

THE PREDICTIVE ACCURACY OF HESI A<sup>2</sup>, MC, AND E<sup>2</sup> EXAMS ON  
SUCCESSIVE HESI EXAM SCORES AND NCLEX-RN OUTCOMES IN AN  
ASSOCIATE DEGREE NURSING PROGRAM

A DISSERTATION

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## ABSTRACT

MARY J. YOHO

### THE PREDICTIVE ACCURACY OF HESI A<sup>2</sup>, MC, E<sup>2</sup> EXAMS ON SUCCESSIVE HESI EXAM SCORES AND NCLEX-RN OUTCOMES IN AN ASSOCIATE DEGREE NURSING PROGRAM

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The purpose of this study was to examine the predictive accuracy of standardized nursing exams produced by Health Education Systems, Inc., (HESI) used in an associate degree nursing program, and the National Council Licensure Examination for Registered Nurse (NCLEX-RN), provided by the National Council of State Boards of Nursing (NCSBN). Specifically, this study will determine the accuracy of student scores on three HESI exams in predicting success on each successive exam presented in the curriculum, beginning with the Admissions Assessment (A<sup>2</sup>), followed by the Mid-Curricular (MC), concluding with the Exit Exam (E<sup>2</sup>), and ultimately determined by NCLEX-RN success.

The study included 139 students who took the HESI A<sup>2</sup>, MC, E<sup>2</sup> and NCLEX-RN from August, 2002 through October, 2004. The A<sup>2</sup> is comprised of nine different exams. Seven of these exams are academically oriented, consisting of math, reading comprehension, grammar, vocabulary, chemistry, anatomy and physiology, and biology. Only the math and reading comprehension exams were administered to the

study population prior to admission into the nursing program. Scores on this exam were used as a component of the selection process. Faculty designated 850 as the benchmark score for the MC, administered half way through the curriculum, and the E<sup>2</sup>, administered during the last semester of the curriculum.

A descriptive longitudinal study design was used to examine the relationship of the scores of the HESI A<sup>2</sup> to the MC, the MC to the E<sup>2</sup>, and the E<sup>2</sup> to the NCLEX-RN. Data analysis revealed that the A<sup>2</sup> Math and Reading Comprehension sub-exam scores were not predictive of MC success with an accuracy rate of 20.6%. The MC was extremely predictive at 100% in predicting E<sup>2</sup> success. The E<sup>2</sup> was highly predictive of NCLEX-RN success at a rate of 94.5%. A Chi-square Goodness of Fit calculation was used to analyze the exams and attrition from the program due to poor academic performance, but no statistically significant relationship between these variables was observed. Utilizing standardized nursing exams assists nursing schools in identifying students who are at-risk academically, and will likely require remediation to be successful.

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## CHAPTER 1

### INTRODUCTION

A severe nursing shortage plagues the U.S.A. with a predicted need for one million new nurses by 2010 (Board of Nurse Examiners for the State of Texas, 2004). The U. S. Department of Labor (2005) has identified registered nursing as the top occupation in terms of job growth through the year 2012. Although the demand for nurses is up, the number of candidates taking the licensing examination has not increased as rapidly as the need. In 2004, a total of 143,553 candidates took the National Council Licensure examination for Registered Nurses (NCLEX-RN), with a pass rate of 85.3% for nurses educated in the United States, and in 2005, 154,896 graduate nurses took the NCLEX-RN, with pass rate of 87.3%, demonstrating a 7.4% increase in graduate nurses taking and passing NCLEX-RN (National Council of State Boards of Nursing, 2005) (NCSBN). While this trend is optimistic, it was estimated that 29.4% more graduates are need to meet the need for registered nurses by 2014 (The U. S. Department of Labor, 2005).

Though nursing remains an attractive career with bountiful opportunities for employment, qualified nursing school applicants are being turned away. The American Association of Community Colleges (AACCC) (2005) approximated that 125,037 nursing applicants were denied admission in the 2004 Fall semester, with 2.4 associate degree applicants turned away for each bachelor's degree program applicant. Insufficient

number of faculty, inadequate space, and budget constraints control the number accepted into nursing programs (AACC, 2005).

The aging registered nursing (RN) workforce, with the average age of a RN now at 46 years, and the average age of nurse faculty at 51.5 years, exacerbates an already critical need for registered nurses and nurse educators (American Association of Colleges of Nursing, 2003). The U.S. Department of Health and Human Services (2004) identified a decreasing trend in the percentage of younger nurses entering the profession. In 1980, 52.9% of RN's were younger than age 40, and 26% under the age of 30. In 2000, 31.7% of registered nurses were under the age of 40, with a less than 10% age 30 or less.

Nursing school applicants accepted into nursing programs must meet the challenge of remaining in school, demonstrate success, and ultimately graduate and prepare to take the NCLEX-RN. Both nursing school attrition and NCLEX-RN failure have contributed to the nursing shortage by decreasing the number of nursing school graduates or delaying entrance into the workforce. Examining predictors of success in an associate degree in nursing (ADN) program provides insight into factors that can promote program completion.

### Problem of Study

The purpose of this study was to determine the predictive accuracy of three standardized tests produced by Health Education Systems, Inc. (HESI) and used in an ADN program located in the southwestern U.S.A. Predictive accuracy was assessed to test the ability of the HESI Admissions Assessment Exam (A<sup>2</sup>) to predict performance on

the HESI Mid-Curricular Exam (MC), the ability of the MC to predict performance on the HESI Exit Exam (E<sup>2</sup>), and the ability of the E<sup>2</sup> to predict performance on the National Council Licensure Examination for Registered Nurses (NCLEX-RN). The study also described the relationship between achieving a passing score on the HESI A<sup>2</sup> math and reading comprehension exams and program attrition due to poor academic performance. The assessment of standardized examination assists administrators of ADN programs in identifying nursing students who will most likely be successful in completing the nursing program, pass the NCLEX-RN, thereby helping to alleviate the nation's overwhelming deficit of nurses.

### Rationale for the Study

Increasing the number of RN's, in an effort to ameliorate the nursing shortage, is dependent on several factors including the number of applicants accepted into the entry-level RN programs, the number who are retained in the programs, and the number who successfully pass the NCLEX-RN. However, community college ADN program attrition rates have been reported as high as 70% (Johnson, 2003). Johnson attributed attrition to students not being prepared for the rigorous nursing curriculum and the need for students to engage in outside employment while in the nursing program. Even when students successfully completed a program, approximately 12% of the RN candidates failed the NCLEX-RN, thereby delaying these graduates from entering their profession.

Studies to identify predictors which increase student nurse retention have been a focal point in an attempt to increase RN graduates. Early identification of academically

challenged students through admission criteria and grades of prerequisite academic courses provide opportunity for intervention and retention initiatives (Higgins, 2005). Once admitted into the nursing program, tutoring and mentoring strategies can be achieved to student success (Symes, Tart, Travis, & Toombs, 2002). Additionally, Higgins (2005) acknowledged assessment testing throughout the curriculum reduced attrition and increased NCLEX-RN success.

Recognizing opportunities for early intervention is essential in 2-year ADN programs. Providing standardized nursing exams assist nursing schools in identifying students who are at-risk for failure, and who will likely require remediation to be successful. Using standardized nursing exam scores to predict which students would most benefit from timely remediation could be a highly successful strategy in decreasing attrition in nursing programs.

### Theoretical Framework

Classical test theory served as the theoretical framework for this study. This theory is based upon the conceptual models which demonstrate relationships among constructs. These concepts are relevant to the study of predictive accuracy of the HESI A<sup>2</sup>, MC, E<sup>2</sup>, and NCLEX-RN exams. The underpinnings for classical test theory were established by Spearman (1904, 1907, 1913) in his description of attenuation by errors, fallible measures and true objective values which established the origin of the classical true score model.

The foundation of the classical true score model was the perception of an individual test score as a random variable (Crocker & Algina, 1986). A test score can be perceived as one of many possible scores an individual could achieve with multiple administrations of the same test. A true score can be established by identifying the expected value of a test score over multiple administrations of the same test. Essentially, the true score and the random error are the two theoretical components of a test score. It is postulated that the observed score combined with the error score comprises the individual's true score, and all of these measures are indirectly identifiable.

Properties established for the true and error scores are that: 1) the mean error scores for a population should be zero, 2) the correlation between the true and error scores for a population should be zero, and 3) the correlation between the error scores of two separate testings should be zero (Crocker & Algina, 1986). These properties are the basis for the classic true score model and the establishment of a correlation between equivalent measures and the established reliability of test scores. Several variations of reliability have resulted in the development of reliability coefficients and correlations between replicable measures, including the Spearman-Brown formula for theoretical test lengthening, the Kuder-Richardson coefficients for internal consistency, the Cronbach's alpha, and correlations for attenuation (Cattell, 1945; Levy, 1995).

Tests constructed within the framework of the classical test theory consisted of the student's true score, obtained score, and error of measurement (Crocker & Algina, 1986). The reduction of systematic and random error is important to assure that the

obtained score represents the true score for a particular test. A multiple step process for test construction, as described by Sax (1997) and later by Morrison and Free (2001), include establishing the need for the test, determining the test objectives and how test questions met the objectives, development of a test blueprint, and a table of specifications. The tests constructed by HESI utilize this multiple step process, and the NCSBN has developed a published blueprint for the NCLEX-RN exam.

### Assumptions

Assumptions associated with Spearman's classical true score model are related to those of classical test theory. A quantifiable assumption is that classical test theory postulates that psychological attributes can be defined by constructs and measured by assigning value to behaviors. Measuring behaviors and attitudes can be used to predict future behaviors. Error is controlled by using the specific test construction method, and thus increasing the possibility that the true score and error scores will correlate. Essentially, the units should have equal reliabilities, equal inter-correlations, and equal validities or correlations with other variables (Becker, 2001).

The key assumption of this study is that using standardized successive exams in an ADN program will provide predictive information of the student's ability to be successful in the nursing program, the need for additional support or remediation to be successful, and ultimately passing the NCLEX-RN and obtaining licensure.

### Research Questions

The following research questions were answered in this study:

1. What is the predictive accuracy of the HESI A<sup>2</sup> math and reading comprehension exams in predicting benchmark scores on the HESI MC exam for students in an associate degree nursing program?
2. What is the predictive accuracy of the custom-designed HESI MC exam in predicting benchmark scores on the HESI E<sup>2</sup> exam for students in an associate degree nursing program?
3. What is the predictive accuracy of the HESI E<sup>2</sup> exam in predicting success on the NCLEX-RN in associate degree nursing students?
4. Does the attrition rate of students who have a below passing score of 70% on the A<sup>2</sup> math and reading comprehension exams have a different rate of attrition from the associate degree nursing program for poor academic performance than students with passing scores on the A<sup>2</sup> math and reading comprehension exams?

