



# Effect of Community and Academic Surgical Rotation Sites on Medical Student Performance Outcomes and Career Choices

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**OBJECTIVE:** We hypothesize that students exposed to both academic and community surgery clerkship sites will have higher National Board of Medical Examiners Subject Exam in Surgery (NBME SES) scores and be more likely to pursue a career in a surgical specialty.

**DESIGN:** The NBME surgery subject exam scores and National Resident Matching Program (NRMP) results were collected for all medical students rotating through the surgery clerkship over 4 years. Permutations of sites were analyzed against exam scores and match rates into surgical and nonsurgical specialties.

**SETTING:** This study was performed at the Tulane University School of Medicine, in New Orleans, Louisiana, United States of America.

**PARTICIPANTS:** Data for a total of 910 students rotating through the surgery clerkship over a period of 4 years was collected and analyzed.

**RESULTS:** There was no statistical difference in NBME subject exam scores ( $p = 0.44$ ) or match rates into a surgical specialty ( $p = 0.13$ ) as stratified by site placement. Average NBME surgery subject exam scores were higher for those pursuing a surgical specialty ( $p < 0.001$ ).

**CONCLUSIONS:** The combination of sites experienced during the surgery clerkship did not affect NBME surgery subject exam scores nor lead to a tendency to match into a surgical specialty. (*J Surg Ed* 76:970–974. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

**KEY WORDS:** Surgery clerkship, National board of medical examiners subject exams, surgical career, medical student education, community rotation sites

**COMPETENCIES:** Medical Knowledge, Systems-Based Practice

## INTRODUCTION

The purpose of the third-year medical student clerkship in surgery is to provide a foundation of surgical knowledge that is essential for any type of physician. Certain studies have demonstrated that student experiences during this clerkship can influence perception of the surgical field and may affect whether students choose to match into a surgical specialty.<sup>1-4</sup> Because of the possibility of influencing such a substantial decision, it is paramount to assess the quality of the clerkship experience. However, in recent years, this has become more challenging. In 2018, it is estimated that medical school enrollment will have increased by 30% since 2002 to 2003.<sup>5</sup> As such, institutions must expand the number of clinical rotation sites to accommodate increasing class size. Additional sites are often community-based practices with new affiliations to the medical schools. It is unclear whether this increased diversity and exposure benefits students or instead, leads to a less educational quality experience secondary to a decrease in clerkship centralization and structure. The Liaison Committee on Medical Education (LCME) has also recognized the importance of this concept in its standards for medical school accreditation.<sup>6</sup>

At Tulane University School of Medicine (TUSOM), the third-year medical student surgery clerkship requirements include 2 separate 4-week clinical service assignments and participation in a standardized weekly

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didactic curriculum. Eleven separate clinical sites with seventeen unique surgical services are included. The didactic curriculum is standardized and includes weekly faculty and resident lectures, mortality and morbidity conference, grand rounds, case presentations, and skills lab. Inevitably, secondary to the variety of clinical sites, student's experiences vary significantly in the number of hours spent in the operating room, floor management, resident or attending teaching, and self-directed study. It seems logical that this may affect performance in the clerkship, specifically on the National Board of Medical Examiners Subject Exam in Surgery, and ultimately career specialty choice. In order to assess this possibility, we aim to identify if the placement of students during the TUSOM surgery clerkship across 11 separate sites influences the performance on the NBME Surgery Subject Examination. We also seek to identify if site placement will affect match rates into a surgical residency through the National Residency Matching Program (NRMP). We hypothesize that students exposed to clinical experiences at both academic and community rotation sites have higher subject exam scores and will be more likely to pursue a career in a surgical specialty

## MATERIALS AND METHODS

We performed a retrospective analysis on de-identified NBME Surgery Subject Exam data for 910 students who completed the surgery clerkship at TUSOM from 2012 to 2016. This NBME exam is a standard examination used across most accredited institutions. The 17 clinical services available for students in the surgery clerkship, located at 11 different hospital sites, were divided into 2 categories: academic or community. Academic sites were defined as sites where general surgery residents and faculty of TUSOM worked. Community sites were defined as sites where there was no resident involvement in the educational process, since the presence of residents even in a community setting mandates such academic activities as resident-led rounds and teaching within the operating room and clinic. All students participating in the surgery core clerkship rotated at 2 different sites for a total of 8 weeks. Each rotation at a given site was 4 weeks in duration. The students were

randomly assigned to the 2 sites. Permutations of site combinations were analyzed against student's NBME exam scores using a one-way ANOVA. Available data from the NRMP match program for this same cohort were then analyzed to compare clinical site combinations to matched specialties. Specialties were grouped as surgical or nonsurgical and compared to sites with a chi-squared test. Surgical specialties included: general surgery, integrated plastic surgery, obstetrics and gynecology, orthopedic surgery, otolaryngology, neurologic surgery, and urology. All other specialties were considered nonsurgical.

