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NCLEX-RN® Success: Are There Predictors

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Abstract

Student success on the National Council Licensure Examination for Registered Nurses (NCLEX-RN®, hereafter NCLEX-RN) examination is of paramount importance to both nursing students and nursing schools. Knowing which factors may influence success is helpful to schools of nursing in making decisions about admission requirements and curriculum. This work provides an analysis of variables from a baccalaureate nursing program used to determine predictors of NCLEX-RN® success and subsequent changes to admission requirements and curriculum. NCLEX-RN® pass rates are of interest to the faculty in professional nursing programs, institutions, and the profession, as they represent a measure of faculty and program effectiveness; accreditation agencies and state boards of nursing expect graduate success; and the profession of nursing needs prepared practitioners as it faces a shortage of licensed professional nurses in the workplace. NCLEX-RN® pass rates are of special interest to potential students who may choose a program due to reported rates, and graduates who are not successful may face anxiety and financial loss.

Keywords: NCLEX-RN®, nursing, logistic regression

NCLEX-RN® Success: Are There Predictors

The National Council Licensure Examination for Registered Nurses (NCLEX-RN®, hereafter NCLEX-RN) was instituted in 1984, moved to computerized testing (CAT) in 1994, increased in difficulty in 1998, 2004,⁷ and again in 2010. Since the beginning of licensure examinations for nurses, there has been variable interest in studying factors related to pass rates with interest heightened during periods of declining pass rates. Success on this examination has widespread ramifications for students, nursing schools, and employers. The stakes are high related to first-time pass rates. The identification of

factors affecting NCLEX-RN success is useful for nursing schools in making decisions about admission requirements and curriculum issues.

Variables associated with performance on the NCLEX-RN may be categorized as academic and nonacademic. Academic variables include scores on the Scholastic Aptitude Test (SAT) or the American College Test (ACT), performance in pre-nursing courses and selected nursing courses, and scores on standardized nursing assessment tests. Nonacademic variables associated with NCLEX-RN® performance include the taker's age, gender, ethnicity, English as the primary language, and critical thinking skills.⁴

The purpose of this study was to examine student academic variables from a baccalaureate nursing program to determine which factors may be predictive of student success on the NCLEX-RN examination. This nursing program, like many others, saw a decline in NCLEX pass rates after the difficulty of the examination was increased in 2004. Rather than attempting to make changes to the curriculum haphazardly, the faculty decided to do a systematic assessment of variables that could be influencing the pass rates. Systematic assessment provides evidence so that students who are at risk for failure can be identified early and remediation and/or curriculum changes may be instituted.

Review of Literature

Beeman and Waterhouse used a convenience sample of 289 baccalaureate nursing students who graduated between 1995 and 1998 to examine predictors of success or failure on the NCLEX-RN examination.¹ The most significant predictor of NCLEX-RN failure was the number of C+ or lower grades received in nursing theory courses ($r = -.394$, $P < .0001$). Higher grades in other core nursing courses and pathophysiology were also correlated with NCLEX-RN success. Discriminant analysis was used to predict 94 percent of the students who passed and 92 percent of the students who failed NCLEX-RN. The authors noted that “all this data is available by the end of the first semester of our students' senior year” thus allowing time for intervention.^{1p163}

Many studies have examined how well standardized examinations predict NCLEX-RN success. Bondmass, Moonie, and Kowalski studied the relationship of scores of the Nursing Entrance Test (NETTM) and Educational Resources, Inc (ERI) examination scores with NCLEX-RN success in a baccalaureate curriculum. Results indicated that nursing students who passed the NCLEX-RN® scored significantly higher on both of the other standardized examinations.² Laucher, Newman, and Britt determined that the Health Education Systems, Inc. (HESI) Exit Examination was significantly predictive of

success on the NCLEX-RN.⁶ Nibert, Young, and Adamson reported the results of the fourth annual validity study using the HESI as a predictor of NCLEX-RN success and found it to be highly predictive (98.3%) for registered nurse (RN) students, as was the case in the prior three studies.⁸

Daley, Kirkpatrick, Frazier, Chung and Moser used data from student records on 224 baccalaureate nursing graduates (1999 and 2000 cohorts) to predict NCLEX-RN success. Considering both cohorts, two program variables were correlated with success on the NCLEX-RN: final course grade for a senior medical-surgical nursing course and cumulative program grade point average. This study also compared scores on two standardized tests and found that both tests (HESI Exit Examination and Mosby Assess Test) demonstrated a difference in the students who were successful versus those who were not, but found the HESI Exit Examination to demonstrate greater sensitivity.³

