A Pilot Program: Remote Summer Program to Improve Opportunity and Mentorship Among Underrepresented Students Pursuing Orthopaedic Surgery

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Background: The purpose of this study was to evaluate the impact of an 8-week remote summer program in supporting underrepresented students interested in orthopaedic surgery.

Methods: We received 115 applications, and a total of 17 students participated in the program (14.8%). Nine faculty mentors were matched with 1 or 2 students each. The program delivered a curriculum from June-August 2021 consisting of (1) weekly instructional courses on research-related topics led by a content expert; (2) weekly faculty lectures discussing topics including orthopaedic topics, diversity in medicine, leadership, and work-life balance; and (3) a research experience paired with a faculty mentor and peer mentor. We surveyed students to measure skill progression, satisfaction, and overall program evaluation. Preprogram/postprogram evaluation, midprogram check-in, and student feedback surveys were collected.

Results: Program participants represented a range of race and ethnic backgrounds, research experience levels, and various geographic locations across the United States. The cohort included a high rate of female (42%) and Black (35%) participants. On average, postprogram survey scores indicated that participants believed that the summer program improved their research skills (9.6 of 10), improved their orthopaedic interest (8.9 of 10), and improved mentorship and networking (9.1 of 10). For feedback surveys, 14 respondents of 15 total responses (93%) felt they were adequately matched to their faculty mentor. Twelve (80%) felt they had realistic deliverables for research projects within the 8-week program. Thirteen (87%) indicated they contributed to an abstract or manuscript as a coauthor.

Conclusion: Our findings indicate that students improved their research skills, interest, and confidence to pursue orthopaedic residency and mentorship/networks in the field. The long-term goal is to improve the accessibility and quality of mentorship for underrepresented students in order to foster an equitable pathway into the field of orthopaedic surgery.

Introduction

In December 2018, the American Academy of Orthopaedic Surgeons Board of Directors approved a 5-year strategic plan that included diversity as a strategic goal. The organization released the American Academy of Orthopaedic Surgeons Governance Diversity Report in June 2020 indicating a baseline...
for improving diversity among the volunteer structure, member engagement, and applicant selection. Although there has been a small increase in women and underrepresented minorities (URMs) holding leadership and member positions, these groups comprise less than 15% of the total positions. A recent report from an orthopaedic residency program indicated that the greatest barrier to improving diversity programs is the lack of representation from URMs among their faculty.

The need for equity and inclusion in orthopaedics to improve diversity and representation has been well documented. Nonprofit organizations such as Nth Dimensions, the Perry Initiative, and Women in Sports Tech were founded to bridge the gap between access and opportunity for underrepresented groups as a pathway into the field of orthopaedic surgery. After the COVID-19 pandemic and shelter-in-place orders, many institutions had to abruptly cancel summer programs, which left hundreds of medical students without an experience to bolster their background for competitive residency programs. Students from disadvantaged backgrounds were likely disproportionately affected by this lack of opportunities, further widening the diversity gap in orthopaedics. With a robust research infrastructure, our institution is in a privileged and unique position to positively influence equity and inclusion efforts because research opportunities are a common entry point for students pursuing a career in the field.

The goal of this pilot program was to determine the feasibility of implementing and executing an 8-week remote summer program for women and URM students interested in orthopaedic surgery. The program aims to improve access and exposure to orthopaedic research opportunities for underrepresented students, in addition to increasing the availability of structured remote research opportunities for students during summer periods. The long-term goal is to improve the accessibility and quality of mentorship for underrepresented students in order to foster an equitable pathway into the field of orthopaedic surgery.