#### Definition of Terms

The following conceptual and operational terms were used in this study:

1. Students were conceptually defined as full and part time students enrolled unconditionally in one selected ADN program in the southwest U.S.A. Students were operationally defined as first time test takers who took the HESI A<sup>2</sup>, MC, E<sup>2</sup>, and NCLEX-RN, and were scheduled to graduate from a selected ADN program in May, 2004, and complete NCLEX-RN by October, 2004.

2. Predictive accuracy was conceptually defined as a scoring range achieved on the HESI E<sup>2</sup> exam which is identified as highly predictive of success on the NCLEX-RN (Lauchner, Newman, & Britt, 1999). Operationally defined, predictive accuracy was the percentage of occurrences of the A<sup>2</sup> scoring interval successfully predicting the student's MC score, the percentage of occurrences of the MC scoring interval successfully predicting the student's E<sup>2</sup> score, and the percentage of occurrences of the E<sup>2</sup> scoring interval successfully predicting the student's NCLEX-RN score.
3. Associate Degree Nursing Program (ADN) was conceptually defined as a program of instruction that requires at least two years of full time college academic courses generally within a junior or community college. The program completion results in an associate degree with a major in nursing and eligibility to apply for licensure as a registered nurse. Operationally, ADN program was the academic nursing program of the study's sample. The ADN program was administered by one college district, located on two college campuses, and used the same integrated nursing curriculum, academic prerequisites, admission criteria, grading and graduation policies, and was five semesters in length.
4. Attrition rate was conceptually defined as the percentage of students in a given cohort who did not progress from one point in the program to the next point in the program without interruption. The attrition rate was operationalized by taking the number of students who entered the nursing program as a cohort, divided by the

total number of students who did not complete the ADN program at the time scheduled for the cohort completion.

5. HESI Admissions Assessment Exam (A<sup>2</sup>) was conceptually defined as a computerized standardized exam developed by a proprietary company, Health Education Systems, Inc., Houston, Texas, and administered to students applying for entrance into the ADN program. Operationally defined, the HESI A<sup>2</sup> exam contained seven academically oriented sections related to math, reading comprehension, vocabulary, and general knowledge, grammar, chemistry, biology, and anatomy and physiology, although only the math and reading comprehension sections were required by the ADN program. Composite scores of the math and reading comprehension exams range from 0-100, and were used as part of the criteria for ranking into the ADN program.
6. HESI Mid-Curricular Exam (MC) was a computerized and customized exam developed by HESI with the individual schools objectives and course content, and administered to students at the mid-point of the nursing program. The operational definition of the HESI MC was a mid-curricular exam in the ADN program in which the test items relate to the ADN programs course syllabi and also included nationally-normed critical thinking questions. Scores reported identified the student's academic strengths and weaknesses, thereby provided individual remediation guidance for each student.

7. HESI Exit Exam (E<sup>2</sup>) was conceptually defined as a comprehensive, computerized, standardized nursing competency exam developed by HESI, and administered to students at the conclusion of their accredited academic nursing program: ADN, BSN, or Diploma program. The exam's blueprint used the same design developed for the NCLEX-RN exam. Operationally, the HESI E<sup>2</sup> scores report identified the student's academic strengths and weakness at the end of the educational program. Exam results were predictive of the student's success on the NCLEX-RN.
8. National Council Licensure Examination for Registered Nurses (NCLEX-RN) was conceptually defined as the licensure exam developed by the National Council of State Boards of Nursing for graduates of initial RN programs. The NCLEX-RN was constructed as a comprehensive, standardized, nursing competency exam with established validity and reliability, and scores yield information regarding nursing knowledge, critical thinking, and safe nursing practice of the RN candidate. Successful examinees were then allowed to apply for licensure as a RN. Operationally defined, the NCLEX-RN exam was the national nursing licensure exam, taken by graduate nurses upon successful completion of the study's ADN program. Scores on the licensure examination were reported to the state nursing licensure exam office, the graduate nurse, and nursing school administrators as either pass or fail.

9. Benchmark score was conceptually defined as a “cut-off score” which categorizes the HESI A<sup>2</sup>, MC, and E<sup>2</sup> exam scores as either at or above the benchmark score as pass, or below the benchmark score as fail. Operationally, the benchmark score was used as a means of student assessment throughout the in the ADN program. The benchmark for the HESI A<sup>2</sup> Math and Reading Comprehension exams was 70%, and was used to assess readiness for entry into the nursing program. The HESI MC benchmark was a score of 850, and used to determine if students needed additional academic support or remediation prior to entry into the last two semesters of the ADN program. The E<sup>2</sup> benchmark was also established at 850, and predicted the nursing student’s probability of passing the NCLEX-RN. The NCLEX-RN benchmark score was established as either pass or fail.
10. Poor academic performance was conceptually defined by averaging academic exam scores or clinical performance evaluation outcomes and declared the outcomes as less than the passing course grade. Operationally, poor academic performance was determined by course grades of 70% or less, or by a clinical evaluation of unsatisfactory, both outcomes leading to nursing program attrition.

### Limitations

The following limitations of the research methodology for this study were:

1. The research design lacks the control of personal or environmental factors, which may have occurred during the administration of the HESI A<sup>2</sup>, MC, E<sup>2</sup>, and NCLEX-RN exams. Personal factors include the student’s physical and emotional

health at the time of the test. Environmental factors include the temperature and noise level of the room.

2. The use of a convenience sample of HESI test scores and NCLEX-RN pass rates is not be a true representation of the population, thus limiting the ability to generalize the results.

### Summary

This study examined the predictive accuracy of the HESI A<sup>2</sup>, MC, E<sup>2</sup>, and NCLEX-RN exams on successful HESI test scores and NCLEX-RN outcomes for students enrolled in a selected ADN program with two campuses located in the southwest U.S.A. In addition, the study analyzed the passing scores on the A<sup>2</sup> math and reading comprehension exams and the rate of student attrition related to poor academic performance, in comparison to the attrition rate of students who had passing scores on the A<sup>2</sup> math and reading comprehension tests. The theoretical framework was based on the classical test model, which incorporated the underpinnings of Spearman's classical true score model, and proposed that the observed score combined with the error score comprises the individual's true score, and all of these measures are indirectly discriminatable. Limitations of the study design included the lack of control of factors which may have occurred during the test administration, and the use of a convenience sample from one nursing program.

## CHAPTER 2

### REVIEW OF LITERATURE

Predicting nursing student success in nursing programs and on licensure exams has been a continuous challenge for nurse educators. Nursing students must achieve the program's objectives, and pass the National Council Licensure Examination for Registered Nurses (NCLEX-RN), to attain licensure. Extensive nursing research has been dedicated to identifying dependable predictors and methodologies for nursing school applicant selection, retention, and graduation. Although more than 60% of graduate nurses who take the NCLEX-RN are alumnae of associate degree in nursing (ADN) programs, minimal research has been dedicated to this exclusive population.

ADN programs became a nationwide educational phenomenon following Mildred Montag's doctoral dissertation, explicating the need for a 2-year education program to educate a technical nurse to assist professional nurses (Montag, 1953). In 1958, Montag received funding from the W.K. Kellogg Foundation to implement pilot programs based on her dissertation at seven colleges. This led to the creation of over 940 ADN programs, with more than 60% of new nurses receiving their basic nursing education through ADN education (NCSBN, 2005). Even so, literature on the predictive accuracy and student success relating to ADN students was not as abundant as with studies involving baccalaureate nursing students (BSN), a population which has been modestly researched, and utilized academic variables as predictors.

Presented in this chapter is a review of both historic and current literature related to academic variables and influences impacting nursing student success, predictive accuracy in ADN programs, and strategies to decrease attrition in nursing programs. Database sources used to search for headings related to the study include CINAHL, Dissertation Abstracts International (Theses and Dissertations), ERIC First Search, Health and Psychosocial Instruments, Nursing and Health Sciences (SAGE full-text collection), OVID Full Text, and Proquest Nursing Journals. Search headings included student success, predictive accuracy, academic testing, remediation, and standardized testing. In addition, the findings of previous predictability studies of HESI Exit Exam (E<sup>2</sup>) exams are described, offering a background to the research conducted in the area of standardized testing to predict student outcomes.

#### Academic Factors Associated With Nursing Student Success

Numerous academic variables impact student nurse success. Several investigations compared academic predictors and their influence on student success on the NCLEX-RN. Literature related to historical and current research on academic predictors of nursing program achievement was reviewed to explore key components of student success. Additionally, in an effort to describe variables for success on the NCLEX-RN exclusively in ADN programs, 21 studies were conducted between 1986 and 2005. Table 1 summarizes these studies.

Authors identified approximately 30 predictors using several methodologies for analysis including correlation, logistic, linear and multiple regression, chi-square, factor

Table 1.

*Summary of Studies Analyzing Academic Variables Predicting Nursing Program and NCLEX-RN Success in ADN Programs*

Date and Author	Variables	Study Design and Sample	Statistical Methodology	Variables Predicting NCLEX-RN Success
1986 Woodham & Taube	Admission criteria (SAT, ACT, high school graduation rank, GPA of pre-requisite courses) and performance in seven nursing major didactic courses as predictors for performance on the NCLEX.	Ex post facto study of a convenience sample of 104 graduates of an integrated ADN program.	Correlation and multivariate regression.	Significant positive relationship with NCLEX-RN ( $p = .01$ ) was demonstrated with seven ADN didactic courses and SAT verbal scores, with cores strongly correlated ( $n=78551$ , $p<.001$ ). SAT math non-significant.

Date and Author	Variables	Study Design and Sample	Statistical Methodology	Variables Predicting NCLEX-RN Success
1988 Cloud- Hardaway.	Mosby's Assess Test, Nelson Denny Reading Test (NDRT), and prior PN licensure on NCLEX results.	Ex post facto study of a convenience sample of 558 ADN graduates who wrote the NCLEX in 1983 & 1984.	Pearson Product Moment Correlation.	Significant positive relationships found among Mosby scores and NDRT ( $r=.41, p=.001$ ), and semester averages.
1990 Lengacher and Keller	Entrance GPA, ACT subtests scores in English and math, composite ACT scores, success in clinical and courses, pass on NLN exams, exit GPA, NCLEX.	Correlational study of a convenience sample of 146 graduates who attended an ADN program in 1987.	Pearson Product Moment correlations and stepwise multiple regres.	NUR 2712 ( $R = .77$ ) and NUR 2713 ( $R = .79$ ). Best predictor of NCLEX and NLN were Basics Two Exam ( $R = .66$ ) and Psyc Exam ( $R = .70$ ).

Date and Author	Variables	Study Design and Sample	Statistical Methodology	Variables Predicting NCLEX-RN Success
1992 Stright	High school rank, entrance math score, transfer status, GPA of each semester, grades in A & P I & II, and NLN exam scores.	Descriptive and correlational study of a convenience sample of 205 ADN students from one university.	Chi square and logistic regression model.	GPA at the end of the second semester was statistically significant for NCLEX-RN failure ( $p < .01$ ).
1993 Anderson	High school GPA, ACT composite scores, GPA in ADN program, GPA of science and humanities grades, and NLN test scores.	Descriptive comparative study of a convenience sample of 156 graduates of a 1989 ADN program.	Logistic regression analysis.	Combined NLN score and Nursing semester I grades combined, contributed to 93% predictive performance on the NCLEX-RN.

