This retrospective cohort study examined the Uniformed Services University of the Health Sciences Registered Nurse Anesthesia program to identify reasons for high attrition rates. Relevant data were examined for 180 students enrolled in classes from 2005 through 2011. During that period, 40 students were dismissed or disenrolled, with the highest attrition rate (35%) occurring in the class of 2010. Evidence from this investigation indicates students who completed the program were younger, earned higher grade point averages while completing their undergraduate bachelor of science in nursing, and achieved higher analytic and total Graduate Record Examination scores than did students who withdrew or were dismissed. Gender differences were noted, as a greater proportion of women completed the program compared with men. Personal, family, and other issues frequently overlapped, with academic performance problems leading to attrition. Based on these findings, a number of important changes were made in the admission process to the USUHS RNA program and in the nonacademic mentoring and assistance offered to students.

**Keywords:** Academic progression, attrition, military health system, process improvement, registered nurse anesthesia program.
improvement as a means to better understand factors leading to attrition.\(^5\,^6\)

Previous studies of graduate nursing and nurse anesthesia programs have focused on cognitive and noncognitive (ie, nonacademic) predictors of success.\(^1\,^2\,^7\) Studies focusing on cognitive predictors of success such as undergraduate grade point average (GPA) and Graduate Record Examination (GRE) scores can inform decisions about admission criteria, but they offer little insight into specific ways programs can ensure the success of students during matriculation.\(^7\) A study by Burns\(^8\) in 2011 revealed a statistically significant association between success in the nurse anesthesia program, students’ undergraduate GPA, and their science GPA but offered little insight into other factors that may have significant influence on success in a nurse anesthesia program. One notable exception comes from a 2007 study by Hulse and colleagues,\(^1\) who investigated noncognitive factors and found that locus of control and trait anxiety were predictors of whether a student progressed in a graduate nurse anesthesia program. Student registered nurse anesthetists with a low external locus of control and high trait anxiety were less likely to progress, and noncognitive factors were just as significant as cognitive factors for determining students’ success.\(^1\) Collins\(^9\) studied the emotional intelligence of student registered nurse anesthetists as another possible noncognitive factor, associating it with academic factors at 3 points in a nurse anesthesia program, attempting to demonstrate the use of emotional intelligence for predicting success. However, none of these assessments are commonly accepted as part of the admission procedure for RNA students, and these few studies indicate that a variety of factors affect student progression.

The uniqueness of the USUHS RNA program attrition problem called for a systematic approach to identify, analyze, and improve existing processes.

- **Problem.** The primary goal of the USUHS RNA program is to produce safe, competent, adaptable anesthetists who can meet the challenges of today’s federal healthcare needs. High attrition rates during the years 2007 through 2010 led to changes in the USUHS RNA program’s admission criteria for classes matriculating in 2011 and 2012. Attrition rates peaked at 35% with the class that matriculated in 2010, which is considered high compared with other academic institutions, where the national average for the past 30 years has been around 8% and in one study was a mean (± SD) of 7.7% ± 9.1%.\(^3\,^10\) Admission GPA and admission GRE requirements were rigidly enforced, and predmission interviews were conducted with the program director. This interview gave the program director an opportunity to speak candidly about the rigor of the program and the challenges this can present to individuals and their families. With an attrition rate almost 4 times the national average, further investigation was needed to understand and mitigate this high rate of attrition without decreasing academic and clinical standards.\(^10\) In our study, attrition rate is the percentage of students who were unsuccessful (ie, dismissed or voluntarily withdrew) from the USUHS RNA program for a given year of expected graduation.

The purpose of this process improvement project was to identify cognitive (eg, admission GPA, GRE score) and noncognitive (eg, demographic, social, and psychological) factors that were associated with successful student completion of the RNA program. Specific questions to be answered included the following:

1. What were the differences between successful (ie, graduated) and unsuccessful (ie, dismissed or voluntary withdrawal) students in the USUHS RNA program with respect to academic and demographic factors?
2. What other factors (eg, personal illness, family illness, motivation, and other problems) were associated with lack of progression and attrition from the USUHS RNA program?

**Methods**

A retrospective cohort study was conducted to achieve a deeper understanding of factors and processes that could be improved on to recruit and retain students in the RNA program with the potential to succeed in the program. Following USUHS institutional review board approval, the researchers (2 CRNAs and a nurse practitioner) systematically reviewed students’ quantitative and qualitative data. The study population included all students who matriculated to the USUHS RNA program between 2005 and 2011. Data sources included the registrar’s computerized student database and individual student records.

