

Improving Medical Student Mentorship in Orthopaedic Surgery

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ABSTRACT

Introduction. Owing to limited clinical clerkships and travel restrictions related to COVID-19, recent medical student mentorship in orthopaedic surgery has been impacted negatively. The purpose of this quality improvement (QI) project was to determine if medical student awareness of orthopaedics as a possible career field may be improved through a mentoring program designed and delivered by orthopaedic residents.

Methods. A five-resident QI team developed four educational sessions aimed at a medical student audience. Forum topics included: (1) orthopaedics as a career, (2) fracture conference, (3) splinting workshop, and (4) residency application process. Pre- and post-forum surveys were administered to student participants to assess changes in their perceptions regarding orthopaedic surgery. Data derived from the questionnaires were analyzed with nonparametric statistical tests.

Results. Of 18 forum participants, 14 were men and 4 were women. A total of 40 survey pairs were collected, averaging 10 per session. In the all-participant encounter analysis, there were statistically significant improvements in all outcome measures including interest in, exposure to, and knowledge of orthopaedics; exposure to our training program; and ability to interact with our residents. Those undecided regarding their specialty demonstrated larger increases in post-forum responses, suggesting that the learning experience was more impactful for that subgroup.

Conclusions. This QI initiative was a successful demonstration of orthopaedic resident mentorship of medical students, wherein perceptions of orthopaedics were influenced favorably by the educational experience. For some students with limited access to orthopaedic clerkships or formal one-on-one mentoring, forums like these may be an acceptable alternative. *Kans J Med* 2023;16:48-52

INTRODUCTION

The cornerstone of medical education, mentorship, is the guidance provided by an experienced physician to a medical student or novice physician-in-training. The mentor teaches, supports, and counsels the protégé for the purposes of personal and career development in preparation for the young physician to assume responsibilities in patient care, peer education, and medical leadership.¹⁻³ Mentors are advocates

for their pupils during residency, fellowship, and beyond. Without exception, they also serve as role models of professional honesty and integrity.⁴

The importance of mentorship in medical training is embodied in the first vow of the Hippocratic oath: "To hold my teacher in this art equal to my own parents...; to impart precept, oral instruction, and all other instruction...to indentured pupils who have taken the physician's oath..."³ This passage not only highlights the high esteem afforded mentors by protégés, but also reminds all physicians of their obligation to be mentors to the next generation of physicians-in-training who will inherit their patients and practices. Mentors certainly may derive personal satisfaction from this succession planning and from the accomplishments of the protégé as an extension of their own achievements.⁵

Medical student mentorship in orthopaedic surgery, however, varies considerably from institution to institution.⁴ For instance, in a recent survey of orthopaedic surgeons at academic residency programs, Brook et al.⁶ found that 50% of respondents did not have mentors during their undergraduate medical training. Like many other medical schools, our institution offers a two-week rotation in orthopaedic surgery for third-year students and a four-week elective rotation for fourth-year students applying for orthopaedic residency, but has no formal medical student mentoring program. Moreover, while our students must complete musculoskeletal (MSK) clinical skills training and competency checkoffs during matriculation, there is no MSK clinical rotation requirement (e.g., orthopaedics, rheumatology, or physical medicine and rehabilitation) for third- or fourth-year students. Senior students, therefore, often select a residency without ever having considered MSK-related specialties as viable options for their own careers.

In March 2020, the opportunity for medical student exposure to the field of orthopaedics further was compromised by the COVID-19 pandemic. In our program, in-person educational conferences in orthopaedics were suspended for several weeks and virtual sessions only were held for the remainder of the calendar year. During this period, orthopaedic away rotations for medical students nationwide were restricted severely or altogether suspended in some locations, thereby limiting opportunities for student interaction with orthopaedic faculty at other residency programs.⁷

In this context, our residents proposed establishing an orthopaedic education program to create a framework for medical student mentorship. Undertaken as a quality improvement (QI) project, the goals of this program were to familiarize medical students at our institution with orthopaedics as a potential career choice, to increase student-resident interaction, and to foster and cultivate orthopaedic mentorship.