Date and Author	Variables	Study Design and Sample	Statistical Methodology	Variables Predicting NCLEX-RN Success
1996 Drake	Grades received in the 18 program courses (eight nursing theory courses, six nursing laboratory courses, and four biology-related courses) and in unweighted composites of nursing lab and theory courses and GPA's earned prior to nursing program admission.	Correlational study of a convenience sample of 350 ADN students.	Factor analysis of intercorrelations of the grades of these two different types of courses.	A GPA earned in a theory-oriented course seems to offer the greatest potential in identifying those students most likely to pass the NCLEX-RN with nursing laboratory courses being weak indicators of success on the NCLEX-RN ( $p < .05$ ).

Date and Author	Variables	Study Design and Sample	Statistical Methodology	Variables Predicting NCLEX-RN Success
1997 Roye	ACT scores, SAT scores, and cognitive GPA.	Retrospective study of 194 ADN students.	Descriptive statistics.	ACT composite, GPA's scores higher when passed NCLEX.
1999 Briscoe & Anema	Pre-admission GPA, failing a clinical nursing course, and two NLN test scores.	Correlational study of a convenience sample of 38 1997 graduates from an ADN program.	Pearson Correlation Coefficient.	Significant relationship between scores of the NLN I exam ( $p=.01$ ); and NLN II exam ( $p=.01$ ), on NCLEX.
2001 Percoco	Course grades in pharm. and psych., GPA's of biology and English courses.	Retrospective descriptive study of a convenience sample of 177 ADN students.	Logistic regression.	Pharm. course grades the only predictor of both program and NCLEX-RN pass ( $p<0.008$ ).

Date and Author	Variables	Study Design and Sample	Statistical Methodology	Variables Predicting NCLEX-RN Success
2001 Yellen & Geoffrion	Nurse Entrance Exam (NET) or the Entrance Examination for Schools of Nursing (RNEE)	Correlational study of a convenience sample of 190 ADN student academic records using a retrospective review.	Pearson Correlation Coefficient.	Entrance exam reading score was significantly different between students who were success and those who failed the nursing program ( $p=.001$ ).
2002 Collins, P.	A & P I and II, Chemistry, Microbiology, cumulative pre-program GPA, first three nursing theory courses.	Ex post facto study of a convenience sample of 558 ADN graduates who took NCLEX in 1983 & 1984.	Pearson Product Moment Correlation logistic regression.	GPA in the nursing program theory courses was the strongest variables ( $p<.001$ ).

Date and Author	Variables	Study Design and Sample	Statistical Methodology	Variables Predicting NCLEX-RN Success
2002 Daley, Kirkpatrick, Frazier, Chung, & Moser	Mosby's AssessTest, HESI E <sup>2</sup> exam, final didactic course grade, and cumulative GPA	Ex post facto study of a convenience sample of two cohorts of ADN students: 121 and 103.	Chi square analysis.	Only two variables routinely continue to be associated with success on the NCLEX-RN, the final course didactic grade (senior medical-surgical nursing course), and grade point average (GPA) ( $p=.001$ ). HESI E <sup>2</sup> demonstrated greater sensitivity as compared to the Mosby AssessTest ( $p=.001$ ).

Date and Author	Variables	Study Design and Sample	Statistical Methodology	Variables Predicting NCLEX-RN Success
2003 Yin & Burger.	GPA at admission into the nursing program, psychology and natural sciences grades.	Correlational and descriptive study of a convenience sample of 158 ADN senior students eligible to take the NCLEX-RN.	Pearson Product Moment Correlation.	GPA at admission strongest predictor ( $r = 0.15, p < 0.01$ ), but course grades in psychology and natural sciences were also positively correlated.
2004 Haas, Nugent, & Rule	Nursing cumulative GPA, transfer graduate GPA, cumulative undergraduate GPA, & SAT scores.	Retrospective study of a convenience sample of 205 students from an ADN program.	Chi-square analysis.	Only nursing cumulative GPA ( $p < .001$ ) was statistically significant.

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Date and Author	Variables	Study Design and Sample	Statistical Methodology	Variables Predicting NCLEX-RN Success
2005 Hardin	Admission GPA, Graduation GPA, Texas Assessment Skills Placement Text (TASP). Math scores, TASP reading scores TASP writing scores, cumulative GPA in required science courses, HESI mid-curricular exam, HESI Exit exam.	Correlational study of a convenience sample of 288 ADN graduates from 2003-2004 from two Northeast Texas Community Colleges.	Logistical regression analysis.	Two areas were significantly significant ( $p=.001$ ). GPA of the entering program and exit HESI scores.

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analysis, and descriptive statistics. Five criteria emerged as major predictors for NCLEX-RN success: (1) standardized scholastic aptitude exams which included the SAT and ACT, (2) specialized college admission exams identified as the Productive Environment Preference Survey (PEPS), College Characteristics Index-Short Form (CCI-SF), and Nelson-Denning Reading Test (NDRT); (3) standardized nursing program entrance exams which consisted of the National League of Nursing (NLN) entrance exam, Mosby Nursing Entrance Exam, Entrance Examination for Nursing Schools (RNEE), Nurse Entrance Exam (NET), and Watson-Glaser Critical Thinking exams (WG); (4) course grades including academic pre-requisite and nursing curriculum course grades; and (5) grade point averages (GPA's) which were further defined by each study and included the cumulative GPA of high school courses, pre-requisite nursing program courses, undergraduate courses, and selected academic courses (Biology, Psychology, Humanities, and Pharmacology).

#### *Standardized Scholastic Aptitude Tests*

Although standardized scholastic aptitude tests were studied as a predictor of NCLEX-RN success, the outcomes were mixed. Woodham and Taube (1986) found that verbal SAT scores were associated with performance in seven nursing courses and NCLEX-RN success. Roye (1997) found that ACT composite scores were higher for the 95% of students in their study who were successful on the NCLEX-RN. However, in five research studies, standardized scholastic aptitude tests were shown to be poor predictors.

Woodham and Taube (1986) found that math scores on the SAT were not predictors of NCLEX-RN success. Similarly, ACT Mathematics, English and composite scores were also found non-predictive of passing the NCLEX-RN (Lengacher & Keller, 1990; Anderson, 1993; Milam, 1997; Swenty, 1998).

### *Specialized College Admission Exams*

College admissions tests, other than the traditional SAT and ACT exams, have been considered as possible predictors of NCLEX-RN success. Cloud-Hardaway (1988) and Silage (2002) found the Nelson-Denning Reading Test (NDRT) to be a good academic predictor of NCLEX -RN success. Although these results were promising, two specialized admissions exams, the Productive Environmental Preference Survey (PEPS) and the College Characteristics Index-Short Form (CCI-SF), were also studied as possible correlations to NCLEX-RN pass rates, but were not found to be useful predictors (Kizilay, 1991).

### *Standardized Nursing Program Entrance Exams*

Five standardized exams, developed to determine nursing program achievement and forecast positive NCLEX-RN results, have been investigated to verify their predictability. The National League of Nursing (NLN) exam has been studied both in its entirety (Gross, Takazawa, & Rose, 1987; Lengacher & Keller, 1990; Stright, 1992; Anderson, 1993; Brisco & Anema, 1999) as well as a medical-surgical subspecialty test (Milan, 1997). Positive relationships between the NLN exam NCLEX-RN outcomes were

identified in four of the six studies, with Stright (1992) and Milan (1997) reporting no statistical significance on student NLN exam performance and the NCLEX-RN results.

Likewise, studies comparing the Mosby Assess Test, the Entrance Exam for Nursing Schools (RNEE), the Nurse Entrance Exam (NET), and the Watson-Glaser Critical Thinking Appraisal (WG) with NCLEX-RN success for ADN students have demonstrated mixed results. Though Cloud-Hardaway (1988) found the Mosby Assess Test predictive, a separate study did not find it sensitive to positive NCLEX-RN results (Daley, Kirkpatrick, Frazier, Chung, & Moser, 2002). The RNEE proved to be a fairly good predictor in one study (Gallagher, Bomba, & Crane, 2001), while Swenty (1998) and Yellen and Geoffrion (2001) were unable to support similar results. NET exam results continued the pattern of inconsistency by demonstrating predictive results in two studies (Yellen & Goeffrion, 2001; Silage, 2002) while a separate study demonstrated no predictive ability (Gallagher, Bomba, & Crane, 2001). Finally, one study attempted to identify the WG as a predictor of NCLEX-RN success, but significance could not be demonstrated (Gross, Takazawa, & Rose, 1987).

### *Course Grades*

Grades in both academic and nursing courses have been studied as potential predictors of NCLEX-RN outcomes. Of the nine studies evaluated, five emerged as successful NCLEX-RN predictors of courses related to ADN programs (Woodham & Taube, 1986; Drake, 1996; Percoco, 2001; Daley, Kirkpatrick, Frazier, Chung, & Moser, 2002; Yin & Burger, 2003). Collins (2002) showed a relationship between nursing theory

courses and NCEX-RN success, but unable to demonstrate a similar correlation with courses in Anatomy and Physiology, Chemistry, and Microbiology. Likewise, Stright (1992) was unable to demonstrate a relationship with Anatomy and Physiology I and II with the NCLEX-RN. Swenty (1998) and Briscoe and Anema (1999) attempted to predict success in nursing didactic and clinical courses but were unsuccessful.

### *Grade Point Averages (GPA's)*

GPA of academic prerequisite courses has long been utilized as a possible predictor of the NCLEX-RN pass rates. Seven of the eleven studies that focused on ADN program outcomes identified admission GPA as a reliable predictor to performance on the NCLEX-RN (Woodham & Taube, 1986; Gross, Takazawa, & Rose, 1987; Drake, 1996; Roye, 1997; Yin & Burger, 2003; Daley, Kirkpatrick, Frazier, Chung, & Moser, 2002; Haas, Nugent, & Rule, 2004). The remaining studies were unable to support GPA as a predictor (Briscoe & Anema, 1999; Lengacher & Keller, 1990; Stright, 1992; Hardin, 2005), and demonstrated continual variation in identifying stable predictors of the NCLEX-RN.

Of the 21 studies restricted to ADN programs, only one study (Hardin, 2005) included evaluation of the HESI MC and E<sup>2</sup> exams scores to NCLEX-RN success, in conjunction with admission and graduation GPA, and Texas Assessment Skills Placement Test (TASP) reading, writing, and math scores. Hardin (2005) concluded the admission GPA and the HESI E<sup>2</sup> were successful NCLEX-RN predictors. Despite the predictive variables, and statistical test analysis utilized, no consistently reliable or

constant predictors have been identified as predictive for student success in ADN programs.