**Materials and Methods**

**Screening and Interviewing**

The program description and application were advertised on the department website along with various social media accounts from January to March 2021. For targeted outreach, we worked with colleagues who are alumni of historically Black colleges and universities to distribute program details. The application form consisted of a brief online survey (using REDCap) requiring demographic and contact information, a resume, and a short essay detailing qualifications and interests. Students were selected based on a set of basic criteria: identified as an underrepresented student within orthopaedics (i.e., women, URM, and/or first-generation college), research experience level (i.e., novice, intermediate, or advanced), ability to access courses and materials remotely, research interest fit with faculty mentors, and ability to legally work in the United States. All applications were evaluated, and those meeting the criteria were followed up by email with a set of additional details and questions. We interviewed a total of 27 students through Zoom using a standardized set of interview questions, and 18 students were offered placement in the program by April 2021. A total of 17 students accepted and participated from June to August 2021.

**Program Design**

Our program consists of 3 main components: (1) weekly instructional courses on research-related topics, (2) weekly faculty guest lectures discussing various orthopaedic topics, and (3) an 8-week research experience with an assigned faculty mentor and a peer mentor. Each student received a stipend (approximately $3,000) for participating. Research experiences involved a range of activities such as conducting literature reviews, study design, data collection, curation, and/or analysis. A copy of the pilot program’s 2021 curriculum, including a complete list of the weekly instructional courses and faculty lecture topics, can be accessed in the Appendix. Other program activities included Q&A sessions with “student ambassadors” (i.e., medical students who worked in the department) and orthopaedic surgery residents within our institution and ad hoc training sessions conducted by research coordinators on resources such as REDCap and working with “big data sources.”

**Mentorship Matching**

Program administrators distributed a department-wide email requesting faculty mentors for the pilot program. A total of 9 faculty mentors agreed to participate and were followed up with a handout detailing the program goals, mentorship expectations, and deliverables. Each faculty mentor was matched to 2 students based on research projects available and overall fit with the student’s experience and orthopaedic interests. The student pairs were matched based on varying experience levels (one early learner and one advanced learner) to promote peer-to-peer mentorship, with the “advanced learner” taking on an additional mentorship role for the “early learner.” An advanced learner was defined as a student with over 2 years of research experience in any field and/or experiences with conducting independent research. Early learners were defined as any student with less than 2 years of experience, with most of them having little to no research experience before the program. Once faculty-student matches were assigned, student participants met one on one with their faculty mentor ahead of the program start date to discuss goals and potential projects. Faculty mentors were expected to meet at least weekly with student participants throughout the 8-week program.

**Program Delivery**

All components of the program were delivered fully remotely from June to August 2021. For those requiring access to secure data for their research projects, encrypted laptops were mailed to students for use throughout the program. The program hosted a Welcome Orientation session for all participants. Orientation topics included timetick duties and required hiring documentation, email access and library resources, department contact information, and program goals and expectations. The program materials were presented using handouts and/or PowerPoint slides and conducted over Zoom video. The style of course
delivery varied by instructor (i.e., lecture-based, discussion, breakout rooms with activities). All course materials could be assessed within a shared Google Drive, including video recordings of the instructional courses and lectures. To optimize scheduling and participation, courses and lectures were held on the same day and time every week. For example, instructional courses occurred each week on Mondays from 12 to 1 PM and faculty lectures (1-2x per week) on Wednesdays and Fridays from 12 to 1 PM. Faculty lectures were scheduled at least 3 months in advance. If a scheduling conflict arose, we were able to reschedule with the faculty mentor within 1 week. On the last day of the program, the program manager held a 1-hour “offboarding” virtual meeting to discuss student feedback and experiences.

**Data Collection and Analysis**

Student demographic information was obtained from the application surveys (Table I). Other surveys were developed and disseminated to participants and faculty mentors at various time points. Student participants were surveyed to measure skill progression and satisfaction. Faculty mentors were surveyed to assess productivity and student skill building, program satisfaction, and feedback. Preprogram/postprogram evaluation, midprogram check-ins, and student feedback surveys were all collected and analyzed. All surveys were collected anonymously and completed within 1 week.

