (OR = 2.99, $p < .05$) and grades in the following courses: Therapeutic Interventions (OR = 2.43, $p < .05$), Adult Health Care (OR = 5.5, $p < .01$), and Pediatrics (OR = 4.57, $p < .001$). In the second model predicting NCLEX success, the independent variables consisted of junior and senior level GPA’s and exit exam scores. The model was significant ($\chi^2 = 67.37, \text{df} = 3, p < .001$). All of the independent variables were significant predictors of NCLEX success: exit exams (OR = 4.56, $p < .001$), junior level GPA (OR = 4.8, $p < .05$), and senior level GPA (OR = 6.06, $p < .01$). The final model predicting NCLEX success included the independent variables of admission GPA, exit exam scores, cumulative nursing GPA, and number of C grades earned in nursing courses. The model was significant ($\chi^2 = 73.55, \text{df} = 5, p < .001$) and the significant predictor variables were admission GPA (OR = .101, $p < .01$), exit exam scores (OR = 4.13, $p < .001$), and cumulative nursing GPA (OR = 143.59, $p < .01$). Using t-tests, Horton found a significant difference between graduates and nongraduates on the Nurse Entrance Test reading and math subtests. Only 97 students had taken the test, so NET scores were not included in predictor models for graduation or NCLEX success. (Horton, 2006)

Only one nursing theory was cited as the theoretical framework for a study of nursing student retention. Leininger’s (1991) theory of cultural care, diversity, and universality, was cited as the theoretical framework for a study that examined predictors of attrition in 150 American Indian nursing students. Manifold and Rambur (2001) reviewed student records.
and found that increasing age and language scores on a standardized entrance exam correlated most strongly with program completion. (Manifold & Rambur, 2001)

Studies of Academic Success and Retention in Nursing Students

An integrative review of literature by Campbell and Dickson (1996) examined 47 research studies published in U.S. nursing journals and unpublished dissertation studies between 1981 and 1990 on predictors of retention, graduation, and NCLEX-RN success of baccalaureate nursing students. Only one qualitative study was included in the review. Four of the studies reviewed by Campbell and Dickson were treated as meta-analyses. Most of the studies were descriptive in design and used convenience sampling. Students have been studied at various levels in the educational process (33%); approximately 32% of studies sampled graduates, 21% sampled senior level students, 7% sampled freshmen students, and only 1 study sampled juniors. Cognitive variables were most frequently studied; grade point averages (college cumulative, science, liberal arts, prenursing, and nursing) and scores on standardized tests have been significantly correlated with student success. The greatest cognitive predictors of student success were grade point averages in nursing and science courses. Relatively few studies examined noncognitive and demographic factors of student success; these variables were shown to be weak predictors of student success. In a small number of studies, demographics such as age, financial status, and educational level of parents were correlated with NCLEX success, although none were significantly related to retention or graduation. Gender was studied as a predictor of NCLEX in three studies, but was not statistically significant. (Campbell & Dickson, 1996)
Studies that have been conducted on the academic success of nursing students can be divided into two primary categories: those using NCLEX-RN success as the dependent variable and those using some measure of course or program outcome (program completion, GPA in specific courses or at the end of a particular year, or cumulative GPA). There are some researchers who have used a combination of dependent variables in their investigations. Studies in the literature review are grouped according to their primary outcome measure or dependent variable.

**Studies of NCLEX-RN Success**

The majority of studies on academic success of nursing students have used passing NCLEX-RN as the dependent variable. Passing the national licensure examination awards the student who has graduated from a nursing program the credentials to practice as a registered nurse; students most often take the exam soon after graduation. Schools of nursing are judged according to their annual passing rates; state and national rankings are greatly influenced by NCLEX-RN passing rates.

In a study of 257 graduates of a BSN program, Waterhouse, Carroll, and Beeman (1993) used discriminant analysis to place the subjects into two groups (pass or fail). The researchers examined 15 variables in relation to NCLEX-RN success. Results indicated that grades in the first senior level nursing course and graduation GPA were the two best predictors of passing NCLEX-RN. Correct classification was achieved for 91% of the graduates who took the NCLEX-RN exam, for 93% of those who passed and 80% of graduates who failed. Waterhouse and associates concluded that reasonably accurate data for
identification of high risk students is available by the conclusion of the junior year. (Waterhouse et al., 1993)

In a follow-up study, Waterhouse, Bucher, and Beeman (1994) attempted to cross-validate the procedure for predicting NCLEX-RN success reported in the 1993 study. Using data from 142 BSN graduates from 1991 to 1992, results showed that subjects in this sample differed significantly from the previous group on variables of SAT scores, physiology grades, and nursing grades. Using the original discriminant function, 84% of subjects were correctly classified; 87% of those who passed and more than 62% of those who failed were correctly categorized. The researchers concluded that the procedure for identifying students at risk of NCLEX-RN failure was statistically and ethically sound. (Waterhouse et al., 1994)

The two previous investigations by Waterhouse and associates were conducted prior to the adoption of the computerized administration of the national licensure examination for registered nurses. Therefore, in an effort to determine if the same procedure for predicting NCLEX-RN was still valid, Beeman and Waterhouse (2001) conducted a study of 289 graduates from the BSN program at the University of Delaware between 1995 and 1998. They studied the relationship between 21 predictor variables and passing NCLEX-RN. The best predictor was the total number of C+ or higher grades in nursing theory courses. Grades in the introductory nursing course and pathophysiology were also highly correlated with NCLEX-RN success. The discriminant analysis correctly categorized 93.3% of all students who took the NCLEX-RN exam; more than 94% who passed and more than 92% of failures were accurate categorized. In this study, there were significant differences in those who passed and failed in terms of type of program and age. Fewer failures were noted among
students in the accelerated program and among older students. (Beeman & Waterhouse, 2001)

Using data from the records of 188 BSN students, Alexander and Brophy (1997) investigated the admission, progression, and exit variables that were predictive of student performance on NCLEX-RN. The sample consisted of all NCLEX-RN failures (N = 94) between 1988 and 1994 and 94 randomly selected graduates who passed NCLEX-RN during that same time frame. The independent admission variables included: age, high school rank, SAT scores, admission status, GPA, number of credits, and years of high school math and chemistry. Independent progression variables consisted of grades in all nursing courses, nine cognate courses, and GPA at end of level 1 and level 2. The single independent exit variable was the score on the National League for Nursing (NLN) Comprehensive Achievement Test. Results of logistic regression analyses indicated that a model including the NLN Comprehensive Achievement Test Score in combination with grades in three nursing courses (Childbearing, Nursing Adult I, and Mental Health) was 80.63% accurate in predicting NCLEX-RN success. (Alexander & Brophy, 1997)

In a retrospective study of 81 baccalaureate nursing students at a large southeastern university, Barkley, Rhodes, and Dufour (1998) investigated the correlation between cognitive variables and NCLEX-RN success. The results indicated that grades in clinical nursing courses and scores on NLN achievement tests were significantly related to passing NCLEX-RN. They also found a significant negative relationship between passing NCLEX-RN and grades of C in nursing courses; the probability of failure increased as the number of C’s in nursing courses increased. The researchers developed and tested an NCLEX-RN Risk

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Appraisal Instrument (RAI) as a means of identifying at-risk students. Analysis revealed a significant correlation between high scores on the RAI and NCLEX-RN failure. (Barkley et al., 1998)

Waterhouse and Beeman (2003) compared the NCLEX-RN Risk Appraisal Instrument (RAI) developed by Barkley and associates (1998) with more statistically complex methods of prediction. The researchers modified the RAI to suit the nursing program at their university and retroactively applied the formula to the records of 538 graduates. The formula accurately classified 61% of NCLEX-RN failures. Waterhouse and Beeman concluded that while the RAI is helpful in predicting students at risk of failure, its accuracy does not approach levels reported by more statistically complex prediction methods. (Waterhouse & Beeman, 2003)

Arathuzik and Aber (1998) studied both academic and nonacademic factors associated with NCLEX-RN success among a sample of 79 senior students enrolled in an urban public university nursing program. Students identified internal and external barriers to success such as family responsibilities, emotional distress, fatigue, work, and financial burdens. The researchers found that several factors were significantly correlated with NCLEX-RN success including cumulative nursing GPA, English as primary language, lack of family demands or responsibilities, lack of emotional distress, and sense of competency in critical thinking. (Arathuzik & Aber, 1998)

Beeson and Kissling (2001) sampled 505 graduates of a baccalaureate nursing program in the southeastern United States to determine predictors of success on the NCLEX-RN licensure examination. The independent variables included gender, type of student
(freshman admission, second degree, transfer), age at time of taking the NCLEX-RN exam, grades in selected prenursing courses, grades in all junior and senior level nursing courses, and cumulative GPA at graduation. Results of logistic regression analysis showed that students who passed NCLEX-RN had significantly higher biology and sophomore nursing grade point averages and higher scores on the Mosby Assess Test. The most significant finding was the negative relationship between NCLEX-RN success and the number of C’s, D’s, and F’s earned during the junior year. Age was positively correlated with NCLEX-RN success; nontraditional college-age students were more likely to pass NCLEX-RN than traditional age students. Entry status (freshman, transfer, or second degree) was only marginally related. (Beeson & Kissling, 2001)

Washington and Perkel (1999) conducted a pilot study in which they examined predictors of NCLEX-RN success among graduates of traditional and accelerated BSN programs at a private university. In the sample of 47 traditional and 20 accelerated program students, the only variable found to be predictive of NCLEX-RN success through logistic regression analysis was student performance on the Arnett Test, a practice test designed to simulate the NCLEX-RN examination. (Washington & Perkel, 1999).

A group of educators at Creighton University used multivariate analysis of covariance and discriminant analysis to examine predictors of NCLEX-RN success among a sample of 127 accelerated BSN students. The independent variables included in the study were admission grade point average, previous degree (science or nonscience), senior complex care (SCC) course grades, and results of the Health Education Systems, Inc. (HESI) Pre-RN assessment exam. Seven students failed the licensure exam on the first attempt. HESI scores
and SCC grades were found to be significantly related to NCLEX results. Students with previous science degrees had higher grades in the SCC course and were more likely to pass NCLEX-RN than those with nonscience degrees. Admission GPA’s for science and nonscience degree students were higher for those who passed NCLEX than for those who failed. (Abbott et al., 2008)

One of the few national studies of variables associated with NCLEX-RN success was conducted by Crow and associates (2004) with a sample of 160 respondents from BSN programs representing 38 states and the District of Columbia. The purposes of the correlational study were to identify specific program requirements and interventions used to promote student success on NCLEX-RN and to identify the best predictors of passing NCLEX-RN used by the nursing programs. Respondents completed a survey developed by the researchers. Analysis revealed that the most common admission criterion used by BSN programs was college cumulative GPA (86.9%), followed by ACT scores, high school GPA, SAT scores, and letters of recommendation. The most frequently used criteria for progression were cited as course grades, clinical performance, and college cumulative GPA. The number of credits required for graduation ranged from 120 to 144. Ninety percent of the nursing programs reported use of a standardized comprehensive examination to predict NCLEX-RN success. The specific interventions used by the BSN programs to help prepare students to take the NCLEX-RN exam included academic referral, commercial reviews, social support referrals, and computerized reviews. As part of the survey, participants were asked to report the extent to which admission and progression requirements and other data predicted NCLEX-RN success at their institution. Results showed that the only admission criteria
significantly correlated with NCLEX-RN success were SAT scores and use of a standardized entrance exam. The relationship between SAT scores and NCLEX-RN was inconsistent with other studies. Crow and associates found an inverse relationship between the two variables; that is, the higher the SAT scores required for admission, the lower the NCLEX-RN passing rates for the nursing program. The researchers found a positive association between scores from two NLN content exams (mental health and community health nursing) and passing NCLEX-RN. The only demographic variable correlated with passing NCLEX-RN was ethnicity. Minority students were less likely to pass NCLEX on the first attempt. (Crow et al., 2004)

While many studies have investigated critical thinking skills in nursing students, few researchers have attempted to correlate critical thinking and academic outcomes such as NCLEX-RN success. Giddens and Gloeckner (2005) conducted a study to investigate the relationship between critical thinking and NCLEX-RN success. The sample consisted of 218 baccalaureate students who graduated from a university-based nursing program in the southwestern United States between 1998 and 2001. Students completed the California Critical Thinking Skills Test (CCTST) and the California Critical Thinking Disposition Inventory (CCTDI) during their final semester of the nursing program; approximately 50% of the sample had taken the tests on entry into the program. There passed and those who failed NCLEX-RN. (Giddens & Gloeckner, 2005)

Relationships among work experience, academic achievement, clinical decision-making, critical thinking and passing NCLEX were investigated by Morris (1999) with a sample of 83 senior nursing students. The variables that were found to be significantly
related to NCLEX-RN success were health care work experience, cumulative and nursing GPA, and scores on the CCTST. (Morris, 1999)

Hall (1996) sampled 105 senior nursing students from three BSN programs in North Dakota when she examined the relationship between critical thinking abilities and age, gender, socioeconomic status, level of cognitive development, college GPA, ACT scores, and NCLEX-RN success. Hall reported significant positive correlations between critical thinking, ACT scores, cognitive development, financial status, and grade point average. Logistic regression analyses revealed that only two variables (critical thinking ability and financial status) were significant predictors of passing NCLEX-RN. (Hall, 1996)

The value of standardized nursing examinations to predict NCLEX-RN success has been examined by researchers. A variety of test measures have been correlated with NCLEX-RN success.

Using data from the records of 68 graduates of an associate degree nursing program, Sayles, Shelton, and Powell (2003) examined the relationship between NCLEX-RN success and scores on the Nurse Entrance Test (NET) and Pre-RN Examinations. The correlational comparative study also tested the relationship between NCLEX-RN success and other independent variables including demographic characteristics, grade point average, ACT scores, NET scores, courses completed, and previous work experience. Variables found to be significantly related to NCLEX-RN success were: ethnicity ($r = 0.27, p = .03$), GPA for required courses ($r = 0.29, p = .02$), NET math score ($r = 0.31, p = .01$), NET reading score ($r = 0.35, p = .003$), NET composite score ($r = 0.41, p = .02$), Pre-RN composite score
(r = 0.38, p = .001), and grade in the last nursing course in the curriculum (r = 0.28, p = .02).
(Sayles et al., 2003)

Using a descriptive research design, faculty at the University of Nevada in Las Vegas conducted a study comparing standardized test scores between BSN graduates who passed or failed NCLEX-RN. The convenience sample consisted of four consecutive classes admitted to a 16 month BSN program (N = 187). The retention rate was reported as 87.7% and the NCLEX first time pass rate was 87.8%. The researchers examined Nurse Entrance Test scores for graduates who passed NCLEX on the first attempt compared with those who failed. Results of independent t-tests indicated that graduates who passed NCLEX scored significantly higher. The most significant differences were in the overall composite score, reading comprehension, reading percentile rank, and critical thinking-inferential reading scores. No significant differences between the two groups were found for math, reading rate, social interaction, stress level profiles, or learning style subscale scores. The mean NET composite score for the sample was higher than the average score of 61% reported by ERI for that time period. Using a cut off score of 70%, which was slightly higher than the mean for students who failed NCLEX, the researchers conducted a Chi-square test comparing scores of graduates who passed and failed NCLEX. They found that 87.6% of those who passed NCLEX had NET composite scores greater than 70% while 55.6% of those who failed NCLEX had NET composite scores less than 70% ($\chi^2 = 11.57, p = .001$). In further analysis, the researchers also found that composite scores on 13 of the 16 standardized ERI content specific exams were significantly higher for graduates who passed NCLEX on the first attempt compared with those who failed. (Bondmass et al., 2008)
In four annual validity studies of the computerized Health Education Systems (HESI) Exit Exam, the standardized comprehensive examination was found to be highly accurate in predicting NCLEX-RN success. Researchers studied large national samples of nursing students from diploma, associate, and baccalaureate degree programs as well as practical nursing students and found that for all types of nursing students, the HESI Exit Exam significantly predicted the ability to pass NCLEX (Lauchner et al., 2005; Newman et al., 2005; Nibert & Young, 2005; Nibert et al., 2005).

Another study that examined the predictive value of scores from standardized testing on NCLEX-RN success was conducted by Seldomridge and Dibartolo (2004) with a sample of 186 BSN students in a rural, public BSN program. Logistic regression analysis revealed that student scores on the NLN Comprehensive Achievement Test for Baccalaureate Students (NLNCATBS) and test average in an advanced medical/surgical nursing course predicted 94% of NCLEX-RN passes. The combination of pathophysiology course grade and NLNCATBS scores were predictive of 93.3% of NCLEX-RN passes and 50% of failures. (Seldomridge & Dibartolo, 2004)

A study by Daley and colleagues (2003) examined demographic (age, gender, and ethnicity) and nursing program variables (including standardized test scores) to determine their relationship with passing NCLEX-RN. In addition, the researchers evaluated the predictive accuracy of two standardized examinations, the Mosby Assess Test and the HESI Exit Examination. Two cohorts of BSN students comprised the study sample; one graduating in 1999 (N=121) and the other in 2000 (N=103). Due to the large number of variables and small number of students who were unsuccessful on NCLEX-RN, the researchers were
unable to perform a regression analysis. The results of t-tests and chi-square tests showed that the variables consistently correlated with NCLEX-RN success were cumulative nursing grade point average and the final course grade for a senior level medical-surgical nursing course. The researchers found that scores on the Mosby Assess Test and the HESI Exit Examination were significantly different for students who passed NCLEX-RN compared with those who did not. Students who passed NCLEX-RN were older and had higher GPA’s in prerequisite courses. (Daley et al., 2003)

Henriques (2002) used multiple linear regression to test the predictive value of selected variables on NCLEX-RN success. The independent variables were scores on standardized tests: Pre-Nursing Guidance Test, Nelson-Denny Reading Test, California Critical Thinking Disposition Inventory, California Critical Thinking Test, and the Diagnostic Readiness test. The sample consisted of 135 graduates of a small private BSN program who had passed NCLEX-RN and 17 who had failed on the first attempt. The model was significant with the independent variables predictive of 30% of the variance in NCLEX success. The two primary predictors of NCLEX-RN success were the Diagnostic Readiness Test and reading level as measured by the Nelson Denny Reading Test (Henriques, 2002)

In a doctoral dissertation research investigation, Harris (2006) used logistic regression analysis to determine the predictive value of seven variables on NCLEX-RN success. Data were extracted from academic records of 167 BSN students between mid 1999 and December, 2003. The independent variables included age, ethnicity, marital status, gender, admission GPA, cumulative GPA, and repeating a science course. Only two variables, age and ethnicity, were found to be significant predictors of NCLEX success. The odds ratio for
age was 1.19, indicating that older students were more likely to pass the licensure exam. The odds ratio for ethnicity was 0.48, suggesting that Caucasian students were 0.48 times more likely to pass NCLEX than minority students. (Harris, 2006)

Studies of Academic Success as a Program Outcome

Researchers who have studied academic success in the nursing program as the dependent variable have measured this outcome in four primary ways: whether or not the student completed the nursing program, grades in specific nursing courses, grade point average at the end of a specific semester or year, and cumulative GPA at the end of the program. A variety of independent variables have been studied in relation to student success, although the majority of studies have examined the influence of cognitive variables.

While most researchers have limited the scope of their investigations to one or two outcome measures of nursing student success, multiple dependent variables have been examined in the same study. In a doctoral dissertation research project, Schafer (2002) tested numerous models in an effort to find the best models to predict BSN program admission, upper division grade point average, graduation, and NCLEX success. Independent variables included demographics such as age, ethnicity, gender, and religion; high school GPA; ACT scores; grades in lower division courses; and grades in upper division nursing courses. The study sample consisted of 401 subjects: 327 graduates, 44 persons who were denied admission, and 30 who began the nursing program, but failed to graduate. The results of multiple regression analysis identified the best predictors of prenursing GPA as ethnicity, age, high school GPA, and ACT social science mean. Multiple regression analysis showed that the significant predictors of admission GPA were ethnicity, high school GPA, and ACT
social science mean. Logistic regression analysis was used to determine the best model predicting admission to the nursing program. Results showed that the significant variables were NET reading score, lower division social science course grades, and lower division natural science course grades (anatomy and physiology I and II, and microbiology). The best model predicting upper division nursing GPA was identified using multiple regression analysis. The variables that were significant in the model included age, catholic religion, the number of lower division courses with grade of C, mean grade in Human Growth and Development and Abnormal Psychology, mean grade in four science courses (anatomy and physiology I and II, chemistry, and microbiology). Results of logistic regression analysis identified only two significant variables were predictive of graduation: number of upper division courses with grade of C and grades from upper division nursing courses. Logistic regression was used to determine the best model to predict passing NCLEX on the first attempt. The significant variables were ethnicity, number of C’s in lower division courses, NET composite score, and lower division anatomy and physiology grade, Schafer cited the importance of age in several of the models: older students had higher GPA’s in prerequisite courses, lower upper division GPA’s, and slightly increased odds of passing NCLEX. Grades in science courses were significant in models predicting admission, upper division GPA, and passing NCLEX. The study failed to show the value of the Nurse Entrance Test; scores on the test only slightly increased the odds of admission and passing NCLEX. (Schafer, 2002)

Student performance in pre-nursing science courses has been recognized as an important factor related to academic achievement in the nursing program. Students who have earned higher grades in the required pre-requisite science courses are more likely to be
successful in the nursing program. Studies that support this finding are described in the following paragraphs.

