SHAWNEE STATE UNIVERSITY

DEPARTMENT OF MATHEMATICAL SCIENCES

Predicting Success on the NCLEX-RN for Associate Degree Nursing Students from a Small Public University

A Thesis

By

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This thesis is dedicated to my nieces and nephews.

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CHAPTER I

INTRODUCTION

The success of an associate degree nursing program is often dichotomized into either passing or failing the National Council Licensure Examination for registered nursing (NCLEX-RN). Not only are individual students' nursing future dependent on successfully navigating this examination, but the licensing and accreditation of nursing education programs are determined by maintaining consistent first-time pass rates of their graduates. This study will investigate academic and demographic factors to determine significant predictors of first-time pass on the NCLEX-RN for the associate degree in nursing program at Shawnee State University.

Shawnee State University is a public university that is situated in Portsmouth, Ohio in Scioto County. It is located near the Ohio River and the Ohio- Kentucky border. Despite being officially created on April 2, 1986, by Ohio HB 739, the university has a history that goes back to 1945. (Shawnee State University, 2022) What began as an academic center transformed later to become the Shawnee State General and Technical College after a merger agreement between Ohio University-Portsmouth and Scioto Technical College. In 1977, Shawnee State General and Technical College was re-designated Shawnee State Community College. Finally, in 1986 Shawnee State University was created (Shawnee State University, 2022).

From 1986 to the present time, Shawnee State University has progressively developed with respect to its facilities, academic offerings and athletics (Shawnee State University, 2022). The university is currently ranked ninth out of 150 U.S. and Canadian institutions for its game design program (Princeton Review, 2022) and has been ranked 12th for its online Master of Science in Mathematics program (Best College Review, 2022). Shawnee State University has 3,135 students as of Fall 2021 (Ohio Department of Higher Education, 2022). The completion rate by demographics for Spring 2018 is provided below (Shawnee State University, 2022).

Table 1 Completion Rates SSU 2018 by Ethnicity

Female	17.07%
Male	12.68%
Asian	14.70%
Caucasian	15.47%
1st Peoples or Indigenous	29.16%
International Students	27.90%
Multiracial	8.79%
Pacific Islander	20.00%
African American	11.60%
Latin Descent	15.38%
Undisclosed Ethnicity	10.43%
Pell Recipient	16.81%
Student Athlete	20.31%

Shawnee State university offers more than seventy associate, bachelor, master and doctorate programs for a multitude of disciplines and majors (Shawnee State, 2022). Shawnee State also offers nine degrees and certification programs for graduate and undergraduate students

that lead to professional licensure examinations (Shawnee State, 2022). Shawnee State University makes this data available through its Student Achievement page. Not all of the professional licensure examinations are required, but all graduates of these programs are eligible to take the examinations. (Shawnee State, 2022) The programs for which licensure examination are required, with the exception of the School of Education, did all collect and make public the pass rate information. The respiratory therapy program opted to report average years of licensure rather than a pass/fail rate for the licensure examination. The licensure pass rates, using the most recent (the data are not necessarily from the same year, but are from the most recent year that each program collected and posted the data on their individual program page) publicly available (Shawnee State, 2022) data are presented in the table that follows:

Table 2 SSU Program Pass Rates

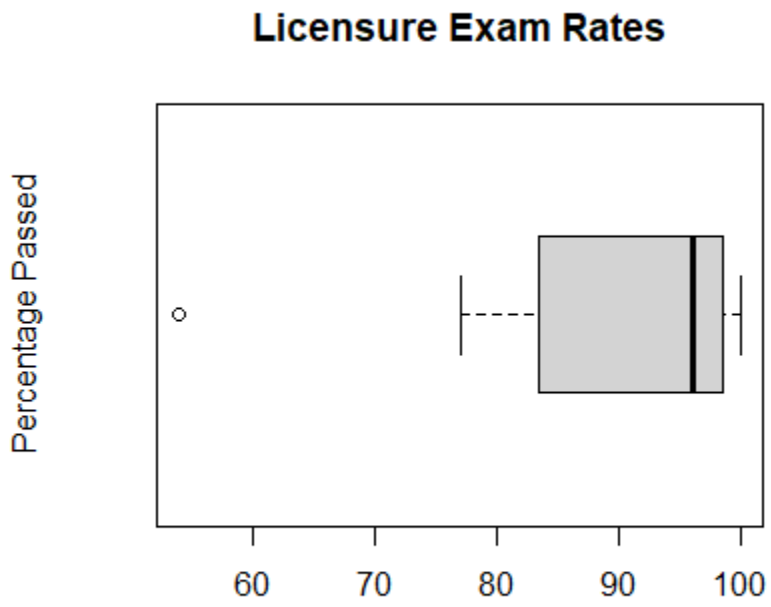
Program	*Pass rate*
Dental hygiene	97%
Medical laboratory technician	100%
Associate degree in nursing	54%
Bachelor of science in nursing	77%
Occupational therapy assistant	90%
Master of occupational therapy	96%
Physical therapist assistant	100%

The Shawnee State University Associate Degree in Nursing Program (ADNR) goes back to 1969 at the Ohio University-Portsmouth Campus. In 1971, the first graduates of the program began their careers in health care. The National League of Nursing Accrediting Commission granted NLNAC Accreditation to the ADNR in 2001 and the program maintains accreditation through the Accreditation Commission for Education in Nursing. Shawnee State University also

offers an RN-BSN, BSN and LPN-RN. The ADNR is the longest running program (Shawnee State, 2022).

The pathways that students may follow to start an occupation in the nursing field all lead to the National Council Licensing Examination for Registered Nurses (NCLEX-RN). When compared to the graduate outcomes at Shawnee State for all other programs that have made their licensure examinations pass rates available to the public, the ADNR pass rate of 53.85% appears to be an outlier as shown in the visualizations of licensure exam pass rates for SSU in figure 1:

Figure 1 SSU Program Professional Licensure Exam Pass Rates



In the past, the Shawnee State University Nursing program shared the same high pass rates as the other programs. While the BSN is not problematic when compared to the ADNR, it

also is low compared to the other programs and has shown a steady decrease in the past three years (Shawnee State, 2022). The ADNR program has a state ranking of 30 out of 84 and a national ranking 644 out approximately 1,700 (RN Careers, 2022). Having adequate pass rates for professional licensure examinations is a critical component of the measured educational outcome, i.e., student achievement. It is also a critical for an institution to maintain adequate pass rates for a myriad other reason including: to prevent loss of licensure or accreditation by state boards, to prevent discouragement and humiliation of students who may fail the NCLEX-RN due to inadequate preparation, and in order to prevent decreasing student enrollment rates (Quinn et al., 2018).

The National Council Licensure Examination for Registered Nurses (NCLEX-RN) is a computer adaptive examination that all prospective licensed registered nurses are required to pass for licensure in the United States. In 2015, the NCLEX was also incorporated into Canada as the exam that leads to an accepted licensure. Governed by the National Council of State Boards of Nursing (NCSBN), the website claims that more than 6 million candidates have taken the NCLEX since April 1994 (NCSBN, 2022).

The NCLEX-RN passing standards change every three years after the NCSBN conducts an analysis of the most contemporary nursing skills and procedures (NCSBN, 2022). According the NCSBN, the examination is designed to assess if the candidate possesses the nursing ability currently required to be deemed adequate at an entry-level position. The current passing standard was put into place in 2016 and will remain until 2023 (NCSBN, 2022).

The current NCLEX-RN passing standard is 0.00 logits. A logit is a unit of measurement to report relative differences between candidate ability estimates and item difficulties. The NCLEX-RN 2021 pass rate for 88,349 for US educated candidates taking the NCLEX-RN for the first time who have completed an associate degree program was 78.78% (NCSBN, 2022).

Thus, the research problem is to analyze anonymized data provided by the Shawnee State University School of Nursing that includes the following variables to identify significant predictors of failure or success on the NCLEX-RN examination of students who complete the ADNR program at Shawnee State University.

Table 3 Independent Variables

Variable	*Description*
Gender	M, F or other
Age	Grouped multiple ways
ACT English Score	Sub score on ACT
ACT Math Score	Sub score on ACT
ACT Science Score	Sub score on ACT
ACT Combined Score	Average of Sub score
Ethnicity	Ethnicity information
First Year GPA	First year GPA SSU
Other Grade Degree	Dichotomized Y /N
Repeated Courses	Dichotomized Y /N
ADNR Grad GPA	Program GPA

Purpose of the Study

The purpose of the study is to identify significant predictors of success for ADNR students who take the NCLEX examination. The ADNR program will be in a position to make data-driven decisions that will assist in increasing the pass rate of the NCELX. The study will

also make comparisons and determine odd ratios across the demographics data.

Significance of Study

While there have been studies regarding the NCLEX and various other variables, there have been only a few conducted in associate degree programs (Trofino, 2013). Furthermore, pass rate is inextricably linked to program accreditation and certification by state and national boards (Lima et al, 2011). Finally, NCLEX pass rate is positively associated with nursing education program success (Pennington & Spurlock, 2010).

Research Questions

The following four research questions will be investigated to determine predictors for NCLEX-RN success:

Research Question 1**:** Given the set of data supplied by the Shawnee State University Nursing program, what are the significant predictors for NCLEX-RN?

Research Question 2: What are the odds of success given the categorical variables and what is the correlation with NCLEX-RN for each of the quantitative variables. Are the predictors for NCLEX-RN success the same across all demographic variables?

Research Question 3**:** Is there a difference of the academic and demographic variables across the groups NCLEX-RN first time pass and NCLEX-RN first time fail.

Research Question 4: What are the significant predictors of success for those with no ACT scores.

Furthermore, a major question is should other factors be tracked in order to identify risk factors

and remediation strategies for students who do not pass the NCLEX-RN on the first attempt, but who pass/fail status is not fully explained by the previously identified significant predictors. In other words, is there a significant percentage of the variation in the pass rate of the NCLEX-RN in the data set that is not explained by the given independent variables. The California Board of Registered Nursing identified several factors for an NCLEX-RN pass rate less than seventy percent, however those factors, including family responsibilities, working 20+ hours per week and speaking English as an additional language were not recorded in the data supplied (California Board of Registered Nursing 2000, as cited by Higgins 2005).

Research Design

The ex post facto data was analyzed using the R statistical programming software. The data was acquired from the ADNR at Shawnee State University. The data included the dichotomous response variable, pass or fail the NCLEX-RN and 11 explanatory variables. The explanatory variables (see Table 3) are academic and demographic. The descriptive statistics can be viewed in the table in the following tables:

Table 4 Quantitative Academic Variables Descriptive Statistics

Variables	*n*	*Mean*	*SD*	*Q1*	*Median*	*Q3*	*Min*	*Max*
ACT Eng	258	21.02	4.44	18.00	21.00	24.00	9.00	35.00
ACT Math	258	19.98	3.78	17.00	19.00	23.00	12.00	32.00
ACT Read	258	22.73	5.08	19.00	22.00	26.00	7.00	34.00
ACT Sci	258	21.78	3.39	20.00	21.00	24.00	13.00	32.00
ACT Comp	258	21.16	3.58	19.00	21.00	24.00	12.00	33.00
FirstGPA	258	2.86	1.16	2.80	3.23	3.57	0	4
ADNR GPA	258	3.16	0.30	2.96	3.13	3.37	2.31	3.85

Table 5 Categorical Academic Variables

Variables	*N*	*Yes*	*No*
Repeated Courses	258	138	120
Other Degree	258	41	217

Table 6 Gender & Ethnicity Information

Gender	*N*	*%*
Male	63	17
Female	313	83
Ethnicity	*n*	*%*
African American / Black	7	1.8
Hispanic / Puerto Rican	4	1.0
Native Hawaiian / Pacific	1	0.3
Non-Citizen	1	0.3
Two or More Races	3	1.1
Unknown / Other	11	2.9
White	354	92.9

B =Persons of Black / African American Descent, H = Persons of Hispanic / Puerto Rican Descent, T = Two or more Races, U = Unknown or other, N = Persons of Native Hawaiian or Pacific Descent, NC = Persons who are Non-citizen, W = Persons who are of one of the White ethnicities

Table 7 Descriptive Statistics by Age

Gender	*n*	*%*	*Mean*	*SD*	*Median*
Female	318	83	32.66	8.07	31
Male	63	17	31.37	6.29	29
Ethnicity					
B	7	1.8	34.43	4.04	35
H	4	1	40.5	8.39	44
T	3	1.1	31.33	5.86	29
U	11	2.9	31.73	7.94	28
N	1	0.3	32	NA	32
NC	1	0.3	42	NA	42
W	353	92.9	32.3	7.86	30
Total	381	100	32.45	7.81	30

A logistic regression model was chosen to identify significant predictors of NCLEX-RN success. due to the dichotomous response variable as well as the necessity to calculate odds ratios across the demographics. The assumptions met included independence of errors, linearity of explanatory variables and log-odds, strongly influential outliers, multicollinearity and a sufficiently large sample size. A mixed methods model was ruled out due to the nature and availability of the data during this particular period.

The logistic model was generated using backward elimination and then analyzed further. Once the best fit model was identified, 95% confidence intervals were calculated for each of the significant predictors and odds ratios.

A Welch's t-test was conducted across the two groups NCLEX-RN first time pass and NCLEX-RN first time fail to determine if there was significant difference in the means of the quantitative academic variables. This was followed up with a Wilcoxon ranked sign test to determine if there was a significant difference between the medians of the quantitative academic variables between the two groups NCLEX-RN first time pass and NCLEX-RN first time fail.

A correlation analysis was done between NCLEX-RN and the quantitative independent variables. Additionally, an exploratory analysis of the observations for which there was no record of ACT scores was also conducted to determine which variables could predict NCLEX-RN first time pass.

Assumptions, Limitations and Scope

The assumptions made in this study are limited to the anonymized data set collected by the Shawnee State University nursing program and used in the analysis herein. The data does not allow for any general categorical statements about nursing programs or NCLEX-RN success in general unless this information is cited from another source and listed in the sources page. The study specifically focused on only students who had completed the associate degree in nursing program at Shawnee State University.

Summary

Chapter 1 introduced the problem to be investigated. Namely, that the ADNR program at Shawnee State University has experienced an NCLEX pass rate in 2019 of 80.77%, followed by 72% in 2020 and 53.85% in 2021. This occurred while the other programs that lead to professional licensure certification at Shawnee State University did not experience a similar decrease for those three years (Shawnee State, 2022). Therefore, the purpose of the study is to determine what significant predictors can explain NCLEX-RN success in the context of an associate degree program. Furthermore, a correlation analysis will be conducted, and an analysis of the odds ratios and likelihood of success will be executed across multiple combinations of demographic. Finally, a comparison between the means and medians of the quantitative academic variables of the NCLEX-RN first time pass and the NCLEX-RN fail groups.

CHAPTER II

LITERATURE REVIEW

The literature review will be presented thematically according to the order in which the research problems have been presented in Chapter 1. The purpose of this literature review is to summarize and synthesize the current literature, identify gaps in the literature and to provide sufficient motivating evidence for the current study. This literature review examined and investigated thirty-two articles that explore various aspects of the problem. A majority of the articles are from peer reviewed journals while two are dissertations for doctoral students in the nursing field.

The literature examined ranges from the year 1986 to the year 2020 despite the existence of literature that goes back even further in time. The relevance of the previous literature to the current study is marginal at best since not only does the NCLEX-RN change every three years, but in addition to that change in subject matter that is on the examination, there is also a historical record of changes in scoring and passing standards. (NCSBN, 2022) The subsections, which will proceed thematically, will address firstly, the theoretical framework followed by the summarization and synthesis of studies that have focused on identifying academic predictors of first time NCLEX-RN pass for associate degree programs. Next will be studies that have focused on identifying demographic predictors of first time NCLEX-RN pass for associate degree programs. Once the studies that focused solely on associate degree nursing programs have been presented, the studies that have focused on both academic and demographic predictors of first

time NCLEX-RN pass for bachelor's degree programs will be presented followed by studies that were qualitative in nature that focused on various aspects of the NCLEX-RN experience and perceived factors for success. Following the presentation of qualitative studies, studies that focused on remediation, identifying at-risk students and interventions to prevent first time NCLEX-RN failure will be presented. Finally, studies that focused on using a third-party examination and preparation software to predict first time NCLEX-RN success for associate degree students will be presented. There is some literature that focuses on identifying significant predictors of first-time failure for the NCLEX-RN, but it is relatively sparse due to the difficult in predicting failure rather than success (Seldomridge and DiBartolo, 2004).

Theoretical Framework

This study relies on Jeffrey's Nursing Universal Retention and Success (NURS) model because it presents a globally applicable framework for analyzing the multitude of factors that are primary and milieu in forming a successful nursing program student. (Jeffrey, 1998) The NURS model takes into account environmental factors, psychological factors (such as student affective factors), professional socialization and enrichment, optimizing outcomes aimed at achieving peak performances, taking a holistic approach to focus on proactive inclusive enrichment and avoid exclusive remediation. The primary advantage of the NURS model is that is consider the multi-dimensionality of the factors that predict nursing program retention and success focusses retention rather than preventing attrition. (Jeffrey, 1998)

Academic Predictors

The current body of literature contains an abundance of studies that assess the significance, correlation and ability of academic factors and NCLEX-RN first time pass. The typically utilized academic predictors include high school GPA, science and math courses taken in high school, transfer GPA, first year GPA, SAT or ACT composite scores, SAT or ACT subjects scores, lesser-known placements examinations, performance in core nursing program courses, repetition or failure of core nursing programs, performance in science and mathematics courses, nursing program GPA and institutional exit examinations. The issue is that the demographics and diversity vary considerably, each institution itself often varies considerably in their methods and teaching philosophies, the presence or absence of remediation or intervention schemes and even the method in which courses are graded can have an impact on the outcome of the study. An illustrative example can be given in the form of the example of GPA calculations. What is considered a "B" in one program may be considered a "D" in another program (Mitchell, 2016). The variety of ways in which a GPA can be calculated can impact the coefficients given in any sort of regression model. Therefore, the best-case scenario is to identify which academic predictors are significant for a specific sample and then to continue to reassess as the institution adjusts to the data and to the inevitable change in the NCLEX-RN exam that occurs after an industry-wide analysis every three years.

Moniyung (2015) conducted a study at a traditional associate degree nursing program at Southern Adventist University. The School of Nursing had experienced a significant decrease in

NCLEX-RN first time pass rate of associate degree students for the year 2014 of 76.5%. (Moniyung 2015). It should be noted that the NCLEX-RN had been updated and a new passing standard had in fact been instituted on April 1, 2013. (NCSBN, 2022). The purpose of the study was to identify predictors of NCLEX-RN success on the first attempt of associate degree students at Southern Adventist University. The study included a sample of 838 students records and variables that were both quantitative and qualitative, i.e., academic and demographic. The academic variables included Admitted Cumulative GPA, ACT English, ACT Math and ACT Reading as well as a list of STEM or core nursing courses. The study also included demographic variables such as age, gender and ethnicity. The investigator concluded by way of logistic regression analysis and demographic analysis that ethnicity and three core nursing program courses were significant predictors of first-time pass of NCLEX-RN for associate degree program students (Moniyung, 2015).

Lengacher and Keller (1990) analyzed a sample of 146 associate degree students enrolled in a nursing program to determine significant predictors of NCLEX-RN success. They examined entrance GPA, ACT English, ACT Math, ACT Composite, age, perception of role strain, achievement in nursing program courses, and exit GPA. Using Pearson product moment correlations (r-value) and stepwise multiple regression analysis, the investigators identified exit GPA and ACT composite scores. The study also found that performance in core nursing program courses were highly correlated with NCLEX-RN success (Lengacher and Keller, 1990).

Trofino (2013) conducted a study to analyze the criteria that are significant predictors of

first-time pass of the NCLEX-RN for associate degree students. Using logistic regression, the investigator determined that the statistically significant predictors of first-time pass on the NCLEX-RN were pre-entrance normalized math scores, success in core nursing program courses and repetition of nursing program courses (Trofino, 2013).

Woodham and Taube, (1986) analyzed a sample of 104 graduates of an associate in science in nursing degree program to determine predictors for first time pass on the NCLEX-RN. They noted that success in core nursing course programs and SAT verbal scores were all significant predictors for first time pass on the NCLEX-RN, while age at graduation, high school rank percentile, and SAT math scores were not significant predictors (Woodham and Taube, 1986).

Romeo (2013) investigated to determine if critical thinking, nursing program GPA and SAT combined math and verbal scores were significant predictors of NCLEX-RN success. They examined ex post facto data of 91 students who passed the NCLEX-RN on the first attempt and 91 students who failed the NCLEX-RN who all graduated from an associate degree in nursing program at a small private college (Romeo 2013). The SAT combined math and verbal scores were not significant predictors. Nursing program GPA and an assessment test designed to measure critical thinking were both highly positively correlated with first time NCLEX-RN pass (Romeo 2013).