## RESULTS

### Site Placements Versus NBME Surgery Subject Exam Scores

The average shelf exam scores were  $75.5 \pm 8.01$  for students who rotated at 2 community sites ( $n = 141$ ),  $75.9 \pm 8.26$  for students who rotated at 1 academic and one community site ( $n = 493$ ), and  $75.1 \pm 8.82$  for students who rotated at 2 academic sites ( $n = 276$ ). One-way ANOVA revealed there was no significant difference between these groups ( $F(2,909) = 0.83$ , MS error = 70.47,  $p = 0.44$ ). When order of the sites was taken into account, there remained no significant difference between the groups in regards to shelf scores ( $t(491) = 1.17$ ,  $p = 0.24$ ). Table 1 summarizes these results.

### Site Placements Versus Match Rates into a Surgical Specialty

Two-hundred thirty-one students in this cohort matched into a surgical specialty and 647 matched into a nonsurgical specialty. Of the 231 students who matched to surgical specialties, 59 rotated through 2 academic sites during the surgery clerkship (26%), 33 rotated through 2 community sites (14%), and 139 rotated through both an academic and a community site (60%). Table 2 displays this data. Of the 647 students who matched into a nonsurgical specialty, 204 rotated at 2 academic sites (32%), 102 rotated at 2 community sites (16%), and 341 (52%) rotated at both an academic and community site during the surgery clerkship. There was no significant relationship identified between

**TABLE 1.** Site Placements Versus NBME Surgery Subject Exam Scores

Rotation Site	Number of Students	Average NBME Score (N = 910)*
2 Community	141	$75.5 \pm 8.01$
1 Community, 1 Academic	493	$75.9 \pm 8.26$
2 Academic	276	$75.1 \pm 8.82$

\*One-way ANOVA indicated no significant difference between these groups ( $F(2,909) = 0.83$ , MS error = 70.47,  $p = 0.44$ ).

**TABLE 2.** Site Placements Versus Match Rates into a Surgical Specialty

Rotation Site*	Surgical Specialty (N = 231)	Nonsurgical Specialty (N = 647)
2 Community	33 (14%)	102 (16%)
1 Community, 1 Academic	139 (60%)	341 (52%)
2 Academic	59 (26%)	204 (32%)

\*Comparing site to student specialty, there was no significant relationship found between the site and eventual student specialty ( $\chi^2 (2) = 4.02, p = 0.13$ ).

clerkship site type and matched specialty category ( $\chi^2 (2) = 4.02, p = 0.13$ ). For those students who rotated at both an academic and a community site, there was also no relationship between site order and the specialty match category ( $\chi^2 (1) = p = 0.57$ ).

### NBME Surgery Subject Exam Scores Versus Match Rates into a Surgical Specialty

The average shelf exam scores for those matching into a surgical specialty ( $n = 231$ ) was  $77.3 \pm 8.67$  ( $n = 231$ ) and  $75.1 \pm 8.20$  for those matching into a non-surgical specialty ( $n = 647$ ). Students matching into a surgical specialty had significantly higher exam score ( $t (876) = 3.41, p < 0.001$ ). This data is summarized in [Table 3](#).

## DISCUSSION

This study sought to evaluate whether the combination of academic and community clinical sites experienced by medical students during the surgery would affect student performance on the NBME Surgery Subject Exam or the decision to match into a surgical specialty. We hypothesized that students who rotated at both academic and community sites would have the highest NBME subject exam scores and greatest number of students matching into surgical specialties. This was based on the thought that these students would be exposed to the largest variety of cases and clinical practices. However, we found no significant correlation between placement at any combination of academic or community clinical sites and NBME subject exam scores or match rates into surgical specialties. We did find that students matching into surgical specialties had significantly higher NBME Surgery Subject Exam scores. The significant difference in average exam scores was only 2 points and likely would not have changed overall clerkship grades for students, but we believe this still demonstrates a notable

trend when correlated with the tendency of students to match into a surgical versus nonsurgical specialty.

The influence of various factors on student performance in the surgery clerkship and the resultant tendency of students to match into a surgical specialty have been studied extensively in the literature.<sup>7-13</sup> Through retrospective analysis of data from a single institution, Myers et al. noted that NBME subject exam scores were higher for those students experiencing higher clinical volumes on services despite less self-study time.<sup>7</sup> In contrast, Rentea et al. performed a retrospective analysis of data from a single institution and did not find a statistical correlation between assigned paired clinical sites for the surgery rotation and NBME Surgery Subject Exam scores.<sup>10</sup>

Others have studied the effects of case volume and types of cases observed during the clerkship—a function of the rotation sites—on the tendency of students to match into surgical specialties. O' Herrin et al. divided students from a single institution into 3 groups: those matching into categorical general surgery, surgical subspecialties, or all other residencies. Case volumes were similar for all 3 groups but students matching into categorical general surgery participated in significantly more abdominal and general surgery procedures.<sup>2</sup> Hagopian et al. performed a retrospective review at a single institution on case volume and time spent in the operating room for a cohort of students; neither amount of time spent in the operating room or numbers of cases observed by the students were associated with a tendency to match into a surgical specialty.<sup>12</sup>