Wong and Wong (1999) investigated the predictive value of basic science courses, both in high school and college, on program success (operationalized as cumulative GPA) and on performance on the national licensure examination. Although the study was conducted with students enrolled in a baccalaureate program in Canada, the findings are pertinent to the literature review for the current study. Using a sample of 258 BSN students, the researchers found that the cumulative GPA in nursing courses was significantly correlated with science grade point average (calculated from grades in anatomy, physiology, chemistry, and microbiology) \((r = 0.75, p < .0005)\). Cumulative nursing GPA was also significantly correlated with age \((r = 0.17, p < .05)\). There was a moderate correlation between science GPA and licensure score \((r = 0.46, p < .0005)\). Two models were tested to predict cumulative nursing GPA. In the first model, all three independent variables were significant: high school chemistry grade, high school biology grade, and age. In the second model containing the independent variables of age, science GPA, and nursing GPA for each of the four years, the significant predictors of cumulative nursing GPA were science GPA, GPA for second year nursing courses, GPA for third year nursing courses, and GPA for fourth year nursing courses. In another regression analysis with score on the licensure examination as the dependent variable and high school sciences and age as the independent variables, age was the only significant predictor. In a second model predicting licensure exam score, the independent variables were science GPA, cumulative nursing GPA, and age; the only significant variable was cumulative nursing GPA. Using logistic regression
analysis, the researchers estimated the probability of failing the nursing program using the independent variables of science GPA, GPA of first and second year nursing courses, and age at time of admission to the program. The model was significant and all of the variables except age were significant predictors of failure in the program: lower science GPA, lower first year nursing GPA, and lower second year nursing GPA. (Wong & Wong, 1999)

Byrd, Garza, & Nieswiadomy (1999) examined the predictive value of demographic, pre-admission and progression criteria on graduation from a baccalaureate nursing program at a large southern university. The researchers gathered data from the academic records of 285 students. Using logistic regression, three predictor models were tested for all students (those who graduated, failed, or dropped out) and three models were tested for only the students who graduated or failed. The outcome was graduation or failure; there was no mention of delayed graduation. The models corresponded to time periods before enrollment in nursing courses, after the first semester, after the second semester. Results showed that the model consisting of pre-enrollment variables of age, ethnicity, science grade point average, and pre-nursing grade point average successfully predicted graduation in 77% of all students, and in 87.8% of students when drop-outs were not included; science GPA and pre-nursing GPA were significant in the model. For students who had completed their first semester of nursing, a model with the independent variables of age, pre-nursing grade point average, and pharmacology course grade was predictive of graduation in 82.6% of all students; significant variables were prenursing GPA and pharmacology course grade. When students who had dropped out were excluded from the analysis, the variables of age, science grade point average, grades in pharmacology and an introductory nursing course predicted graduation in
92.3% of students; significant variables in the model were grades in pharmacology and the introductory nursing course. Following completion of the second semester of the nursing program, a model with the variables of age, ethnicity, social science grade point average, and grades in the first medical-surgical nursing course predicted graduation for 90.9% of all students; the only significant variable was the medical-surgical nursing grade. When those who had dropped out were excluded, a model with five independent variables (ethnicity, grades in pharmacology, an introductory nursing course, the first medical/surgical nursing course, and the fundamentals of nursing course) predicted graduation for 97.2% of students; all of the variables were significant except for ethnicity. (Byrd et al., 1999)

The relationship between grades in prerequisite science courses and academic performance during the first semester was investigated by Potolsky, Cohen, and Saylor (2003). In the convenience sample of 37 baccalaureate nursing students, the researchers found a strong positive correlation between the average prerequisite science course grades (anatomy, physiology, microbiology, organic chemistry, and inorganic chemistry) and mean grade in pathophysiology. \( r = 0.77, p = .01 \). Additionally, there was a moderate positive correlation between mean prerequisite science grades and mean pharmacology grade \( r = 0.60, p = .01 \). (Potolsky et al., 2003)

Brennan, Best, & Small (1996) examined academic performance prior to admission in relation to grades in nursing courses and progression in the first two years of a baccalaureate nursing program. Analysis of data from 89 students revealed that grades in prerequisite mathematics, biology, and chemistry were significantly correlated with grades in first year
nursing courses (health assessment, pharmacology and nutrition, and pathology). The strongest correlation was between grades in chemistry and pharmacology/nutrition ($r = .46$, $p < .01$). Cumulative pre-nursing GPA was significantly correlated with grades in the first year nursing courses; the strongest correlation was between cumulative GPA and grades in pharmacology and nutrition. (Brennan et al., 1996)

Using a sample of 195 students from three public university baccalaureate nursing education programs, Hayes (2005) used multivariate correlational statistics and discriminant analysis to develop a model to predict attrition. The independent variables in the study consisted of GPA for prerequisite courses; number of institutions attended; ACT composite score; ACT reading subscore; ACT math score; and grades in the following courses: Anatomy and Physiology I, Algebra I, English I, Chemistry with Lab I, and Microbiology with Lab I. A six variable model was the most efficient and parsimonious model to predict attrition in 77.6% of cases. The variables were weighted according to their predictive value. The greatest predictor was GPA for prerequisite courses; the other variables in the model in the order of importance were ACT composite score, English I, Chemistry with Lab I, Microbiology with Lab I, and number of institutions attended. (Hayes, 2005)

Griffiths and associates (1995) studied nursing student performance on a criterion-referenced anatomy and physiology (A/P) exam in relation to success in the nursing program. A sample of 98 incoming junior generic students completed a criterion-referenced A/P exam during the first week of the academic year. Scores on this exam were regressed on six predictor variables (type of previous anatomy and physiology course taken, focus of the course [mammalian vs. human], total number of A/P credits earned, mean final A/P grade,
type of institution at which the course was taken, and number of years since the course was completed). Two variables, mean final A/P grade and type of college at which the course was taken, accounted for 18% of the variance in A/P exam scores. The scores on the A/P exam and the other six predictor variables were regressed on student grades in the second clinical nursing course (NUR 303). Three of the variables (mean final A/P grade, type of college at which A/P course was taken, and number of A/P credits earned) explained 39% of the variance in NUR 303 grades. (Griffiths et al., 1995)

Factors associated with success and failure of transfer students were examined in a predictive study by Lewis and Lewis (2000). Data were obtained from the records of 168 students enrolled in a Midwestern university BSN program over a three year period. The dependent variable was academic success (cumulative GPA > 2.5) at the end of the junior year. Independent variables included: number of transferring college credit hours in social science, natural science, and physical science; total number of transferring college credits; converted transferring GPA; and type of institution from which the student transferred. Results of stepwise logistic regression showed that successful students were more than twice as likely to come from a four-year institution (OR = 2.1) and five times (OR = 5.51) as likely to have taken two or more anatomy/physiology courses than unsuccessful students. (Lewis & Lewis, 2000)

Standardized nursing aptitude examinations such as the Nurse Entrance Test (NET) produced by Educational Resources Incorporated (ERI) or the Test of Essential Academic Skills (TEAS) produced by Assessment Technologies Institute (ATI) are used by many nursing programs as admission screening tools. Other schools of nursing administer these
standardized exams to students upon enrollment in the nursing program, prior to matriculation, in an effort to identify students who may be at risk of academic difficulty in the nursing program. Researchers have studied the predictive value of student performance on the Nurse Entrance Test in relation to program outcomes, although most of the studies were conducted with associate degree nursing students. Findings indicate that the best predictors of student success are scores on the cognitive portions of the NET (math and reading), although results on the noncognitive measures have also been correlated with student success.

Using program completion as the dependent variable, Simmons and Haupt (2003) studied the relationship between NET scores and BSN program completion with a sample of 1860 students from seven states. The sample included 1385 students from seven states who had completed a nursing program and 475 who did not. The researchers used regression analysis to assess the value of math and reading scores as predictors of completion. The model was significant and the NET reading score was the leading predictor. Students were divided into groups of program completion and noncompletion. Results of a t-test showed that the two groups differed significantly on reading, math, and composite scores. The researchers found that 48% of those who completed a BSN program scored at or below the mean on reading and 56% scored below the mean on math. Of those who did not complete, 60% scored below the mean on reading and 57% scored below the mean on math. (Simmons & Haupt, 2003)

Simmons, Haupt, and Davis (2004) conducted a large scale study of 4339 students from baccalaureate, associate degree, diploma, and practical nursing programs to examine the
predictive value of NET composite scores and subscale scores on student status (program completion, withdrawal, academic failure). For the subsample of 884 BSN students, there were significant, but weak, correlations between NET variables and student status: composite score (r = 0.14, p < .01), math score (r = 0.07, p < .05), reading (r = 0.16, p < .01), family stressors (r = 0.08, p < .05), social stressors (r = 0.11, p < .01), critical thinking/inferential reasoning (r = 0.19, p < .01), and critical thinking/predicting (r = 0.09 p < .01). The authors stated that regression analysis was performed, although they did not report any regression statistics. They reported that significant predictors of student status were NET composite scores, reading comprehension scores, inferential reasoning (critical thinking) scores, and social stressors. (Simmons et al., 2004)

The relationship between NET scores and academic performance within the first year of a baccalaureate nursing program was studied by Abdur-Rahman, Femea, and Gaines (1994) using a sample of 128 predominantly African-American students. NET reading score showed a significant positive correlation with grades in four of the five first year nursing courses; NET math score was positively correlated with grades in all five courses. There were also significant negative correlations between grades in three courses and stress profile scores for family stressors, social stressors, and workplace stressors. Results of step-wise multiple regression analysis showed that the NET composite score explained 10% of the variance in Health Assessment grade; NET math score accounted for 26% of the variance in the Basic Concepts Practicum grade and 7% was explained by the social stressor score. The NET composite score explained 33% of the variance in the Basic Concepts Practicum course and 25% of the variance in the Basic Concept theory grade. The NET composite accounted
for 28% of the variance in Introduction to Professional Nursing grade. (Abdur-Rahman et al., 1994)

Using Nurse Entrance Test scores and semester grades, Femea, Gaines, Brathwaite, and Abdur-Rahman (1995) compared the sociodemographic and academic characteristics of BSN students whose primary language was English with students for whom English was a second language (ESL). The sample consisted of 173 students from four classes admitted between 1991 and 1993. The majority of the students were African-American, 25% were foreign born. English was the primary language for 138 (79.7%) of the students. T-tests were used to examine the differences between English speaking and ESL students on NET variables and academic performance. These researchers found that ESL students scored significantly lower on the NET math, reading, and test-taking skills. Stress scores in the categories of family, social and workplace stressors were significantly higher for the ESL students, although academic stressor scores were lower. The ESL students earned significantly lower grades in all first semester nursing courses except for Health Assessment. (Femea et al., 1995)

Scores on the Nurse Entrance Test were examined in relation to program completion in a study by Symes, Tart, and Travis (2005). The primary purpose of the study was to evaluate the effectiveness of a mandatory retention program (Nursing Success Program [NSP]) for students identified as high risk based on low NET reading comprehension scores. Students who scored below 55% on the reading comprehension subtest of the Nurse Entrance Test were required to participate in the mandatory five-semester Nursing Success Program, while students who scored greater than 55% entered the traditional four semester BSN
program. The researchers compared graduation rates for a cohort of students enrolled in the nursing program prior to the NSP with a cohort that participated in the retention program. Of the 213 students in cohort 1, 60 (28%) had NET reading scores less than 55%; of those, 31 (52%) did not graduate. Among the students in cohort 1 with NET reading scores less than 55%, 29 (48%) graduated and 31 (52%) did not. In cohort 2 (N=160), 48 students participated in the NSP program; 39 (81%) graduated, 7 (19%) did not, and one (2%) continued part-time. Using students in cohort 1, the researchers also examined the correlation between graduation and NET reading comprehension score (r = 0.43, p = 0.00), NET math score (r = 0.21, p = .002), admission GPA (r = 0.23, p = .001), and science GPA (r = 0.23, p = .002). (Symes et al., 2005)

Another standardized test to measure nursing aptitude was developed by Assessment Technologies Institute (ATI). The Test of Essential Academic Skills (TEAS) consists of four components: math, science, reading, and English (ATI, 2008). Few studies have been reported that have examined the predictive value of the TEAS in relation to nursing student success.

A recent study conducted by Newton, Smith, Moore, and Magnan (2007) examined the predictive value of scholastic aptitude and nursing aptitude on early academic achievement in a BSN program. The sample consisted of 164 sophomore nursing students admitted in two cohorts during the fall (N = 103) and winter (N = 70) of the same academic year. The dependent variable was the overall GPA based on four nursing courses at the end of the first semester. Scholastic aptitude was measured as prenursing GPA, based on student grades in seven required prerequisite courses including biology, anatomy, physiology,
chemistry, biochemistry, psychology, and composition I and II. Nursing aptitude was defined as the composite score on the Test of Essential Academic Skills. Using multiple regression analysis, the researchers found that the model accounted for 35.9% of the variance in first semester GPA ($F = 29.87, p < .001$). Scholastic aptitude, measured by prenursing GPA ($\beta = .39, p < .001$), had the greatest predictive value although nursing aptitude (TEAS score) was also significant ($\beta = .23, p < .001$). In a second analysis, the researchers controlled for the order of admission and reported that prenursing GPA accounted for 15.4% of the variance in first semester GPA. When TEAS scores were entered into the model, they accounted for an additional 4.8% of the variance. (Newton, Smith, Moore, & Magnan, 2007)

Using an exploratory descriptive design, Newton, Smith, and Moore (2007) compared two cohorts of first semester BSN students admitted within the same year under a rolling admissions policy. The fall cohort consisted of 108 students and the winter cohort was 76 students. All had taken the Test of Essential Academic Skills. The researchers found that the two cohorts differed significantly in their pre-nursing GPA’s, TEAS composite scores, and first semester GPA’s in the nursing program. The predictive value of pre-nursing GPA and TEAS composite score on first semester nursing GPA was examined using multiple regression analysis. (Pre-nursing GPA was calculated from grades in biology, anatomy/physiology, chemistry, biochemistry, psychology, and two composition courses.) For the fall cohort, the pre-nursing GPA was the best predictor, accounting for 20% of the variance in first semester nursing GPA. The TEAS composite score was the best predictor for the winter cohort, accounting for 16% of the variance in first semester GPA. The attrition rate for the fall cohort was 2% and 10% for the winter cohort. The researchers called into
question the policy of rolling admissions, suggesting that such policies affect the quality and academic outcomes of students who are admitted. (Newton, Smith, & Moore, 2007)

Scores on the Nelson-Denny Reading Test, a standardized measure of reading ability, were examined by Conklin, More, and Muller (1996) in relation to academic success in nursing school. With a sample of 95 students representing a mixture of sophomores (N = 56), juniors (N = 28), and seniors (N = 11), the researchers found that the three groups of students differed significantly in total scores (vocabulary plus comprehension). They report that student reading level was higher than expected. The researchers correlated student scores on the Nelson-Denny Reading Test with nursing grade point average. They found that the total reading score (vocabulary and comprehension) was significantly correlated with GPA (p < .01). The vocabulary score was the strongest predictor, while reading comprehension was not a significant predictor of nursing GPA. Statistical data related to results of the analysis were not presented in the article describing the study. (Conklin et al., 1996)

Research on critical thinking as a predictor of academic success in the nursing program is limited. Bowles (2000) evaluated the relationship of critical thinking to clinical-judgment abilities in 68 baccalaureate nursing students at the end of their program. She found the two variables were significantly correlated and also reported that critical thinking skills were significantly correlated with GPA. (Bowles, 2000)

In a sample of 73 nursing students, scores on the California Critical Thinking Skills Test and the California Critical Thinking Disposition Inventory were compared and the relationship of each measure was correlated with other variables. Crawford (2002) found that
critical thinking skills did not correlate with disposition and that only the scores on the CCTST were significantly related to GPA. (Crawford, 2002)

Noncognitive Factors Influencing Nursing Student Success and Retention

Because cognitive student characteristics do not account for all the factors that influence academic success, a limited number of researchers have explored the relationship between noncognitive variables and academic success and retention of nursing students. The majority of studies using noncognitive variables have sampled students during their program of nursing education, not at the time of program entry. There have been few studies that have examined the predictive value of noncognitive variables on academic performance and retention. A variety of noncognitive factors have been explored in quantitative and qualitative studies. Stress and self-efficacy are the most commonly studied noncognitive variables among samples of nursing students.

Stress is defined as “a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being” (Lazarus & Folkman, 1984, p. 19). Research in higher education has shown that high levels of perceived stress in students can lead to poor academic performance, attrition, depression, and serious health problems (Hudd, Dumlao, Erdman-Sager, Murray, Phan, Soukas, & Yokozuka, 2000; Misra, McKean, West, & Russo, 2000; Pengilly & Dowd, 2000).

High levels of stress among nursing students have been documented repeatedly, specifically related to pressures of clinical practice, interpersonal relationships with instructors, heavy workload, long hours of study, learning difficult content, and the stress of
exams (Beck et al., 1997; Deary, Watson, & Hogston, 2003; Elliott, 2002; Hamill, 1995; Hegge & Larson, 2008; Lindop, 1999; Mahat, 1998; Nicholl & Timmins, 2005; Rhead, 1995; Timmins & Kaliszer, 2002).

While the journey through nursing education may evoke stress, it is important to recognize that most students enter nursing education programs with pre-existing personal and environmental stressors that may influence their ability to adapt and succeed (Cuthbertson et al., 2004; Gigliotti, 2004; Jeffreys, 2004; Lengacher, 1996; Lo, 2002; Ogunsiji & Wilkes, 2004; Steele et al., 2005). The interaction of pre-existing stressors with those inherent to nursing education programs can potentially impede academic performance and program completion (Jeffreys, 2004; Hegge & Larson, 2008).

Perceived stress levels at the time of enrollment in a nursing education program, as measured by the Nurse Entrance Test, have been studied by a few researchers in relation to academic success. Family and social stress were significantly related to course grades in the study by Abdur-Rahman and associates (1994) when they examined the relationship between NET scores and academic performance within the first year of a baccalaureate nursing program. In a study that examined NET scores in relation to academic success, Simmons and Haupt (2003) reported that social stressors were significantly related to student success or failure in the program. Simmons, Haupt, and Davis (2004) found that social stressors were among the significant predictors of program completion.

O’Connor and Bevil (1996) studied stress and academic outcomes of BSN students enrolled in a full-time day program compared with students enrolled in a part-time evening program. Although both groups exhibited high stress levels, no relationship between stress
and academic outcomes were shown in either group. Age and number of dependents were related to stress level. (O’Connor & Bevil, 1996)

In a dissertation study, Morgan (2001) sampled 141 BSN and 227 ADN students in 13 Texas programs to examine stress as a predictor of academic performance, as well as academic and social integration. She also studied indices of integration most highly associated with student persistence and retention. Morgan used a four part survey consisting of demographics, 14 items related to stress in nursing school, 14 items related to academic and social integration, and the Derogatis Stress Profile (a 77 item self-reported stress inventory). Chi-square automatic interaction detection (CHAID) analysis was used to identify the variables that were significantly related to retention. Results showed that stress was not significantly related to academic performance in the first year. However, the data demonstrated a clear trend that as grades decreased, levels of stress increased. There was no significant difference between ADN and BSN students in terms of stress scores. Consistent with Tinto’s theory, Morgan found that academic and social integration were significantly related to persistence and retention, although the most significant predictor was admission grade point average. (Morgan, 2001)

The types of stressors that affect the academic success of nursing students have been identified and described in numerous studies. In a qualitative study of 23 academically successful African-American students in three predominantly white universities, Kirkland (1998) investigated stressors and coping strategies. The major stressors identified by the students in order of importance were academics, environmental factors, finances, interpersonal stressors, and personal stressors. The most successful coping strategies reported
by the students were active coping (attempting to remove or circumvent the stressor) and seeking social support. (Kirkland, 1998)

In a descriptive, correlational study, Lo (2002) investigated students’ perceptions and sources of stress, their coping mechanisms, and self esteem during three years of an undergraduate nursing program. The study showed that both transient and chronic stress were significantly correlated with negative self esteem and avoidance coping behaviors. The four main stressors affecting nursing students in order of significance were nursing studies, finances, family, and health. (Lo, 2002)

Hegge and Larson (2008) surveyed 137 students enrolled in six accelerated BSN programs to identify sources of stress and coping strategies. The researchers modified the COPE scale, a tool designed to measure coping strategies in the general population, by adding items related to major stressors during the nursing program. Data analysis revealed that 61.3% of students rated their stress level as extensive or extreme; only 3.6% had stress ratings of slight or none. The top five major stressors reported by the students included (in order of importance): the amount of material to be mastered in a short time (45.3%), personal/family life stressors (27.7%), instructors/course organization (24.8%), financial concerns (21.9%), and examinations (21.2%). (Hegge & Larson, 2008)

Self-efficacy is another noncognitive factor that has been studied in relation to student success. Using a sample of 97 associate degree students beginning their first semester in nursing school, Jeffreys (1998) explored the influence of self-efficacy and selected academic and environmental factors on academic performance and retention. A self-efficacy inventory was completed by the students; they also responded to a student perception appraisal...
concerned with academic and environmental variables and their influence on retention and academic performance. Jeffreys reported that student perceptions of academic variables significantly contributed to academic achievement and retention. Students reported family responsibilities and family crises as the most significant hindrances to their academic performance and retention. (Jeffreys, 1998)

Aber and Arathuzik (1996) conducted a descriptive correlational study to identify the factors associated with student performance in a sample of 79 generic students and 44 RN students in a baccalaureate nursing program. Students completed the Clinical Self-Efficacy Scale and the Study Skills Self-Efficacy Instrument. Scores on the two instruments were correlated with theory and clinical course grades, as well as GPA. Significant correlations were found between overall GPA and grades in the synthesis course, plans to attend graduate school, sense of self-efficacy, self-confidence, lack of financial difficulties, motivation and perseverance to succeed, sense of competency in study skills, and physical assessment skills. Students reported stress related to family responsibilities, child care, financial difficulties, fatigue, and emotional stress associated with combining family, work, and school. (Aber & Arathuzik, 1996)

In a correlational dissertation study, Cantrell (2001) explored the relationship between self-efficacy, causal attribution, self-esteem, and academic success in a sample of 24 junior and senior students from three BSN programs. Data were collected using a demographic survey, Harvey and McMurray’s Nursing Academic Self-efficacy Scale, Russell’s Causal Dimension Scale II, and Rosenberg’s Self-Esteem Scale. The dependent variable was success measured as the grade in the nursing course in which the student was
enrolled at the time. Cantrell found that students scored high on self-efficacy and self esteem. Results of multiple regression analysis showed that the independent variables of self-efficacy, causal attribution, and self-esteem accounted for only 2.2% of the variance in success; the model was not significant in predicting student success. (Cantrell, 2001)

One of the few predictive studies evaluating noncognitive factors as predictor variables was conducted by Carroll (2001) in a dissertation study. She sampled 203 current students and graduates of associate degree and BSN programs to examine the effects of academic and social experiences on success and retention. The final logistic regression model included a combination of 23 cognitive and noncognitive variables to predict retention. The predictors shown to be most significant were entry GPA, being female, enrolled in a four-year program, and higher educational level of the father. Other factors that were significant included encouragement by the family, valuing nursing, and informal interactions with faculty. (Carroll, 2001)

The relationship between noncognitive factors and academic success was studied by Kornguth and colleagues (1994) among a random sample of 112 BSN students. The students completed the NCQ, a noncognitive questionnaire developed by Tracey and Sedlacek (1987). The questionnaire examined eight measurable, noncognitive dimensions that had previously been shown to predict student success in higher education: positive self-concept, realistic self-appraisal, understanding and dealing with racism, preference for long-range goals over short-range goals, availability of strong supporting people, successful leadership experiences, demonstrated community service, and knowledge acquired in a field. Using multiple regression analysis, the researchers examined the predictive value of the eight noncognitive
dimensions in relation to the overall GPA. Two of the noncognitive dimensions were significant predictors of overall GPA: understanding of racism and realistic self-appraisal. The researchers also examined the predictive value of the eight noncognitive dimensions in relation to nursing GPA. The only significant variable was understanding of racism. (Kornguth, Frish, Shovein, & Williams, 1994)

Demographic Factors Influencing Nursing Student Success and Retention

Demographic variables have been included as predictor variables in a limited number of studies. In their integrative literature review of 47 studies with BSN students, Campbell and Dickson (1996) reported ten studies that had examined demographic variables in relation to retention, graduation, or NCLEX-RN success. The specific variables were identified as age, race/ethnicity, finance, gender, and educational level of the parents; these were most often studied in relation to NCLEX-RN success. Among the 47 studies examined by Campbell and Dickson, age was included as a demographic variable in six studies about NCLEX success; it was significant in five of those. Ethnicity was identified in one study predicting graduation and four predicting NCLEX success; it was significant in two studies that examined NCLEX success. (Campbell & Dickson, 1996)

While age is the most commonly studied demographic variable in relation to academic success and retention of nursing students, its significance has not been consistently demonstrated. Evidence suggests that older students tend to have greater academic success than younger, traditional students, although they make take longer to complete a program of study due to family, financial, or other personal obligations (Beeson and Kissling, 2001;
Older students may be more likely to pass the licensure examination on the first attempt. In their study of NCLEX-RN success, Beeson and Kissling (2001) found that age was a significant predictor of passing the licensure exam; students over the age of 23 had higher NCLEX pass rates than younger students. Daley and associates (2003) reported that age was significantly correlated with passing NCLEX-RN; older students were more likely to pass the licensure exam on the first attempt. Harris (2006) reported similar findings.