Sayles et al. (2003) executed a correlation comparative study designed to determine the relationship between successful completion of the associate degree nursing program and first

time of the NCLEX-RN. Although one of the main purposes of this study was to determine the reliability of pre-admission entrance examinations (NET), it also studied nursing program GPA. Using a sample of 68 students who graduated from an associate degree in nursing program, they concluded that nursing program GPA and performance on the NET entrance exam in math, reading and composite score were significant predictors of NCLEX-RN first time pass (Sayles et al, 2003).

Tipton et al (2008) conducted a correlation analysis of 385 graduates of an associate degree in nursing program. They concluded that performance on nursing program courses is significant predictor of first-time pass of the NCLEX-RN. In particular, they identified that higher grades in the early nursing program courses were highly predictive of cumulative nursing grade, which in turn predicts NCLEX-RN first time (Tipton et al 2008). Therefore, in this case, higher grades in the beginning nursing program courses are significant predictors of NCLEX-RN success (Tipton et al, 2008).

Bosch et al (2012) conducted a study of associate degree in nursing program students with a sample size of 71 students. They examined five pre-admission academic variables including pre-program GPA, pre-program science credits, pre-program mathematics and pre-program developments courses (Bosch et al, 2012). The research utilized logistic regression to determine the significant predictors of NCLEX-RN success on the first attempt. The conclusion is that the only significant predictor of first-time pass on the NCLEX-RN was pre-program science credit and pre-program GPA was marginally significant. Ultimately, the study concluded

that thought incoming GPA was marginally statistically significant (p =0.05), students with a higher GPA (M=3.2) were significantly more likely to pass the NCLEX-RN than student with lower GPA (M=2.5) (Bosch et al., 2012).

Shaffer and McCabe (2013) conducted a regression analysis on a sample of 335 associate degree in nursing program students to determine the best pre and post admission academic non-nursing course predictors of NCLEX-RN first-attempt outcome. This study found a significant positive correlation between preadmission GPA and NCLEX-RN outcome, but preadmission GPA was not a significant predictor of first-time pass on the NCLEX-RN (Shaffer and McCabe, 2013). There was a significant, positive correlation achieved between anatomy and physiology, and microbiology courses and NCLEX-RN outcome, but these courses were not significant predictors of NCLEX-RN success (Shaffer and McCabe, 2013). The study found that the only significant predictor of NCLEX-RN first time pass was repeating science courses (Shaffer and McCabe, 2013).

Summary of Academic Predictors

Studies that have sought to determine academic predictors of first time NCLEX success for associate degree in nursing program graduates have had varying results. The significant predictors of NCLEX-RN success vary perhaps due to the heterogeneity of nursing programs methodologies, nursing program student diversity, and a question that could be investigated more thoroughly, the numerous ways that course grades and GPA are calculated and assigned. There are contradicting results with respect to standardized exams such as the ACT and the SAT, as

well as other lesser-known pre-entrance examinations (Sayles et al 2003). The conclusion is that while many studies have been conducted, they have taken many different approaches which makes it difficult to find a consensus.

Demographic Predictors

Demographic variables that are consistently analyzed in order to determine if they have a positive or negative correlation with NCLEX-RN success or if they are significant predictors of first-time pass on the NCLEX-RN are age, gender, ethnicity, birthplace (born in the United States of America or not) and whether or not English is the student's first language (Banks et al, 2018). Determining if and which group memberships increase or decrease the likelihood of success or failure on the first attempt at the NCLEX-RN are critical for nursing programs in order to determine if some remediation or intervention is required. However, using the NURS model, all remediation should be implemented so as not to exclude those being remediated (Jeffrey 1998).

Seago and Spetz (2005) conducted a comprehensive study of California community college nursing programs to examine admission requirements, attrition rates, on-time completion rates and NCLEX-RN first time pass rates. The primary focus of the study was to determine if demographic variables, namely ethnic group membership, were factors in determining success rates (Seago and Spetz, 2005). Additionally, the study sought to determine institutional predictors of NCLEX-RN first time pass rates in California community colleges (Seago and Spetz, 2005). This study found that programs with higher percentages of Black and Filipino

students were negatively associated with lower NCLEX-RN first time pass rates while controlling for other program attributes (Seago and Spetz, 2005).

Moniyung (2015), found that Black and Hispanic students had lower NCLEX-RN first time pass rates when compared with other self-reported student ethnicities. Age and gender were not significant predictors of first time NCLEX-RN success. Lengacher and Keller (1998) found that age had no predictive value and was not a significant demographic predictor of NCLEX-RN first time pass. Sears et al. (2015) conducted a systematic review of the literature when the NCLEX-RN replaced the Canadian Registered Nursing Examination. They examined 17 studies and found that gender, age and ethnicity showed varying results, but speaking English as a first language showed a high correlation with NCLEX-RN success. Lima et al. (2011) found that in a sample of 650 students where 12% were men, 29% were Black and 8% were "other minorities", males, Black people, Hispanics and Asians had a lower pass rate than White students. Mitchell (2016) found that age, race and gender were not significant. Alameida et al. (2011) conducted a study that included 589 students where 38% identified as Asian, non-Hispanic, 30.6% identified as White, non-Hispanic, Black American, non-Hispanic 7.3%, Native American / Alaskan Native 5.08%, Native Hawaiian 10.9% and other 4.1%. The data lacked racial information for 42 of the 589 students. (Alameida et al. 2011) The number of males in the sample was 23.3% and the number of females was 76.7% (Alameida et al. 2011). The study found that there was "no significant association between any of the demographic variables examined and first-time pass success." (Alameida et al. 2011).

Sayles et al. (2003) found that in a sample of students that was 82.4% female and 85.3% Caucasian that minority students were not as likely to pass the NCLEX-RN.

Summary of Demographic Predictors

Studies that have determined to find significant academic predictors of first time NCLEX-RN success have had varying results. Nursing programs have a diverse population that do have a skew toward being predominantly female and predominantly Caucasian, but that is not always the case. Some studies have found that demographic variables can explain NCLEX-RN success while others found that they were not significant. These contradictory results give rise to several questions. Firstly, are the current and past studies using the best quantitative methods to determine significant predictors? If so, are the assumptions for the specific statistical test being met and discussed? Second, in the cases where demographic variables have not been identified as significant predictors, but it has been shown that a particular demographic attribute has a higher or lower odds of first time NCLEX-RN success, what can be done to address the disparity?

Studies focused on bachelor's degrees in nursing

While the current body of literature contains a bounty of assorted studies focused on determining variables that are significant predictors of first time NCLEX-RN success, a weighty portion of this work cannot be extrapolated due to differences in program types. This section of

the literature review will summarize and synthesize results of studies that sought identify first time NCLEX-RN success for BSN programs. The purpose is to compare findings in the studies focused on associate degree in nursing programs and observe if there appear to be consistent similarities or differences.

Lockie et al. (2013) found that people who are of African American descent were less likely to pass than Whites and that the student's Chemistry course grade was a significant predictor of NCLEX-RN success. McCarthy et al. (2014) found pre-nursing GPA, communication course grade and math, science and English scores on the (Test of Essential Academic Skills) TEAS were significant predictors of NCLEX-RN success.

Although these results cannot be extrapolated and applied to an associate degree of nursing program, it is useful to not that despite numerous studies, there has been a failure to identify consistent significant predictors of success for Bachelor of Science in nursing degree programs other than the HESI, ATI and NLN as well. (Banks et al. 2018)

Literature Review Summary

There remains doubt about what variable can significantly predict NCLEX-RN success despite the numerous studies that have attempted to identify significant predictors of NCLEX-RN success on the first attempt for associate degree, Bachelor of Science degree and master's entry programs. The academic variables found most often to be significant were nursing program courses success, GPA and standardized exams. (Banks et al. 2018). There are varying results

with respect to demographic variables. There is noteworthy evidence that the examinations called the HESI, and the ATI can predict NCLEX-RN success with a high accuracy, up to 100% accuracy. Alameida et al. (2011), De Lima et al. (2011). The evidence suggests that each associate degree nursing program must investigate and determine what produces the best results in their own specific program and student population and that utilizing appraisal tools and examinations such as the HESI, ATI or NLN can provide highly accurate predictions as to which students will pass the NCLEX-RN and therefore provide opportunities for remediation and intervention that will prevent a drop in NCLEX-RN pass rate for that nursing program.

This literature review analyzed literature that included studies that sought to identify significant predictors of NCLEX-RN success or to identify factors that are highly correlated with NCLEX-RN success. The review of studies that sought to identify academic factors yielded mixed results. The review of the studies that sought to identify demographic factors also yielded mixed results. Therefore, it is possible that there were many factors that are more predictive or more highly correlated than the factors previously explored. Using Jeffrey's NURS model, it may be possible to identify more predictive factors that are enumerated in the NURS model. (Jeffrey's 1998)

CHAPTER III

METHODOLOGY

The purpose of this study is to determine significant predictors of NCLEX-RN success from a variety of variables. These variables can be described as academic predictors, i.e., quantitative measures academic performance, and demographic variables. The academic variables included in this study are ACT English, ACT math, ACT reading, and ACT composite scores, first year GPA, GPA upon graduating the associate degree in nursing program (ADNR GradGPA), if the student has repeated courses, and if the student has already completed an additional degree or not. The demographic variables included in this study are age, gender and self-identified ethnicity. Previous studies have demonstrated that the significant predictors of NCLEX-RN first time pass are inconsistent from study to study. There are contradicting results for all academic and demographic variables. This seems to suggest that there is significant variation from program to program and determining significant predictors of success on the NCLEX-RN is more complex that has been previously considered. A potential solution is to use Jeffrey's NURS model (Jeffrey's 1998). Additionally, tailoring the nursing program to the specific data obtained at the institution has been identified as a key strategy (Banks, et al. 2018). In this study, we utilize logistic regression analysis to determine program specific predictors of NCLEX-RN first time pass that are considered statistically significant.

In 2020, Shawnee State University's associate degree in nursing program recorded an all-

time low pass rate on the NCLEX-RN of 53.85% (Shawnee State, 2022). Improving this pass rate is vitally important for a variety of reasons including concerns regarding certification and licensing of the program, the reputation of and attraction to the Shawnee State University associate degree in nursing program (De Lima, et al., 2011). Another compelling and pressing reason for determining significant predictors of NCLEX-RN first time success is in ensuring that students do not suffer other negative side-effects by being inadequately prepared for passing the NCLEX-RN on the first attempt (Griffiths, et al. 2004).

The Research Questions

The following four research questions will be investigated to determine significant predictors for NCLEX-RN success:

Research Question 1**:** Given the set of data supplied by the Shawnee State University Nursing program, what are the significant predictors for NCLEX-RN?

Research Question 2: What are the odds of success given the categorical variables and what is the correlation with NCLEX-RN for each of the quantitative variables. Are the predictors for NCLEX-RN success the same across all demographic variables?

Research Question 3**:** Is there a difference of the academic and demographic variables across the groups NCLEX-RN first time pass and NCLEX-RN first time fail.

Research Question 4: What are the significant predictors of success for those with no ACT scores.

Additional discussion arises from the implications of the analysis of this data that

indicates that the question- should other factors be tracked in order to identify risk factors and remediation strategies for students who do not pass the NCLEX-RN on the first attempt, but who pass/fail status is not fully explained by the previously identified significant predictors- should be asked. In other words, is there a significant percentage of the variation in the pass rate of the NCLEX-RN in the data set that is not explained by the given independent variables. The California Board of Registered Nursing identified several factors for an NCLEX-RN pass rate less than seventy percent, however those factors, including family responsibilities, working 20+ hours per week and speaking English as an additional language were not recorded in the data supplied (California Board of Registered Nursing 2000, as cited by Higgins, 2005).

Setting and Participants

Shawnee State University is a public university that is situated in Portsmouth, Ohio in Scioto County. It is located near the Ohio River and the Ohio-Kentucky Border. The student population in 2019 was 3,641 undergraduate and graduate students whose demographic variability consisted of 83.3% Caucasian, 4.09% Black, 2.42% two or more races, 0.879% Asian, 0.687% Hispanic or Latino, 0.439% Native American or Alaska Native and 0.0824% Native Hawaiian or Other Pacific Islanders (DataUSA, 2019). 77.4% of the students are enrolled full-time and 79% of undergraduate students receive grants while 58% of undergraduates receive federal loans (DataUSA, 2019). The most common job for all majors at Shawnee State University is registered nurse (DataUSA, 2019). Thus, finding how to determine significant

predictors of NCLEX-RN success is supremely urgent.

The Sample Data

The study is a retrospective review of Shawnee State University associate degree in nursing program data that has been anonymized prior to being turned over to the investigator. The data was collected by the nursing program department and by the university registrar office for the years 2012 to 2021. The Institutional Review Board approved this study on February 8, 2022, and ethical considerations for human subjects met exemption status. The data originally contained 903 records from the year 2012 to 2021. Out of these 903 observations, only 511 of them had NCLEX-RN scores and of those, 460 (90%) were NLCEX-RN pass and 51 (10%) were NCLEX-RN fail. After eliminating observations that did not have NCLEX-RN results or were duplicate values and after restricting the data to that which fell in the years 2014-2021, the sample size was reduced to $n = 381$. A sample size of $n \geq 50 + 8 \times k$, for k predictors are required to assess the fit of the overall regression model and $n \geq 104 + 8 \times k$ to test the individual predictors (Green, 1991). According to Green, we take the largest of the two numbers. Given that our maximum number of predictors is 11, we a sample size of $n = 192$.When the observations are removed that are missing ACT scores and either first and/or graduating GPA, we are left with a sample size of $n = 258$, which is above the required threshold. Therefore, we calculate demographic features based on $n = 381$, but the prediction through logistic regression and the correlation analysis are done on the reduced sample size of observations that included

those particular variables.

The remaining sample includes 83% (318) females and 17% (63) males. The ethnic attributes include 93% (354) Caucasian, 3% (11) Unknown/Other, 2% (7) Black, 1% (4) Hispanic/Puerto Rican, 0.3% (1) Native Hawaiian/Pacific Islander, 0.3% (1) non-Citizen, 0.8% (3) 2 or More Races.

The data includes 95 students who graduated in 2014, 75 students who graduated in 2015, 60 students who graduated in 2016, 53 students who graduated in 2017, 22 students who graduated in 2018, 37 students who graduated in 2019, 23 students who graduated in 2020 and 17 students who graduate in 2021. The following charts visualizes this data. It should be noted that this data set does not include all of the students who graduated in 2021.

The data contains 346 students who passed the NCLEX-RN on the first attempt and 35 students who did not pass the NCLEX-RN on their first attempt. All of the students were in the associate degree of nursing program.

Limitations of the Study

The study is limited to the current data set that was taken from the Shawnee State University associate degree in nursing program for the years 2014-2021. The data does not include all students who graduated in 2021, but it does include all who graduated with the academic year 2020-2021. Additionally, it must be noted that the data provided is not representative of the trends on record at the Ohio State Board of Nursing website or on the SSU website. When the

pass rates using this data set of $n = 511$ are calculated, the following table results

Table 8 Pass Rates Using All Available Data

Year	*NCLEX-RN Fail*	*NCLEX-RN Pass*	*Pass Rate %*
2014	20	75	79
2015	9	66	88
2016	1	59	66
2017	0	53	100
2018	1	21	95
2019	1	36	97
2020	1	23	96
2021	2	15	88

When the pass rates were calculated using the data set of $n = 318$, the following table results

Table 9 Pass Rates Using Sample Data

Year	*NCLEX-RN Fail*	*NCLEX-RN Pass*	*Pass Rate %*
2014	20	74	79
2015	9	66	88
2016	1	59	66
2017	0	53	100
2018	1	21	95
2019	1	36	97
2020	1	22	96
2021	2	15	88

According to the SSU ADNR website that includes achievement data the pass rates for the ADNR for the years 2019 and 2020 were 80.77% and 72%, respectively, which is not reflected in the data set that was provided (Shawnee State, 2022). It was communicated that data set was incomplete with respect to the years 2021, but there was no explanation for the other discrepancies. According to the Ohio State Board of nursing the pass rates the SSU ADNR program for the years 2018, 2019 and 2020 were 81.25%, 83.33% and 78.26%, respectively

(Ohio Board of Nursing, 2022). As demonstrated in the literature review, there have not been any significant academic or significant predictors of first-time success on the NCLEX-RN that have proved to be consistent across the many studies examined in the current investigation other than the HESI, ATI or other predictive examinations. Although HESI data was provided, it was not included in this study because out of the 212 observations that include HESI scores, only 7 of these are NCLEX-RN fails on the first attempt. Therefore, any analysis that would result would be unreliable. Furthermore, the predictive logistic model and other conclusions cannot be generalized to other samples or populations outside of this particular data set.

Procedure

The procedures utilized in this study were analysis of descriptive statistics for the variables and a logistic regression analysis. The explanatory variables are following in the table below and the response variable is NCLEX-RN first time pass or fail. The general analysis and the logistic regression analysis are done using the R statistical programming software. Logistic regression is utilized because it allows one to predict a discrete outcome such a group membership from a set of variables that may be continuous, discrete, dichotomous or a mix (Tabachnick et al., 2007). The goal of analysis is to predict the category of each observation and once a set of predictors is found, the equation can be used to predict outcomes for new cases on a probabilistic basis (Tabachnick et al., 2007).

Logistic regression is also the optimal choice when the outcome variables are categorical due to the necessity that there be a linear relationship between the variables in a multiple linear regression analysis (Fields, 2012). Furthermore, the method of logistic regression is uniquely useful as it allows for the calculation of the odds ratio, which is the change in odds resulting from a unit change in the predictor (Fields, 2012). While it may be determined that some of the variables are not significant predictors, it is useful to know if the odds of NCLEX-RN first time success are more likely for a specific variable. In particular, the odds ratio is used to determine if there is disparity among demographic variables. The results may be problematic given that the student demographics are in the majority Caucasian females.

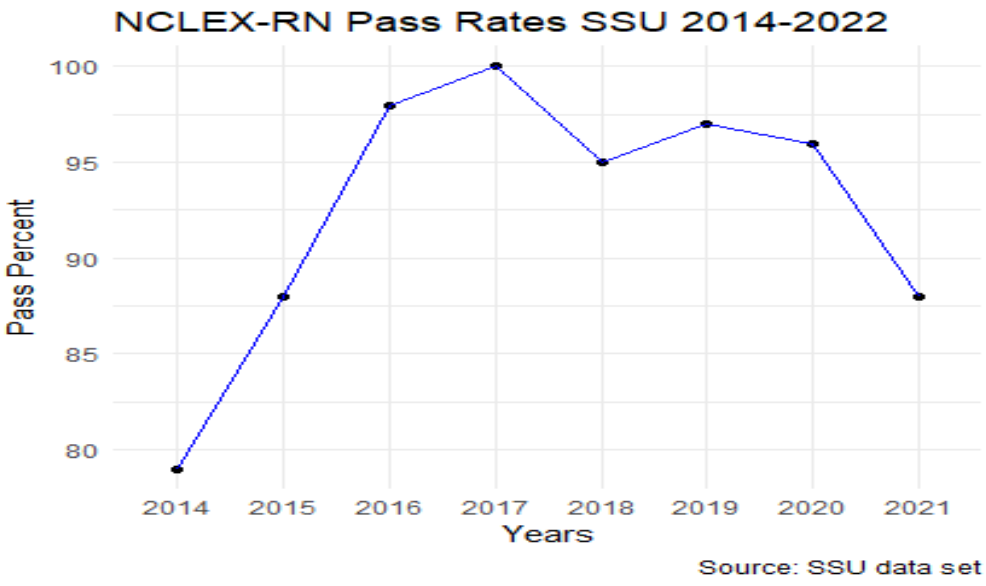
Table 10 Table of Academic & Demographic Variables

Description of Data Variable	*Data Variable Options*	*Variable Type*	*Reason for inclusion*
Gender	Gender information	Categorical	May be predictive
Age	Student age in years	Continuous	May be predictive
ACT English	Score	Continuous	May be predictive
ACT Math	Score	Continuous	May be predictive
ACT Reading	Score	Continuous	May be predictive
ACT Science	Score	Continuous	May be predictive
ACT Composite	Score	Continuous	May be predictive
ADNR Graduation GPA	Score on 0-4.0 scale	Continuous	May be predictive
Repeat Count	Number of repeated courses	Categorical	May be predictive
First GPA	Score on scale 0-4.0	Continuous	May be predictive
Ethnicity	Ethnicity information	Categorical	May be predictive
Other Degree	Previous degree holder	Categorical	May be predictive

Summary

This analysis was conducted on a set of 381 observations that were taken over that were collected during the years 2014 to 2021. The ex post facto data set does not include all of the observations from 2021, but does include observations up to the April 23rd, 2021, graduation. The data was anonymized prior to being received by the investigator and the research received IRB approval in February of 2022 on exempt status. The purpose of this study is to determine the significant predictors of NCLEX-RN first time pass for the graduates of the associates degree in nursing program at Shawnee State University. The impetus for this study was the urgent need to address the declining pass rates of the SSU associate degree in nursing student which hit an all-time low in 2021 (Ohio Board of Nursing, 2022).