METHODS

Setting and Participants. This study was conducted at the University of Kansas School of Medicine-Wichita (KUSMW) in the Department of Orthopaedic Surgery. The five-member QI team, comprised of one resident from each PGY level, was one of four resident QI teams in our department. During every academic year, each resident team is expected to identify a quality issue concerning the residency, medical education, or local healthcare delivery; formulate and implement an intervention to foster quality improvement; evaluate

the effectiveness of the intervention; analyze the data derived from the study; and disseminate the project results. While designed and executed by residents, QI projects such as the study reported herein are authorized and overseen by department leadership. This study did not require Institutional Review Board approval.

Early in the 2021-22 academic year, the resident QI team in this study developed four one-hour educational sessions specifically for a medical student audience, MS-1 through MS-4. Each session or forum was advertised through a KUSMW-wide email invitation to all medical students on campus. The meetings were held every other month from November 2021 to May 2022 and were scheduled on weeknights at 5 pm in the hope of maximizing student attendance. The students who were mentored by the resident team during these forums agreed to participate in this QI study.

Quality Improvement Intervention. The orthopaedic surgery forums (Table 1) were designed as concrete learning experiences for the participants in accordance with experiential learning theory.⁸ Each session provided the learners with an opportunity for either: (1) direct hands-on experience (fracture conference, splinting workshop) and/or (2) interactive discussion with resident mentors (introduction to orthopaedic surgery, residency application process). The forum learning experience was intended to stimulate student interest in the specialty of orthopaedics, to promote further student-resident interaction, and to prompt students to consider orthopaedic surgery as a potential career choice.

The first session consisted of a podium slide presentation describing a career in orthopaedic surgery and the many subspecialties within orthopaedics. The presentation also provided students with a more detailed explanation of our residency program and the resources available for interested students to obtain additional information. This was an interactive session during which resident mentors encouraged students to ask questions.

The second forum was a classic fracture conference, an interactive podium presentation on the common fractures encountered by residents-in-training and general orthopaedists in practice. Students were shown radiographs of distal radius fractures, tibial shaft fractures, femur fractures, and ankles fractures and were asked to interpret the films. Emergency management of these fractures was discussed, as well as non-operative and operative treatment options.

The third session was a splinting workshop, a hands-on experience for students to learn the basics of splint application and molding for common fracture patterns. Residents demonstrated the application of various plaster splints, including sugar-tong splint, long-arm splint, and short-leg splint. Following the demonstrations, students had the opportunity to practice splint application and molding on their classmates.

The final forum was an interactive panel discussion concerning orthopaedic away rotations, residency applications, and the match process. After a podium slide presentation, there was a question-and-answer session with KUSMW graduating medical students from the class of 2022 who recently had matched into orthopaedic surgery residency. Junior students were advised how to improve away rotation performance and how to strengthen their residency application.

Table 1. Summary of orthopaedic surgery forums for medical students.

Introduction to Orthopaedic Surgery
Podium presentation describing a career in orthopaedic surgery
Subspecialties within orthopaedic surgery (e.g., hand, spine, pediatrics)
KUSMW orthopaedic residency program
Educational resources to learn more
Fracture Conference
Interactive presentation of common fractures
Examples included distal radius, femoral shaft, and tibial shaft fractures
Discussed emergency department management of fractures
Outlined nonoperative and operative treatment options
Splinting Workshop
Hands-on workshop format
Residents demonstrated splint applications and molding techniques
Common types included long-arm, sugar-tong, and short-leg splints
Medical students practiced splint applications on classmates
Residency Application Process
Panel discussion Q&A format with applicants who matched into orthopaedics
Medical student opportunity to ask questions about the application process
Discussed value of orthopaedic surgery away rotations
Methods to strengthen residency application before the match

Evaluating the Intervention. Anonymous pre- and post-forum questionnaires were administered to all medical student attendees at each session. Authored by the resident QI team, these surveys obtained student demographic data including medical school year, gender, specialty interest, and previous exposure to orthopaedics. The before- and after-forum surveys also were used to rate participant experience on a 1-10 (lowest to highest) integer scale for five key inquiries which served as outcome measures (Table 2). Paired responses for each encounter were analyzed to evaluate the forum influence on participants.

