

Correlating Graduate Record Exam Scores with
National Certification Exam First-Attempt Scores

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Abstract

There is a national shortage of Certified Registered Nurse Anesthetists (CRNAs) in the United States. To strengthen the workforce, more Student Registered Nurse Anesthetists (SRNAs) need to graduate and pass the National Certification Exam (NCE). Evaluation of specific nurse anesthesia program admission criteria may help predict the applicant's future post-graduation NCE potential success. This scholarly project determined if there is a correlation between pre-admission Graduate Record Exam (GRE) scores and post-graduation first attempt NCE scores, if GRE scores are predictive of NCE scores, and provided evidence-based recommendations for appropriate use of the GRE in the AdventHealth University (AHU) Doctor of Nurse Anesthesia Practice (DNAP) Program admission process. Data was analyzed using correlational analysis and multiple regression analysis methods. A quantitative retrospective correlational approach was used for data about the AHU nurse anesthesia graduates from 2015 to 2019. This scholarly project took place at AdventHealth University in central Florida. A correlation was found between total GRE scores and first-attempt NCE scores, but low predictability was found when looking at the GRE alone. Examination of the GRE categories demonstrated a correlation between GRE quantitative scores and first-attempt NCE scores, and no correlation was determined when looking at GRE qualitative scores and first-attempt NCE scores.

Introduction

Successful completion of a nurse anesthesia program does not guarantee one a career as a Certified Registered Nurse Anesthetist (CRNA) after graduation. To fulfill the final step for a career as a CRNA requires completion of a national certification exam meeting the minimum score requirement. Once the National Board of Certification and Recertification for Nurse Anesthetists (NBCRNA) National Certification Exam (NCE) has been successfully completed, the graduate registered nurse anesthetist (GRNA) becomes a certified registered nurse anesthetist (CRNA).

Most nurse anesthesia programs hold an interview process to select candidates that are appropriate for the program and hold a high probability of successful graduation (Burns, 2011). The Council on Accreditation of Nurse Anesthesia Educational Programs (COA) (2020) determines admission requirements including: an appropriate baccalaureate or graduate degree, an unencumbered professional registered nurse license, and a minimum of one-year of full-time experience working in a critical care setting. Admission requirements outside what is set by the COA are at the discretion of each individual program (Stewart, 2016).

Graduate Record Exam (GRE) scores are often a requirement for admission into nurse anesthesia programs within the United States and specifically to the Doctor of Nurse Anesthesia Practice (DNAP) program of AdventHealth University (AHU) (AdventHealth University, 2020 Burns, 2011; Dail, Byrd, MacKenzie, & Cantwell, 2009; Ortega, Burns, Hussey, Schmidt, & Austin, 2013; Stewart, 2016). AHU has an application process utilizing multiple different requirements. Similar to other accredited nurse anesthesia programs in the country, AHU assesses each applicant's grade point average, GRE score, and critical care experience, along with a personal interview (AdventHealth University, 2020; Duke University, 2019; Virginia

Commonwealth University, 2020). Specific to AdventHealth University's Academic Catalog, a GRE score must be current within the last five years, while not every program holds a time constraint on their score (2020). At AHU, the only exception for no required GRE score pertains to applicants holding a prior graduate degree from a regionally accredited institution (AdventHealth University, 2020).

Significant Background

In the United States, there currently is a shortage of CRNAs (Burns, 2011; Wunder, Glymph, Schirle, & Valdes, 2017). Due to this shortage, it is imperative to optimize accepted applicants into nurse anesthesia programs to increase the likelihood of passing the NCE and allow for more CRNAs to enter the workforce (Ortega et al., 2013). The performance data from graduates' first-time attempt NCE passing percentages has shown a decline since 2008 at 89.9 percent until the most current data for 2019 of 84.3 percent (NBCRNA, 2020). The decline in first-time pass rates delays GRNAs from achieving certification and entering anesthesia practice.

Not only does the first-attempt NCE affect the graduate, but the first-attempt NCE pass rate can also impact the accreditation of a program (COA, 2020). COA has a systematic method of reviewing programs' NCE pass rates. Method 1 examines first-time NCE pass rates from graduates of the most recent cohort (COA, 2020). If the pass rate is below 80 percent, method 2 is utilized. Method 2 examines first-time NCE scores from the average of the three most recent cohorts. If the average of method 2 is below 80 percent, a subsequent method is used. Method 3 examines graduates from the most recent cohort's first-time attempt plus the graduates who passed on the second attempt within 60 days of the completion of the program. This result must be at least 80 percent. When a nurse anesthesia program is unsuccessful at meeting criteria using at least one of these three methods, its accreditation status can become jeopardized. Examining

relevant admission data may demonstrate requirements that could benefit, hinder, or have no significant value to optimize program success. A comparison of GRE scores and first-attempt NCE scores can offer guidance for possible future admission criteria.

In addition, CRNA programs are changing from the master's level to the doctorate level. The transition to the doctoral level increases the length of time in school which increases the amount of debt acquired by the student registered nurse anesthetist (SRNA) for tuition and cost of living (Malina & Izlar, 2014). The doctoral programs are longer than the master's program, with a minimum of 36 months rather than an average of 28 months (Malina & Izlar, 2014). Also, SRNAs often do not work while attending a nurse anesthesia program due to the rigorous workload, therefore increasing the loans obtained for living expenses (Malina & Izlar, 2014). Tuition cost for graduate nurse anesthesia programs ranges from \$15,000 to \$118,056 depending on program level and private or public status (MacIntyre, Stevens, Collins, & Hewer, 2014). Factoring in the cost of living, loans obtained by SRNAs in doctoral level programs can easily increase to over \$100,000 (Malina & Izlar, 2014). These sources regarding program tuition costs were published in 2014, and multiple programs have transitioned to the doctoral level since then; thus, it is likely that some programs' tuition may have increased. By reviewing admission criteria to optimize the accepted applicants to increase first-time NCE scores, some financial stress may be alleviated for the GRNA.

PICOT Evidence Review Questions

Two questions have assisted in the literature review and are stated here in PICOT format. The first question guides the literature review: do Graduate Record Exam (GRE) scores predict the National Board of Certification and Recertification for Nurse Anesthetists (NBCRNA) National Certification Exam (NCE) scores (O) in nurse anesthesia applicants (P) for first-time

attempts (T)? The second addresses a proposed innovation: In Student Registered Nurse Anesthetists who graduated from the AdventHealth University Nurse Anesthesia Program (P) during 2015-2019 (T), is there a correlation between Graduate Record Exam (GRE) scores (I) and first attempt National Certification Exam (NCE) scores (O)?

Search Strategy

Search strategies included databases and professional organizations. Databases searched included Google Scholar and ScienceDirect. Key search terms included: nurse anesthesia, admission criteria, first time board pass, certification pass, advanced practice nurse, physical therapy program, physician assistant program, graduate record exam (GRE) correlation. Exclusion criteria included: non-English language, articles dating back greater than 27 years, publication outside the United States. The total articles found were 2,632, and after exclusion criteria were applied, the articles were narrowed down to a total of 18.

Grade Criteria

The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) criteria was used to determine the quality of evidence in the literature. Most of the literature consisted of correlational studies and retrospective studies; initially a GRADE score of 3 was assigned. The final overall score was downgraded to 2 (Appendix A). Factors that warranted this downgrade included methodological flaws, inconsistency, indirectness, imprecision, and publication bias. Methodological flaws were the most significant contributor due to small and limited sample sizes, convenience, and large number of variables. Publication bias was rare but did occur within one article.

A strong recommendation that GRE correlates with first-time NCE scores cannot be made with support from the literature. There is no comparison of the GRE specifically to first-

time NCE scores. Completion of exclusive correlation between GRE and first-time NCE scores could reveal beneficial data.

Literature Review

Student attrition rates amongst nurse anesthesia programs impact the nurse anesthesia community (educational institutions, SRNAs, anesthesia field), making it crucial for appropriate applicants to be admitted. Admission criteria are required for all nurse anesthesia programs but can vary depending on the institution. Literature solely examining the GRE's role in the admission process was lacking, however it was generally examined alongside and compared to other admission criteria.

