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Connecting Standardized Assessments and NCLEX-Failures: A Multi-Site Collaboration

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Background: The National Council of State Boards of Nursing (NCSBN) reported the total first-time, US educated, passing percentage of candidates taking the National Council State Board Licensure Exam for registered nurses (NCLEX-RN®) in the first quarter of 2018 was 89.25%. The 2017 percentage leaves 5,421 graduates unavailable for the workforce that is projected to need more than one million nurses by 2030. Workforce concerns and pass rates on NCLEX-RN examinations remain a major focus for the profession. In response to these ongoing concerns, nurse educators seek valid and reliable tools to assist in early identification and intervention for students at-risk of NCLEX-RN failure. Consequently, many prelicensure nursing programs select commercially available end-of-program comprehensive predictor exams in an effort to identify students predicted to fail NCLEX-RN. Standardized assessments have been studied with varying results using primarily case study designs using one commercially available standardized assessment package. While many of these studies find significance in variables related to NCLEX-RN success, there is sparse evidence in the literature of relationships to student failure. Collaboration among multiple programs is needed to provide a sample of standardized assessment scores from students failing NCLEX-RN on their first attempt.

Purpose: This study sought to analyze standardized assessment scores from multiple sources representing a variety of commercial vendors. The purpose of this cross-sectional study was to use principal components analysis to explore relationships within standardized assessment scores from a sample of students who failed NCLEX-RN on the first-attempt. The aim was to explore the relationships among the SA scores in a sample from students failing NCLEX-RN on the first attempt. This appears to be the first study to use this statistical approach to analyze SA scores across multiple vendors and multiple programs of nursing.

Methods: Mixed modeling sought to reveal SA scores that represented redundancy or duplication. Principal Component Analysis (PCA) was employed as an exploratory technique to analyze the scores to acquire new insight into NCLEX-RN failure for future hypothesis testing. Standardized assessment (SA) scores were collected from prelicensure programs between 2009 and 2016 (n=296). The SA scores were provided by multiple sources, including 10 programs of study and one commercial vendor in the US. The sample of first-attempt SA scores were matched across vendors to the 10 content-specific areas, 1) fundamentals of nursing care, 2) pediatrics, 3) maternal/newborn or obstetrics, 4) pharmacology, 5) adult medical-surgical, 6) mental health/psychiatric nursing, 7) leadership, 8) community and 9) nutrition along with the comprehensive end-of-program assessment. Inclusion criteria for the sample were (a) completion of a prelicensure program of nursing; (b) completion of a minimum of three

of the eight SA retained; and (c) recorded failure of NCLEX-RN on the first attempt. SA scores were merged into an Excel file and then transformed to Z-scores.

Results and Discussion: The structure of the rotated loading values, represented as correlations, found that six of the original SA correlated strongly on component #1, contributing the most, overall, to the variation in the SA scores for first-attempt NCLEX-RN failures. Component #1 represented content related to fundamentals of nursing care, maternal/newborn, pediatrics, mental health, leadership, and the end-of-program comprehensive examination. Component #1 is especially related to maternal/newborn ($r = 0.85$) even more so than the comprehensive predictor ($r = 0.78$). This is an interesting finding given one might expect the comprehensive predictor to load the strongest since it is thought to represent all the content expected for NCLEX-RN preparation. The remaining two content-specific assessments – pharmacology and adult medical-surgical – correlated strongly on component #2 and contributed greatly to the overall variation in the scores suggesting the assessments contained redundant or duplicated content. The principal component analysis found 2 distinct components emerging from the 10 SA included in the study signifying duplication in the content assessed. Within these 2 components, maternal newborn and pharmacology were found to have the strongest correlations among the SA scores.

Some nursing programs are now opting to administer a reduced number of SA to decrease the testing overload and mental fatigue that students can experience. Selection of SA is largely dependent upon faculty preference as the evidence to identify the best SA to include in the program of study which seems to be absent in the literature. The quest for early identification of students at-risk for NCLEX-RN failure has resulted in an increased number of assessments and exams students are expected to complete. Students are reporting “too many standardized assessments” are administered throughout the nursing program. Selection decisions for using standardized assessments should be evidence-based to assess students’ performance compared to national standards. Faculty have an ethical responsibility to ensure tests are fair and based upon the best available evidence.