In 1988, the NCLEX-RN was revised, which initiated the pass/fail reporting system and raised the passing standard (NCSBN, 2005). Studies conducted post-1988 following the NCSBN's adoption of a computer adaptive testing (CAT) format for the NCLEX-RN are particularly relevant to this study. Some factors, which were cited in the pre-1998 literature, have remained reliable despite the fundamental changes in the NCLEX-RN following CAT implementation. The numerous computerized assessment tools designed for NCLEX review and exam preparation provided an opportunity to determine the predictive accuracy of new instruments. A study conducted by Lauchner, Newman, and Britt (1999) was the first study to document HESI E<sup>2</sup> scores as a predictor of NCLEX-RN success since the NCSBN introduced the CAT format of the NCLEX-RN.

#### Predictive Accuracy of Heath Education Systems, Incorporated (HESI) Exams

Heath Education Systems, Incorporated (HESI), provides computerized nursing exams that are used to assess nursing student likelihood of success in nursing programs and on the NCLEX-RN. HESI examinations include the Admission Assessment exam (A<sup>2</sup>) that assesses student readiness to enter a nursing program, the customized mid-curricular examination (MC) that evaluates student competency following one year of the nursing curriculum, and the Exit Examination (E<sup>2</sup>) that evaluates student ability to succeed on the licensure examination. HESI also markets specialty and exit exams for

other nursing program types. Test outcomes indicate the student's areas of strength and weakness, providing a guide for remediation to facilitate their success in the journey toward RN licensure. Multiple test versions allow students to retake the exam and assess the effectiveness of the remediation (Nibert, Young, & Britt, 2003).

HESI exam scoring intervals were established to identify predictive success in nursing programs, and ultimately predict passing the NCLEX-RN on the first attempt. The HESI A<sup>2</sup> entrance exam consists of seven academically oriented sections consisting of: math, reading comprehension, vocabulary and general knowledge, grammar, chemistry, biology, and anatomy and physiology. Schools of nursing can select to administer any number or all of the exams. The A<sup>2</sup> exam scores are reported as a composite score, and reflect only the scores of the exams administered. Seventy percent (70%) is the established passing score. Scores for the MC and E<sup>2</sup> exams are reported in categories, ranging from A/B, the highest scoring category, to H, the lowest scoring category. Scoring intervals A/B and C are identified as passing scores for the HESI MC and E<sup>2</sup>, and have been shown predictive of success on the NCLEX-RN. Scores in intervals D through H are not predictive of passing the NCLEX-RN and support remediation of nursing program curriculum with review of test-taking strategies.

Most research to date has focused on the predictive accuracy of the HESI E<sup>2</sup> examination on NCLEX-RN passage. Predictive accuracy is calculated by “the number of students scoring in category A/B on the E<sup>2</sup> exam who failed the NCLEX-RN is divided by the total number of students predicted to pass and subtracted by one” (Nibert, Young,

& Adamson, 2002). Chi Square Goodness of Fit is calculated to detect differences between expected and observed frequencies among NCLEX-RN outcomes among students in five different categories (Nibert, Young, & Adamson, 2002). Five validity studies have been conducted on the HESI E<sup>2</sup> for registered nurse programs, with predictive accuracy calculations ranging 96.49% to 98.46% for combined baccalaureate, associate degree, and diploma program students, and 95.67% to 99.5% specifically for ADN program students (Lauchner, Newman, & Britt, 1999; Newman, Britt, & Lauchner, 2000; Nibert & Young, 2001; Nibert, Young, & Adamson, 2002; Lewis, 2005). For data analysis of student scores on the E<sup>2</sup>, five scoring intervals categories have been identified to determine predictive accuracy. In 2003, the scoring mechanism was changed to more purely reflect a test score, and discourage comparison of the HESI score to a percentage score.

Murray (Murray, Yoho, & Nibert, 2005) conducted a study of 52 students in an ADN program located in southeast Texas program, which specifically addressed the use of HESI examinations used throughout their curriculum during the 2002-2003 academic year. The 13 HESI exams included in the study were the HESI A<sup>2</sup>, academically oriented sub exams (math, science, anatomy and physiology, reading comprehension, vocabulary, and grammar sections), Custom Exam 1, 2, and 3, and Specialty Exams: Psych-Mental Health, Maternity, Pediatrics, and the HESI E<sup>2</sup>. Data were analyzed using Pearson correlations to determine the relationship between students' HESI scores and the final course grades. Chi Square Goodness of Fit analysis determined differences in NCLEX-

RN outcomes in each of the E<sup>2</sup> scoring intervals, and predictive accuracy of the E<sup>2</sup> measures by NCLEX-RN outcomes. Results included the nursing program's exam (college-specific) reliability coefficients varying from 0.51 to 0.77, consistent with reliabilities expected of a homogenous population, such as a cohort of nursing students (Murray, Yoho, & Nibert, 2005). Reliability estimates for all HESI exams varied from  $r = 0.88-0.99$  which is consistent with standardized nursing exams (Murray, Yoho, & Nibert, 2005). The validity of the HESI A<sup>2</sup> test scores for the Math, Science, Anatomy and Physiology, Reading Comprehension, Vocabulary, and Grammar were significantly correlated ( $p=.05$ ), with the exception of two courses: Therapeutic Communication and Principles of Adult Health. The HESI Specialty Exams were all significantly correlated with the nursing program exams ( $p = .01$ ). Custom 1 Exam did not significantly correlate, though Custom Exams 2 and 3 achieved significant correlation ( $p = .01$ ) with the ADN program exams. The Exit Exam (E<sup>2</sup>) achieved a predictive accuracy of 96.43%. Conclusions of this study support the use of testing throughout the curriculum as a means of validating curriculum, predicting of student success in the nursing program, and predicting success on NCLEX-RN.

#### Decreasing Attrition and Facilitating Success in Nursing Programs

Nurse educators and administrators are concerned about student success on the NCLEX-RN particularly due to the nursing shortage and the need for nurses at record numbers. Educational outcomes and graduation rates of nursing programs is a focus for state legislators who have funded initiatives to increase both nursing school enrollment

and nursing faculty (Yoho, Timpanaro, & Fowler, 2006). Attrition within nursing programs is very costly to educational programs, to health care systems, and to students and their families. If students are not able to complete their nursing program, they are unable to enter the job market and contribute to alleviating the nursing shortage. Additionally, students make great sacrifices to attend a nursing program, and physical, emotional, and financial resources are required to attain a nursing education (Poorman & Webb, 2000). Students can also be affected psychologically if they fail the nursing program. Likewise, student failure can affect nursing school peers and faculty. Peers experience personal loss when they see their classmates fail. Faculty experience loss when they believe personal time and energy was of no use in trying to assist students to achieve their goal. Many students may not be academically prepared for the rigors of the nursing curriculum, and could be screened with entrance or standardized examination scores. Therefore, if educators were able to predict success based upon academic variables, these variables could be placed into nursing programs selection criteria (Lengacher & Keller, 1990).

Two qualitative studies highlight reactions and responses of nursing graduates who were unsuccessful in taking the NCLEX-RN. Eddy and Epeneter (2002) conducted a phenomenological study that included semi-structured interviews of 19 graduate nurses, of which nine graduates had failed their initial NCLEX-RN exam, and revealed two major themes. The first theme related to preparing for and experiencing the NCLEX-RN, in which 33% of students who failed on the first attempt admitted they did not prepare

adequately for the exam. Study materials supplied by the nursing school did not prepare them for the level of difficulty of the NCLEX-RN questions. The second theme which emerged revealed graduate nurses who failed the NCLEX-RN held others responsible for their lack of success. These students seemed less able to manage stress and reported taking the examination when they did not feel ready. Investigators discovered that both successful and unsuccessful participants felt unprepared to answer NCLEX-RN-type questions and believed nothing had prepared them for this experience.

Griffiths, Papastrat, Czekanski, and Hagan (2004) conducted a phenomenological study which included the utilization of both survey instruments and interviews with 21 nursing BSN and ADN graduates who failed the NCLEX-RN at least once. Researchers identified three common themes. The first theme related to the failure experience, citing emotions which included an increase in self doubt, decrease in self-confidence, changes in self-perception, and intense fear that the second NCLEX-RN testing would also be unsuccessful. The second theme reflected successful remediation strategies for retesting, stating they continued to need contact with their faculty for support, mentoring, and study materials until they were successful in passing the NCLEX-RN. Finally, participants made recommendations for faculty interventions during this vulnerable period. Nursing faculty recognized they have a responsibility to identify, inform, and intervene with students who are at high risk of failing the NCLEX-RN, and their role extended beyond graduation. The faculty's ultimate responsibility was to help nursing graduates transition

from failure to licensure as the final step of successful undergraduate nursing experiences.

Several studies identified strategies to decrease attrition experienced in schools of nursing, specifically to assist at-risk students with interventions to achieve NCLRX-RN success, and become a member of the nursing workforce. Demonstrating effectiveness of these initiatives has been more challenging, though Campbell and Dickinson (1996) identified four successful strategies in their meta analysis of research studies published from 1981-1990. Support groups, computer-assisted instruction, personalized system of instruction, and integrated curriculum were recognized as interventions which were helpful, but only the support group was predictive of NCLEX-RN success ( $t=2.10$ ,  $p=.05$ ).

The Partnership in Learning for Utmost Success (PLUS) program (Lockie & Burke, 1999) conducted a correlational study of a convenience sample of 210 students during 1989-1993, and compared students participating in the program to students not participating in the program. The PLUS program involved four components: a comprehensive assessment plan, a program of study, faculty development, and partnership for learning. Attrition rate of the PLUS students was 9.9% as compared to 43.8% for the non-PLUS students. NCLEX-RN pass rate was 81.6% for PLUS students and 75% for non-PLUS students, demonstrating the success of this strategy. Symes, Tart, Travis, and Toombs (2002) developed the Student Success Program (SSP) to retain bright and capable nursing students by supporting them to become expert learners. Retention

rates increased following implementation of the program which included enhancing their study skills, test taking, time and stress management, written and oral communication, and critical thinking skills. Students for whom English is a second language also received instruction in accent reduction. Of the 35 students participating in SSP, 32 (89%) completed the nursing program.

A correlational study was conducted to evaluate problem-based learning (PBL) of 400 students enrolled in eight undergraduate nursing education courses (Alexander, McDaniel, Baldwin, & Money, 2002). Outcomes revealed an increase in student satisfaction, and a significant increase in the probability scores of the HESI E<sup>2</sup> from pretest to posttest ( $p=.001$ ) of a comprehensive HESI exam for those in the study group. NCLEX-RN results demonstrated 100% pass rates for three consecutive years, and graduates obtained positions in areas of nursing which often require experience, including intensive care, emergency departments, and community nursing. Employer and graduate satisfaction surveys were high, and many graduates were admitted to graduate programs immediately after achieving their undergraduate degree and receiving RN licensure.