GRE

The GRE is created and distributed by Educational Testing Service (ETS). ETS created the GRE as a tool to measure the skills that are needed to be successful in graduate school, as determined by graduate school faculty and deans (Educational Testing Service [ETS], 2011). The GRE questions endeavor to simulate the thought process required by graduate schools (ETS, 2020). ETS states the GRE has been researched for 60 years and has been proven as a good tool to assess and predict academic performance (ETS, 2011). A meta-analysis conducted by Kuncel, Hezlett, and Ones (2001) was used to support ETS's statement which demonstrated the GRE was predictive of graduate GPA (GGPA), 1st year GGPA, faculty ratings, comprehensive exam scores, citation accounts, and degree attainment. Although ETS places some focus on social science programs, such as business and law schools, the GRE is generalized to be applicable to any graduate school program (ETS, 2011).

GRE Relevance through Opinions

Stewart (2016) evaluated perceived attitudes of different common admission criteria from nurse anesthesia program directors and assistant directors. The study surveyed 13 schools, 17 people in total, ranking their opinions of the ten most important aspects of the admission criteria. A seven-point Likert scale survey was utilized, assigning one as not important and seven as most important. GRE scored with the second lowest mean of 3.8 and resulted in the largest standard deviation of 1.89 when compared to: grade point average (GPA), science-based GPA (SGPA), years of critical care experience, personal interview, reference letters, applicant essay, applicant ages, emotional intelligence interview, and critical care experience acuity. The highest mean score was 6.58 for the SGPA and the lowest was found to be applicants' age with an average of 2.93.

Best Found Predictors

Conflicting data was found regarding the meaningful value of the GRE within the admission process. Burmeister et al. (2014), utilized a sample from a single institution totaling 108 graduate students in the medical physics program. Data correlated with the GRE by both the quantitative and verbal score. The GRE quantitative scores correlated with statistical significance to the course grade average ($p = 0.003$) and exit exam scores ($p = 0.003$). Areas where the GRE had no statistical significance were the first year GPA ($p = 0.467$) and faculty rating on importance of requirement ($p = 0.345$). The GRE verbal scores presented with statistical significance with not only the course grade average ($p = 0.048$) and the exit exam scores ($p = 0.009$), but unlike the quantitative score also included first-year GPA ($p = 0.03$). However, according to multiple studies, the strongest predictor of success for student registered nurse anesthetists was the GPA, more specifically the SGPA. Success was related to current GPA in

the program as well as completion of the program (Burns, 2011; Collins, & Callahan, 2014; Creech, Cooper, Aplin-Kalisz, Maynard, & Baker, 2018; Ortega et al., 2013; Zaglaniczny, 1992).

Burns (2011), looked at GPA, SGPA, GRE scores, and critical care experience from 12 nurse anesthesia programs for a total of 914 student results. Not all programs mandated the GRE for admission, decreasing the total to 653 students. When comparing GRE scores to the students' current GPAs, a significant relationship ($p = <0.001$) was determined. However, even with a significant relationship, there was only a small correlated value between the GRE and academic success. Strength between overall GPA and academic success was found to have a stronger correlation. A recommendation of this study was the consideration of eliminating GRE scores for admissions into nurse anesthesia graduate programs.

An ex post facto cross-sectional study, with a total of 137 students from four nurse anesthesia programs in the southeastern United States, explored a relationship between clinical scores and NCE scores (Collins & Callahan, 2014). Further into the study, it was examined if preadmission criteria (GRE, acute care experience, and GPA) predicted NCE scores. Didactic transferring, which focuses on the ability to use critical thinking and the knowledge gained in the classroom and apply it to the clinical practice, was the only area found to be predictive of NCE scores in relationship to preadmission criteria; clinical setting ($p < .001$), efficiency ($p < .027$), technical skill ($p < .05$) and the ability for equipment troubleshooting ($p < .035$). When looking at the GRE there was no statistical significance: Quantitative ($p = 0.553$), Verbal ($p = 0.467$), and Analytic ($p = 0.700$) GRE scores.

In contrast, some data demonstrates that GRE scores have a positive correlation in relationship to applicant admission criteria (Dail et al., 2009; Richard-Eaglin, 2017). Dail et al. (2009) collected data from two nurse anesthesia programs for a total of 185 students and found

that the GRE was the strongest correlation to graduate nursing GPA over science GPA ($p = 0.003$). A review of pass rates for the NCE was attempted, but no variability was found due to the high success in the pass rates between the two programs.

National Comparison

The researchers reviewed the website of each nurse anesthesia program in the United States to determine if a GRE score was a requirement for the admission process. As of August 2020, 52 of the 122 (42.6%) nurse anesthesia programs required a GRE score; 21 of the 52 programs stated the GRE must be within a 5-year period, and 26 of the 52 programs stated an expected GRE score. Twelve of the programs waived the GRE score if other qualifications are met, such as GPA, previous master or doctoral degrees, or other examinations. Some programs required the critical care registered nurse (CCRN) certification instead of the GRE. The remaining 58 nurse anesthesia programs did not require a GRE score for admission into their program (Appendix B).

Similar Graduate Healthcare Programs

Nurse practitioner, physical therapy, and physician assistant programs hold a similar structure to that of nurse anesthesia programs, with the GRE as a part of some admission criteria and respective certification examination upon program completion. Evidence demonstrates similar findings when looking at a relationship of GRE scores with academic success and first-time pass attempts for certification examinations. Findings remain mixed, resulting in a positive correlation finding in some studies and negative correlation of GRE to graduates' respective certification exam performance in others.

Prediction of success in nurse practitioner (NP) programs was studied by Richard-Eaglin (2017). A correlational study from 2009-2014 was completed at a southeastern university in the

United States which reviewed GPA and GRE in relation to prediction of academic success throughout the NP program. Richard-Eaglin deemed academic success by program completion (2017). Data from the total GRE score demonstrated a statistical significance of ($p = 0.00$) in correlation to program completion. Divided further into the GRE subcategories of verbal and quantitative, statistical significance was also found in the results of GRE verbal scores ($p = 0.01$) and the GRE quantitative scores ($p = 0.004$) in relation to program completion. Other methods used to measure academic success (cumulative GPA, practicum course grades) were not deemed as noteworthy.

Kume, Reddin, and Horbacewicz found the relationship for physical therapy program success and National Physical Therapy Exam (NPTE) certification was the most significant when related to the GRE and least significant for the GPA (2018). However, multiple other studies showed that the GRE held significance for success in physical therapy programs but was deemed weak when compared to GPA, which demonstrated a stronger correlation with first-attempt NPTE scores (Hinds, 2014; Bayliss, Thomas & Eifert-Mangine, 2017). Similar to those results, Butina, Wyand, Reder, and Cardom, examined physician assistant programs and potential predictors for poor physician assistant national certification exam (PANCE) performance (2017). GPA had the strongest influence on performance. The GRE results were divided into its subcategories of verbal and quantitative. The quantitative data demonstrated no meaningful effect, but the verbal GRE did (Butina et al., 2017). Conflicting data comes from Pack, who found no statistical significance ($p = 0.645$) when using the GRE to predict first-attempt scores on the PANCE (2019). Greater statistical significance was found in the first-year GPA ($p = <0.05$) (Pack, 2019). In summary, evidence from three other similar graduate

healthcare fields demonstrates somewhat conflicting results regarding the correlation of GRE scores with professional certification exam scores.

Contribution to Professional Growth

Due to lack of evidence, the literature does not support a current change in practice. Some literature suggests placing more weight on GPA, as it has been found to correlate more to academic success, and to consider removing the requirement of the GRE (Burns, 2011; Ortega et al., 2013). The researchers questioned whether investigating to determine if there was a correlation between preadmission GRE and first-time NCE scores at AHU's nurse anesthesia program may reveal an admission criterion that is predictive of a strong applicant. Strong applicants can decrease attrition rates, help universities maintain accreditation, enter the short-staffed profession sooner, and acquire less debt by passing the NCE on the first attempt. The goal is to have graduates pass the NCE on their first attempt. After examining the evidence, recommendations were formulated for AHU's future admission criteria. With first-time NCE pass rates at AHU less than the ideal of 100% on first attempts, providing evidence-based recommendations may help to strengthen the program.

