Intensive Care Unit Experience and First-Attempt National Certification Examination Scores

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Abstract

With the yearly increase of surgical procedures performed and the growing rates of certified registered nurse anesthetists (CRNAs) retiring, it is crucial that nurse anesthesia programs (NAPs) produce competent student registered nurse anesthetists (SRNAs) to help alleviate the strain placed on the healthcare system. For SRNAs to transition into CRNAs, they must pass the National Certification Exam (NCE). With first-attempt NCE scores on a gradual decline since 2008, it is important that NAPs around the country work to improve this statistic. For a NAP to preserve their accreditation status, it must maintain a minimum annual pass rate of 80%. By admitting SRNAs who are better prepared to handle the challenges and rigorous academic pressure of nurse anesthesia school, program directors and faculty members may be able to improve the first-attempt NCE scores. One component of the admissions process that warrants research is the Council on Accreditation (COA) requirement of intensive care unit (ICU) nursing experience prior to the start of the program. Data was obtained on months of experience prior to admission to the NAP at AdventHealth University (AHU) from six cohorts that graduated between 2014 and 2019 and analyzed for correlational relationship to first-attempt NCE scores. The findings of this study led to recommendations to AHU's NAP program administrators and faculty.

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ICU Experience and First-Attempt NCE Scores

Certified Registered Nurse Anesthetists (CRNAs) are responsible for providing anesthesia in diverse healthcare arenas across the United States. The job market is in need of qualified CRNAs as there is a 31% predicted job growth between 2014 and 2024 (Bureau of Labor Statistics, 2019). CRNAs provide anesthesia for nearly 45 million individual cases each year and are usually the primary anesthesia providers for the military, rural areas, and underserved areas (AANA, 2019). As the general population age increases, the number of needed surgical procedures will also increase (Etzioni, Liu, Maggard, & Ko, 2003). With CRNAs providing most of the anesthesia for these surgical procedures, the education and production of capable CRNAs is vital in order to keep up with growing demand put on America's healthcare system (AANA, 2019).

Significance and Background of Problem

Approximately 2,400 Student Registered Nurse Anesthetists (SRNAs) graduate every year (AANA, 2019). As the job field is predicted to increase by 31%, the continuous production of SRNAs ready to enter the job field is crucial (Bureau of Labor Statistics, 2019). For SRNAs to become CRNAs, they must pass the NCE to become certified. A recent review of National Certification Exam (NCE) statistics has shown a gradual decline in the first-attempt NCE scores for SRNAs taking the exam. The 2008 first-attempt pass rate was 89.9% and has decreased to 84.3% for the year of 2018 (NBCRNA, 2017 & Council of Accreditation, 2019). The challenge to get SRNAs to transition to CRNAs is one that the program directors and educators face every year (Zaglaniczny, 1992). It is imperative to explore if admissions criteria, in particular, if months of intensive care unit (ICU) experience correlates with first-attempt NCE scores, which could lead to reconsideration of this criterion.

PICOT Evidence Review Questions

The main question of this scholarly project was: In student registered nurse anesthetists (P), does the number of months practicing nursing in ICU prior to the beginning of the program (I) correlate with first-attempt National Certification Examination scores? This question was formed from reviewing literature that explored the admissions process for nurse anesthesia programs. Multiple research articles explored different variables of the admissions process; however, there was a lack of literature that examined the duration of ICU experience and its influence on NCE first-attempt scores. These variables included the Graduate Record Examination (GRE), Grade Point Average (GPA), science GPA, non-ICU clinical experience, and months of ICU experience. A decision was made to focus on the quantity of experience, specifically months of ICU experience. The second PICO question was: In student registered nurse anesthetists at AdventHealth University (AHU) enrolled in the 2014-2019 graduating cohorts (P), did the number of months practicing nursing in ICU prior to the beginning of the program (I) correlate with first-attempt National Certification Examination scores (O)?

Literature Review

With the growing need for CRNAs in the United States, coupled with declining first-attempt pass rates for SRNAs, the pressure placed on nurse anesthesia program directors, faculty, and members of professional organizations to educate and prepare students to become working CRNAs is high. For SRNAs to transition to CRNAs, they must complete either a master's or doctoral program and ultimately pass the NCE. Since passing the NCE is a goal after completion of nurse anesthesia school, a literature review was conducted on quantity of ICU experience and its influences on NCE first-attempt scores.

Search Strategy and Results

The search strategy contained the databases PubMed, Google Scholar, and AANA publications. Key search terms included: "*evidence-based practice admission criteria for graduate school*", "*nurse anesthesia admissions criteria*", "*nurse anesthesia national certification exam*", "*predictors of success in nurse anesthesia education*", "*years of experience and nurse anesthesia school*", "*national certification exam*", and "*predictors of nursing graduate school success*". A total of 157 articles were initially retrieved. Articles were excluded based on the use of multivariate variables which did not include asking the participant how much time was spent as an ICU RN, as well as if titles of the study were not applicable to the research topic.

GRADE Criteria

The literature was reviewed using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) tool. The GRADE score was used to evaluate the quality of the evidence and data. The overall quality was moderate with an initial score of 3 on the GRADE scale. The research articles included quantitative correlational studies, retrospective studies with multiple regression analyses, exploratory descriptive studies, and systematic reviews. GRADE score was increased to 4 due to large sample sizes, the absences of indirectness, inconsistencies, and imprecision. However, several of the studies contained inconsistencies, indirectness, small samples sizes, and one article had potential for publication bias which brought the GRADE score down from a 4 to a 3. Based on GRADE, it is recommended that duration of ICU experience be a question asked on application to a NAP but is suggested that it not be a major determinant on acceptance into a program.