The use of NCLEX-RN preparatory books, software simulation questions, and enrollment in review courses, whether in group didactics or independent study, have been popular in reducing student attrition and preparing for the NCLEX-RN (Ashley & O'Neil, 1991,1994; Ross, Nice, May, & Billings,1996). Ashley and O'Neil (1991) conducted a descriptive comparative study of a convenience sample of 30 students to investigate if test-taking coaching would achieve better NCLEX-RN pass rates as

compared to those who did not participate in test-coaching. Students who were at risk of NCLEX-RN failure participated in test-coaching, and achieved a better pass rate on NCLEX-RN ( $\chi^2=6.30$ ,  $p=.01$ ) and than those non-participant students ( $\chi^2=13.87$ ,  $p=.01$ ).

Ross, Nice, May, and Billings (1996) study of 230 nursing students examined the outcomes of providing an optional practice NCLEX-RN exam used to guide a student's individual review and to assess the need to attend an NCLEX-RN review course. No consequences of course failure were tied to the results of this exam. Only four of the 46 students scoring between 50-61% and identified to be at-risk for NCLEX-RN failure refused to take the practice exam. All four students failed NCLEX-RN, as well as three other at-risk students who did not participate. As a result, investigators suggested that all students use a practice exam until an acceptable "passing" score was met.

In more recent studies, schools of nursing are demonstrating they are not only in the "education business", but also in the "remediation business", in order to assist students to pass the NCLEX-RN (Siktberg, & Dillard, 2001). Investigations compared the predictive accuracy of standardized nursing examination in an attempt to identify the best opportunities for both student and program success. Daley, Kirkpatrick, Frazier, Chung, and Moser (2002) compared the Mosby AssessTest and the HESI E<sup>2</sup> exam in two cohorts of senior nursing students (1999 cohort  $N=121$ ; 2000 cohort  $N=103$ ), and found the HESI E<sup>2</sup> to have greater sensitivity, specificity, positive and negative predictive value, and test efficiency, when compared with the Mosby AssessTest ( $p=.001$ ). In this study, only two variables routinely continue to be associated with success on the NCLEX-RN, the final

course didactic grade (senior medical-surgical nursing course), and cumulative grade point average (GPA) (Daley, Kirkpatrick, Frazier, Chung, & Moser, 2002).

Due to the predictive accuracy of the HESI E<sup>2</sup> exam on passing the NCLEX-RN, specific benchmarks that identify students who are at-risk of NCLEX-RN failure and in need of remediation have been identified. Nibert, Young, and Adamson (2002), noted that many schools of nursing have implemented policies for progression and remediation benchmarks. Though nursing programs take the responsibility to ultimately set the standards for their individual schools, guidelines are available to support the school's decision on developing remediation and benchmarking standards (Nibert, Young, & Britt, 2003). Morrison, Free, & Newman (2002) studied five schools of nursing which had implemented progression policies relating to the HESI E<sup>2</sup> exam and compared NCLEX-RN pass rates before and after remediation policy implementation. School pass rates consistently improved by 9%, 12%, 19%, 22%, 34%, 36%, and 41% respectively within two years of implementing the progression policy, demonstrating the effectiveness of the progression policy, which motivated students to prepare for the HESI E<sup>2</sup> exam, and eventually the NLCEX-RN.

### Summary

This literature review comprises numerous years of research related to student nurse success with the ultimate accomplishment of passing the NCLEX-RN and entering the workforce as a RN. An analysis of quantitative studies included a review of literature related to transfer, cumulative, and nursing program grade point averages (GPA's), often

utilized as predictive values for NCLEX-RN success in ADN programs. The outcomes of most studies did not demonstrate a relationship between nursing school GPA and NCLEX-RN success (Lengacher & Keller, 1990; Briscoe & Anema, 1999; Daley, Kirkpatrick, Frazier, Chung, & Moser, 2002; Haas, Nugent, & Rule, 2004; Hardin, 2005). Nursing didactic course GPA's surfaced as a common predictor of NCLEX-RN success in studies conducted by Gross, Takazawa, & Rose (1987) ( $N=108$ ,  $p<.01$ ), Drake (1996) ( $N=350$ ,  $p<.05$ ), and Collins (2002) ( $N=588$ ,  $p<.001$ ), as well as studies conducted on nursing prerequisite academic course GPA's by Woodham & Taube (1986) ( $N=104$ ,  $p=.01$ ), Milan (1997) ( $N=272$ ,  $p=.01$ ), and Swenty (1998) ( $N=319$ ,  $p=.05$ ). Additionally, Percoco (2001) demonstrated Pharmacology course grades as a predictor for NCLEX-RN success ( $N=177$ ,  $p<.008$ ).

Studies conducted on the relationship of standardized exam scores and the NCLEX-RN proved to be less consistent predictors of NCLEX-RN success. Investigations included the Mosby's AssessTest (Cloud-Hardaway, 1988; Daley, Kirkpatrick, Frazier, Chung, & Moser, 2002), National League of Nursing (NLN) Pre-Admission Test (Straight, 1992; Anderson, 1993), Watson-Glaser Critical Thinking Appraisal (WG) (Gross, Takazawa, & Rose, 1987), Productive Environmental Preference Survey (PEPS) and College Characteristics Index-Short Form (CCI-SF) (Kizilay, 1991).

Significant to this study is the predictability of the mathematics & reading comprehension subsets scores of the NET and RNEE exams (Gallagher, Bomba, & Crane, 2002) ( $r=0.23$ ,  $p<.05$ ) and the Nelson Denny Reading Test to the success on

NCLEX-RN (Cloud-Hardaway, 1988) ( $r=.41, p=.001$ ). HESI E<sup>2</sup> exams demonstrated predictability in achieving NCLEX-RN success in both comparative studies of other standardized nursing exit exams (Daley, Kirkpatrick, Frazier, Chung, & Moser, 2002) ( $N=224, p=.001$ ) and a greater than 96% predictive accuracy of the five consecutive studies conducted on the HESI E<sup>2</sup> and NCLEX-RN success (Lauchner, Newman, & Britt, 1999; Newman, Britt, & Lauchner, 2000; Nibert & Young, 2001; Nibert, Young, & Adamson, 2002; Lewis, 2005). Though minimally studied, HESI A<sup>2</sup>, MC, E<sup>2</sup> and Specialty Exams utilized in ADN programs were predicatively accurate in achieving NCLEX-RN pass rates, with the exception of the HESI A<sup>2</sup> exam's inability to significantly correlate with only two courses in the ADN curriculum, Therapeutic Communication and Principles of Adult Health (Hardin, 2005; Murray, Yoho, & Nibert, 2005).

Although quantitative studies have dominated the research related to RN program and NCLEX-RN success, two qualitative studies emerged describing student's views on NCLEX-RN failure. Eddy and Epeneter (2002) ( $N=19$ ) and Griffiths, Papastrat, Czekanski, and Hagan (2004) ( $N=21$ ) conducted phenomenological studies, which revealed student's felt unprepared to take the NCLEX-RN, held others accountable for their failure, and the inability to manage stress. Student reporting of their experiences adds another dimension in the evaluation and prediction of student nurse success and achieving an RN licensure.

Recognizing opportunities for early intervention is essential in two-year ADN programs. Providing standardized nursing exams assists nursing schools in identifying students who are at-risk academically, and will likely require remediation to be successful. This study assists ADN programs in recognizing nursing students who will most likely be successful in completing a nursing program, pass the NCLEX-RN, thereby alleviating the nation's severe nursing shortage. Using standardized nursing exam scores to predict which students would most benefit from timely remediation could be a highly successful strategy in decreasing attrition in nursing programs. The review demonstrates inconsistent strategies predictive of student completion of a nursing program and success on the NCLEX-RN. This investigation supports the continuation of further research of the predictive accuracy of the HESI A<sup>2</sup>, MC, E<sup>2</sup> exams, and NCLEX-RN outcomes, thereby supporting of the use of successive standardized exams in an ADN programs to promote student retention and alleviate the severe nursing shortage which plagues the country.

## CHAPTER 3

### PROCEDURE FOR COLLECTION AND TREATMENT OF DATA

A descriptive longitudinal study design was used to examine the relationship of the scores of the HESI A<sup>2</sup> to the MC, the MC to the E<sup>2</sup>, and the E<sup>2</sup> to the NCLEX-RN, of an associate degree in nursing program (ADN) with an integrated nursing curriculum. This study design was used to explain a problem or concept within a given population as it currently exists using data that have been gathered about variables of interest (Brink & Wood, 1998). Demographic student data was collected to describe the student population. The relationship of poor academic performance and A<sup>2</sup> score outcomes to student attrition was described. Data was exported from the HESI database into a spreadsheet. The NCLEX-RN results were available from the National Council for State Boards of Nursing (NCSBN) (2005) in a report that is accessible to the investigator.

#### Setting

The setting was an ADN program of a large community college district in southeast Texas. The college district has two campuses, located approximately 20 miles apart, each with an ADN program which use the same integrated nursing curriculum. Nursing program demographics are similar, and students select which campus they would like to attend. The ADN program was led by one nursing director with nursing coordinators at each program location. Both programs required the same prerequisites, admission criteria, grading, graduation policies, and is five semesters in length. The

combined program accept 139 students annually, but has recorded up to a 70% attrition rate.

### Population and Sample

The study sample included a cohort of 139 students who took the HESI A<sup>2</sup>, MC, E<sup>2</sup>, and NCLEX-RN from August 2002 through October 2004. The sample was representative of the student population and was comparable in size to six previous study samples.

### Protection of Human Subjects

This study was approved by the Texas Woman's University Institutional Review Board, Houston (Appendix A). The research utilized standardized exam scores housed in an existing database. Each subject in the database has been stripped of student identifiers. There was no direct participation by the students. The only basis for exclusion was an incomplete data record. Permission for database use was obtained from the college district (Appendix B). Approval for access to HESI exam scores was also obtained (Appendix C).

### Instruments

Demographic data describing student age, ethnicity, marital status, and English as a Second Language (ESL) status at the time of entry into the ADN program was gathered from a self-reported demographic form voluntarily completed by each individual student of the cohort study group. Instruments for this study included the scores of the HESI A<sup>2</sup>,

administered August 2002, the MC, administered April 2003, the E<sup>2</sup>, administered March 2004, and results of the NCLEX-RN, taken June 2004 through October 2004.

The HESI A<sup>2</sup> is an entrance test that includes math and reading comprehension exam scores that are reported as a composite score, and used as part of the admission process in the ADN program. Seventy percent (70%) is the established passing score for students in the ADN program. A<sup>2</sup> exam reliability is established by calculating the Kuder Richardson Formula 20 (KR 20). For the A<sup>2</sup> exams, the reliability estimates for the A<sup>2</sup> Math exam KR 20 is 0.93, and the A<sup>2</sup> Reading Comprehension Exam KR 20 is 0.90 (Murray, Yoho, & Nibert, 2005). Content validity of the HESI A<sup>2</sup> exam was accomplished by having expert nurse clinicians write and evaluate test items.