Schafer (2002) reported that older students had higher grade point averages in prerequisite courses, although they had lower upper division (nursing) grade point averages. She also found that older students had a slightly increased chance of passing NCLEX. (Schafer, 2002)

With a sample of 150 American Indian students enrolled in an associate degree nursing program, Manifold and Rambur (2001) examined the predictive value of age, number of dependents, and Test of Adult Basic Education (TABE) scores on program completion. The researchers indicated the use of logistic regression analysis, but did not report odds ratios or other typical logistic results. They stated that “Analysis by logistic regression supported the bivariate analysis with increasing age and TABE language score correlated most strongly with completion of the nursing program.” (Manifold & Rambur, 2001, p. 280)

Byrd, Garza, and Niewiadomy (1999) reported that age was predictive of academic success in nursing education at the end of first semester, second semester, and graduation.
Findings showed that younger students were more likely to graduate from the nursing program (Byrd et al., 1999).

In their study of predictors of academic performance and licensure exam success, Wong and Wong (1999) reported that age was a significant predictor of cumulative GPA in nursing; older students had higher cumulative grade point averages. They did not find that age was significant in predicting success on the licensure examination. (Wong & Wong, 1999)

The relationship between ethnicity and nursing student success and retention has not been well substantiated in correlational or predictive studies, although according to the higher education literature and numerous articles in the nursing literature, minority students are recognized to be at greater risk of academic difficulty and attrition than Caucasian students (Bessent, 1997; Flowers and Pascarella, 2003; Murtaugh, Burns, & Schuster, 1999; Peltier, Laden, & Mastranga, 1999; Reason, 2003; Rodriguez, 1997; Tucker-Allen & Long, 1999). This lack of significance as a predictor variable may be related to the small percentage of minorities among the population of BSN students across the United States. It is interesting that review of the nursing literature reveals numerous studies and essays describing recruitment and retention strategies for minority students (Amaro, Abriam-Yago, & Yoder, 2006; Braithwaite, 1999; Buchanan, 1999; Fletcher, Williams, Beacham, Elliott, Northington, et al., 2003; Gardner, 1995; Nugent, Childs, Hones, & Cook, 2004; Stokes, 2003) although empirical evidence of the relationship between ethnicity and academic success is lacking.
Byrd, Garza, and Niewiadomy (1999) reported that ethnicity was predictive of graduation from a nursing education program. They found that white students were more likely to graduate than ethnic minorities. (Byrd et al., 1999)

In their study of 160 BSN programs, Crow and associates (2004) found that ethnicity was the only demographic variable associated with NCLEX-RN success. Minority students were more likely to fail NCLEX-RN than their white counterparts (Crow et al., 2004). Harris (2006) and Sayles (2003) also reported a significant relationship between ethnicity and NCLEX success. White students were more likely to pass NCLEX on the first attempt than minority students.

Findings regarding ethnicity and NCLEX-RN success in a study by Endres (1997) were somewhat contradictory to others reported in the literature. Endres explored the relationship between ethnicity and the likelihood of passing NCLEX-RN in a correlational study focused on identifying the strongest predictors of NCLEX-RN success for African-American and foreign born students. The random sample consisted of 50 African-Americans, 50 foreign-born, and 50 white graduates from four baccalaureate schools. Surprisingly, results showed no significant differences between the passing rates of African-American, foreign-born, and white graduates on NCLEX-RN, although the African-American students took significantly longer to complete the nursing curriculum than the other two groups. (Endres, 1997)

Seago and Spetz (2005) conducted a study to examine success rates of ethnic minority groups enrolled in California nursing education programs. In addition, they evaluated the predictive value of institutional factors related to on-time completion rates,
attrition rates, and NCLEX-RN first time pass rates. The researchers found that nursing programs with high percentages of African-American and non-Filipino Asian students had lower on-time completion rates, higher attrition rates, and lower first time NCLEX-RN pass rates. (Seago & Spetz, 2005)

Reports of qualitative studies have demonstrated barriers to academic success and retention among minority students. Rodebaugh (1999) conducted a qualitative study of African-American nursing students in a baccalaureate program in which she interviewed seven nursing students about their perceptions of their educational experiences and the affect of those perceptions on their persistence or departure. Three basic themes emerged in the data analysis: educational climate, myth of homogeneity, and desire for a level playing field. Participants who perceived the educational climate as supportive were more likely to persist; those who experienced feelings of oppression were more likely to depart. The myth of homogeneity was instrumental in departure decisions. The tendency of others to view African-American students as a monolithic group influenced some of the students to leave their educational program. The lack of role models, feelings of being “trail-blazers”, and fear of prejudice in the workplace were found to be related to student persistence or departure. (Rodebaugh, 1999)

In a qualitative study involving seven African-American women enrolled in an RN completion program, Aiken, Cervero and Johnson-Bailey (2001) conducted one-on-one semi-structured interviews in an effort to identify issues affecting program participation. Feelings of racism and being “the other” discouraged student participation. Personal characteristics and beliefs (sense of determination and belief in God), potential for social
mobility, and previous work experience as an RN encouraged participation. (Aiken et al., 2001)

A qualitative study by Taxis (2006) investigated the experiences of nine Hispanic/Latina senior students and graduates of a BSN program in relation to institutional factors that influenced their retention and graduation. Analysis of individual interviews, focus groups, and questionnaire responses revealed key influences: student commitment, intellectual ability, and work ethic; financial assistance; family emotional support; peer support from other Hispanic students; and experiencing caring relationships with peers and institutional agents. (Taxis, 2006)

Gardner (2005) explored the experiences of 15 minority students enrolled in a predominantly White nursing program. Analysis of in-depth interviews revealed eight themes related to student success: loneliness and isolation, feelings of being different, absence of acknowledgement of individuality from teachers, peers’ lack of understanding knowledge about cultural differences, lack of support from teachers, coping with insensitivity and discrimination, determination to build a better future, and overcoming obstacles. (Gardner, 2005)

In a qualitative study of 17 recently graduated ethnic minority nurses in California, Amaro and colleagues (2006) examined perceived barriers related to completion of the nursing program. Eleven of the subjects were graduates of associate degree programs and 6 had earned baccalaureate degrees in nursing. Students’ perceptions ranged from no obstacles to extensive barriers, although the majority reported a high level of barriers. Data analysis revealed four major categories of student needs that could potentially become barriers if not
addressed by educators or by the nursing program. Personal needs included lack of finances, insufficient time, family responsibilities, and language difficulties. Academic needs identified by students were study workload, the need for tutoring, and the need for study groups. Language needs were reported by nearly all the subjects as a major barrier in their nursing education. Cultural needs related to cultural differences and were identified as communication, assertiveness, and lack of ethnic role models. Students who were successful in spite of a high level of barriers were persistent and used available resources such as study groups, tutoring, and were involved in ethnic nursing student associations. (Amaro et al., 2006)

**Identifying At-Risk Students**

There is a scarcity of literature that reports specific criteria used to identify BSN students who may be at risk of academic difficulty or attrition. While each institution needs to develop criteria based on their student populations, it is useful for faculty to know what is done in other nursing programs.

In a dissertation study, Tracey (2003) surveyed 57 associate degree and BSN programs regarding academic support programs. While a stated goal of the study was to describe criteria used to identify at-risk students, the results were not specific in terms of those criteria. Tracey reported various admission criteria utilized by nursing programs and indicated that those criteria were also used to identify at-risk students. She found that sixty-five percent of the nursing programs used standardized assessment tests to rank students for admission and to evaluate students for remediation; the most common tests used by the schools were the NET (24%) and the ACT (21%). (Tracey, 2003)
Peter (2005) reported on the Learn for Success (LFS) program at the University of Southern California, designed to reduce attrition rates by providing assistance for at risk students. The criteria for identifying at-risk students at the beginning of the nursing major were: cumulative GPA less than 2.5 for college and university students and less than 2.75 for community college students as well as science GPA at or below 2.5. Student performance on the Nurse Entrance Test was used to identify specific areas of weakness; NET scores below the national pass rate indicated the need for assistance in developing the skill tested by that particular scale (Peter, 2005).

Symes, Tart, and Travis (2005) reported on an evaluation of the Nursing Success Program at Texas Women’s University. Students who scored below 55% on the NET reading comprehension subtest were identified as being at risk and were enrolled in the five semester Nursing Success Program, while students with NET reading scores above 55% entered the traditional four semester BSN program. The authors indicated that this criterion for identifying at-risk students was selected based on preliminary findings that higher rates of attrition were associated with lower NET reading comprehension scores. They also cited previous studies that supported this finding. (Symes et al., 2005)

The effectiveness of a retention program for at-risk nursing students was reported by Lockie and Burke (1999). The Partnership in Learning for Utmost Success (PLUS) Program included six one-credit hour academic courses in nursing, faculty development activities, and partnerships for learning between faculty and students. The authors indicated the use of a comprehensive assessment plan to identify at-risk students among new admissions and for matriculating students at the end of each semester. The criteria on which students were
evaluated included: cumulative college GPA of less than 2.0, cumulative nursing GPA less than 2.2, repeated courses, nonpassing grades of D/F and W (withdrawal) in supportive courses, placement on university academic probation, and recommendations by nursing academic advisors and the progression review committee. Students who met the at-risk criteria were required to participate in the PLUS program. (Lockie & Burke, 1999)

Higgins (2004) described a peer-tutoring program for students who were at risk of failure in a medical/surgical nursing course. At-risk students were identified if they had an average score of less than 70 after taking the first two course exams. Participation in the peer tutoring program was voluntary. Higgins reported that there was a significant relationship between participation in the program and academic success and retention (Higgins, 2004).

Other reports of assistance programs for at-risk students have indicated that participation was voluntary. The effectiveness of a peer-tutoring program for students enrolled in pathophysiology and pharmacology courses was demonstrated in a study by Potolsky, Cohen, and Saylor (2003). Students were invited to participate and those who attended the sessions achieved greater academic success (Potolsky et al., 2003).

Jeffreys (2001) described an enrichment program for nursing students, designed to increase their academic success and to promote retention. This program involved study groups that were led by peer mentors/tutors and participation by students was voluntary. Those who participated experienced greater academic success in the program (Jeffreys, 2001).
Summary

Review and analysis of studies in the nursing and education literature related to academic success and retention of BSN students revealed that few researchers have reported the use of a theoretical framework in conceptualizing their studies. The only well-defined model of nursing student retention, the NURS model by Marianne Jeffreys (2004), has provided the theoretical framework for a limited number of studies. Further testing of the NURS model is needed.

While the majority of researchers have examined nursing student success in terms of passing NCLEX-RN, relatively few studies have investigated student success early in the nursing program. Although a variety of program outcomes (grades in specific courses, GPA at end of semester or year, cumulative GPA) have been used as dependent variables, there is an obvious gap in the literature in studies that have examined program completion as an outcome measure.

Researchers have examined a vast array of independent variables in relation to nursing student success and retention with the majority representing cognitive student profile characteristics. There are few studies that have included noncognitive or demographic variables in predictor models.

The vast majority of studies that have examined cognitive measures as predictors of academic success and retention have operationalized the independent variables as interval or ratio scale values. There is minimal evidence of the use of benchmarks or cutpoints to differentiate between students with high and low scores on cognitive variables. By using such
benchmarks, the study findings have immediate practical application for faculty involved in admissions decisions and recognition of at risk students.

Few studies have identified criteria used in BSN programs to identify students who are at risk of academic difficulty or attrition. Specific criteria have been reported in a minimal number of studies.

Standardized nursing aptitude tests are often used in BSN programs to screen applicants or to identify at-risk students. Although this is common practice, there is minimal evidence to support the effectiveness of these exams.

This study will add to the body of literature on nursing student success and retention, extending the scope of findings from previous investigations that have examined the predictive value of student profile characteristics (cognitive, noncognitive, and demographic) on academic success and program completion. Independent variables for this investigation were selected based on the evidence of their predictive value as reported in previous studies. The predictor variables represent a unique combination of variables with relevance for the particular institution that was the setting for the study.

Further studies need to be conducted within and among nursing education programs to identify factors that are predictive of early student success and retention. Study findings have pragmatic value for faculty who participate in establishing admissions policies and for those who serve on admissions committees. The study findings also have implications for identifying and assisting at-risk students. By using student profile characteristics that are known at the onset of the nursing program as predictors, faculty can identify at-risk students
early in the nursing program and implement interventions designed to promote student success and timely graduation.
CHAPTER III
METHODOLOGY

Design of the Study

For this quantitative, nonexperimental research study, a cross sectional predictive design was utilized. According to Johnson (2001), the clearest way to classify research is according to the primary research objective. In this case, the research was conducted in order to predict a phenomenon, without regard for cause and effect (Johnson, 2001).

This chapter describes the setting for the study, the population and sample, and data collection. Descriptions of dependent and independent variables are included along with information relative to their operationalization in the study. Methods of data analysis are discussed in relation to each of the research questions.

Setting

The setting for this research study was the University of North Carolina at Chapel Hill School of Nursing. The University of North Carolina at Chapel Hill (UNC-CH) is a four-year public comprehensive research institution that includes fourteen colleges and schools offering instruction in more than 100 fields. The School of Nursing, established in 1950, is one of five schools in the Division of Health Affairs at UNC Chapel Hill. The School offers a full range of degree programs including two prelicensure baccalaureate of science in nursing programs: a traditional six semester option and a four semester accelerated option for students with previous baccalaureate or higher degrees; an RN-BSN completion option, RN-MSN bridge program, a master’s degree or post-master’s option in seven advanced practice areas, a doctoral program with a BSN-to-PhD option, and pre-doctoral and post-doctoral
fellowships. The prelicensure BSN program varies from 126 to 133 hours in length, including a total of 64-68 credit hours of liberal studies and other prerequisites at the lower division level (UNC-CH, 2008). The six semester BSN program option was the focus for this research investigation.

Population and Sample

The population for this study included all students who were admitted to the University of North Carolina at Chapel Hill School of Nursing six semester prelicensure baccalaureate program in the last ten years. The cohorts of students who were included in the study sample entered the nursing program in May of 2001, 2002, and 2003. The total number of students in the sample was 370.

Data Collection

This retrospective study involved secondary analysis of data from a student database belonging to UNC Chapel Hill School of Nursing Office of Admissions and Student Services (OASS). Admission and academic records of students admitted to the six semester prelicensure BSN program at the University of North Carolina at Chapel Hill in May of 2001, 2002, and 2003 provided the source of data for this study. Data were extracted from the original documentation (admission applications and student transcripts) by personnel in the Office of Admissions and Student Services. The database included more than 150 variables representing student profile characteristics such as demographics, earned degrees, grades in postsecondary courses, results of admission testing, and grades in nursing courses.
Study Variables

Dependent Variables

Early Academic Success

The first dependent or outcome variable in this study was early academic success, determined by student performance in courses during the first two semesters of the six semester prelicensure BSN program. It was operationalized as a dichotomous variable with students being categorized as 1 = successful or 0 = unsuccessful. Students who were categorized as successful were those who had earned grades above C in all nursing courses and students who had earned no more than one grade of C during the first two semesters of the BSN program. Students were considered unsuccessful if they earned two or more C’s and/or any grade below C in nursing courses. Students who withdrew from any course during the first two semesters were also considered unsuccessful.

During the first two semesters of the nursing program, students in the sample were enrolled in didactic courses that provide content foundational to nursing practice. During the second semester, students were enrolled in their first clinical course – Nursing 56: Nursing Care of Patients with Major Adult Health Problems – Part I. (See Appendix for a complete listing of courses in the curriculum.)

The nursing courses included in data analysis for this study were: N51: Introduction to the Discipline of Nursing, N56: Basic Theories, Processes, and Skills for Clinical Nursing, N57: Pathophysiology, N58: Pharmacology, and N59: Nursing Care of Patients with Major Adult Health Problems – Part I. Student performance in N52: Individual and Life Span Development and N60: Nursing Role in Normal and Therapeutic Nutrition were not included.
in the analysis. Grades in these two courses for many students were missing. This is because students are often exempt from these courses when they enter the nursing program if they have completed an equivalent course prior to admission. In fact, in many schools of nursing, courses in nutrition as well as growth and development are considered prerequisites and must be completed prior to admission to the nursing program. In addition, students generally perform quite well in both these courses, with the majority of grades higher than C.

**Program Completion**

The second dependent variable in this study was program completion. It was a dichotomous variable, operationalized as either completing the program on time, (graduating at the end of six semesters with the original admission cohort) or completion being delayed or denied. The variable was coded as 1 = on-time graduation and 0 = delayed or denied graduation. Graduation may be delayed if students are required to repeat a nursing course due to withdrawal or earned grade of less than C-. It may also be delayed for students who experience academic or personal difficulties that necessitate changing from full-time to part-time study; this prolongs their program of study beyond six semesters or 24 months. Graduation is denied for students who do not complete the program because of voluntary withdrawal or because they were dismissed from the program.

**Independent Variables**

The independent or predictor variables in this study were student profile characteristics categorized as cognitive, noncognitive, and demographic. The cognitive variables included cumulative GPA, science GPA, number of science credits, previous degree, reading comprehension, and math skill. The single noncognitive independent variable
was stress and the demographic variables were age and ethnicity. With the exception of reading comprehension, math skill, and stress, all of the variables were known prior to admission to the School of Nursing, at the time students submitted applications. Reading comprehension, math skill, and stress were measures of student responses on the Nurse Entrance Test (NET). This standardized assessment of nursing aptitude was completed by students on their first day of the nursing program. The NET and evidence of its validity and reliability are described at the conclusion of the discussion of independent variables. (See Table 3.1 for list and descriptions of study variables.)

Cognitive Independent Variables

The independent variables representing student cognitive abilities included cumulative grade point average, science grade point average, science credits, previous degree, reading comprehension, and math skill. While most studies have operationalized these cognitive variables as ratio or interval scale, this study took a unique approach. For logistic regression analysis, cumulative GPA, science GPA, reading comprehension, and math skill were converted from continuous to ordinal level. Benchmarking of the selected cognitive variables (cumulative GPA, science GPA, reading comprehension, and math skill) was done by determining cut points to differentiate between high and low scores for each variable. The cut point between high and low scores for each variable was determined to be one standard deviation below the sample mean. Because scores for most students on these variables cluster around the sample mean, one standard deviation below the mean seemed to be more useful to identify those students who are most likely to succeed and those who are at greatest risk for academic difficulty, delayed graduation, or attrition. Thus, values for each
variable at or above one standard deviation below the sample mean were coded as 1, and scores less than one standard deviation below the sample mean were coded as 0.

**Cumulative Grade Point Average (GPA).** The first independent variable in the cognitive category of student profile characteristics was cumulative GPA on admission to the School of Nursing. Cumulative GPA, on a scale of 0 to 4, was calculated based on grades in courses that were completed by the student after high school. This was calculated by OASS staff from original student transcripts provided at the time of application to the School of Nursing. Cumulative GPA’s greater than or equal to one standard deviation below the sample mean were coded as 1 and cumulative GPA’s less than one standard deviation below the sample mean were coded as 0.

**Science Grade Point Average.** Science GPA, on a scale of 0 to 4, was calculated by OASS based on grades in required prerequisite science courses. The courses that were included in the calculation of science GPA included: Fundamentals of Anatomy and Physiology, Physiology, Microbiology, Psychology, and Statistics. Student grades were obtained from official student transcripts submitted at the time of application. Science GPA’s greater than or equal to one standard deviation below the sample mean were coded as 1 and those less than one standard deviation below the sample mean were coded as 0.

**Science Credits.** The number of science credits was calculated by adding the number of semester credits earned by the student in biology, chemistry, anatomy and physiology, physiology, and microbiology courses. This information was obtained from official transcripts. The number of science credits was as a continuous variable in the analysis. It was not converted to an ordinal variable because it is not considered by the Admissions
Committee as a strict criterion. Students are considered for admission if they have already completed all science prerequisites or if they are in process of taking the required courses at the time of submitting the application for admission.

**Previous Degree.** The independent variable of previous degree was designed to identify students who entered the nursing program having previously earned a degree in higher education. Students in the sample were categorized according to their highest earned degree as reported on the application for admission. This variable was coded as: 0 = no previous degree, 1 = baccalaureate or higher degree.

**Reading Comprehension.** This predictor variable was defined as the ability to read and comprehend science related material (Frost, 2004). It was operationalized as student scores on the reading comprehension subtest of the Nurse Entrance Test (NET). Reading comprehension is evaluated on the NET at the inferential level for science-related material, with reading selections at the 10th grade level of difficulty for vocabulary and sentence syntax (Frost, 2004). Reading comprehension scores were recorded as a percentage (0 - 100). NET reading scores greater than or equal to one standard deviation below the sample mean were coded as 1 and NET reading scores less than one standard deviation below the sample mean were coded as 0.

**Math skill.** This variable was operationalized as student scores on the Essential Math Skills subtest of the Nurse Entrance Test. This NET subtest covers whole numbers, decimal operations, fractions operations, percent operations, number system conversions, and algebraic equations (Frost, 2004). Student scores were recorded as percentages (0 -100). NET math scores greater than or equal to one standard deviation below the sample mean were
coded as 1 and NET math scores less than one standard deviation below the sample mean were coded as 0.