Definitions

The National Board of Certification and Recertification for Nurse Anesthetists

(NBCRNA) is a corporation dedicated to patient safety and improving the quality of nurse

anesthetists (NBCRNA, n.d.). In 1975, the National Board of Certification and Recertification

for Nurse Anesthetists (NBCRNA) was recognized by the American Association of Nurse

Anesthetists (AANA) to oversee the credentialing process for CRNAs; this included the

administration of the NCE. The NCE is a variable-length test (NBCRNA, 2019). The sections

covered are basic sciences (25%); equipment, instrumentation, and technology (15%); general

principles of anesthesia (30%); and anesthesia for surgical procedures and special populations

(30%) (NBCRNA, 2019). A COA requirement of applying to a NAP is ICU experience (COA,

2019). ICU experience as defined by COA is "…one where, on a routine basis, the registered

professional nurse manages one or more of the following: invasive hemodynamic monitors (e.g.,

pulmonary artery, central venous pressure, and arterial catheters), cardiac assist devices,

mechanical ventilation, and vasoactive infusions" (2018).

Background Information

The certification requirement was first introduced into the nurse anesthesia profession in

1945 (Zaglaniczny, 1992). In 1979, researchers evaluated and compared types of degrees before

admission into nurse anesthesia school and concluded that students with baccalaureate and

master's degrees scored higher than students with certificates and associate degrees

(Zaglaniczny, 1992). Researchers are now looking at preadmission criteria such as GPA, GRE

score, science GPA, types of nursing experience, and duration of ICU nursing experience and

their correlation with program success (Clayton, Lypek, Douglas, & Connely, 2000; Burns, 2011;

Ortega et al., 2013; Conner, 2015; Patzer et al., 2017). The overall purposes of these studies were

to try to identify positive correlations between preadmission criteria and program success.

Interestingly, although a majority of the previously mentioned studies referred back to the study

done by Zaglaniczny in 1992, none of them used compared preadmission criteria to NCE scores.

Zaglaniczny (1992), was the only researcher to compare preadmission criteria and NCE scores.

In 1975, the NBCRNA began to administer the NCE for credentialing CRNAs (NBCRNA,

2019). NBCRNA publishes data on SRNA characteristics and compared it to first-time pass rates

(NBCRNA, 2019). These characteristics include gender, age, clinical background, and degree

earned. These same characteristics and correlating pass/fail percentages are published every year.

One characteristic that was not collected is the duration of ICU experience. This dissimilarity

creates an interesting topic for further research as ICU experience is a criterion for admission to

all NAPs.

Literature Review Results and Synthesis of Evidence

Overall, the literature has been ambiguous when it pertains to the duration of ICU

experience and its correlation with first-attempt NCE scores. There is also dissimilarity regarding

collecting duration data in months versus years. A hindrance to the review of literature was the

overall lack of direct correlation of duration of ICU experience and NCE scores. A majority of

the literature listed years of ICU experience as an important factor for admission into a NAP or

other Graduate Nursing Program (Ortega et al., 2013; Patzer et al., 2017; Zaglaniczny, 1992).

Zaglaniczny (1992) concluded that SRNAs with more years of nursing experience scored higher

on the NCE. Burns (2011) did not directly correlate years of nursing experience to NCE scores

but did conclude that years of nursing had an inverse relationship with GPA. This provided an

interesting point that was mentioned in a separate study. Ortega et al. (2013) reiterated

Zaglaniczny's study from 1992 that graduates with more ICU experience scored higher on the

NCE but had lower GPAs in their respective Nurse Anesthesia programs.

　　　　Furthermore, ICU experience has been and continues to be a major part of the admissions

process for NAPs throughout the United States (Ortega et al., 2013). Research that shows a true

correlation with NCE first-attempt scores is still lacking. Although studies showed correlation

between years of ICU experience with NCE scores, the articles compared multiple variables and

were not specific. Zaglaniczny (1992) looked at scores from 1987-1989, and Ortega et al. (2013)

reviewed previous data from the 1992 study that Zaglaniczny published.

　　　　With the decline of first-attempt NCE pass rates from 89.9% in 2008 to 84.3% in 2018,

coupled with the growing need for CRNAs, it is important that NAPs admit candidates who will

not only be successful in the program, but will ultimately pass the NCE (NBCRNA, n.d.). There

is current literature that examines admissions criteria and their correlation with NCE first-attempt

scores. However, there is a lack of literature that looks at the quantity of ICU experience and the

role that it plays compared with NCE first-attempt scores. The NBCRNA correlates

demographics (i.e. gender, age, clinical background, and degree earned) with NCE first-attempt

scores but does not take duration of ICU experience into account. There is a need to examine this

pre-admission requirement to provide evidenced-based data analysis to help support, reject, or

recommend changes that will ultimately assist NAPs to select candidates who will ultimately

pass the NCE on their first attempt. Furthermore, this scholarly project used the number of

months, instead of years, of ICU experience as a more precise measurement to assess for a

correlation with NCE first-attempt scores.

Conceptual Framework

A clear-cut theoretical framework could not be identified within the relevant literature. Therefore, the Witkin and Altschuld's needs assessment model (Witkin & Altschuld, 1995) was used as the conceptual framework for this study. The Witkin and Altschuld's needs assessment model serves as an analysis, assessment, and action plan framework all within one method. The process includes three phases that can be adapted to fit the needs of an organization (Witkin & Altschuld, 1995). The three phases include the pre-assessment, assessment, and post-assessment phases.

Methodology for Scholarly Project

Project Aims

The purpose of this scholarly project was to determine if a relationship existed between duration of ICU experience prior to the admission to a NAP, as measured in months, and NCE scores. A secondary aim was to make evidence-based recommendations appropriate for those findings. The project objectives were delineated as follows: determine if there is a correlation between duration (measured in months) of ICU experience and NCE scores within the 2014-2019 NAP cohorts by Spring of 2020 and make recommendations regarding use of duration of ICU experience as an influencing factor on the AHU NAP admission process and its potential implications.