Project Aims

The purpose of this scholarly project was to determine if a relationship exists between GRE scores and NCE scores. A secondary aim was to make evidence-based recommendations to the AHU nurse anesthesia program in relation to the data. The project objectives were delineated as follows: determine if there is a correlation between GRE and NCE scores among the 2015-2019 nurse anesthesia program graduates by Spring 2020 and make evidence-based recommendations for the optimal use of GRE scores as an influencing factor on the AHU nurse anesthesia program admission process.

Methods

The proposed study used a quantitative retrospective correlational design to examine electronic data regarding overall GRE and first-attempt total NCE scores collected by the AHU nurse anesthesia department chair. Since a correlation was found between the overall GRE and first-attempt total NCE scores, a multiple regression design was conducted comparing subcategories of the GRE score, verbal, quantitative, and writing, to first-attempt total NCE score. The study took place at a private university in the southeastern United States, focusing on the nurse anesthesia department. Sample size included all AHU nurse anesthesia graduates from 2015 to 2019. Exclusion criteria were students who held previous graduate degrees and did not submit GRE scores, students who were admitted prior to 2015 when the GRE scoring scale was different, and repeat attempt NCE scores. A total of 114 graduated during this time, but after applying the exclusion criteria the sample size decreased to 97 ($N = 97$). For data analysis, a predetermined significance alpha level of 0.05 ($p = 0.05$) was used. With the sample size of 97 ($N = 97$) and the assistance of software XLSTAT 2017, a power of 0.997 was determined for the correlational study and a power of 0.999 was determined for multiple regression design. Randomized, paired, de-identified total NCE and GRE total and subcategory scores were provided by the AHU nurse anesthesia department chair, Dr. Alescia DeVasher Bethea. Dr. Roy Lukman was consulted to assist with statistical analysis using the IBM Statistical Package for Social Sciences (SPSS) software version 21. Data exchange occurred via an electronic Microsoft Excel spreadsheet, with data stored on a password secured Microsoft SharePoint cloud system offered by the AHU informational technology (IT) department. Data was only accessed by the chair, Dr. Alescia DeVasher Bethea, Dr. Roy Lukman for the statistical analysis, and the two co-investigators, Breann Montgomery and Taylor McQuaig. After this scholarly project is

completed and the data is no longer required, the stored information will be erased in 5 years, by January 1, 2026.

Planning, Implementation, and Limitations

The AHU nurse anesthesia department chair and program director, who is also the project committee chair, was the biggest contributor to the success of this project, as she collected and deidentified the data. The project committee also includes a project mentor and a project reviewer who contributed to the project's success. Resources allotted were time, a secure electronic storage database through Microsoft SharePoint, Microsoft Excel spreadsheet, and a data analysis software tool.

After a thorough literature review, AHU Institutional Review Board (IRB) approval was acquired before proceeding with the project's data collection. Data was deidentified, appropriately randomized while remaining correctly paired, and transferred via a Microsoft Excel spreadsheet by the nurse anesthesia department chair, Dr. Alescia DeVasher Bethea and was stored at a secure cloud-based location on Microsoft SharePoint. Statistical analysis was completed by Dr. Roy Lukman to determine between GRE total and subcategory scores with overall NCE total scores. Feasible, evidence-based recommendations were formulated and was presented to the AHU nurse anesthesia department and key players.

A major factor that could have delayed this project was time. The personnel collecting the data hold important roles with various responsibilities within the nurse anesthesia department. Dana Williams and Dr. Alescia DeVasher Bethea agreed to assist but stipulated an adequate amount of time for the preparation of data to be deidentified and randomized while remaining paired correctly. IRB could have been an environmental factor delaying the scholarly project. To avoid delays, actions were taken such as ensuring confidentiality, clearly defining

project objectives, and a detailed project process. IRB approval was required prior to data collection.

Limitations of this project included the sample population and the data collection period. Although the size was adequate for data analysis, the information collected was from one university and was a convenience sample, which limits the project's generalizability. The data collected was over a relatively small amount of time, as only 5 years of data was collected for this project. A recommendation is to re-analyze the project in future years, after more data can result. Additionally, all the data was from the MSNA program, which closed after completion of the final MSNA graduates, and the program transitioned to the DNAP program. Therefore, similar data could be collected and analyzed regarding the future DNAP graduates, after the initial DNAP cohort graduates in 2021. Another recommendation is to conduct the project at other nurse anesthesia programs across the country, which could increase generalizability of the results.

Timeline

This project began with the formation of two PICOT questions to identify a nurse anesthesia problem. A thorough literature review of the topic was completed. A detailed project plan was created including an aim statement with objectives, methods, and an implementation plan. IRB approval was obtained in December 2019, before data collection began. Data collection was completed during Spring 2020. Data analysis was performed during Summer 2020. Project implementation consists of evidence-based recommendations regarding the nurse anesthesia program application process, which was presented to the nurse anesthesia department faculty and AHU key players in Spring 2021. An application to present a poster to the Florida Association of Nurse Anesthetists (FANA) was submitted by September 1, 2020. The application

was accepted, and the poster was presented at the virtual FANA Annual Meeting on October 10-11, 2020. An application to present a poster at a conference of the American Association of Nurse Anesthetists (AANA) was submitted by September 15, 2020. The poster was approved by AANA and was presented virtually in February 2021 during the Assembly of Clinical and Didactic Education (ACDE).

Results

Data was collected from 97 ($N = 97$) graduate students from AHU. The correlation method Pearson R was used for this data analysis. After exploring the data, 3 cases were identified as outliers and subsequently removed from further analysis, dropping the sample size to 94 ($n = 94$). A correlational analysis was conducted to compare total GRE scores with first-attempt NCE total scores with findings of a significant positive correlation demonstrated by $r = .224$ and $p = .03$ (Table 1). The predictive ability of total GRE scores was estimated at 5.02%.

Table 1

Total GRE & Total NCE Score Correlations

| | | NCE Total | GRE Total |
|-------|---------------------|-----------|-----------|
| NCE | Pearson Correlation | 1 | .224* |
| | Sig. (2-tailed) | | .030 |
| Total | N | 94 | 94 |
| | | | |
| GRE | Pearson Correlation | .224* | 1 |
| | Sig. (2-tailed) | .030 | |
| Total | N | 94 | 94 |
| | | | |

*Correlation is significant at the 0.05 level (2-tailed)

To investigate the correlation between each GRE sub-score (verbal and quantitative) with NCE total score, a partial correlation was conducted. The results indicated that there was no significant correlation between the verbal sub-score GRE value and the NCE total score while controlling for GRE quantitative scores as indicated by $r = -.008$ and $p = .939$ (Table 2).

Table 2
Verbal GRE & Total NCE Score Correlations

| Control Variables | | | NCE Total | GRE Verb |
|-------------------|--------------|-------------------------|-----------|----------|
| GRE Quant | NCE Total | Correlation | 1.000 | -.008 |
| | | Significance (2-tailed) | . | .939 |
| | | df | 0 | 91 |
| | GRE Verb | Correlation | -.008 | 1.000 |
| | | Significance (2-tailed) | .939 | . |
| | | df | 91 | 0 |

However, statistical significance was achieved in the correlation between the quantitative GRE sub-score and the NCE total score when controlling for GRE Verbal as indicated by $r = .264$ and $p = .01$ (Table 3). The predictive ability of GRE Quantitative scores on NCE Total scores was estimated at 6.97%.

Table 3
Quantitative GRE & Total NCE Score Correlations

| Control Variables | | | NCE Total | GRE Quant |
|-------------------|-----------|-------------------------|-----------|-----------|
| GRE | NCE Total | Correlation | 1.000 | .264 |
| | | Significance (2-tailed) | . | .010 |
| | | df | 0 | 91 |
| Verb | GRE | Correlation | .264 | 1.000 |
| | | Significance (2-tailed) | .010 | . |
| | | df | 91 | 0 |

Unfortunately, a comparison of verbal GRE scores with NCE first-attempt scores was not conducted as originally intended. The researchers inadvertently overlooked requesting that retrospective data, and when the oversight was discovered it was too late to collect the data within the project timeline.