Additionally, authors have sought specifically to address the effects of community hospital rotations on surgery clerkship performance. Imperato et al. performed an analysis on data from a single institution regarding student performance after rotations at the principle teaching hospital and affiliated teaching hospitals in the form of NBME subject exam scores, oral exam scores, clinical appraisals, and student's clerkship evaluations.<sup>8</sup> There was a significant difference in NBME

**TABLE 3.** NBME Surgery Subject Exam Scores Versus Match Rates into a Surgical Specialty

Specialty Category	Number of Students Matching	Average NBME Exam Score	p value
Surgical Specialty	231	$77.3 \pm 8.67$	< 0.001
Nonsurgical Specialty	647	$75.1 \pm 8.2$	

subject exam scores and clerkship evaluations that favored some affiliated hospitals over the principle hospital, and the authors concluded that the education obtained at the affiliated hospitals was at least equivalent to the principle hospital. Ng and McKay performed a review of the literature to evaluate surgery clerkship training in affiliated community hospital sites versus tertiary teaching hospitals and noted no significant difference in written exam or clinical performance evaluations, suggesting that affiliated sites were comparable.<sup>9</sup> Ng and McKay noted that regardless of clerkship training locations, positive role models are important in influencing the choice of a surgical career. This correlates with the findings of more recent systematic reviews on the topic of factors determining career choices in surgery. Marshall et al. found that positive experiences during the surgical placement were associated with increased interest in surgical careers—this included involvement in operative procedures, a welcoming environment, and avoidance of syncopal events.<sup>1</sup> Schmidt et al. also identified several factors associated with the decision to pursue a career in surgery, including mentorship, surgical experience, stereotypes, timing of exposure, and personal factors.<sup>13</sup>

Although we did not specifically study case volume or time in the operating room for each rotation site type, we do believe the findings in our study represent important trends to consider with regard to student rotations at community hospitals and overall performance in the surgery clerkship, as well as the tendency to pursue surgical specialties. The community sites associated with our institution do not have resident involvement and therefore, students tend to have greater involvement and opportunity in the operating room, in addition to full mentorship from staff surgeons since residents are not present. At academic sites, students are taught and mentored by both faculty and residents but may have less direct operative experience. As both types of rotations have their own advantages and drawbacks, it would seem logical that a student who could rotate at both would have the most educational experience with the broadest exposure to surgical pathology, thus performing better on the NBME Surgery Subject Exam. These students would also see diversity in surgical careers resulting in a greater likelihood the student would pursue a surgical career. This was not reflected in our data, as there was no significant difference found in subject exam scores and the numbers of students matching into surgical specialties. Although this finding was unexpected, it provided reassurance regarding the quality of the overall clinical experience of the surgery clerkship, which is of the utmost importance as medical school administration across the nation seeks to expand clinical rotation sites to accommodate increasing numbers of students.

With a total of 17 clinical rotation services available, we report on one of the most diverse pools of rotation sites available to medical students in the current literature. We hope that our results encourage other institutions to explore additional sites to broaden the clinical education opportunities as this may not weaken their aggregate experience. Diversifying the experience by offering clinical rotations at community sites in addition to traditional academic sites may in fact encourage interest in fields which students may not otherwise pursue. It exposes students to a larger variety of not only cases but also lifestyles and patient populations which they may otherwise not see. Students may find mentorship in affiliated community sites in addition to traditional academic clinical sites, and this may encourage pursuit of a career in surgery. It is important to ensure a degree of standardization; for instance, this could be done by having one curriculum that all students are responsible for regardless of location.

There are several limitations to this study. Self-selection bias exists in this study, as many students have decided to pursue a surgical career prior to the surgery clerkship or even prior to matriculation into medical school. These students may request specific rotation sites or may spend more time studying for the NBME subject exam. This in fact may be reflected in our study by the fact that students matching into surgical specialties had higher scores on the NBME Surgery Subject Exam. Future work may include pre- and postcourse surveys to identify such pre-existing interest and the bias which may result. Additionally, this data originates from a single academic institution which limits the generalizability of this work. Multi-institutional studies on factors contributing to student performance and leading to selection of and matriculation into careers in the fields of general surgery and all related subspecialties are needed.

## CONCLUSIONS

Though students at our institution rotate through an assorted combination of surgical practices at both academic and community sites, this diversity did not result in significant differences in NBME Surgery Subject Exam scores or the tendency to match into a surgical specialty. There was a correlation of higher NBME Surgery Subject Exam scores with those students matching into surgical specialties, but this did not correlate with clinical rotation sites. These findings suggest the overall quality of the surgery clerkship is not determined by site alone, and future studies may help to further evaluate and address additional underlying factors.

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## SUPPLEMENTARY INFORMATION

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