Noncognitive Independent Variable

Stress. The single noncognitive predictor variable in this study represented self-perceived levels of student stress. Stress can be defined as “a particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being” (Lazarus & Folkman, 1984, p. 19).

Student stress was operationalized for this study as scores on the Stress Level Profile subtest of the Nurse Entrance Test. The Stress Level Profile consisted of five areas of personal coping: family life, social life, money/time commitment, academic stress, and stress in the workplace. Students received a percentage score (0-100) for each area of personal stress. For this study, the total stress score was calculated by summing the percentages for each of the categories of personal stress (total stress score = 0 - 500).

Demographic Independent Variables

Age. This continuous demographic variable was defined as the student’s chronological age in years. It was self-reported data obtained from the admissions application form.

Ethnicity. This demographic variable was determined from the student’s self-selected response on the application for admission to the nursing program. Each student was placed in one of two categories: majority or minority. Ethnicity was coded as 1 = majority (Caucasian), 0 = minority (African-American, Hispanic, Asian, American-Indian, or other).
Reliability and Validity of the Nurse Entrance Test

Data relative to the independent variables of reading comprehension, math skill, and stress reflected student responses on subtests of a standardized nursing aptitude assessment, the Nurse Entrance Test (NET). This test is described in the following section.

The Nurse Entrance Test was completed by nursing students at UNC-Chapel Hill on the first day of the nursing program. The NET, published by Education Resources, Inc. (ERI), is a diagnostic instrument designed to evaluate academic, social, and learning profiles of beginning nursing students. The NET is administered to approximately 100,000 students each year in practical nursing, diploma, associate degree, and baccalaureate degree programs. Many schools use the NET as a screening tool for admission while others use the instrument as a diagnostic and counseling tool to identify at-risk students as they begin the nursing program (Simmons, Haupt, & Davis, 2004).

The NET consists of six subtests (essential math skill, reading comprehension skills, test-taking skills, social interaction profile, stress profile, and learning style). Scores (ranging from 0-100) from math and reading subtests are combined to produce the overall composite percentage scores for each student. (Frost, 2004)

Validity of the Nurse Entrance Test. Content and construct validity for the NET relates to the appropriateness of the test items for assessing related academic and learning behaviors. Test items were written by a committee of faculty who are actively involved in teaching and academic counseling in health occupations programs throughout the United States. Test items were evaluated by the Examination Committee according to guidelines derived from results of a survey of nursing program directors across the United States. Items
included in the NET reflect appropriate skill focus and learning style behaviors of nurses. Ongoing evaluation of test items is performed by the Examination Committee with the assistance of other test specialists at ERI. Concurrent or criterion validity of the NET was examined through comparison of composites scores with ACT composite scores. Correlation coefficients ranged from +.79 to +.83, indicating a substantial relationship between the two measures. Diagnostic validity of the NET was determined by administration of the test to 365 graduating nurses during the last academic month of their educational program. T-tests were performed for each NET subtest to compare students’ scores with the established norm. For each subtest, the scores of the nurses were significantly higher than the average of norms for entering students (Frost, 2004).

ERI has performed differential item functioning on the NET using the Mantel-Haenszel procedure to examine the Nurse Entrance Test for cultural bias. Using a sample of 1060 examinees, researchers found no evidence of cultural bias (Jarvis, 2004).

Reliability of the Nurse Entrance Test. Standardization testing of the instrument was conducted with 1385 beginning nurses from health occupation programs throughout the United States in 1989. Reliability was examined using the parallel-forms method. Reliability coefficients ranged from +.81 for math to +.98 for reading comprehension, with an overall average of +.92. Subtest reliability coefficients were: reading comprehension = .98, stress = .97, social = .92, math = .81 and learning styles = .91 (Frost, 2004).
Table 3.1

Description of Study Variables

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>TYPE OF VARIABLE</th>
<th>DEFINITION</th>
<th>QUANTIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early academic success</td>
<td>Ordinal</td>
<td>Academic performance at the end of the second semester of the 6 semester prelicensure BSN nursing program; having earned grades of C or above in all nursing courses, with no more than one grade of C; having no course withdrawals</td>
<td>1 = Successful 0 = Unsuccessful</td>
</tr>
<tr>
<td>Program completion</td>
<td>Ordinal</td>
<td>Graduated on schedule at the end of 6 semesters with the original admission cohort</td>
<td>1 = On-time graduation 0 = Delayed or denied graduation</td>
</tr>
<tr>
<td><strong>Independent: Cognitive</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cumulative grade point</td>
<td>Ordinal</td>
<td>Cumulative grade point average at the time of application for admission (4.0 scale)</td>
<td>1 = cumulative GPA ≥ 2.84 0 = cumulative GPA &lt; 2.84</td>
</tr>
<tr>
<td>Science grade point average</td>
<td>Ordinal</td>
<td>Earned grade point average in science courses required for admission to nursing: fundamentals of anatomy and physiology, physiology, statistics, microbiology, and psychology (4.0 scale)</td>
<td>1 = science GPA ≥ 2.68 0 = science GPA &lt; 2.68</td>
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</tbody>
</table>

91
Table 3.1 (continued)

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>TYPE OF VARIABLE</th>
<th>DEFINITION</th>
<th>QUANTIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Science credits</td>
<td>Continuous</td>
<td>Semester credit hours for science courses completed prior to admission (biology, chemistry, anatomy and physiology, physiology, microbiology)</td>
<td>Number of credit hours completed prior to application for admission</td>
</tr>
<tr>
<td>Previous Degree</td>
<td>Ordinal</td>
<td>Graduated from any postsecondary institution with baccalaureate, master’s, or doctoral degree</td>
<td>1 = previous baccalaureate or higher degree 0 = No previous degree,</td>
</tr>
<tr>
<td>Reading comprehension</td>
<td>Ordinal</td>
<td>Ability to read and comprehend science related material (0 - 100) (Frost, 2004)</td>
<td>Score on NET reading subtest: 1 = NET reading ≥ 61.77 0 = NET reading &lt; 61.77</td>
</tr>
<tr>
<td>Math skill</td>
<td>Ordinal</td>
<td>Ability to perform basic operations in math and algebra that are deemed essential for success in health professions (0 - 100) (Frost, 2004)</td>
<td>Score on NET math subtest 1 = NET math ≥ 68.57 0 = NET math &lt; 68.57</td>
</tr>
</tbody>
</table>

Independent: Noncognitive

| Stress                | Interval         | “A particular relationship between the person and the environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her well-being.” (Lazarus & Folkman, 1984, p. 19) | Total NET stress level profile score: sum of scores in all areas of stress: family life, social life, money/time commitment, academic stress, and stress in the workplace. (0 - 500) |
Table 3.1 (continued)

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>TYPE OF VARIABLE</th>
<th>DEFINITION</th>
<th>QUANTIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent: Demographic</td>
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<td></td>
</tr>
<tr>
<td>Age</td>
<td>Continuous</td>
<td>Self-reported age in years on application for admission</td>
<td>Age in years</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Ordinal</td>
<td>Self-reported race/ethnicity on application for admission</td>
<td>1=Majority (Caucasian) 0=Minority (Asian, African-American, Hispanic, American-Indian, or other)</td>
</tr>
</tbody>
</table>

Data Analysis

Research Question I: What is the predictive value of selected cognitive (cumulative GPA, science GPA, number of science credits, previous degree, reading comprehension, math skill), noncognitive (stress), and demographic (age, ethnicity) characteristics on the early academic success of students enrolled in a prelicensure baccalaureate nursing education program?

Research Question II: What is the predictive value of selected cognitive (cumulative GPA, science GPA, number of science credits, previous degree, reading comprehension, math skill), noncognitive (stress), and demographic (age, ethnicity) characteristics on BSN program completion?

Descriptive and inferential statistical methods were used for data analysis in this study. Descriptive statistics included frequencies, means, and standard deviations.
The statistical significance level selected for data analysis was \( p = .05 \). The standard alpha value of .05 is most often used by researchers (O’Rourke et al., 2005) and was consistently the significance level reported in previous studies of nursing student success and retention that were reviewed for this study.

Correlational analysis was performed to determine if there were any significant relationships among the study variables. The correlations among the independent variables were examined for multicollinearity, which is an intrinsic problem of regression and can cause misinterpretation of the data. Multicollinearity occurs if there is a strong linear dependency between independent variables in the model, meaning two or more variables are highly correlated with one another. This is a concern because multicollinearity can cause the effects of the independent variables to be obscured. (Allison, 1999; O’Rourke et al., 2005)

Logistic regression analysis was used to examine the predictive value of the independent variables and to assess the effectiveness of the models predicting early academic success and program completion. Logistic regression is an appropriate statistical analysis technique that is used to predict a binary or dichotomous dependent variable on the basis of multiple continuous, ordinal, and/or categorical independent variables (Allison, 1999). The dependent variables of early academic success and program completion were dichotomous, while the independent variables represented a mixture of nominal, ordinal, and continuous predictors (See Table 3.1).

Summary

This cross-sectional predictive research study sampled students who were admitted to the six semester prelicenseure BSN program at UNC Chapel Hill School of Nursing in 2001,
2002, and 2003. Data were obtained from an existing student database maintained by the
UNC Chapel Hill School of Nursing Office of Admissions and Student Services (OASS).
Using logistic regression analysis, the ability of selected student profile characteristics to
predict early academic success and program completion was assessed.

This study represents a unique combination of independent variables in the two
logistic regression models predicting early academic success and program completion. The
operationalization of cognitive variables to differentiate between students with high and low
scores is a novel approach to data analysis that will provide pragmatic information for faculty
in the BSN program.

Findings of the study have implications for the students, faculty, and administrators in
the School of Nursing, as well as for the university, future employers of graduates from the
program, and for the public who will become recipients of nursing care. Other baccalaureate
nursing education programs may also benefit from the study findings. Examination of factors
that predict success and graduation should provide insight related to refinement of admission
criteria, and should assist faculty to identify at-risk students early in the curriculum. Early
identification promotes prompt and ongoing interventions to increase the likelihood of
student success, timely graduation, and entry into nursing practice. It is important that the
School of Nursing produce as many graduates as possible each year, making an optimal
contribution to reducing the current and future nursing shortage.
CHAPTER FOUR
RESULTS

The purpose of this study was to examine the predictive value of selected cognitive, noncognitive, and demographic student profile characteristics on early academic success and program completion in prelicensure baccalaureate nursing students.

This chapter presents the results of descriptive and inferential analyses of study data accomplished using the SAS 9.1 for Windows (2002-2003) statistical package. Descriptive statistics include frequency distributions, means, and standard deviations. Correlational analysis was used to examine relationships among the study variables. Finally, logistic regression analysis was performed to determine the predictive value of the independent variables.

The data set for this study was extracted from a student database maintained by the Office of Admissions and Student Services at UNC-Chapel Hill School of Nursing. Approval to conduct the study was granted by the Institutional Review Boards at both UNC Chapel Hill and North Carolina State University.

Description of the Sample

The sample for this study included all individuals admitted to the six semester pre-licensure baccalaureate of science in nursing program at the University of North Carolina at Chapel Hill from 2001-2003 (N=370). Of the 370 students, 132 (35.68%) were admitted in 2001; 118 (31.89%) were admitted in 2002, and 120 (32.43%) were admitted in 2003. The sample size was considered adequate for analysis of a nine variable logistic regression model.
as it is generally expected that there are a minimum of ten observations per variable (Allison, 1999).

Table 4.1

Description of the Sample \((N = 370)\)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Year of Admission</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td>132</td>
<td>35.68%</td>
</tr>
<tr>
<td>2002</td>
<td>118</td>
<td>31.89%</td>
</tr>
<tr>
<td>2003</td>
<td>120</td>
<td>32.43%</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>347</td>
<td>93.78%</td>
</tr>
<tr>
<td>Male</td>
<td>23</td>
<td>6.22%</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>311</td>
<td>84.05%</td>
</tr>
<tr>
<td>African-American</td>
<td>35</td>
<td>9.46%</td>
</tr>
<tr>
<td>Asian</td>
<td>13</td>
<td>3.51%</td>
</tr>
<tr>
<td>Native American</td>
<td>4</td>
<td>1.08%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>5</td>
<td>1.35%</td>
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<tr>
<td>Other</td>
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<td>0.54%</td>
</tr>
<tr>
<td><strong>Previous Degree</strong></td>
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<td></td>
</tr>
<tr>
<td>Baccalaureate</td>
<td>110</td>
<td>29.73%</td>
</tr>
<tr>
<td>Master’s</td>
<td>11</td>
<td>2.97%</td>
</tr>
</tbody>
</table>

Analysis of student demographics revealed that there were 347 females (93.78%) and 23 males (6.22%). According to the American Association of Colleges of Nursing
(2008), males accounted for 9.7% of students in pre-licensure baccalaureate nursing
programs in the United States in 2006-2007. Thus, the number of males in the sample is
somewhat less than the national average reported for BSN programs. The number of males
admitted to the UNC-CH School of Nursing in 2007-2008 has increased beyond the national
average to 12-14% of students (Moore, 2008).

Ethnic representation was predominantly Caucasian (N = 311, 84.05%). The largest
group of minority students was African-American (N = 35, 9.46%); the percentages of other
ethnic groups are displayed in Table 4.1. Minority students accounted for over 25% of
Thus, there were fewer minority students in the sample compared with other BSN programs.
The percentage of each ethnic group was similar to national trends, with African-American
students as the predominant minority group (AACN, 2008). Recent data indicate that
minority representation at UNC-CH School of Nursing has increased to approximately 25 %
(Moore, 2008).

The youngest student at the time of admission to the School of Nursing was 20 years
of age, while the oldest was 56. The average age of the students was 23.59 years (SD = 5.91)
and the median age was 21. Age was missing for one student, as the year of birth was not in
the data set. Figure 4.1 demonstrates that the distribution of age was skewed toward the older
ages.

One-third of the students entered the nursing program having earned previous college
degrees (N = 121, 32.7%). The baccalaureate was the highest degree for 110 students
(29.3%), while 11 (2.97%) had earned a master’s degree. During the admission cycles of
2007-2008, the percentage of students with previous degrees ranged from 15% to 53% (Moore, 2008).

Figure 4.1: Histogram of age

Descriptive Statistics of Other Independent Variables

Cognitive independent variables reflective of students’ previous academic achievements included cumulative grade point average, science grade point average, science credits, and previous degree. The variables of reading comprehension and math skill were representative of student performance on a standardized nursing aptitude examination that was administered on the first day of program entry.

A desired outcome of the study was to provide faculty with pragmatic information that would enable them to identify students who are at risk of experiencing academic difficulty during their first two semesters as well as those who are at risk of delayed or denied graduation. Another desired outcome was to provide information that would foster re-evaluation of admissions committee policies and decisions. With these goals in mind, the
cognitive independent variables were first examined according to their descriptive statistics. For inclusion in the regression models, several of the cognitive variables were coded in a unique manner that was not previously reported in studies of nursing student success and retention. The continuous cognitive variables that would most likely be considered by admissions committees as criteria for admission or by faculty for identification of at-risk students were closely evaluated and cut points determined that would differentiate between high and low scores. Realizing that the mean of each variable indicates the “average” for all students, it was decided that using one standard deviation below the mean as the cut point would likely be most effective in identifying at-risk students. The variables included in this coding were cumulative GPA, science GPA, reading comprehension, and math skill.

Cumulative grade point average was based on all courses completed by students after high school graduation. The cumulative grade point average for the sample of nursing students ranged from 2.27 to 4.0 with a mean of 3.21, and a standard deviation of 0.37. The range of cumulative grade point averages was normally distributed as shown in Figure 4.2.

An ordinal variable was created for cumulative grade point using the mean minus one standard deviation as the cut point between high and low scores. Therefore, students with cumulative grade point averages at or above 2.84 were coded as 1, and those with cumulative GPA’s below 2.84 were coded as 0.

The science grade point average at the time of admission was calculated from grades in required prerequisite courses including Fundamentals of Anatomy and Physiology, Physiology, Microbiology, Psychology, and Statistics.
Figure 4.2: Stem and leaf plot for cumulative grade point average

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<table>
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</table>

Multiply Stem.Leaf by 10**-1

Figure 4.3: Stem and leaf plot for science grade point average

The science GPA for the study sample ranged from 2.12 to 4.0 with a mean of 3.15 and a standard deviation of 0.47. Science GPA was missing for one student. The range of science grade point averages was normally distributed as depicted in Figure 4.3. Science GPA’s at or above 2.68 were coded as 1 and science GPA’s below 2.68 were coded as 0.
Science credits represented science courses completed by the student prior to submitting the application for admission. The courses included in the calculation were chemistry, biology, anatomy and physiology, physiology, and microbiology. The total number of science credits at the time of admission ranged from 4 to 96 with a mean of 30.33 (SD = 9.23). The distribution was skewed toward the higher number of credits (See Figure 4.4).

Figure 4.4: Histogram of science credits

The students with fewer science credits were likely still in the process of completing prerequisite science courses at the time of admission so their applications did not include those credit hours. It is important to note that admissions decisions were not tied to the number of science credits on student transcripts; if students were in process of completing required science courses at the time of application, they were considered for admission. Therefore, this variable remained continuous for analysis purposes.
Reading comprehension was measured by NET reading scores. The mean score for NET reading was 73.10 (SD = 11.23) with a range of 30 to 96. NET reading scores were skewed toward the lower values (See Figure 4.5). One student had a missing score for NET reading. Mean NET reading scores for students in the sample were higher than those reported by Educational Resources Incorporated (2001). According to ERI (2001), the average NET reading score for BSN students was 56. NET reading scores at or above 61.77 were coded as 1 and scores below 61.77 were coded as 0.

![Boxplot](image)

Figure 4.5: Histogram for NET reading scores

The independent variable, math skill, was measured by student performance on the math subtest of the Nurse Entrance Test. Scores for NET math ranged from 31 to 97 with a mean score of 81.92 (SD = 13.35). NET math scores were skewed toward the lower values (See Figure 4.6). One student had a missing score for NET math. According to ERI (2001), the average NET math score for BSN students was 66, thus, students in the sample had higher mean scores than the national average. NET math scores at or above 68.57 were coded as 1 and scores below 68.57 were coded as 0.
Figure 4.6: Histogram for NET math scores

The one noncognitive variable in the study was stress, measured by the total stress level profile score on the Nurse Entrance Test. Total stress scores were calculated by adding student scores in the areas of family stressors, social stressors, stressors related to money and time, academic stressors, and work place stressors. The maximum score for each category of stress was 100. Total stress scores for the sample ranged from 40 to 350 with a mean of 168.19. The scores were skewed toward the higher values (See Figure 4.7).
Among the study sample, the highest levels of stress were related to money and time (mean = 60.08, SD = 19.95) and the lowest levels were related to work place stressors (mean = 18.68, SD = 12.59). The norms for stress level profile scores reported by Educational Resources Incorporated (2001) are displayed in Table 4.2. Levels of academic stressors and money/time stressors were higher in the study sample than the ERI mean scores. Stress level profile scores for the other categories were similar to those reported by ERI.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
<th>ERI Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading comprehension</td>
<td>73.10</td>
<td>11.23</td>
<td>30</td>
<td>96</td>
<td>56</td>
</tr>
<tr>
<td>Math skill</td>
<td>81.92</td>
<td>13.35</td>
<td>31</td>
<td>97</td>
<td>66</td>
</tr>
<tr>
<td>Family Stressors</td>
<td>22.03</td>
<td>17.44</td>
<td>0</td>
<td>90</td>
<td>22</td>
</tr>
<tr>
<td>Social Stressors</td>
<td>27.24</td>
<td>16.61</td>
<td>0</td>
<td>90</td>
<td>24</td>
</tr>
</tbody>
</table>
### Variable Mean SD Minimum Maximum ERI Mean

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>SD</th>
<th>Minimum</th>
<th>Maximum</th>
<th>ERI Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Money/time Stressors</td>
<td>60.08</td>
<td>19.95</td>
<td>0</td>
<td>100</td>
<td>45</td>
</tr>
<tr>
<td>Academic Stressors</td>
<td>40.16</td>
<td>19.62</td>
<td>0</td>
<td>100</td>
<td>21</td>
</tr>
<tr>
<td>Work Place Stressors</td>
<td>18.68</td>
<td>12.59</td>
<td>0</td>
<td>70</td>
<td>15</td>
</tr>
</tbody>
</table>

#### Dependent Variables

The dichotomous dependent variable, early academic success, reflected performance in nursing courses during the first two semesters of the prelicensure BSN program. Early academic success was defined as having earned no grade less than C and no more than one C in any nursing course during the first or second semester. Unsuccessful students were those who had withdrawn or failed to complete any nursing course, who earned any grade less than C or more than two C’s in any nursing course during the first two semesters. The nursing courses included in this analysis were: N51: Introduction to the Discipline of Nursing, N56: Basic Theories, Processes, and Skills for Clinical Nursing, N57: Pathophysiology, N58: Pharmacology, and N59: Nursing Care of Patients with Major Adult Health Problems – Part I. This variable was coded as 1 = successful and 0 = unsuccessful. Of the 370 students in the sample, 278 (75.14%) were identified as successful, while 92 students (24.86%) were unsuccessful.

The dichotomous dependent variable of program completion was operationalized as 1 = on-time graduation and 0 = delayed or denied graduation. Students who graduated on schedule, at the end of the six semester BSN curriculum, represented 84.86% of the sample.
(N = 314), while for 15.14 % (N = 56), graduation was delayed or denied. Twenty-one students withdrew from the program, either voluntarily or involuntarily; this represented 6.68% of the total sample and 37.5% of those in the category of delayed or denied completion. The category of delayed or denied graduation included any student who had withdrawn from a nursing course or had earned a grade of less than C minus in any course (in which case the course must be repeated and graduation is delayed), as well as any student who had withdrawn or was dismissed from the program. For students who did not complete the program, the database did not specify whether they were dismissed or had withdrawn voluntarily.

Results of Correlational Analyses

Strength and direction of correlations among study variables were assessed using Spearman’s rho rank order coefficients. This type of correlation analysis is appropriate when both variables are assessed on an ordinal level of measurement or when one variable is ordinal level and the other is either interval or ratio level. The strength of correlation is determined based on the absolute value of the coefficient: ± 1 = perfect correlation, strong correlation = ± .80, moderate correlation = ± .50, and weak correlation = ± .20 (O’Rourke, Hatcher, & Stepanski, 2005). The results of the correlations are displayed in Table 4.3.