Methods

This scholarly project was conducted with a quantitative, retrospective, correlational design. All ICU experience data and NCE scores were quantified and provided by the AHU NAP department and were fully de-identified prior to any evaluation or analysis performed by the scholarly project team. The number of ICU months was extrapolated from the applicant-

submitted resumes, based on the number of months they self-reported plus an extrapolation process that assumed that the applicant continued working full-time in the stated current ICU setting through the end of the month immediately prior to the Master of Science in Nurse Anesthesia (MSNA) program start. The sample consisted of 136 students that were previously enrolled at AHU's MSNA NAP in the graduating cohorts of 2014-2019. The setting was a private Christian college in the southeastern United States. The measured variables were the number of months practicing in the ICU (independent) and overall first-attempt NCE scores (dependent). Data was analyzed using the Statistical Package for Social Sciences (SPSS) statistics software: version 21 provided by AHU and with the assistance of Dr. Roy Lukman. A bivariate correlational analysis measuring the strength of relationship between the two variables was employed. Ethical considerations included the protection of identity and privileged information. There were no interactions with human subjects, and data was completely de-identified prior to being provided to the scholarly project team for analysis, therefore, no informed consent was required. The Information Technology Department at AHU created a secured cloud-based storage for data protection. Information will be kept for a 5-year period and then cleared by the Information Technology Department at AHU. Based on the literature review and data analysis, the project made recommendations regarding the minimum quantity of ICU experience required as part of the AHU NAP admissions process.

Planning and Procedures

The support of the AHU NAP was essential in facilitating the proposed scholarly project, and key players were Dr. Alescia DeVasher Bethea, Dr. Sarah Snell, Dana Williams, and Dr. Roy Lukman. Through the identification and interviews of key players, an implementation plan was formulated. Dr. DeVasher Bethea and Dana Williams worked together in data collection to

provide de-identified data (personal communication, June 17, 2019). Dr. Lukman assisted with the processing and analysis of data.

Timeline

The project began with a PICOT question guided literature review leading to an issue warranting investigation. Thorough project aims and an implementation plan were formulated. AHU Scholarly Review Committee (SRC) and Institutional Review Board (IRB) approval was completed in the Fall of 2019. Data was obtained in the Spring of 2020 and analyzed in the Summer of 2020. Post implementation, development of a final manuscript for professional dissemination, presentation to key players, and the development of a poster presentation will take place during the Fall of 2020 through Spring of 2021.

<div align="center">Analytic Approach</div>

Analysis was performed on de-identified retrospective data collected on previously enrolled students (N = 136) at AHU's MSNA NAP in the graduating cohorts of 2014-2019. The objective of the data analysis was to determine if there was a correlation between quantity (measured in months) of ICU experience (M = 49.8, SD = 35.9) and NCE scores (M = 498.3, SD = 44.8) within the 2014-2019 NAP cohorts.

Several assumptions failed to be upheld when determining the validity of using Pearson's Correlation analysis. As illustrated in **Figure 1**, the first assumption that failed to be upheld was the need for a linear relationship between the two variables. The second assumption that failed to be upheld was the absence of significant outliers in the data. The Skewness coefficient in the variable "ICU" (Skp = 1.834) indicated that there were 21 outliers in the data (**Table 1**). Consequently, the 21 identified outliers were removed to correct the Skewness in the variable "ICU". Therefore, descriptive statistics were adjusted for the removal of the 21 outliers. The new

sample size was reduced (n = 115) and the descriptive statistics were adjusted (**Table 2**). The last

assumption that failed to be withheld was that there was a bivariate normality in the data. Using

the Shapiro-Wilk test for normality, the variable "ICU" failed the assumption of bivariate

normality (S-W = .925, p < .001). As a result of the failed three assumptions, Pearson's

Correlation analysis could not be utilized. Spearman Rank Order correlation was the appropriate