Figure 2 NCLEX RN Pass Rates 2014-2022



The following four research questions will be investigated to determine significant predictors for NCLEX-RN success:

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Research Question 3**:** Is there a difference of the academic and demographic variables across the groups NCLEX-RN first time pass and NCLEX-RN first time fail.

Research Question 4: What are the significant predictors of success for those with no ACT scores.

Additional discussion arises from the implications of the analysis of this data that indicates that the question- should other factors be tracked in order to identify risk factors and remediation strategies for students who do not pass the NCLEX-RN on the first attempt, but who pass/fail status is not fully explained by the previously identified significant predictors- should be asked. In other words, is there a significant percentage of the variation in the pass rate of the NCLEX-RN in the data set that is not explained by the given independent variables. The California Board of Registered Nursing identified several factors for an NCLEX-RN pass rate less than seventy percent, however those factors, including family responsibilities, working 20+

hours per week and speaking English as an additional language were not recorded in the data supplied (California Board of Registered Nursing 2000, as cited by Higgins, 2005).

CHAPTER IV

THE RESULTS

The purpose of this study is to determine significant predictors of NCLEX-RN success from a variety of variables given a data set of associate degree in nursing students at Shawnee State University that was draw from students who graduate in the years 2014-2020. These variables can be described as academic predictors, i.e., quantitative measures of academic performance, categorical predictors of academic characteristics and demographic variables. The research questions were as follows:

Research Question 1**:** Given the set of data supplied by the Shawnee State University Nursing program, what are the significant predictors for NCLEX-RN?

Research Question 2: What are the odds of success given the categorical variables and what is the correlation with NCLEX-RN for each of the quantitative variables. Are the predictors for NCLEX-RN success the same across all demographic variables?

Research Question 3**:** Is there a difference of the academic and demographic variables across the groups NCLEX-RN first time pass and NCLEX-RN first time fail.

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Additional discussion arises from the implications of the analysis of this data that indicates that the question- should other factors be tracked in order to identify risk factors and remediation strategies for students who do not pass the NCLEX-RN on the first attempt, but who pass/fail status is not fully explained by the previously identified significant predictors- should be asked. In other words, is there a significant percentage of the variation in the pass rate of the NCLEX-RN in the data set that is not explained by the given independent variables. The California Board of Registered Nursing identified several factors for an NCLEX-RN pass rate less than seventy percent, however those factors, including family responsibilities, working 20+ hours per week and speaking English as an additional language were not recorded in the data supplied (California Board of Registered Nursing 2000, as cited by Higgins, 2005).

Analysis of Observations and Variables

The data was provided by the Shawnee State University Office of the Registrar and the Shawnee State University Nursing Program. The data had been fully anonymized and IRB approval was received on the 8th of February in 2022. The data originally included 901 observations. After removing the observations that did not have an NCLEX variable and constraining to study to those observations that included students who graduated from the ADNR program at SSU from 2014 to 2021, there were 381 observations remaining.

The descriptive characteristics of the sample includes 83% (318) females and 17% (63) males. The ethnic attributes include 93% (354) Caucasian, 3% (11) Unknown/Other, 2% (7)

Black, 1% (4) Hispanic/Puerto Rican, 0.3% (1) Native Hawaiian/Pacific Islander, 0.3% (1) non-Citizen, 0.8% (3) 2 or More Races.

The total number of observations that were included in the analysis was 381. Of that sample, there 67 observations that did not include ACT variable data and another 56 observations were omitted due to missing values across the rows leaving a sample size of 258 that was free from missing data. A sample size of $n \geq 50 + 8 \times k$, for k predictors are required to test the fit of the overall regression model and $n \geq 104 + 8 \times k$ to test the individual predictors (Green, 1991). According to Green, we take the largest of the two numbers. Given that our maximum number of predictors is 11, we a sample size of $n = 192$.When the observations are removed that are missing ACT scores and either first and/or graduating GPA, we are left with a sample size of $n = 258$, which is above the required threshold.

We first examine the data based on demographic characteristics starting with gender, which is considered for only the case male or female. This visualization represents the 83% female and 17% male observations who graduated from the ADNR program at SSU and subsequently took the NCLEX-RN from 2014 to 2021.

Figure 3 Gender Characteristics

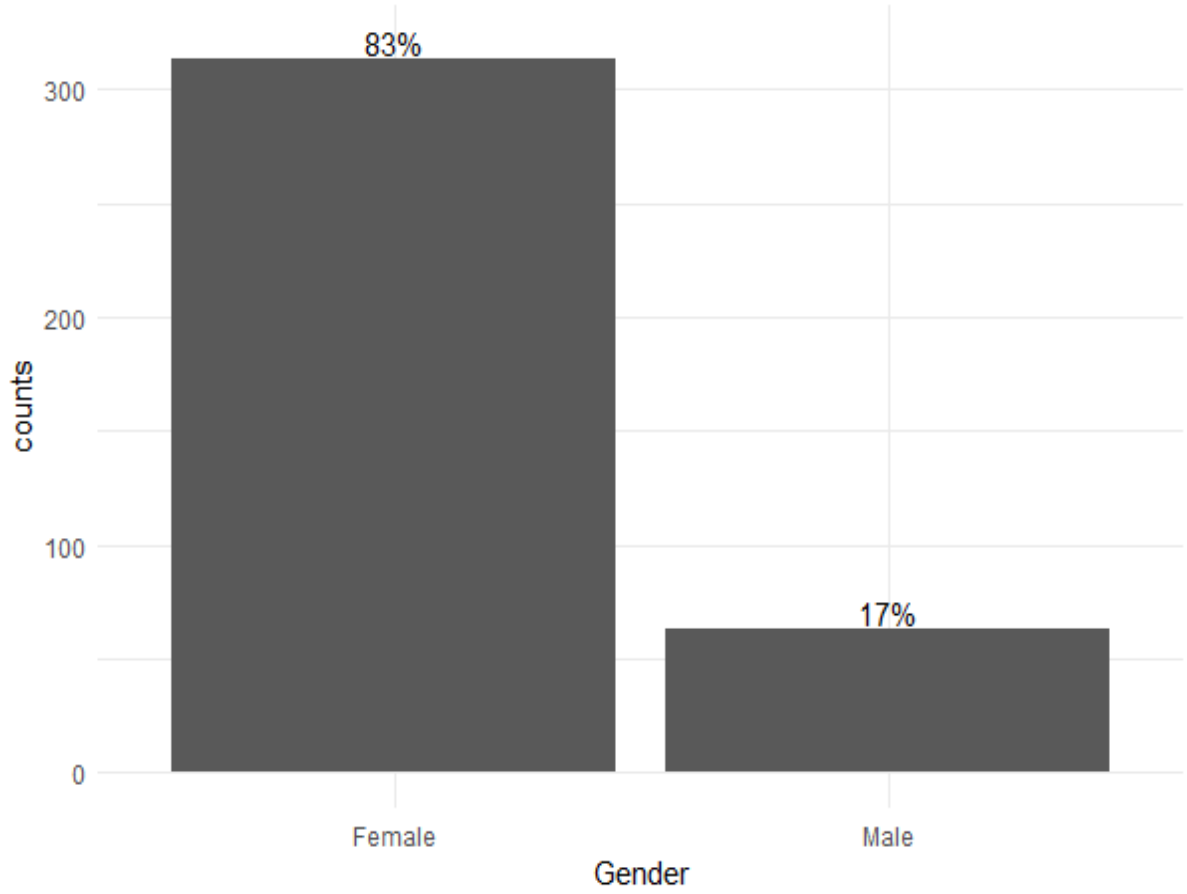


Table 11 Gender Characteristics

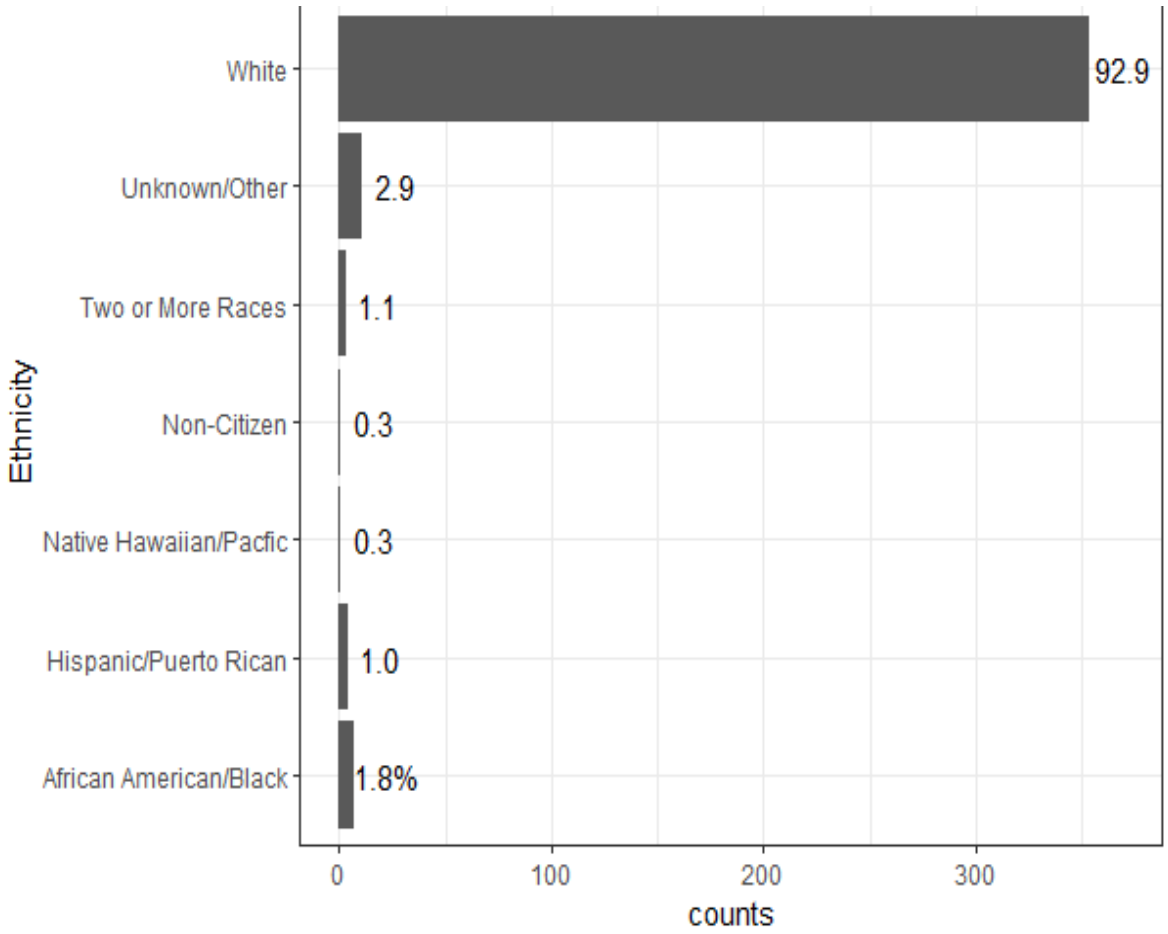
Gender	***N***	***%***
Male	63	17
Female	313	83

Table 12 Ethnicity Characteristics

Ethnicity	***N***	***%***
African American / Black	7	1.8
Hispanic / Puerto Rican	4	1.0
Native Hawaiian / Pacific	1	0.3
Non-Citizen	1	0.3
Two or More Races	3	1.1
Unknown / Other	11	2.9
White	354	92.9

The next analysis is to determine the ethnicity characteristics of the data. The majority of the observations were categorized as “White” (92.9%); therefore, this must be considered when reviewing the results of the relationship between NCLEX-RN first time pass and demographic characteristics.

Figure 4 Ethnic Characteristics



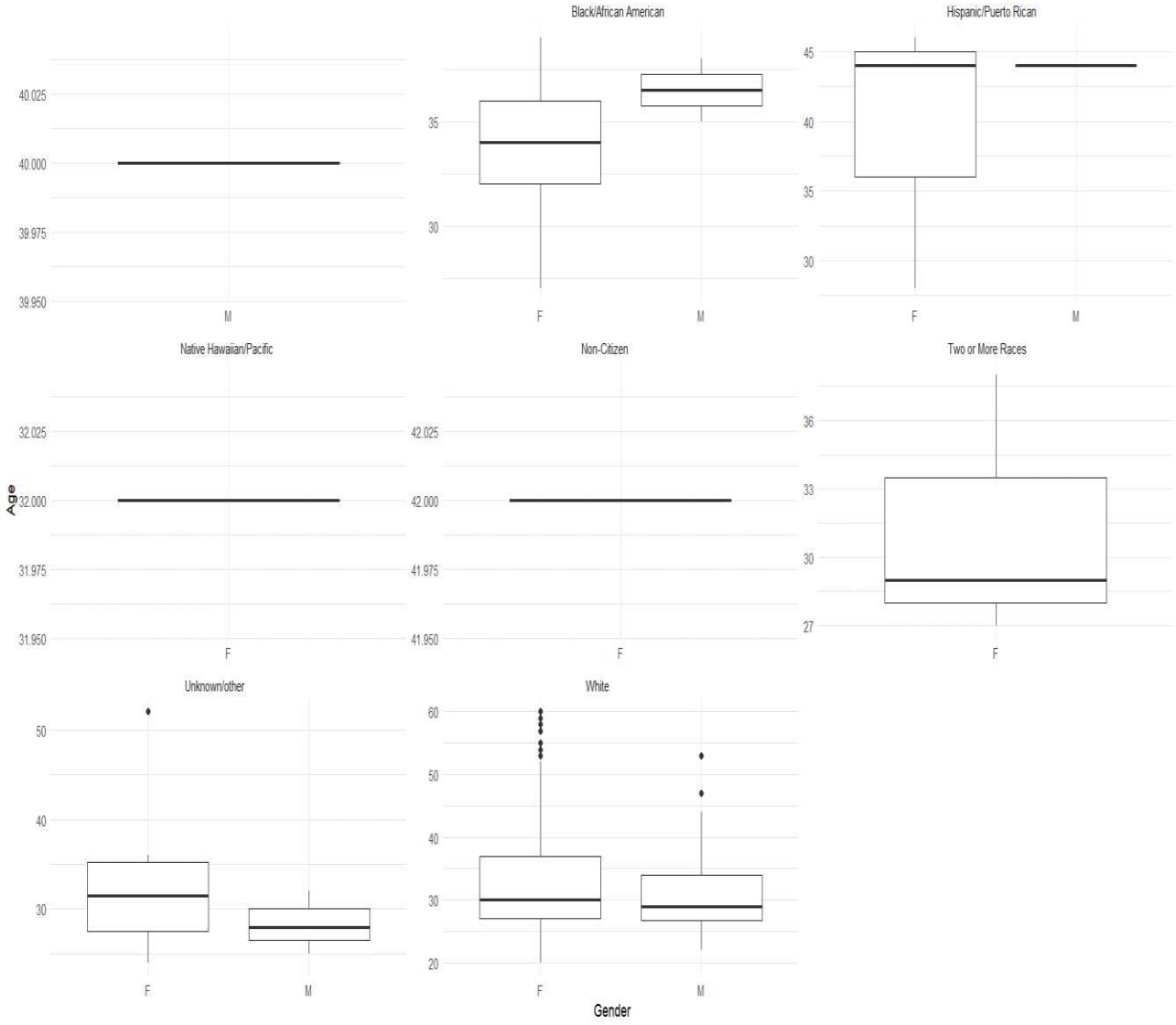
The age variable was next examined. There does appear to be a deviation from the commonly understood "college age" of 18-22 years old. The mean age of the observations was 30.7 with a standard deviation of 6.17 years. The median age was 29 years old. The minimum

age was 20 years old, and the maximum age was 54 years old. 25% of the observations were between 20 and 27 years old and 25% of the observations were between 34 and 54 years old. The mean age for female students was 32.66 with a standard deviation of 8.07 years. The mean age for male students was 31.37 with a standard deviation of 6.29 years. The descriptive statistics for the age are given categorized by gender and ethnicity. Following, the several age groups were examined to analyze first time pass rate on the NCLEX-RN per age group. The ages of the participants are given in the following table and visualization.

Table 13 Descriptive Statistics Over Age

Gender	***n***	***Mean***	***SD***	***Median***
Female	318	32.66	8.07	31
Male	63	31.37	6.29	29
Ethnicity				
Black/African American	7	34.43	4.04	35
Hispanic/Puerto Rican	4	40.5	8.39	44
Native Hawaiian/Pacific	1	32	NA	32
Non-Citizen	1	42	NA	42
Two or More Races	3	31.33	5.86	29
Unknown/Other	11	31.73	7.94	28
White	353	32.3	7.86	30
Total	381	32.45	7.81	30

Figure 5 Demographic Characteristics by Age and Gender



Univariate Analysis of Academic Variables

All of the variables were examined individually before beginning the logistic regression and other statistical tests and analysis. The following tables and graphs display the univariate features of each variable.

Table 14 Quantitative Variables

Variables	*n*	*Mean*	*SD*	*Q1*	*Median*	*Q3*	*Min*	*Max*
ACT Eng	**258**	**21.02**	**4.44**	**18.00**	**21.00**	**24.00**	**9.00**	**35.00**
ACT Math	**258**	**19.98**	**3.78**	**17.00**	**19.00**	**23.00**	**12.00**	**32.00**
ACT Read	**258**	**22.73**	**5.08**	**19.00**	**22.00**	**26.00**	**7.00**	**34.00**
ACT Sci	**258**	**21.78**	**3.39**	**20.00**	**21.00**	**24.00**	**13.00**	**32.00**
ACT Comp								
FirstGPA	**258**	**2.86**	**1.16**	**2.80**	**3.23**	**3.57**	**0**	**4**
ADNR GPA	**258**	**3.16**	**0.30**	**2.96**	**3.13**	**3.37**	**2.31**	**3.85**

Table 15 Categorical Variables

Variables	*N*	*Yes*	*No*
Repeated Courses	**258**	**138**	**120**
Other Degree	**258**	**41**	**217**

