Predicting NCLEX-PN Performance for Practical Nursing Students

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Success on the licensure examination, NCLEX-PN, is a fundamental outcome criterion for practical nursing programs as well as a state requirement for professional practice. Nurse educators and administrators have an interest in identifying factors that predict success on the licensure examination. This study examined demographic, pre-admission, and programmatic variables to determine their predictive value for NCLEX-PN success in a statewide 2-year college system.

*N*urse educators have an ethical obligation to ensure admission criteria and academic standards are reasonable and fair, yet effective indicators of graduate success. Limited-enrollment practical nursing programs in open-access colleges face the additional challenge of supporting the open access institutional mission and facilitating educational mobility while protecting academic integrity. While selective admission practices are thought to protect the high standards of professional nursing practice, opponents claim these practices prohibit many educationally disadvantaged and nontraditional students from attaining their goals.

The research surrounding predictors of success in nursing education is primarily focused on baccalaureate graduates, and to a lesser extent, associate degree graduates of programs preparing registered nurses. There is little research in comparison regarding predictors of success for practical nursing graduates. The non-traditional nature of the practical nursing student, differences required in their program admission standards, differences in academic preparation, and variances in the licensure examinations provide rationale for why research results from graduates of registered nursing programs should not be generalized to practical nursing graduates.

This researcher was concerned with increasing the effectiveness of predicting NCLEX-PN success. Therefore, the purpose of this study was to identify and to determine which demographic characteristics, pre-admission variables, and programmatic variables significantly predict success on the NCLEX-PN licensure examination for students in practical nursing programs at Indiana's statewide 2-year open-access technical college.

Review of the Literature

Research directed at predicting nursing success suggests that past academic performance is an indicator of future academic success in nursing education. Although the research has shown academic variables such as standardized test scores,[1–3] nursing theory grades,[4,5–7] and cumulative grade point average[4] to be predictive of nursing success, demographic characteristics[5,8] and grades in certain pre-nursing courses[5,9] have demonstrated conflicting results in regards to their relationship to nursing success.

Research directed at predictors of success for students in baccalaureate degree nursing programs is extensive.

A review and meta-analysis of 47 studies of nursing research within the years 1981 to 1990 was conducted to predict success of baccalaureate degree nursing students.[10] The requisites to be included in the review were (1) publication year during the period of 1981 though 1990, (2) at least 1 nurse author, and (3) baccalaureate degree nursing students as subjects. The authors reported SAT, ACT, and NLN examination scores to be the most frequently used standardized tests to predict retention, graduation, or NCLEX success. The most frequently studied cognitive variables were found to be college GPA, nursing GPA, and GPA from the biological sciences. Findings of the integrative review revealed grade point averages in science and nursing courses as the greatest academic predictors and student age and parental education level to be the strongest demographic predictors of student success.

Other researchers have explored predictors of success for associate degree nursing students. Alexander and Brophy[3] noted the lack of studies reported since 1988 using pass/fail NCLEX-RN data exclusively. The purpose of their study was to identify admission, progression, and exit variables predicting performance on the post-1988 NCLEX-RN examination. Data were obtained retrospectively from 188 records of associate graduates between the years 1988 and 1994. SAT verbal scores and nursing grade point average were found to be the strongest indicators of success. Regarding nursing grade point average, the researchers found the mean for those who passed NCLEX to be 3.33, and the mean for those who failed NCLEX to be 2.70. The researchers concluded the

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findings could not be generalized to other nursing programs, but rather, each nursing program should identify its own variables for study.

As is apparent in a review of the literature, the combinations of predictor variables appear to be unique to individual nursing schools. However, a paucity of research is available in the area of predictors of success on the licensure examination for practical nursing graduates. No research was found regarding predictors of NCLEX-PN performance following the 1996 implementation of changes to the content of the licensure examination. Thus, this study sought to determine predictors of success for practical nursing students at Ivy Tech State College (Ivy Tech).

Methods

A quantitative research design using archival data was conducted to analyze the impact of certain demographic characteristics (age, race, method of high school completion, and needs-based financial aid recipient), pre-admission variables (five Psychological Services Bureau-Aptitude for Practical Nursing Examination [PSB-APNE] sub-scale scores and type of remedial basic skill courses taken), and programmatic variables (course grade in a medical-surgical nursing course, PNU 127; and cumulative nursing GPA at program completion) as predictors of success on the NCLEX-PN licensure examination.

Graduate success in nursing is most often defined in the literature as successful program completion, acceptable cumulative grade point average, or obtainment of a pass score on the NCLEX licensure examination. The NCLEX-PN licensure examination was chosen as the dependent variable in this exploratory study because passing the examination is an accepted measure of entry-level nursing practice and licensure, and because Ivy Tech recognizes NCLEX-PN as the outcome assessment for program graduates.