analysis that was chosen.
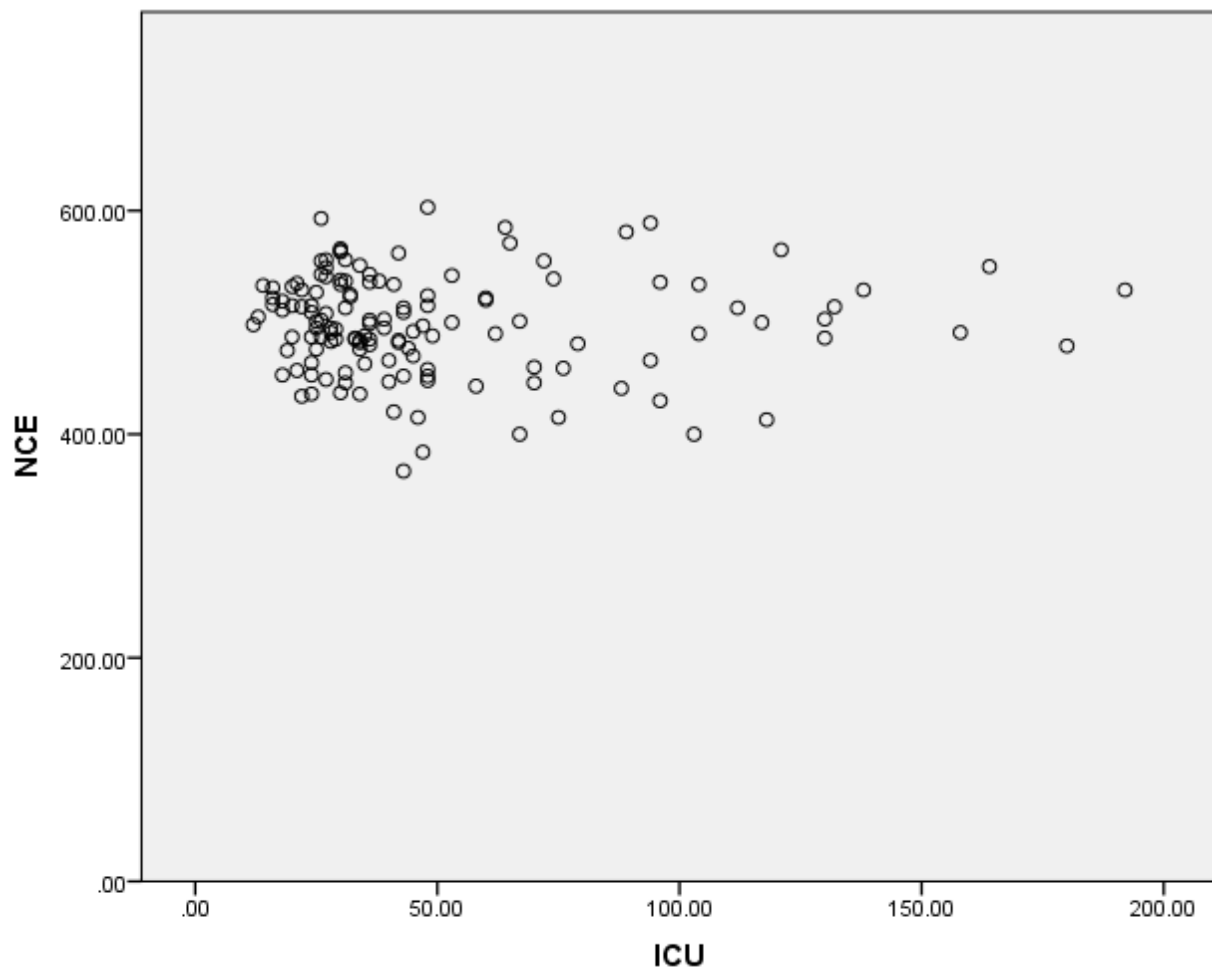

Figure 1. Scatter Plot. Intensive Care Unit Experience and First-Attempt National Certification

Examination Scores (N = 136). Note: ICU= Intensive Care Unit experience (measured in

months); NCE= National Certification Exam score.

Table 1

Descriptive Statistics: Intensive Care Unit Experience and First-

Attempt National Certification Examination Scores

			Statistic	Std. Error
ICU	Mean		49.7941	3.08290
	95% Confidence Interval for Mean	Lower Bound	43.6971	
		Upper Bound	55.8911	
	5% Trimmed Mean		45.7729	
	Median		36.0000	
	Variance		1292.580	
	Std. Deviation		35.95246	
	Minimum		12.00	
	Maximum		192.00	
	Range		180.00	
	Interquartile Range		33.00	
	Skewness		1.834	.208
	Kurtosis		3.210	.413
NCE	Mean		498.3456	3.84151
	95% Confidence Interval for Mean	Lower Bound	490.7483	
		Upper Bound	505.9429	
	5% Trimmed Mean		499.0948	
	Median		499.5000	
	Variance		2006.983	
	Std. Deviation		44.79937	
	Minimum		367.00	
	Maximum		603.00	
	Range		236.00	
	Interquartile Range		60.50	
	Skewness		-.259	.208
	Kurtosis		.049	.413

Note: ICU= Intensive Care Unit experience (measured in months); NCE= National Certification

Exam score. *Skewness of data is indicated in the variable ICU (1.834). Consequently, 21

identified outliers were removed.

Table 2

Adjusted Descriptive Statistics

	N	Minimum	Maximum	Mean		Std. Deviation
	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic
ICU	115	12.00	79.00	36.6261	1.44132	15.45648
NCE	115	367.00	603.00	497.7043	4.06910	43.63625
Valid N	115					

Note: ICU= Intensive Care Unit experience (measured in months); NCE= National Certification

Exam score.

Results

Analysis was done on the adjusted descriptive statistics found on **Table 2** using

Spearman's Rank Order correlation. No conclusion can be drawn between the duration of ICU

experience (measured in months) and NCE scores within the 2014-2019 AHU's MSNA NAP

cohorts (Spearman r_s = -0.156, n = 115, p = .096) **(Table 3)**.

Table 3

Spearman Rank Order correlation between the duration (measured in months) of ICU

experience and NCE scores within the 2014-2019 AHU's MSNA NAP cohorts

			ICU	NCE
Spearman's rho	ICU	Correlation Coefficient	1.000	-.156
		Sig. (2-tailed)	.	.096
		N	115	115
	NCE	Correlation Coefficient	-.156	1.000
		Sig. (2-tailed)	.096	.
		N	115	115

*Correlation is significant at the 0.05 level (2-tailed). Note: ICU= Intensive Care Unit experience

(measured in months); NCE= National Certification Exam score

Discussion

The purpose of this scholarly project was to investigate the relationship between months of ICU experience prior to the admission to a NAP program and NCE scores. Retrospective data was collected from a total of 136 previously enrolled AHU's MSNA NAP students from the graduating cohorts of 2014-2019. During data analysis 21 outliers were identified and removed ($n = 115$). Additionally, the use of Pearson's Correlation analysis could not be utilized due to several assumptions not being able to be upheld. Therefore, Spearman's Rank Order correlation was chosen for correlational statistical analysis.