Figure 6 ACT Subject Scores

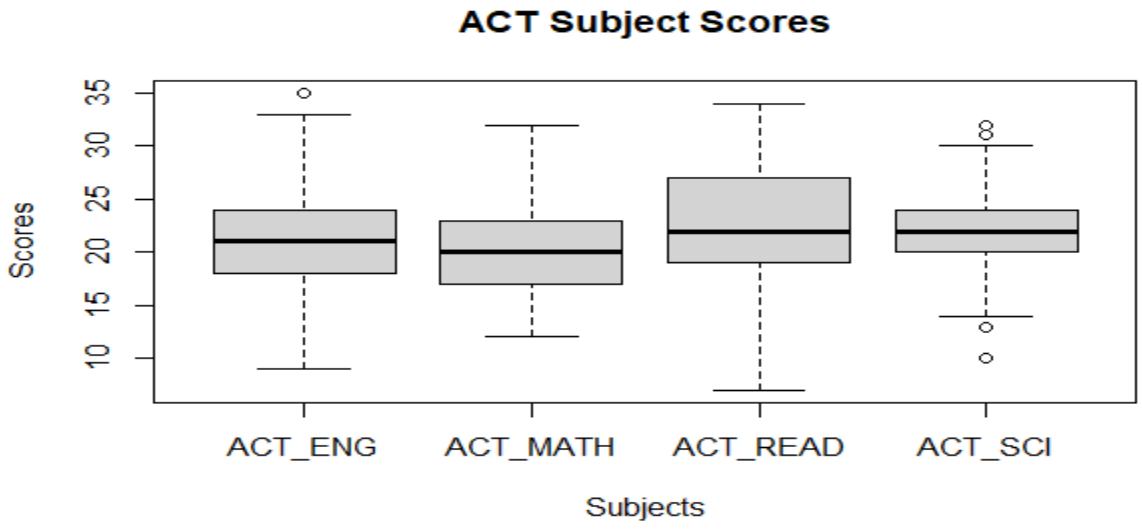


Figure 7 First GPA & ADNR GPA

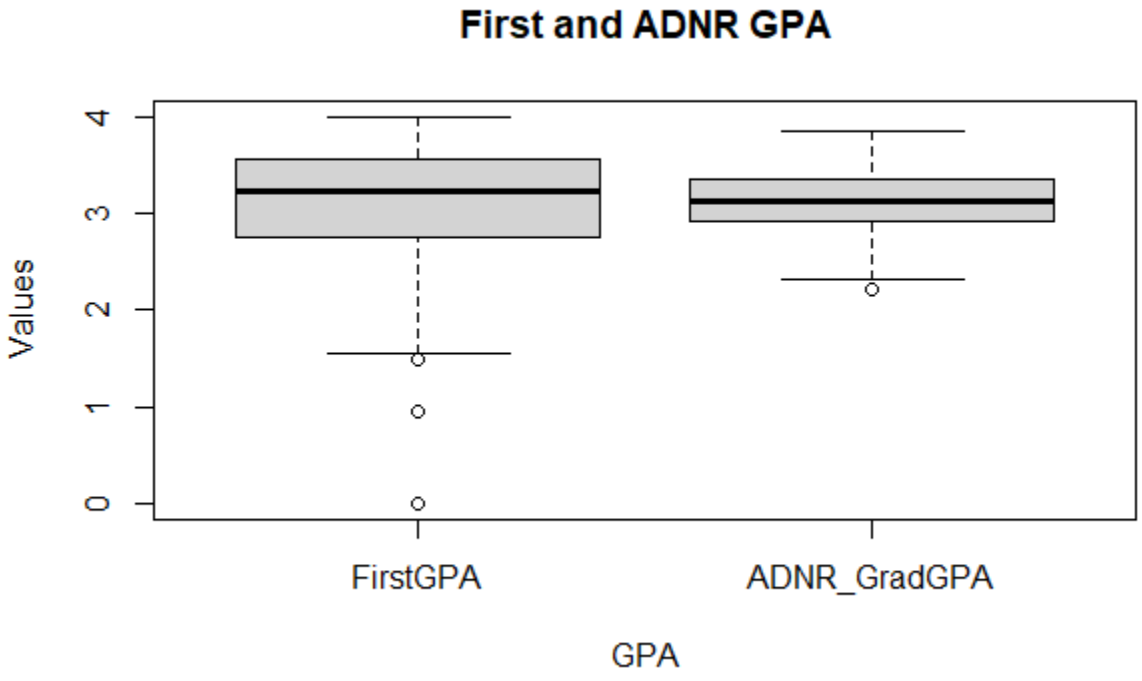


Figure 8 ACT Subject Histograms

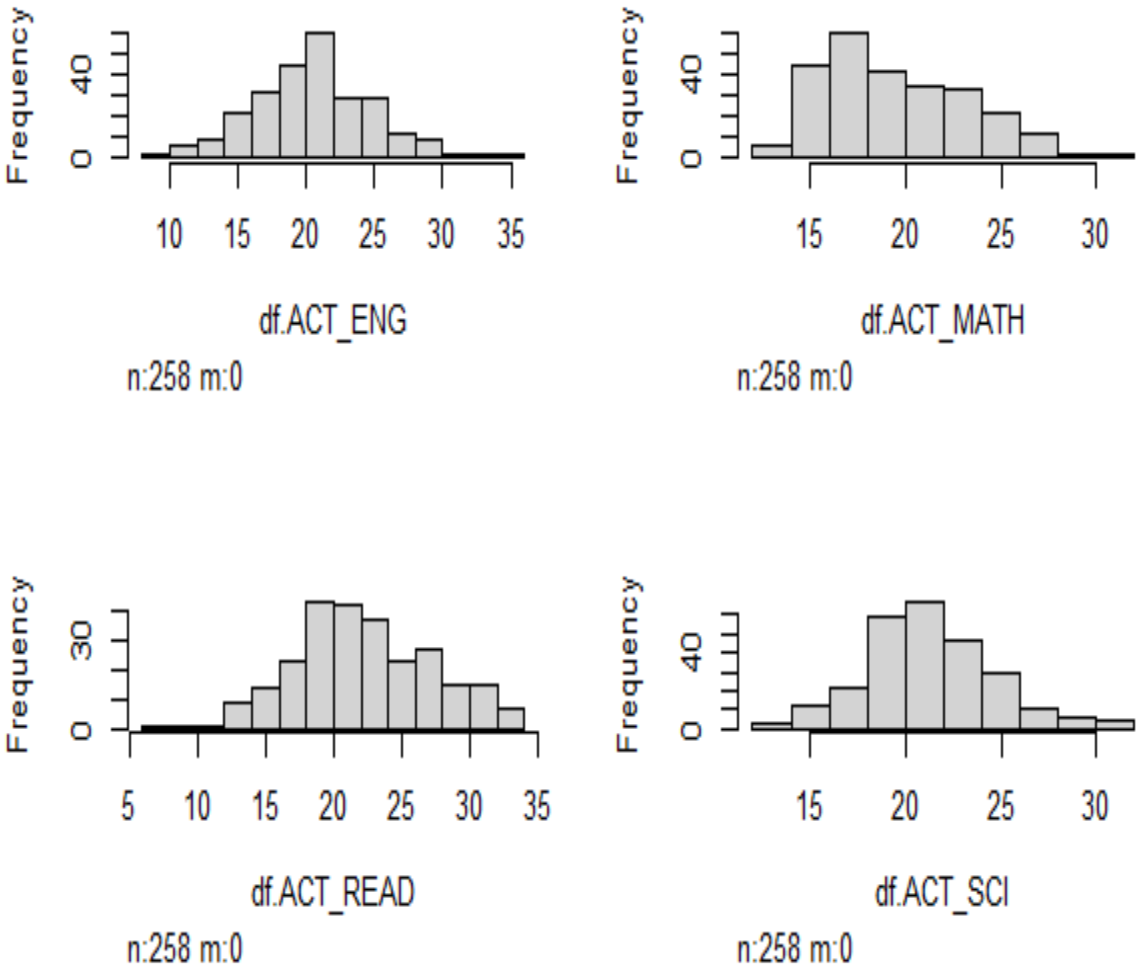


Figure 9 ADNR Graduating GPA Histogram

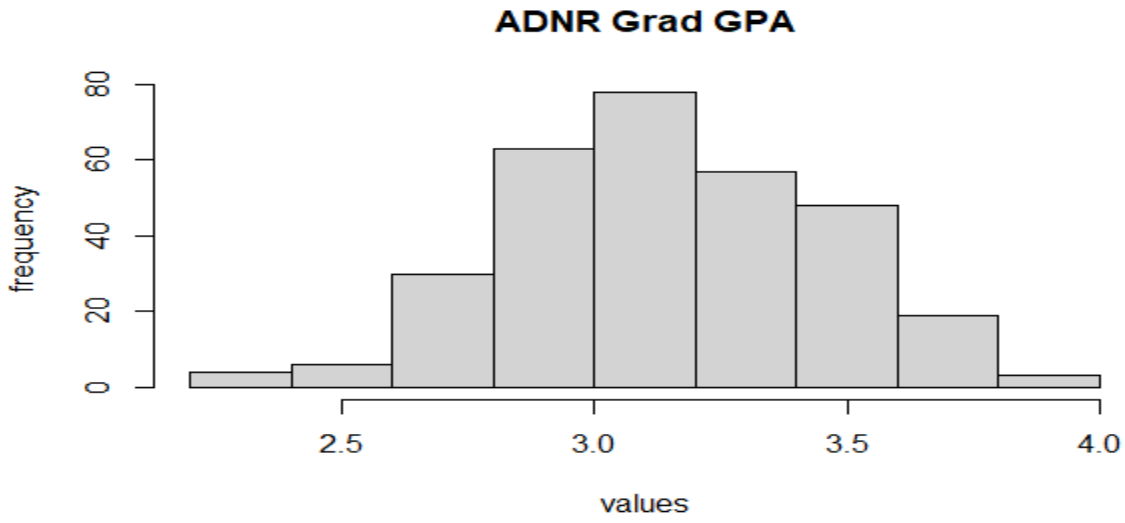
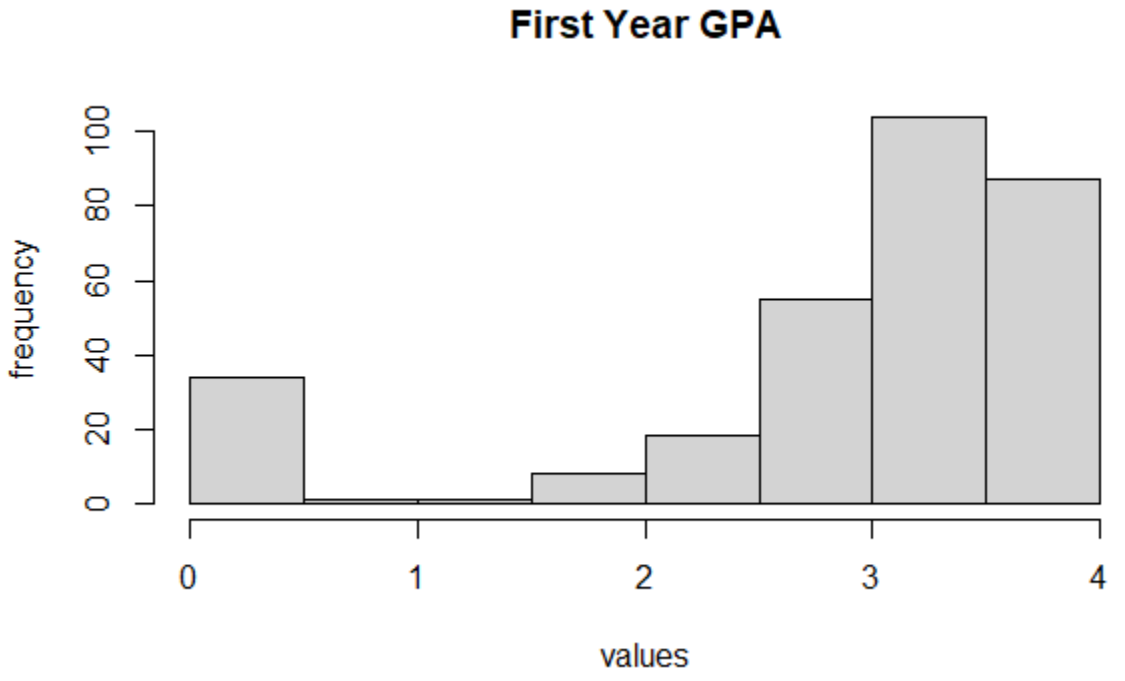


Figure 10 First Year GPA Histogram



NCLEX-RN Pass or Fail Groups

Out of the total sample of $n = 381$, three hundred and forty-six students (91%) passed the NCLEX-RN on the first attempt while thirty-five students (9%) failed the NCLEX-RN on the first attempt. One hundred and twenty-three observations were omitted during the logistic regression analysis due to missing variables; the remaining sample was $n = 258$. Two hundred and thirty-five (91%) of those observations were NCLEX-RN first time pass and twenty-three (9%) were NCLEX-RN fail.

The next analysis was done on the basis of membership into first time pass or fail on the NCLEX-RN. Age was stratified into groups of five years from 20 (the minimum age) to 60 (the maximum age). This revealed that the age group from 40-45, n=15, had a pass rate of 100%, followed by 20-25, n=57, and pass rate of 94.7% and the age group from 35-40, n=62, pass rate of 91.9% was slightly higher than the age group from 31-35, n = 72, and pass rate of 91.7%. The age group with the lowest pass rate was 55-60 at 75%, however this group was n =4. The age group 26-30 had a pass rate of 87.6% with n=137 and accounted for 49% of the NCLEX-RN fails.

Table 16 NCLEX First Time Pass / Fail by Age Group

Group	***n***	***%***	***NCLEX Pass***	***NCLEX Fail***	**rf *%* Pass**	**rf% *Fail***	***Pass %***	***Fail %***
20-25	57	15%	54	3	16%	9%	94.7%	5.3%
26-30	137	36%	120	17	35%	49%	87.6%	12.4%
31-35	72	19%	66	6	19%	17%	91.7%	8.3%
35-40	62	16%	57	5	16%	14%	91.9%	8.1%
40-45	23	6%	21	2	6%	6%	91.3%	8.7%
45-50	15	4%	15	0	4%	0%	100%	0%
50-55	11	3%	10	1	3%	3%	90.9%	9.1%
55-60	4	1%	3	1	1%	3%	75%	25%

The academic variables were then analyzed to determine if there was a significant different in the means between a grouping of students who passed the NCLEX-RN on the first attempt and a grouping of students who did not pass the NCLEX-RN on the first attempt. There were 346 (91%) students who passed the NCLEX-RN on the first attempt and 35 (9%) who did not pass the NCLEX-RN on the first attempt. The academic predictors' descriptive statistics are displayed in the following tables. It should be noted that of the 381 observations there were 67 observations that did not include ACT data and of the remaining 381 observations, 2 were missing the data for the ACT English scores. After considering filling these missing values with the mean, it was determined to just report their missingness instead.

Table 17 NCLEX Fail Group

Variable	***n***	***SD***	***Mean***	***Median***
Age	35	7.94	31.89	29
Act English	29	3.98	19.66	20
Act Math	29	3.76	19.52	18
Act Read	29	4.5	20.48	20
Act Science	29	2.95	21	21
Act Composite	29	3.05	20.07	20
First Year GPA	27	0.76	3.06	3.27
ADNR Grad. GPA	35	0.24	3.01	3.01

Table 18 NCLEX Pass Group

Variable	*n*	*SD*	*Mean*	*Median*
Age	346	7.81	32.50	30
Act English	283	4.77	21.19	21
Act Math	285	3.91	20.28	20
Act Read	285	5.25	22.85	22
Act Science	285	3.71	21.95	22
Act Composite	285	3.79	21.34	21.00
First Year GPA	281	1.16	2.84	3.06
ADNR Grad. GPA	346	0.35	3.15	3.13

NCLEX-RN Pass or Fail – Academic Variable Comparisons

Each academic variable was compared between the two groups using a Welch's Two Sample t-test given that the samples have differing lengths and because the Welch's t is recommended when the assumptions of the student's t-test are not met since it is robust to violations of these assumptions (Delacre, Lakens, et al. 2017). The null hypothesis was that there was no difference between the mean values of the academic variable between the NCLEX-RN first time pass group and the NCLEX-RN first time fail group. The alternative hypothesis was that there is a difference between the means of the academic variable between the NCLEX-RN pass group and the NCLEX-RN fail group.

There was a statistically significant difference between the ACT Reading scores of students who passed the NCLEX-RN on the first attempt, ($n = 285, M = 22.85, SD = 5.25$) and students who failed the NCLEX-RN on the first attempt ($n = 29, M = 20.48, SD = 4.5$) with $t(36.233) = -2.6533, p < .05$ with a 95% confidence interval of $(-4.175, -0.558)$, and effect size of $r^2 = 0.16$ which falls in the medium effect size interval. There

was a statistically significant difference for ACT Comp scores for students who passed the NCLEX-RN on the first attempt ($n = 285, M = 21.34, SD = 3.79$) and those who failed the NCLEX-RN on the first attempt ($n = 29, M = 20.07, SD = 3.05$) with $t(37.434) = -2.0888,\ p < .05$ with a 95% confidence interval of $(-2.504, -0.039)$ and effect size $r^2 = 0.1$, which is a medium effect size. There was a statistically significant difference between the ADNR Graduating GPAs for students who passed the NCLEX-RN on the first attempt ($n = 346, M = 3.15, SD = 0.35$) and those students who failed the NCLEX-RN on the first attempt ($n = 35, M = 3.01, SD = 0.24$) with $t(50.185) = -3.034, p < 0.01$ and a 95% confidence interval of $(-0.227, -0.046)$ and effect size $r^2 = 0.15$. The remaining variables did not present that there was a statistically significant difference between the means of the two groups. Also notable is that the effect size of the remaining variables fell into the "small" effect size interval, with the exception of ACT English which is a threshold value between small and medium effect size. The results for each hypothesis test between the two groups can be seen in the following table.

Table 19 Table of Results for Welch's t-test between Pass/Fail groups, α=0.05

Variable	*Welch's t*	*df*	*p-value*	*Effect size* r^2	*95% Confidence interval*
ACT English	-1.9376	36.774	0.06039	0.09	(-3.135, 0.0704)
ACT Reading	-2.6533	36.233	0.01176*	0.16	(-4.175, -0.558)
ACT Science	-1.604	37.641	0.1171	0.06	(-2.143, 0.249)
ACT Math	-1.0435	34.455	0.304	0.03	(-2.26, 0.726)
ACT Comp	-2.0888	37.434	0.04358*	0.1	(-2.504, -0.039)
First Year GPA	1.3297	38.722	0.1914	0.04	(-0.112, 0.542)
ADNRGrad GPA	-3.034	50.185	0.003816*	0.15	(-0.227, -0.046)

Table 20 Repeated Courses or Other Degree

	n	*Repeated Courses*	*% Repeated*	*Other Degree*	*% Other*
NCLEX Pass	346	157	45%	41	12%
NCLEX Fail	35	19	54%	4	11%
TOTALS	381	176	46%	45	12%

Several of the variables also violated the normality assumption of Welch's t. Therefore, in addition to Welch's t, a Wilcoxon rank sum test was also executed across the groups. The following tables display the data for the Shapiro test for normality and also the results of the Wilcoxon test. Homogeneity of variance was not tested. The only variables that did not violate the normality assumption were the ACT English subtest score $W = 0.991, ns$, and ADNR GPA, $W = 0.992, ns$. The NCLEX-RN Fail group had only two variables that the Shapiro-Wilk test indicate could have come from a non-normal distribution. These were the ACT Math subtest score $W = 0.881, p < .05$, and the First Year GPA with $W = 0.657, p < .001$. The Wilcoxon test demonstrated a statistically significant difference between the ACT reading subtest score for the NCLEX-RN Pass group (Mdn=22) and the ACT reading subtest score for the NCLEX-RN Fail group (Mdn=20) $W = 3616.5, p < .01, r = -0.167$. It was also found that there was a statistically significant difference between NCLEX-RN Pass (Mdn=21) ACT composite scores and NCLEX-RN Fail (Mdn=20), $W = 3396, p < .05, r = -0.127$. Finally, there was a statistically significant difference between the NCLEX-RN Pass ADNR GPA scores (Mdn=3.15) and NCLEX-RN Fail ADNR GPA scores (Mdn=2.98), $W = 3633\ p < .01, r = -0.170$.

Table 21 Shapiro-Wilk Normality Test NCLEX-RN Pass Group

Variable	*W*	*p-value*
ACT Eng	0.991	0.1597
ACT Math	0.964	1.048e-05
ACT Sci	0.978	0.00112
ACT Comp	0.984	0.009144
FirstYear GPA	0.730	2.2e-16
ADNR GPA	0.992	0.2677

Table 22 Shapiro-Wilk Normality Test NCLEX-RN Fail Group

Variable	*W*	*p-value*
ACT Eng	0.939	0.1699
ACT Math	0.881	0.010
ACT Sci	0.943	0.204
ACT Comp	0.934	0.1341
FirstYear GPA	0.657	4.018e-06
ADNR GPA	0.979	0.8913

Table 23 Table of Results for Wilcoxon Test NCLEX-RN Pass vs. Fail Group

Variable	*W*	*p-value*	*Effect size r*	*Median Pass*	*Median Fail*
ACT English	-1.9376	0.06039	-0.130	21	20
ACT Reading	3616.5	0.007*	-0.167	22	20
ACT Science	3075.5	0.2737	-0.068	22	21
ACT Math	3218	0.1302	-0.094	20	18
ACT Comp	3396	0.0415*	-0.127	21	20
First Year GPA	2760.5	0.8662	-0.010	3.23	3.27
ADNRGrad GPA	3633	0.006*	-0.170	3.15	2.98

NCLEX Pass or Fail – Demographic

B = Black African American, H = Hispanic / Puerto Rican, T = Two or more Races, U = Unknown or other, N = Native Hawaiian or Pacific, NC = Non-citizen, W = White

Table 24 Table of Academic Variables Means by Ethnicity

	n	*ACT Eng*	*ACT Read*	*ACT Scie*	*ACT 0Math*	*ACT Com*	*First GPA*	*ADNR GPA*	*Pass*	*Fail*	*% Pass*
B	7	20.25	20.75	19	16.75	18.75	2.37	3.05	7	0	100%
H	4	18.5	17.5	21	17.5	18.5	3.14	3.16	3	1	75%
T	3	18	17	21.67	19	18.67	3.3	3.14	3	0	100%
U	11	23.22	23.56	23.56	20.89	22.56	3.17	3.26	10	1	91%
N	1	23	25	22	27	24	3.28	3.28	1	0	100%
NC	1	-	-	-	-	-	3.91	3.55	1	0	100%
W	354	21.03	22.66	21.87	20.26	21.24	2.85	3.13	321	33	91%

The information provided when viewed over the demographic variables is inconsequential given that the diversity of the observations, although representative of the population at SSU, is not robust. Therefore, the data cannot provide any meaningful insights with respect to odd ratio or any general trend among ethnicities other than the most prevalent.

Correlation Analysis

A correlation analysis was carried out to the correlation between the quantitative variables and NCLEX-RN first time pass. The results indicate that there was a statistically significant correlation between the ACT reading subtest scores and NCLEX-RN first time pass, $r = 0.13, p < .05$ and there was a statistically significant correlation between ADNR Graduation GPA and NCLEX-RN first time pass, $r = 0.11, p < .05$.