Discussion

This scholarly project aimed to determine if a relationship existed between total first-attempt NCE scores and GRE scores as an admission criteria into a nurse anesthesia program. GRE and NCE first-attempt scores of 97 AHU nurse anesthesia graduates were reviewed. Three outliers were identified during the data analysis and were excluded to ensure clean data. After reviewing the statistical analysis, a significant correlation was determined between total GRE scores and first-attempt NCE total scores. However, the predictive ability of total GRE scores, estimated at 5.02%, indicates there is little predictive value. A strong predictive ability score is considered to be 30% or greater. Therefore, while the GRE total score can be correlated with total NCE scores, data indicates a low predictive value.

The verbal sub-scores of the GRE demonstrated no significant correlation with total NCE first-attempt scores. Thus, a predictive ability was unable to be generated due to the lack of a relationship. The quantitative sub-score of the GRE demonstrated a positive correlation with the total NCE first-attempt score. Due to the positive correlation, a predictive ability value of 6.97% was determined from the GRE quantitative sub-score.

Recommendations

After reviewing the statistical analysis, the researchers recommend the AHU nurse anesthesia program to use the total GRE score in conjunction with other admission criteria. Since the analysis revealed that the total GRE scores have a correlation with first-attempt NCE scores, it is beneficial to utilize the GRE as an admission requirement. However, due to the predictive ability only estimated at 5.02%, looking at the GRE alone is not sufficient as the sole predictor of first-attempt NCE scores. Utilizing the GRE in conjunction with other admission criteria can allow for a stronger prediction than the GRE alone.

A second recommendation would be to consider the GRE quantitative sub-score more than the qualitative sub-score. A correlation was found between the GRE quantitative sub-scores and first-attempt NCE scores, yet no such correlation existed for the GRE qualitative scores. However, since the predictive ability of GRE quantitative scores was only 6.97%, this should be considered in conjunction with other admission criteria.

Finally, the researchers recommend an expansion of this study to include looking at additional nurse anesthesia programs across the country. This study only looked at one university's graduates' results. Collecting additional data from other programs could increase generalizability and strengthen the statistical relevance.

Dissemination Plan

After data analysis was completed and studied, evidence-based recommendations regarding the AHU nurse anesthesia program's admission process were created. The key findings from the literature review were also presented to allow for a more wide-spread comparison. Dissemination occurred via a Microsoft PowerPoint presentation of the data findings and recommendations, as well as poster presentations at state and national level conferences. The 2020 FANA Annual Meeting occurred October 9 through 11, 2020 virtually, due to the COVID-19 pandemic. The application for the AANA conference was submitted on September 15, 2020. The poster was approved by AANA and was presented virtually in February 2021 during the ACDE. The PowerPoint was presented to the AHU nurse anesthesia department faculty and key players from the AHU campus. Additionally, a poster was created and displayed to disseminate the findings for faculty, staff, and students at AdventHealth University.

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Appendix A- Matrix Tables

| <p>1: Dail, N.R., Byrd, E.N., MacKenzie, D.W., & Cantwell, K.M. (2009). Correlation of undergraduate GPA and GRE score with academic success and pass rates on the national certification exam of nurse anesthesia students. <i>International Student Journal of Nurse Anesthesia</i>, (8)3, 39. Retrieved from https://sharepoint.aana.com/ceandeducation/students/Pages/International-Student-Journal-of-Nurse-Anesthesia-Table-of-Contents.aspx</p> <p>2: Ortega, K.H., Burns, S.M., Hussey, L.C., Schmidt, J., & Austin, P.N. (2013). Predicting success in nurse anesthesia programs: an evidence-based review of admission criteria. <i>AANA Journal</i> (81)3, 183-189. Retrieved from https://www.aana.com/publications/aana-journal</p> | | | | | |
|--|--|---|---|--|---|
| Purpose | Variables | Setting/Subjects | Measurement and Instruments | Results | Evidence Quality |
| <p>1: Examine whether undergrad GPA and GRE scores are indicators of GPA in NURSE ANESTHESIA PROGRAM and passing NCE</p> <p>2: Review of evidence supporting admission criteria to formulate and evidence-based selection process</p> | <p>1: GPA and/or GRE, GPA in school and NCE pass rates</p> <p>2: Bachelor of Science vs other bachelor's degree, undergrad GPA, GRE scores, applicant essay, CC experience & age, nontraditional criteria, success in NAEP</p> | <p>1: Medical University of South Carolina's 185 NURSE ANESTHESIA PROGRAM de-identified students, 2 different schools (A&B)</p> <p>2: 19 source documents from NURSE ANESTHESIA PROGRAM and graduate nurse programs</p> | <p>1: Correlation generated via SPSS version 16.0; linear regression, ANOVA statistical analysis; t-test</p> <p>2: Academic records graded based on Melnyk and Fineout-Overhold</p> | <p>1: (A)- GRE predicted grad GPA p=0.001, UGPA did not; (B)- GRE did not predict grad GPA p=0.247, but UGPA did p=0.05</p> <p>2: No consensus on admission factors predicting success in NAEP</p> | <p>Methodological flaws:</p> <p>1: small study size, does not state timeframe</p> <p>2: multiple different variables, large time frame (1980-2011)</p> <p>Inconsistency:</p> <p>1: none</p> <p>2: none</p> <p>Indirectness:</p> <p>1: none</p> <p>2: none</p> |
| Design | | | | Implications | |
| <p>1: Correlational study</p> <p>2: Literature review</p> | | | | <p>1: GRE stronger predictor</p> <p>2: No consensus on admission factors predicting success</p> | <p>Imprecision:</p> <p>1: none</p> <p>2: none</p> <p>Publication bias</p> <p>1: none</p> <p>2: none</p> |

| <p>3: Richard-Eaglin, A. (2017). Predicting student success in nurse practitioner programs. <i>Journal of American Association of Nurse Practitioner</i>, 29(10), 600-605. https://doi.org/10.1001/2327-6924.12052</p> <p>4: Burmeister, J., McSpadden, E., Rakowski, J., Nalichowski, A., Yudelev, M., & Snyder, M. (2014). Correlation of admissions statistics to graduate student success in medical physics. <i>Journal of Applied Clinical Medical Physics</i>, 15(1), 375-385. https://doi.org/10.1120/jacmp.v15i1.4451</p> | | | | | |
|---|--|---|---|--|--|
| Purpose | Variables | Setting/Subjects | Measurement and Instruments | Results | Evidence Quality |
| <p>3: Examine factors that influence academic success in NP programs</p> <p>4: Develop metrics for evaluation of medical physics graduate students</p> | <p>3: Undergrad GPA, BSN GPA, year of BSN completion, type of program, GRE scores, success, changing concentration, preadmit cum GPA, advanced patho & pharm & health assessment grades</p> <p>4: UGPA, prior grad degree w/ type, GRE scores, GRE physics subject test scores</p> | <p>3: 150 fulltime master's NP students at a 4-year college & university in southern region of US during 2009-2014</p> <p>4: 108 medical physics graduate students from Wayne State University School of Medicine between 2004-2011</p> | <p>3: Time to graduate, grades, number of graduates; description statistics, analyzed via SPSS software</p> <p>4: Faculty rating via scale of 1-5 of desire to hire student, course average, 1st year GPA, exit exam t-test, ANOVA, linear regression, SAS version 9.2</p> | <p>3: 48 graduates, the remaining were still enrolled, average time to graduate 2.4 years, GRE p= 0.000, cum GPA p=0.603, BSN GPA = 0.325, BSN year completion p=0.856</p> <p>4: UGPA facility 0.998, course ave 0.430, 1 yr GPA 0.941, exit exam 0.592; GRE 0.208, 0.048, 0.030, 0.009; GRE physics 0.008, 0.793, 0.647, 0.763; undergrad degree 0.020, 0.579, 0.161, 0.656</p> | <p>Methodological flaws: 3: limited study size 4: limited study size</p> <p>Inconsistency: 3: none 4: none</p> <p>Indirectness: 3: none 4: none</p> <p>Imprecision 3: none 4: none</p> <p>Publication bias 3: none 4: none</p> |
| Design | | | | Implications | |
| <p>3: Correlation, literature review</p> <p>4: Correlational study</p> | | | | <p>3: GRE scores and program completion were statistically significant; undergrad GPA, BSN GPA, year of BSN were not significant; health assessment & NP program grades correlated; no correlation with cum GPA & NP program grades</p> <p>4: GRE correlated with course average & exit exam</p> | |

