



A Plausible Pipeline to Diversifying Orthopaedics: Premedical Programming

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OBJECTIVE: To determine whether premedical programming can address the interest level and perception of barriers to women in orthopaedics held by female high school and medical students.

DESIGN: A thirteen-question paper-based survey was distributed among the high school and medical school participants prior to the January 2020 Perry Outreach Program and Medical Student Outreach Program. After a day of participation in mock procedures and speaker sessions, participants subsequently completed another survey of seven-questions.

SETTING: The Perry Outreach Program and Medical Student Outreach Program were conducted at the University of Alabama at Birmingham campus.

PARTICIPANTS: Participants consisted of high school and medical school women hailing from the Birmingham metropolitan area, who had signed up for the Perry programs via email, outreach to local high schools, and social media interest pages. Participant sampling was stratified by race and level of education (high school vs. medical school).

RESULTS: A total of 36 women, 18 high school and 18 medical school, attended the Perry Initiative events and responded to the pre-event and post-event surveys. Before the Perry Initiative programs, all participants felt women faced more barriers than men in pursuing a career in orthopaedics. Participation in the Perry Initiative event increased average interest in orthopaedics by 28% among high school and 11% among medical school students.

CONCLUSIONS: Prior to the Perry Initiative, 31% percent of the total attendees reported knowing a female orthopaedist. The Perry Initiative improved perceptions

of both high school and medical students regarding the ability of women to have a work/life balance, family life, and children during orthopaedics residency. Medical student participation in the events led to a decreased belief in barriers regarding schedule, family life, perceptions of an orthopaedic surgeon, and perceptions of peers within healthcare setting. (J Surg Ed 79:122–128. © 2021 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Orthopaedics, Undergraduate medical education, Gender, Survey

COMPETENCIES: Professionalism, Practice-Based Learning and Improvement, Systems-Based Practice

INTRODUCTION

Although females make up more than half of US medical school matriculants, female residents only make up 15.3% of total residents and fellows.¹ This gender gap in orthopaedic training programs has long been documented, and various groups have been formed to address the plausible reasons for its existence. For example, the Ruth Jackson Orthopaedic Society (RJOS) was founded in 1983 to support the growing number of female orthopaedic surgeons through mentorship and networking.² Working closely with the RJOS, the Perry Initiative is a nonprofit organization founded in 2009 that focuses on recruiting women to orthopaedics and engineering.³ In 2012, the Perry Initiative launched its first Medical Student Outreach Program (MSOP) which targets first- and second-year female medical students.³ This program uses hands-on surgical activities and networking with female orthopaedists to expose medical students to the field.³ The Perry Initiative has expanded their reach with the Perry Outreach Program (POP), which targets high school students with similar events.

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A study found that the Perry Initiative's MSOP positively influenced women to choose orthopaedic surgery as a profession; in fact, students who finished the program were twice as likely to match into an orthopaedic residency.³ Despite these and other efforts at achieving greater equity within the field, gender disparities persist in orthopaedic surgery, and few data-driven solutions have been presented in the literature.

Recent literature supports the importance of hiring female and underrepresented minorities to faculty positions in order to increase mentorship opportunities and attract future female applicants.⁴ Targeting students earlier in their careers has also been shown to increase interest. This study seeks to determine the extent to which the Perry Initiative Outreach Program influenced female high school and medical students with regards to pursuing a career in orthopaedic surgery and perceptions of barriers to entry and success for women.