Table 2. Five questions asked of medical student participants before and after each orthopaedic forum.

Please rate the following on a lowest-to-highest 1-10 integer scale.
1. How would you rate your interest in orthopaedic surgery (regardless of your desired specialty)?
2. How would you rate your ability to interact with the KUSMW orthopaedic residency program?
3. How would you rate your exposure to orthopaedic surgery?
4. How would you rate your exposure to the KUSMW orthopaedic surgery residency program?
5. How would you rate your knowledge/understanding of orthopaedic surgery?

Data Analysis and Reporting. Data from the surveys were uploaded to the Research Electronic Data Capture (REDCap[®]) system^{9,10} for management and analysis. REDCap[®] is a web-based software program used for secure data capture. This research tool is provided to investigators by the University of Kansas Medical Center.

Categorical responses were summarized as frequencies and percentages. Ratings data were analyzed as medians and interquartile ranges. Bivariable analyses included the Wilcoxon Signed Ranks exact test (for sparse data). IBM SPSS Statistics, version 29 was used to conduct all two-sided analyses with an alpha level after Bonferroni adjustment for multiple tests¹¹ set at 0.0033 (0.05/15).

The Standards for Quality Improvement Reporting Excellence in Education (SQUIRE-EDU) guidelines¹² were used as the framework for reporting this QI study.

RESULTS

Participant Characteristics. Eighteen of the estimated 195 medical students on the KUSMW campus (9%) attended at least one of the orthopaedic educational forums during the 2021-22 academic year (Table 3). There were 14 men and 4 women. Participants included five first-year students, five second-year students, six third-year students, and two fourth-year students. Many of the attendees were members of the KUSMW Orthopaedic Interest Group.

Table 3. Medical student participation by year and by forum.^a

Year in KUSMW	MS-1	MS-2	MS-3	MS-4	All Students
Number of students on KUSMW campus	28	28	66	73	195
Unique student participants	5	5	6	2	18
Medical student forum ^b					
Orthopaedics as a career	2 (2, 0)	5 (4, 1)	3 (1, 2)	2 (2, 0)	12 (9, 3)
Fracture conference	2 (1, 1)	4 (2, 2)	3 (1, 2)	2 (2, 0)	11 (6, 5)
Splinting workshop	4 (2, 2)	4 (2, 2)	3 (1, 2)	0	11 (5, 6)
Residency application process	0	0	6 (3, 3)	0	6 (3, 3)
Participant encounters for all forums ^b	8 (5, 3)	13 (8, 5)	15 (6, 9)	4 (4, 0)	40 (23, 17)

^aSome students attended more than one orthopaedic forum.

^bValues are number of student encounters (decided, undecided).

The first three sessions were well attended, but the last forum on the residency application process was attended only by third-year students. The survey administered at each forum asked the participant to declare if he or she had decided on a career in orthopaedic surgery or if they were undecided. For all four sessions, 40 questionnaire sets were collected, 23 being completed by those who were decided on orthopaedics

and 17 by undecideds who often were considering orthopaedics and other surgical specialties such as general surgery, ophthalmology, and plastic surgery as possible career choices. All but one student had some previous exposure to orthopaedic surgery through meetings, lectures, patient encounters, or clinical rotations.

Pre- and Post-Forum Comparisons. For each participant encounter, survey responses to the five key outcome questions (Figure 1) before the forum were compared to the responses after the forum. The after-forum Likert scale integer rating increased for most participant encounters for responses to four of the five questions. Orthopaedic knowledge increased in 35 of 40 encounters (nearly 88%); exposure to our residency improved in 30 of 40 (75%); exposure to orthopaedic surgery in general was better in 25 of 40 (almost 63%); and ability to interact with residents in our program was enhanced in 21 of 40 (about 53%). However, interest in orthopaedics was heightened in only 12 of 40 survey comparisons (30%).