Table 25 Correlation Analysis Using Pearson's Product-Moment Correlation

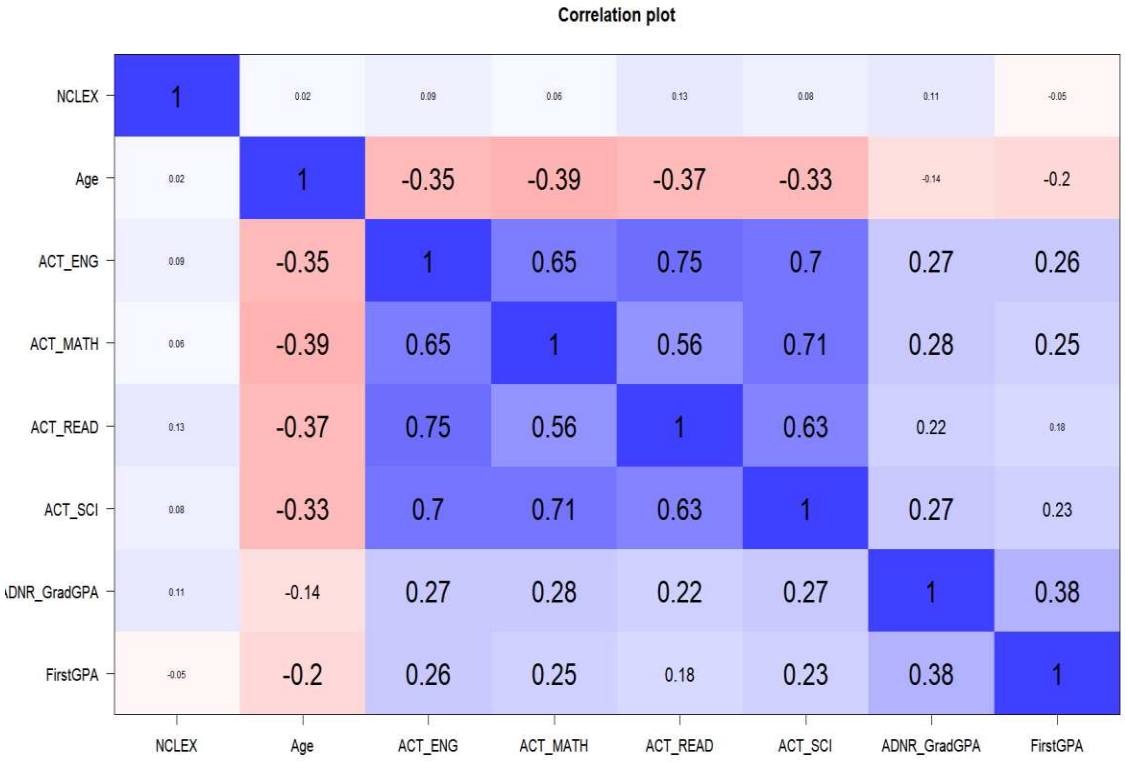
Variable	*n*	*NCLEX*	*Age*	*ACT Eng*	*ACT Math*	*ACT Read*	*ACT Sci*	*ADNR GPA*	*First GPA*
NCLEX	381	1	0.02	0.09	0.06	0.13	0.08	0.11	-0.05
Age	381		1	-0.35	-0.39	-0.37	-0.33	-0.14	-0.20
ACT Eng	312			1	0.65	0.75	0.70	0.27	0.26
ACT Math	314				1	0.56	0.71	0.28	0.25
ACT Read	314					1	0.63	0.22	0.18
ACT Sci	314						1	0.27	0.23
ADNR GPA	381							1	0.38
First GPA	308								

Table 26 Significant Correlation Pearson's r

Variable	*NCLEX*	*r*	*t*	*df*	*p*	*Lower 95% CI*	*Upper 95% CI*
ACT Read		0.13	2.339	312	0.0200	0.027	0.238

Variable	*NCLEX*	*r*	*t*	*df*	*p*	*Lower 95% CI*	*Upper 95% CI*
ADNR GPA		0.11	2.229	379	0.0264	0.013	0.212

Figure 11 Correlation of NCLEX and Quantitative Variables



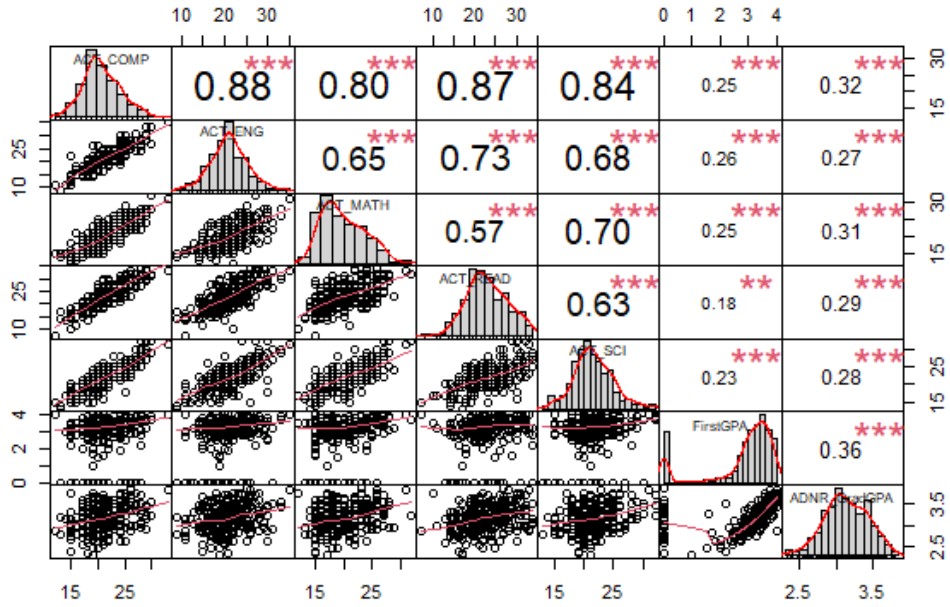
Logistic Regression Analysis of Academic Predictors

The variables included in this portion of the analysis are those that are considered to be academic variables such as the ACT subjects scores for English, math, reading and science, first year GPA, the associate degree in nursing program graduating GPA, whether or not courses were repeated and whether or not the student held an additional degree. ACT composite scores were omitted since they are the average of the subject scores. The goal is to determine if a model can be generated that can predict NCLEX first time pass or NCLEX first time fail using this set of predictors. The univariate analysis follows is demonstrated in section devoted to univariate analysis.

In order to determine if multicollinearity will be problematic among the quantitative variables, a correlation analysis was carried out with the NCLEX-RN variable. The first thing that is noted is the understandably high correlation between the ACT composite score and the ACT subject scores. Thus, the logistic regression ought to be carried out using the ACT composite scores only or the ACT subject scores only in order to prevent problems of multicollinearity (Tabchnick and Fidell, 2007).

Therefore, the first model is generated using the ACT subjects scores. Following a model using the ACT Composite scores is generated for comparison with the previous model. In either case the minimum sample size threshold will be achieved.

Figure 12 Correlation Data Between Quantitative Academic Variables



Logistic Regression Analysis – Full Model Academic Predictors Only

A direct logistic regression was performed on NCLEX-RN pass or fail as the outcome with eight academic predictors. Data from $n = 381$ observations was available, however, due to missing values in observations, the final sample size was $n = 258$, still well above the minimum sample size. There were 235 (91%) of the observations in the NCLEX-RN pass group and there were 23 (9%) observations in the NCLEX-RN fail group. Analysis was performed using R (R Core Team 2022).

A test of the full model that included the eight academic predictors against a constant-only model using the loglikelihood ratio was statistically reliable, $\chi^2(8, N = 258) =$

$17.871, p < 0.5$, indicating that this set of predictors reliably differentiated between the NCLEX-RN pass group and the NCLEX-RN fail group. The variance NCLEX-RN group membership is described by McFadden's $rho = 0.12, df = 8$. The AIC for the full model (155.31) was slightly less than the AIC for the null model (157.09) which indicates the full model is a better fit than the constant only model.

Prediction accuracy (using 0.5 as the threshold) was 234 out of 258 (90%) correctly predicted outcomes. Sensitivity and specificity were calculated to 0 and 0.99, respectively. The following table presents the coefficients, Wald's statistic, p-value and the odds ratios with their 95% confidence intervals.

Table 27 Logistic regression analysis of NCLEX-RN pass predicted by academic variables

Variables	*β*	*SE*	*Wald's*	*p-value*	*Odds Ratio*	*95% CI Lower*	*95% CI Upper*
ACT Eng	0.021	0.091	0.231	0.8171	1.021	0.855	1.226
ACT Math	0.010	0.095	0.103	0.9183	1.010	0.841	1.224
ACT Read	0.097	0.0767	1.266	0.2057	1.102	0.951	1.287
ACT Sci	-0.026	0.109	-0.236	0.8133	0.975	0.786	1.206
First GPA	-0.804	0.420	-1.916	0.055	0.447	0.577	0.865
ADNR GPA	2.551	1.125	2.267	0.0234*	12.818	1.582	138.509
RepeatedY	-0.514	0.531	-0.967	0.3335	0.598	0.200	1.642
OtherDegreeY	-0.277	0.691	-0.401	0.6885	0.758	0.216	3.550

Table 28 Additional Model Diagnostics Pseudo R-Square Values

Pseudo R^2	R_L^2	R_{CS}^2	R_N^2
	0.115	0.067	0.147

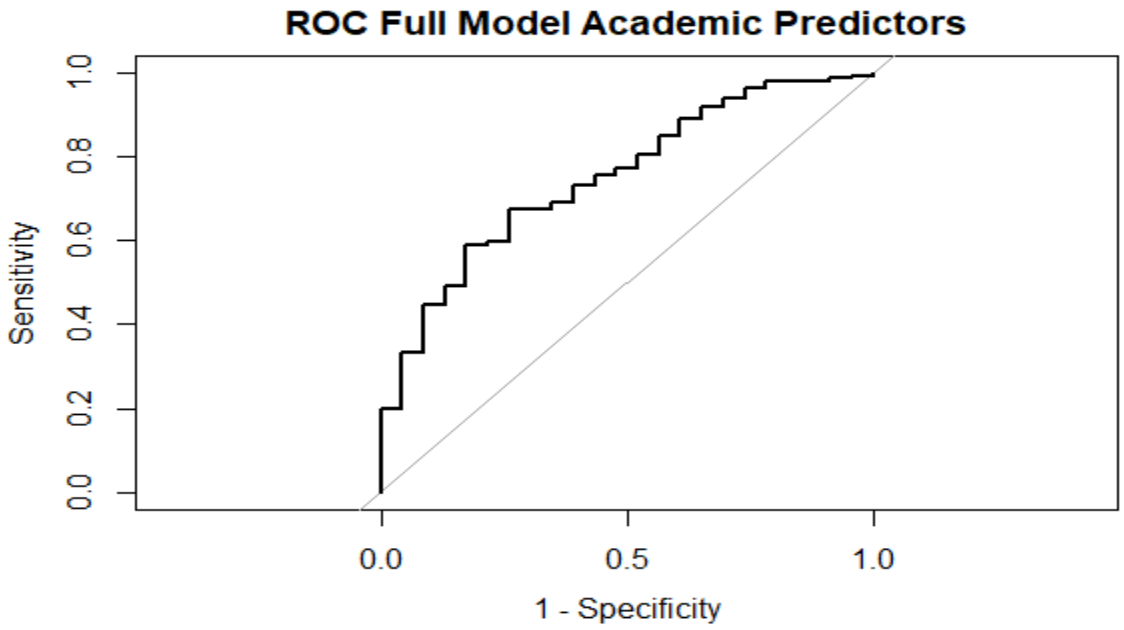
According to the Wald criterion, only ADNR GPA (the program graduating GPA) reliably predicted NCLEX-RN first time pass, $z = 2.67, p < 0.5$, and FirstGPA (first year GPA) was nominally significant $z = -1.916, p = .0554$. Variance Inflation Factors (VIF) for the full model are all below five. The significance levels of the interaction between each quantitative predictor and the log of itself indicates that linearity between each predictor and the logit of itself may be assumed with the exception of ACT Math logit $z = -2.105, p < 0.05$ and ACT English logit $z = 0.0121, p < 0.05$.

Table 29 Variance Inflation Factors Model 1

	ACT Eng	*ACT Math*	*ACT Read*	*ACT Sci*	*First GPA*	*ADNR GPA*	*Repeat*	*Other Degree*
VIF	2.638	1.925	2.449	2.007	1.656	1.833	1.180	1.083

A receiver operating characteristic curve was generated (in figure 13 with the caption: "Receiver Operating Characteristic Curve Academic Predictors.) using the full model that was demonstrated to be statistically reliable. The area under the curve (AUC) was .748.

Figure 13 Receiver Operating Characteristic Curve Academic Predictors



Logistic Regression Analysis – Reduced Model Academic Predictors

A stepwise backward elimination logistic regression model was then generated. The remaining academic variables were ACT Read, FirstGPA and ADNR GPA. A test of this reduced model, that included only three academic variables, compared to the constant only model was statistically reliable $\chi^2(3, N = 258) = 16.412, p < 0.001$ indicating that the set of predictors reliably differentiates between NCLEX-RN pass group and the NCLEX-RN fail group. The variance in NCLEX-RN group membership was accounted for by McFadden's $rho = 0.11, df = 3$. The AIC for the reduced model (146.67) was smaller than both the constant only model (157.09) and the full model (155.31) indicating that reduced model is a better fit than

both.

Prediction accuracy (using 0.5 as the threshold) was 234 out of 258 (90%) correctly predicted outcomes. Sensitivity and specificity were calculated to 0.043 and 0.99, respectively. All of those values were precisely the same as the full model. The following table presents the coefficients, Wald's statistic, p-value and the odds ratios with their 95% confidence intervals.

Table 30 Logistic Regression Analysis Reduced Model Academic Variables Only

Variable	*β*	*SE*	*Wald's*	*p-value*	*Odds Ratio*	*95% CI Lower*	*95% CI Upper*
ACT Read	0.096	0.050	1.922	0.5457	1.101	1.001	1.220
FirstGPA	-0.756	0.340	-1.898	0.5770	0.469	0.176	0.882
ADNR GPA	2.785	1.062	2.622	0.00873**	16.196	2.330	157.581

Table 31 Additional Model Diagnostics Pseudo R-Square Values Reduced Model

Pseudo R^2	R_L^2	R_{CS}^2	R_N^2
	0.016	*0.062*	*0.136*

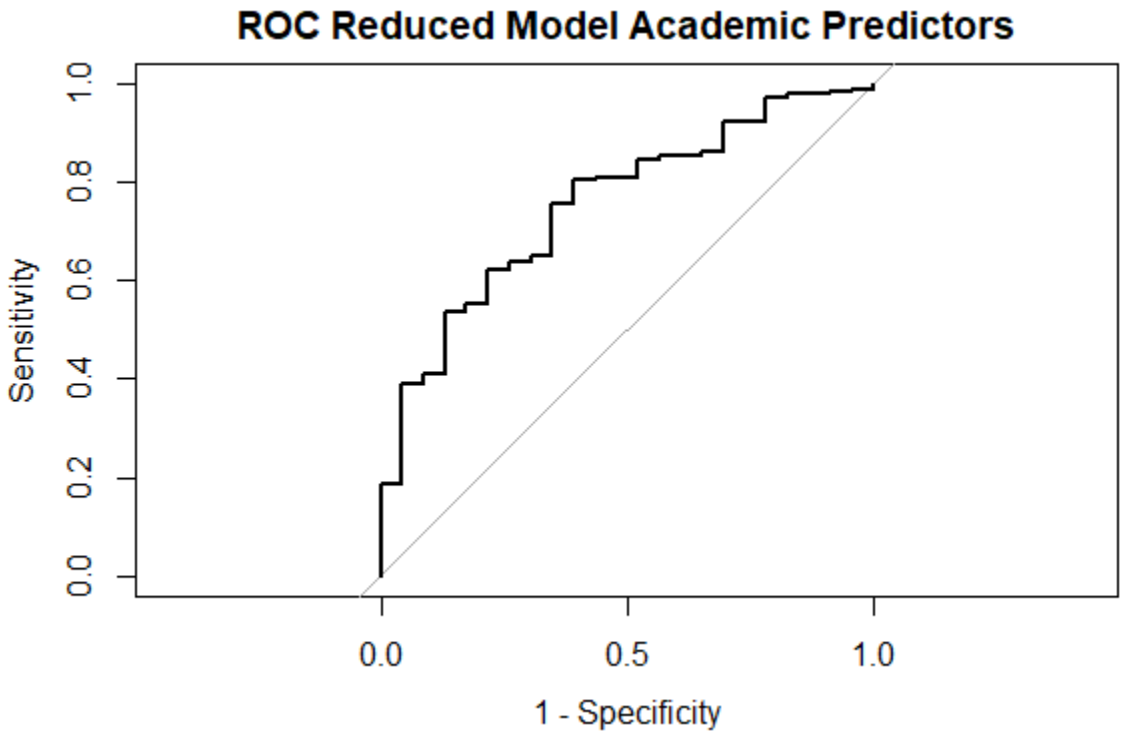
According to the Wald criterion, only ADNR GPA (the program graduating GPA) reliably predicted NCLEX-RN first time pass, $z = 2.622, p < .01$. FirstGPA (first year GPA) was nominally significant $z = -1.898, p = .577$ and ACT Read was nominally significant $z = 1.922, p = .5457$. Variance Inflation Factors (VIF) for the reduced model are unremarkable. The significance levels of the interaction between each predictor and the log of itself indicates that linearity between each predictor and the logit of itself may be assumed.

Table 32 Variance Inflation Factors Reduced Model

	ACT Read	*FirstGPA*	*ADNR GPA*
VIF	1.0565	1.666	1.727

A receiver operating characteristic curve was generated (in the figure below) using the reduced model that was demonstrated to be statistically reliable and to have a lower AIC score than both the constant only and full model. The area under the curve (AUC) was .753 which is only nominally different from the AUC (.745) of the full model.

Figure 14 Receiver Operating Characteristic Curve Reduced Model



According to the reduced model diagnostics, there is only one significant predictor, ADNR Graduation GPA. There are two nominally significant predictors the ACT reading subtest score and the first year GPA. There is a problem with ADNR Graduation GPA because the range of the confidence interval is excessively large (2.330, 157.581) meaning that the coefficient given in the model to estimate the true population parameter is unreliable. A possible solution is to drop this variable from the analysis. Thus, a new model was then created an analyzed after dropping ADNR Graduation GPA from the data. The results follow.

A direct logistic regression analysis was then done the academic variables ACT English, ACT Read, ACT Math, ACT Science, First Year GPA, Repeated Course and Other Degrees. The model was not statistically reliable compared to a constant only model $\chi^2(7, N = 258) = 11.972, p = 0.101$. The variance in NCLEX-RN group membership was accounted for by McFadden's $rho = 0.077, df = 7$. The AIC for the model (159.12) was slightly larger than the AIC for the null model (157.09) indicating that the model is not a better fit than the constant only model.

The prediction accuracy of this model (using threshold 0.5) was 91%. Sensitivity and specificity were calculated to 0 and 0.99, respectively. The following table presents the coefficients, Wald's statistic, p-value and the odds ratios with their 95% confidence intervals.

Table 33 Logistic Regression Analysis -Full Model - ADNR GPA Dropped

Variable	*β*	*SE*	*Wald's*	*p-value*	*Odds Ratio*	*95% CI Lower*	*95% CI Upper*
ACT Eng	0.037	0.086	0.432	0.661	3.306	0.878	1.233
ACT Math	0.022	0.091	0.236	0.814	1.037	0.857	1.230
ACT Read	0.111	0.042	1.533	0.125	1.117	0.973	1.297
ACT Sci	-0.030	0.109	-0.270	0.787	1.022	0.783	1.204
First GPA	-0.420	0.278	-1.513	0.1303	0.657	0.341	1.052
RepeatCountY	-0.904	0.503	-1.797	0.0724	0.405	0.142	1.045
OtherDegreeY	-0.001	0.670	-0.002	0.999	0.999	0.301	4.546

Table 34 Additional Model Diagnostics Pseudo R-Square Values ADNR GPA Dropped

Pseudo R^2	R_L^2	R_{CS}^2	R_N^2
	0.077	0.045	0.1

According to the Wald criterion, there were no statistically significant predictors. Variance Inflation Factors (VIF) for the model are unremarkable. The significance levels of the interaction between each predictor and the log of itself indicates that linearity between each predictor and the logit of itself may be assumed.