| <p>5: Bayliss, J., Thomas, R., & Eifert-Mangine, M. (2017). Pilot study: What measures predict first time pass rate on the national physical therapy examination?. <i>Internet Journal of Allied Health Sciences and Practice</i>, 15(4). Retrieved from https://nsuworks.nova.edu/cgi/viewcontent.cgi?referer=https://scholar-google-com.resource.ahu.edu/scholar?hl=en&as_sdt=0,10&q=Pilot Study: What Measures Predict First Time Pass Rate on the National Physical Therapy Examination?&btnG=&httpsredir=1&article=1693&context=ijahsp/</p> <p>6: Butina, M., Wyant, A., Remer, R., & Cardom, R. (2017). Early predictors of students at risk of poor PANCE performance. <i>The Journal of Physician Assistant Education</i>, 28(1), 45-48. https://doi.org/10.1097/JPA.000000000000107</p> | | | | | |
|--|--|---|---|---|---|
| Purpose | Variables | Setting/Subjects | Measurement and Instruments | Results | Evidence Quality |
| <p>5: Determine variables predicting success on the National Physical Therapy Examination</p> <p>6: Identify early predictors in the PA program that could be used to identify students “at risk” of failing the PANCE</p> | <p>5: GRE, identified key course grades, evidence of academic difficulties, Clinical Performance Instruments (CPI) and professional grade point average.</p> <p>6: Prerequisite courses GPA, functional courses GPA, undergraduate GPA, verbal and quantitative GRE scores, PANCE scores</p> | <p>5: 175 students at Mount St. Joseph University Doctor of Physical Therapy 2006-2011</p> <p>6: 469 participants from years 2003-2014 for a PA program at the University of Kentucky</p> | <p>5: A Pearson correlation matrix</p> <p>6: Historical record review</p> | <p>5: vGRE $r = 0.291$ ($p < 0.002$) GPA $r = 0.315$ ($p < 0.001$)</p> <p>6: GPA in functional courses ($b = 0.71$), uGPA ($b = 0.14$) and vGRE ($b = 0.12$). Prereq GPA to PANCE ($b = 20.14$) and mGRE to PANCE ($b = 20.08$)</p> | <p>Methodological flaws: 5: lack of requirement for GRE reducing number of data points 6: convenience sample</p> <p>Inconsistency: 5: none 6: none</p> <p>Indirectness: 5: none 6: none</p> |
| Design | | | | Implications | |
| <p>5: Retrospective correlational study</p> <p>6: Retrospective multiple regression</p> | | | | <p>5: Academic performance with DPT course grade point average and vGRE scores to be the greatest predictor of first time and ultimate pass rate on the NPTE</p> <p>6: The strongest PANCE predictor was average GPA in functional courses; prerequisite and mGRE suggest no meaning The strong predictors of PANCE performance include uGPA and vGRE</p> | <p>Imprecision 5: none 6: none</p> <p>Publication bias 5: none 6: none</p> |

| 7: Burns, S. (2011). Predicting academic progression for student registered nurse anesthetists. <i>AANA Journal</i> , 79(3), 193-201. Retrieved from https://www.aana.com/publications/aana-journal | | | | | |
|---|--|--|--|--|--|
| 8: Stewart, G. (2016). Nurse anesthesia program directors: applicant selection, attitudes, and admission criteria. Retrieved from Rhode Island College website: https://digitalcommons.ric.edu/etd/175/ | | | | | |
| Purpose | Variables | Setting/Subjects | Measurement and Instruments | Results | Evidence Quality |
| 7: Determine if a relationship exists between admission criteria and academic progression. 8: Study examines nurse anesthesia program directors' attitudes about the perceived importance of admission criteria and attributes in relation to success in program | 7: Admission GPA, SGPA, GRE score, and critical care experience and academic progression 8: GPA, SGPA, GRE, years of critical care experience, personal interview, reference letter, applicant essay, applicant age, emotional intelligence, critical care experience acuity | 7: 914 records (406 males and 508 females) of 21 nurse anesthesia programs 8: Nurse anesthesia program directors within the New England Assembly of School Faculty during summer 2016 meeting – 21 total program director and assistant directors – with 17 participating in survey | 7: Data collection Excel spreadsheet of de-identified preadmission GPA, GRE, SGPA, number of years critical care nursing experience and current GPA and academic status. Using SPSS. 8: Informational letter and survey utilizing seven-point interval scale (1-least important;7 most important). Analysis conducted in Excel with descriptive statistics (range, mean, and variances) | 7: GPA: current GPA = $r(914) = 0.31$ SGPA: current GPA = $r(516) = 0.28$ GRE: current GPA = $r(653) = 0.15$ Yrs Expert: current GPA = $r(914) = -0.14$ 8: GPA (m)=6.23 (SD)= 0.56, SPGA (m)=6.58 (SD)= 0.5, GRE (m)=3.8 (SD)= 1.89, Yrs expert (m)=6.05 (SD)= 0.74, CC acuity (m)=6.58 (SD)= 0.5, Interview (m)=6.47 (SD)= 0.71 | Methodological flaws: 7.None 8. Small sample size, convivence of sample Inconsistency: 7. Variability of results among included studies noted 8. None Indirectness: 7. None 8. None Imprecision: 7.None 8.None Publication bias: 7.None 8. no allocation concealment- in folder but given back to researcher and not 3 rd party |
| Design | | | | | |
| 7: Quantitative correlational study 8: Retrospective non-experimental descriptive survey-mixed methods qualitative and quantative data | | | | | |
| | Implications 7: Retain GPA as primary criteria, calculate & include SGPA, retain years' experience & consider eliminating GRE scores as admission criteria. 8: There is a need for further studies regarding nurse anesthesia programs' selection process, admission requirements and their predicative value for success in programs | | | | |

| <p>9: Collins, S., & Callahan, M. (2014). A call for change: Clinical evaluation of Student Registered Nurse Anesthetist. <i>AANA Journal</i>, 82(1), 65-72. Retrieved from https://pdfs.semanticscholar.org/f5ab/820dc9bb8843626c12f8994b851eb61c4716.pdf</p> <p>10: Creech, C., Cooper, D., Aplin-Kalisz, C., Maynard, G., & Baker, S. (2018). Examining admission factors predicting success in a doctor of nursing practice program. <i>The Journal of Nursing Education</i>, 57(1), 49-52. https://doi.org/10.3928/01484834-20180102-10</p> | | | | | |
|--|--|---|--|---|---|
| Purpose | Variables | Setting/Subjects | Measurement and Instruments | Results | Evidence Quality |
| <p>9: Evaluate 17 item clinical instrument tool to demonstrate validity need for evaluation tools and relation to the NCE</p> <p>10: Determine which factors predicted nursing program outcomes.</p> | <p>9: NCE, Clinical Instrument Tool (focused to 17 areas)</p> <p>10: last 60 credit GPA, essay, recommendation letter, demographic</p> | <p>9: 137 students in 4 accredited NA programs in the southeastern United States</p> <p>10: 5 consecutive cohorts of DNP students of 4-year graduate program (144 students) midwestern public university, graduation date or dropped from program</p> | <p>9: Clinical evaluation instrument, SPSS, Eigenvalues</p> <p>10: Excel spreadsheet and SPSS for data analysis of last 60 credit hour GPA, admission essay score, age, recommendation letter.</p> | <p>9: Care plan p = 0.194, Didactic transfer p = 0.001, Clinical judgment p = 0.156, Skill mastery p = 0.107, Data adjust care p = 0.387, Efficient p = 0.027, Valid self-critique p = 0.057, Budget p = 0.488, Equipment malfunction p = 0.035, Standard precautions p = 0.431, Peer comparison p = 0.41, Resource mgt p = 0.422, Technical skills p = 0.05, Pt-focused p = 0.123, Resource mgt p = 0.088</p> <p>10: GPA p=0.047: 1/10 increase give 56.3% better chance of graduation Age p=0.031: each additional year of age gradation decreases 4.8%</p> | <p>Methodological flaws: 9: small sample size, inaccuracy of cognitive data varied by collection 10: single educational setting</p> <p>Inconsistency: 9: none 10: none</p> <p>Indirectness: 9: none 10: essay score results not documented</p> <p>Imprecision 9: none 10: none</p> <p>Publication bias 9: none 10: none</p> |
| Design | | | | Implications | |
| <p>9: Ex post facto cross-sectional study</p> <p>10: Retrospective study</p> | | | | <p>9: Significant positive finding to predict NCE scores from the ability of transferring didactive knowledge to the clinical setting</p> <p>10: GPA positively affected student success and that being older of a minority adversely affected it.</p> | |