After reviewing the statistical analysis, no conclusion can be found between the duration of ICU experience (measured in months) and NCE scores within the 2014-2019 AHU MSNA NAP cohorts. Interestingly, the obtained p-value of 0.096 approached statistical significance ($p > .05$, but $< .10$). This indicated that there could be good chance of obtaining statistical significance with a larger sample size.

Recommendations for Applicability to Practice and Contribution to Professional Growth

Through examination of the current literature and the analysis of data, insight can be obtained on the relevance of the requirement of a minimum quantity of ICU experience for entry into the nurse anesthesia program. With the shift of NAPs to a doctoral degree, it is imperative that the admissions process grow as well, with one area for improvement being the inclusion of evidenced-based admissions criteria. Admissions criteria have not been reexamined for several years, and the need for innovation may be crucial. A better understanding of the relationship between admissions criteria and student success is needed to help promote best practice in education for NAPs (Burns, 2011).

This project examined AHU's NAP admissions criteria. Through data analysis and literature review, conclusions were formulated, and recommendations provided, relating to the specific admissions criteria of a minimum time requirement of ICU experience prior to admission into AHU's NAP. Although the statistical analysis did not show a clear correlation between months of ICU experience and NCE scores, previous research from the literature review demonstrated a positive correlation between years of experience and higher NCE scores (Ortega et al., 2013; Zaglaniczny, 1992).

Despite the positive correlation found between years of experience and higher NCE scores (Ortega et al., 2013; Zaglaniczny, 1992), caution should be taken, and other factors should be considered. Burns (2011), found an inverse relationship between years of critical care nursing experience and overall GPA in NAPs. This led to an assumption that years away from academia may be more of an influencing factor on academic success when compared to the number of years of critical care experience (Burns, 2011). Furthermore, Zaglaniczny (1992) found that younger graduates achieved higher NCE scores than older graduates but graduates with more nursing experience (mean age-31.39 years) still scored higher when compared to graduates with less nursing experience (mean age-32.75 years). Although ICU experience may be beneficial towards clinical success, since there is no conclusion on its effect on NCE first-attempt pass rates, its overall contribution to the program should be considered thoughtfully.

After reviewing the results from the statistical analysis and comparing those results to the literature review the following recommendations were constructed:

- Replicate this scholarly project using a larger sample size and data from more than one program to increase the chances of obtaining a result with statistical significance.

- Incorporate a qualitative component into the study (i.e. "type of ICU experience") and perform a multiple linear regression analysis.

- The AHU NAP to continue to use ICU experience as an influencing factor in the admission process, but not rely on it solely regarding first-time pass rates for NCE.

Conclusions and Limitations

Limitations included the translation of self-reported years of experience to months of experience due to previous admissions' questionnaire left room for error. Furthermore, flaws in the data included applicants' months of ICU experience was a self-reported number, and it was assumed the applicants worked up until the start of the program. As discussed earlier, the statistical analysis indicated that with a larger sample size there could be a good chance of obtaining statistical significance. The researchers recommend that this study be replicated to include data from multiple NAPs. The use of a larger sample size can help researchers achieve a result that is statistically significant.

Dissemination Plan

After data was processed and analyzed, a final manuscript was prepared during the Fall of 2020. This manuscript contains findings, discussions, conclusions, limitations, proposed applications, and recommendations for AHU's NAP admissions process. A PowerPoint presentation was made that highlights key points from the scholarly project. After final approval from the Scholarly Project Chair, the PowerPoint presentation will be presented to all necessary key players. Finally, a scholarly project poster will be developed to present at the AHU NAP Scholarship and Poster Presentation Day which is planned for April 5th, 2021.

References

American Association of Nurse Anesthetists (AANA) (2019). Education of nurse anesthetists in the

    United States at a glance. Retried from https://www.aana.com/membership/become-a-

    crna/education-of-nurse-anesthetists-in-the-u.s

Bureau of Labor Statistics. (2019). Occupational employment statistics: Occupational employment

    and wages, May 2018 29-1151 nurse anesthetists. Retrieved from

    https://www.bls.gov/oes/current/oes291151.htm

Burns, S. M. (2011). Predicting academic progression for student registered nurse

    anesthetists. *AANA Journal, 79*(3), 193-201.

Clayton, LTC Brian L., CRNA, MSN, USAF, NC, Lypek, MAJ Douglas J., CRNA, MSN, USAF,

    NC, & Connely, COL Lyne M., RN, PhD, USA, AN. (2000). Faculty perceptions of

    characteristics needed for clinical success at military nurse anesthesia programs. *AANA*

    Journal, 68(6), 515-523. Retrieved from https://cms.aana.com/docs/default-source/aana-

    journal-web-documents-1/facultyperceptions1200_p515-523.pdf?sfvrsn=a18b48b1_6

Conner, M. (2015). Self-efficacy, stress, and social support in retention of student registered nurse

    anesthetists. *AANA Journal, 83*(2), 133-138.

Council on Accreditation (2019.). Standards for accreditation of nurse anesthesia programs:

    Practice doctorate. [PDF]. Retrieved from

    https://www.coacrna.org/accreditation/Documents/Accreditation%20Policies%20and%20Pr

    ocedures%20Manual,%20revised%20May%202019.pdf

Crosby, F. E., Joan Dolce Dunn, Fallacaro, M. D., Jozwiak-Shields, C., & MacIsaac, A. M. (2003).

    Preadmission characteristics of advanced practice nursing students. *Journal of the American*

Academy of Nurse Practitioners, 15(9), 424-431. Retrieved

from https://resource.ahu.edu/login?url=https://search-proquest-

com.resource.ahu.edu/docview/212879513?accountid=35793

El-Banna, M. M., Briggs, L. A., Leslie, M. S., Athey, E. K., Pericak, A., Falk, N. L., & Greene, J.