The HESI MC is a customized exam that is taken at the end of the first year of the two year program of study. Reliability estimates are based on prior usage of questions on exams, and are recalculated after the exam is administered and scored. Discrimination data are ascertained by calculating the point biserial correlation coefficient. Overall exam reliability is established by calculating the KR 20. The custom-made MC exam KR 20 was 0.919 (A. Nibert, personal communication, May 9, 2006). Content validity was accomplished by having expert nurse clinicians write and evaluate test items relevant to the level of nursing practice being tested. Construct validity is inferred in the respect that test items are written according to nursing practice as defined by the NCSBN and NCLEX-RN test plans (Morrison, Adamson, Nibert, & Hsia, 2004; NCSBN, 2005).

The E<sup>2</sup> exit exam was taken at program completion. As with the MC exam, reliability estimates are based on calculating the point biserial correlation coefficient and prior usage of questions on exams which varies from 180 to 47,320 uses (Morrison, Adamson, Nibert, & Hsia, 2004). Overall exam reliability was calculated with the KR 20 which is  $r = .90$  (A. Nibert, personal communication, May 9, 2006). Content validity and construct validity are inferred in the same respect as the MC. Criterion-related validity is demonstrated with research studies which have shown predictive accuracy E<sup>2</sup> scores to the NCLEX-RN scores, ranging from 96.36% to 98.30% (Lauchner, Newman, & Britt, 1999; Newman, Britt, & Lauchner, 2000; Nibert & Young, 2001; Nibert, Young, & Adamson, 2002; Lewis, 2005). Scores for the MC and E<sup>2</sup> exams are reported in categories, ranging from A/B, the highest scoring category, to H, the lowest scoring category, and are located in Table 2. Scoring intervals A/B, and C are identified as passing scores for the HESI MC and E<sup>2</sup> exams in the ADN program studied.

NCLEX-RN, the national licensure exam for students who graduate from ADN, BSN, and Diploma nursing programs, reports exam results as either pass or fail. Competency level must be at least at minimum to pass the exam. Reliability of the NCLEX-RN is evaluated with a decision consistency statistic (NCSBN, 2005), which is psychometrically reliable between .87 and .92. The NCLEX-RN results reflect either the possibility the graduate's true ability is above passing or their true ability is below passing. Content validity is established by having questions developed by panels of nurses with various backgrounds, covering all fields of nursing for entry-level practice.

Table 2.

*HESI Mid-Curricular and Exit Exam Scoring Intervals*

Category/Year	1996-2003 score interval	2004-present score interval
Category A/B	90.00-99.99	900-uncapped (~1300)
Category C	85.00-89.99	850-899
Category D	80.00-84.99	800-849
Category E/F	70.00-79.99	700-799
Category G/H	< or = 69.99	< or = 699

Each exam consists of 15 pilot questions, which are tracked for analysis by NCSBN (NCSBN, 2005).

Data Collection

Data were derived from the HESI exam databases, which consisted of exact student exam scores. Student confidentiality was protected by placing only the exam scores into a spreadsheet. Students leaving the program during the study period were included in the analysis up to their point of program exit. Students who have incomplete score records were not included in the analysis.

*Pilot Study*

A descriptive, longitudinal study design was used to examine the relationship of the scores of the HESI A<sup>2</sup> to the MC, the MC to the E<sup>2</sup>, and the E<sup>2</sup> to the NCLEX-RN, of

an ADN program which utilizes an integrated nursing curriculum. The pilot study was approved in an exempt review by the Texas Woman's University Institutional Review Board, Houston. Data included scores of 141 students who took the HESI A<sup>2</sup>, MC, E<sup>2</sup> and NCLEX-RN exams from August, 2001 through October, 2003. Data were exported from the HESI database into a spreadsheet. The NCLEX-RN results were acquired from the National Council of State Boards of Nurses (NCSBN) NCLEX-RN Results Report. Tests for reliability included the Kuder Richardson Formula 20 (KR-20) for each exam, and the point biserial correlation coefficient for each exam item. Criterion-related validity established from the analysis of E<sup>2</sup> scores for NCLEX-RN prediction, as identified in previous HESI predictability studies, range from 96.49% to 98.46% (Nibert, Young, & Adamson, 2002).

Data analysis revealed the A<sup>2</sup> was poorly predictive of MC success with predictive accuracy rate of 21.6%. The MC was fairly accurate, at a rate of 77.8%, in predicting E<sup>2</sup> success. The E<sup>2</sup> was highly predictive of NCLEX-RN success at a rate of 95.5%. A Chi Square Goodness of Fit test was used to describe the relationship between achieving a passing score on the HESI A<sup>2</sup> and program attrition. Results of the Chi Square Goodness of Fit computation revealed a significant difference  $\chi^2(1, N = 141) = 6.596, p = .010$ . A greater number of students who were successful on the A<sup>2</sup> exam left the program than stayed. The attrition rate was 70.9%.

The pilot study demonstrated that providing standardized nursing exams in ADN programs assisted nursing schools in identifying students who are at-risk academically,

and will likely require remediation to be successful. Using standardized nursing exam scores to predict which students would most benefit from timely remediation could be a highly successful strategy in decreasing attrition in nursing programs. Demographic data were not collected in the pilot study. A demographic database, developed by the investigator, was an addition to this study, in order to more explicitly describe the characteristics of the students whose exam scores were studied.

#### Treatment of Data

Demographic information were analyzed using frequencies and percentages. Research Question 1, which examines the predictive accuracy of the A<sup>2</sup> to the MC, was analyzed by calculating the number of students scoring at or above a score of 70% for the combined A<sup>2</sup> math exam and reading comprehension exam scores but not achieving a benchmark score of 850 or greater on the MC exam was divided by the total number of students predicted to receive a benchmark score on the MC exam and subtracting from 1.

To answer Research Question 2, and examine the predictive accuracy of the MC to the E<sup>2</sup>, the number of students scoring 850 or greater for the MC but not achieving a benchmark score of 850 or greater on the E<sup>2</sup> exam was divided by the number of students who were predicted to receive a benchmark score on the E<sup>2</sup> exam and subtracting from 1.

In order to answer Research Question 3, and examine the predictive accuracy of the E<sup>2</sup> to the NCLEX-RN, the number of students scoring a benchmark score of 850 or greater on the E<sup>2</sup> exam who failed the NCLEX-RN was divided by the number of these students who were predicted to pass the NCLEX-RN and subtracting from 1.

To examine the fourth research question, a Chi Square Goodness of Fit calculation was used to evaluate the relationship between achieving a passing score of the HESI A<sup>2</sup> math and reading comprehension exams and program attrition for poor academic performance. Program attrition were determined by summing the number of students who entered the nursing program as a cohort, and dividing by the total number of students who do not complete the ADN program at the time scheduled for the cohort completion.

## CHAPTER 4

### ANALYSIS OF DATA

A descriptive, longitudinal study design was used to examine the predictive accuracy and the relationship of the scores of the Health Education Systems, Inc. (HESI) Admission Assessment Exam (A<sup>2</sup>) to the Mid-Curricular Exam (MC), the MC to the Exit Exam (E<sup>2</sup>), and the E<sup>2</sup> to the National Council Licensure Examination for Registered Nurse (NCLEX-RN) of an associate degree in nursing program (ADN) with an integrated nursing curriculum. No previous studies have been conducted which analyzed the predictive accuracy of standardized or nationally-normed exams throughout an ADN program, from admission to NCLEX-RN. Five HESI E<sup>2</sup> validity studies have demonstrated predictive accuracy calculations of the E<sup>2</sup> to the NCLEX-RN ranging from 96.49% to 98.46% for combined baccalaureate, associate degree, and diploma program students, and 95.67% to 99.5% specifically for ADN program students (Lauchner, Newman, & Britt, 1999; Newman, Britt, & Lauchner, 2000; Nibert & Young, 2001; Nibert, Young, & Adamson, 2002; Lewis, 2005). This chapter also addresses the description of the study cohort and the results of the data analysis.

#### Description of the Sample

The study sample included a cohort of 139 students who took the HESI A<sup>2</sup>, MC, E<sup>2</sup>, and NCLEX-RN from August 2002 through October 2004. The student sample included those who successfully completed the ADN program or left the program due to

poor academic performance. Students who left the program during the study period were included in the analysis up to their point of program exit. At the end of the study, a total of 77 students remained in the sample cohort. Data were derived from the HESI exam databases, which consists of exact student exam scores. NCLEX-RN results were acquired from the National Council of State Boards of Nurses (NCSBN) NCLEX-RN Results Report (2005). Student confidentiality was protected by placing only the exam scores into the spreadsheet.

The student sample consisted of 10% males ( $n = 14$ ) and 90% females ( $n = 125$ ), with 18.8% self-identified English as their second language (ESL) ( $n = 22$ ). Of these students, 20.86% were less than 25 years of age, 51.08% were 25-34 years of age 21.58% were age 35-44 years of age, and 6.48% were 45-54 years of age ( $M = 31.0$ ,  $Md = 29.5$ ,  $SD = 6.06$ ). Marital status revealed 61.15% were married, 36.69% were single, and 2.16% were divorced. The ethnicity included 60.43% Caucasian, 11.51% Hispanic, 9.35% Black American, 7.91% African American, 7.20% Asian, 2.16% American Indian, and 1.44% International. Table 3 illustrates the demographic description of the sample.

## Findings

### *Predictive Accuracy*

Three research questions addressed the predictive accuracy of HESI exams. Predictive accuracy is the percentage of occurrences of the  $A^2$  scoring interval successfully predicting the student's MC score, the percentage of occurrences of the MC scoring interval successfully predicting the student's  $E^2$  score, and the percentage of

Table 3.

*Demographic Description of Student Sample (n=139)*

Demographics	Frequency	Percentage
<b>Age</b>		
24 and under	29	20.86%
25-34	71	51.08%
35-44	30	21.58%
45-54	9	6.48%
<b>Marital Status</b>		
Married	85	61.15%
Single	51	36.69%
Divorced	3	2.16%
<b>Ethnicity</b>		
Caucasian	84	60.43%
Hispanic	16	11.51%%
Black American	13	9.35%%
African American	11	7.91%
Asian	10	7.20%
American Indian	3	2.16%
International	2	1.44%

occurrences of the E<sup>2</sup> scoring interval successfully predicting the student's NCLEX-RN score.

The first research question addressed the predictive accuracy of the HESI A<sup>2</sup> math and reading comprehension exams in predicting benchmark scores on the HESI MC exam for students in an ADN program. A total of 139 students took the HESI A<sup>2</sup> math and reading sub-tests. By the end of the first year of the ADN program 101 students took the MC exam. Based on their A<sup>2</sup> scores, 97 of these students were predicted to pass the MC exam. Of these 97 students, 77 who were predicted to pass the MC did not achieve a MC benchmark score of 850 or greater. The predictive accuracy of the A<sup>2</sup> to the MC exam was 20.62%.