Also using a database established from student records, Haas, Nugent, and Rule used discriminant function analysis to predict baccalaureate nursing student success on NCLEX-RN. The sample consisted of 368 students who graduated from a program, located on two campuses, from 1991 to 2001. Results indicated that men failed the examination at a significantly higher rate than women ($p = .064$). There were also differences across races and between campus locations. Students who passed had grade point averages approximately 0.3 point higher than students who failed.⁵

Using standard measures of critical thinking and discriminant analysis, Giddens and Gloeckner were able to correctly classify 98% of students who passed NCLEX-RN, but incorrectly identified approximately 79% of those who failed. The authors concluded that variables such as critical thinking may be useful for predicting students who will likely pass, but are not reliable predictors of those likely to fail.⁴

Romeo examined critical thinking as a predictor of NCLEX-RN success. Quantitative research was reviewed and analyzed using an integrative review process. After an extensive review, it was determined that research is needed to better understand the relationship between critical thinking and NCLEX-RN success.⁹ Presently, there is neither agreement on a definition of critical thinking in nursing, nor an appropriate theory to use as a framework for critical thinking in nursing education. Further, an entire supplement to a 2008 volume of the journal *Computers, Informatics, Nursing* was dedicated primarily to research predicting NCLEX-RN success. It is apparent from the literature that success on this examination is a high priority among nurse educators and more research is needed.

Methods

Sample

The sample from this study consists of data from the records of 153 graduates of a baccalaureate nursing school over a period of three years between fall 2006 and spring 2009. Students are admitted to this program in the fall and in the spring, so there are two graduating classes each year. As students enter the nursing program, the administrative assistant for the school begins to collect data for each one. This data bank, displayed on an Excel spread sheet includes the entry date of the student into the nursing program, SAT/ACT scores, any failed prerequisite courses, the overall science grade point average (GPA) prior to admission into the nursing program (from anatomy, physiology, and chemistry), scores on all standardized tests, a critical thinking test score, individual nursing course grades, writing portfolio scores (a portfolio required of each student in this university to promote writing competency), graduating GPA, number of semesters taken to complete the nursing program, and whether or not the student passed NCLEX on the first attempt. The standardized tests include a critical thinking test, an end of course test for each nursing course, and a RN Assessment Test that is designed to be predictive of NCLEX-RN® success. After the data were collected for this study, student names were removed so that no individual could be identified. This data set is updated each semester. This study received an exemption from the Institutional Review Board because no identifiers were in the data set.

Variables

The independent variables in this study originally included SAT/ACT scores, science GPA before admission to the nursing program, critical thinking test score, writing portfolio score, individual nursing course grades, number of nursing course failures, all standardized test scores, graduating GPA, and number of semesters taken to complete the nursing program (the program is designed to be five semesters after completion of general education courses and acceptance into the nursing program). Each of these variables was used in the initial analysis, but the final analysis included only science GPA before admission to the nursing program, the four course grades in the first semester of the nursing program, and the RN Assessment Test. The four first semester courses were Fundamentals of Nursing, Health Assessment, Pathophysiology, and Theoretical Foundations. The other variables were eliminated because they did not statistically contribute significantly to the results. NCLEX-RN success or failure at first sitting was the dependent variable.

The first-semester nursing courses included in this study are those that are commonly taught at this level in baccalaureate programs, but may vary from institution to institution, thus a brief description of each of these courses will follow.

Fundamentals of Nursing introduces the nursing student to the theory and practice related to the application of concepts

and skills in providing nursing care. This is the course in which beginning students learn basic nursing skills and begin their clinical rotations. *Theoretical Foundations* is a nonclinical course that presents theories and concepts that provide the foundation for nursing practice with an emphasis on the health/illness continuum and health promotion. Theories of human development, the concept of health, and the nursing process are integrated into this course. *Health Assessment* introduces students to a foundation in assessing the physical and psychosocial health status of individuals across the lifespan. This course includes a client simulated lab. Pathophysiology focuses on the basic concepts of pathophysiology, the pathophysiology of common alterations according to body systems, and the clinical manifestations of selected diseases.

