

# Pre-admission Predictors of Student Success in a Traditional BSN Program

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# The Problem

- We currently have over 500 students in pre-nursing, and only 80 seats per semester for students to enter the program.
- Of those who do gain entry into the BSN, 25-30% fail to complete the program, mostly due to academic failure.
- This loss of students from the program is an economic drain on both the students and the university.

# Our Goal - Successful Students



# National Data Lacking

- Attrition is a serious issue among Bachelor of Science in Nursing (BSN) students with some programs reporting graduation rates as low as 50% (Newton 2009).
- National data on graduation rates is not readily available, as NCSBN does not collect this data, and while ACEN does collect and report, it does so only for those programs it accredits.

# ACEN Graduation Rate\* Data 2009-2014

Program Type	2009-2010	2010-2011	2011-2012	2012-2013	2013-2014
Generic BSN	79.5%	78.3%	78.29%	79.15%	79.77%
ADN	73.6%	73.4%	74.61%	74.52%	74.75%

\*ACEN defined graduation rate: the number of students who complete the program within 150% of the time of the stated program length, beginning with the first nursing course.

# Kentucky Graduation Rate Data 2011-2015

Program Type	2011	2012	2013	2014	2015
<b>Generic BSN</b> (N = 15)	77.2%	70%	75%	75%	69%
<b>*ADN (N = 39)</b>	61.1%	73.8%	60%	68%	51%

\*KBN Annual Report Data. Includes data from 16 non-accredited nursing programs. Uses 150% of program completion time, similar to ACEN.

# Purpose

- Using data from 341 students admitted over a three-year period, the goal of this study was to determine which factors best predicted student success in a Baccalaureate of Science in Nursing (BSN) Program.
- These factors were then used to develop an admission formula which was tested retroactively to determine its ability to differentiate between successful and non-successful students.

# Rational Versus Statistical Selection

- Rational Selection Model: based on judgments of faculty experts to identify high quality candidates using reference letters, interviews, and essays along with GPA and other data
- Statistical or Mechanical Model. Selecting students based on a quantitative prediction formula which best predicts successful program completion
- Cunningham, Manier, Anderson, & Sarnosky, 2014



# Rational Versus Statistical Selection Model

- Existing research supports the predictive power of several common admission criteria (GPA, standardized exam scores, grades in selected science courses).
- A number of studies comparing different models support better prediction of student outcomes using the Statistical Model instead of the Rational Model (Cunningham 2014; Crow, 2004; Newton, 2007; Wolkowitz 2010).

# Review of Literature

- Used California Community College System Data to examine over 50 factors that were expected to predict student success (completion) of ADN programs.
- 5 year data set over 5,000 students from 20 different ADN programs.
- Four factors rose to the top of the prediction model; College GPA, English GPA, Core Biology GPA (Anatomy, Physiology and Microbiology); and Biology repetitions (the number of times a student repeats any of the core biology courses).
- Phillips, Spurling & Armstrong (2002)

# Review of Literature

- The application of these variables significantly improved ADN program completion from a completion rate of 73% to 82%.
- When disaggregated by ethnicity, use of the formula to predict success resulted in improved completion rates for ethnic groupings.
- Increase for Caucasian students was approximately 3%, while for African American students, use of the composite variable for program admission improved completion rates by approximately 15%.

# Billows (2007) Rationale vs Statistical Selection

- 1,343 baccalaureate students
- No correlations between the supplemental application materials (reference letters, goal statements), or interview scores and the grades earned in the program
- Supplemental admission tools did not add value to the selection process over the use of GPA alone.

# Cunningham, et al., 2014 Rational Versus Statistical Model

- Data from 283 BSN students enrolled over 8 years
- Compared use of a rational points-based system with use of a statistical model for student admission decisions.
- The rational system included weighting total GPA and Science GPA (example, GPA of 3.8-4.0 = 30 admission points) and use of non quantitative data, such as reference letters, interviews and giving points for prior degrees (BS/BA = 2 points, MS = 3 points) and points for completion of various pre-reqs.