Results of the correlational analysis showed a significant positive relationship between early academic success and program completion (r_s = .52, p < .001). A two-by-two classification table showed that forty-four of the fifty-six students (78.6%) for whom graduation was delayed or denied were not successful during their first two semesters.
Eight of the nine independent variables were significantly correlated with the dependent variable of early academic success. The independent variables demonstrating the strongest correlations with early academic success were math skill ($r_s = 0.27, p < .0001$), reading comprehension ($r_s = 0.25, p < .0001$), and science GPA ($r_s = 0.24, p < .0001$). (See Table 4.3)

Six predictor variables demonstrated a significant correlation with the dependent variable of program completion. The strongest correlations were between program completion and the variables of reading comprehension ($r_s = 0.35, p < .0001$) and math skill ($r_s = 0.27, p < .0001$). (See Table 4.3)

The strongest correlation among the predictor variables was between age and previous degree ($r_s = 0.78, p < .0001$). This means that as age increased, so did the likelihood of having earned a previous academic degree. There were moderate correlations between two other pairs of variables: cumulative GPA and science GPA ($r_s = 0.43, p < .0001$) and between reading comprehension and math skill ($r_s = 0.43, p < .0001$). This means that higher cumulative grade point averages were associated with higher science GPA’s and higher reading comprehension (NET reading scores) were associated with higher math skill (NET math scores).

There was a significant weak positive correlation between reading comprehension and science GPA ($r_s = 0.11, p < .05$) and between reading comprehension and science credits ($r_s = 0.12, p < .05$). This suggests that higher science GPA’s and science credits were associated with higher reading comprehension.
Ethnicity demonstrated a significant positive correlation with reading comprehension ($r_s = 0.36, p < .0001$) and math skill ($r_s = 0.3, p < .0001$); this means that higher reading comprehension and math skill were associated with Caucasian ethnicity.

Age showed significant weak negative correlations with cumulative GPA ($r_s = -0.1, p = .0009$), science credits ($r_s = -0.24, p < .0001$), reading comprehension ($r_s = -0.13, p = .009$), math skill ($r_s = -0.1, p = .04$), and ethnicity ($r_s = -0.11, p = .03$). This means that younger age was associated with higher cumulative grade point averages, science credits, reading comprehension, math skill, and Caucasian ethnicity.

The correlations among the independent variables were examined to assess for multicollinearity, the strong linear relationship among independent variables. A strong correlation ($r = \pm .80$) suggests that multicollinearity may exist (Allison, 1999). The strongest correlation was .78, between age and previous degree, which is considered a strong correlation and suggests the possibility of multicollinearity.
Table 4.3

*Correlation Matrix of Study Variables*

<table>
<thead>
<tr>
<th>Variables</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Early academic success</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Program completion</td>
<td>0.52***</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Cumulative GPA</td>
<td>0.19***</td>
<td>0.05</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Science GPA</td>
<td>0.24***</td>
<td>0.12*</td>
<td>0.43***</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Science credits</td>
<td>0.09</td>
<td>0.04</td>
<td>-0.002</td>
<td>-0.003</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Previous degree</td>
<td>-0.12*</td>
<td>-0.17***</td>
<td>-0.12*</td>
<td>0.04</td>
<td>-0.23***</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Reading comprehension</td>
<td>0.25***</td>
<td>0.35***</td>
<td>0.09</td>
<td>0.11*</td>
<td>0.12*</td>
<td>-0.04</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Math skill</td>
<td>0.27***</td>
<td>0.27***</td>
<td>0.06</td>
<td>0.07</td>
<td>0.07</td>
<td>-0.05</td>
<td>0.43***</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Stress</td>
<td>-0.08</td>
<td>-0.05</td>
<td>-0.05</td>
<td>-0.09</td>
<td>-0.02</td>
<td>-0.07</td>
<td>-0.06</td>
<td>-0.08</td>
<td>1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Age</td>
<td>-0.17**</td>
<td>-0.21***</td>
<td>-0.17***</td>
<td>0.04</td>
<td>-0.24***</td>
<td>0.78***</td>
<td>-0.14**</td>
<td>-0.10*</td>
<td>-0.09</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>11. Ethnicity</td>
<td>0.13*</td>
<td>0.17**</td>
<td>0.06</td>
<td>0.08</td>
<td>-0.07</td>
<td>-0.11*</td>
<td>0.36***</td>
<td>0.3***</td>
<td>-0.11*</td>
<td>-0.11*</td>
<td>1.0</td>
</tr>
</tbody>
</table>

*p < .05   **p < .01   ***p < .001
To rule out the existence of multicollinearity in logistic regression models, it is possible to use collinearity diagnostic statistics for linear regression models. These statistics include tolerance and variance inflation factors. Low tolerance values (less than 0.4) and variance inflation factors greater than 10 are indicative of multicollinearity (Allison, 1999).

Tolerance for all variables was greater than 0.4 and variance inflation factors were all below 10, indicating that there were no strong linear dependencies among the predictor variables and that multicollinearity was not a problem. See Table 4.4 for tolerance and inflation factors for the independent study variables.

Table 4.4

*Tolerance and Variance Inflation Factors for Independent Variables*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Tolerance</th>
<th>Variance Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative GPA</td>
<td>0.77</td>
<td>1.29</td>
</tr>
<tr>
<td>Science GPA</td>
<td>0.76</td>
<td>1.31</td>
</tr>
<tr>
<td>Science Credits</td>
<td>0.97</td>
<td>1.02</td>
</tr>
<tr>
<td>Previous Degree</td>
<td>0.59</td>
<td>1.69</td>
</tr>
<tr>
<td>Reading Comprehension</td>
<td>0.72</td>
<td>1.39</td>
</tr>
<tr>
<td>Math skill</td>
<td>0.79</td>
<td>1.27</td>
</tr>
<tr>
<td>Stress</td>
<td>0.96</td>
<td>1.04</td>
</tr>
<tr>
<td>Age</td>
<td>0.56</td>
<td>1.79</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>0.82</td>
<td>1.21</td>
</tr>
</tbody>
</table>
Results of Logistic Regression Analysis Predicting Early Academic Success

Research Question One: What is the predictive value of selected cognitive (cumulative GPA, science GPA, number of science credits, previous degree, reading comprehension, math skill), noncognitive (stress), and demographic (age, ethnicity) student profile characteristics on the academic success of students enrolled in a prelicensure baccalaureate nursing program?

Logistic regression analysis was utilized to predict early academic success, measured at the end of the second semester of the six semester pre-licensure BSN curriculum. The dichotomous dependent variable was operationalized as 1 = successful and 0 = unsuccessful. The form of the logit predicted by the logistic regression equation was determined by the ordered values in the response profile. In this study, the logistic regression equation compared the probability of early academic success (success = 1) to the probability of lack of success (success = 0). The statistical significance level for this analysis was .05. Table 4.5 displays the results of the logistic regression analysis.

Of the 370 students in the sample, 367 were included in this analysis. Three students were excluded from the analysis due to missing data on one or more of the variables. Of the 367 students included in the analysis, 275 (74.93%) were identified as successful, while 92 (25.07%) students were considered to be unsuccessful.

The logistic model was evaluated for overall goodness-of-fit using the Hosmer and Lemeshow test (Hosmer & Lemeshow, 2000). For well-fitting models, the p value of the chi-square statistic is greater than .05. This suggests that model prediction does not differ significantly from observed values (Hosmer & Lemeshow, 2000). For the logistic regression model predicting early academic success, the Hosmer and Lemeshow
goodness-of-fit statistic showed that the model was a good fit for the data ($\chi^2 = 6.8$, df = 9, p = 0.56).

Table 4.5

*Summary of Logistic Regression Analysis for Variables Predicting Early Academic Success*

<table>
<thead>
<tr>
<th>Variable</th>
<th>$\beta$</th>
<th>SE</th>
<th>Wald Chi-Square</th>
<th>P Value</th>
<th>Odds Ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative GPA</td>
<td>0.45</td>
<td>0.35</td>
<td>1.68</td>
<td>0.20</td>
<td>1.57</td>
<td>0.79 – 3.12</td>
</tr>
<tr>
<td>Science GPA</td>
<td>1.07</td>
<td>0.36</td>
<td>9.01</td>
<td>0.003**</td>
<td>2.93</td>
<td>1.45 – 5.91</td>
</tr>
<tr>
<td>Science Credits</td>
<td>0.003</td>
<td>0.01</td>
<td>0.05</td>
<td>0.83</td>
<td>1.003</td>
<td>0.98 – 1.04</td>
</tr>
<tr>
<td>Previous Degree</td>
<td>-0.45</td>
<td>0.35</td>
<td>1.71</td>
<td>0.19</td>
<td>0.64</td>
<td>0.32 – 1.26</td>
</tr>
<tr>
<td>Reading Comprehension</td>
<td>0.93</td>
<td>0.43</td>
<td>4.54</td>
<td>0.03*</td>
<td>2.52</td>
<td>1.08 – 5.89</td>
</tr>
<tr>
<td>Math skill</td>
<td>1.11</td>
<td>0.36</td>
<td>9.55</td>
<td>0.002**</td>
<td>3.03</td>
<td>1.50 – 6.13</td>
</tr>
<tr>
<td>Stress</td>
<td>-0.004</td>
<td>0.002</td>
<td>2.90</td>
<td>0.09</td>
<td>0.99</td>
<td>0.99 – 1.001</td>
</tr>
<tr>
<td>Age</td>
<td>-0.03</td>
<td>0.03</td>
<td>1.003</td>
<td>0.32</td>
<td>0.97</td>
<td>0.92 – 1.03</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>-0.16</td>
<td>0.38</td>
<td>0.19</td>
<td>0.67</td>
<td>0.85</td>
<td>0.40 – 1.80</td>
</tr>
<tr>
<td>Constant</td>
<td>-0.19</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hosmer-Lemeshow Goodness of Fit Statistic: $\chi^2 = 6.80$ (df = 8, p = 0.56)
Likelihood ratio: $\chi^2 = 57.76$ (df = 9, p < .0001)
*p < .05    **p < .01    ***p < .001

Another method used to assess the predictive power of the logistic model is the generalized $R^2$ statistic. It is based on the likelihood ratio chi-square used to test the null hypothesis that all coefficients are equal to 0. While the interpretation of $R^2$ in multiple regression measures the amount of variance in the dependent variable that is explained by
the model; this interpretation is not appropriate for logistic regression. According to Allison (1999), a potential weakness of generalized R$^2$ is its upper bound of less than 1. To remedy this, SAS also reports “max-rescaled R$^2$” which is calculated by dividing the original R$^2$ by its upper bound (Allison, 1999). For this model, the generalized R$^2$ was 0.15 and the max-rescaled R$^2$ was 0.22. According to Hosmer and Lemeshow (2000), generalized R$^2$ values for logistic regression are low in comparison with R$^2$ values of good linear regression models. They caution that low R$^2$ values are the norm in logistic regression and may be problematic for audiences accustomed to the higher linear regression R$^2$ values. Additionally, there exists no widely accepted “cutoff” value for generalized R$^2$ values and this statistic is not preferred for assessing the logistic regression model’s predictive value. (Hosmer & Lemeshow, 2000)

The likelihood ratio chi-square statistic evaluates the overall model that includes all the independent variables. It tests the null hypothesis that all the coefficients are equal to 0. A well-fitting model is significant level at the .05 level or better (Allison, 1999), suggesting that the observed values of the dependent variable can be predicted from the observed values of the independent variables. For this model, the likelihood ratio chi-square was 57.76 (df = 9, p < .0001) indicating that at least one of the coefficients was not equal to 0 and that the model containing all the predictor variables was significantly different from the one with the constant only.

Logistic regression analysis produces logistic coefficients (also called logits) for each independent variable. These coefficients indicate the log odds of the predicted event occurring. The logits are difficult to interpret except for their positive or negative sign (Allison, 1999). Logistic coefficients vary between plus and minus infinity; a coefficient
of 0 indicates the predictor variable makes no difference in the probability that the dependent variable is equal to 1. The logistic coefficient is the value of the change in log odds of the dependent variable per unit change in the predictor variable. A positive coefficient is associated with an increase in the log odds that the dependent variable is equal to 1, while a negative coefficient is associated with a decrease in the log odds that the dependent variable is equal to 1 (Allison, 1999). The logistic coefficients are displayed in Table 4.5.

To determine the significance of the individual predictor variables in the model, logistic regression analysis calculates maximum likelihood estimates. The Wald chi-square statistics and associated p values for each of the logistic coefficients indicate the variables that are significant in the model. In the model predicting early academic success, the variables with Wald chi-square statistics that were significant at the p < .05 level were math skill ($\chi^2 = 9.55, p = .002$), reading comprehension ($\chi^2 = 4.54, p = 0.03$), and science GPA ($\chi^2 = 9.01, p = .003$).

The most meaningful and useful information relative to the predictive value of the independent variables is the odds ratio estimates (Allison, 1999). The odds ratio indicates the odds of the event occurring. In this model, the odds ratios indicate the odds of early academic success. An odds ratio greater than one is associated with an increase in the odds that the dependent variable is equal to one. An odds ratio less than one is associated with a decrease in the odds that the dependent variable is equal to one. (Allison, 1999)

The 95% Wald confidence interval for odds ratios of significant predictor variables should not contain the value of 1.0. If the confidence interval around the odds ratio includes the value if 1.0, this indicates that a change in the value of the predictor
variable is not associated with a change in the odds of the dependent variable. Therefore, that particular independent variable is not a useful predictor in the model. (Allison, 1999)

The odds ratio for science GPA was 2.93 with a 95% confidence interval of [1.45, 5.91]. This finding indicates that students with science grade point averages greater than or equal to 2.68 were 2.93 times more likely to achieve early academic success than students with science GPA’s less than 2.68.

For reading comprehension, the odds ratio was 2.52 with a 95% confidence interval of [1.08, 5.89]. This means that students with NET reading scores greater than or equal to 61.77 were 2.52 times more likely to achieve early academic success than students with NET reading scores less than 61.77.

The odds ratio for math skill was 3.03 with a 95% confidence interval of [1.50, 6.13]. This indicates that students with NET math scores greater than or equal to 68.57 were 3.03 times more likely to achieve early academic success than students with NET math scores less than 68.57.

Results of Logistic Regression Analysis Predicting Program Completion

Research Question Two: What is the predictive value of selected cognitive (cumulative GPA, science GPA, number of science credits, previous degree, reading comprehension, math skill), noncognitive (stress), and demographic (age, ethnicity) student profile characteristics on program completion?

Logistic regression analysis was utilized to identify significant predictors of program completion. The dichotomous dependent variable of program completion was operationalized as 1 = on-time graduation and 0 = delayed or denied graduation. The logistic regression equation compared the probability of on-time program completion...
(completion = 1) to the probability of delayed or denied graduation (completion = 0). The results of logistic regression analysis are displayed in Table 4.6.

Table 4.6

<table>
<thead>
<tr>
<th>Variable</th>
<th>β</th>
<th>SE</th>
<th>Wald Chi-Square</th>
<th>P Value</th>
<th>Odds Ratio</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cumulative GPA</td>
<td>-0.45</td>
<td>0.47</td>
<td>0.93</td>
<td>0.34</td>
<td>0.64</td>
<td>0.25 – 1.60</td>
</tr>
<tr>
<td>Science GPA</td>
<td>0.79</td>
<td>0.45</td>
<td>3.04</td>
<td>0.08</td>
<td>2.20</td>
<td>0.91 – 5.35</td>
</tr>
<tr>
<td>Science Credits</td>
<td>-0.01</td>
<td>0.01</td>
<td>1.01</td>
<td>0.31</td>
<td>0.99</td>
<td>0.96 – 1.01</td>
</tr>
<tr>
<td>Previous Degree</td>
<td>-1.02</td>
<td>0.41</td>
<td>6.16</td>
<td>0.01**</td>
<td>0.36</td>
<td>0.16 – 0.81</td>
</tr>
<tr>
<td>Reading Comprehension</td>
<td>1.80</td>
<td>0.46</td>
<td>4.41</td>
<td>&lt;.0001***</td>
<td>6.03</td>
<td>2.46 – 14.78</td>
</tr>
<tr>
<td>Math skill</td>
<td>0.87</td>
<td>0.41</td>
<td>15.47</td>
<td>0.04**</td>
<td>2.38</td>
<td>1.06 – 5.33</td>
</tr>
<tr>
<td>Stress</td>
<td>-0.004</td>
<td>0.003</td>
<td>1.28</td>
<td>0.26</td>
<td>0.99</td>
<td>0.99 – 1.003</td>
</tr>
<tr>
<td>Age</td>
<td>-0.02</td>
<td>0.03</td>
<td>0.30</td>
<td>0.58</td>
<td>0.98</td>
<td>0.91 – 1.016</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>-0.13</td>
<td>0.44</td>
<td>0.08</td>
<td>0.77</td>
<td>0.88</td>
<td>0.79 – 3.410</td>
</tr>
<tr>
<td>Constant</td>
<td>1.28</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hosmer-Lemeshow Goodness of Fit Statistic: $\chi^2 = 8.04$ (df = 8, p = 0.43)
Likelihood ratio: $\chi^2 = 55.10$ (df = 9, p < .0001)

*p < .05  **p < .01  ***p < .001

Of the 370 students in the sample, 367 were included in this logistic regression analysis. Three students were excluded due to missing data on one or more of the variables. Of the 367 students included in the analysis, 311 (84.74%) completed the program on time and 56 (15.26%) experienced delayed completion or attrition from the program.
To determine if the overall model was a good fit for the data, the Hosmer and Lemeshow (2000) goodness-of-fit test was used. The results demonstrated that the model was a good fit for the data ($\chi^2 = 8.04$, df = 8, p = 0.43).

The significance of the model was tested with the generalized $R^2$ and the likelihood ratio chi-square test. The generalized $R^2$ for this model predicting program completion was 0.13. The max re-scaled $R^2$ was 0.24. The likelihood ratio chi-square for the model was 55.1 (df = 9, p < .0001). This indicated that at least one of the logistic coefficients was not equal to 0 and that the model was significantly different from the one with the constant only.

In the model predicting program completion, there were three significant independent variables, according to the Wald chi-square statistics and their associated p values of less than .05. The variables were reading comprehension ($\chi^2 = 15.47$, p < .0001), math skill ($\chi^2 = 4.41$, p = .04), and previous degree ($\chi^2 = 6.16$, p = .01). (See Table 4.6)

The odds ratio for reading comprehension was 6.03 with a 95% confidence interval of [2.46, 14.78]. This means that students with NET reading scores greater than or equal to 61.98 were 6.03 times more likely to achieve on-time program completion than students with NET reading scores less than 61.98.

The odds ratio for math skill was 2.38 with a 95% confidence interval of [1.06, 5.33]. This finding suggests that students with NET math scores greater than or equal to 68.57 were 2.38 times more likely to achieve on-time program completion than students with NET math scores below 68.57.
For previous degree, the odds ratio was 0.36 with a 95% confidence interval of [0.16, 0.81]. This means that students with previous academic degrees were .36 times less likely to achieve on-time program completion than students who were earning their first degree. It could also be interpreted as students who were earning their first degree were .36 times more likely to achieve on time program completion than those who had earned a previous degree.

Summary

Logistic regression analysis was used to examine the predictive value of cognitive, noncognitive, and demographic student profile characteristics on early academic success and program completion among a sample of 370 prelicensure baccalaureate nursing students at the University of North Carolina at Chapel Hill.

For the logistic model predicting early academic success, three independent variables were found to be significant. All of the variables were representative of cognitive abilities; these variables were science grade point average, reading comprehension, and math skill. Noncognitive and demographic variables were not found to be significant predictors of early academic success.

For the logistic model predicting program completion, the cognitive independent variables of reading comprehension, math skill, and previous degree were found to be significant. There were no significant noncognitive or demographic variables in the model.

The logistic models in this study reflect academic outcomes at two distinct points in the nursing program, one at the end of the first two semesters (early academic success) and the other at the conclusion of the nursing program (program completion). The two
models share two significant predictor variables: reading comprehension and math skill. While the odds ratio for math skill is similar for both models, it is important to note that the odds ratio for reading comprehension as a predictor of program completion is more than twice the odds ratio for early academic success.

The results of the study provide pertinent data for evaluation of admission policies, recognizing that the best predictors of early academic success and program completion are cognitive variables that are available either at the time of application or at the time of program entry. The study findings are insightful for faculty involved in identification of at-risk students and in development of strategies to promote their success.
CHAPTER FIVE
CONCLUSIONS

This chapter will first discuss findings related to the dependent study variables of early academic success and program completion. Subsequently, the variables that were found to be significant in predicting the two outcomes will be discussed, followed by those that were not significant. Implications for practice, limitations of the study, and recommendations for future research will be described.

The study examined the predictive value of cognitive, noncognitive, and demographic variables on early academic success and on-time program completion in a sample of baccalaureate nursing students at a large public university in the southeastern United States. Results indicated that cognitive factors were the strongest predictors of both outcome variables. Science grade point average, reading comprehension, and math skill were predictive of early academic success. Reading comprehension, math skill, and previous degree were significant predictors of program completion. Noncognitive and demographic variables were not found to be significant predictors of either dependent variable in this study.

Dependent Variables

Early Academic Success

The first research question in this study sought to identify significant predictors of early academic success, measured by student performance in courses during the first two semesters of a six semester prelicensure baccalaureate nursing program. Seventy-five percent of the students in the sample achieved early academic success, while 25% were unsuccessful.
It is difficult to compare the percentages of academically successful and unsuccessful students in this study with results of previous studies. Researchers have used a variety of criteria to measure and define early academic success such as grades in specific courses, GPA at the end of the first or second semester, or GPA at the end of the first year. There has been little consistency in definitions of early academic success across research studies. This has been due, in part, to variations in nursing curricula and sequencing of courses as well as specific goals of the researchers in conducting the studies.

Program Completion

The second research question examined predictors of BSN program completion. The on-time completion rate for students in this study was 84.9%, which is higher than the average on-time completion rate of 74.8% for all prelicensure BSN programs in North Carolina as reported by the North Carolina Center for Nursing (2006). For 56 (15%) of students in the sample, graduation was delayed or denied. Of those, 21 did not graduate; they either withdrew or were dismissed before they were able to complete program requirements.

It is difficult to compare program completion rates in the study with national data. Graduation rates for BSN students in the United States are not clearly identified in reports from AACN or NLN. The most informative data related to program completion is from the National League for Nursing Data Review Report for the Academic Year 2005-2006. In this report, they indicated that overall graduation rates have increased and that 90% of BSN students who enrolled in 2005 remained enrolled or graduated by 2006 (NLN, 2008).
The completion rate in this study is likely related to the academic characteristics of the student population in the School of Nursing. The highly competitive nature of nursing school admission implies that applicants must have outstanding academic credentials to be considered a viable candidate amongst the hundreds who seek admission to the School of Nursing each year. In recent years, the number of qualified students seeking admission to nursing education program across the country has risen steadily, although enrollments have not increased concomitantly. Competition for nursing school admission is intense; more than 30,000 applicants were turned away from BSN programs in 2007 (AACN, 2008). During the admission cycles of 2007-2008, there were more than 700 applicants for 273 slots in the BSN program at UNC Chapel Hill School of Nursing (Moore, 2008). As nursing school admission becomes more competitive, the academic credentials of entering BSN students are enhanced. It logically follows then, that higher overall academic profile characteristics of the students in the nursing program would lead to higher completion rates and lower attrition.