METHODS

Participants of the Perry Initiative's POP and the MSOP in January 2020 each voluntarily completed a thirteen-question survey, distributed by paper and collected before the start of each program. No identifiable information was collected during survey distribution. Questions included demographic information such as anticipated graduation year, school of attendance, and racial ethnicity. Participants were asked about the importance of work-life balance and reasons they were more interested in careers other than orthopaedics. Reasons for interest in other careers and specialties outside of orthopaedics included more convenient schedule, more interesting subject matter, greater financial reimbursement, and an "other" category for write-in answers. Students were asked to rate their interest in pursuing orthopaedics as a career on a scale of 1-10. Additional questions targeted perceptions of barriers to women in orthopaedics held by participants, including belief in the ability of women in orthopaedics to have a successful career and family life, to have children during residency, and to take maternity leave during residency. Students were asked if they had known any female orthopaedic surgeons, and if they felt that women faced additional barriers to a career in orthopaedics compared with their male peers including more demanding schedules, difficulties balancing career and family life, a write-in "other" category, and expectations of an orthopaedic surgeon from patients, fellow physicians, nurses, and hospital administration. Lastly, the participants were surveyed regarding whether they believed female orthopaedic surgeons received the same financial compensation as male counterparts with similar experience and training.

Upon completion of the mock procedures and speaking events set up by the Perry Initiative, participants completed a seven-question survey which repeated many of the pre-survey questions. The surveys were collected upon completion and included as *Supplements 1 and 2*. The project was approved by the institutional review board at a major academic center, and the data was analyzed using unequal variance t-test.

SOURCE OF FUNDING

The Perry Initiative POP and MSOP events were supported by funding from Stryker and Sawbones, but the funding did not directly support this investigation.

RESULTS

Thirty-six students attended the Perry Initiative hosted at a Southern institution and completed the pre-event and post-event surveys; eighteen students each from the high school and medical school groups, a response rate of 100%. The majority of students within the high school group were seniors or juniors (83%), with the majority identifying as Black (50%). Demographic information about the participants such as graduation year and race are broken down further in *Supplemental Table 1*. Students in attendance hailed from a variety of public and private schools across the deep South, with most attending schools in the Birmingham metropolitan area. Prior to the Perry Initiative event, the average interest in a career in orthopaedics among the high school group was 6, with no students selecting an initial interest of 10/10. While all high school participants believed female orthopaedists could have a successful career and fulfilling family life, only fifteen believed these women could have children during orthopaedics residency. Even less, eleven, believed women could take maternity leave during residency. Additional responses regarding interest in other specialties/careers, importance of work/life balance, and perception of equal pay for male and female orthopaedists are shown in *Supplemental Table 2*. When asked about whether women faced more barriers than men in the field of orthopaedics, 100% responded in the affirmative. Prior to the event, students felt a barrier for women seeking a career in orthopaedic surgery was upholding the expectations and perceptions of an orthopaedic surgeon from peers in the medical field such as patients, fellow physicians, nurses, and hospital administration (*Fig. 1*).

After the Perry Initiative seminars and mock procedures, women in the high school group rated interest ($p = 0.003$) in pursuing a career in orthopaedics higher,