To answer the second research question, and examine the predictive accuracy of the MC to the E<sup>2</sup>, the number of students scoring 850 or greater for the MC but not achieving a benchmark score of 850 or greater on the E<sup>2</sup> exam were divided by the number of students who were predicted to receive a benchmark score on the E<sup>2</sup> exam and subtracting from 1. A total of 77 students took the HESI E<sup>2</sup> exam. Based on these their MC scores, 22 of these students were predicted to pass the E<sup>2</sup> exam. Of these 22 students, all 22 who were predicted to pass the E<sup>2</sup> achieved the E<sup>2</sup> benchmark score of 850 or greater. The predictive accuracy of the MC to the E<sup>2</sup> exam was 100%.

Research question 3 examined the predictive accuracy of the E<sup>2</sup> to the NCLEX-RN. The number of students who scored a benchmark score of 850 or greater on the E<sup>2</sup> exam and failed the NCLEX-RN were divided by the number of students who were

predicted to pass the NCLEX-RN and subtracting from 1. A total of 77 students took the E<sup>2</sup> exam. Based on their E<sup>2</sup> scores, 58 of these students were predicted to pass the NCLEX-RN. Of these 58 students, 55 students passed the NCLEX-RN with the benchmark score of 850 or greater. The predictive accuracy of the E<sup>2</sup> to the NCLEX-RN was 94.82%.

### *Attrition*

Nursing program attrition rate is the percentage of students in a given cohort who do not progress from one point in the program to the next point in the program without interruption. Program attrition was determined by summing the number of students who entered the nursing program as a cohort, and dividing by the total number of students who do not complete the ADN program due to poor academic performance at the time scheduled for the cohort to complete the program. Of the 139 students in the ADN initial cohort, 62 left the program due to poor academic performance, over the program duration, demonstrating a 44.60% attrition rate. The remaining 77 students successfully completed the ADN program and took the NCLEX-RN after their graduation. The NCLEX-RN pass rate for first-time test-takers was 92.20% ( $n = 71$ ).

To examine the fourth research question, a Chi Square Goodness of Fit calculation was used to evaluate the relationship between achieving a combined passing score of 70% on the HESI A<sup>2</sup> math and reading comprehension exam sub-tests and program attrition for poor academic performance. The analysis was non-significant and indicated that A<sup>2</sup> scores did not predict student success or failure in the first year of the

indicated that A<sup>2</sup> scores did not predict student success or failure in the first year of the ADN program. Table 4 describes the relationship between achieving a combined passing score of 70% on the HESI A<sup>2</sup> math and reading comprehension exam sub-tests and program attrition.

Table 4

*The relationship between achieving a combined passing score of 70% on the HESI A<sup>2</sup> math and reading comprehension exam sub-tests and program attrition (n = 139).*

A <sup>2</sup> scores	Status in Program	
	Remained	Left
< 70	3 (2.2%)	7 (5.0%)
70 or >	74 (53.2%)	55 (39.6%)

#### Summary of the Findings

Data analysis revealed that the A<sup>2</sup> Math and Reading Comprehension sub-exam scores were poorly predictive of MC success with a predictive accuracy of 20.6%. The MC was extremely predictive (100%) in predicting E<sup>2</sup> success. The E<sup>2</sup> was highly predictive of NCLEX-RN success at a predictive accuracy of 94.82%. A Chi-square Goodness of Fit calculation was used to analyze the exams and attrition from the program due to poor academic performance, but no statistically significant relationship between these variables was observed. The nursing program attrition rate was 44.60%.

## CHAPTER 5

### SUMMARY OF THE STUDY

The purpose of this study was to determine the predictive accuracy of three standardized exams produced by Health Education Systems, Inc. (HESI) and used in an ADN program located in the southwestern U.S.A. Predictive accuracy was assessed to test the ability of the HESI Admissions Assessment Exam (A<sup>2</sup>) to predict performance on the HESI Mid-Curricular Exam (MC), the ability of the MC to predict performance on the HESI Exit Exam (E<sup>2</sup>), and the ability of the E<sup>2</sup> to predict performance on the National Council Licensure Examination for Registered Nurses (NCLEX-RN). The study also described the relationship between achieving a passing score on the HESI A<sup>2</sup> math and reading comprehension exams and program attrition due to poor academic performance. The assessment of standardized examinations may assist administrators of ADN programs in identifying nursing students who will most likely be successful in completing the nursing program, passing the NCLEX-RN, thereby helping to alleviate the nation's overwhelming deficit of nurses. This chapter contains a summary of the investigation, a discussion of findings, conclusions, implications, and recommendations for further study.

#### Summary

A descriptive, longitudinal study design was used to examine the predictive accuracy and examine the relationship of the scores of the Health Education Systems,

Inc. (HESI) Admission Assessment Exam (A<sup>2</sup>) to the Mid-Curricular Exam (MC), the MC to the Exit Exam (E<sup>2</sup>), and the E<sup>2</sup> to the National Council Licensure Examination for Registered Nurse (NCLEX-RN) of an associate degree in nursing program (ADN) with an integrated nursing curriculum. Data were derived from the HESI exam databases, which consists of exact student exam scores. NCLEX-RN results were acquired from the National Council of State Boards of Nurses (NCSBN) NCLEX-RN Results Report (2005). Student confidentiality was protected by placing only the exam scores into a spreadsheet.

The sample included a cohort of 139 students who took the HESI A<sup>2</sup>, MC, E<sup>2</sup>, and NCLEX-RN from August 2002 through October 2004. A demographic database was developed by the investigator in order to more explicitly describe the characteristics of the students whose exam scores were studied. Descriptive data of the student sample consisted of gender, age, marital status, and ethnicity. The student sample was described as predominately female (90%,  $n = 125$ ), 51.08% were 25-34 years of age ( $n = 71$ ), as compared to 20.86% were less than 25 years of age ( $n = 29$ ), 21.58% were age 35-44 years of age ( $n = 30$ ), and 6.48% were 45-54 years of age ( $n = 9$ ). Most students were married ( $n = 85$ , 61.15%), with 36.69% single ( $n = 51$ ) and 2.16% divorced ( $n = 3$ ). The ethnicity included 60.43% Caucasian ( $n = 84$ ), 11.51% Hispanic ( $n = 16$ ), 9.35% Black American ( $n = 13$ ), 7.91% African American ( $n = 11$ ), 7.20% Asian ( $n = 10$ ), 2.16% American Indian ( $n = 3$ ), and 1.44% International ( $n = 2$ ).

The student sample included those who successfully completed the ADN program or left the program due to poor academic performance. Students who left the program during the study period were included in the analysis up to their point of program exit. Of the 139 students in the ADN initial cohort, 62 students left the program due to poor academic performance, over the program duration, demonstrating a 44.60% attrition rate. The remaining 77 students successfully completed the ADN program and took the NCLEX-RN after their graduation.

The A<sup>2</sup> exam was used as part of the ranking criteria for nursing program admission. The predictive accuracy of the A<sup>2</sup> to the MC was 20.62%. Data analysis revealed the A<sup>2</sup> was poorly predictive of MC success. Students who both passed and failed the A<sup>2</sup> left the ADN program due to poor academic performance.

The predictive accuracy of the MC to the E<sup>2</sup> was 100%. The MC exam was custom designed by HESI and developed using the first year syllabi of the ADN program's integrated curriculum. Nursing students were required to participate in a review of content area weakness as identified by the MC results summary. Faculty met with each student who did not achieve the benchmark score of 850 to identify content areas for individualized remediation.

E<sup>2</sup> scores for NCLEX-RN prediction, as identified in five previous HESI predictability studies, range from 96.49% to 98.46% for combined baccalaureate, associate degree, and diploma program students, and 95.67% to 99.5% specifically for ADN program students (Lauchner, Newman, & Britt, 1999; Newman, Britt, & Lauchner,

2000; Nibert & Young, 2001; Nibert, Young, & Adamson, 2002; Lewis, 2005). The predictive accuracy of this study revealed the E<sup>2</sup> was highly predictive of NCLEX-RN success at a predictive accuracy of 94.82%. Students who did not achieve the benchmark score of 850 participated in mandatory remediation of content area weaknesses as identified on the E<sup>2</sup> results summary. According to program policy, students had to achieve the benchmark score for progression in the nursing program. Students who were unsuccessful on the first attempt were given additional opportunities to retest with alternate versions of the E<sup>2</sup> exam.

A Chi Square Goodness of Fit test was used to describe the relationship between achieving a passing score on the HESI A<sup>2</sup> and program attrition. Results of the Chi Square Goodness of Fit computation were not significant. The ADN program utilized the combined score of the HESI A<sup>2</sup> math and reading comprehension exam sub-tests as part of their admissions criteria. Though 70% was considered a benchmark score for passing the exam, the student's A<sup>2</sup> exam, regardless if the score met the benchmark, was entered into the nursing program admission ranking tool.

### Discussion of the Findings

#### *Predictive Accuracy*

The HESI A<sup>2</sup> exam is designed to provide a composite score of seven academic exams: math, reading comprehension, vocabulary and general knowledge, chemistry, biology, and anatomy and physiology. The ADN program utilized the HESI A<sup>2</sup> math and reading comprehension exams as part of an assessment tool for ranking students into the

ADN program. In this study the predictive accuracy of the A<sup>2</sup> to the MC was low (20.62%), with an attrition rate of 27.34% during the first year of the program. Only two A<sup>2</sup> subtests were used in this study, whereas greater predictability may have been achieved by testing students with all A<sup>2</sup> academic exams. While combined and individual composite scores of A<sup>2</sup> subtests are available, HESI's recommendation is to test students using all the A<sup>2</sup> exams, and utilize this composite score to determine which students may benefit from enrichment courses, tutoring in study skills and basic knowledge courses, and other remediation strategies (Murray, Yoho, & Nibert, 2005).

The review of literature demonstrated academic assessment strategies to be non-predictive of student completion of a nursing program and success on the NCLEX-RN. Significant to the predictive accuracy of the A<sup>2</sup> to the MC is the predictability of the mathematics and reading comprehension subsets scores of the NET and RNEE exams (Gallagher, Bomba, & Crane, 2002) and the Nelson Denny Reading Test to the success on NCLEX-RN (Cloud-Hardaway, 1988), which were found to be inconsistently predictive of student success in nursing programs. Another reason for poor performance on the MC may relate to the score not having a consequence, as students took the exam as only an evaluation for their current academic status mid-way through the program. Hence, students may have not prepared adequately for the exam or taken it seriously. The A<sup>2</sup> may not be a poor predictor, and student performance may have improved if the MC score was connected to a grade or progression consequence.

The ADN program established a benchmark score of 850 for the customized MC exam. The predictive accuracy of the MC to the E<sup>2</sup> was 100%. Few students ( $n = 22$ ) achieved the benchmark score of 850 or greater, which may represent academically stronger students. Murray (Murray, Yoho, & Nibert, 2005) conducted a study of 52 ADN students which specifically addressed the use of HESI examinations used throughout an ADN program. In this study, the program's Custom 1 Exam did not significantly correlate to the student's final course grades in one of three courses the exam was designated to evaluate. Custom Exams 2 and 3 achieved significant correlation ( $p = .01$ ) with the ADN program exams.

