The American Journal of Surgery (2014) 207, 623-627

The American Journal of Surgery®

Surgical Education

# Higher clinical performance during a surgical clerkship is independently associated with matriculation of medical students into general surgery

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**KEYWORDS:**
General surgery;
Academic measures;
Residency;
Predictors

**Abstract**

**BACKGROUND:** The purpose of our study was to determine the predictive impact of individual academic measures for the matriculation of senior medical students into a general surgery residency.

**METHODS:** Academic records were evaluated for third-year medical students (n = 781) at a single institution between 2004 and 2011. Cohorts were defined by student matriculation into either a general surgery residency program (n = 58) or a non–general surgery residency program (n = 723). Multivariate logistic regression was performed to evaluate independently significant academic measures.

**RESULTS:** Clinical evaluation raw scores were predictive of general surgery matriculation ($P$ = .014). In addition, multivariate modeling showed lower United States Medical Licensing Examination Step 1 scores to be independently associated with matriculation into general surgery ($P$ = .007).

**CONCLUSIONS:** Superior clinical aptitude is independently associated with general surgical matriculation. This is in contrast to the negative correlation United States Medical Licensing Examination Step 1 scores have on general surgery matriculation. Recognizing this, surgical clerkship directors can offer opportunities for continued surgical education to students showing high clinical aptitude, increasing their likelihood of surgical matriculation.



Despite a steady number of medical students matching into general surgery positions over the past 4 years, recent studies show a shrinking pool of practicing surgeons in the workforce.[1–5] From 1985 to 2005, the number of general surgeons per 100,000 people in the United States declined by 25.91%.[5] Furthermore, it is predicted that the general surgery field will have a 9% workforce shortage by the year 2030.[3] This phenomenon is attributed to an increasing population over the age of 65 with more health care needs combined with a greater proportion of surgeons entering retirement than being trained. Facing a shrinking surgical workforce, 1 study estimates a 31.5% workload increase for surgeons from 2000 to 2020.[6] To meet the growing demand for general surgeons, increasing the number of training positions and active recruitment of medical students into general surgery is crucial.

The authors declare no conflict of interest.

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Manuscript received March 8, 2013; revised manuscript July 10, 2013

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http://dx.doi.org/10.1016/j.amjsurg.2013.07.037

Historically, matriculation into surgical residency programs has been associated with measures of academic achievement. Many small studies have evaluated the relationships of surgical matriculation to United States Medical Licensing Examination (USMLE) Step 1 and Step 2 scores, medical school class rank, surgical clerkship grades, Alpha Omega Alpha membership, research experience, and the Medical Student Performance Evaluation.[1,2,7–10] In addition to academic achievement, studies have shown that preclinical interest in surgery and individual experience during the third-year surgical clerkship impact students' decisions to pursue a surgical career.[11–15]

To address the projected increase in surgical workload and the declining number of surgeons in the workforce, the need to increase the number of available training positions and active recruitment of medical students into these positions will be paramount. We hypothesized that the academic achievements met during the third-year surgical clerkship could be used as a marker to predict interest in pursuing a career in general surgery and may be used by programs to identify potential candidates. The purpose of this study was to identify academic markers recognizable during medical students' surgical clerkship predictive for eventual matriculation into general surgery residency.

## Methods

Academic records were retrospectively evaluated for third-year medical students (N = 781) at a single institution between 2004 and 2011. Third-year medical students were grouped by their matriculation into either a general surgery residency program (n = 58) or a non–general surgery residency program (n = 723). Demographic information and matriculating field of training were collected and are shown in Tables 1 and 2, respectively. During their third-year surgical clerkship, all academic measures were collected and recorded. Academic measures evaluated in the study included clinical evaluations, the National Board of Medical Examiners (NBME) surgical shelf examination, the clerkship essay examination, the clerkship technical skills examination, USMLE Step 1 and Step 2 scores, the clerkship history and physical examination score, and the final clerkship grade.

Clinical evaluations at our institution are administered by service attending surgeons and chief residents. The clinical evaluation is divided into 5 categories: patient care, medical knowledge, interpersonal and communication skills, self-directed and life-long learning skills, and global patient care. Patient care measures the student's ability to complete a history and physical examination and comprehensive patient evaluation, vocalize appropriate diagnostic and treatment plans, recommend appropriate interventions, and perform common procedures. Interpersonal and communication skills measure the student's ability to communicate and collaborate with families and perform as a member of a health care team, and global patient care measures the ability of the student to respect patient diversity and his/her ability to analyze medical issues in the framework of environmental and contextual factors. All these measures are included in our clinical evaluations and are instrumental in determining a medical student's clinical aptitude.

In addition, statistical analysis on all academic measures predicting matriculation into any surgical residency program (n = 180) or a nonsurgical residency program (n = 601) was performed. Surgical residency programs included training in otolaryngology, neurosurgery, obstetrics and gynecology, ophthalmology, orthopedic surgery, general surgery, and urology. All measures were initially evaluated with either a chi-square test or the unpaired *t* test. All variables found to have a *P* value less than .20 were analyzed using a multivariate logistic regression model to evaluate for independently significant academic measures. Significance was defined by a *P* value less than .05. The study was approved by the institutional review board (12080102-IRB01).

## Results

No difference was shown in age or sex between students matriculating into general surgery or a non–general surgery training program (Table 1). Matriculation into general surgery for all medical students enrolled in the study was 7.4%, which is below the estimated 9.0% shortage faced by the field of general surgery. The matriculation rate into any surgical field for medical students enrolled in the study was 29.7%. The individual field of study with the largest matriculation rate was internal medicine with 22.3%. Individual matriculation rates are shown in Table 2.

The median clinical evaluation raw score for matriculation into general surgery was 74.5 compared with 69.5 for matriculation into a non–general surgery residency program ($P < .001$). Multivariate logistic regression showed the clinical evaluation raw score to be independently associated

**Table 1** Student demographics

| Demographic | General surgery | Non–general surgery | All surgical fields | All students | *P* value* |
|---|---|---|---|---|---|
| Number | 58 | 723 | 180 | 781 | |
| Age | 26 | 26 | 26 | 26 | .41 |
| Male (n, %) | 28 (48) | 353 (49) | 97 (54) | 381 (49) | .52 |
| Female (n, %) | 30 (52) | 370 (51) | 83 (46) | 400 (51) | .52 |

Age in years at graduation.
*Analysis between general surgery and non–general surgery cohorts.