Pre-Perry Event and Post-Perry Event High School

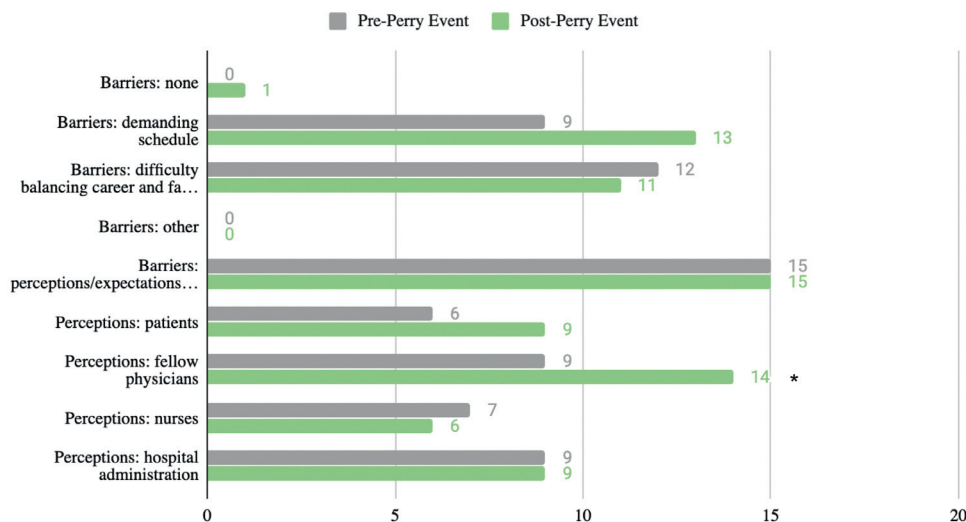


FIGURE 1. demonstrates the survey responses collected from the high school students before and after the Perry Outreach Program event. Perceptions and expectations of an orthopaedic surgeon was the most selected barrier both before and after the program. * indicates $p < 0.05$.

with an average of 7.67, and with three students increasing their interest to 10/10. 89% of high school participants reported an increased interest in orthopaedics. Participants perceived fewer barriers for female orthopaedists in balancing a career and family life, however, more students responded that women are more affected by demanding schedules than their male peers (Fig. 1). Students also believed that females pursuing orthopaedics were likely to encounter stereotypical perceptions/expectations from fellow physicians ($p = 0.04$) that would be a barrier to success in the field (Fig. 1). Belief in whether female orthopaedic surgeons had equal pay compared to their male counterparts increased from seven to eleven after the POP.

Among the MSOP attendees, fifteen were enrolled in allopathic programs, two from osteopathic programs, and one was awaiting matriculation to medical school. Graduation year and racial data of the participants are stratified in *Supplemental Table 1*. Before the Perry Initiative event, initial interest in an orthopaedics career among the medical students averaged 7.17 out of 10, with five students selecting 10/10. Women surveyed were encouraged to share if their interest was greater for another specialty, with answers listed in *Supplemental Table 2*. Eight students selected interest in specialties other than orthopaedics for the following reasons: two selecting more convenient schedules, three selecting more interesting subject matter, and three wrote in answers indicating they were exploring options and had not decided on a specialty. None selected interest in a different specialty due to greater financial reimbursement. Similar to the high school group, 100% of the participants in the medical group felt that women faced

more barriers to a successful career in orthopaedics than their male counterparts. The majority of medical school respondents cited greater barriers for women in balancing schedule (89%), career and family life (78%), and stereotypical perceptions/expectations of an orthopaedic surgeon from patients (89%), fellow physicians (83%), nursing staff (61%), and hospital administration (61%) (Fig. 2). Two participants wrote in additional barriers to a career in orthopaedics, citing perceptions from among their own “social circle” and male athletes having trust in a female surgeon.

When surveyed after the events, average medical student interest in orthopaedics increased to 7.94 ($p = 0.16$), with seven of eighteen students rating 10/10 interest. 94% of respondents felt that female orthopaedic surgeons could have a successful career and family life. After the event, every medical student felt women could have children during orthopaedics residency ($p = 0.04$), with seventeen citing that they believed women could also take maternity leave ($p = 0.04$). Sixteen medical students believed there are gender-based barriers faced by women in orthopaedics. While most medical students initially believed women faced more impediments to a successful career in orthopaedics than their male counterparts, belief in barriers relating to schedule ($p = 0.04$) and perceptions of orthopedists from patients ($p = 0.002$), fellow physicians ($p = 0.0008$), nurses ($p = 0.009$), and hospital administration ($p = 0.009$) decreased after the MSOP (Fig. 2). One student cited the additional barrier of being respected by professional athletes. Seven medical students believed that women in orthopaedic surgery were paid equally to male peers, an increase from the four prior to the Perry Initiative.