**Funding and Total Spending**

The pilot program was awarded a departmental grant ($50,000 for one year). Most of the funding was allocated to participant stipends. We partnered with the College of Idaho, contributing $5,000 as a scholarship opportunity for one of their undergraduate students to also participate in the pilot program. This partnership allowed us to assess the feasibility and appropriateness of including undergraduate students in the program. Other programmatic costs included a total of 10 laptops, FedEx shipping costs, costs related to onboarding and background checks, and participant gifts. Total program spending for the 1-year pilot program was $52,490.37 (U.S. Dollars (USD)).

**Results**

**Participant Demographics**

We received 115 applications from January to March 2021 and selected 17 students to participate in the program (15%). Student participants represented a range of race/ethnic backgrounds, research experience levels, and a high rate of female (42%) and Black (35%) participation and came from various geographic locations across the United States (Table I). A total of 9 faculty members within the department at our single institution participated as mentors. The faculty mentors ranged in subspecialty areas (e.g., spine, pediatrics, trauma, sports medicine) and years in practice (range: 3-20 years). A total of 3 of 9 faculty mentors were women.

**Participant Outcomes**

All 17 participants completed the preprogram/postprogram evaluation surveys. In postsurvey findings, participants rated program outcomes (research skills, mentorship, interest in orthopaedics) favorably. All participants indicated that they improved research skills, with scientific writing and literature search/review being the skill that they improved the most. There is a strong interest in continuing to improve “presentation” and “grant writing” skills, which could be a course to build out in future years. A majority of student participants believed that the program further increased their interest and candidacy in orthopaedic surgery and strengthened their likelihood of applying to an orthopaedic residency. Several indicated they are now considering taking a gap year to conduct research based on this experience.

**Participant Feedback**

Fifteen of 17 students completed the feedback survey (88%). All respondents reported high satisfaction levels with the program. Fourteen of 15 students felt they were adequately matched to their faculty mentor. Of the 3 program components, most indicated that the research experience contributed greatest to their overall learning, then faculty lectures, and then...
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Participants indicated that the greatest room for improvement was increased access to course materials (i.e., all materials located in an online learning platform such as Canvas or email), more time in the program (increase to 10 vs. 8 weeks), and improvements to specific course content. Regarding course improvements, there was a desire to make content more interactive and to include more advanced research topics. Course delivery (through Zoom video) was highly effective in learning, but participants would have enjoyed additional opportunities to interact with their peers. The top 3 instructional courses were Literature Search and Review, Citation Manager and Bibliography, and Good Presentation Practice. The top ranked faculty lectures were “Diversity and Decision Making,” “Applying to Orthopaedic Residency” hosted by our residency director, and a tie for “Diversity in Orthopaedic Surgery” and “Balancing Family, Volunteer, and Professional Life.” Thirteen of 15 respondents said that they would have contributed to a publication through this program, and most of them (12 of 15) felt that research expectations were realistic.

We also received many positive comments from students regarding the program:

“He [faculty] was incredibly encouraging and motivating and I left that session feeling very inspired about my path to orthopaedics. Immediately after that session, I became much more intentional about seeking out orthopaedic shadowing/mentorship opportunities in my home institution throughout the summer.”

“I think with my mentor it was stressed that it’s a 2-way relationship and that as the mentor, they are also looking to learn from the mentee, so having confidence to speak up and bring your own idea to a relationship can help create a strong mentorship.”

“...before having written the manuscript to our paper, it seemed like an insurmountable task. I am leaving this program with much more confidence in my ability to write.”

Faculty Mentor Feedback

All 9 faculty mentors completed feedback surveys. Majority of the faculty (8 of 9) mentored a total of 2 program participants this summer, with 1 faculty mentoring 1 participant. Nearly all faculty mentors were able to meet weekly with their student, and if not, at least one member of their team was able to meet with participants 1 time per week. Majority (7 of 9) indicated they also worked with other summer students outside this program, and only one mentioned that the workload was “not manageable.” All faculty mentors, except one, indicated they have worked with students previously and felt adequately prepared to take on students this summer. All faculty mentors felt they were appropriately matched to their participants. In addition, all faculty mentors indicated that they would participate again, with only one indicating they could only take one participant in the future. Majority of faculty mentors (5 of 8 responses) felt that 8 weeks was enough time to complete a meaningful research experience. Any negative feedback was directly related to the desire to work with students in-person for additional clinical experiences. However, faculty recognized that remote accessibility is a strength overall and indicated that it did not affect their satisfaction and willingness to participate in the future.