# Predicting Performance:

- Four primary predictors (GPA, Science GPA, entrance exam scores and number of pre-reqs completed) explained a statistically significant proportion of the variance in all outcomes targeted in the study
- Targeted Outcomes were Graduation, ATI RN predictor scores, Second semester nursing GPA and Graduation GPA).
- Among the four predictors, science GPA and entrance exam scores were the best predictors of the target outcomes

# Manieri, De Lima, and Ghosal (2015)

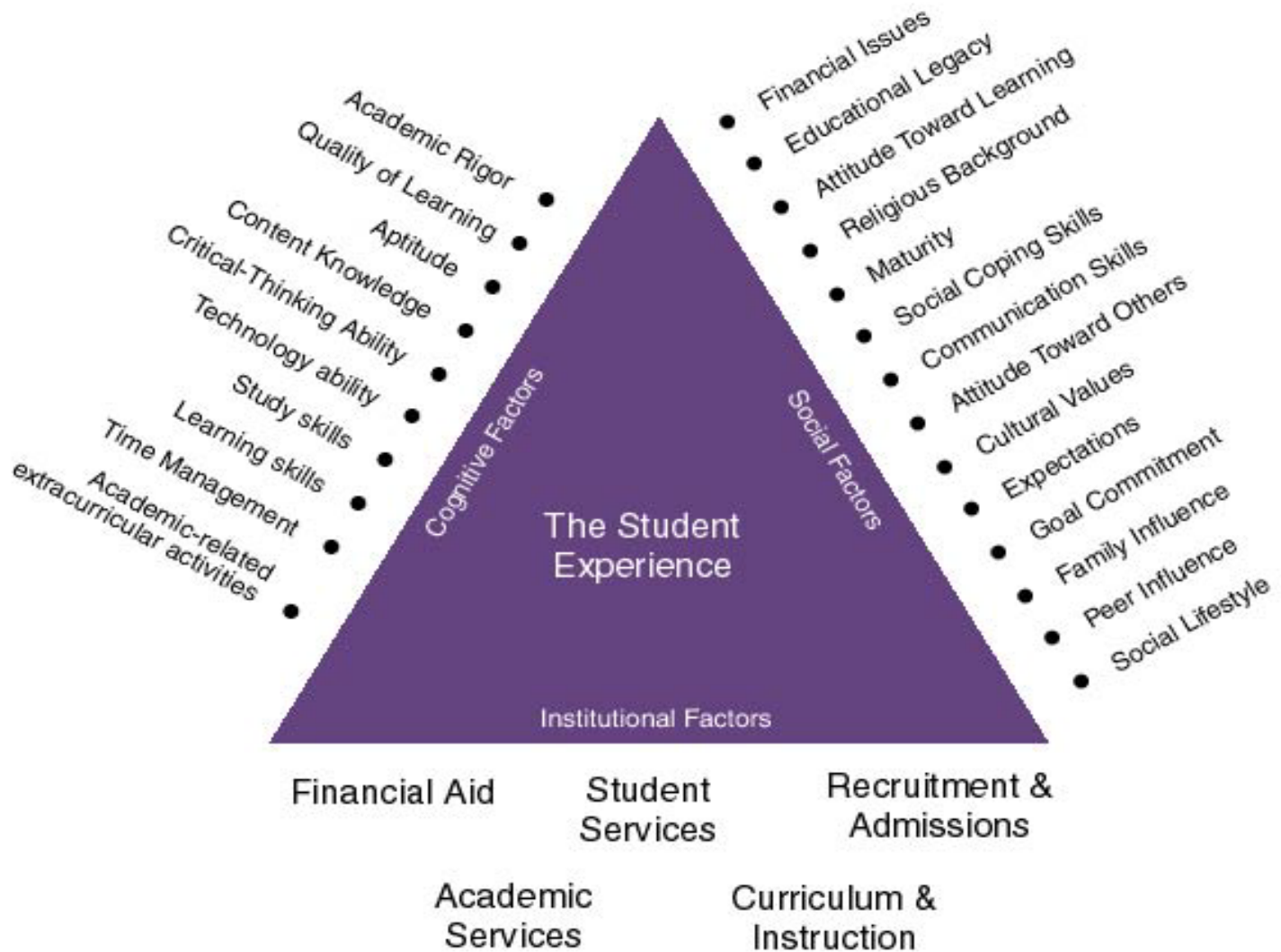
- 339 ADN students
- Compared three entrance exams (PAX-RN, HESI, ATI TEAS)
- Logistic regression analysis of data from two cohorts of ADN students (339) who were followed over 5 years.
- The HESI  $A^2$  ( $p = .000$ ) and TEAS ( $p = .004$ ) were both statistically significant in predicting program completion, but not the PAX-RN.

# Summary

- Studies which compared their current rational admissions systems with the statistical method found that the statistical method was a better predictor of student success
- Variables that were significant across the studies were GPA, Science GPA and scores on standardized nursing admissions exams.