Pre-Perry Event and Post-Perry Event Medical School

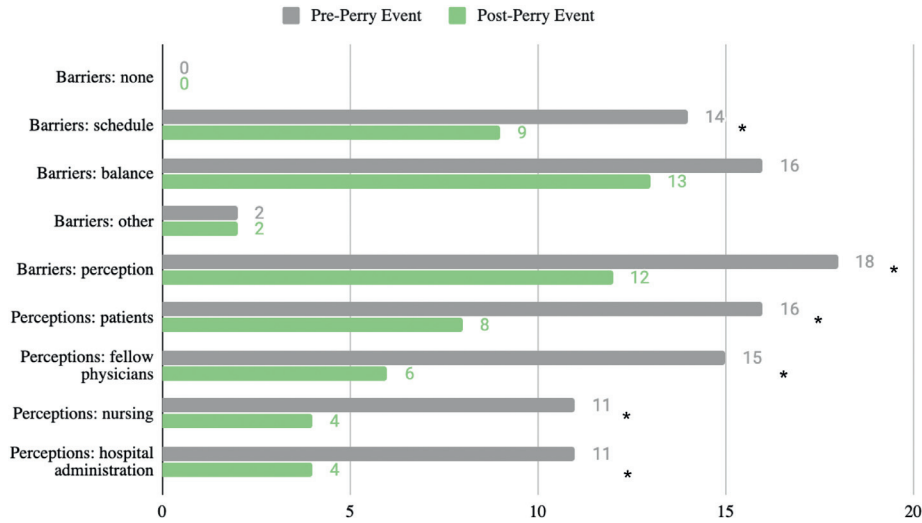


FIGURE 2. demonstrates the survey responses collected from the medical school students before and after the Medical Student Outreach Program. Perceptions and expectations of an orthopaedic surgeon was the most selected barrier before the program and work/life balance was the most selected barrier after the program. *indicates $p < 0.05$.

Among attendees from both groups, overall initial interest in orthopaedics was 6.6, with Hispanic/Latina women having the highest at 7.6 as seen in Fig. 3. After the Perry initiative event, interest increased to an average of 7.8, with Hispanic/Latina women citing the highest interest at 8.4 ($p = 0.19$), followed by White at 8.3 ($p = 0.10$), then Asian at 7.3 ($p = 0.14$), and Black at 6.9

($p = 0.02$) (Fig. 3). Prior to the Perry Initiative, attendees who were non-white had less interest in orthopaedic surgery ($p = 0.02$) and did not cite knowing a female orthopaedic surgeon ($p = 0.004$) compared to white participants. After the events, there were no differences between the groups in any perceptions or interest for the specialty. Initially 100% of medical student