Discussion

Medical students are increasingly challenged with a limited number of research opportunities to prepare for an exceptionally competitive process for orthopaedic residencies. Unfortunately, the financial burden and time constraints to taking on low or unpaid summer internship experiences prohibits those from disadvantaged backgrounds and perpetuates an uneven playing field for applications. Without equitable pathways into the field, URM students are less likely to be admitted and/or pursue orthopaedics as a career, further contributing to the lack of diversity in orthopaedics. Our findings indicate that not only did students gain foundational research skills and orthopaedic knowledge but also felt that their experience made them a more competitive applicant for residency applications and, importantly, gave them a newfound confidence to pursue the field.

Based on student and faculty mentor feedback, we plan to incorporate several improvements. First, many students indicated that they would like increased opportunities for informal peer-to-peer interactions. This will be incorporated through designated “office hours,” which will be optional weekly meetings through Zoom hosted by the program manager to answer any questions among participants. We also plan to implement biweekly “coffee chats” where participants have the opportunity to get to know each other, play games, and engage with peer mentors in a less formal setting. We will also host a virtual student poster session at the end of the summer to allow students to showcase their work among colleagues and faculty in a lowstakes environment. Course materials will be organized and delivered through Canvas. Canvas is an online learning platform, where students can access weekly schedules and assignments, lecture recordings, and graded assignments in a single location. Other no-cost learning/cloud-based platforms (e.g., Google Drive) can also be used to organize course materials.

There were some operational and logistical challenges worth mentioning. First, it is advisable to offer a small stipend ($2-3,000 each) to prevent exclusion of students unable to take unpaid opportunities over the summer. Program administrators surveyed students at the end of the program and found that at least a quarter of respondents indicated that they may not have been able to participate if it was unpaid. Second, there was a general interest to increase program length from 8 to 10 weeks. This may be challenging with varying summer schedules across medical schools, which overlapped with our start and end dates. Third, we emphasize the need to appoint a program manager to spearhead various programmatic logistics before, during, and after the program launch. Tasks may include...
interviewing, scheduling courses and lectures, building a curriculum into an online course delivery platform, and more. Frequent check-ins and/or monitoring attendance throughout the program were essential to maintain engagement among students and faculty. Fourth, ensuring there were institutional means to acquire secure data remotely was fundamental to research productivity. To do so, we purchased laptops that were encrypted and shipped directly to students. Laptops were shipped back at the end of the program. Laptops will then be reused for several cohorts over the years. Finally, we suggest prioritizing medical students over undergraduate students. A baseline level of medical proficiency was required to be productive remotely and with minimal supervision (i.e., magnetic resonance imaging measurements, anatomical knowledge).

Overall, we believe that this work serves as a stepping stone in building effective and evidence-based remote programs that can be adopted to continue to expand opportunities for URMs in orthopedics. Our pilot program leveraged digital resources, a team of strong mentors, and a robust research infrastructure with the goal to meaningfully engage students in orthopaedic research. While remote opportunities are becoming increasingly popular, this pilot program underscored the necessity of a thoughtfully curated program that not only includes a research experience but also in combination with instructional courses and lectures for structured learning and mentorship. Findings from this study serve as preliminary evidence of the effectiveness of this program, which will then lead to additional grant opportunities for sustained funding. Our future steps are to partner with other equity-oriented organizations to develop long-standing relationships that serve as a network of diverse faculty for research and professional mentorship among participants. Our team plans to longitudinally track our program alumni and evaluate the impact of this program on student progression toward careers in medicine and orthopaedics.

Appendix

Supporting material provided by the authors is posted with the online version of this article as a data supplement at jbjs.org (http://links.lww.com/BJJSOA/A426). This content was not copyedited or verified by JBJS.

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