Table 35 Variance Inflation Factors - ADNR GPA Dropped

	ACT Eng	*ACT Math*	*ACT Read*	*ACT Sci*	*FirstGPA*	*RepeatCount*	*Other Degree*
VIF	2.405	1.904	2.259	2.202	1.158	1.093	1.041

A stepwise backward elimination logistic regression model was then generated. The remaining academic variables were ACT Read, FirstGPA and RepeatCountY. A test of this

reduced model, that included only three academic variables, compared to the constant only model was statistically reliable $\chi^2(3, N = 258) = 11.661, p < 0.001$ indicating that the set of predictors reliably differentiates between NCLEX-RN pass group and the NCLEX-RN fail group. The variance in NCLEX-RN group membership was accounted for by McFadden's $rho = 0.075, df = 3$. The AIC for the reduced model (151.43) was smaller than both the constant only model (157.09) and the full model (157.30) indicating that reduced model is a better fit than both.

The prediction accuracy of this model (using threshold 0.5) was 91%. Sensitivity and specificity were calculated to 0 and 0.99, respectively. The following table presents the coefficients, Wald's statistic, p-value and the odds ratios with their 95% confidence intervals.

Table 36 Logistic Regression Analysis -Reduced Model - ADNR GPA Dropped

Variable	*β*	*SE*	*Wald's*	*p-value*	*Odds Ratio*	*95% CI Lower*	*95% CI Upper*
ACT Read	0.129	0.049	2.646	0.00814	1.138	1.037	1.257
FirstGPA	-0.399	0.270	-1.478	0.139	0.671	0.355	1.059
RepeatCountY	-0.913	0.501	-1.824	0.068	0.401	0.141	1.030

Table 37 Additional Model Diagnostics Pseudo R-Square Values Reduced Model -ADNR GPA Dropped

$R^2_{McFadden}$	R^2_L	R^2_{CS}	R^2_N
$0.075, df = 3$	*0.075*	*0.044*	*0.098*

According to the Wald criterion, only the ACT reading subtest score was statistically significant $z = 2.646, p < .01$. Variance Inflation Factors (VIF) for the reduced model are

unremarkable. The significance levels of the interaction between each predictor and the log of itself indicates that linearity between each predictor and the logit of itself may be assumed.

Table 38 Variance Inflations Factors Reduced Model - ADNR GPA Dropped

	ACT Read	*FirstGPA*	*RepeatCount*
VIF	1.034	1.115	1.084

Case-wise Diagnostics

The reduced model produced and analyzed in the previous section produced results that indicate that there are potentially influential cases, outliers or other observations that are phenomenon that affect the model. An analysis of the standardized residuals, df betas, df fits and leverage can determine what observations, if any, can be excluded. The standardized residuals for the full model were examined. The range of the standardized residuals fell in the interval $(-2.646, 1.020)$ and it was found that there 14 observations that had a standardized residual less than -2 and none greater than 2. Examining these observations revealed that they all had NCLEX values of 0. Next the df betas were examined for the full model using the threshold of absolute value of 1. The range of the df Betas fell in the interval $(-0.604,\ 0.666)$. Thus, there are not problematic observations indicated by this diagnostic.

Next, the dffits for the full model were calculated. The threshold was determined as such

$$2 \times \sqrt{\frac{k+2}{n-k-2}}$$

which yielded a threshold of 0.281. The range of the dffits for the full model fell in the interval

$(-0.771, 0.572)$. There were fourteen observations that had a dffit value above the threshold. Finally, the Cook's distance was examined for the full model of academic predictors. The threshold was acquired using the calculation

$$3 \times \frac{k}{n}$$

which yielded a threshold of 0.035. The range of the leverages falls in the interval (0.007, 0.150) and there are fourteen observations that are outside of the threshold. The figures that follow demonstrate each the of diagnostics measures considered.

Figure 15 Standardized Residuals for the Reduced Model of Academic Predictors with ADNR GPA Dropped

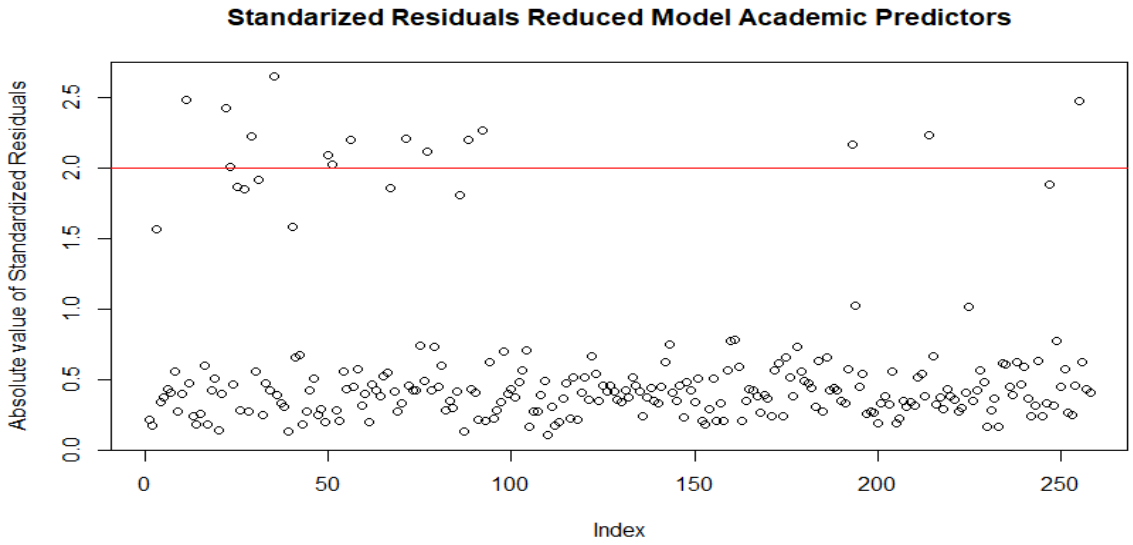


Figure 16 Dffits for the Reduced Model of Academic Predictors with ADNR GPA Dropped

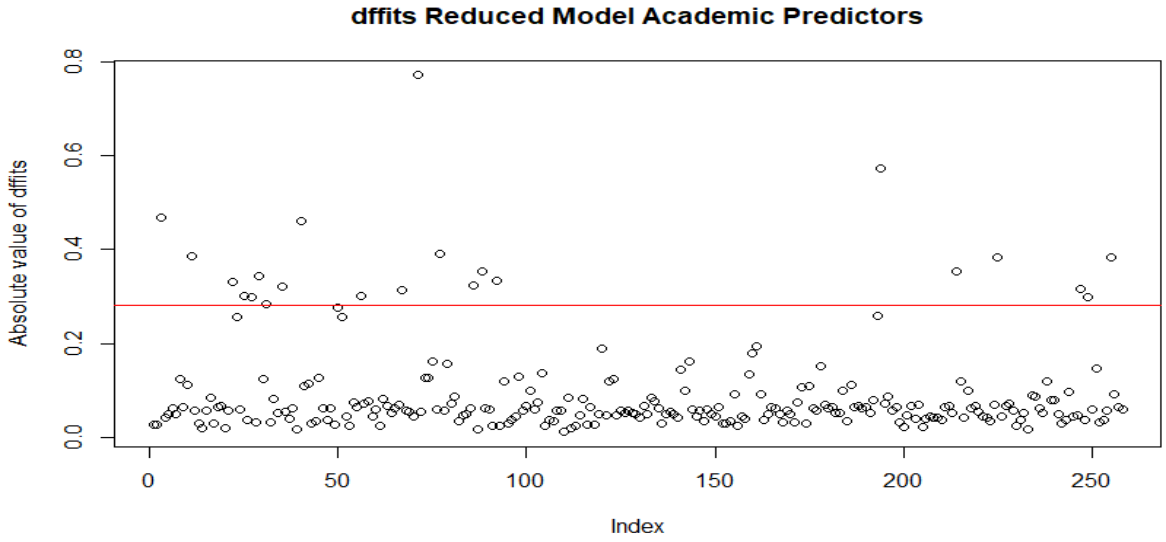


Figure 17 dfBetas for the Reduced Model of Academic Predictors with ADNR GPA Dropped

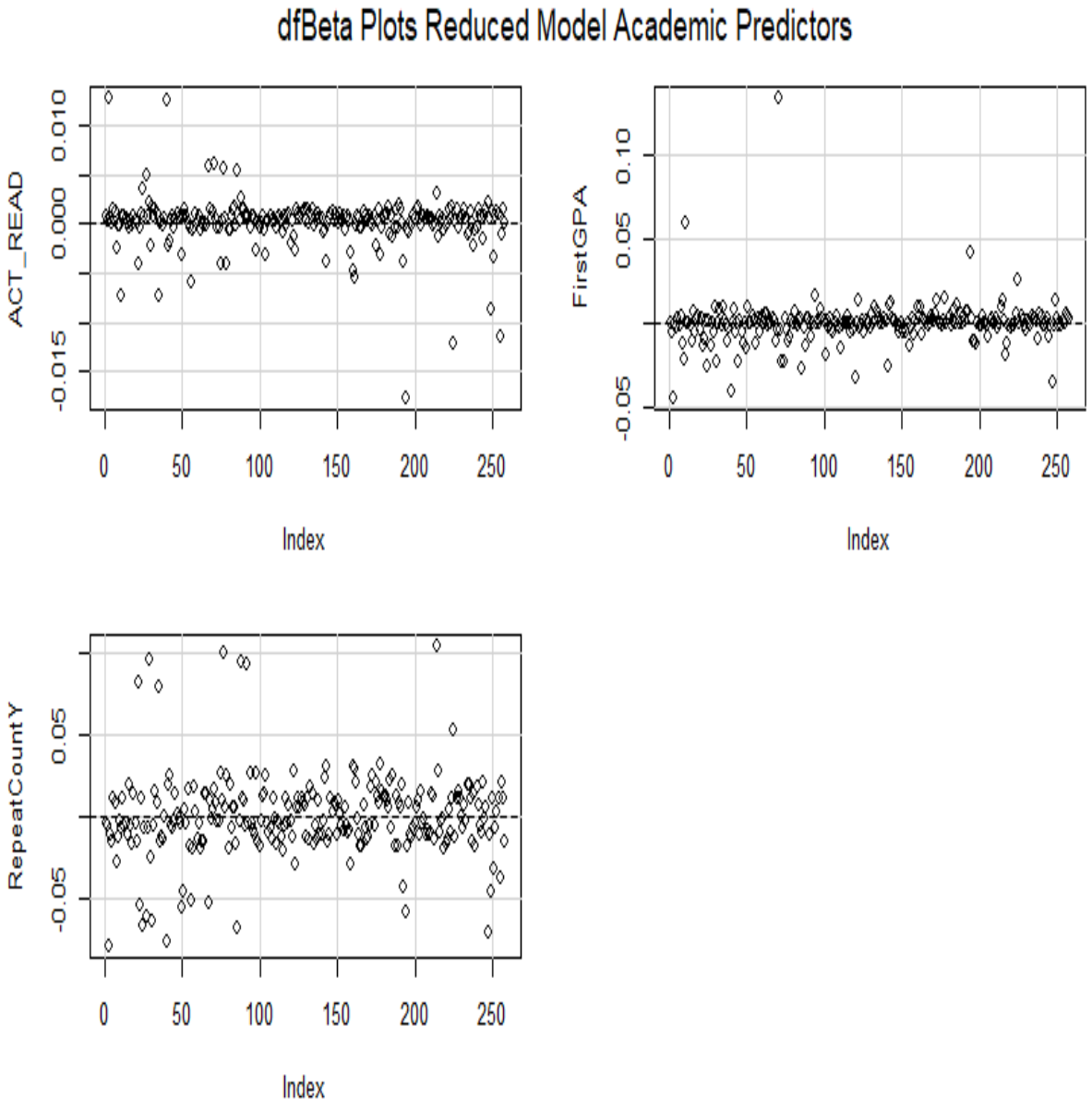
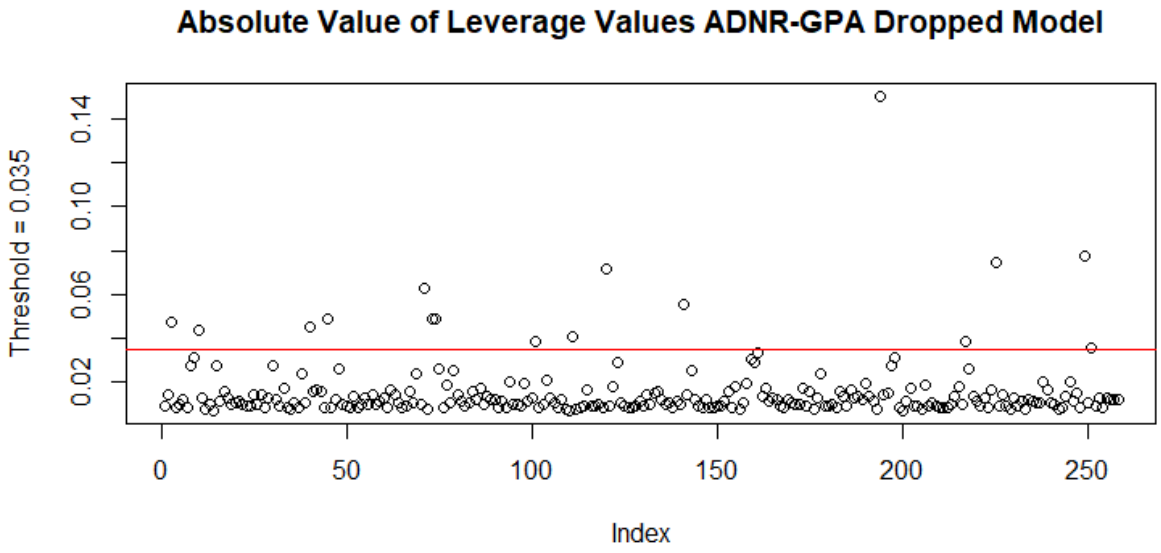


Figure 18 Leverage Analysis for the Reduced Model of Academic Predictors with ADNR GPA Dropped



Logistic Regression Analysis of Academic and Demographic Predictors

The variables included in this portion of the analysis are those that are considered to be academic as well as demographic variables. The academic variables are ACT composite and subjects scores, first year GPA, whether or not courses were repeated and whether or not. The demographic variables include age, gender and ethnicity. The associate degree in nursing graduating GPA was not included based on the performance in the previous analysis. The goal is to determine if a model can be generated that can predict NCLEX first time pass or NCLEX first time fail using this set of predictors. This data set contains 23 (9%) NCLEX-RN fail and 235 (91%) NCLEX-RN pass.

A direct logistic regression was performed on NCLEX-RN pass or fail as the outcome with nine academic predictors and three demographic predictors. A test of the academic and demographics model that included the eight academic predictors and three demographic predictors against a constant-only model was nominally reliable, $\chi^2(14, N = 258) = 19.355, p = 0.152$, indicating that this set of predictors does not reliably differentiate between the NCLEX-RN pass group and the NCLEX-RN fail group. The variance NCLEX-RN group membership is described by McFadden's $rho = 0.125, df = 14$. The AIC for the model (165.73) was and the AIC for the null model (157.09) which indicates that the model not more reliable than a constant only model.

Prediction accuracy (using 0.5 as the threshold) was 234 out of 258 (90%) correctly predicted outcomes. Sensitivity and specificity were calculated to 0.043 and 0.99, respectively. The following table presents the coefficients, Wald's statistic, p-value and the odds ratios with their 95% confidence intervals.

Table 39 Logistic Regression Analysis Academic and Demographics Model

Variable	*B*	*SE*	*Wald*	*p-value*	*Odds Ratio*	*95% CI Lower*	*95% CI Upper*
ACT Eng	4.48E-02	9.19E-02	0.487	0.6261	1.05E+00	8.76E-01	1.26E+00
ACT Math	2.22E-02	9.68E-02	0.229	0.8188	1.02E+00	8.49E-01	1.24E+00
ACT Read	1.21E-01	7.78E-02	1.557	0.1195	1.13E+00	9.75E-01	1.33E+00
ACT Sci	-1.55E-03	1.19E-01	-0.013	0.9896	9.98E-01	7.90E-01	1.26E+00
First GPA	-3.74E-01	2.78E-01	-1.344	0.1789	6.88E-01	3.59E-01	1.11E+00

RepeatY	-8.78E-01	5.12E-01	-1.716	0.0863	4.16E-01	1.43E-01	1.09E+00
OtherDegreeY	2.49E-01	8.00E-01	0.312	0.7553	1.28E+00	3.19E-01	8.64E+00
Age	4.17E-02	4.52E-02	0.921	0.3569	1.04E+00	9.58E-01	1.15E+00
Gender	6.05E-02	6.47E-01	0.093	0.9255	1.06E+00	3.23E-01	4.30E+00
H/P	-3.49E+01	4.42E+03	-0.008	0.9937	7.34E-16	0.00E+00	8.36E+58
NH	-6.14E-01	4.42E+03	0	0.9999	5.41E-01	2.65E-97	2.81E+69
TMR	5.14E-01	3.29E+03	0	0.9999	1.67E+00	8.61E-29	5.53E+24
UK	-1.61E+01	1.96E+03	-0.008	0.9935	1.05E-07	NA	2.12E+159
W	-1.53E+01	1.96E+03	-0.008	0.9938	2.25E-07	NA	1.09E+90

A stepwise backward elimination logistic regression model was then generated. The remaining academic variables were ACT Read, FirstGPA and RepeatCountY. A test of this reduced model, that included only three academic variables, compared to the constant only model was statistically reliable $\chi^2(3, N = 258) = 11.661, p < 0.001$ indicating that the set of predictors reliably differentiates between NCLEX-RN pass group and the NCLEX-RN fail group. The variance in NCLEX-RN group membership was accounted for by McFadden's $rho = 0.075, df = 3$. The AIC for the reduced model (151.43) was smaller than both the constant only model (157.09) and the full model (157.30) indicating that reduced model is a better fit than both.

The prediction accuracy of this model (using threshold 0.5) was 91%. Sensitivity and specificity were calculated to 0 and 0.99, respectively. The following table presents the coefficients, Wald's statistic, p-value and the odds ratios with their 95% confidence intervals.

Table 40 Academic and Demographics Reduced Model

Variable	*β*	*SE*	*Wald's*	*p-value*	*Odds Ratio*	*95% CI Lower*	*95% CI Upper*
ACT Read	0.129	0.049	2.646	0.00814	1.138	1.037	1.257
FirstGPA	-0.399	0.270	-1.478	0.139	0.671	0.355	1.059
RepeatCountY	-0.913	0.501	-1.824	0.068	0.401	0.141	1.030

Table 41 Additional Model Diagnostics Pseudo R-Squared Academic and Demographic Reduced Model

Pseudo R^2	R_L^2	R_{CS}^2	R_N^2
	0.075	*0.044*	*0.098*

According to the Wald criterion, only the ACT reading subtest score was statistically significant $z = 2.646, p < .01$. Variance Inflation Factors (VIF) for the reduced model are unremarkable. The significance levels of the interaction between each predictor and the log of itself indicates that linearity between each predictor and the logit of itself may be assumed.

Table 42 Variance Inflation Factors Academic and Demographic Reduced Model

	ACT Read	*FirstGPA*	*RepeatCount*
VIF	1.034	1.115	1.084

Case-wise Diagnostics

The reduced model produced and analyzed in the previous section retains precisely the

same variables as was generated in this case. Therefore, the case wise diagnostics are the same. The standardized residuals for the full model were examined. The range of the standardized residuals fell in the interval $(-2.646, 1.020)$ and it was found that there 14 observations that had a standardized residual less than -2 and none greater than 2. Examining these observations revealed that they all had NCLEX values of 0. Next the df betas were examined for the full model using the threshold of absolute value of 1. The range of the df Betas fell in the interval $(-0.604,\ 0.666)$. Thus, there are not problematic observations indicated by this diagnostic. Next, the dffits for the full model were calculated. The threshold was determined as such

$$2 \times \sqrt{\frac{k+2}{n-k-2}}$$

which yielded a threshold of 0.281. The range of the dffits for the full model fell in the interval $(-0.771, 0.572)$. There were fourteen observations that had a dffit value above the threshold. Finally, the Cook's distance was examined for the full model of academic predictors. The threshold was acquired using the calculation $3 \times \frac{k}{n}$ which yielded a threshold of 0.035. The range of the leverages falls in the interval (0.007, 0.150) and there are fourteen observations that are outside of the threshold. The figures that follow demonstrate each the of diagnostics measures considered.

Logistic Regression Analysis – Replacing ACT subject test scores with ACT Composition

As previously demonstrated the ACT composite score and ACT subject test scores have significant multicollinearity by design. Thus, it is difficult to include both. Thus, it is necessary

to choose one or the other. In this logistic regression analysis, the ACT composite score was used rather than the subject scores. Starting will all of the academic and demographic variables, with the exception of ADNR GPA since this variable demonstrated unreliability in previous models.