Pre and Post Event Interest in Orthopaedics

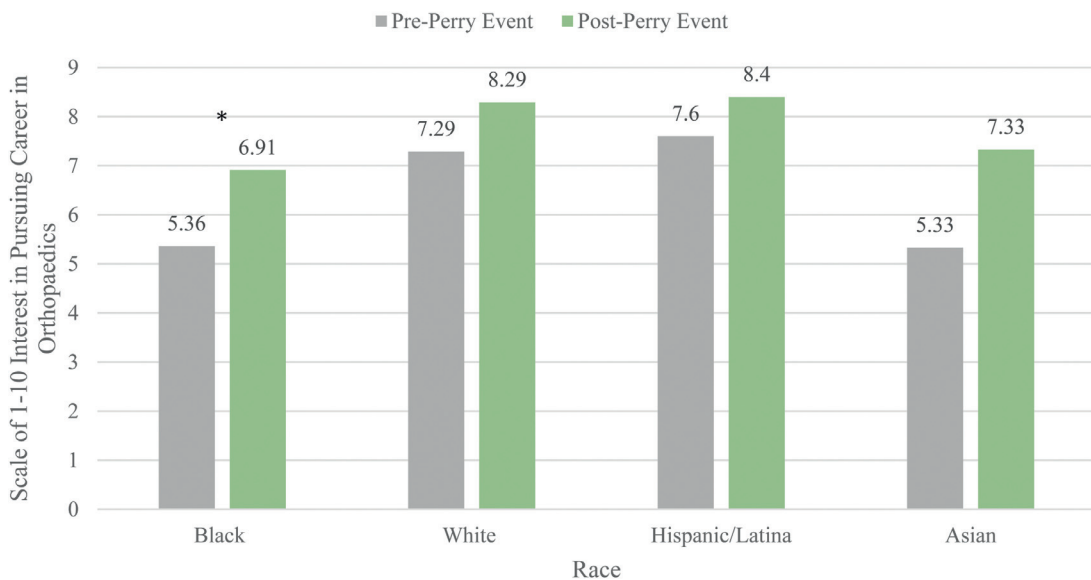


FIGURE 3. illustrates the change in interest the high school and medical school women had in orthopaedic surgery prior and subsequently after the Perry Initiative POP and MSOP, divided by race. The Black attendees rated themselves as most interested in orthopaedics at an average of 7.6. *indicates $p < 0.05$.

participants believed that women faced more barriers to success in orthopaedics than their male peers, which decreased to 78% after the program. Despite these barriers, 94% of medical students still believed that female orthopaedists could still achieve a work-life balance. Interacting with female orthopaedists changed outlook held by medical students regarding barriers to females within orthopaedic surgery, leading to a decreased belief in barriers including schedule (-28%), balance of career and family life (-18%), overall perceptions and expectations of an orthopaedic surgeon (-33%) as well as perceptions/expectations from nurses or administration (-39%), patients (-44%), or fellow physicians (-44%) (Fig. 2).

DISCUSSION

A diverse workforce is critical when it comes to addressing healthcare disparities and treating a diverse patient population.⁵ In fact, patients are more satisfied and comfortable when receiving treatment from a physician of the same sex or race.⁶ Practitioner diversity in patient care is an important component in improving communication and healthcare disparities.⁷ For underrepresented minorities (URMs), having a physician of the same race has been shown to improve health outcomes.⁸ Additionally, studies have shown that patients treated by female physicians are less likely to be readmitted to the hospital and have a lower mortality rate than those of male physicians.⁹ In a 2018 study, 68% of orthopaedic residency directors reported a deliberate effort to recruit underrepresented minorities to their program.¹⁰ As hospital and department diversification is increased to better represent the patients they serve, leadership must consider why this achievement gap remains, particularly in orthopaedic surgery.

The dearth of both females and persons of color in orthopaedics is widely acknowledged. People of non-white ethnicity trail their white peers in both medical school matriculation and orthopaedic residency, making up approximately half of medical students nationally yet only about 30% of orthopaedic residents.¹¹⁻¹³ While females now comprise over half of all medical students, they still only make up 14% of orthopaedic residents – the smallest percentage among surgical subspecialties.¹⁴⁻¹⁶ Not only are the discrepancies in representation from underrepresented minorities in medical school seen nationwide, but they were also notable in the demographics of our study groups. 61% of the high school attendees at the POP were Black or Hispanic/Latina, however, this demographic only represented 28% of the participants at the MSOP. The reasons for low matriculation of female and URM medical students into orthopaedic residency are complex, including a paucity of female

orthopaedic mentors, little exposure to the field during undergraduate education or medical school, perceptions and expectations of an orthopaedic surgeon by physicians and patients, belief that physical prowess is needed for the procedures, challenging schedule, and difficulty with work/life balance.

Without a female orthopaedic mentorship and direct first-hand knowledge of orthopaedics, many female students develop beliefs about the field based on second-hand knowledge from peers and physicians with whom they interact. The difficulty of finding role models who identify as females or underrepresented minorities was highlighted in our data, as 94% of high school students and 44% of medical students denied knowing a female orthopaedist prior to the event. The Perry Initiative programs contend with this issue, as students interact with female orthopaedists throughout the program and are given contact information of the female attendings and residents. Students were not asked whether they had met an orthopaedic surgeon of their ethnicity in this survey. The Perry Initiative is not alone in these efforts; a 2013 survey of female orthopaedic residents found that increased exposure to orthopaedics during earlier stages of their education and an increased focus in female mentorship may help recruit additional females into the orthopaedic workforce.¹⁷ Another organization known as Nth dimensions developed a pipeline curriculum along with a summer internship to expose and mentor minority medical students into careers in orthopaedic surgery. A supporting study found that completing the Nth Dimensions curriculum results in increased application rates of both females and underrepresented minority students into orthopaedic surgery residencies.¹⁸