(2015). Does prior RN clinical experience predict academic success in graduate nurse

practitioner programs? *The Journal of Nursing Education, 54*(5), 276-

280. http://dx.doi.org/10.3928/01484834-20150417-05 [doi]

Etzioni, D. A., Liu, J. H., Maggard, M. A., & Ko, C. Y. (2003). The aging population and its impact

on the surgery workforce. *Annals of surgery*, *238*(2), 170–177.

doi:10.1097/01.SLA.0000081085.98792.3d

Marshal, J., Bosco, L., Adhikari, N., Connolly, B., Diaz, J., Dorman, T., … Zimmerman, J. (2016).

What is an intensive care unit? A report of the task force of the World Federation of

Societies of Intensive and Critical Care Medicine. *Journal of Critical Care 37,* 270-276.

https://doi.org/10.1016/j.jcrc.2016.07.015

NBCRNA. (n.d.). About the NBCRNA. Retrieved from https://www.nbcrna.com/about-us

NBCRNA. (2017). *Summary of NCE and SEE performance and clinical experiences FY 2017 data.*

Retrieved from https://www.nbcrna.com/docs/default-source/initial-certification/program-

administration/2017_nce_see_annual-report.pdf

NBCRNA. (2019). NCE handbook. [PDF]. Retrieved from https://www.nbcrna.com/docs/default-

source/p_ublications-documentation/handbooks/nce_hb(1).pdf?sfvrsn=5ed2310c_4

Niemczyk, N. A., Cutts, A., & Perlman, D. B. (2018). Prior work and educational experience are

not associated with successful completion of a master's-level, distance education midwifery

program. *Journal of Midwifery & Women's Health, 63*(2), 161-

167. http://dx.doi.org/10.1111/jmwh.12716 [doi]

Ortega, Keri H,C.R.N.A., D.N.A.P., Burns, Sharon M,C.R.N.A., EdD., Hussey, Leslie C,R.N.,

PhD., Schmidt, J., PhD., & Austin, Paul N,C.R.N.A., PhD. (2013). Predicting success in

nurse anesthesia programs: An evidence-based review of admission criteria. *AANA*

Journal, 81(3), 183-9. Retrieved

from https://resource.ahu.edu/login?url=https://search.proquest.com/docview/1440809895?a

ccountid=35793

Patzer, B., Lazzara, E. H., Keebler, J. R., Madi, M. H., Dwyer, P., Huckstadt, A. A., & Smith-

Campbell, B. (2017). Predictors of nursing graduate school success. *Nursing Education*

Perspectives, 38(5) retrieved from https://journals.lww.com/neponline/Fulltext/2017/09000/

Predictors_of_Nursing_Graduate_School_Success.13.aspx

Wilson, J. T., Gibbons, S. W., & Wofford, K. (2015). Process improvement: Addressing attrition

from the uniformed services university of the health sciences nurse anesthesia

program. *AANA Journal, 83*(5), 351-356.

Zaglaniczny, K. L. (1992). Factors which predict performance on the National Certification

Examination for Nurse Anesthetists. Journal of the American Association of

NurseAnesthetists,60(6), 533-540. Retrieved May 29, 2019.

Appendix A- Matrix Tables

Bibliography					
Burns, S. M. (2011). Predicting academic progression for student registered nurse anesthetists. *AANA Journal, 79*(3), 193-201. Zaglaniczny, K. L. (1992). Factors which predict performance on the National Certification Examination for Nurse Anesthetists. Journal of the American Association of Nurse Anesthetists,60(6), 533-540. Retrieved May 29, 2019.					
Purpose	**Variables**	**Setting/Subjects**	**Measurement and Instruments**	**Results**	**Evidence Quality**
Study One: Determine if a relationship existed between admission criteria (GPA, SGPA, GRE scores, critical care experience) and academic progression (current academic status and GPA) **Study Two:** Examine rates and reasons for attrition in SRNA 2005 cohort	**Study One:** Admission criteria consisting of GPA, SGPA, GRE scores, critical care experience (independent) effects on academic progression defined as current academic status and GPA (dependent)	**Study One Subjects:** 12 randomly selected nurse anesthesia program directors **Setting:** 12 randomly selected United States nurse anesthesia programs **Study Two Subjects:** 1690 SRNAs **Setting:** United States nurse anesthesia programs	**Study One:** Data analysis performed using Statistical Package for Social Sciences software. Means and standard deviations were calculated for admission GPA, SGPA, total GRE score, number of years of critical care experience, and current GPA **Study Two:** One-way analysis of variance (ANOVA), Stepwise multiple regression analysis.	**Study One:** Significant relationship between GPA and current GPA (p<.1), Significant relationship between SGPA and current GPA (p<.001), Significant relationship between total GRE and current GPA (p<.001), Significant inverse relationship between number of years of critical care experience and current GPA (P<.001) **Study Two:** Science GPA accounted for 24% of the variance of overall certification R square 0.239, the other 6 variables- age, gender, years of experience, and previous degree was 3%	**Study One:** **Methodological flaws:** Convenience sample **Inconsistency:** Consideration of alternative variables influence on correlation between years' experience and GPA was not done **Indirectness:** Cannot validate honesty of program directors' responses **Imprecision:** Small sample size (12 schools) **Publication bias:** None **Study Two:** **Methodological flaws:** None **Inconsistency:** None **Indirectness:** None **Imprecision:** None **Publication bias:** Supported by AANA education and research foundation.
Design				**Implications**	
Study One: Quantitative correlational study **Study two:** Retrospective analysis, multiple regression analysis	**Study Two:** Admissions criteria (independent), NCE success (dependent)			**Study One:** As admission GPA increases, SGPA increases, or total GRE increases, current GPA will also increase. As the number of years of critical care experience increases, current GPA will decrease. **Study Two:** GPA was highest predictor. Years of experience in nursing cor related with higher pass rates.	

