A study comparing characteristics of nurse anesthesia programs with the success rate on the certification examination

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This study was conducted to determine if a relationship exists between various characteristics of nurse anesthesia schools and their success rate on the national certification examination (NCE). Independent variables included the number of students per class, number of clinical rotation sites, program length, type of degree or certificate granted, program structure, and date of graduation. Data were collected by a questionnaire mailed to all anesthesia schools in the country. Statistical analysis of the data was by Pearson's Product Moment Correlation Coefficient and analysis of variance. No statistically significant relationship was found between any of the variables studied. Recommendations for future study include correlating the schools' passing rate with admission criteria, curriculum, and required instructor qualifications.

Key words: Credentialling, national certification examination, nurse anesthesia education.

Introduction
The goal of nurse anesthesia programs is to prepare nurses to become competent, responsible, and skilled professionals capable of practicing anesthesia in a variety of clinical settings. It has been stated that the real key to determining a program's quality is the knowledge and skill of its graduates and the percentage of its graduates that pass the national certification examination (NCE). Presently, two thirds of the states in the United States recognize certification in their licensing statutes, and most facilities require certification to practice anesthesia.

To obtain certification, one must meet several requirements. First, the applicant must be a registered nurse with a valid license who is in good standing with the state board of nursing. In addition, the individual must be a graduate of an accredited school of nurse anesthesia and in good standing within the profession. Finally, the applicant must pass the comprehensive test known as the national certification examination.

The Council on Accreditation (COA) of Nurse Anesthesia Educational Programs grants accreditation to schools that meet the criteria outlined in the Standards for Accreditation of Nurse Anesthesia Educational Programs. While each school must meet all criteria to be accredited, distinct differences set some programs apart from others. Because of multiple educational approaches, the research question arises—"Do different characteristics of accredited nurse anesthesia educational programs impact upon graduates' performance on the first measure of basic competence—the national certification examination (NCE)?"

Few research data are available relating school characteristics to success on the NCE. The importance of research in this area is evident when one considers the increasing need for CRNAs and the recent decline in graduates of nurse anesthesia pro-
grams. The Health Economics Research, Inc. CRNA manpower study projects a shortage of 35,000 CRNAs by the year 2010. It is imperative that schools continue to graduate qualified anesthesia providers capable of passing the NCE.

Certification for nurse anesthetists indicates minimum competency for entry-level practice. However, certification in other nursing specialties suggests achievement of excellence in that specialty.

The Council on Certification of Nurse Anesthetists (CCNA) is an autonomous, multidisciplinary body existing under the corporate structure of the AANA. CCNA membership consists of 11 representatives: six certified registered nurse anesthetists, two anesthesiologists, one hospital administrator, one student currently enrolled in an accredited nurse anesthesia educational program, and one public member. The Council has the final responsibility for the NCE. The first certification examination was administered on June 4, 1945. It is constantly being evaluated and revised. Between 1985 and 1987, a job analysis was conducted in conjunction with Assessment Systems Incorporated, and a professional practice analysis was repeated in collaboration with American College Testing in 1992. Beginning in 1987, the test results were reported on a scaled basis and a revised test blueprint was introduced. To ensure a valid, defensible examination, the CCNA currently seeks test questions from nurse anesthesia educators, practitioners, and anesthesiologists.*

Students are educated by several avenues in the anesthesia specialty. At the time of this study, there were 90 nurse anesthesia schools in the United States with programs varying in length from 24 to 36 months. Sixty of the 90 anesthesia schools offer a master's degree in science or arts, 11 programs offer a certificate in anesthesia with the option of obtaining a master's degree, and 18 offer only a certificate in nurse anesthesia. Of the remaining nurse anesthesia schools, one offers a bachelor's degree.**

Another varying characteristic is the number of clinical affiliates ranging from one to 17. The number of students per class also varies, usually from one to about 50. The characteristics compared in this project included the number of students per class, length of the program, type of degree or certificate granted, number of clinical sites, and graduation date. Additionally, integrated programs were compared with two-phase programs. While there are pros and cons associated with each variable, it is worthwhile to determine the effect each characteristic has on a school's graduates.