Similarly, data from the Perry Initiative hosted during this study indicates that many factors can be countered through deliberate outreach to female students that includes female mentorship, combatting misconceptions, and hands-on learning. This study also demonstrates not only are female students and students of color interested in orthopaedics, but that their interest can be increased through programs such as those hosted by the Perry Outreach Initiative. A participant's average interest in pursuing orthopaedics increased over 19% due to participation in the program, from 6.6 to 7.8. This increase in interest was significantly different for black participants ($p = 0.02$), but no significant change in interest was seen in white, hispanic/latina, and asian participants. With a greater number of URM participants in future studies, it is possible significant interest increases could be observed as the number of black attendees was greater than both Hispanic/Latina and Asian participants. In addition, differences in interest and knowing a female orthopaedic surgeon between URM and white participants prior to the Perry Initiative events could have

been observed due to the shift in demographics between the high school and medical school groups. High school student interest was initially lower than medical student interest (6, compared to 7.17), which was expected as high schoolers were more likely to attend due to interest in engineering and science rather than a narrow specialty field. Interest among high school students also increased more dramatically after participation than did that of medical students (+1.67 among high schoolers ($p = 0.003$), +0.77 among medical students, ($p = 0.16$)). Three high school students selected a post-program interest level of 10/10 whereas no students selected this level of interest at the outset, and seven medical students selected 10/10 compared to five students initially. This indicates that while programs such as the Perry Initiative are effective tools for recruitment of women into orthopaedics, the effect may be more significant when geared toward high school students.

The data in this study provides useful insight into how medical schools and orthopaedic programs can better diversify the pool of potential orthopaedic applicants. Through female mentorship, hands on learning through mock procedures, and breaking down misconceptions about the field, the Perry Initiative program engenders confidence in women's ability to have a successful career in orthopaedics. To close the gap in both gender and ethnicity disparity within orthopaedics, academic orthopaedic centers and university leadership should seek to hire diverse faculty and encourage outreach to underrepresented minorities within the community. As Hariri et al. said, "Attracting female medical students to orthopaedics and making orthopaedic subspecialties approachable for women should be a priority to ensure that the field attracts the brightest candidates."¹⁸ Future studies should seek to include the impact of outreach programs such as the Perry Initiative on attracting female university students to the field of orthopaedic surgery. Likewise, more longitudinal studies are needed to appreciate the effect of the Perry Initiative on the application rate of female medical students to orthopaedic programs who had previously attended in high school or medical school.

Prior to the Perry Initiative event, only 31% percent of the total attendees knew a female orthopaedic surgeon. The Perry Initiative improved perceptions of both high school and medical school students regarding the ability of women to have a work/life balance, family life, and children during orthopaedics residency. Medical student participation in the events led to a decreased belief in barriers regarding schedule, family life, perceptions of an orthopaedic surgeon, and perceptions of peers within healthcare setting. Limitations of this study were inherent to survey method collection, such as lack of open-ended questions and narrow response options that did not truly represent participant opinions or beliefs,

although many chose to write in answers. In addition, our study is limited geographically due to the location of the event being in the deep South. Participant bias must also be considered since they chose to attend the event due to personal interests. Initial interest in orthopaedics could have been affected by recall bias as participants may have reported higher interest due to presence at the events.

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SUPPLEMENTARY INFORMATION

Supplementary material associated with this article can be found in the online version at [doi:10.1016/j.jsurg.2021.07.006](https://doi.org/10.1016/j.jsurg.2021.07.006).