Bibliography

Niemczyk, N. A., Cutts, A., & Perlman, D. B. (2018). Prior work and educational experience are not associated with successful completion of a master's-level, distance education midwifery program. *Journal of Midwifery & Women's Health, 63*(2), 161-167. http://dx.doi.org/10.1111/jmwh.12716 [doi]

Patzer, B., Lazzara, E. H., Keebler, J. R., Madi, M. H., Dwyer, P., Huckstadt, A. A., & Smith-Campbell, B. (2017). Predictors of nursing graduate school success. *Nursing Education Perspectives, 38*(5) Retrieved from https://journals.lww.com/neponline/Fulltext/2017/09000/Predictors_of_Nursing_Graduate_School_Success.13.aspx

Purpose	Variables	Setting/Subjects	Measurement and Instruments	Results	Evidence Quality
Study One: To identify admission factors in a nurse midwifery program that correlate with success or failure **Study Two:** factors (nursing course GPA, undergraduate GPA, experience at specialization, and duration of experience) contribute to student nursing graduate program success	**Study One:** Factors including demographics, academic records, and advising notes (independent) were compared to whether or not the student completed the program (dependent). **Study Two:** Nursing course GPA, undergraduate GPA, experience at specialization, and duration of experience (independent variables) effects on success in graduate school (dependent variable)	**Study One: Setting:** ACME-accredited distance education midwifery program. **Subjects:** 58 students who matriculated into the cohort of 2012 with expected graduation date of 2016 **Study Two: Setting:** Graduate nursing school at large Midwestern university **Subjects:** 37 students (35 females, 2 males, mean age 32.32 years)	**Study One** Descriptive statistics were compared using Fisher's exact tests and 2-sample t-tests. The SAS statistical software was used for statistical analysis. **Study Two:** Data was analyzed using a multiple regression analysis to predict success (GPA)	**Study One:** GPA and previous nursing experience were not significantly associated with completion of the nurse midwifery program **Study Two:** Admission GPA had the highest relative importance in predicting nursing graduate school success (p<.001). Experience at specialization and experience duration were not significant predictors of nursing graduate school success (p >.05)	**Study One: Methodological flaws:** Results were not statistically significant **Inconsistency:** None **Indirectness:** None **Imprecision:** Small sample size **Publication bias:** Conflicts of interests were identified in the study **Study Two: Methodological flaws:** Success was measured as GPA not attrition **Inconsistency**: Inconsistency in definition of experience at specialization **Indirectness:** Used graduate nursing students not limited to SRNAs **Imprecision:** Small sample size **Publication bias:** None
Design **Study One:** Retrospective study **Study Two:** Retrospective data collection				**Implications** **Study One:** Increased number of years of nursing experience is not associated with success in a graduate nursing program **Study two:** GPA is more important for predicting success than previous experience	

Bibliography

Clayton, LTC Brian L., CRNA, MSN, USAF, NC, Lypek, MAJ Douglas J., CRNA, MSN, USAF, NC, & Connely, COL Lyne M., RN, PhD, USA, AN. (2000). Faculty perceptions of characteristics needed for clinical success at military nurse anesthesia programs. *AANA Journal, 68*(6), 515-523. Retrieved from https://cms.aana.com/docs/default-source/aana-journal-web-documents-1/facultyperceptions1200_p515-523.pdf?sfvrsn=a18b48b1_6

El-Banna, M. M., Briggs, L. A., Leslie, M. S., Athey, E. K., Pericak, A., Falk, N. L., & Greene, J. (2015). Does prior RN clinical experience predict academic success in graduate nurse practitioner programs? *The Journal of Nursing Education, 54*(5), 276-280. http://dx.doi.org/10.3928/01484834-20150417-05 [doi]

Purpose	Variables	Setting/Subjects	Measurement and Instruments	Results	Evidence Quality
Study One: To identify student characteristics needed for success in the clinical portion of a NAP **Study Two:** To determine if prior RN clinical experience was related to better academic success	**Study One:** Student characteristics needed (independent) for clinical success (dependent) **Study Two:** Number of years of prior clinical experience (independent) and educational outcomes: GPA, Clinical GPA, Graduation, and Probation (dependent)	**Study One:** **Setting:** Military clinical anesthesia site **Subjects:** 29 clinical faculties from the Army, Air Force, and Navy **Study Two:** **Setting:** The George Washington University. **Subjects:** 106 MSN nurse practitioner students	**Study One:** Qualitative and Quantitative surveys. Quantitative data was analyzed via The Statistical Package for the Social Sciences (SPSS). Qualitative data was analyzed using content analysis and content validity index **Study Two:** Manual Data extraction from student applications were performed. Bivariate, Chi-Square, multiple regression, and one-way analyses were used to examine different relationships. Ordinary least-square and logistical regression models were also used.	**Study One:** Science GPA and 1-2 years of critical experience were identified as important characteristics for success **Study Two:** Having more clinical experience did not lead to improved educational outcomes	**Study One:** **Methodological flaws:** Convenience sampling **Inconsistency:** Wide variety of questions/variables **Indirectness:** No clear conclusion was reached. **Imprecision** Small sample size **Publication bias:** None **Study Two:** **Methodological flaws:** Small magnitude and power to detect significant differences due to small sample size. **Inconsistency:** None **Indirectness:** None **Imprecision** Small sample size **Publication bias:** None
Design				**Implications**	
Study One: Exploratory descriptive study **Study Two:** Retrospective study				**Study One:** The study identified a need for a way to evaluate personal characteristics. **Study Two:** With clinical experience not being significant, NP programs should lower barriers/requirements for admission.	