| <p>11: Hinds, G. (2014). A study on the relationship between GRE scores of doctor of physical therapy students and first time pass scores on the national physical therapy exam scores: A retrospective study. <i>Digital Commons at Andrews University</i>. Retrieved from https://digitalcommons.andrews.edu/cgi/viewcontent.cgi?article=1097&context=honors</p> <p>12: Kuncel, N. R., Hezlett, S. A., Ones, D. S. (2001). A comprehensive meta-analysis of the predictive validity of the Graduate Record Examinations: Implications for graduate student selection and performance. <i>Psychological Bulletin</i>, 127(1), 162-181. https://doi.org/10.1037//Q033-2909.127.1.162</p> | | | | | |
|--|---|--|---|--|---|
| Purpose | Variables | Setting/Subjects | Measurement and Instruments | Results | Evidence Quality |
| <p>11: Explore relationships between GRE and NPTE scores</p> <p>12: To improve on previous reviews and meta-analyses of the GRE.</p> | <p>11: Verbal GRE, Quantitative GRE, and Total GRE</p> <p>12: GRE (V, Q and A), GGPA, 1st-year GGPA, and comprehensive exam scores.</p> | <p>11: 102 Doctor of Physical Therapy students at Andrews University from three consecutive cohorts (2010-2012)</p> <p>12: Data from 1,753 independent previously conducted studies.</p> | <p>11: Excel spreadsheet, SPSS 21 software, Spearman rho correlation</p> <p>12: Data from the studies were analyzed with the Hunter and Schmidt (1990) psychometric meta-analytic method.</p> | <p>11: vGRE and NPTE ($r = 0.454, p < 0.001$) qGRE and NPTE ($r = 0.420, p < 0.001$) tGRE and NPTE ($r = 0.484, p < 0.001$)</p> <p>12: GGPA for GRE-V ($N = 14,156, k = 103$), GRE-Q ($N = 14,425, k = 103$), GRE-A ($N = 1,928, k = 20$). 1st-year GGPA GRE-V ($N = 46,615, k = 1,231$), GRE-Q ($N = 46,618, k = 1,231$), GRE-A ($N = 36,325, k = 1,080$). Comprehensive exam scores GRE-V ($N = 1,198, k = 11$) and GRE-Q ($N = 1,194, k = 11$).</p> | <p>Methodological flaws: 11: small sample size 12: none</p> <p>Inconsistency: 11: none 12: none</p> <p>Indirectness: 11: none 12: none</p> <p>Imprecision 11: none 12: none</p> <p>Publication bias 11: none 12: none</p> |
| Design | | | | Implications | |
| <p>11: Retrospective correlational study</p> <p>12: Meta-analysis</p> | | | | <p>11: A weak but significant correlation between vGRE, qGRE and tGRE scores and NPTE raw scores.</p> <p>12: The GRE-V, GRE-Q, GRE-A were found to be valid predictors of GGPA, 1st-year GGPA, and comprehensive exam scores.</p> | |

| <p>13: Kume, J., Reddin, V., & Horbacewicz, J. (2018). Predictors of physical therapy academic and NPTE licensure performance. <i>ScienceDirect</i>. https://doi.org/10.1016/j.hpe.2018.06.004</p> <p>14: Malina, D. P. & Izlar, J. J. (2014). Education and practice barriers for Certified Registered Nurse Anesthetists. <i>The Online Journal of Issues in Nursing</i>, 19(2). https://doi.org/10.3912/OJIN.Vol19No02Man03</p> | | | | | |
|--|--|---|--|---|--|
| Purpose | Variables | Setting/Subjects | Measurement and Instruments | Results | Evidence Quality |
| <p>13: Explore between pre- and post- admission criteria and the performance scores on the national physical therapy licensure exam (NPTE)</p> <p>14: Discuss education and practice barriers of CRNAs.</p> | <p>13: First year GPA, 2nd/3rd year GPA, vGRE, qGRE, first attempt NPTE</p> <p>14: N/A</p> | <p>13: Touro College School of Health Science Doctoral of Physical Therapy Program class of 2014, 2015 and 2016 for 190 students</p> <p>14: States within the United States of America. CRNA practice and educational programs.</p> | <p>13: Excel 2013 and SPSS version 24</p> <p>14: N/A</p> | <p>13: vGRE and NPTE ($r = 0.31$, $p < 0.001$), qGRE and NPTE ($r = 0.24$, $p < 0.05$), 1st year GPA and NPTE ($r = 0.60$, $p < 0.001$), 2nd/3rd year GPA ($r = 0.6$, $p < 0.001$)</p> <p>14: Medicare will reimburse CRNAs for chronic pain management, changing of program to a doctoral level degree increases time in school, some state statutes prevent CRNAs from practicing to their full extent, limited Medicare reimbursement</p> | <p>Methodological flaws: 13: small sample size 14: none</p> <p>Inconsistency: 13: none 14: none</p> <p>Indirectness: 13: none 14: none</p> <p>Imprecision 13: none 14: none</p> <p>Publication bias 13: data non-confidential so missing data not reported due to willingness of wanting to turn over results 14: none</p> |
| Design | | | | Implications | |
| <p>13: Linear regression analysis and Retrospective correlational analysis</p> <p>14: Reviewing of federal and state regulations and statistics.</p> | | | | <p>13: Of all the pre-admission criteria, findings suggest verbal and quantitative GRE are the best predictors of the NPTE scores specifically</p> <p>14: Barriers to CRNA practice are complicated and multi-factorial.</p> | |

| <p>15: Pack, J. (2019). A Correlational Study of Preadmission and Early Program Predictors of Physician Assistant Certification Exam Scores. <i>Liberty University Doctoral Dissertation and Projects</i>. Retrieved from https://digitalcommons.liberty.edu/cgi/viewcontent.cgi?article=3085&context=doctoral</p> <p>16: Wunder, L., Glymph, D., Schirle, L., & Valdes, J. (2017). Workforce initiative for current predictors of CRNA employment in state of Florida. <i>AANA Journal</i>, 85(3), 217-221. Retrieved from https://cms.aana.com/docs/default-source/aana-journal-web-documents-1/workplace-initiative-0617-pp217-221.pdf?sfvrsn=1c948b1_6</p> | | | | | |
|--|---|---|---|--|---|
| Purpose | Variables | Setting/Subjects | Measurement and Instruments | Results | Evidence Quality |
| <p>15: Attempt to demonstrate a predictive relationship between the predictor variables, physician assistant program science GPA, and the criterion variable</p> <p>16: Predict changes between 2014-2018 of the supply and demand need of nurse anesthetists in Florida</p> | <p>15: Undergraduate SGPA, graduate GPA, GRE scores, Physician Assist National Certification Exam scores</p> <p>16: Number of SRNA graduates, demand numbers for Florida CRNA needs</p> | <p>15: 109 graduates from PA program at Mountain View University and Cedar Grove University.</p> <p>16: Florida hospital and surgical centers that used anesthesia services</p> | <p>15: Transcripts, application to program, report from the National Commission on Certification of PA exam scores, collected by program administrators</p> <p>16: Survey</p> | <p>15: Mean PANCE score ($M = 491.65$, $SD = 80.06$), mean undergraduate SGPA ($M = 3.49$, $SD = 0.45$), for GRE ($M = 300.90$, $SD = 7.50$), and for the graduate GPA ($M = 3.61$, $SD = 0.39$).</p> <p>16: 18.4% growth rate with approximately 633 new full-time positions for CRNAs through 2018</p> | <p>Methodological flaws: 15: none 16: small sample size (17%)</p> <p>Inconsistency: 15: none 16: none</p> <p>Indirectness: 15: none 16: none</p> <p>Imprecision 15: none 16: none</p> <p>Publication bias 15: none 16: none</p> |
| Design | | | | Implications | |
| <p>15: Predictive correlational design</p> <p>16: Cross sectional research study</p> | | | | <p>15: Predictive relationship between grade GPA and exam scores but failed with the other</p> <p>16: In 2013, 83% of AANA members in Florida worked full time; consequently, this projection suggests the proportion of full-time CRNAs will remain relatively constant</p> | |