Factors other than the academic abilities of students may contribute to the higher completion rate at this institution compared with other BSN programs. Lower attrition may also be related to the effectiveness of the academic counseling program at the School of Nursing that provides advising and assistance for students who are experiencing academic or personal issues. Another possible contributing factor is the support offered to students by the faculty and administration of the undergraduate program. Students who are experiencing significant academic difficulties are often encouraged to withdraw from courses and/or to extend their program of study as needed to facilitate their academic success. This often prevents the need to withdraw completely from the program. By
encouraging students to withdraw from courses before earning a failing grade, there is a decreased likelihood of dismissal from the program.

Relationship between Early Academic Success and Program Completion

The results of the study showed that there was a significant relationship between early academic success and program completion. Seventy-eight percent (N = 44) of the students for whom graduation was delayed or denied were not successful during their first two semesters. Students who made grades less than C minus or withdrew from courses were required to repeat those courses and because of course sequencing in the curriculum, this automatically delayed their graduation. The unsuccessful students also included those who withdrew from the program during their first two semesters, either voluntarily or involuntarily. It is evident, then, that students who were not successful during their first two semesters were much less likely to complete the nursing program in a timely manner.

Significant Independent Variables

Science Grade Point Average

In this study, student achievement in science courses (science GPA) was found to be a significant predictor of early academic success. Science GPA was calculated from student grades in prerequisite anatomy and physiology, physiology, microbiology, psychology, and statistics courses. The mean science GPA for the sample was 3.15 on a 4.0 scale (SD = .47). Students with science GPA’s greater than or equal to 2.68 (one standard deviation below the sample mean) were 2.52 times more likely to achieve early academic success than students with science GPA’s below 2.68. This also means that students with science GPA’s of less than 2.68 were 2.52 times less likely to achieve early
academic success than those with science GPA’s greater than or equal to 2.68. Thirty-three percent of students who were unsuccessful during their first two semesters and 27% of those for whom graduation was delayed or denied had science GPA’s below 2.68.

The significance of science GPA as a predictor of early academic success is not surprising. A previous unpublished study conducted by UNC-CH faculty showed that the major predictor of cumulative nursing GPA was the science grade point average at the time of admission (Lynn, 2005).

This finding is also consistent with other studies that have examined science grade point average in relation to academic success in the early stages of nursing education programs. Potolsky and colleagues (2003) reported significant positive correlations between science GPA and grades in first semester pathophysiology (r = 0.77, p = .01) and pharmacology courses (r = 0.60, p = .01) (Potolsky et al., 2003). Brennan and associates (1996) found that the GPA for the first year of the nursing program was significantly correlated with grades in prerequisite mathematics (r = 0.37, p < .01), biology (r = 0.45, p < .01), and chemistry (r = 0.49, p < .01) courses (Brennan & Small, 1996).

The predictive value of grades in prerequisite science courses was demonstrated in a dissertation study by Schafer (2002). In testing numerous models to predict admission, lower division GPA, upper division GPA, graduation, and NCLEX success, results indicated that grades in science courses were significant predictors. Mean grades in anatomy and physiology I and II and microbiology increased the odds of BSN program admission (OR = 105,501.96, p = .02). Mean grades in four science courses (anatomy and physiology I and II, chemistry, and microbiology) accounted for 34% of the variance in
upper division nursing GPA. In the model predicting NCLEX success, grades in anatomy and physiology I and II were significant predictors (OR = 3.49, p = .04) (Schafer, 2002).

The importance of student performance in prerequisite science courses was apparent in two recent studies led by Newton (Newton, Smith, & Moore, 2007; Newton, Smith, Moore, & Magnan, 2007). The researchers examined the predictive value of pre-nursing GPA and student performance on the Test of Essential Academic Skills in relation to first semester GPA. It is important to note that in both studies the pre-nursing GPA consisted primarily of grades in prerequisite science courses (biology, anatomy/physiology, chemistry, biochemistry, and psychology), although two composition courses were part of the calculation. In both studies, results of multiple regression analysis showed that the pre-nursing grade point average was a significant predictor of academic achievement during the first semester of a BSN nursing program. Newton, Smith, and Moore (2007) sampled two cohorts of BSN students admitted in the same year (N = 184). They reported that for one cohort, the best predictor of first semester nursing GPA was the pre-nursing GPA, which accounted for 20% of the variance, while for the other cohort, the TEAS composite score was shown to be the best predictor, accounting for 16% of the variance. In a similar study, with a sample of 164 BSN students in two cohorts admitted fall and winter, Newton, Smith, Moore, and Magnan (2007) created a hierarchical regression model to predict first semester nursing GPA. In the model, they treated order of admission as a covariate along with the other independent variables of pre-nursing GPA and TEAS composite score. The overall model accounted for 35% of the variance in first semester GPA. Pre-nursing GPA was the best predictor, accounting for 15.4% of the variance. (Newton et al., 2007)
It is somewhat surprising that in this current study, science GPA was not a significant predictor of program completion, although it approached significance (p = .08). The value of science GPA as a predictor of program completion has been demonstrated in previous studies. Based on their 10 year review and metanalysis of 47 studies, Campbell and Dickson (1996) reported that grades in science courses were significant predictors of graduation and NCLEX success among BSN students (Campbell & Dickson, 1996).

Other researchers have shown the importance of science GPA in relation to program outcomes. Using a model of pre-enrollment variables (age, ethnicity, science GPA, and prenursing GPA), Byrd, Garza, & Nieswiadomy (1999) found that science GPA was a significant predictor of graduation from a BSN nursing program. The researchers did not report odds ratios; they indicated only that science GPA was a significant positive predictor of graduation (Byrd et al., 1999).

In a study by Wong and Wong (1999), a significant correlation was demonstrated between grades in university basic science courses (introductory anatomy, physiology, chemistry, and microbiology) and cumulative nursing GPA (r = 0.75, p < .0005). The researchers used multiple regression analysis to evaluate a model predicting cumulative nursing GPA. The independent variables in the model were science GPA and nursing GPA at the end of each of four years. Science GPA exerted the largest magnitude of influence on cumulative nursing GPA (β = 0.42, p = .0001). (Wong & Wong, 1999)

A significant correlation between science GPA and retention to graduation was also shown in a study by Symes, Tart, and Travis (2005). However, it is important to
note that they used only one course (microbiology) to represent science GPA in the study 
($r = 0.23$, p .002). (Symes et al., 2005)

In a dissertation research study by Hayes (2005), the results of discriminant analysis showed that the GPA for prerequisite courses had the greatest predictive value among six independent variables in a model predicting attrition in a sample of students from three BSN programs in Mississippi (Hayes, 2005). The prerequisite GPA was calculated primarily from grades in science courses: Anatomy and Physiology with Lab I, Chemistry with Lab I, Microbiology with Lab I; grades in Algebra I and English I were also part of the calculation. Additionally, grades in Chemistry I with Lab and Microbiology I with Lab were significant predictors of attrition. (Hayes, 2005)

The importance of a strong science background for nursing student success was demonstrated by Abbott and associates (2008). In their study of accelerated BSN students, they found that those with previous science degrees had higher classroom grades and were more likely to pass NCLEX on the first attempt than those with nonscience degrees. (Abbott et al., 2008)

The significance of science GPA as a predictor of early academic success was an expected finding. Prerequisite science courses such as anatomy, physiology, and microbiology provide the foundation on which nursing education and nursing practice are based. Students who do well in science courses are more likely to earn higher grades in the nursing courses, particularly in early courses such as pathophysiology and pharmacology that build directly on the foundational science courses that are required for nursing school admission. The analytical and problem solving skills acquired in science courses help nursing students develop critical thinking skills that are essential to safe,
effective nursing practice. Additionally, nursing practice is based on the foundation of scientific knowledge that provides rationale for clinical decision-making. The importance of scientific knowledge carries throughout the nursing curriculum, particularly in clinical courses where students must understand the pathophysiology of disease processes and the pharmacotherapeutics involved in treatment of the patients they are assigned as well as in their classroom work.

It is somewhat surprising that science GPA was not a significant predictor of program completion, although it approached significance (OR = 2.2, p = .08). In a larger, more longitudinal sample, it is likely that science GPA would be significant at the p < .05 level. Therefore, it is important not to discount the influence of science GPA in relation to graduation simply based on the findings of this study. The importance of a strong science background is relevant throughout the nursing curriculum, particularly as students progress through clinical courses. The development of clinical decision-making skills is largely dependent on a sound science foundation.

Science GPA showed a significant positive correlation with cumulative GPA ($r_s = 0.43$, $p<.001$). This finding suggests that students with higher science GPA’s also had higher cumulative GPA’s. This is logical because a substantial number ($N = 28$) of science credits are required for admission to the nursing program and grades in those courses are included in the calculation of cumulative GPA. This correlation may also be influenced by the timing of science courses. Students often complete required science courses near the time of application for admission when they are acutely aware of the need to maximize their grades in order to be considered for the nursing program. Students
sometimes take science prerequisites more than once in an effort to raise the cumulative grade point average and increase the likelihood of admission to the nursing program.

**Reading Comprehension**

Reading comprehension, measured by student performance on the reading subtest of the Nurse Entrance Test, was shown to be a significant predictor of early academic success and program completion. It is most interesting that the predictive value of this variable was greater in relation to program completion than for early academic success. The odds ratio for reading comprehension as a predictor of early academic success was 2.52, and the odds ratio for reading comprehension as a predictor of program completion was 6.03.

The mean reading score for the sample was 73.1 (SD = 11.23). Students with NET reading scores greater than or equal to 61.77 (one standard deviation below the mean) were 2.52 times more likely to achieve early academic success than students with NET reading scores below 61.77. This also means that students whose NET reading scores fell below 61.77 were 2.52 times more likely to be unsuccessful during their first two semesters than students with NET reading scores at or above 61.77. Twenty-five percent of the students who were unsuccessful during their first two semesters had NET reading scores less than 61.77.

Nursing students with NET reading scores greater than or equal to 61.77 were 6.03 times more likely to complete the nursing program on time than students with NET reading scores less than 61.77. This means that students whose NET reading scores fell below 61.77 were 6.03 times more likely to be unsuccessful during their first two semesters in the program than students who scored at or above 61.77. Over 37% of
students for whom graduation was delayed or denied had NET reading scores less than 61.77.

The sample mean of 73.1 for NET reading was higher than the average score of 56 for BSN students reported by ERI (2001). It was also higher than mean scores reported by previous researchers. (It is important to note that not all studies using NET data have reported mean scores for student samples.)

Two studies conducted in the mid 1990’s reported lower mean scores than the current study sample. Abdur-Rahman and associates (1994) reported a sample mean of 50.91 for NET reading; however, it is important to note that the subjects in their study were predominantly African-American. Femea, Gaines, Braithwaite, and Abdur-Rahman (1995) reported a mean of 56.23 on NET reading for primary English speaking students and a mean of 29.22 for ESL students. The majority of students in the Femea study were also primarily African-American. This is distinctly different from the ethnic representation in the current study sample where the vast majority of students were Caucasian. It is also important to note that the studies were actually conducted in the early 1990’s when nursing school admission was less competitive and fewer students were seeking admission. Therefore, comparison with the current study sample may be somewhat flawed.

In a sample of 1860 BSN students representing seven states, Simmons and Haupt (2003) reported the mean score for NET reading as 61. This is more than ten points lower than the current sample mean of 73.1.

In a sample drawn from BSN programs in seven states (N = 884), Simmons, Haupt and Davis (2004) did not report the overall sample mean for NET reading, but they
did report a mean reading score of 70 for students who completed a BSN program, 57 for students who experienced academic failure during the first half of their nursing program, and 55 for those who experienced academic failure the second half of the program (they did not report a mean score for those who successfully completed the first half of the program). In this study, the mean NET reading score for students who completed the nursing program on time was 74.5. Those who did not complete on time had a mean NET reading score of 65.14. Those who were successful during their first two semesters had a mean NET reading score of 74.88 and students who were not successful during their first two semesters had a mean NET reading score of 67.67. All means in the current study are higher than those reported by Simmons and associates (2004).

Horton (2006) reported NET reading scores for 97 students in her sample of 351 BSN students. The mean score for graduates was 64.16, and for nongraduates, it was 45.59. Compared with the mean scores reported by Horton (2006), the scores for this current study were higher for students who completed the program on-time as well as for those who had delayed or denied program completion.

The higher mean scores for reading comprehension in this study are reflective of the academic qualifications of the student population in the nursing program and the university in general. It is important to remember that the sample for this study is representative of one baccalaureate nursing program at a large public university, where admission to the program is highly competitive. The majority of previous studies have also been institution-specific, making comparability across student populations more problematic.
Symes, Tart, and Travis (2005) did not report the mean NET reading score for their sample, although they used the NET reading score of 55 as the benchmark to identify BSN students who were at academic risk. Students who scored below 55 were required to participate in a retention program. The researchers did not explain why they chose 55 as the benchmark; however, the national passing score for the reading comprehension subtest at that time was reported by ERI (2001) as 56. They indicated that 28% of their sample had reading scores less than 55% (Symes et al., 2005).

In this study, reading comprehension, as measured by reading scores on the Nurse Entrance Test, was a significant predictor of both early academic success and program completion. This is consistent with previous research findings.

NET reading score was significantly correlated with grades in four nursing courses during the first year of a BSN program; correlations ranged from \( r = 0.3 \) to \( r = 0.5 \) (\( p < .05 \)). The results of stepwise multiple regression analysis showed that NET reading score was not a significant predictor of grades in any of the first year nursing courses, although the NET composite score (math + reading) was a significant predictor of grades in three of the courses. (Abdur-Rahman et al., 1994).

Symes and associates (2005) found that NET reading scores were significantly correlated with retention to graduation in a sample of baccalaureate nursing students (\( r = 0.43, p = .000 \)). Among the four independent variables in their study (NET reading, NET math, admission GPA, and science GPA), the reading score showed the strongest correlation with retention to graduation (Symes et al., 2005).

Simmons and Haupt (2003) reported that NET reading score was the leading predictor of successful BSN program completion among a sample of 1860 students from
seven states. In a model with NET reading and math scores as independent variables, the results of ANOVA showed that reading score was the primary predictor. (Simmons & Haupt, 2003)

In a sample of 884 BSN students, Simmons, Haupt, and Davis (2004) found that NET reading score was a significant predictor of student status (program completion, withdrawal, academic failure). The researchers indicated that they used regression analysis, but did not report statistical results. (Simmons et al., 2004)

Horton (2006) found that graduates and nongraduates of a BSN program differed significantly on NET reading scores. She did not include the NET reading score in a predictor model because only 97 of the 351 subjects in the sample had taken the NET. (Horton, 2006)

The importance of reading comprehension in relation to nursing student success was also demonstrated using another standardized measure, the Nelson-Denny Reading Test. Conklin, More, and Muller (1996) found a significant correlation between the total reading score (vocabulary plus comprehension) and grade point average in nursing, although they did not report the correlation coefficient. (Conklin et al., 1996)

The reading level, measured by the Nelson Denny Reading Test, was identified as a significant predictor of NCLEX-RN success in a study by Henriques (2002). The independent variables in the study were all standardized test scores. (Henriques, 2002)

In the current study, reading comprehension was found to be a significant predictor of early academic success and program completion. Yet, the odds ratio for reading comprehension in relation to program completion was more than twice the odds ratio for early academic success. This was a somewhat surprising finding as there were
no other studies in the literature with similar results. The implication of the finding is that the ability to read and understand written material is essential to nursing student success throughout the program, and may be even more critical as students progress beyond the first two semesters. During the last four semesters of the program, students are enrolled in one to two clinical courses per semester. Each course has a didactic component of approximately three hours per week and a clinical practicum ranging between six and eight hours per week. There are extensive weekly reading assignments associated with the didactic portion of each course, and expectations for the clinical components dictate that students spend hours reading appropriate references in preparation to deliver safe, effective patient care in the clinical setting.

It has been reported that 85% of college learning requires careful reading (Simpson & Nist, 2000); this percentage may be underestimated for baccalaureate nursing education courses. For students to be successful in nursing courses, they must be able to read carefully and comprehend a large volume of material. The reading and study skills they found useful in previous college courses may no longer be effective; they must read for the purpose of learning and applying knowledge, not simply memorizing in order to pass a test. (White, 2004)

**Math Skill**

Math skill, measured by student performance on the math section of the Nurse Entrance Test, was found to be a significant predictor of early academic success and program completion. The predictive value of math skill was greater for early academic success than for program completion. The odds ratio for math skill as a predictor of early academic success was 3.03 and for program completion, it was 2.38.
The mean math score on the Nurse Entrance Test for the study sample was 81.92 (SD = 13.35). Students with NET math scores greater than or equal to 68.57 (one standard deviation below the mean) were 3.03 times more likely to achieve early academic success than students whose NET math scores fell below 68.57. This also means that students with NET math scores less than 68.57 were 3.03 times more likely to be unsuccessful during their first two semesters in the nursing program. Thirty-two percent of students who were unsuccessful during their first two semesters had NET math scores below 68.57.

Students with NET math scores at or above 68.57 were 2.38 times more likely to achieve on-time graduation than those with NET math scores less than 68.57. This also means that students who scored less than 68.57 on the NET math subtest were 2.38 times more likely to experience delayed graduation or attrition than students with NET math scores at or above 68.57. Of the students for whom graduation was delayed or denied, 37.5% had NET math scores less than 68.57.

The mean NET math score of 81.92 for the study sample was greater than the average score of 66 for BSN students reported by ERI (2001) and greater than mean scores reported by previous researchers. Simmons and Haupt (2003) reported a mean NET math score of 73 in their sample of 1860 students from BSN schools in seven states. In their study of predominantly African-American nursing students, Abdur-Rahman and associates (1994) reported a mean NET math score of 73.6. In a study by Femea and colleagues (1995), the mean NET math score for primarily English speaking students was 74.88 and the mean for ESL students was 65.77. (Femea et al., 1995). The higher scores
in this current study are reflective of the academic characteristics of the student
population in the nursing program from which the sample was drawn.

The mean NET math score for students in this study who were successful during
their first two semesters was 83.98 and for those who were not successful, the mean score
was 75.64. Simmons, Haupt, and Davis (2004) reported that students who experienced
academic failure during the first half of the nursing program had a mean NET math score
of 72; they did not report the mean score for students who were successful during the first
half of the program. Thus, the mean scores for unsuccessful students in both studies are
similar. Students who graduated on-time from the BSN program at UNC-CH had a mean
NET math score of 83.47 and those for whom graduation was delayed or denied, the
mean was 73.3. In the study by Simmons and associates (2004), those who completed the
program on time had a mean NET math score of 80 and those who did not complete on
time had a mean score of 72. In a study by Horton (2006), graduates of a BSN program
had a mean NET math score of 69.92 and nongraduates had a mean score of 58.32. The
scores for students in the current study sample in relation to program completion are
similar to the large sample in the study by Simmons and associates. The sample used by
Simmons and associates (2004) represented BSN programs in seven states, while the
current study was institution specific. However, the scores are higher than those reported
by Horton (2006); her sample of 97 was from a small private nursing program. The
results suggest that the population of nursing students at UNC-Chapel Hill is similar to
those in most other BSN programs with regard to NET math performance.

Previous research has demonstrated the importance of NET math score in relation
to student outcomes. NET math score was significantly correlated with grades in all five
nursing courses during the first year of study in a BSN program. The correlations ranged from $r = 0.34$ to $r = 0.47$ ($p < .05$). Results of stepwise multiple regression analysis showed that the NET math score was a significant predictor of the grade in the Basic Concepts Practicum, accounting for 26% of the variance. (Abdur-Rahman et al., 1994)

Symes and associates examined the correlation between NET math score and retention to graduation in a sample of BSN students. They reported a significant positive correlation between the two variables ($r = 0.21$, $p = .002$) (Symes et al., 2005).

Horton (2006) found a significant difference in NET math scores between graduates and nongraduates of a BSN program. The NET math score was not included in a predictor model in the study because only 97 of 351 subjects had taken the Nurse Entrance Test. (Horton, 2006)

The Nurse Entrance Test assesses math skill that is reflective of a student’s ability to perform basic operations in mathematics and algebra such as decimals, fractions, percentages, number system conversions, and algebraic equations (Frost, 2004). The early nursing courses such as pharmacology and the initial clinical course require students to incorporate and practice these mathematical operations. Throughout the clinical courses, students are expected to utilize math skills as they calculate medication dosages and intravenous infusion rates. The inability of students to correctly calculate a dosage or infusion rate may result in deleterious consequences for their patients. This is particularly true in a setting such as pediatrics where dosages are based on body weight. Although students and practicing nurses often rely on calculators, they must be able to perform mathematical operations independently of technological assistance in the event that they are required to do so.
Previous Degree

Approximately one-third of the students in the study sample had earned a previous academic degree. Of those, 110 (29.3%) had earned a baccalaureate degree and 11 students (2.97%) had earned a master’s degree. It is difficult to compare the percentage of previous degrees with other study samples, as it is rare that researchers have included this variable in demographics or in predictor models.

While previous degree was not shown in this study to be significant in predicting early academic success, it was found to be a significant predictor of program completion. The odds ratio of 0.36 suggests that students with previous degrees were 0.36 times less likely to graduate on time than students who were earning their first degree. Thus, students who were earning their first academic degree in the nursing program were more likely to complete the program on time than those with previous degrees. Fifty-two percent of those for whom graduation was delayed or denied had earned a previous degree.

Minimal research has been conducted regarding the relevance of previous academic degrees to academic success and retention of nursing students. Abbott and colleagues (2008) studied predictors of NCLEX success among a sample of accelerated BSN students. An entry requirement for the accelerated program was a previous baccalaureate or higher degree, so the researchers examined the value of having a previous science vs. non-science degree in relation to NCLEX success. They found that students with previous science degrees had higher classroom grades and were more likely to pass NCLEX on the first attempt than students with previous non-science degrees. (Abbott et al., 2008)
Perhaps, it is possible that the significance of previous degree as a predictor of program completion in the current study was more related to the age of the student than the fact that he/she had earned a previous academic degree. If a student had entered a baccalaureate program directly from high school, and if they graduated in four years, they would have been at least 22 years old. Thus, the majority of students with previous degrees would be considered nontraditional (> 24 years old), as defined by Bean and Metzner (1985).