The characteristics of class size and program length were included due to the existing differences in each program as stated above. The type of degree or diploma granted refers to a diploma, certificate, or bachelor's or master's degree. No consideration was given as to the type of graduate degree (i.e., master in Health Arts versus master in Nurse Anesthesiology).

The number of different clinical sites refers to the average number of clinical locations through which a typical student must rotate during the course of the program. This was studied to determine if a relationship exists between a variety of clinical experiences and the passing rate of the program's graduates on the NCE. For example, some inner-city hospitals may offer more trauma experience than would a private institution. In addition, not all facilities have the capacity for obstetrics or cardiovascular surgery. The phrase "passing rate" refers to the percentage of students of a particular program who pass the NCE on the first attempt.

The graduation date was studied to determine if the length of time between graduation and the certification examination affected the performance on the NCE. The class taking the examination immediately following the completion of the nurse anesthesia program may have different outcomes than a class several months between graduation and the NCE.

In general, nurse anesthesia programs are of two major structural frameworks, referred to as program structure. The first is a two-phase program wherein the students spend an initial period in the classroom learning didactic material without clinical responsibility (phase I), followed by a clinical portion for the remainder of the program (phase II). The second type of program is called an integrated or concurrent program. The integrated programs allow students to simultaneously spend time in the classroom and clinical areas for the entire program. The two-phase nurse anesthesia programs attempt to provide students with all the necessary knowledge before entering the clinical area. Concurrent programs reinforce classroom learning with clinical experiences to enable prompt clinical application of the knowledge obtained. The United States Army and a growing number of other institutions are moving toward a

*Beginning April 8, 1996, the certification examination will be administered by computer using a methodology called computerized adaptive testing (CAT). The Council on Certification of Nurse Anesthetists has contracted with Computer Adaptive Technologies, Inc. to provide psychometric guidance for the testing program.

**Currently, there are 90 nurse anesthesia schools with programs varying in length from 24 to 36 months. Of the 90 programs, 47 offer a master's degree; 38 offer a master's degree in nursing; and 5 offer a certificate.
centralized academic program with regionalized clinical experience. This entails a university-based didactic portion (phase I), usually granting a degree, and a clinical portion (phase II), conducted at various affiliate sites. These programs deliver the didactic and clinical portions separately. All of the didactic work is completed in the first year, and the remainder of the program consists of clinical experience (phase I/phase II). Many of these programs have moved into the master's degree framework. Advantages and disadvantages of the two-phase program are displayed in Table I.

<table>
<thead>
<tr>
<th>Table I</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advantages and disadvantages of two-phase nurse anesthesia programs&lt;sup&gt;5, 7, 8&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Advantages:
1. It provides students with a solid background in the basic sciences and anesthesia principles before their clinical experience.
2. The academic environment is more conducive to learning. Clinical requirements would not interfere with didactic instruction.
3. All students receive the same academic instruction in the basic sciences.
4. Didactic courses are taught by professors in their area of expertise. Instructors can be from disciplines other than the field of anesthesia (this could also be seen as a disadvantage).
5. Students can focus on one phase at a time.

Disadvantages:
1. Large universities predispose to variability in course content and instructor quality.
2. Didactic information is difficult to retain due to lack of immediate clinical application.
3. Criteria for evaluating students vary among clinical sites.
4. Absence of clinical experience in phase I can result in an overload of clinical hours in phase II to make up for lost time.

The progression of nurse anesthesia programs toward a graduate framework is compatible with the goal of American Association of Nurse Anesthetists (AANA) to have all programs in a master's framework by 1998.<sup>1</sup> Still, many programs retain an integrated curricula after converting to a graduate level format.