The sample consisted of students who graduated from an Ivy Tech practical nursing program (limited enrollment programs in an open-access, statewide technical college system) in December 1997, May 1998, and Au-

gust 1998, and who took the NCLEX-PN licensure examination by December 1998. Sixteen Ivy Tech campuses with practical nursing programs were included in the study. A pilot test of the data collection was conducted to ensure the independent predictor variables in the design were obtainable in usable format from the institutional student information database. In addition, a follow-up study was conducted to validate the adequacy of the classification model resulting from the first study. Ivy Tech practical nursing students were chosen as participants for both studies because the college is the primary educator of practical nursing graduates in Indiana and because the admission criteria and curriculum are similar among the campus locations. Data were retrieved from the institutional student information database and from the academic files maintained by the Practical Nursing Program Chairs.

Forward inclusion logistic regression procedures (with a significance level of 0.15 for inclusion and 0.20 for retaining the variables in the model) were used to identify the contribution of the 13 independent variables to NCLEX-PN performance and to determine the probability of passing the licensure examination according to selected independent variables. The Wald statistic, having a chi square distribution, and odds ratios were chosen as the criteria on which to base the significance of the predictions.

Results

Descriptive statistics were calculated on the students in the original sample who had reported NCLEX-PN licensure examination results (N = 880). Randomly missing data from some of the predictor variables reduced the number of student records eligible for the logistic regression procedure to 770. A disproportional number of cases with complete data for all variables in the two NCLEX-PN result groups (57 fail scores versus 713 pass scores) were found. Thus, all cases with scores for all variables having a result of fail (n = 57), and a randomly-selected sample of 57 complete cases reporting a score of pass, comprised the sample of 114 used for the logistic regression analyses.

Descriptive Analyses

The average age of the practical nursing graduates in this study was 30.04, evidence of the nontraditional students served by the college's practical nursing program. The majority of the sample (55%) represented lower-income students as evidenced by their Pell grant awards. This number may be conservative in that the study design classified Pell grant recipients as those individuals who were coded in the college's database as having received the federal grant rather than including individuals who qualified for federal financial assistance. A greater percentage of females (95%) graduated from the practical nursing program as compared to males. The disproportional representation of males among nursing graduates was similar to the sample distribution of other nursing studies.[5,8] Minorities (12%) also comprised a smaller portion of the sample as compared to Caucasians, although 1 campus reported minorities as the majority group (81%).

Comparisons of licensure performance by demographic characteristics are presented in Table 1. Differences in NCLEX-PN performance in regards to age were minimal, although the mean age of those who failed the exam (30.77) was slightly higher than the mean age of those who passed the exam (29.98). Married students in the study were less likely than single or divorced students to fail NCLEX-PN. There were minimal differences in the frequencies of pass and fail NCLEX-PN results between Pell recipients and non-Pell recipients, and among GED recipients and high school graduates. Minority subjects in this study were more than twice as likely to fail NCLEX-PN as Caucasian subjects. Gender differences were difficult to ascertain because of the small number of males in the study.

Predictors of NCLEX-PN Performance

Three variables were found to be statistically significant for predicting NCLEX-PN performance as a result of forward inclusion logistic regression for the population studied (Table 2). The programmatic variable of cumula-

Table 1. Comparisons of NCLEX-PN Results by Demographic Characteristics

Variable	NCLEX-PN Pass Frequency (%)	NCLEX-PN Fail Frequency (%)
Gender		
• Male	42 (95.5)	2 (4.5)
• Female	769 (92.0)	67 (8.0)
Diploma		
• GED	95 (90.5)	10 (9.5)
• High school diploma	116 (92.4)	59 (7.6)
Marital status		
• Divorced	89 (88.1)	12 (11.9)
• Single	264 (87.1)	39 (12.9)
• Married	351 (95.4)	17 (4.6)
Pell Grant recipient		
• No Pell	362 (92.3)	30 (7.7)
• Pell	448 (92.0)	39 (8.0)
Race		
• Caucasian	772 (93.5)	50 (6.5)
• Minority	84 (82.4)	18 (17.6)
Age range		
• 18–24	272 (90.7)	28 (9.3)
• 25–34	328 (94.0)	21 (6.0)
• 35–44	143 (95.3)	7 (4.7)
• 45–54	59 (83.1)	12 (16.9)
• 55–64	9 (90.0)	1 (10.0)
Total sample	811 (92.2)	69 (7.8)

tive nursing grade point average demonstrated the largest partial contribution to the final model. Only 2 pre-admission variables, PSB-APNE Natural Science subscale test score (PSB-science) and remedial reading, were shown to be partially correlated with the outcome variable, NCLEX-PN performance. The odds of a practical nursing student from the study population passing the licensure examination on the first attempt increased with an increase in cumulative nursing grade point average and PSB-science score, while the odds decreased if a student had taken a basic skill reading class. To illustrate, a student who took remedial reading was approximately 0.35 times as likely to fail the licensure examination on the first attempt than a student who did not take remedial reading. In contrast, for every one unit increase in PSB-science score, the odds of passing NCLEX-PN increased 1.03 times. A one-unit increase in cumulative nursing grade point average increased the odds of passing NCLEX-PN by a ratio of about 21.52.