For quantitative analysis, noncognitive (ie, nonacademic) students’ attributes were defined as the following: (1) academic status; (2) sex; (3) race; (4) age at matriculation; and (5) cumulative years of registered nursing experience in a monitored care setting. The following were defined as cognitive (ie, academic) student attributes: (1) undergraduate nursing GPA; (2) undergraduate science GPA; (3) verbal, quantitative, analytical, and total scores on the GRE; and (4) completion of organic chemistry or biochemistry with a B GPA within 5 years of matriculation (yes or no).

Academic status was defined as having graduated (ie, successful) vs being dismissed or withdrawing from the program in phase 1 or phase 2 (ie, unsuccessful). Race was categorized as white, black, or other. Acute care experience was defined as the intensive care unit, postanesthesia care unit, labor and delivery unit, emergency room, or operating room. Analytical scores of students who took the GRE after October 2002 were rescaled from a 6-point scale to an 800-point scale. This transformation allowed the inclusion of analytic scores for all students to be considered as a measure of success regardless of date of GRE.
completion, and it facilitated data analysis by allowing computation of a cumulative GRE score by summing the verbal, quantitative, and rescaled analytical scores.

Data were examined for normality. No statistical deviations were observed. Continuous data are presented as mean and standard deviation, and categorical data are presented as number and percent. Statistical tests compared students who graduated with students who were dismissed or withdrew from the program before graduation. Student t test and χ² tests of association were used for between-group comparisons as appropriate. In addition, bivariate logistic regression models were used to compute odds ratio (OR) effect sizes, with 95% confidence intervals using logistic regression, to estimate the magnitude of the relationship between students' attributes and program success. For categorical variables (sex, race, and chemistry course completion), an OR greater than 1 indicated that a student with the given attribute was at greater odds of successful program completion compared with students without the attribute. An OR less than 1 indicated that a student with the attribute was at lesser odds of being successful in completing the program compared with students without the attribute. For continuous variables (age, years of monitored care experience, GPA, and GRE scores), an OR greater than 1 indicated that each unit increase in the variable placed the student at greater odds of successfully completing the program. An OR less than 1 indicated that each unit increase in the variable placed the student at lesser odds of successfully completing the program. All data analyses were conducted using SAS software (SAS Institute Inc) with an α level of .05, two-tailed. Because of the exploratory nature of the project, adjustments were not made for multiple comparisons.

Qualitative data were extracted from the individual records of all students dismissed or withdrawn to further explore factors associated with attrition. Possible reasons for attrition were identified by reviewing the following: (1) written narratives from academic advisors; (2) documentation from Student Promotions Committee (SPC) meetings with information surrounding remediation and probation; (3) written plans to informally monitor progress and other recommendations; (4) letters written by the students, the program director, the Graduate School of Nursing dean, and other officials in the university; (5) student-specific documents from the National Board of Certification and Recertification for Nurse Anesthetists, and (6) other miscellaneous documents to identify personal circumstances, professional circumstances, academic challenges, and clinical challenges that may have contributed to the individual student's withdrawal or dismissal from the program. Of particular interest was the academic phase of departure (phase 1, didactic; or phase 2, clinical), student's departure status, withdrawal or dismissal, and official reason for departure, academic or nonacademic.

Results

Analysis of completion of the RNA program included 180 students who were enrolled in the RNA program from 2005 to 2011. Of the 180 students, 40 (22.2%) were unsuccessful as evidenced by voluntary withdrawal or by dismissal from the program in phase 1 (n = 22; 12.2%) or phase 2 (n = 18; 10%). Successful and unsuccessful students are compared by demographic characteristics in Table 1 and by academic characteristics in Table 2. Bivariate OR effect sizes for student demographic and academic characteristics are presented in Table 3. A greater proportion of female students successfully completed the program (P < .01), with 3.32 times the odds of success compared with male students. Successful students were also significantly younger (P < .01), with each additional year of age being associated with a 13% decrease in the odds of success (OR = 0.87). Successful students earned higher GPAs while completing their undergraduate bachelor of science in nursing degrees (P = .04), with each GPA point being associated with 7.12 times the odds of success. Successful students also achieved higher analytic (P = .04) and total (P < .01) GRE scores than students who withdrew or were dismissed before graduation, with each analytic or total GRE score point being associated with 1.005 or 1.003 times the odds of success, respectively. Race, years of experience in an acute care setting, quantitative and verbal GRE scores, and proportion of students who completed a recommended chemistry course before matriculation were not significantly different between students who graduated and students who withdrew or were dismissed from the program.