The significance of previous degree in predicting program completion is consistent with previous evidence suggesting that attrition rates for nontraditional students are higher than those for traditional students (Jeffreys, 2004; Barbee & Gibson, 2001; Tucker-Allen & Long, 1999; Bessent, 1997). While older students tend to have greater academic success than younger, traditional students, they may take longer to complete a program of study due to family, financial, or other personal obligations (Bean & Metzner, 1985; Beeson and Kissling, 2001; Campbell & Dickson, 1996; Daley et al., 2003; Jeffreys, 2001, 2004; Kevern, Ricketts, & Web, 1999; Manifold and Rambur, 2001; Wong & Wong, 1999).

Non-significant Independent Variables

*Cumulative Grade Point Average*

Cumulative grade point average represented student achievement in all previous postsecondary courses. This variable was not found to be a significant predictor of early academic success or program completion.

The mean cumulative GPA for the sample was 3.21 (SD = 0.37). This is significantly higher than the minimum GPA of 2.0 that was required for admission during
the years of data collection and demonstrates the excellent academic credentials of the applicant pool during that time.

Cumulative grade point average is a common independent variable in models to predict nursing student outcomes. Although cumulative GPA was not a significant predictor variable in this study, some researchers have demonstrated its value in predicting nursing student success and retention. From their meta-analysis of 47 studies related to BSN student success, Campbell and Dickson (1996) reported that cumulative GPA was included in twenty-two studies with significant results in nine of the studies. The authors concluded, however, that cumulative GPA was among the least predictive of variables studied in relation to nursing student success (Campbell & Dickson, 1996).

In a model containing the pre-admission variables of age, Caucasian ethnicity, science GPA, and pre-nursing (cumulative) GPA, Byrd, Garza, & Nieswiadomy (1999) found that pre-nursing grade point average (cumulative GPA) was one of two significant predictors of graduation among BSN students. In another model with the independent variables of age, pre-nursing GPA, and pharmacology grade (completed during the first semester), pre-nursing GPA was significant in predicting graduation (Byrd et al., 1999).

Other researchers have found that cumulative grade point average was a significant predictor of program completion. A significant correlation between admission GPA and retention to graduation was shown by Symes, Tart and Travis (2005). Horton (2006) reported that admission GPA was a weak, but significant predictor of graduation in a sample of BSN students. Entry GPA was shown to be a significant predictor of success and retention among a sample of ADN and BSN students in a study by Carroll.
Morgan (2001) found that admission GPA was a significant predictor of retention among both ADN and BSN students representing 13 nursing programs.

It is interesting that cumulative GPA was not significant as a predictor of early academic success or program completion considering that it is the most common admission criteria used by BSN programs. In a sample of 160 baccalaureate programs in the United States, Crow and associates (2004) found that 87% used cumulative grade point average in screening applicants. (Crow et al., 2004)

The insignificance of cumulative GPA as a predictor of early academic success and program completion in this study may be related to a variety of factors. In part, this may be due to the time lapse that often occurs between completion of basic college courses and entry into nursing education programs (Jeffreys, 2004). Further evidence to support this conclusion was the study finding of a weak, but significant negative correlation between age and cumulative grade point average ($r_s = -0.17$, $p < .001$) in the study sample. This suggests that older students have lower cumulative grade point averages.

For the older, nontraditional students (over the age of 24), previous courses may have been completed when they were much younger, with less motivation to succeed, and lacking specific career goals. Even for younger students who enter nursing school after having completed two years of general college, performance in courses during the freshman and sophomore years may not be true indicators of ability to succeed in a nursing program. Academic and social integration associated with adjustment to college life and course expectations may have impeded student success in early courses (Tinto, 1997).
Science Credits

The number of science credits earned prior to nursing school admission was not found to be a significant predictor of either early academic success or program completion. The range of science credits in the sample was from 4 to 96, with a mean of 30.22 (SD = 9.22). If a student had completed the minimum admission requirement for science courses, he or she would have earned 28 science credits, which is close to the sample mean of 30.22. The lower number of science credits for some students indicated that they had not yet completed all of the prerequisite science courses at the time they applied for admission. Students who were in process of completing prerequisite courses at the time of submitting the application were considered for admission. Students with higher numbers of science credits may have earned previous degrees in chemistry, biology, or other related fields. Some students may have repeated science courses if they had initially completed the courses more than ten years previous; others may have repeated courses in an effort to earn higher grades. In either case, credits for all previous courses would have been included in the calculation of science credits.

It is somewhat surprising that the number of science credits was not a significant predictor in either model, especially since science GPA was a significant predictor of early academic success and it approached significance in the model predicting program completion. Perhaps, if all students in the sample had already completed all the science prerequisites, there may have been a greater likelihood that the number of science credits would be a significant predictor.

There is scant evidence in the literature about the influence of science credits on nursing student success and retention. One such study was conducted by Lewis and
Lewis (2000) with a sample of 168 students transferring into a BSN program. They found a significant difference between successful and unsuccessful students in terms of the number of transferring credit hours and the number of anatomy and physiology courses taken prior to admission to the nursing program. (Success was measured as a cumulative GPA > 2.5 at the end of the junior year in the nursing program.) Results of logistic regression analysis showed that successful students were more than twice as likely to have transferred from a four-year institution (OR = 2.1) and five times as likely to have taken two or more anatomy/physiology courses than students who were unsuccessful (OR = 5.51). (Lewis & Lewis, 2000)

In the current study, the institutional location where science prerequisites were completed was not part of the data analysis. It would be insightful to repeat the study and include a variable identifying the number of science credits from a four year institution and the number from a community college to see if the findings reported by Lewis and Lewis (2000) would hold true.

**Stress**

The single noncognitive variable in the two predictor models was stress at the time of program entry. This was measured by the total stress level profile score on the Nurse Entrance Test. The total score represented five categories of stressors: family, academic, social, money/time, and workplace. The possible maximum score for each category was 100, and the total possible score for stress was 500.

The stress profile subtest of the NET has rarely been examined in relation to nursing student outcomes. Most often, researchers have studied student scores in the five individual categories of stress (Abdur-Rahman et al., 1994; Femea et al., 1995; Sayles et
al., 2003; Simmons & Haupt, 2003; Simmons et al., 2004). The current study took a
unique approach in combining all five categories to form a total stress level profile score.
However, the single noncognitive independent variable of stress was not found to be a
significant predictor of early academic success or program completion.

The mean total stress profile score for the sample was 168.19 (SD = 50.06). The
highest possible score for this variable was 500. Perceived levels of stress varied widely
among the sample, from a low score of 40, which would suggest minimal stress to a
maximum of 350, suggesting a moderate level of stress. It is difficult to compare the
sample mean to an average for BSN programs as ERI (2001) did not report a mean total
stress score. They only publish mean scores for the individual categories of stressors.

Students in this study demonstrated the highest stress levels related to the
category of money/time. Because stressors related to money and time are reported on the
NET as one value, it is not possible to identify if one of the categories evoked a greater
level of stress than the other. The lowest stress score was in the category of workplace
stressors (mean = 18.68, SD = 12.59), which might suggest that few students were
planning to work while in the nursing program.

Scores for the category of stressors related to money/time ranged from 0 to 100
and the sample mean was 60.08 (SD = 19.95). The average score for this category among
BSN students was reported by ERI (2001) as 45. Thus, students in the sample perceived
greater stress related to financial and time management concerns than the average BSN
student. Abdur-Rahman and associates (1994) also found that the highest level of stress
among their sample of predominantly African-American BSN students was in the
category of money/time (mean = 63.18). Stress related to money/time was also the
highest category of stress (mean = 61.39) among another sample of primarily African-American students (Femea et al., 1995). Thus, the mean score for stress related to money/time among the current sample is similar to the levels reported by the previous researchers.

Financial concerns have been commonly identified as a major source of stress for nursing students. However, the majority of studies have sampled students during their educational programs, not at the time of entry (Aber & Arathuzik, 1996; Amaro et al., 2006; Cuthbertson et al., 2004; Hegge & Larson, 2008; Jeffreys, 2007; Jeffreys, 2004; Kirkland, 1998; Lo, 2002; Steele et al., 2005; Taxis, 2006; Timmins & Kalisner, 2002).

Because the category of stress in the study represented both money and time, it is necessary to consider concerns related to time management. Stress related to time may have stemmed from “fear of the unknown”, being unsure of the time commitment required for such things as class preparation, class attendance, and clinical practicum experiences. Concerns about balancing academics with other responsibilities may have contributed to stress levels related to time management.

A clearer differentiation between stress related to money and stress related to time would facilitate interpretation of results. In order to identify student concerns more effectively and to provide appropriate assistance, it would be more efficacious to assess each category of stress separately. Another measure of student stress may be more informative.

Specific categories of stressors measured by the Nurse Entrance Test have been recognized by previous researchers as significantly related to student outcomes. Social stressors were identified as a significant predictor of BSN student status (graduation,
withdrawal, failure) in a study by Simmons, Haupt, and Davis (2004). In a study of BSN students, family and social stressors were lower among students who were successful during their first semester (Abdur-Rahman et al., 1994). Stressors related to academics, money/time commitments, and family life were significantly correlated with NCLEX success in a sample of ADN students (Sayles et al., 2003).

The finding in this study that stress, measured as the total stress level profile score on the NET, was not a significant predictor of early academic success or program completion may be related to the timing of the Nurse Entrance Test. The NET was given at the beginning of the program, even before students began classes in their first semester. While scores may have reflected the level of current and projected stress in the student’s life at the time of program entry, they did not reflect stress that may have developed or accelerated as students progressed through the nursing curriculum. The majority of studies that have explored stress in relation to nursing student success and retention have sampled students during the nursing program, not at the point of entry as was done in the current investigation. Previous studies have demonstrated that nursing students often experience significant stress related to classroom and clinical performance and faculty expectations (Beck, Hackett, Srivastava, McKim, & Rockwell, 1997; Deary, et al., 2003; Elliott, 2002; Hamill, 1995; Hegge & Larson, 2008; Lindop, 1999; Mahat, 1998; Nicholl & Timmins, 2005; Rhead, 1995; Timmins & Kaliszer, 2002). A critical examination of stress levels at various points during the nursing program may provide more accurate information regarding the predictive value of stress on academic achievement and retention. In addition, a more sensitive measure of stress would likely be a more effective measure of student stress. The stress profile is one section of the Nurse Entrance Test,
consisting of fifty questions related to the five categories of stress, therefore the sensitivity of the measure to reflect accurately the student’s current stress level is questionable.

It is plausible that stress was not a significant predictor of student outcomes in this study for another reason. Stress does not always have a negative impact on performance. Moderate levels of stress can actually enhance performance and encourage motivation. According to Lazarus & Folkman (1984), stress is the result of how a stressor is appraised and how an individual appraises his/her resources to cope with the stressor. Prior to performing a task, there is an appraisal of the task’s difficulty as well as the individual’s ability cope with the demands of the task. Such appraisals can be categorized as either threatening or challenging. If a task is appraised as threatening, the individual perceives that his/her resources and coping abilities are exceeded by the demands of the task. On the contrary, if the task is appraised as challenging, this indicates that the person’s resources and coping abilities are sufficient to meet the task demands. Challenging appraisals provide greater motivation and energy mobilization, thus enhancing the likelihood of success (Lazarus & Folkman, 1984). Perhaps, the stress associated with entry into nursing school was perceived by the majority of students as challenging instead of threatening, and they were motivated to succeed.

The insignificance of stress as a predictor variable in this study implies that other noncognitive factors may be more important. Jeffreys has suggested that nonacademic variables such as environmental and personal factors may be more important predictors of success than cognitive factors (Jeffreys, 1998, 2001, 2004, 2007). Few researchers have included noncognitive variables in correlational or predictive studies of BSN
Aber and Arathuzik (1996) found that self-efficacy was significantly correlated with over all nursing GPA. Jeffreys (1998) also found a significant relationship between self-efficacy and academic success of nursing students. The importance of noncognitive variables in relation to nursing student success and retention has not been well documented in the literature and warrants further study.

**Age**

Age was not a significant predictor of early academic success or program completion in this study. However, it may have been significant if the sample were larger and more longitudinal. The lack of significance is likely related to the demographics of the sample. The mean age of students in the sample was 23.56 years (SD = 5.9), which suggests that the students were relatively young compared with the mean age of 25.6 years for all students in prelicensure BSN programs in North Carolina (N.C. Center for Nursing, 2006).

A possible contributing factor to the younger mean age of the student sample may be that during the years that students in the sample were admitted to the nursing program, the School of Nursing had opened a new accelerated option for students with previous degrees. This may have influenced the age distribution among the study sample as more students with previous degrees, who would naturally have been older than the traditional college students, had entered the accelerated program. Still, approximately one-third of the students in the sample had earned a previous degree.

The younger mean age of the sample is likely related to number of students who enter the nursing program each year as juniors from within the university. UNC Chapel Hill School of Nursing faculty are committed to admitting a considerable number of
students each year who entered the university as freshmen with career goals of professional nursing.

Although age was not found to be a significant predictor of either early academic success or program completion in the logistic regression models, there were significant correlations between age and the two dependent variables. Age showed a weak, but significant correlation with early academic success \( (r = -0.17, p<.01) \) and program completion \( (r = -0.21, p<.001) \). There was a strong positive correlation between age and previous degree \( (r = 0.78, p<.001) \), indicating that as age increased, so did the likelihood of having a previous degree.

In the majority of studies on nursing student success and retention, age was not included in predictor models and was often not included in demographic descriptions of study samples. Studies that have examined age as a predictor of academic success or graduation have reported inconsistent findings. Byrd, Garza, and Niewiadomy (1999) reported that younger age was predictive of academic success in nursing education at the end of first semester, second semester, and graduation. The mean age of students was not reported, however the researchers noted that more than 48% of students were older than 28 (Byrd et al., 1999). In contrast, Manifold and Rambur (2001) reported a significant correlation between increasing age and graduation in a sample of American-Indian students; the mean age of students in the study was 32 (Manifold & Rambur, 2001).

In their study of predictors of academic performance and Canadian licensure exam success, Wong and Wong (1999) found that older students had higher cumulative grade point averages and that older age was a significant predictor of success on the licensure examination, although it was not predictive of program completion. The mean
age of the sample was only 20 years (Wong & Wong, 1999). Schafer (2002) reported that older students had higher grade point averages in prerequisite courses, although they had lower upper division (nursing) GPA’s; the mean age for the sample was 27.56 years (Schafer, 2002).

Age has been identified by some researchers as a significant predictor of NCLEX success. Older students were more likely to pass the licensure examination on the first attempt compared with their younger peers (Beeman & Waterhouse, 2001; Beeson & Kissling, 2001; Daley et al., 2003; Harris, 2006; Schafer, 2002).

Ethnicity

Ethnicity was not a significant predictor of early academic success or program completion in this study. This is not surprising because the percentage of minority students in the sample was relatively small (15.95%).

According to AACN (2007), minorities accounted for 25.2% of students enrolled in BSN programs during the fall of 2006. However, only 21.6% of graduates from BSN programs were minority students (AACN, 2007). Although ethnicity was not a statistically significant predictor in this study, it is interesting to note that 60% of the minority students in the sample were not successful during their first two semesters and 40% experienced delayed graduation or attrition.

There is evidence in the literature that minority students in BSN programs may be at greater risk of academic difficulty and attrition. Byrd, Garza, and Niewiadomy (1999) reported that ethnicity was predictive of graduation from a nursing education program. They found that white students were more likely to graduate than ethnic minorities (Byrd et al., 1999). Results from a study by Endres (1997) showed that African-American
students took significantly longer to complete the nursing curriculum. Seago and Spetz (2005) found that nursing programs with high percentages of African-American and non-Filipino Asian students had lower on-time completion rates, higher attrition rates, and lower first time NCLEX-RN pass rates. (Seago & Spetz, 2005)

Ethnicity has been shown to be a significant predictor of NCLEX success; minority students may be more likely to fail NCLEX-RN on the first attempt than Caucasian students (Crow et al., 2004; Harris, 2006; Sayles et al., 2003; Washington & Perkel, 2001). In contrast, Endres (1997) found no significant differences between the NCLEX passing rates of African-American, foreign-born, and white graduates.

Although ethnicity was not shown to be a significant predictor of early academic success or program completion in this study, it is important that faculty are aware of the potential challenges facing minority students and that they consider the learning needs of minority students. The literature abounds with articles related to minority students in nursing education and the barriers to their academic success and retention (Aiken et al., 2001; Amaro et al., 2006; Barbee & Gipson, 2001; Bessent, 1997; Childs et al., 2004; Gardner, 2005; Mills-Wisneski, 2003; Rodebaugh, 1999; Taxis, 2006; Tucker-Allen & Long, 1999).

Implications for Practice

The results of this study have important implications for evidence-based practice in nursing education. Evidence-based practice in health care professions is critical to providing the safest and most effective patient care. Similarly, educational practices must necessarily be based on research evidence in order to optimize the learning experiences and outcomes for nursing students.
While the study was institution-specific, and the greatest relevance is for the UNC Chapel Hill School of Nursing, there are also implications for other baccalaureate nursing education programs. Findings of the study are particularly relevant for faculty involved in admission decisions and for those who are responsible for identifying and assisting at-risk students.

The models predicting early academic success and program completion represent a unique combination of cognitive, noncognitive, and demographic independent variables that had not previously been examined by other researchers. In addition, the cognitive independent variables most likely to be used as admission criteria were operationalized in a novel manner. Benchmarks were established for science GPA, cumulative GPA, reading comprehension, and math skill based on mean scores minus one standard deviation. This created a differentiation between high and low scores for the variables. Data analysis revealed the odds of success and program completion for students scoring above the benchmarks compared with those scoring below the selected levels. The study findings provide pertinent pragmatic data to inform admission policies and program efforts to identify and assist at-risk students.

The study examined predictors of outcomes at two distinct points in the nursing curriculum: early academic success measured student performance at the end of the first two semesters, and program completion was measured at the end of six semesters when the entry cohort would have graduated. Science GPA, reading comprehension, and math skill were found to be significant predictors of early academic success and two of the same variables (reading comprehension and math skill) were also significant predictors of program completion. The other independent variable that was shown to be a significant
predictor of program completion was previous degree. It is notable that the predictive value of reading comprehension for program completion was more than double the predictive value for early academic success.

The finding that reading comprehension, measured by NET reading score, was predictive of both academic success and program completion has important implications for nursing education programs. The ability to read and comprehend is critical to learning the foundational theoretical concepts and clinical decision-making processes essential to nursing. Students who have difficulties with reading comprehension are likely to experience academic problems as they attempt to progress through the nursing curriculum. Nursing texts and other educational references may be challenging for students with inadequate reading skills. This may be especially true for ESL students, students with learning disabilities, and those with ADD or ADHD. Extensive reading assignments are common in nursing courses and students with reading deficits may not be able to complete the assignments, and even if they do, they may not be able to adequately comprehend and apply the information to nursing practice. It is important that faculty identify students who have problems with reading comprehension. The NET reading score is one means of identifying these students. Using the benchmark of 61.77, which is one standard deviation below the mean, faculty at UNC-CH can determine at program entry those students who are likely to need assistance with reading skills as they proceed through the nursing program. Other schools need to establish their own benchmarks based on their student populations. Because the NET provides a single assessment of reading ability, a second measure to confirm reading ability may be
warranted prior to recommending intervention programs. The Nelson-Denny Reading test is one possible instrument that can be used (Conklin et al., 1996).

The role of faculty in providing assistance to students with weakness in reading comprehension is critical. However, while nursing educators may be experts in education and clinical content, the majority are not academically prepared to teach reading skills to their students (White, 2004). They may be unfamiliar with strategies to help students with reading comprehension problems. Continuing education programs or other courses that focus on strategic reading skills can enhance the ability of faculty to provide students with needed assistance. Teaching students to read strategically can enhance their academic performance. Models that have been suggested to assist students in meeting the demands of college reading include stand alone courses, linked courses, and learning center support (Caverly, Nicholson, & Radcliffe, 2004). There is evidence that ongoing or sustained interventions may be more effective than a single course. Pairing a strategic reading course with a reading-intensive course can provide students with guided practice as they implement suggested reading strategies. (Simpson, 2002; White 2004)

The importance of math skill, measured by the NET math subtest, was elucidated by the study findings. The primary use of math in nursing education involves medication and intravenous fluid calculations. Safe administration of medications and IV therapy requires that dosages are accurate. The math section of the NET requires students to recall principles of high school mathematics and algebra as they solve problems involving decimals, fractions, conversions, and algebraic equations. For some students, the time that has lapsed since high school may affect their performance on the math subtest and they may need simply to review and practice similar mathematical operations.
This may be accomplished through a variety of instructional strategies such as a self-study medication calculation module or text. Maag (2004) reported the effectiveness of an on-line interactive multimedia learning tool to enhance math skill. Allen & Pappas (1999) suggested that students who need more help than can be provided by their individual clinical faculty may benefit from a one-hour medication administration course. Group or individual review sessions may be useful for students who are weak in math or need to review. In some cases, students may need to be referred to the institutional learning center for assistance. (Maag, 2004; Allen & Pappas, 1999)

It was not surprising that science GPA was a significant predictor in this study as previous studies have consistently shown the value of science courses in predicting student success in nursing education. It was an unexpected finding to discover that science GPA was not a significant predictor of program completion, although it approached significance.

Academic achievement in the prerequisite science courses significantly influences student performance in the foundational nursing courses during the first two semesters. Students who are considering application to nursing programs would benefit from counseling regarding the need for academic achievement in prerequisite science courses. They also need to understand the value of content mastery in science courses and the importance of this knowledge as foundational to nursing practice.