Design and Procedure

The study used a retrospective correlational design. Logistic regression for the analysis of data was used with NCLEX-RN passing success as the dependent variable. The predictor variables were science GPA, RN Assessment Test score, and four indicator variables for passing (with a C or better) the four first-semester nursing courses. Logistic regression is nonlinear, and was utilized because it allows prediction of a discrete outcome such as passing or failing. It also can be used when the independent variables are categorical or a mix of continuous and categorical, as they are in this study. The initial model included all the main effects, and interaction effects between the passing of the separate nursing courses and the science GPA and RN Assessment test score. The backward stepwise technique was used to eliminate predictor variables and interactions that were not significant predictors of NCLEX-RN success.

Results

Preliminary Results

During the early phase of data collection, it became apparent that several changes needed to be made in the curriculum and for admission requirements. These changes were based on faculty experience in tracking students for several years and noting trends among students who did not pass NCLEX-RN. The changes that were made can be clustered into three categories: admission factors, course factors, and program issues. The one admission factor change was limiting admission to the nursing program to students with no more than one science course failure (from anatomy, physiology, and chemistry). The course factors included increasing the minimum score to pass a nursing course to 80%, and splitting a 9-hour medical-surgical course into two 5-hour courses. The program issues included limiting the number of nursing

program failures to one in order to remain in the program, limiting time in the five semester nursing program to 3.5 calendar years, and changing the format of the standardized testing to systematically include practice tests, remediation, and tests with rationales. These changes were then incorporated into the database to determine if they affected the NCLEX-RN pass rate. All changes were instituted in 2007. The pass rate on the NCLEX-RN did increase significantly after the changes. It went from an average of 83% passing in the previous five graduating classes to an average of 93% in the next two graduating classes. Data analysis will continue on these factors since the sample size of students examined after these changes were instituted is small.

Final Results

Results from the logistic regression analysis indicated that several variables did have a significant main effect on NCLEX-RN success (see Table 1). These variables were RN Assessment Test scores, passing grades (C or better) in Theoretical Foundations (N202), and passing grades in Pathophysiology (N312).

Obviously, significant interactions indicate that certain variables combined have more predictive power of NCLEX-RN success than a single variable alone. An independent variable may not have any main effect on the dependent variable, but when interacting with another independent variable may have a very significant effect. There were several two-way interactions, and one three-way interaction, among the variables found to be significantly related to NCLEX-RN success. These interactions are shown found in Table 2. The most significant interaction was found between the RN Assessment Test and Pathophysiology (N312). The p value was $<2.2e-16$, which is essentially zero.

The error table (Table 3) illustrates how well the independent variables accurately predict success or failure on the NCLEX-RN®. All of the variables used in the main effects and interaction analysis (Science GPA, RN Assessment, four first-semester course grades) were included in the formation of the error table. This table shows both raw numbers and percentages. The error table indicates that these variables predicted that six students (4%) would fail, and indeed they actually did fail. It was predicted that one student (<1%) would fail who actually passed. Further, it was predicted that 15 students (9%) would pass but they failed, and that 131 students (86%) would pass and they did. This model indicates that the variables do a better job of predicting success than failure.

Discussion

Although the literature describes both academic and nonacademic variables associated with NCLEX success, many of the nonacademic variables (age, gender, ethnicity, stress, study skills, situational factors) are either difficult to measure or are not amenable to change, and therefore were not included in this study. The main effects that were most significantly related to NCLEX-RN success in this study were the RN Assessment Test and success in courses in Theoretical Foundations and Pathophysiology. The variables that were significant in the interaction models included science GPA, RN Assessment Test, the Fundamentals course, and courses in Health Assessment and Pathophysiology. It is interesting to note that the only course taught in the first level that did not emerge as significant in the two or three-way interactions was Theoretical Foundations, yet it was the single most significant variable having a main effect. A possible explanation for this could be that this course is very different from the other three first-semester nursing courses. Further, the course is rather conceptual while the other three courses are fairly concrete. It might be expected that more critical thinking is needed for this course, and students who are able to achieve this early on are more likely to be successful later when taking the NCLEX-RN examination. The strongest predictors of NCLEX-RN success were found among the interactions, which indicate that no single variable should be used to predict success. This is logical in that nursing education is multidimensional, and of course no single experience or class stands alone. Courses build upon prior learning experiences, and students must use knowledge and skills from each course in the final analysis for the NCLEX-RN examination.

It is also reasonable that each of the four first-semester nursing courses were found to be significant either solely or in an interaction model. The first semester of nursing in this curriculum is the fourth semester of a 4-year, 8-semester program, and provides a strong foundation for the future courses throughout the curriculum. Success at this first level is critical to accomplish the objectives necessary to pass at subsequent levels. It is found by most students to be the most challenging of all semesters, and there are always a few students who decide to choose another career during or after this semester. It is rare however, for a student to be successful in this semester and not successfully graduate from the nursing program. Any nursing curriculum is challenging, and it is advantageous to students to be able to discern early in the program whether or not they have made the right career choice.