Conclusions: The findings of this study are the first in the literature to explore the utility of using PCA to analyze SA scores from students who failed NCLEX-RN on the first attempt. This is also the first study to collect and analyze SA scores from multiple prelicensure nursing programs from across the US using a variety of commercial vendors. The extensive literature surrounding student performance on NCLEX-RN shows strong evidence to support the ability to predict success. Yet, the decades of studies have yielded little evidence to correct the problem as current trends in national pass rates have remained in the 80% range for a number of years. Discovering those SA that assess similar content and have the strongest correlations can act as a catalyst for change and inform decision making when implementing standardized assessments throughout the nursing curriculum. Creating collaborations in research serves to connect and expand the professions to provide the best quality education for future nurses.

Title:

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Abstract Summary:

The purpose of this cross-sectional study was to explore relationships within standardized assessment scores and students failing NCLEX-RN. Standardized assessment (SA) scores were collected from collaborating partners between 2009 and 2016. The analysis revealed overlapping content tested. Recognizing similar content within SA can be a catalyst for change in nursing curricula.

Content Outline:

1. Background – Why this is a problem?
 - In addition to workforce concerns, pass rates on NCLEX exams remain a major focus for programs of nursing.
 - In the 2016 NCSBN report (2017b), US states – including Washington, DC – with a minimum of 50 candidates, possess pass rates ranged from 55% to 93.2% with a national average of 83.6%.
 - Individual nursing program pass rates below the national average can have serious implications for the respective academic institution, faculty, graduates and employers (De Lima, London & Manieri, 2011).
 - In response to this ongoing concern, nurse educators continue to seek valid and reliable tools to assist students and educators in early identification and intervention of those *at risk* and to predict NCLEX failure.
2. Review of Literature – What do we know?
 - In an effort to meet the desire to predict NCLEX outcomes, NCLEX preparation companies developed comprehensive end of program exams that claim to predict NCLEX outcomes with 90% and greater accuracy.
 - In a national study conducted by Assessment Technologies Institute [ATI] (2013), RN Comprehensive Predictor scores ($N = 7126$) were analyzed for accuracy in predicted NCLEX-RN success. The exam predicted successes 96% of the time when students ($n = 4268$) scored between 90 – 100% on the comprehensive exam.
 - The evidence lacks large studies focused on NCLEX-Failures with scores across multiple programs of nursing. The evidence shows a limitation of these end-of-program comprehensive predictor exams is that recognizing at-risk students toward the end of a program of study is too late in the educational process for early intervention and remediation. The need for continued investigation using collaborative partners across schools and standardized assessment companies is needed to discover connections within the student scores. The findings can be a catalyst to further inform nursing curricula.
 - In recent years, standardized assessment packages (SAP) have emerged to offer nurse educators another tool to recognize at risk students in preparation for the NCLEX.

- SAP typically offer content specific assessments (SA), methods for remediation and a comprehensive end-of-program predictor exam to be implemented throughout a program of study.
- SA measure students' mastery level of concepts and content in specific areas such as adult medical-surgical, pharmacology, pediatrics and others.
- SA have been studied for predicting NCLEX outcomes with varying results.
- Adult medical-surgical, mental health, community, nursing care of children, pharmacology and fundamentals SA were discovered to be significantly correlated with NCLEX outcomes (Emory, 2013; Homard, 2013; Yeom, 2013).
- In the strongest evidence found, ATI (n. d.) completed a study utilizing SA scores from the nine available. The findings showed 78% of students ($n = 2440$) performing at a level 2 or above on all nine assessments were "highly likely to pass NCLEX".
- In this same study, adult medical surgical (14.9%), nutrition (13.9%) and maternal-newborn (12.9%) SA scores were found to contribute the most in predicting success on the end-of-program comprehensive predictor.
- In the work reviewed the studies lacked (a) consistency in commercial vendors; (b) placement of SA in the program of study; (c) number of SA utilized; (d) type of nursing program sampled; (e) focus on NCLEX failure (Emory, 2013).
- While many studies find significance in variables related to success, there is sparse evidence in the literature of a relationship to student failure (Alexander & Brophy, 1997; De Lima et al., 2011; Jacobs & Koehn, 2006; Spurlock & Hunt, 2008).
- Delima, et al., (2011) found the fundamentals, parent-child and mental health SA developed by the NLN to be the most significant variables in profiling students likely to fail NCLEX.
- Emory (2013) found the pharmacology SA developed by ATI predictive of NCLEX outcomes of either pass or fail with 73.7% accuracy.
- A number of scientists studying NCLEX failure, found weak levels of significance or low predictability – ranging from 24% to 30.8% (Bondmass, Moonie & Kowalski, 2008; Steunkel, 2008; Vandenhouten, 2008; Seldomridge & DiBartolo, 2004).
- Schooley and Kuhn (2013) found support for the fundamentals and maternal child SA as benchmarks for early intervention to predict NCLEX outcomes.
- Goal of this study - To provide greater generalizability across multiple programs of nursing this larger study was completed.
- The purpose of this quantitative, non-experimental cross sectional study was to explore the use of Principal Components Analysis (PCA) to recognize redundancy and correlations in the variables – standardized Content Specific Assessments (SA) – in a sample of first-attempt NCLEX failures from multiple programs across the US.
- The aim of this study is to investigation the relationships among the SA and those failing NCLEX to identify unique factors evident.