The resulting model with the three significant variables yielded a reduced -2LL statistic (110.97) as compared to the constant-only model and a statistically significant chi-square statistic [$\chi_2 (3) = 47.07$, $P < .001$], indicating the final model permitted improved prediction of NCLEX-PN performance in comparison to the constant-only model. The Nagelkerke R_2 statistic indicated a moderately strong relationship between NCLEX-PN and the three significant predictor variables, with approximately 45.1% of the variation in NCLEX-PN performance explained by the final logistic regression model. In addition, the resulting model, with an overall predictive accuracy rate of 74.56%, was found to be slightly more effective in its ability to predict fail results (77.19%) as it was in predicting pass scores (71.93%).

To further evaluate the adequacy of the classification model, forward inclusion methods of stepwise logistic regression were performed using the same methods of data collection on student data from the subsequent academic year. The second sample included 802 students who graduated from an Ivy Tech practical nursing program in December 1998, May 1999, or August 1999, and who took NCLEX-PN for the first time by December 1999. Missing data reduced the sample size to 704, of which 648 reported NCLEX-PN scores of pass, and 56 reported scores of fail. Thus, the final sample (n = 112) for the logistic regression analysis was comprised of all complete cases reporting a result of fail (n = 56) and a randomly-selected sample of 56 complete cases having a score of pass. A forward inclusion logistic regression, using the same levels of significance and criteria for variable selection as was used in the initial study, was calculated using the three predictor variables of cumulative nursing grade

Table 2. Summary of Logistic Regression Final Model

Variable	β	SE	Wald	df	Sig	R	Exp(B)
PGPA	3.07	0.719	18.22	1	0.000	0.320	1.03
SCI	0.027	0.012	4.92	1	0.027	0.136	21.52
REA	−1.06	0.589	3.25	1	0.071	−0.089	0.35
Constant	−9.38	1.91	24.08	1	0.000		

SE, standard error; df, degrees of freedom; sig, significance.

point average, PSB-science score, and basic skill reading.

The second study confirmed that the odds of an Ivy Tech practical nursing student passing NCLEX-PN on the first attempt increased with an increase in cumulative nursing grade point average and PSB-science score, while the odds decreased if a student had taken a basic skill reading class. The final model, with an overall predictive accuracy rate of 71.43%, was found to be slightly more effective in its ability to predict fail results (73.21%) as it was in predicting pass scores (69.64%). These results were similar to those of the original study.

None of the demographic characteristics from the original study were found to be statistically significant in predicting NCLEX-PN performance. The other four PSB sub-scale scores, basic skill mathematics, and course grade in the nursing theory course PNU 127 were also found to have no significance in predicting the likelihood of passing the licensure examination.

Discussion of the Findings

Ivy Tech promotes equity in education and fulfills the traditional role of a community college by providing disadvantaged groups with an opportunity to advance economically. The demographics of the study sample of practical nursing students illustrated the economic status of the student population served by the college. Approximately 55% of the original study sample (N = 880) received Pell grant assistance, an indicator of low income as defined by federal standards, sometime throughout their course of study.

Of the 13 variables studied, the strongest predictor of success was found to be cumulative nursing grade point average. The importance of the programmatic variable in predicting NCLEX-PN success in comparison to the smaller partial contributions of the 2 pre-admission variables suggests that efforts to improve practical nursing student success should be directed at students after they are admitted to the program. Efforts focused on improving the pre-admission status of practical nursing students may not be as beneficial to improving success rates on the licensure examination.

This finding also implies that Ivy Tech should maintain the academic standards of its practical nursing curriculum. In this study, a student with a 2.8 nursing grade point average was 3.03 times more likely to pass the licensure examination on the first attempt compared to a student with a 1.8 nursing grade point average. Other researchers found the likelihood of passing the NCLEX-RN examination influenced by cumulative nursing grade point average.[3,4,6]

The standardized PSB-APNE Natural Science subscale test score (PSB-science) was the only 1 of the 5 subtests to demonstrate statistical significance. The content of the Natural Science subscale test includes life sciences, health, physics, and chemistry, all of which provide the foundation for nursing theory and practice. Since the content of the NCLEX-PN licensure examination reflects entry-level competencies for practical nurses, it appeared reasonable to find NCLEX-PN performance influenced by PSB-science.