The RN Assessment Test was a predictor both alone and in four interactions. This test is administered during the final semester of the nursing curriculum. It is part of the total standardized testing package utilized in this program, and was developed to be a strong indicator of NCLEX-RN success. Students use this test to determine where they have weaknesses and focus on these areas before taking the NCLEX-RN examination. Results of this study confirm its usefulness as an indicator of success.

Science GPA was found to be significant in four different interaction models. This is consistent with other studies for both associate degree and baccalaureate programs.^{10,11} The courses included in the calculation of the science GPA in this study were Anatomy, Physiology, and Chemistry. These courses form a foundation for many of the nursing courses, such as pathophysiology, health assessment, pharmacology, and the specific clinical courses, so it is not surprising that they would be included in a predictor model of success on the NCLEX-RN®. They are essentially part of the nursing curriculum even though they must be taken before admission to the nursing program.

The most significant interaction model included the variables of the RN Assessment Test and the Pathophysiology course. The strength of this significance is overwhelming. It is interesting that the Pathophysiology course is taught in the first semester of the nursing curriculum, the RN Assessment Test is taken in the last semester, and together they were the most significant predictors of success on the NCLEX-RN examination. Pathophysiology is foundational to all of the subsequent clinical nursing courses, and the RN Assessment Test examines the students' ability to put all of their coursework together in a comprehensive manner similar to what is expected on the NCLEX-RN. Pathophysiology and the RN Assessment Test are also included in other significant interaction models, but the level of significance does not approach the same value in them.

The error table indicates that the study variables do a fairly good job of predicting NCLEX-RN success, but do not predict failures well. This may be expected due to the fact that there are simply more passes than failures in the study and in the general population. There were only 21 failures in the study compared to 132 passes. This is consistent with the findings of Daley et al.³ and Haas et al.⁵ As Daley et al. pointed out, the prevalence in a population does influence the positive and negative predictive values in a study.³ When prevalence is low (NCLEX failures), the positive predictive value is likely to reveal a number of false positives, and the negative predictive value would be expected to be close to 1.0.

Results of this study must be interpreted in light of the small sample size. The data were collected at a single university, so results may not be generalizable to graduates of other nursing programs. Another limitation of this study is that changes were instituted to admission criteria and the nursing curriculum after preliminary results of the study were examined. These changes could impact the final results as well. Data collection is ongoing and analysis will continue. Results do indicate however, that there are several variables that appear to be significant in predicting which students will be successful on the NCLEX-RN examination. There are obviously additional variables that impact success or failure on this exam, and many of these cannot be controlled. Nonacademic variables such as a student's individual stress level, generalized test anxiety, outside events and family variables that occur close to the time of taking the exam, and individual

preparation for the exam itself may affect how well a student performs on the exam, but these variables are outside the realm of a nursing school's control.

Implications

Results of this study do have implications for nursing schools and the need for further research. While there were actually several interactions among variables that were found to be predictive of success on the NCLEX-RN examination, there were some commonalities. The science GPA prior to admission to the nursing program, the RN Assessment Test score, and the grades from each of the first semester nursing courses each ended up in the final analysis. Passing a licensing examination that reflects the culmination of years of study obviously is the product of many factors. The fact that no single variable appeared as an overwhelming predictor is to be expected. That the foundational courses upon which a nursing curriculum is built were found to be significant interacting variables confirms that these are critical courses to the curriculum and to the students' progress and success.

Findings also indicate that admissions committees should look carefully at college work completed prior to the beginning of nursing school, especially the required science courses. Students who either do not successfully complete or repeat these courses are at risk for not being successful in nursing school as well. The prerequisite science courses provide a solid foundation for many of the required courses in nursing school.

Findings also confirmed that the RN Assessment Test is a variable in predicting NCLEX-RN success. It appears to be a main effect as well as an interacting variable. This test is advertised as being predictive of success on the NCLEX-RN, and this study does offer further substantiation of this.

This particular nursing program used results of this study in several ways. A program for students considered to be "at risk" during that first nursing semester was instituted. One faculty member worked with these students as a group and one on one to build on individual strengths. A mentorship program was also developed that paired upper class students with first level students to provide social and intellectual mentoring. The content from the Pathophysiology and Health Assessment courses was also made available on-line with a voice-over. This enabled students who were auditory learners to hear the content again while also having the handouts/slides available for visual learners. Outcome results of such activities are yet to be determined.