Fleming conducted a study regarding how student nurse anesthetists (SNAs) performed on NCEs given from November 1975 through June 1978. The results suggested that SNAs from master's and baccalaureate degree programs and military programs had the best passing scores in the NCE. She also concluded that background of the SNAs before anesthesia education had little relationship to their performance on the NCE.<sup>9</sup>

A more recent study sought to detect predictors of SNA performance on the NCE. The results indicated that higher scores were achieved by SNAs enrolled in baccalaureate or master's degree nurse anesthesia programs than those enrolled in certificate programs. Inverse relationships existed between the length of the nurse anesthesia program, case hours, and total number of cases and performance on the NCE.<sup>10</sup>

In a study regarding passing rate on national certifying examinations, Raymond found a positive correlation between the educational preparation and successful test performance.<sup>11</sup> These results differ from other studies comparing education level with the passing rate of the National Council Licensure Examination for Registered Nurses (NCLEX-RN). Raymond proposed that the tests for certification and tests for licensure are in different planes. The licensure examination for registered nurses measures entry level knowledge, whereas certification recognizes advanced knowledge and skill in nursing. However, for nurse anesthetists, success on the NCE indicates entry level knowledge of anesthesia.

State boards of nursing maintain a record of individual nursing schools' NCLEX-RN success rate. A nursing school must maintain a 75% passing rate to avoid probationary status.<sup>12</sup> Some of the above-mentioned studies were conducted because of a drop in a particular school's success rate on the NCLEX-RN. However, nurse anesthesia programs with low passing rates on the NCE are not threatened with probation. This is possibly why more studies on nurse anesthesia programs are not available. Nevertheless, this issue is in the interest of the students because they must pass the examination to work in most facilities. It is also in the interest of the public, as the shortage of CRNAs continues to rise.

Methods and rationale

The author was interested in the possibility of establishing a connection between nurse anesthesia program traits and the success of graduates from those programs in passing the NCE. There will be a significant relationship between nurse anesthesia program characteristics and the success rate of their graduates on the certification examination. To this end, a study was designed that targeted all accredited nurse anesthesia schools. This approach was taken because it would include the entire population of nurse anesthesia students and programs.

Each school was mailed a questionnaire pertaining to its characteristics (independent vari-
The survey requested disclosure of the 1991 NCE passing rate of their graduates (dependent variable). A cover letter to the program director accompanied the questionnaire to describe the purpose and nature of the study. Participants were instructed to complete the questionnaire and return it in a self-addressed, stamped envelope. A follow-up letter was sent to all programs 2 weeks after the initial mailing.

The sample consisted of all schools that responded to the questionnaire. When the questionnaires were received, the sample was divided into three groups: schools with 1 to 10 students, 11 to 20 students, and greater than 20 students in each class. This was done to report characteristics and NCE success rate based on school size. The effectiveness of each characteristic studied was evaluated and correlated with the success rate of the school on the NCE.

Data from each completed survey were analyzed and displayed on tables. Analysis consisted of descriptive and inferential statistics. Pearson's Correlation Coefficient was used to determine the relationships between variables. Analysis of variance (ANOVA) was also used to detect any relationship between the structure of the school and the passing rate.

**Results**

Of the 90 schools surveyed, 69 replies were received. Only 63 of the questionnaires were complete as some schools had not yet had a graduating class. No statistically significant relationship was found between any of the variables studied. The highest correlation found was a negative correlation between the passing rate and the graduation date (number of months before the NCE) with a Pearson's coefficient of -0.5 with + or -0.8 being significant (see Tables II-IV). The mean, standard deviation, and range are included in Table V. No significant relationship between the mean passing rates and school structure was shown by ANOVA (P=0.82). Pearson's Coefficient for type of degree offered was .001998. Therefore, it was concluded that characteristics of nurse anesthesia programs could not be used to predict how graduates of those programs would fare in successfully completing the NCE. The hypothesis was rejected.

**Discussion**

Although no statistically significant relationship was found between the characteristics of nurse anesthesia schools and their NCE passing rates, observations of interest to students and faculty were obtained. For example, the number of schools with 1-10 students per class was 35. Of these schools, 13 had 100% passing rates. Eighteen schools had between 11 and 20 students per class. Of these, one half had 100% passing rates. None of the nine schools with greater than 20 students had 100% passing rates. It appears that as graduating classes grow larger, the likelihood decreases that all students will pass the NCE.