Nursing students in this sample were required to achieve the benchmark score of 850 on the E<sup>2</sup>. Students who did not achieve the benchmark score were required to participate in individualized review of content area weaknesses as identified by the exam results. Per program policy, the E<sup>2</sup> exam benchmark score was required for student progression. The predictive accuracy of the E<sup>2</sup> to the NCLEX-RN was 94.82% ( $n = 58$ ), which was congruent with other studies. ADN students in Murray's study (Murray, Yoho, & Nibert, 2005) achieved a 96.43% predictive accuracy of E<sup>2</sup> to NCLEX-RN ( $n = 29$ ). Likewise, E<sup>2</sup> scores for NCLEX-RN prediction, as identified in five previous HESI predictability studies, ranged from 96.49% to 98.46% for combined baccalaureate, associate degree, and diploma program students, and 95.67% to 99.5% specifically for ADN program students (Lauchner, Newman, & Britt, 1999; Newman, Britt, & Lauchner, 2000; Nibert & Young, 2001; Nibert, Young, & Adamson, 2002; Lewis, 2005).

The MC and E<sup>2</sup> predictive accuracy results suggest these exams are more predictable of success when utilized as successive standardized exams. Findings are supported by the key assumption that using standardized successive exams in an ADN program will provide predictive information of the student's ability to be successful in the nursing program, the need for additional support or remediation to be successful, and ultimately passing the NCLEX-RN and obtaining licensure.

### *Attrition*

Nursing program attrition rate is the percentage of students in a given cohort who do not progress from one point in the program to the next point in the program without interruption. Program attrition was determined by summing the number of students who entered the nursing program as a cohort, and dividing by the total number of students who do not complete the ADN program due to poor academic performance at the time scheduled for the cohort completion. ADN program attrition rates have been reported as high as 70% (Johnson, 2003). Of the 139 students in the ADN study cohort, 62 left the program due to poor academic performance, demonstrating a 44.61% attrition rate. The remaining 77 students successfully completed the ADN program and took the NCLEX-RN after graduation. The NCLEX-RN pass rate for first-time test-takers was 90.90%.

In this study, the A<sup>2</sup> math and reading comprehension scores did not predict student attrition due to poor academic performance. There has been minimal success discovering program admission predictors which relate to nursing student retention. Woodham and Taube (1986) found that math scores on the SAT were not predictors of

NCLEX-RN success. Similarly, ACT Mathematics, English and composite scores were also found non-predictive of passing the NCLEX-RN (Lengacher & Keller, 1990; Anderson, 1993; Milam, 1997; Swenty, 1998). Studies comparing the Mosby AssessTest, the Entrance Exam for Nursing Schools (RNEE), the Nurse Entrance Exam (NET), and the Watson-Glaser Critical Thinking Appraisal (WG) with NCLEX-RN success for ADN students have demonstrated mixed results (Cloud-Hardaway, 1988; Daley, Kirkpatrick, Frazier, Chung, & Moser, 2002; Gallagher, Bomba, & Crane, 2001; Swenty, 1998; Yellen & Geoffrion, 2001; Silage, 2002; Gallagher, Bomba, & Crane, 2001; and Gross, Takazawa, & Rose, 1987). Exams historically used to predict student successes in nursing programs are knowledge-based, which may not reflect the critical-thinking skills required for achievement throughout the nursing curriculum.

In an attempt to identify students who were at risk for nursing program and NCLEX-RN failure, the ADN faculty implemented benchmark scores for the MC and E<sup>2</sup> exams, mandatory remediation for students who did not achieve the benchmark scores, and a progression policy for the E<sup>2</sup> exam. These attempts to decrease student attrition and NCLEX-RN failure were supported in the review of literature by Nibert, Young, and Adamson (2002), noting that many schools of nursing have implemented policies for progression and remediation benchmarks. Morrison, Free, and Newman (2002) studied five schools of nursing which had implemented progression policies relating to the HESI E<sup>2</sup> exam and compared NCLEX-RN pass rates before and after remediation policy implementation. School pass rates consistently improved by 9%, 12%, 19%, 22%, 34%,

36%, and 41% respectively within two years of implementing the progression policy, demonstrating the effectiveness of the progression policy, which motivated students to prepare for the HESI E<sup>2</sup> exam, and eventually the NLCEX-RN.

### Conclusions and Implications

Findings from this investigation support the following conclusions:

1. A<sup>2</sup> math and reading comprehension subtest scores are insufficient predictors of potential academic success as indicated by MC scores.
2. The MC was extremely predictive of nursing student success on the E<sup>2</sup>.
3. The E<sup>2</sup> was highly predictive of nursing student success on the NCLEX-RN.
4. Applicant A<sup>2</sup> math and reading comprehension scores were insufficient indicators of potential student attrition from the ADN program for poor academic performance.

Several implications can be derived from this study. Findings revealed the A<sup>2</sup> math and reading comprehension exam scores were not predictive of success on the MC or in the nursing program. Nursing faculty should consider using the composite score of all A<sup>2</sup> academic exams as an applicant evaluation instrument, rather than using only math and reading comprehension subtest scores. Utilizing all A<sup>2</sup> exams may attenuate the score, and decrease the risk of an individual score positively or negatively impacting the composite score. Likewise, attaching an academic consequence to the results of the MC may improve student performance.

The predictive accuracy of the MC to the E<sup>2</sup> and the E<sup>2</sup> to the NCLEX-RN were highly predictive. For students who do not achieve the benchmark score on the MC and E<sup>2</sup>, mandatory individualized remediation in weak content areas should be required. The literature demonstrated students with low MC and E<sup>2</sup> scores benefited from remediation and improved future test performances.

An additional consequence was attached to the E<sup>2</sup> exam. According to program policy students were required to achieve the benchmark score for progression in the nursing program, graduation, and permission to take the NCLEX-RN. Students who were unsuccessful on the first attempt were given additional opportunities to retest with alternate versions of the E<sup>2</sup>. For this student cohort, all students successfully graduated from the ADN program after achieving a benchmark score on a subsequent version of the E<sup>2</sup> exam.

### Recommendations for Further Study

Suggestions for future research are as follows:

1. Further research is needed to establish the predictive accuracy of the A<sup>2</sup> to the MC exam utilizing the composite score of seven academic exams: Math, Reading Comprehension, Vocabulary and General Knowledge, Chemistry, Biology, and Anatomy and Physiology, as a means for predicting student success in the first year of a nursing program.
2. The effectiveness of attaching a consequence to a MC benchmark score or the benchmark score attached to a course grade should be examined. Student

remediation at mid-point in the nursing curriculum using the MC results should also be studied as an intervention for student success on the E<sup>2</sup>.

3. The effectiveness of establishing a benchmark score for the E<sup>2</sup> exam, mandatory remediation for students who did not achieve the benchmark score, and progression policies related to the E<sup>2</sup> exam as strategies to predict NCLEX-RN success for students in initial licensure nursing programs should be explained.
4. Success on the NCLEX-RN should be examined for students who retest the E<sup>2</sup> with a different version. Remediation plans for success on subsequent E<sup>2</sup> exams should also be evaluated.
5. The effectiveness of successive standardized exams from admission to graduation in ADN, BSN, and Transition-to-RN programs needs explained. Further study is needed to trend this strategy to increase program retention and success on the NCLEX-RN.

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APPENDIX A

Texas Woman's University IRB Approval

**MEMORANDUM**

**TO:** Anne Young  
Mary J. Yoho  
Student ID #0671188

**FROM:** IRB

**DATE:** August 7, 2006

**SUBJECT:** IRB Exempt Application

**TITLE:** The predictive accuracy of HESI A<sup>2</sup>, MC and E<sup>2</sup> exams on successive HESI exam scores and NCLEX-RN outcomes in an associate degree nursing program

This application is approved. This approval lasts for 1 year. The study may not continue after the approval period without additional IRB review and approval for continuation. It is your responsibility to assure that this study is not conducted beyond the expiration date.

Any changes in the study must receive review and approval prior to implementation unless the change is necessary for the safety of subjects. In addition, you must inform the IRB of adverse events encountered during the study or of any new and significant information that may impact a research participant's safety or willingness to continue in your study.

## APPENDIX B

Agency Permission, North Harris Montgomery Community College District



November 18, 2004

NORTH HARRIS MONTGOMERY COMMUNITY COLLEGE DISTRICT  
District Services and Training Center  
5000 Research Forest Drive  
The Woodlands, Texas 77381-4356  
832.813.6500

Anne Young, EdD, RN  
Professor and Doctoral Program Coordinator  
College of Nursing  
Texas Woman's University  
1130 John Freeman Blvd.  
Houston, TX 77030-2597

Re: Approval for Dissertation Data Collection

Dear Dr. Young:

This letter is in support of Mary J. Yoho, RN, MSN, doctoral in nursing student at Texas Woman's University, Houston, and director of nursing programs at Tomball College. Ms. Yoho has our approval to use exam scores from HESI Admissions Assessment, Mid-curricular, and Exit exams of nursing students who attend or have attended the North Harris Montgomery Community College District associate degree in nursing programs. No identifying information such as student names or social security numbers will be required for data analysis.

This study is timely as it will assist faculty in identifying nursing students who will most likely be successful in completing a nursing program and passing the NCLEX-RN. The study will also identify nursing students who are at risk academically and those requiring remediation to be successful. Using standardized nursing exam scores to predict which students would most benefit from remediation could be a highly successful strategy in decreasing attrition in nursing programs. A higher graduate rate will benefit the community by reducing the nursing shortage.

I look forward to reviewing the results of this study. If you need further information, please contact me at 832.813.6597.

APPENDIX C

Agency Permission, Health Education Systems, Inc. (HESI)



November 21, 2003

Anne Young, EdD, RN  
Professor and Doctoral Program Coordinator  
College of Nursing  
TEXAS WOMAN'S UNIVERSITY  
1130 John Freeman Blvd.  
Houston, TX 77030-2597

Re: Approval for Dissertation Data Collection for Mary Yoho

Dear Dr. Young:

This letter indicates my unconditional approval for Ms. Mary Yoho, MSN,RN, doctoral student enrolled in your program in the College of Nursing at TWU, to collect data for her dissertation study stored within the Health Education Systems, Inc. (HESI) computerized database. Ms. Yoho will be using test scores obtained for administrations of the HESI Admissions Assessment, Mid-curricular Exam, and Exit Exam for several cohorts of students in the nursing programs offered by the Montgomery County Community College district. Ms. Yoho currently serves as the director of the associate degree nursing program at Tomball College, and has received permission from her superiors at the College to complete this study. No identifying information, such as student names, will be required for the data analysis. I am pleased that Ms. Yoho has chosen to conduct this study regarding effectiveness of the three HESI exams administered within the nursing curricula in her district, and look forward to reading the final report of her findings and related analysis. Please do not hesitate to contact me at 713-838-7787, or via e-mail, [susanm@hesitest.com](mailto:susanm@hesitest.com), if you have any questions regarding this approval.