These before- and after-forum responses were compared for three study cohorts: (1) all participant encounters, (2) encounters of students who had decided on a career in orthopaedics, and (3) encounters of those who were undecided on a career field (Table 4). Increases in the post-forum Likert scale ratings for each of the five key outcome questions were found to be statistically significant in the analysis of all-participant encounters ($p < 0.001$ for each comparison). These differences were more pronounced in the undecided cohort where the before-forum ratings were generally lower than in the decided cohort. For example, those who were undecided significantly increased their orthopaedic knowledge rating from median of 5 to 7 ($p < 0.001$), as compared to the decided cohort where both pre- and post-forum ratings were median of 7 ($p = 0.066$).

DISCUSSION

This QI study demonstrated that the intervention of orthopaedic forums prepared for medical students improved their perceptions both of orthopaedic surgery as a career and of our specific residency program. Comparison of questionnaire response data of all study participant encounters before and after the forum experience showed statistically significant increases in all five outcome measures including medical student exposure to orthopaedic surgery, interest in orthopaedics, knowledge of orthopaedic topics, exposure to our residency program, and ability to interact with our residents. Results suggested that the sessions were more impactful for students who were undecided regarding career choice compared to those who already were committed to an orthopaedic career. Overall, this QI intervention was a successful exercise in orthopaedic resident mentorship of medical students.

Effective surgical residents have been shown to influence medical students strongly to pursue surgical careers. In a five-year study of third-year medical-student rotators in general surgery, Musunuru et al.¹³ found that a statistically significant higher percentage of students exposed to residents judged to be the best clinical teachers and most effective role models graduated to residency in a surgical specialty (12% of this cohort) compared to students exposed to the least effective resident mentors (5% of this group). The authors suggested leadership and teaching workshops for residents during their training may produce more effective surgeon educators in the future.

Table 4. Comparison of before- and after-forum survey responses for all encounters and as a function of career choice.

Outcome Inquiry	All Encounters (n = 40)			Decided for Orthopaedics (n = 23)			Undecided on Career (n = 17)		
	Before	After	p	Before	After	p	Before	After	p
Interest in orthopaedic surgery	9 (8, 10)	9 (9, 10)	< 0.001	9 (9, 10)	10 (9, 10)	0.125	8 (7, 9)	9 (9, 9)	0.004
Ability to interact with residents	8 (7, 8)	8 (8, 9)	< 0.001	8 (7, 8)	8 (8, 9)	< 0.001	8 (7, 9)	9 (8, 9)	0.009
Exposure to orthopaedic surgery	7 (5, 8)	8 (6, 9)	< 0.001	7 (6, 8)	8 (7, 9)	0.003	6 (5, 7)	7 (6, 8)	< 0.001
Exposure to our residency program	7 (4.5, 8)	8 (7, 9)	< 0.001	7 (5, 9)	8 (7, 9)	< 0.001	6 (4, 7)	8 (7, 9)	< 0.001
Knowledge of orthopaedics	6 (5, 7)	7 (6, 8)	< 0.001	7 (6, 7)	7 (6, 8)	0.066	5 (4, 7)	7 (6, 8)	< 0.001

Notes: Survey responses are ratings ranging from 1 to 10 (lowest to highest impact). Before- and after-forum values are medians (interquartile ranges). Wilcoxon Signed Ranks exact test for ordinal responses with sparse data. p values < 0.0033 indicate significant differences between before- and after-forum responses.

In a survey of applicants to a single orthopaedic residency program, Yong et al.¹⁴ determined that medical students highly valued advice from residents in their home program above all other resources, including advice from medical school counselors, information from the Accreditation Council for Graduate Medical Education, and web-based data sources. The authors attributed this finding to orthopaedic residents being more approachable than faculty members and being more familiar with the nuances of the recently navigated application process. The investigators recommended that institutions foster resident mentoring opportunities in collaboration with orthopaedic surgery interest groups as was accomplished in our study.