The likelihood of passing the NCLEX-PN examination on the first attempt was also influenced by basic skill reading, in that those students who enrolled in a remedial reading course were less likely to pass than those who did not require remedial reading. This finding is consistent with that of Baker,[11] who found a significant relationship between student success in community college nursing programs and completion of remedial reading. Students who failed to complete the program were more likely than those who graduated to have taken remedial reading. The NCLEX-PN examination is comprised of multiple choice questions, many in the form of case scenarios, requiring cognitive skills of reading comprehension and application, and it stands to reason that a strong foundation of reading skills and the ability to comprehend would influence success on the licensure examination. Although this study did not seek to identify success or failure of the basic skill reading courses in preparing a student adequately for the rigor of the NCLEX-PN examination, this finding did raise questions regarding the success of the college's remedial reading program. However, this was merely speculation and does not imply a causal relationship between completion of basic skill reading courses and inadequate reading skill. The data from this study, which supports the importance of reading skills in passing the NCLEX-PN, could be used to motivate students with deficiencies in this area to seek available assistance from the college.

The logistic regression analyses revealed no relationship between the demographic characteristics of race, age, needs-based financial aid recipient, or method of high school completion and NCLEX-PN performance. Other researchers have found age not to be a significant predictor of nursing student success.[2] A meta-analysis conducted by Campbell and Dickson,[10] however, found student age to be among the strongest demographic predictors of success. A possible explanation for the contrary findings regarding age is that the effect of age on success may diminish with time. Whereas the majority of the students enroll in Ivy Tech nursing programs several years after high school graduation, many baccalaureate nursing students enroll directly after high school.

A surprising finding of this study was no statistically significant relationship between course grade in a medical-surgical nursing course (PNU 127) and NCLEX-PN performance. This conclusion was contradictory to the findings of several other researchers[2,3,5,9] who reported significant differences in individual nursing course grades between those who failed and those who passed NCLEX-RN.

The results of this study should be interpreted with caution due to the exploratory nature of the study and the sample size (n = 114). Second, there was no attempt to separate the records of full-time and part-time graduates because (1) the same admission criteria were practiced for all practical nursing students, (2) each campus offered an identical curriculum for full-time and part-time students, and (3) a set period of time for completion was established for both enrollment options. Also, several students enrolled in the full-time, 3-semester option took a lesser course load than required because they had previously completed their non-nursing courses. Finally, factors not considered by this study design could have influenced the dependent

variable. These include intrinsic characteristics such as motivation, self-discipline, and self-esteem; number of children in the household and educational level of the parents; and student learning style. There were also uncontrollable environmental factors that were not taken into account, such as differences in availability of student support services, commuting distance, and variances in faculty ratios at the campuses.

These findings have implications for nurse educators, administrators, admission staff, and students of practical nursing programs, particularly those in open-access technical colleges. Since the results of this study indicated other factors not accounted for influenced the likelihood of NCLEX-PN success, continued qualitative and quantitative research on practical nursing students is warranted to identify other significant variables. Research to determine what personal characteristics and special abilities predict graduate success in practical nursing is required to identify valid nonacademic predictor variables. It is imperative for open-access institutions to determine, to the best of their ability, what variables predict success for practical nursing students. The results can justify selection criteria and support the establishment of appropriate intervention programs for students at risk of failure. In addition, identifying valid admission criteria can aid open-access colleges in fulfilling their obligation to society to promote equity in education.

Acknowledgments

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questions of one another, clarifies the plan of care, and coordinates patient-care activities such as physical therapy, documentation, hygiene, and medication administration. At the end of the sophomore's clinical (approximately 10 a.m.), each student reports off to the junior team member, who continues to care for the patient until 1 p.m.

Outcomes

In reviewing the sophomore student self-assessment responses, there was overwhelming agreement that anxiety associated with the progression to acute-care was lessened by the project. The junior students unanimously agreed that they would have benefited from the project as sophomores. Comments from the students included:

- "(The project) let me see how the skills in long-term care can be directly applied to acute care."
- "Totally decreased my anxiety for next year."
- "Having the junior student to mentor me made me less anxious."
- (I)"felt like a role model" (to the sophomores).
- "Made me feel like I had learned a lot since my sophomore year."
- "The best thing was mentoring the sophomores."

There were unexpected benefits of the project as well. The students interacted readily with each other throughout the clinical experience. The juniors discussed care plans, performance expectations, and gave the sophomores a sense of what the next year's curriculum would be like. The sophomore-junior teams valued each other's expertise. Based on the sophomore students' report of less anxiety and the junior students' comments about satisfaction with the preceptor role, we continue to use the project as a tool to support our students' learning.

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