| 17: Zaglaniczny, K. (1992). Factors which predict performance on the National Certification Exam for Nurse Anesthetists. <i>AANA Journal</i> , 60(6), 533-540. | | | | | |
|--|--|---|--|--|--|
| Purpose | Variables | Setting/Subjects | Measurement and Instruments | Results | Evidence Quality |
| <p>17: Investigate 13 academic, demographic and preadmission factors which predicts RNAS performance on the NCE</p> <p>18: Compare cost of education and salary of CRNAs</p> | <p>17: Overall GPA in program, science GPA in program, highest degree attained before entry, gender, number of cases, age, years of nursing experience, nursing preparation, clinical background, length of anesthesia program, total number of science hours in anesthesia curriculum, case hours, type of anesthesia program, certification exam scores.</p> <p>18: Tuition from private and public educational programs, average salary</p> | <p>17: 1690 students first time candidates on five NCEs administered between December 1987 and December 1989</p> <p>18: 60 private and 48 public educational institutions according to COA. Average CRNA salary within the US</p> | <p>17: Stepwise MRA, ANOVA, t-test</p> <p>18: Cost data collected were obtained from each school's website for tuition and fees costs. Salary data for CRNAs were collected from the MGMA Physician Compensation and Production Survey: 2012 Report Based on 2011 data</p> | <p>17: Science GPA $r = 0.239$, Highest degree $r = 0.248$, gender $r = 0.256$, case number $r = 0.261$, age $r = 0.263$, years of experience $r = 0.267$, overall GPA $r = 0.271$</p> <p>18: Public programs \$37,243, private program cost of \$61,345. Median salary \$158,092</p> | <p>Methodological flaws: 17: none 18: none</p> <p>Inconsistency: 17: none 18: none</p> <p>Indirectness: 17: none 18: none</p> <p>Imprecision 17: none 18: none</p> <p>Publication bias 17: none 18: none</p> |
| Design | | | | Implications | |
| <p>17: Multiple regression retrospective analysis</p> <p>18: Comparison design</p> | | | | <p>17: Students science GPA is the most predicative factor for performance on the NCE</p> <p>18: Nurse anesthetists have better opportunities to attain a higher income.</p> | |

Appendix B

National Nurse Anesthesia Program GRE Admission Requirements
 (Data compiled by researchers from review of each program's public website in August 2020)

| Program | GRE Required | GRE Not Required | Total Score | Verbal Score | Quant Score | Analytical Score | Within 5 years | NOTE |
|---|--------------|------------------|-------------------------------------|--------------|-------------|------------------|----------------|---------------------------|
| AdventHealth University Nurse Anesthesia Program | X | | 300 | | | 3.5 | X | Graduate degree exemption |
| Albany Medical College Nurse Anesthesiology Program | X | | | 150 | 150 | 3.5 | X | |
| Allegheny School of Anesthesia | | X | | | | | | |
| Antillean Adventist University Nurse Anesthesia Program | X | | 284 | | | | | |
| Arkansas State University College of Nursing and Health Professions School of Nursing | X | | 300 | | | 3.5-4 | X | |
| Augusta University Nursing Anesthesia Program | X | | 290 | | | | X | |
| Baptist Health Murray State University Program of Anesthesia | | X | | | | | | |
| Barry University College of Nursing and Health Sciences Nurse Anesthesiology Program | X | | | | | | X | |
| Baylor College of Medicine Doctor of Nursing Practice Program - Nurse Anesthesia | X | | > 50 percentile in all 3 categories | 156 | 155 | 4 | X | |
| Boston College William F. Connell School of Nursing Nurse Anesthesia Program | X | | > 50 percentile in all 3 categories | | | | | |

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|---|----|---|-----------------|-----|-----|---|---|--|
| Bryan College of Health Sciences School of Nurse Anesthesia | X | | | | | | | |
| Carolinas Medical Center Nurse Anesthesia Program/UNCC | X | | 293 | | | | | |
| Cedar Crest College Nurse Anesthesia Program | | X | | | | | | |
| Charleston Area Medical Center School of Nurse Anesthesia | X | | | 153 | 144 | | X | |
| Clarkson College Nurse Anesthesia Program | | X | | | | | | |
| Cleveland Clinic Foundation Frances Payne Bolton School of Nursing Case Western Reserve University School of Nurse Anesthesia | | X | | | | | | |
| Columbia University School of Nursing Program in Nurse Anesthesia | | X | | | | | | |
| Crozer Chester Medical Center/ Villanova University Nurse Anesthesia Program | X* | | | | | | | Not required if GPA > 3.4 |
| Department of Nurse Anesthesia Ida V. Moffett School of Nursing Samford University | X | | | 153 | 144 | 4 | X | |
| Doctor of Nurse Anesthesia Practice Program School of Nursing & Health Studies at Georgetown University | X* | | | | | | X | |
| Drexel University Nurse Anesthesia Program | X* | | 50th percentile | | | | X | Not required if GPA > 3.25 AND SGPA > 3.25 |
| Duke University Nurse Anesthesia Program | | X | | | | | | |
| East Carolina University College of Nursing Nurse Anesthesia Program | X | | | | | | X | |
| Emory University Doctor of Nursing Practice Nurse Anesthesia Program | | X | | | | | | |

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|--|----|---|-----|--|--|---|---|--------------------------------|
| Excela Health School of Anesthesia | X | | | | | | | |
| Fairfield University and Bridgeport Hospital Nurse Anesthesia Program | | X | | | | | | |
| Florida Gulf Coast University Nurse Anesthesiology Program | X | | | | | | | |
| Florida International University Nicole Wertheim College of Nursing and Health Sciences Anesthesiology Nursing Program | X | | | | | | | |
| Florida State University Nurse Anesthesia Program | X | | 300 | | | | X | |
| Frances Payne Bolton School of Nursing Program of Nurse Anesthesia Care Western Reserve University | | X | | | | | | |
| Franciscan Healthcare School of Anesthesia | | X | | | | | | |
| Franciscan Missionaries of Our Lady University Nurse Anesthesia Program | X | | 290 | | | 3 | X | |
| Frank J. Tornetta School of Anesthesia at Einstein Medical Center Montgomery / La Salle University School of Nursing | X* | | | | | | | Not required if GPA \geq 3.2 |
| Geisinger Health System / Bloomsburg University of Pennsylvania Nurse Anesthesia Program | | X | | | | | | |
| Goldfarb School of Nursing Barnes-Jewish College Nurse Anesthesia Program | | X | | | | | | |
| InterAmerican University of Puerto Rico Master of Science in Anesthesia | | X | | | | | | |
| Johns Hopkins School of Nursing Nurse Anesthesiology Track of the DNP Program | | X | | | | | | |

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|--|----|---|-----|-----|-----|-----|---|--|
| Kaiser Permanente School of Anesthesia California State University Fullerton | | X | | | | | | CCRN required |
| Keiser University Nurse Anesthesia Program | | X | | | | | | |
| Lincoln Memorial University Caylor School of Nursing Nurse Anesthesia Concentration | X | | | | | | | |
| Loma Linda University School of Nursing Nurse Anesthesia Concentration | | X | | | | | | |
| Louisiana State University Health Sciences Center School of Nursing Nurse Anesthesia Option | X | | 300 | | | 3 | X | |
| Lourdes University MSN Nurse Anesthesia Program | | X | | | | | | CCRN required |
| Marian University Nurse Anesthesia Program Leighton School of Nursing Nurse Anesthesia Program | | X | | | | | | CCRN required |
| Marquette University College of Nursing Nurse Anesthesia Educational Program | X* | | | | | | | Not required if GPA \geq 3.2 |
| Mayo Clinic School of Health Sciences Doctor of Nurse Anesthesia Practice Program | X | | | | | | | CCRN required |
| Medical University of South Carolina Anesthesia for Nurses Program | X* | | | | | | X | Not required if GPA \geq 3.6 or > masters degree |
| Michigan State University Nurse Anesthesia Program | | X | | | | | | |
| Middle Tennessee School of Anesthesia | X | | | 150 | 150 | 3.5 | | Not required if hold masters or doctoral degree |
| Midwestern University Nurse Anesthesia | | X | | | | | | |
| Minneapolis School of Anesthesia | | X | | | | | | |