Assessing why medical students choose orthopaedics as a career, Johnson et al.¹⁵ surveyed fourth-year students and PGY-1 orthopaedic residents at eight training programs in the United States. They reported that orthopaedics-bound respondents were influenced strongly by experiences prior to medical school, as often was reflected in the personal statement of their residency application. Surprisingly, more than twice as many men as women committed to orthopaedics before medical school. The survey also revealed that 80% of female applicants compared to 56% of male candidates experienced their most important orthopaedic career influence during clinical rotations in medical school. Accordingly, the authors suggested that a useful strategy to increase the proportion of women in orthopaedics was to provide early exposure to the specialty in medical school. Similar recommendations regarding the education and mentoring of medical students intended to foster diversity in the orthopaedic workforce have been made by others.¹⁶⁻¹⁸

Investigators at Harvard created a half-day program of skills workshops and panel discussions in the BONES (Bringing Orthopaedics to New England Students) initiative¹⁹ which was designed to raise female medical student awareness of orthopaedic surgery as a possible career choice. Over a three-year period, 155 women students from all New England allopathic and osteopathic medical schools participated with 97% characterizing the program as extremely useful. Among 59 match-eligible participants, 22 of them (37%) matched into an orthopaedic residency, thereby demonstrating that the outreach program was effective improving student interest and gender diversity in the specialty. Owing to the limited number of orthopaedic clinical clerkships, the mentorship provided in programs like the BONES initiative

and our QI project may be the only exposure to orthopaedics for some medical students and thus may serve as model programs for other institutions to emulate.

The need for mentoring of orthopaedic residents during their training was also well documented in the literature. A 2008 census survey of orthopaedic residents nationwide found that while 96% of 506 respondents believed mentors were beneficial or crucial to their training, just 51% had a mentor at the time of the survey.²⁰ About 10 years later, resident respondents to two similar surveys uniformly agreed that mentorship played an important role in their development as orthopaedic residents with 65% of 243 having a mentor in one study²¹ and 75% of 170 having a mentor in the other.²² While it appeared that mentoring was becoming more widely available to residents in training, some institutions did not have formal mentorship programs for residents or medical students.

This study had several limitations. First, the survey used to assess the impact forums had on medical student participants had not been validated. Second, internal validity of the study may have been influenced adversely by confirmation bias in survey responders. Third, study results may not be generalizable to other specialties, thus negatively impacting external validity. Fourth, due to voluntary enrollment of participants, there was the potential for selection bias in the study sample. Fifth, due to the short duration of the study, objective outcomes such as orthopaedic residency match rates were not quantified.

Despite these shortcomings, this QI project provided a template for effective medical student mentoring. The low-cost endeavor required only the investment of resident time and effort to prepare the program and administrative support to send email invitations to the students. The resident-student personal interactions at these sessions have the potential to: (1) act as a proxy for an elective rotation in orthopaedics, (2) allow residents to develop their mentoring skills, (3) provide medical students with strategies for residency matching, and (4) develop enduring professional relationships. Our residents planned to continue this mentorship program in collaboration with students of the KUSMW Orthopaedic Interest Group. Future medical student mentorship QI projects may include a formal educational lecture series with objective outcome measures such as the successful orthopaedic residency match of program participants.

CONCLUSIONS

In this QI initiative, resident-led educational forums offered medical students an opportunity to become more familiar with orthopaedic surgery, raising awareness of the specialty as a possible career option. Analysis of pre- and post-forum participant survey responses revealed statistically significant improvements in student exposure to, interest in, and knowledge of orthopaedics. Data suggested that the sessions were more impactful for the cohort of undecided students than for those who already were committed to the field. Medical student mentorship programs such as described in this study may be useful wherever elective clerkships in orthopaedics are limited and whenever travel restrictions prohibit orthopaedic away rotations.

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