# Theory Geometric Model of Student Persistence and Achievement (Swail, 2004).



# Admission Variables Examined in this Study

- The variables tested were those available at the time of application to the BSN nursing program which also had support from the literature.
- Admission GPA
- Science GPA
- Standardized entrance exam scores
- Entrance exam Subscales (A&P, Reading, Math)

# Outcome Variables

- Student Success for this Study
  - Passing all nursing courses on the first attempt with a grade of C or above
  - Graduating from the program within 4 semesters
  - Passing the NCLEX on the first attempt
  - For this group, 229 students met the criteria as being successful, and 112 students were non-successful in some way (mostly due to failing one nursing course)

# Demographics

- N of 341 BSN students.
- 87.52% Female
- 91.7% Caucasians 3.09% African American, and 5.2% were listed as other.
- Only six students (1.8%) were classified as English as a Second Language (ESL).
- All ESL students are required to meet the same TOFEL requirements as required by NCSBN for graduates of foreign nursing schools to take the NCLEX.

# Logistic Regression


- The following three variables, admission GPA, science GPA and A&P scores taken together gave the best predictive model, accounting for 76% of the variance ( $c=0.762$ ).
- Science GPA included course repeats, so if a student obtained a C (2 points) and repeated the course to obtain an A (4 points), the two grades were averaged for a total of 3 points.

# Odds Ratio Estimates for Significant Predictor Variables

Predictor Variable	Point Estimate	Change in variable	Change in Student Odds of Success	95% Wald Confidence Limits	
Admissions GPA	4.579	Increase of 1 point	Increased by 375%	1.575	13.319
Science GPA	2.377	Increase of 1 point	Increased by 137%	1.238	4.564
A&P Score	0.901	Increase of 10 points	Increased by 70%	0.754	1.075

# Retrospective Analysis using various predictors

- The ideal selection method would be easy to use, would retain the highest number of students who were ultimately successful, and remove from the accepted group those who were ultimately non-successful.
- Using “What If” types of analysis, looked to see which students would have been admitted (or not admitted) using each of the predictors separately and together, to determine a formula which had the least false positives and negatives (sensitivity and specificity)

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- Used the predictors to calculate new admissions scores for all students who applied to the BSN program over a 3 year period
  - Only students whose outcomes were known (already graduated and taken NCLEX) were used in this retrospective analysis to see if the new formula would have admitted the successful students and not admitted the non-successful students



# Effect of Reading Subscale

- At the request of the admission committee, examined the effect of using the Reading subscale score.
- Using the reading score was not very effective.
- Would have eliminated only 13.33% of the non-successful students and would also have eliminated 8% of the successful students.

# Using Entrance Exam Composite Score as a Single Measure

- Using the entrance exam as a cut off score of 80 would have eliminated 37.6% of unsuccessful students
- It would also have eliminated 22% of the successful students

# A&P Scores

- Using the A&P scores as a single variable to rank students would have eliminated the highest number of non- successful students (50%).
- However, it also would have eliminated 24% of the successful students.

# Combining GPA, Science GPA and A&P score divided by 10

- Using all 3 of the significant predictors determined by the logistic regression analysis produced the best results.
- Use of this formula would have eliminated 40.9% of the non-successful students while only eliminating 16% of the successful students.

# Recommended Admissions Formula Used Starting Spring 2016

- GPA + Science GPA + (HESI A&P score divided by 10).
- Example GPA = 3.5, Science GPA (including repeated classes 3.25, A&P 80
- $3.5 + 3.25 + 8 = 14.75$  Admission Score
- Students ranked by Admissions Score and top 80 students admitted into program

# Limitations

- All student data from were from one BSN program
- During this study the BSN program doubled in size, from admitting 40 students per semester to 80 per semester.
- The retrospective analysis told the authors which students would have been eliminated using the various formal. While the logistic regression indicates that other students from the applicant pool would have been more likely to be successful, this cannot be validated using retrospective data.
- During this study the standardized entrance exam was being piloted and the scores were not used in the admissions process. Students were not supposed to know this, but this information may have leaked out. Students might have performed better on the entrance exam if they thought this test was more important

# Limitations

- This model does not account for the use of other non-academic criteria such as being a member of ROTC , relatives of a coach, large university donor or state legislator, or recommendations from the university president.
- During this about 10 students were admitted due to such non-academic criteria
- The BSN program is preparing to increase in size again to 140 students per semester starting in Fall 2017, so retention rates may drop due to going lower in the applicant pool.



# Implications for Educational Nursing Administrators

- Admission of non-successful students is costly for both the program and the students
- Not admitting students who might be successful is harmful to the student and the nursing profession
- Using quantitative data to inform the admission decision making process can lead to more successful outcomes



# Recommendations

- Repeat this type of analysis using data from other nursing programs
- Do a longitudinal study of the outcomes of the new admissions formula over time.
- Include measures of the social/behavioral side of the geometric model for future studies.

# Questions?