3. Methods

▪ Design

A retrospective, multivariate quantitative design, utilizing Principal Component Analysis (PCA), was conducted for further statistical inference. The model sought to detect redundancy in SA scores from samples of pre-licensure program graduates with reported first-attempt failure on NCLEX.

▪ Sample

Associate degree, and baccalaureate programs of nursing were asked to participate in the study by providing de-identified SA results for all students failing NCLEX on the first attempt between spring 2009 and spring 2016.

Inclusion criteria for the student standardized assessment data in the sample were (a) completion of the respective program of nursing; (b) completion of a minimum of three content specific assessments and/or the exit examination; and (c) recorded failure of NCLEX on the first attempt.

- The specified sampling design and study inclusion criteria resulted in retrospectively collected, SA score data from 11 programs of nursing for $N = 296$ students. These scores, standardized within vendor, represented eight original variables corresponding to standard content areas of foundations of nursing care, pediatrics, maternal/newborn, pharmacology, adult medical-surgical, mental health, leadership, and an end-of-program comprehensive predictor examination. When listwise deletion was utilized, the final sample size was $n = 135$ complete cases.
- The sample SA scores were matched across vendors after Z-score transformation, with scores most closely aligned and corresponding to these eight standard content mastery assessment areas included in the study.
- Statistical Approach - Principal Components Analysis - The orthogonal rotations identify and eliminate the redundancy in the SA scores to focus on the information most important in those students failing NCLEX-RN.
- Results
- Overall, the Principal Component Analysis indicated that two nearly distinct components could account for a considerable amount of variation in eight standardized SA scores of students failing NCLEX on their first attempt. Most of the assessments exhibit a great deal of redundancy among first time NCLEX failing students.
- Two of the assessments, pharmacology and adult medical-surgical, seem to be particularly correlated to one another and less so to the other content specific assessments.
- The results showed that the two-component model was the best fit for the observed sample data and that PCA techniques can reduce the observed SA scores to only two principal components, emphasizing the redundancy present in the SA areas.
- 1. In component 1, Maternal/Newborn was found to have the highest loading factor (0.85) even above the comprehensive end of program exam (0.78) and therefore the most redundancy in the content tested.
- 2. In component 2, Pharmacology was found to have the highest loading factor (0.90) followed by Adult Medical-Surgical (0.70) and therefore the most redundancy of content tested (for this component).
- Discussion
- 1. The results could indicate that fewer SA can be used as predictors of NCLEX failure. Two components represent the phenomenon of NCLEX failure in the PCA model. Could these components be represented by using Maternal/Newborn, Pharmacology and Adult Medical Surgical SA? And, could these scores predict failure?
- 2. The findings show the Maternal/Newborn SA is highly correlated with component 1 (0.85). Based on the correlation, component 1 could be considered a primary measure of Maternal/Newborn content.

3. Component 2 shows that Pharmacology is the most redundant and possibly testing the same information as the Adult Medical Surgical. Based on this correlation, component 2 could be considered a primary measure of Pharmacology (Interpretation of the Principal Components, 2018).

Conclusions

1. The investigation of the relationships among the SA and those failing NCLEX could identify factors that are unique to this population.
 2. Discovery of significant relationships between SA scores and prediction of NCLEX-RN failure can assist faculty in identifying the students at risk, inform selection of SA for faculty and act as a catalyst for improving pass rates.
- The findings from this study will be tested in future work in predicting NCLEX outcomes.

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Author Summary: Jan Emory is currently an Associate Professor at the University of Arkansas, Fayetteville. Jan has served as a nurse educator for over 27 years. Her research surrounds trends and issues important to nursing education. She has a special interest in curriculum, methods of assessment and evaluation. She has presented her work at numerous national and international venues.