Bibliography

Crosby, F. E., Joan Dolce Dunn, Fallacaro, M. D., Jozwiak-Shields, C., & MacIsaac, A. M. (2003). Preadmission characteristics of advanced practice nursing students. *Journal of the American Academy of Nurse Practitioners, 15*(9), 424-431. Retrieved from https://resource.ahu.edu/login?url=https://search-proquest-com.resource.ahu.edu/docview/212879513?accountid=35793

Wilson, J. T., Gibbons, S. W., & Wofford, K. (2015). Process improvement: Addressing attrition from the Uniformed Services University of the Health Sciences Nurse Anesthesia Program. *AANA Journal, 83*(5), 351-356.

Purpose	Variables	Setting/Subjects	Measurement and Instruments	Results	Evidence Quality
Study One: To determine the preadmission characteristics that are important for acceptance into graduate programs (nurse anesthesia and nurse practitioner) **Study Two:** To identify reasons for high attrition rates in previous institution cohorts.	**Study One:** Focus group of 16 faculty members and an additional 48 completed surveys from randomly selected graduate programs **Study Two:** Academic and demographic characteristics (dependent) and success or non-success in the program (dependent)	**Study One:** **Setting:** University of Texas, Niagara University, State University of New York at Buffalo, and Virginia Commonwealth University and 147 unnamed graduate programs **Subjects:** 16 faculty members from mentioned universities and an additional 48 surveys **Study Two:** **Setting:** Daniel K. Inouye Graduate School of Nursing in Bethesda, Maryland. **Subjects:** 180 students who were enrolled in the program from 2005-2011	**Study One:** SPSS software. **Study Two:** Student t-test, x2 test, bivariate logistic regression models, and content analysis	**Study One:** Characteristics, proficiencies, and experiences were identified in candidates likely to succeed in graduate programs **Study Two:** Higher GPA(P=0.04) and GRE scores (P<0.04) correlated with successful completion. Years of experience in an acute care setting were not significantly different between students who graduated and students who withdrew/were dismissed (P=0.28)	**Study One:** **Methodological flaws:** Modest response rate to survey **Inconsistency:** None **Indirectness:** None **Imprecision:** Small sample size **Publication bias:** None **Study Two:** **Methodological flaws:** Some failed students may have been misclassified. **Inconsistency:** None **Indirectness:** None **Imprecision:** None **Publication bias:** None
Design				**Implications**	
Study One: Exploratory descriptive study **Study Two:** Retrospective Study				**Study One** Information gained may help in examining admission policies for graduate programs. **Study Two:** Other programs can mimic changes in the admission process to improve attrition rates.	

Bibliography

Ortega, Keri H, C.R.N.A., D.N.A.P., Burns, Sharon M, C.R.N.A., EdD., Hussey, Leslie C,R.N.A, PhD., Schmidt, J., PhD., & Austin, Paul N,C.R.N.A., PhD. (2013). Predicting success in nurse anesthesia programs: An evidence-based review of admission criteria. *AANA Journal, 81*(3), 183-9. Retrieved from https://resource.ahu.edu/login?url=https://search.proquest.com/docview/1440809895?accountid=35793

Conner, M. (2015). Self-efficacy, stress, and social support in retention of student registered nurse anesthetists. *AANA Journal, 83(2), 133-138*

Purpose	Search Strategies	Number and Type of Studies in the Review Including Sample Sizes	Measurement and Instruments	Results	Evidence Quality
Study One: Examination of evaluation process for applicants for admission into graduate nursing programs. What components of admission evaluation (independent) best predict program completion and NCE success (dependent) **Study Two:** To review current literature on stress and self-efficacy (independent) and its relationship with retention rates	**Study One** **Data Bases:** PubMed, Cumulative Index to Nursing & Allied Health Literature, Trip, ProQuest, SumSearch, and Google Scholar from the years 1980-2011. **Search Terms**: "Success in nurse anesthesia programs", "attrition in nurse anesthesia programs", "student registered nurse anesthetist (SRNA) success", "SRNA attrition", "nurse anesthesia education", "success", and "national certification exam". **Limits:** English-language only, peer-reviewed journals, Unpublished theses and dissertations were not included	**Study One** **Subjects:** 19 sources, 8 sources from graduate nurse anesthesia students, 9 from graduate nursing programs without SRNAs, 2 from graduate nursing programs with SRNA's **Study One Setting:** Graduate level nursing programs in the United States	**Study One** Evidence evaluated and leveled using Melnyk and Fineout-Overholt system **Study Two:** The author did not identify any instruments or measurements used	**Study One:** Younger graduates more successful (P < .01), graduates with more nursing experience were more successful (avg age 32.7 years) (P<0.1), and GPA was directly related to success **Study Two:** The literature review concluded that stress management and social support for SRNAs may help improve academic performance and retention.	**Study One:** **Methodological flaws:** Involved schools without SRNAs **Inconsistency:** Measures of success **Indirectness:** Not all schools used same admission criteria or that reported information **Imprecision:** Small sample size of schools containing SRNAs **Publication bias:** None
Design	**Reviewers:** Five independent reviewers **Study Two:** The author performed a literature review of 48 articles related to retention rates, self-efficacy, social support, stress, and SRNAs	**Study Two** **Subjects:** 48 research articles **Study One Setting:** Nurse anesthesia educational programs		**Conclusion/Implications**	**Study Two:** **Methodological flaws:** Evaluation of the evidence was not stated. **Inconsistency:** None **Indirectness:** None **Imprecision:** Small sample size **Publication bias:** None
Study One: Systematic review, literature review **Study Two:** Systematic review, literature review				**Study One:** Experience had inconsistent results; positive relationship w/ GPA and success **Study Two:** Future study on self-efficacy is needed	