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|---|----|---|-----|-----|-----|-----|---|---|
| Missouri State University School of Anesthesia | X* | | | 153 | 150 | 3.5 | X | Not required if CCRN |
| Mount Marty College Graduate Program in Nurse Anesthesiology | | X | | | | | | Not required as of 2019 |
| National University Fresno Nurse Anesthesia Program | | X | | | | | | Profession certs required: CCRN, CEN, or CFRN |
| Newman University Nurse Anesthesia Program | X | | 295 | | | | | |
| Northeastern University Bouve College of Health Sciences School of Nursing Nurse Anesthesia Program | X | | | | | | | |
| Northern Kentucky University Nurse Anesthesia Program | | X | | | | | | |
| NorthShore University Health System School of Nurse Anesthesia DePaul University | X | | 300 | | | 4 | X | |
| Nurse Anesthesia Program of Harford | | X | | | | | | |
| Oakland University Beaumont Graduate Program of Nurse Anesthesia | | X | | | | | | |
| Old Dominion University School of Nursing Nurse Anesthesia Program | X* | | 300 | | | | | Not required if GPA \geq 3.5 |
| Oregon Health and Science University School of Nursing Nurse Anesthesia Program | | X | | | | | | |
| Otterbein University Ohio Health Grant Medical Center Nurse Anesthesia Program | X* | | | | | | | Not required if GPA \geq 3.5 CCRN required |
| Our Lady of Lourdes Medical Center Nurse Anesthesia Program | | X | | | | | | |
| Providence Sacred Heart Medical Center Gonzaga University Nurse Anesthesia Program | | X | | | | | | |

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|--|----|---|--|--|--|--|---|-----------------------|
| Quinnipiac University Nurse Anesthesia Program | | X | | | | | | |
| Rhode Island College School of Nursing / St. Joseph Hospital School of Nurse Anesthesia | X* | | | | | | | Miller Analogies test |
| Rosalind Franklin University of Medicine and Science Nurse Anesthesia Program | | X | | | | | | |
| Rush University College of Nursing Nurse Anesthesia Program | X | | | | | | | |
| Rutgers School of Nursing Anesthesia Program | | X | | | | | | |
| Saint Mary's University of Minnesota Graduate Program in Nurse Anesthesia | | X | | | | | | |
| Samuel Merritt University Program of Nurse Anesthesia | X | | | | | | X | |
| Southern Illinois University Edwardsville Nurse Anesthesia Specialization | | X | | | | | | |
| St. Elizabeth Health Center School for Nurse Anesthesia Inc. | | X | | | | | | |
| Texas Christian University School of Nurse Anesthesia | X | | | | | | | |
| Texas Wesleyan University Graduate Programs of Nurse Anesthesia | X | | | | | | | |
| The Millikin University and Decatur Memorial Hospital Nurse Anesthesia Program | | X | | | | | | |
| The University of Akron Nurse Anesthesia Program | | X | | | | | | |
| The University of Alabama at Birmingham School of Nursing Post-BSN to DNP Pathway for Nurse Anesthesia | X | | | | | | X | |
| The University of Arizona College of Nursing Nurse Anesthesia Program | | X | | | | | | |

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|---|----|---|-----|--|--|-----|--|---------------------------|
| The University of Iowa College of Nursing Anesthesia Nursing Program | | X | | | | | | |
| The University of Tennessee at Chattanooga / Erlanger Health System Nurse Anesthesia Concentration | X | | | | | | | |
| The University of Tennessee College of Nursing Nurse Anesthesia Concentration | X* | | 300 | | | 3.5 | | Not required if GPA > 3.3 |
| The University of Tennessee Health Science Center College of Nursing Nurse Anesthesia Option | | X | | | | | | |
| The University of Tulsa Nurse Anesthesia Program | | X | | | | | | |
| Thomas Jefferson University Jefferson College of Nursing Nurse Anesthesia Program | | X | | | | | | |
| Truman Medical Center Hospital Hill School of Nurse Anesthesia | X | | | | | | | |
| UNC Greensboro, School of Nursing, Doctor of Nursing Practice, Nurse Anesthesia Concentration | X | | | | | | | |
| Uniformed Services University of Health Sciences Daniel K. Inouye Graduate School of Nursing Nurse Anesthesia Program | X | | | | | | | |
| Union University College of Nursing Nurse Anesthesia Track | | X | | | | | | |
| University at Buffalo State University of New York Nurse Anesthetist Program | X | | | | | | | |
| University of Arkansas for Medical Sciences Nurse Anesthesia Program | | X | | | | | | |
| University of Cincinnati, College of Nursing Doctor of Nursing Program - Nurse Anesthesia Major | X | | | | | | | |

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|--|----|---|-----------------|-----|-----|----------|---|--------------------------------|
| University of Detroit Mercy Graduate Program of Nurse Anesthesia | | X | | | | | | |
| University of Kansas Nurse Anesthesia Program | | X | | | | | | |
| University of Maryland School of Nursing Graduate Programs Nurse Anesthesia | | X | | | | | | |
| University of Miami School of Nursing and Health Studies Nurse Anesthesia Program | | X | | | | | | |
| University of Michigan - Flint Nurse Anesthesia Program | | X | | | | | | |
| University of Minnesota School of Nursing Nurse Anesthesia Area of Study | | X | | | | | | |
| University of New England School of Nurse Anesthesia | | X | | | | | | |
| University of North Dakota Nurse Anesthesia Program | | X | | | | | | |
| University of North Florida Nurse Anesthesiology Program | X | | | 153 | 144 | 3.5 | X | |
| University of Pennsylvania School of Nursing Nurse Anesthesia Program | X* | | | | | | | Not required if GPA \geq 3.2 |
| University of Pittsburgh School of Nursing Nurse Anesthesia Program | X | | | | | > or = 3 | | |
| University of Puerto Rico School of Nursing Nurse Anesthesia Program | X | | 400 | | | | | |
| University of Saint Francis BSN-DNP Nurse Anesthesia Program School of Health Sciences - Nursing | - | - | - | - | - | - | - | |
| University of South Carolina Prisma Health Graduate Program in Nurse Anesthesia | X | | 300 | | | | | |
| University of South Florida College of Nursing Nurse Anesthesia Program | X | | > 50 percentile | | | | | |

| | | | in all 3 categories | | | | | |
|---|----|---|---------------------|--|--|--|---|------------------------------------|
| University of Southern California Program of Nurse Anesthesia Department of Anesthesiology Keck School of Medicine | X | | | | | | | |
| University of Southern Mississippi Nurse Anesthesia Program | X | | | | | | | |
| University of Texas Jane and Robert Cizik School of Nursing at Houston Nurse Anesthesia Division | X | | | | | | | |
| University of Wisconsin - Oshkosh College of Nursing Nurse Anesthesia Emphasis | X* | | | | | | | Not required if GPA \geq 2.99 |
| UPMC Hamot School of Anesthesia / Gannon University | X | | | | | | | |
| US Army Graduate Program in Anesthesia Nursing | X | | | | | | | |
| Virginia Commonwealth University Department of Nurse Anesthesia | X | | | | | | | |
| Wake Forest Baptist Health / Wake Forest School of Medicine Nurse Anesthesia Program | X | | 50th percentile | | | | | |
| Wayne State University Eugene Applebaum College of pharmacy and Health Sciences | | X | | | | | | |
| Webster University Nurse Anesthesia Program | | X | | | | | | |
| West Virginia University Nurse Anesthesia Program | X | | | | | | 1 | |
| Western Carolina University Nurse Anesthesia Program | X | | 300 | | | | | |

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|--|-----------|---|--|--|--|--|--|--|
| Westminster College School of Nursing and Health Science Master's of Science in Nurse Anesthesia | | X | | | | | | |
| Yale New Haven Hospital School of Nurse Anesthesia | | X | | | | | | |
| York college of Pennsylvania / WellSpan Health Nurse Anesthetist Program | X | | | | | | | |
| REQUIRED | 52 | | | | | | | |
| REQUIRED contingent on GPA (X*) | 12 | | | | | | | |
| NOT REQUIRED | 58 | | | | | | | |
| Noted Required Scores | 26 | | | | | | | |
| GRE within the 5 year | 21 | | | | | | | |