A backward elimination logistic regression using was performed on NCLEX-RN pass or fail as the outcome with four academic predictors and two demographic predictors. After the backward elimination only three academic predictors and no demographic predictors remained. against a constant-only model was reliable, $\chi^2(3, N = 258) = 10.325, p < .05$, indicating that this set of predictors does not reliably differentiate between the NCLEX-RN pass group and the NCLEX-RN fail group. The variance NCLEX-RN group membership is described by McFadden's $rho = 0.067, df = 3$. The AIC for the model (152.76) was and the AIC for the null model (157.09) which indicates that the model more reliable than a constant only model.

Prediction accuracy (using 0.5 as the threshold) was 236 out of 258 (91%) correctly predicted outcomes. Sensitivity and specificity were calculated to 0.043 and 0.99, respectively. The following table presents the coefficients, Wald's statistic, p-value and the odds ratios with their 95% confidence intervals.

Table 43 Logistic Regression Analysis - ACT Composite in place of ACT Subject

Variable	*β*	*SE*	*Wald's*	*p-value*	*Odds Ratio*	*95% CI Lower*	*95% CI Upper*
ACT Comp	0.176	0.074	2.376	0.0175*	1.192	1.037	1.389
FirstGPA	-0.422	0.272	-1.549	0.1214	0.656	0.345	1.041
RepeatCountY	-0.905	0.497	-1.822	0.0684	0.404	0.143	1.031

Table 44 Additional Diagnostics Pseudo R-squared- ACT Composite in place of ACT Subject

Pseudo R^2	R_L^2	R_{CS}^2	R_N^2
	0.067	*0.039*	*0.087*

According to the Wald criterion, only the ACT composite score was statistically significant $z = 2.376, p < .05$. Variance Inflation Factors (VIF) for the reduced model are unremarkable. The significance levels of the interaction between each predictor and the log of itself indicates that linearity between each predictor and the logit of itself may be assumed.

Table 45 Variance Inflation Factors ACT Composite in place of ACT Subject

	ACT Comp	*FirstGPA*	*RepeatCount*
VIF	1.058	1.132	1.077

Case-wise Diagnostics

The model produced and analyzed in the previous section produced results that indicate that there are potentially influential cases, outliers or other observations that are phenomenon that affect the model. An analysis of the standardized residuals, df betas, df fits and leverage can determine what observations, if any, can be excluded. The standardized residuals for the full model were examined. The range of the standardized residuals fell in the interval $(-2.548, 0.859)$ and it was found that there fifteen observations that had a standardized residual less than -2 and none greater than 2. Examining these observations revealed that they all had NCLEX values of 0. Next the df betas were examined for the full model using the threshold of absolute value of 1. The range of the df Betas fell in the interval $(-0.514,\ 0.634)$. Thus, there

are not problematic observations indicated by this diagnostic. Next, the dffits for the full model were calculated. The threshold was determined as such: $2 \times \sqrt{\frac{k+2}{n-k-2}}$ which yielded a threshold of 0.282. The range of the dffits for the full model fell in the interval $(-0.750, 0.407)$. There were sixteen observations that had a dffit value above the threshold. Finally, the Cook's distance was examined for the full model of academic predictors. The threshold was acquired using the calculation $3 \times \frac{k}{n}$ which yielded a threshold of 0.035. The range of the leverage values falls in the interval (0.007, 0.113) and there are seventeen observations that are outside of the threshold. The figures that follow demonstrate each the of diagnostics measures considered.

Figure 19 Standardized Residuals ACT Comp in place of ACT Subject

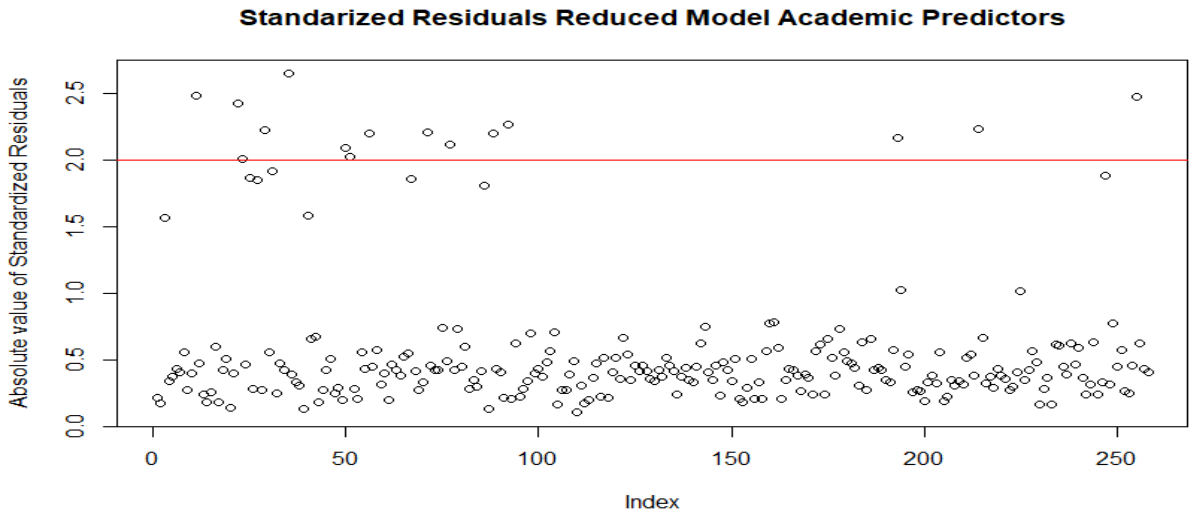


Figure 20 Dffits ACT Comp in place of ACT Subject

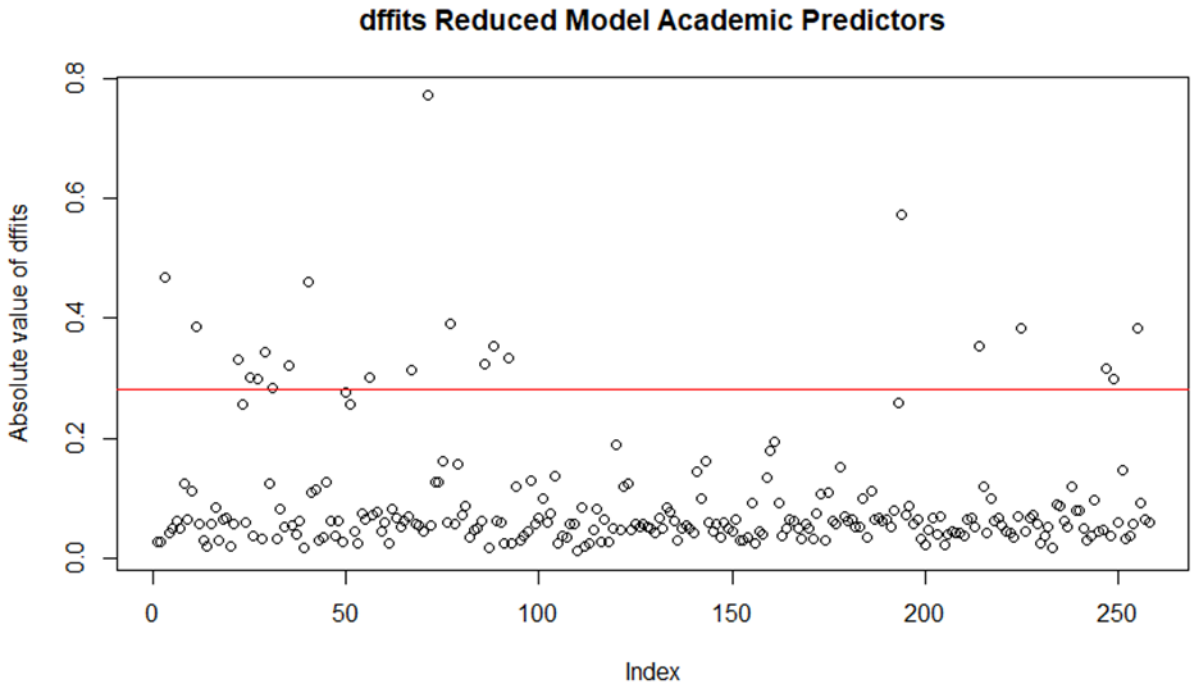


Figure 21 Dfbetas ACT Comp in place of ACT Subject

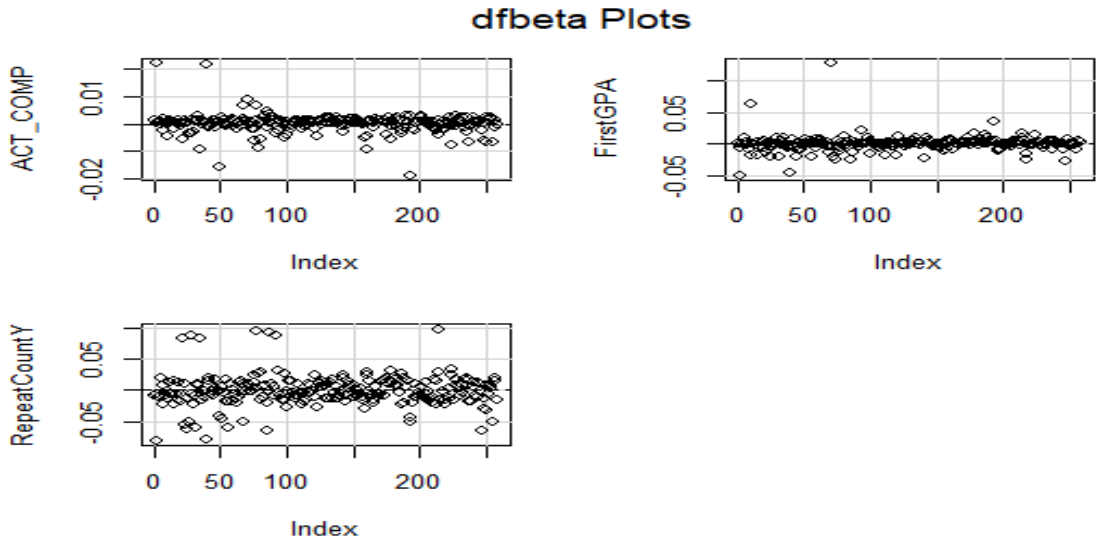
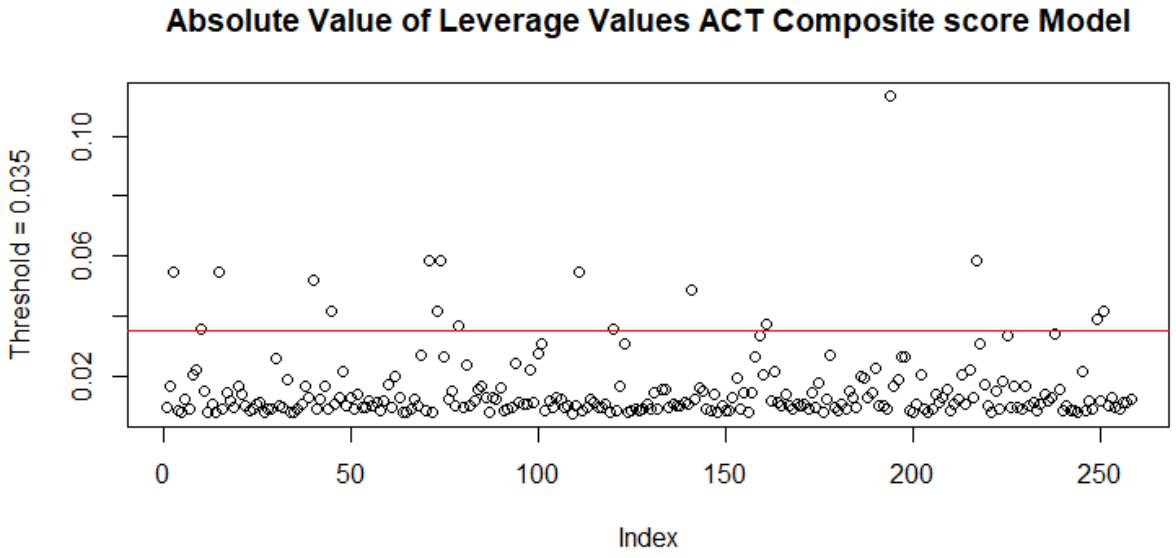


Figure 22 Absolute Value of Cook's D - ACT Comp in place of ACT Subject



Alternative Model Generated After Removing Outliers and Influential Measure

An alternative model was created after removing the observations that failed the case wise diagnostics. This model has limitations because the observations that were removed were the majority of the NCLEX-RN fails leaving 221 (98%) NCLEX-RN pass and 4 (2%) NCLEX-RN fail. Therefore, these observations were largely all of the NCLEX-RN fail observations that had variables values that cannot explain the NCLEX-RN failure. The reduced sample size was $n = 225$ after omitting observations with missing values.

A backward elimination logistic regression using was performed on NCLEX-RN pass or fail as the outcome with all of the predictors included. After the backward elimination four academic predictors and no demographic predictors remained. The model compared against a

constant-only model was reliable, $\chi^2(4, N = 225) = 14.493, p < .01$, indicating that this set of predictors can reliably differentiate between the NCLEX-RN pass group and the NCLEX-RN fail group. The variance NCLEX-RN group membership is described by McFadden's $rho = 0.361, df = 4$. The AIC for the model (35.674) was and the AIC for the null model (42.167) which indicates that the model is more reliable than a constant only model.

Prediction accuracy (using 0.5 as the threshold) was 221 out of 225 (98%) correctly predicted outcomes. Sensitivity and specificity were incalculable since this model predicted only NCLEX-RN success. The following table presents the coefficients, Wald's statistic, p-value and the odds ratios with their 95% confidence intervals.

Table 46 Alternative Model

Variable	*β*	*SE*	*Wald's*	*p-value*	*Odds Ratio*	*95% CI Lower*	*95% CI Upper*
ACT Math	0.504	0.335	1.505	0.1322	1.656	0.970	3.768
FirstGPA	-4.856	2.2712	-2.138	0.0325*	0.008	0.00004	0.490
ADNR GPA	7.929	4.020	1.972	0.0486*	2776.8	2.257	2.3e+7
RepeatCountY	-19.234	3641.592	-0.005	0.9958	0.000	NA	5.4e+180

Due to the summary results, the rest of the analysis was not necessary and therefore was not carried out.

Logistic Regression Analysis – Standardizing the independent variables

A logistic regression analysis was carried out using backward elimination after standardizing all of the independent variables. This was done in order to attempt to improve

interpretability of the coefficients and the confidence intervals. All of the academic and demographic variables were included in the initial model. After the backward elimination, the model contained three academic predictors: ACT reading subtest score, First GPA and ADNR GPA. This model compared to the constant only model was reliable, $\chi^2(3, N = 258) = 16.415, p < .001$, indicating that this set of predictors can reliably differentiate between the NCLEX-RN pass group and the NCLEX-RN fail group. The variance NCLEX-RN group membership is described by McFadden's $rho = 0.11, df = 3$. The AIC for the model (146.67) was and the AIC for the null model (157.09) which indicates that the model is more reliable than a constant only model.

Prediction accuracy (using 0.5 as the threshold) was 0.90. Sensitivity and specificity were 0 and 0.99, respectively. The following table presents the coefficients, Wald's statistic, p-value and the odds ratios with their 95% confidence intervals.

Table 47 Logistic Regression Standardized Independent Variables

Variable	*β*	*SE*	*Wald's*	*p-value*	*Odds Ratio*	*95% CI Lower*	*95% CI Upper*
ACT Read	0.488	0.254	1.922	0.05457	1.169	1.006	2.741
FirstGPA	-0.879	0.463	-1.898	0.05770	0.415	0.133	0.864
ADNR GPA	0.842	0.321	2.622	0.00873**	2.321	1.292	4.620

According to the Wald criterion, only the ACT reading subtest score was statistically significant $z = 2.646, p < .01$. Variance Inflation Factors (VIF) for the reduced model are unremarkable. The significance levels of the interaction between each predictor and the log of itself indicates that linearity between each predictor and the logit of itself may be assumed.

Table 48 Additional Model Diagnostics Pseudo R-squared Standardized Independent Variables Model

Pseudo R^2	R_L^2	R_{CS}^2	R_N^2
	0.067	*0.039*	*0.087*

Table 49 Variance Inflation Factors Standardized Independent Variables Model

	ACT Comp	*FirstGPA*	*RepeatCount*
VIF	1.058	1.132	1.077

Case-wise Diagnostics

The model produced and analyzed in the previous section produced results that indicate that there are potentially influential cases, outliers or other observations that are phenomenon that affect the model. An analysis of the standardized residuals, df betas, df fits and leverage can determine what observations, if any, can be excluded. The standardized residuals for the full model were examined. The range of the standardized residuals fell in the interval $(-2.766, 1.492)$ and it was found that there thirteen observations that had a standardized residual less than -2 and none greater than 2. Examining these observations revealed that they all had NCLEX values of 0. Next the df betas were examined for the full model using the threshold of absolute value of 1. The range of the df Betas fell in the interval $(-0.133,\ 0.248)$. Thus, there are not problematic observations indicated by this diagnostic. Next, the dffits for the full model were calculated. The threshold was determined as such: $2 \times \sqrt{\frac{k+2}{n-k-2}}$ which yielded a threshold of 0.282. The range of the dffits for the full model fell in the interval $(-0.784, 0.927)$.

There were twenty-three observations that had a dffit value above the threshold. Finally, the Cook's distance was examined for the full model of academic predictors. The threshold was acquired using the calculation $3 \times \frac{k}{n}$ which yielded a threshold of 0.035. The range of the leverage values falls in the interval (0.003, 0.172) and there are twenty-two observations that are outside of the threshold. The figures that follow demonstrate each the of diagnostics measures considered.

Figure 23 Absolute Value of Standardized Residuals Standardized Independent Variables Model