Summary

More research is needed to better determine which students will not be successful on the NCLEX-RN examination. Since there are so few failures, this is more difficult than predicting success, but it is important to systematically identify these students so that remediation strategies can be developed and implemented to prevent these failures. With the looming nursing shortage, it is not enough to just “crank out” more graduates if they are not well prepared and able to pass the NCLEX-RN and obtain a license. The failure of the NCLEX-RN has many negative consequences. There are obvious personal and financial consequences for the students; it indirectly contributes to the already critical nursing shortage, and it can effect a school’s reputation and have consequences for faculty and admissions. Success for first-time NCLEX-RN is a priority for nursing schools. Knowing the predictors of success can enable nursing faculty to design curricula to foster success and focus remediation for at-risk students and graduates. It is recommended that individual nursing schools systematically evaluate their curriculum on a frequent basis, look for trends in student success and failure, and strive to make curriculum changes only when there is evidence that they are needed.

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Table 1. Main Effects of Dependent Variables on NCLEX-RN®

Possible Predictors	LR Chi-Square	p
Science GPA	1.11	0.29
RN Assessment	4.65	0.03*
N201 (Fundamentals)	0.30	0.58
N202 (Theoretical Foundations)	10.16	0.001**
N307 (Health Assessment)	0.42	0.52
N312 (Pathophysiology)	3.63	0.056·
* p < 0.05		
** p < 0.01		
· p < 0.1		

Table 2. Interactions between Dependent Variables and NCLEX-RN®

Possible Predictors	LR Chi-Square	p
<i>Two-Way Interactions</i>		
Science GPA:RN Assessment	0.41	0.52
Science GPA:N201 (Fundamentals)	9.58	0.002**
Science GPA:N307 (Health Assessment)	4.25	0.04*
Science GPA:N312 (Pathophysiology)	5.39	0.02*
RN Assessment:N201 (Fundamentals)	7.45	0.006
RN Assessment:N307 (Health Assessment)	2.33	0.13
RN Assessment:N312 (Pathophysiology)	1350.71	< 2.2e-16***
<i>Three-Way Interactions</i>		
Science GPA:RN Assessment:N307	7.47	0.006**
* p < 0.05		
** p < 0.01		
*** p < 0.001		
· p < 0.1		

Table 3. Error Table

Raw Numbers n=153	Actual NCLEX Failures	Actual NCLEX Passes

Predicted NCLEX Failures (n=7)	6	1
Predicted NCLEX Passes (n-146)	15	131
Percentages	Actual NCLEX Failures	Actual NCLEX Passes
Predicted NCLEX Failures	4%	<1%
Predicted NCLEX Passes	9%	86%

Most research studies examining the predictors of NCLEX-RN results have looked at admission data, grade point averages from high school or nursing school, theory course grades, and National League for Nursing (NLN) Achievement or Comprehensive tests. This study was directed toward predicting performance on the NCLEX-RN using the variables of theory course grades and NLN Achievement tests. Although there were numerous studies of performance on NCLEX-RN examination, there were few studies examining specifically the performance of LPNs returning to a registered nurse program. The NCLEX-RN Test Plan is organized into four major Client Needs categories. Two of the four categories are divided into subcategories as shown below: Safe and Effective Care Environment. Management of Care - 17% to 23%. Additionally, although the nurse is serving in a political advocacy effort, the nurse is not necessarily a politician and there is no evidence that this nurse is an entrepreneur.

6. Which of the following are the five Rights of Supervision? The right task, the right circumstances, the right person, the right competency, and the right supervision or feedback.

NCLEX-RN success, Associate Degree Nursing, predictors.

1. Introduction. Numerous studies have attempted to identify the best predictors of National Council Licensure Examination for Registered Nurses (NCLEX-RN) success. A variable which has been reported in numerous studies, showing inconsistencies in predicting NCLEX-RN success or failure is ethnicity. Studies conducted by Endres (1997) and Yin and Burger (2003) found ethnicity to have no impact on NCLEX-RN success, whereas, other studies (Barkley, Rhodes, & Dufour, 1998; Campbell & Dickson, 1996; Crow et al., 2004; Haas et al., 2004; Salyes et al., 2003), stated that African Americans and minorities were less likely than Whites to pass NCLEX-RN.