Other factors affecting student attrition included personal illness, family illness, other family problems, change in motivation, and academic problems (Table 4).
For those students with purely academic problems, half left in phase 1 and the other half left in phase 2. Students who left the program in phase 2, during their clinical rotations, were more likely to be placed on probation and undergo remediation. Personal illness, family illness, and other family problems, together comprised the largest category for withdrawal or dismissal, with 19 students in this group. Many of these students (40%) required remediation and were placed on probation at some point while enrolled in the program. About one-third of those who were unsuccessful went through extensive SPC board processes, which required that the student receive remediation, be put on probation, or be terminated from the program. All these students had the option to appeal the SPC's recommendation by writing an appeal to the dean. In each appeal case, however, the dean supported every recommendation made by the SPC.

Students who left the program because of change in motivation or professional interest, as opposed to academic challenges, were more likely to leave in phase 1 than phase 2. Five of the 24 who left the program for personal reasons had a motivational change, believing that nurse anesthesia was no longer the correct career choice. The overlap of personal issues with academic problems, whether didactic or clinical, made it difficult to definitively determine which had greater influence in final withdrawal or dismissal decisions. A few circumstances were clearly tragic and unavoidable, and could not have been anticipated; however, a large number of departing students left the program because of a combination of personal and academic factors and required a tremendous amount of faculty support.

**Discussion**

The USUHS RNA program’s student attrition for the classes 2005 through 2011 was significantly affected by personal, family, and motivational factors. This finding was unexpected, since extensive remediation and SPC involvement for many struggling students led the faculty to believe that cognitive factors were the reason for lack of success. Life circumstances and personal issues played a pivotal role in attrition, similar to other studies in which factors other than basic demographic and academic predictors were found to be important contributors.¹⁻³,¹³⁻¹⁴

We would like to point out that our USUHS RNA program grading system does not allow for grades lower than “B”; because of this, some students choose to withdraw from the program before the end of the semester.
to avoid the impact of a poor grade on their military career. For students in this study, academic problems in combination with personal illness, family illness, and other family issues contributed most toward attrition, and changes in academic interests contributed least. Subsequent discussions with the RNA program director and faculty addressed those areas where process changes could positively affect student progression and outcomes.

The findings of this study indicate that student characteristics affected success in the program. In order of magnitude of effect, student characteristics that can be used to guide admission decisions were undergraduate GPA, GRE analytic score, and GRE total score. Although unsuccessful students were more likely to be male and older than successful students were, it is unethical and illegal to use gender and age for admission decisions. However, students with these characteristics may benefit from greater oversight or earlier referral to supportive services, especially when male gender or increasing age are present in the same student or in combination with lower GPA and/or lower GRE scores. Particularly troubling were students in good academic standing who left the program because of loss of motivation. As seen in other studies, these students may not have been fully aware of the role and responsibilities of the CRNA and may have benefited from job shadowing before enrollment.

Each potentially successful student who leaves represents a tremendous loss of invested time and money for the federal government. Although altered admission interview processes might prevent some students from seeking admission, student loss of motivation remains a threat to program completion. To combat this potential loss of motivation, the RNA program has initiated a group mentoring program. Students participate in scheduled mentoring program. Mentoring program. From Registered Nurse Anesthesia Program for Students Enrolled 2005-2011 (N = 40) Data are presented as number (percent).