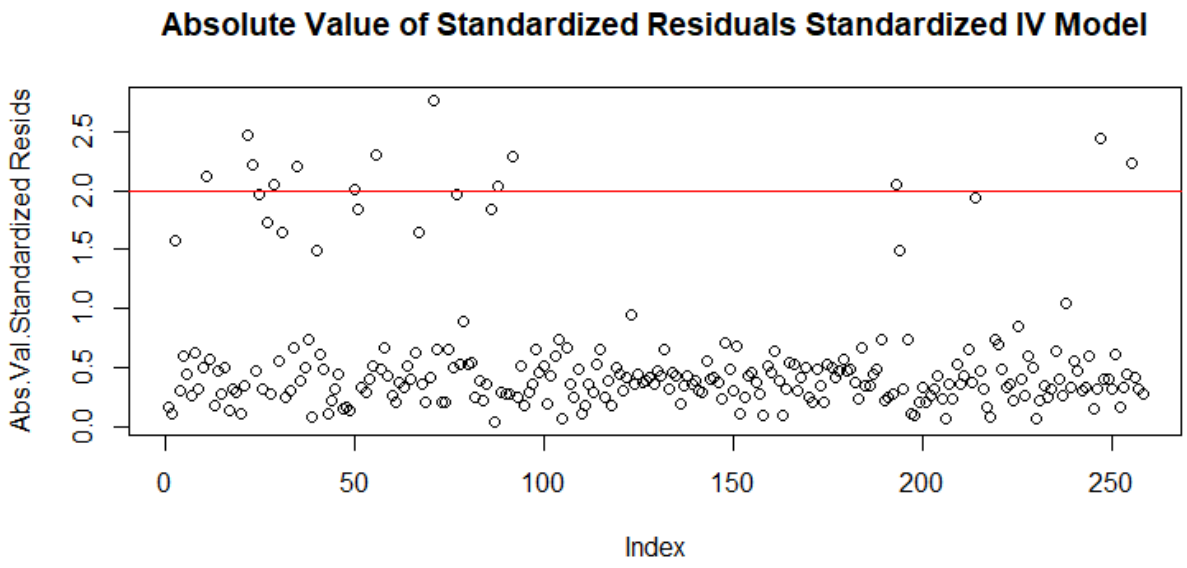


Figure 24 Absolute Value of Dffits for Standardized Independent Variables Model

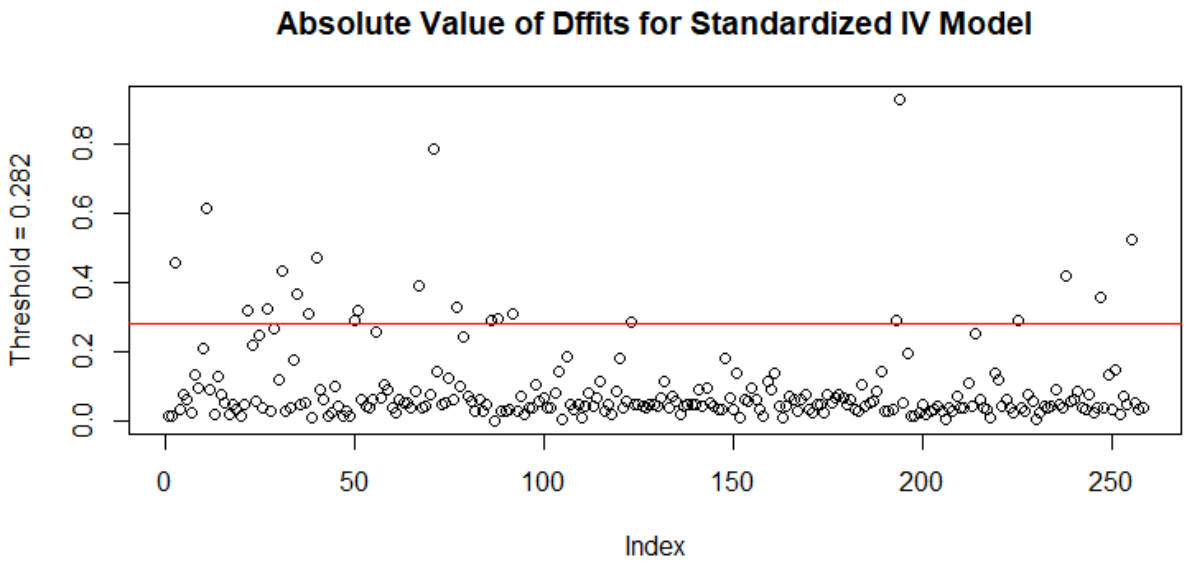
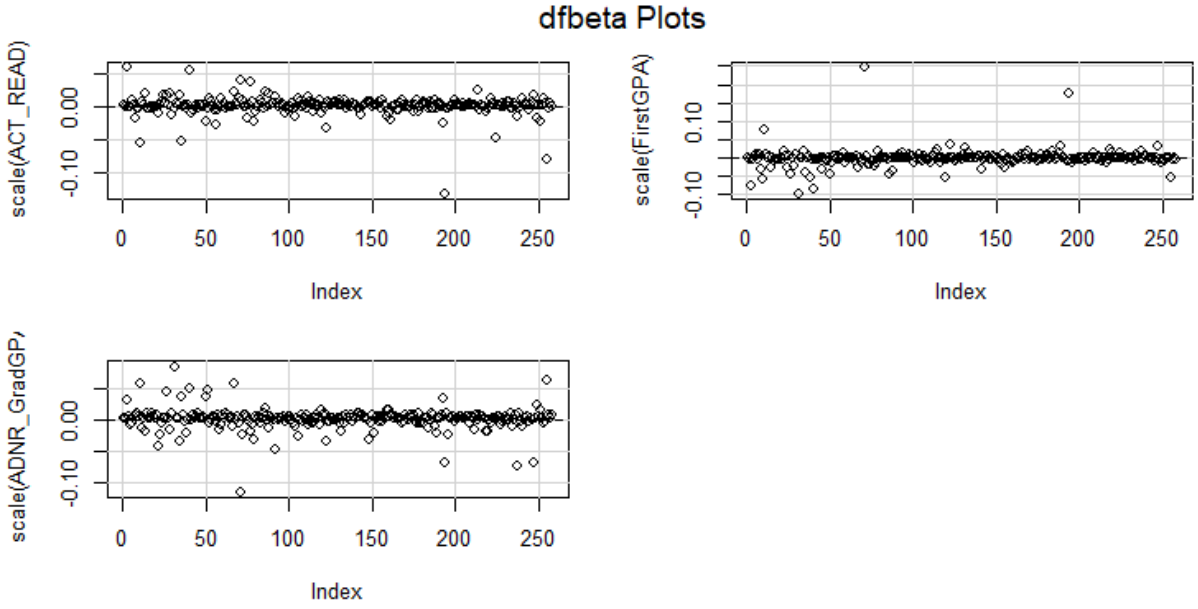
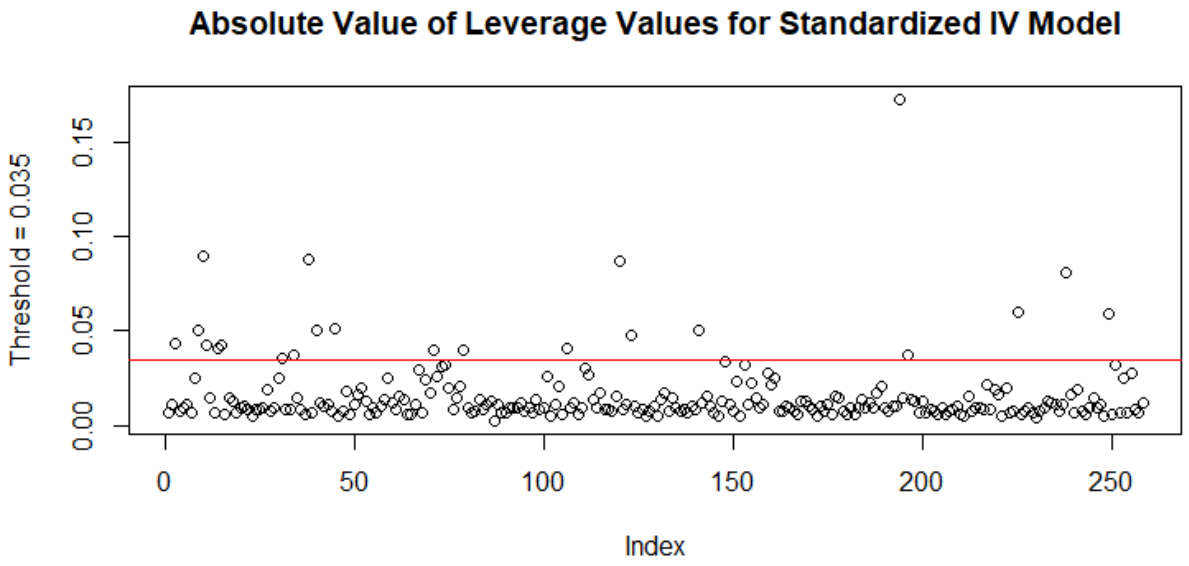


Figure 25 dfBetas Plots Standardized Independent Variables Model





Analysis of no ACT scores observations

The data contained sixty-seven observations without ACT scores. Sixty-one (91%) of these observations were in the NCLEX-RN first-time pass category while the remaining 6 (9%) were in the NCLEX-RN fail category. The descriptive statistics are as follows:

Table 50 Analysis of no ACT scores observations

Variables	*n*	*Mean*	*SD*	*Q1*	*Median*	*Q3*	*Min*	*Max*
Age	67	40	8	35	39	47	26	60
ADNR GPA	67	3.05	0.32	2.83	3.07	3.22	2.22	3.82
First GPA	49	2.877	0.96	2.60	3.00	3.47	0.00	4.00

Given the sample $n = 67$ is not sufficient for logistic regression, a correlation analysis was carried out. The correlation analysis found that of the variables Age, First Year GPA and ADNR

graduating GPA, none of these were significantly correlated with the NCLEX-RN

Table 51 Correlation with NCLEX no ACT

	r	*t*	*df*	*p-value*	*Lower 95% CI*	*Upper 95% CI*
Age	-0.044	-0.357	65	0.722	-0.281	0.198
FirstYear GPA	-0.097	-0.669	47	0.507	-0.368	0.189
ADNR Grad GPA	-0.013	-0.103	65	0.918	-0.252	0.228

Summary of the Results

The results of the logistic regression analysis of this data set revealed that, in this data set, the ADNR GPA and ACT Reading have been demonstrated to be significant predictors of passing the NCLEX-RN on the first attempt. Additionally, there was a significantly positive correlation between ACT Reading and ADNR GPA with NCLEX-RN. There were multiple outliers and influential measures. The majority of these were in the NCLEX-RN fail on the first attempt group. Thus, removing them would have worsened the problem of the data including 91% NCLEX-RN passes on the first attempt and only 9% NCLEX-RN fails. For those without ACT scores, the variables Age, First Year GPA and ADNR GPA are negatively associated with the NCLEX-RN.

There was a significant difference between the means and the medians of ACT reading scores and ADNR GPA of those who passed the NCLEX-RN on the first attempt and those who did not pass the NCLEX-RN on the first attempt. This is insightful since both of these tests, the

Welch's t-test and the Wilcoxon ranked signed test, did not have the same problems that the logistic regression analysis presented given the imbalance of the two groups NCLEX-RN pass on the first attempt and NCLEX-RN fail.

Overall, the two variables, ACT Reading score and the ADNR GPA are indicated by various means to be significant predictors of the NCLEX-RN first time pass. There is a significant difference in the means and medians of these two variables for this data set and these two variables are significantly positively correlated with the NCLEX-RN. It is important to note that these variables are not able to predict NCLEX-RN fail on the first attempt. This is indicated by the sensitivity and specificity of each model. Nearly all of the models were 90-91% accurate. This is interpreted in the context of this data to mean that even if the model predicts every observation to be in the NCLEX-RN first time pass group, it will still achieve 91% accuracy.

CHAPTER V

SUMMARY

The purpose of this study was to identify significant predictors of NCLEX-RN first time success using anonymized, historical data. The motivating factor in this study was to assist the associate degree in nursing program in understanding and predicting NCLEX-RN first time success in order to improve the first-time pass rate. The results of the logistic regression analysis of this data set revealed that, in this data set, the ADNR GPA and ACT Reading have been demonstrated to be significant predictors of passing the NCLEX-RN on the first attempt. Additionally, there was a significantly positive correlation between ACT Reading and ADNR GPA with NCLEX-RN. There were multiple outliers and influential measures. The majority of these were in the NCLEX-RN fail on the first attempt group. Thus, removing them would have worsened the problem of the data including 91% NCLEX-RN passes on the first attempt and only 9% NCLEX-RN fails. For those without ACT scores, the variables Age, First Year GPA and ADNR GPA are negatively associated with the NCLEX-RN.

There was a significant difference between the means and the medians of ACT reading scores and ADNR GPA of those who passed the NCLEX-RN on the first attempt and those who did not pass the NCLEX-RN on the first attempt. This is insightful since both of these tests, the Welch's t-test and the Wilcoxon ranked signed test, did not have the same problems that the logistic regression analysis presented given the imbalance of the two groups NCLEX-RN pass on

the first attempt and NCLEX-RN fail.

Overall, the two variables, ACT Reading score and the ADNR GPA are through each statistical method to be significant predictors of the NCLEX-RN first time pass. There is a significant difference in the means and medians of these two variables for this data set and these two variables are significantly positively correlated with the NCLEX-RN. It is important to note that these variables are not able to predict NCLEX-RN fail on the first attempt. This is indicated by the sensitivity and specificity of each model. Nearly all of the models were 90-91% accurate. This is interpreted in the context of this data to mean that even if the model predicts every observation to be in the NCLEX-RN first time pass group, it will still achieve 91% accuracy.

This study relies on Nursing Universal Retention and Success (NURS) model because it presents a globally applicable framework for analyzing the multitude of factors that are primary and milieu in forming a successful nursing program student. (Jeffery, 1998) The NURS model considers environmental factors, psychological factors (such as student affective factors), professional socialization and enrichment, optimizing outcomes aimed at achieving peak performances, taking a holistic approach to focus on proactive inclusive enrichment and avoid exclusive remediation. The primary advantage of the NURS model is that is consider the multi-dimensionality of the factors that predict nursing program retention and success focusses retention rather than preventing attrition. (Jeffery, 1998)

Through analyzing the case-wise diagnostics it was found that there were outliers and influential measures. By closely examining these observations it could be seen that the majority

of these were in the NCLEX-RN fail group. The current set of variables does not explain the outcome, i.e., the membership in the NCLEX-RN fail group. Therefore, constructing a study wherein the factors explained in Jeffrey's NURS model can be collected and examined could provide an opportunity to understand more about what variables contribute to NCLEX-RN failure on the first attempt and to therefore allow for efforts toward remediation and enrichment to change the outcome.

The review of the literature made clear that there remains doubt about what variable can best significantly predict NCLEX-RN success despite the numerous studies that have attempted to identify significant predictors of NCLEX-RN success on the first attempt for associate degree, Bachelor of Science degree and master's entry programs. The academic variables found most often to be significant were nursing program courses success, GPA and standardized exams. (Banks et al. 2018). There are varying results with respect to demographic variables. The evidence suggests that each associate degree nursing program must investigate and determine what produces the best results in their own specific program and student. It should be noted that SSU does have and use HESI scores to predict NCLEX-RN success. These scores have been shown to be reliably predictive of NCLEX-RN success. The pass rates for the first-time success on the NCLEX-RN have decreased each year in light of the availability of this resource and data. This study did not consider the HESI scores due to a lack of balanced data provided.

The results of this study agreed with the importance of nursing program courses, which in turn lead to the nursing program GPA that was found in the literature review. (Sayles, et al,

2003, Tipton et al, 2004). However, in this study, although First Year GPA was not statistically significant, it was retained in the final model after backwards elimination. Furthermore, this variable was negatively correlated with NLCEX-RN first time success. This is contradictory to the findings that pre-program GPA is statistically significant (Bosch et al, 2012, Shaffer and McCabe, 2013).

Nursing programs have a diverse population but tend to be female and predominantly Caucasian, but that is not always the case. Some studies have found that demographic variables can explain NCLEX-RN success while others found that they were not significant. These contradictory results give rise to several questions. Firstly, are the current and past studies using the best quantitative methods to determine significant predictors? If so, are the assumptions for the specific statistical test being met and discussed? Second, in the cases where demographic variables have not been identified as significant predictors, but it has been shown that a particular demographic attribute has a higher or lower odds of first time NCLEX-RN success, what can be done to address the disparity?

Limitations, Implications and Recommendations

The results of this study are limited to the data set. The data included ninety one percent NCLEX-RN first time pass and nine percent NCLEX-RN fail for the years 2014 to 2021, but not including all of the observations for 2021. Therefore, any results cannot be generalized beyond this data set. The demographic data did suggest that persons of Black / African American

heritage have a higher pass rate than persons who are Caucasian, Hispanic or Puerto Rican and those whose ethnicity is unknown. The author would like to again mention the sparsity of observations that were outside of the prevalent demographic characteristic of persons who were Caucasian and female.

During the course of the study, it was demonstrated that many of the observations that were in the NCLEX-RN first time fail group were outside of the given thresholds for the standardized residuals, dffits and leverage values. Examining these observations revealed that they NCLEX-RN fail did not appear to be explained by the variables under consideration. Therefore, aside from collecting more data, it is also recommended that in a future study, an attempt to understand and analyze the NCLEX-RN failure groups in light of other variables is suggested. The other variables could be qualitative and quantitative in nature. Furthermore, a mixed methods model would also be suggested provided that the data can be obtained.

REFERENCES

Alameida, M. D., Prive, A., Davis, H. C., Landry, L., Renwanz-Boyle, A., & Dunham, M. (2011). Predicting NCLEX-RN success in a diverse student population. *Journal of Nursing Education*, *50*(5), 261-267.

Banks, J., McCullough, E., Ketner, D., & Darby, R. (2018). Tailoring NCLEX-RN indicator assessments for historically black colleges and universities: Literature review. *Journal of Professional Nursing*, *34*(5), 331-345.

Bosch, P. C., Doshier, S. A., & Gess-Newsome, J. (2012). Bilingual nurse education program: Applicant characteristics that predict success. *Nursing Education Perspectives*, *33*(2), 90-95.

Delacre, M., Lakens, D., & Leys, C. (2017). Why psychologists should by default use Welch's t-test instead of Student's t-test. *International Review of Social Psychology*, *30*(1).

De Lima, M., London, L., & Manieri, E. (2011). Looking at the past to change the future: a retrospective study of associate degree in nursing graduates' National Council Licensure Examination scores. *Teaching and Learning in Nursing*, *6*(3), 119-123.

Exam Statistics & Publications. (n.d.). NCSBN. Retrieved 2022, from https://www.ncsbn.org/exam-statistics-and-publications.htm

Field, A., Miles, J., & Field, Z. Discovering Statistics Using R (2012). *Great Britain: Sage Publications, Ltd*, *958*.

Green, S. B. (1991). How many subjects does it take to do a regression analysis. *Multivariate behavioral research*, *26*(3), 499-510.

Griffiths, M. J., Papastrat, K., Czekanski, K., & Hagan, K. (2004). The lived experience of NCLEX failure. *Journal of Nursing Education*, *43*(7), 322-325.

Higgins, B. (2005). Strategies for lowering attrition rates and raising NCLEX-RN® pass rates. *Journal of Nursing Education*, *44*(12), 541-547.

Jeffreys, M. R. (1998). Predicting nontraditional student retention and academic achievement. *Nurse educator*, *23*(1), 42-48.

Lengacher, C. A., & Keller, R. (1990). Academic predictors of success on the NCLEX-RN examination for associate degree nursing students. *Journal of Nursing Education*, *29*(4), 163-169.

Lockie, N. M., Van Lanen, R. J., & Mc Gannon, T. (2013). Educational implications of nursing students' learning styles, success in chemistry, and supplemental instruction participation on National Council Licensure Examination-Registered Nurses Performance. *Journal of Professional Nursing*, *29*(1), 49-58.

Lopez, R. (2022, May 27). *Top Online Master's Programs in Mathematics | BestCollegeReviews*. Best College Reviews. Retrieved 2022, from https://www.bestcollegereviews.org/top/online-masters-mathematics/

McCarthy, M. A., Harris, D., & Tracz, S. M. (2014). Academic and nursing aptitude and the NCLEX-RN in baccalaureate programs. *Journal of Nursing Education*, *53*(3), 151-159.

Mitchell, H. D. (2016). Predicting NCLEX-RN performance: an exploration of student demographics, pre-program factors, and nursing program factors.

Moniyung, C. (2015). Academic and non-academic variables as predictors of NCLEX-RN success among traditional associate degree students at Southern Adventist University.

NCLEX. (2022). Ohio Board of Nursing. https://nursing.ohio.gov/nursing-education-nclex/nclex/

Nursing Achievement Data | Shawnee State. (n.d.). Shawnee State University. Retrieved 2022, from https://www.shawnee.edu/areas-study/college-professional-studies/nursing/achievement-data

Nursing Mission & History | Shawnee State. (n.d.). Shawnee State University. Retrieved 2022, from https://www.shawnee.edu/areas-study/college-professional-studies/nursing/mission-history

Pennington, T. D., & Spurlock Jr, D. (2010). A systematic review of the effectiveness of remediation interventions to improve NCLEX-RN pass rates. *Journal of Nursing Education*, *49*(9), 485-492.

Romeo, E. M. (2013). The predictive ability of critical thinking, nursing GPA, and SAT scores on first-time NCLEX-RN performance. *Nursing Education Perspectives*, *34*(4), 248-253.

Sayles, S., Shelton, D., & Powell, H. (2003). Predictors of success in nursing education. *ABNF Journal*, *14*(6).

Shaffer, C., & McCabe, S. (2013). Evaluating the predictive validity of preadmission academic criteria: High-stakes assessment. *Teaching and Learning in Nursing*, *8*(4), 157-161.

Shawnee History | Shawnee State. (2022). Shawnee State University. Retrieved 2022, from https://www.shawnee.edu/about-us/strategic-planning/shawnee-history

Shawnee State University. (n.d.-b). Data USA. Retrieved 2022, from https://datausa.io/profile/university/shawnee-state-university

Seago, J. A., & Spetz, J. (2005). California's minority majority and the white face of nursing. *Journal of Nursing Education*, *44*(12), 555-562.

Sears, N. A., Othman, M., & Mahoney, K. (2015). Examining the relationships between NCLEX-RN performance and nursing student factors, including undergraduate nursing program performance: A systematic review. *Journal of Nursing Education and Practice*, *5*(11), 10-15.

Seldomridge, L. A., & DiBartolo, M. C. (2004). Can success and failure be predicted for baccalaureate graduates on the computerized NCLEX-RN?. *Journal of Professional Nursing*, *20*(6), 361-368.

Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2007). *Using multivariate statistics* (Vol. 5, pp. 481-498). Boston, MA: Pearson.

Tipton, P., Pulliam, M., Beckworth, C., Illich, P., Griffin, R., & Tibbitt, A. (2008). Predictors of associate degree nursing students' success students. *Southern Online Journal of Nursing Research*, *8*(1), 1-8.

Top Game Design 2022 Press Release | Public Relations | The Princeton Review. (2022, March 22). The Princeton Review. Retrieved 2022, from https://www.princetonreview.com/press/game-design-press-release-2022?source=aw&awc=18466_1658572618_ccb73727648e72137ffe0a2f3d2b227d

Trofino, R. M. (2013). Relationship of associate degree nursing program criteria with NCLEX-RN success: What are the best predictors in a nursing program of passing the NCLEX-RN the first time? *Teaching and Learning in Nursing*, *8*(1), 4-12.

Woodham, R., & Taube, K. (1986). Relationship of nursing program predictors and success on the NCLEX-RN examination for licensure in a selected associate degree program. *Journal of Nursing Education*, *25*(3), 112-117.

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