Students with previous degrees were shown to be at risk of delayed program completion and attrition. Faculty need to be aware that students with previous degrees are typically nontraditional students who may be strong academically, yet life circumstances and responsibilities may interfere with their success in the nursing program. They may
benefit from more flexible scheduling options such as part-time study or evening classes to allow for balance between academics and environmental demands such as family and work responsibilities. Unfortunately, most nursing programs do not offer alternative schedules. There are few options for students who are faced with academic or personal/family concerns that impede their ability to be successful. They may be able to take a reduced course load, which means progressing at a slower pace through the program; this results in delayed graduation. Students may voluntarily withdraw from the nursing program, either temporarily or permanently, or they may be dismissed for not meeting academic requirements. To promote the academic success and retention of students with previous degrees, it is important that faculty increase their awareness and sensitivity to the issues facing nontraditional students. Faculty may provide assistance such as individual counseling and referral to appropriate support services. Nontraditional students may benefit from faculty efforts to foster social integration where students can find support from students with similar lifestyles and concerns. (Jeffreys, 2004; Bean & Metzner, 1985, 1987)

The conceptual model for this study was the NURS model, developed by Jeffreys (2004) to demonstrate the multifaceted phenomena of nursing student success and retention. According to this model, a variety of academic, behavioral, situational, environmental, social, and professional factors contribute to a student’s ability to adapt and succeed in a nursing education program. The variables found in this research study to be the best predictors of early academic success and program completion were cognitive student profile characteristics which are integral to Jeffreys’ model. The single noncognitive variable of stress was not shown to be significant; neither were the
demographic variables of age and ethnicity. Jeffreys has suggested that noncognitive or nonacademic variables may be more important than academic ones in relation to success and retention of nursing students (Jeffreys, 1998, 2001, 2002, 2004, 2007). Therefore, in applying the findings of the study to nursing education, it is essential that faculty do not ignore the influence of other important factors on the outcomes of early academic success and program completion. The finding that there were few significant predictors of both early academic success and program completions suggests that there are other factors influencing the two outcomes. It is important to remember that cognitive or academic variables are objective and measurable criteria by which students can be easily compared; most of these factors are known to faculty when students submit applications for admission. Noncognitive factors such as personal and environmental factors are not included in admission applications, nor is this information routinely gathered in any systematic manner at most Schools of Nursing. The stress measure of the Nurse Entrance Test is one method of assessing noncognitive factors that might influence student outcomes in the nursing program. It provides only a glimpse of stressors that may affect student success. A more sensitive measure of stress might provide greater insight into the influence of student stress on academic outcomes and retention. Research indicates that stress is commonly experienced by nursing students as they progress through the program (Beck et al., 1997; Cuthbertson et al., 2004; Hegge & Larson, 2008; Kirkland, 1998; Lindop, 1999; Mahat, 1998; Richardson, 1996; Steele et al., 2005; Timmins & Kaliszer, 2002). While standardized measures of student stress such as the NET may provide faculty with an idea of what the student’s life is like at the onset of the program, ongoing awareness and assessment of student stress is paramount to providing adequate support.
and promoting success. Periodic assessments of student stress levels may be beneficial in identifying and assisting students with stressors. It is important to remind faculty that stress does not always have a negative impact on performance. Stressors that are perceived as challenging instead of threatening may enhance motivation, energy, and performance (Lazarus & Folkman, 1984).

Although the noncognitive variable of stress, measured by the total stress profile score on the NET, was not a significant predictor of either dependent variable, the results showed that the highest level of stress was related to money and time. The stress level profile of the NET can provide insight into factors that motivate and affect student behavior and academic performance. A student with a high stress profile overall or a high score in any of the five areas may benefit from early discussions with the faculty to assess the concerns and develop appropriate strategies to help reduce the stressors and promote academic achievement. Students may be referred for counseling and other assistance that is outside the scope of nursing education practice. Furthermore, if a group of entering students is recognized to have a high level of stress in any particular area, faculty might create related problem-solving situations and guide class discussion around strategies to reduce the stress. Because the greatest stressor for the sample was money/time, it is essential that information related to financial assistance is made available prior to admission and throughout the program. Counseling and assistance with time management might also be beneficial to students with higher than average levels of stress related to money/time.

Admission policies should be evaluated and refined in light of the study findings. Criteria for admission may be changed or adapted to include the variables that were
found to be significant predictors of early academic success (science GPA, reading comprehension, and math skill) and program completion (reading comprehension, math skill, and previous degree). Using the benchmarks established by the study, admission committees may choose to screen applicants, eliminating those with scores below the benchmarks or they may choose to use the benchmarks to identify students for participation in academic counseling and success programs after admission.

At UNC-Chapel Hill School of Nursing, the admission criteria have included science GPA and cumulative GPA, although scores on the Nurse Entrance Test have not been used for admissions purposes. Instead, NET scores were used to identify at-risk students; students were considered at risk if they scored below the national mean for reading and/or math. While the study findings support this use of the NET results, it would be prudent for the Admissions Committee to consider using the NET as a screening tool for admission.

The significance of science grade point average in predicting early academic success supports the value of this entry criterion in admission decisions. The information from this study may influence admission committees to more closely examine the science GPA requirement for admission. While the earned grade in each prerequisite science course is used to calculate the science GPA, it is important to note any withdrawals, repeated attempts, as well as the academic setting where courses were completed. Further research needs to be conducted to examine the influence of institutional setting on science grades and subsequent performance in nursing education courses (Lewis & Lewis, 2000).
Cumulative GPA was not found to be a significant predictor of early academic success or program completion, although it is used as an admission criterion by UNC-CH School of Nursing and by a large majority of other nursing programs (Crow et al. 2004). Further study is needed to confirm or deny the value of cumulative grade point average in admission decisions.

Because the study findings indicated that students with previous degrees may be at greater risk of delayed completion or attrition, it may be advantageous for the admissions committee to take this factor into consideration when reviewing applicants for the six semester BSN program. Further study needs to be done to determine if the type of degree is significantly related to academic success or retention (Abbott et al., 2008).

Findings from this study provide faculty with evidence to assist in identification of students who may be at risk of academic difficulty and delayed or denied graduation. The significant predictor variables in the study are known to faculty when students enter the program, therefore, early identification of at-risk students is possible, and faculty may then be able to provide appropriate assistance to promote positive student outcomes.

Because nursing curricula and student profile characteristics are unique to each institution, it is important that faculty have evidence-based criteria by which to identify at-risk students. The benchmarks used in the study provide guidelines for establishing criteria to identify at-risk students at UNC Chapel Hill. Each nursing program needs to establish benchmarks based on the student population at that institution.

Identification of at-risk students is not simply a single task accomplished through entrance testing or examination of admission applications. There must be ongoing assessment of student needs by faculty. A formalized program of advisement may
provide such a mechanism, whereby each student is connected with a single faculty
member throughout the curriculum. Specific programs may be developed to address
student needs, issues, and concerns. Administrators, faculty, and students need to
recognize the importance of academic performance during the early stages of the nursing
curriculum and its impact on program completion.

On-time program completion is the desired outcome because delayed graduation
means that students are delayed in entering nursing practice, and their continued
enrollment may inhibit others from entering, based on enrollment capacities. In this time
of intense competition for admission to nursing education programs, it is important that
the maximum number of students graduate each year. In reality, however, all students
who are admitted are not likely to graduate. The influence of academic, environmental,
interpersonal, and personal variables may impact the likelihood of academic success and
program completion. In addition, some students may enter nursing education programs
without a clear picture of what it means to be a nurse, and they may change career goals
once they are able to conceptualize nursing practice (Harvey & McMurray, 1997)

The study findings support the use of standardized nursing aptitude examinations
such as the Nurse Entrance Test. Three independent variables in the study were measures
from the Nurse Entrance Test (reading comprehension, math skill, and stress); two of the
measures (reading comprehension and math skill) were found to be significant in
predicting both early academic success and program completion. The use of standardized
nursing aptitude tests such as the NET is a relatively recent measure adopted by schools
of nursing to assess student readiness for nursing education programs. This study offers
evidence to validate the use of a nursing aptitude examination such as the Nurse Entrance
Test as an admission screening tool and as a means to identify at-risk students early in the nursing program. While some schools of nursing may use it for one purpose or the other, it may well be used for both purposes in the same institution. For example, results of the NET may be used to identify students who are eligible for admission; those with scores below established levels can be eliminated from the applicant pool. This step can aid in reducing the burdensome work of admission committees who laboriously review large numbers of applications. Once students are admitted to the nursing programs, faculty can use the NET data to identify students who may be at risk of academic difficulty and delayed program completion or attrition. In addition to recognizing scholastic issues related to low NET reading and math scores, nursing faculty can utilize nonacademic components of the NET such as the categories of the stress level profile to identify students who may be experiencing personal issues that can impact their ability to succeed in nursing education programs.

The key to student success and retention in nursing education programs is early individualized assessment and intervention for students who may be at risk of academic difficulty or attrition. There is a need for multifaceted formalized plans to address needs of at-risk students. Such plans need to involve administrative support, faculty, and students. One aspect may include academic advising where all students are assigned an academic advisor to follow them throughout the nursing program. If is not possible to assign an advisor to every entering student, it is essential that at risk students are assigned to faculty advisors who are then able to assist students to identify academic strengths and weaknesses and to develop strategies to maximize academic potential and promote success. (Sayles et al., 2003).
In the literature, a variety of intervention programs for at-risk students have been described and their effectiveness demonstrated. Students who participate in such programs have been shown to experience greater academic success and improved retention rates (Dearnley & Matthew, 2007; Higgins, 2004; Lockie & Burke, 1999; Peter, 2005; Symes et al., 2005).

Limitations of the Study

Both a limitation and a possible strength of this study is that it was institution specific. The results of this study are most pertinent to the students, faculty, and administrators of the University of North Carolina at Chapel Hill School of Nursing. The generalizability of findings may be limited to similar institutions with comparable curricula and student profiles. It is important for individual institutions to conduct their own studies of student success and retention and for national studies to be conducted examining trends and patterns among baccalaureate programs.

The study does not address the complexity and multidimensionality of student success and retention. Only a portion of a recently developed NURS retention model (Jeffreys, 2004) was utilized in the conceptual framework. There is need for further testing of the relatively new model to determine its validity.

Another limitation relates to the cross-sectional sampling of the student population. Although the study sampled students admitted over a three year period, more longitudinal data would provide greater understanding and insight into factors associated with student success and retention at this institution.
The study was retrospective, examining student data from past years. A prospective study might provide more relevant and up-to-date information to influence the practice of nursing education.

There was limited assessment in this study of noncognitive influences on academic success and retention. Personal and environmental factors that result in stress were not explored in depth in this study.

Recommendations for Future Research

The academic success and retention of nursing students are rich topics for further investigation at the institution that was the setting for this study as well as in other baccalaureate nursing programs. The results of this study provide valuable information for the development of future studies.

There is a need for periodic re-examination of variables that predict student success and retention at UNC Chapel Hill School of Nursing and at other schools of nursing. As student population profiles change, additional research needs to be conducted to reflect the most current predictors of student outcomes. The same models used in this study could be examined among the sample of students who entered the program since 2001-2003. The results of the studies might be compared to determine if the same independent variables were significant predictors in both studies.

There is evidence that the profile of students admitted to UNC-CH School of Nursing is changing. Since 2007, there have been greater percentages of minorities, males, and students with previous degrees who were admitted to the BSN program; cumulative and grade point averages have risen (Moore, 2008). Further study is
warranted to determine the most significant predictors of academic success and retention among this changing population of students.

Another reason to repeat the study is related to curriculum revision. At UNC-CH, curricular changes were implemented since the study data were collected. Because this altered the sequencing of courses during the first two semesters, it would be important to repeat the study to determine if the findings are similar.

The two predictor models in this study might be examined using another sample of BSN students at the institution that was the setting for the study. At UNC-CH, there are two options for earning a prelicensure baccalaureate degree: the six semester option and an accelerated four semester option. Research might be conducted to compare predictors of success and retention using samples from both program options. This same strategy may be utilized by other institutions with more than one prelicensure program option.

The results of this study showed that students with previous degrees were at greater risk of delayed program completion and attrition. In a future study, it may be insightful to determine if the type of previous degree is a significant predictor of academic success or program completion. This study might be replicated, with an additional independent variable reflecting type of previous degree.

As a follow-up to this study, it may be beneficial to conduct another investigation that includes a larger, more longitudinal sample of students at UNC-Chapel Hill School of Nursing. Those variables that were found to be insignificant in this study may prove to have significant predictive value with a larger sample.
Further study is needed related to the influence of ethnicity on student outcomes. Although the percentage of minority students has increased, it would take more years of data collection to accurately access the predictive value of ethnicity in relation to academic success and program completion. Because the literature provides evidence that minority students may be less successful than Caucasians, it would be useful to conduct a study with minority students as the study sample. This may provide insights into specific needs of those students, enabling faculty to more effectively plan programs and interventions to meet their needs.

The results of this study may prompt other BSN programs to conduct similar investigations to determine if predictors identified in this study hold true for their populations of students. This may be especially important for similar prelicensure programs in the University of North Carolina system. A multi-site study to examine predictors of student success and retention might be conducted across other prelicensure BSN programs in the state and even in the nation. This would make the findings more generalizable.

There is a need for further testing of the Nursing Undergraduate Retention and Success Model developed by Marianne Jeffreys (2004). The multifaceted nature of this recently published model provides a theoretical framework from which researchers can develop studies to examine success and retention. This study included only a few of the variables identified by Jeffreys. A future study might incorporate more nonacademic predictor variables such as environmental, personal, and professional factors in models to predict outcomes.
This study addresses a gap in the literature in regard to predictors of early academic success. Further research is needed to examine predictors of this outcome variable as measured in the current study. There has been a lack of consistency in definitions of academic success used by researchers. Studies that use the same measures of the dependent variable need to be conducted to see if the predictive value of independent variables holds true. In another study, it might be helpful to alter the definition of early academic success, examining student performance at the end of the first semester of study instead of at the end of the second semester. Results could be compared with those of the current study to determine if there are any differences in predictor variables.

Further study is needed to confirm or deny the value of cumulative GPA in predicting student outcomes. Although many schools continue to use this measure of cognitive ability to screen applicants, it may not be relevant in measuring qualifications to enter nursing education programs.

While science GPA was found to be a valuable predictor of early academic success, the number of science credits was not significant in either model. Further study needs to be done to determine the influence of previous science courses on academic success and program completion. This study did not examine the types of science credits earned by students; that is, the particular courses that were represented in the total number of science credits. This could be explored further by differentiating the type of science courses completed by the students and including this information in a predictor model.
The institutional setting in which science prerequisites were completed needs to be examined in relation to science GPA, science credits, and subsequent student outcomes (Lewis & Lewis, 2000). It may be useful to repeat the same study, adding a variable representing the institutional setting where science courses were completed.

Development and testing of other models to predict student outcomes in nursing education programs might vary in both independent and dependent variables, based on the findings of this study and other recent investigations. For example, it may be useful to examine predictors of student performance at the end of year one and year two of the program, or at the conclusion of particular semesters. Course grades throughout the program might be included in predictor models to predict program outcomes such as cumulative GPA in nursing and NCLEX success. Models might include entry characteristics in combination with course grades to predict program outcomes.

Further research is needed to validate the usefulness of standardized tests to assess nursing aptitude. Although the Nurse Entrance Test has been used extensively in the past, there are newer assessments now available. For example, the Test of Essential Academic Skills (TEAS) was developed by Assessment Technologies Institute and is being adopted by increasing numbers of nursing programs. It is important to examine the effectiveness of this and other newer nursing aptitude examinations in predicting student success and program completion. A comparison of the standardized examinations in predicting student outcomes within and across nursing programs may provide evidence to assist faculty in selecting the best assessment for their student populations.

Although this study found that stress was not a significant predictor of early academic success or program completion, the influence of stress on nursing student
outcomes deserves further investigation. A future study might operationalize stress in a
different manner; for example, instead of using the total NET stress profile score, it might
be prudent to insert the individual categories of stress as independent variables in
predictor models.

This study was one of few that have examined stress at the beginning of the
nursing program as a predictor of academic success or retention. Examination of stress
upon entry into the nursing program may provide baseline information, but stress
assessment at intervals throughout the nursing program would likely be more effective in
identifying and assisting students in need as they progress through the curriculum. For
example stress levels might be examined at the time of program entry, half-way through
the program, and during the final semester.

Student stress may be more accurately assessed using an instrument other than the
Nurse Entrance Test. A more sensitive measure of stress should provide more useful
information.

This study included only one noncognitive variable (stress) in the predictor
models. Future research might study the influence of other noncognitive variables on
BSN student success and retention. For example, previous research has shown that self-
efficacy influences student outcomes (Aber & Arathuzik, 1996). The inclusion of self-
efficacy or other noncognitive variables into predictor models of academic success and
retention may enhance the value of study findings and applicability to practice.

Student perceptions related to factors that promote and inhibit success and
retention may be examined through surveys or interviews. Analysis of this information
would provide additional insight into academic, environmental, personal, and social
factors that influence student outcomes. Interviewing students who have experienced academic difficulty and those who are exiting the program may be strategies for obtaining pertinent data.

Research might also be conducted to examine strategies utilized by nursing education programs to identify students who are at risk of academic difficulty, delayed program completion, and attrition. The effectiveness of programs to assist at-risk students might be evaluated through quantitative or qualitative methodologies. Because reading comprehension is so critical to successful student outcomes, it is important to study the development, implementation, and evaluation of reading programs for nursing students.

Summary

The purpose of this study was to examine the predictive value of selected cognitive (cumulative GPA, science GPA, science credits, reading comprehension, math skill, previous degree), noncognitive (stress), and demographic (age, ethnicity) characteristics of prelicensure BSN students on their early academic success and on-time program completion. The significant predictors in both models were reflective of cognitive abilities. The noncognitive and demographic predictors were not significant in either model. The variables that were found to be significant in predicting early academic success included science grade point average, reading comprehension, and math skill. In the model predicting on-time program completion, the significant independent variables were reading comprehension, math skill, and previous degree. Science GPA approached significance in predicting on-time program completion. While the two models shared the significant predictor variables of reading comprehension and math skill, the odds ratio for reading comprehension (OR = 6.03) as a predictor of on-time program completion was
more than twice the odds ratio for early academic success. This finding emphasizes the important influence of reading comprehension on a student’s academic success in the initial nursing courses, but perhaps, more importantly, the findings show that reading comprehension is significant throughout the curriculum, influencing a student’s chances of graduating on-time. Reading comprehension is a student profile characteristic that warrants serious consideration by faculty as they evaluate and refine admission criteria as well as criteria to identify at-risk students. The emphasis on reading comprehension as a predictor of success and retention has implications for the design of programs and interventions to address student deficiencies in reading comprehension. By assisting students to improve their reading skills, faculty may be able to help promote greater student success and on-time graduation.

This study tested portions of the NURS model (Jeffreys, 2004), the only well-defined model of nursing student success and retention. The cognitive variables in the study corresponded with student profile characteristics in the model that were categorized as “prior educational experience”. The results of the study support the importance of prior learning on success and retention in nursing education. Based on the study findings related to reading comprehension and math skill, perhaps, it would be more appropriate to consider these two variables in the category of “academic factors” in Jeffreys’ model.

In this study, stress was the single noncognitive predictor variable and it was not significant as a predictor of early academic success or program completion. Stress, measured by the NET, was consistent with Jeffreys’ category of “environmental variables”. The timing and lack of sensitivity of the stress measure likely impacted the study findings. To more adequately test this portion of the NURS model, further study of
the influence of stress on student outcomes is warranted, using more sensitive measures and assessing stress levels at intervals throughout the nursing program.

Jeffreys (2004) lists demographic variables such as age and ethnicity under the category of “student profile characteristics” in the NURS model. Although this study did not provide evidence that age and ethnicity are significant influences on early academic success and program completion, there is evidence in the literature that these variables are important. The lower mean age of the sample and the small percentage of minorities in the study may have influenced the results. Further study is needed to examine the predictive value of these demographic variables.

A unique feature of this study was the operationalization of cognitive variables (cumulative GPA, science GPA, reading comprehension, math skill) to differentiate between students with high and low scores. There is little evidence in the nursing literature that previous researchers have utilized this strategy. Because the variables were operationalized to differentiate between high and low scores, the results have immediate pragmatic value. The findings of the study provide useful, practical information to assist faculty in identifying students who are likely to be unsuccessful during the first two semesters and those who are likely to experience delayed or denied graduation. The same method for operationalizing cognitive variables might be used by other nursing programs in predictive studies of success and retention among their student populations.

The findings of this research investigation are most relevant for the institution that is the setting for the study. The results have pertinent pragmatic value for the faculty, administration, and most importantly, for the students. There are also implications for other prelicensure BSN programs.
The ever-worsening severity of the nursing shortage and the increasing complexity of nursing practice demand that greater numbers of baccalaureate prepared nurses enter the profession (Aiken et al., 2003). To help meet this demand, nursing education programs have expanded to admit more students. At the same time, applications for admission have increased dramatically; with thousands of qualified applicants being turned away from BSN programs across the United States (AACN, 2008). The extremely competitive nature of nursing school admission would suggest that students bring increasingly higher academic credentials. Yet, in spite of the entry qualifications, there is evidence that some students will experience academic problems that may result in delayed graduation or withdrawal from the program, either voluntarily or involuntarily. Academic issues may be related to cognitive factors such as a weak background in the foundational science courses, or problems with reading comprehension or math skill. Lack of success may stem from factors outside the realm of academics such as stress related to financial concerns and other responsibilities. Nontraditional students, such as those with previous degrees may take longer to complete the nursing program.

Research on predictors of nursing student success and retention provides insightful information for nursing education programs. Results of this and similar studies can assist schools of nursing to strengthen admissions policies as they re-evaluate and refine admission criteria. Progression criteria and remediation efforts may be evaluated and improved based on research findings.

Early identification of at-risk students is essential to maximizing their potential for academic success. Promoting the academic success and on-time program completion of entering students will assist schools of nursing to produce baccalaureate nurses who
will go on to pass NCLEX and enter the workforce as a professional nurses prepared to provide safe, effective care to clients in a complex health care environment.
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APPENDIX A

UNC Chapel Hill School of Nursing Six Semester BSN Curriculum
# APPENDIX A

UNC Chapel Hill School of Nursing  
Prelicensure Six Semester BSN Curriculum 2000-2004

<table>
<thead>
<tr>
<th>Session</th>
<th>Courses</th>
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<tbody>
<tr>
<td>Summer Session I</td>
<td>Nursing 52: Individual and Life Span Development</td>
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<tr>
<td></td>
<td>Nursing 51: Introduction to the Discipline of Nursing</td>
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<td></td>
<td>Nursing 60: Nursing Role in Normal in Therapeutic Nutrition</td>
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<tr>
<td>Fall Semester I</td>
<td>Nursing 56: Basic Theories, Processes, and Skills for Clinical Nursing</td>
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<td>Nursing 57: Pathophysiology</td>
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<td>Nursing 58: Pharmacology</td>
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<td></td>
<td>Nursing 59: Nursing Care of Patients with Major Adult Health Problems – Part I</td>
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<tr>
<td>Spring Semester I</td>
<td>Nursing 66: Health Assessment</td>
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<tr>
<td></td>
<td>Nursing 73: Maternal/Newborn Nursing*</td>
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<td></td>
<td>Nursing 74: Community Health Nursing*</td>
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<td>Summer Session II</td>
<td>Nursing 81: Care Management</td>
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<tr>
<td>Fall Semester II</td>
<td>Nursing 71: Nursing Care of Infants and Children*</td>
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<td>Nursing 75: Mental Health Nursing*</td>
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<td>Nursing 88: Nursing Research</td>
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<td>Spring Semester II</td>
<td>Nursing 89: Leadership</td>
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<tr>
<td></td>
<td>Nursing 92: Nursing Profession</td>
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<tr>
<td></td>
<td>Nursing 93: Nursing Care of Patients with Major Adult Health Problems – Part II</td>
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