### Table II

**Schools with 1-10 students per class**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pearson's r</th>
<th>Level of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>0.09142</td>
<td>0.6015</td>
</tr>
<tr>
<td>Length of program</td>
<td>0.04234</td>
<td>0.8088</td>
</tr>
<tr>
<td>Graduation date</td>
<td>-0.29060</td>
<td>0.0904</td>
</tr>
<tr>
<td>Number of clinical sites</td>
<td>-0.16348</td>
<td>0.3481</td>
</tr>
<tr>
<td>Program structure</td>
<td>-0.21422</td>
<td>0.2166</td>
</tr>
</tbody>
</table>

*Pearson's r correlations of independent variables with passing rate of schools on NCE (Pearson r of + or -0.5 being significant). No statistically significant correlation was found.

### Table III

**Schools with 11-20 students per class**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pearson's r</th>
<th>Level of significance</th>
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</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>-0.19615</td>
<td>0.4666</td>
</tr>
<tr>
<td>Length of program</td>
<td>-0.01833</td>
<td>0.9463</td>
</tr>
<tr>
<td>Graduation date</td>
<td>0.09951</td>
<td>0.7139</td>
</tr>
<tr>
<td>Number of clinical sites</td>
<td>0.30642</td>
<td>0.2484</td>
</tr>
<tr>
<td>Program structure</td>
<td>0.02436</td>
<td>0.9287</td>
</tr>
</tbody>
</table>

*Pearson's r correlations of independent variables with passing rate of schools on NCE (Pearson r of + or -0.5 being significant). No statistically significant correlation was found.

### Table IV

**Schools with greater than 20 students per class**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pearson's r</th>
<th>Level of significance</th>
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</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>0.13698</td>
<td>0.7253</td>
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<tr>
<td>Length of program</td>
<td>-0.30649</td>
<td>0.4225</td>
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<td>Graduation date</td>
<td>-0.18759</td>
<td>0.1830</td>
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<tr>
<td>Number of clinical sites</td>
<td>-0.24736</td>
<td>0.5211</td>
</tr>
<tr>
<td>Program structure</td>
<td>0.03017</td>
<td>0.9386</td>
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</tbody>
</table>

*Pearson's r correlations of independent variables with passing rate of schools on NCE (Pearson r of + or -0.5 being significant). No statistically significant correlation was found.
Table V

Mean, standard deviation, and range of variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of students</td>
<td>29</td>
<td>8.46</td>
<td>3-47</td>
</tr>
<tr>
<td>Length of program</td>
<td>25.6</td>
<td>2.24</td>
<td>24-30</td>
</tr>
<tr>
<td>Graduation date (months before national certification examination)</td>
<td>2.2</td>
<td>1.73</td>
<td>0-6</td>
</tr>
<tr>
<td>Number of clinical sites</td>
<td>5.6</td>
<td>3.24</td>
<td>1-12</td>
</tr>
<tr>
<td>Percent passing</td>
<td>87</td>
<td>7.57</td>
<td>33-100</td>
</tr>
</tbody>
</table>

One weakness of this study was that it examined only 1 year of NCE passing rates. Future studies could correlate characteristics with 3-5 years of NCE passing percentages. In addition, due to the varied number of students in each program, the passing percentages also varied greatly. For example, if one person in a school with only three students fails, the passing rate is only 66%. Future studies could be conducted that prorate the NCE passing rates to a common scale, e.g., the number of students apt to pass the NCE per 100 graduates. Result reporting in this manner may be a more useful measure for making comparisons between programs.

Conclusion

There are numerous nurse anesthesia schools across the country with a wide range of board passing rates. Perhaps other characteristics not included in this study will prove to be related to the schools' passing rate on the NCE. Admission criteria such as the Graduate Record Examination or Miller's Analogy test could be correlated with NCE passing rates. Number of years of nursing experience before entering the nurse anesthesia program may provide an interesting correlational study. Also, other areas such as curriculum, required faculty qualifications, and prior exposure of the student to a specialty nursing area need to be addressed.

REFERENCES


AUTHOR

Idena Carroll-Perez, CRNA, MS, is a graduate of Charity Hospital/Xavier University School of Nurse Anesthesiology in New Orleans, Louisiana. She is currently a staff anesthetist at the James A. Haley Veterans' Hospital in Tampa, Florida.

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