<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Odds ratio</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female sex (reference = male)</td>
<td>3.32</td>
<td>1.22-9.03</td>
</tr>
<tr>
<td>Nonwhite race (reference = white)</td>
<td>0.86</td>
<td>0.40-1.83</td>
</tr>
<tr>
<td>Age in years at matriculation (per year)</td>
<td>0.87</td>
<td>0.81-0.94</td>
</tr>
<tr>
<td>Years of acute care experience (per year)</td>
<td>1.07</td>
<td>0.92-1.24</td>
</tr>
<tr>
<td>Bachelor of science in nursing GPA (per point)</td>
<td>7.12</td>
<td>1.99-25.51</td>
</tr>
<tr>
<td>Undergraduate science GPA (per point)</td>
<td>1.85</td>
<td>0.82-4.16</td>
</tr>
<tr>
<td>Graduate Record Examination scores (per 10 points)</td>
<td>1.042</td>
<td>0.998-1.089</td>
</tr>
<tr>
<td>Quantitative score</td>
<td>1.042</td>
<td>0.998-1.089</td>
</tr>
<tr>
<td>Verbal score</td>
<td>1.047</td>
<td>0.997-1.100</td>
</tr>
<tr>
<td>Analytical score</td>
<td>1.046</td>
<td>1.001-1.093</td>
</tr>
<tr>
<td>Total score</td>
<td>1.032</td>
<td>1.008-1.056</td>
</tr>
<tr>
<td>Completed chemistry course within 5 years (reference = no)</td>
<td>0.80</td>
<td>0.37-1.70</td>
</tr>
</tbody>
</table>

Table 4. Categories With Frequencies for Attrition From Registered Nurse Anesthesia Program for Students Enrolled 2005-2011 (N = 40)

<table>
<thead>
<tr>
<th>Category</th>
<th>Total</th>
<th>Phase 1</th>
<th>Phase 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Personal illness (mental health or physical health problem)</td>
<td>5 (12.5)</td>
<td>4 (10)</td>
<td>1 (2.5)</td>
</tr>
<tr>
<td>Family illness (death or illness of family member)</td>
<td>6 (15)</td>
<td>3 (7.5)</td>
<td>3 (7.5)</td>
</tr>
<tr>
<td>Other family problems (family issues such as divorce)</td>
<td>8 (20)</td>
<td>4 (10)</td>
<td>4 (10)</td>
</tr>
<tr>
<td>Motivation (change in academic interest)</td>
<td>5 (12.5)</td>
<td>3 (7.5)</td>
<td>2 (5.0)</td>
</tr>
<tr>
<td>Purely academic failure (no other issues identifiable)</td>
<td>16 (40)</td>
<td>8 (20)</td>
<td>8 (20)</td>
</tr>
</tbody>
</table>

Abbreviation: GPA, grade point average. 
All odds ratios are unadjusted.

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factors such as locus of control, trait anxiety, emotional intelligence, and critical thinking abilities were not captured, although they may have contributed to student attrition. The authors acknowledge that students may have been misclassified during content analysis because those who failed for academic reasons may have had life or health events but chose not to disclose these. In addition, lack of adjustment for multiple hypothesis tests inflates the risk of type I error. However, we believe the fact that our students are enrolled continuously for 36 months, have expectations for B or better grades, often relocate their entire family to attend nurse anesthesia studies at our university, and face the possibility of being deployed shortly after graduation to a combat or terrorist region, are all factors that can potentially affect progression and success in our program. The USUHS School of Medicine, which is also a uniformed program with unique student educational and professional requirements, has faced similar issues and observed the impact of noncognitive/nonacademic factors on student success.\textsuperscript{12}

We are pleased to report that changes we instituted have had a positive effect on student progression. We have lost only 1 student from the class of 2014, and all others are doing very well.

**Conclusion**

Study results led to a number of important changes in the USUHS RNA admission process and in the nonacademic mentoring and assistance offered to students. These included increasing the total GRE score and minimum GPA standards for admission, initiating an in-depth student candidate interview with the program director, and instituting a student group mentoring program to help sustain student motivation to complete the program. Recommendations were made to the program director to disclose the realities to applicants, whose anxiety or confidence issues can make it difficult for them, that they are entering a rigorous and often stressful professional program. The program director wants applicants to know the realities of the program, that expectations are high, and that there can be an impact on personal and family life. It is up to the student to decide if he or she can cope with these expectations and stressors. Lack of progression in the program is usually multifactorial.

Because of the influence of health or family problems on the success of RNA program students, there is a need for ongoing support that includes education about wellness, stress, and coping strategies. Faculty must remain alert to nonacademic student issues because a student who might otherwise fail to progress can benefit from a leave of absence to more effectively cope with personal or family health problems. Through a critical analysis of admission and remediation processes, the USUHS Graduate School of Nursing faculty recognizes a variety of factors can influence student progress. Faculty members are committed to provide individually tailored support through programs and other interventions, making every effort to facilitate student success.

**REFERENCES**


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