

A Cross-Sectional Study of Factors Influencing Orthopedic Surgery Application, Diversity, and Trainee Experiences

Olufunmilola Adeleye, Joseph Brinkman, Soojie Yu, Anikar Chhabra, Lopa Misra

Department of Anesthesiology, Mayo Clinic, Phoenix, Arizona, USA
Email: misra.lopa@mayo.edu

How to cite this paper: Adeleye, O., Brinkman, J., Yu, S., Chhabra, A. and Misra, L. (2024) A Cross-Sectional Study of Factors Influencing Orthopedic Surgery Application, Diversity, and Trainee Experiences. *Open Journal of Anesthesiology*, **14**, 197-208.

<https://doi.org/10.4236/ojanes.2024.1410018>

Received: August 30, 2024

Accepted: October 9, 2024

Published: October 12, 2024

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Abstract

Background: Women and racial and ethnic minorities remain underrepresented in orthopedic surgery. Exploring factors that draw individuals from these demographics to pursue orthopedic surgery and their experiences during training can provide valuable insights into this disparity. We aimed to quantify the current state of diversity in terms of race, ethnicity, gender, and sexual orientation among orthopedic surgery residents and fellows, and to identify factors that influenced their decision to pursue orthopedic surgery. **Methods:** An institutionally validated survey was delivered via Qualtrics to national orthopedic surgery residency programs from January to April 2023. Topics addressed included gender identity, sexual orientation, racial and ethnic background, reasons for pursuing orthopedic surgery, and medical training experiences. Differences between gender and racial discrimination were assessed via Chi-square test. **Results:** A total of 119 orthopedic surgery residents and fellows responded. Of these, 62.2% (n = 74) identified as non-Hispanic White, 60.5% (n = 72) were male, and 86.6% (n = 103) identified as straight or heterosexual. Mentorship was cited by 79.9% (n = 95) of respondents as a critical factor in their decision to pursue orthopedic surgery. Additionally, 23% of female respondents and 4.2% of male respondents highlighted the presence of women and diverse faculty as very important. Gender identity negatively impacted the decision to pursue orthopedic surgery in 15.4% of female and 1.4% of male respondents (p = 0.004). Among underrepresented minorities (URMs), 24.4% reported negative experiences during training compared to 4.1% of non-Hispanic White participants (p = 0.002). Discrimination experiences ranged from 2.6% due to sexual orientation, 20.7% due to race and ethnicity, and 26.3% due to gender and gender identity. **Conclusions:** Discrimination based on race, ethnicity, and gender continues to pose significant challenges for orthopedic surgery trainees. The presence of mentors, particularly women and individuals

from diverse backgrounds, remains crucial in fostering interest in orthopedic surgery among underrepresented groups. Sustained efforts are needed to create a more inclusive and supportive environment all trainees.

Keywords

Diversity, Race, Ethnicity, Gender, Gender Identity, Sexual Orientation

1. Introduction

In the United States, the lack of women and underrepresented minorities (URM) in medicine is well-established and is particularly notable within orthopedic surgery [1]-[4]. Despite long-standing efforts to promote diversity within medicine, equitable representation remains elusive and orthopedic surgery continues to be the least diverse of all specialties [5] [6]. In 2021, the representation of American Indian/Alaska Native, Black/African American, and Hispanic/Latino residents in orthopedic surgery was less than 15%, significantly lower than in other medical and surgical specialties [3] [7]. Additionally, women made up just 18.3% of orthopedic surgery residents, in sharp contrast to their 54% representation within medical schools [2] [8]. In spite of increasing diversity seen across other medical and surgical fields, orthopedic surgery remains predominantly white and male with minimal demographic changes over time [3] [9].

To improve diversity in the workforce, it is proposed that there must be focused, intentional, and consistent effort in supporting and creating positive experiences for trainees. The well-documented benefits of a diverse workforce, including culturally competent care, and alleviating healthcare disparities as well as improved quality, patient outcomes, and satisfaction, underscore the importance of promoting diversity among orthopedic surgery [10]. As a result, numerous medical schools and residency programs have made it a priority to enhance diversity among their matriculants and create a culture of equity and inclusivity [5] [6] [11]. Within orthopedic surgery, there are many ongoing efforts to improve the representation of minority and URM individuals.

Previous studies have investigated factors influencing diverse candidates' application to specific orthopedic residency programs. These studies have revealed that factors including the presence of URM residents or faculty, in addition to overall perceived resident camaraderie, are crucial factors for program selection. [6] Further, it has been shown that URM orthopedic surgery residents considered the absence or presence of URM faculty in their rank list [12]. Recently, the COVID-19 pandemic has significantly impacted residency application cycles by decreasing visiting opportunities for clinical exposure, interactions between applicants and trainees, and assessments of cultural fit [13] [14]. These circumstances have the potential to exacerbate existing barriers that deter diverse candidates from pursuing orthopedic surgery as a career. Beyond the mentioned studies, there is minimal

information regarding the experience of orthopedic surgery residents regarding discrimination based on gender, race, or sexual orientation. Improved understanding of these areas can inform initiatives to create a more inclusive environment and ultimately attract more underrepresented individuals to the field. Equally important is gaining insight into the factors that drive women and URM students to choose orthopedic surgery despite facing perceived discrimination. Therefore, this study aims to investigate the influential factors behind pursuing orthopedic surgery, explore ongoing areas of discrimination during training in orthopedic surgery, and quantify the current state of diversity in terms of race, ethnicity, gender, and sexual orientation among orthopedic surgery trainees.

2. Methods

2.1. Overview

This study utilized data collected from a convenience sample (*i.e.*, nonprobability sampling) of U.S. orthopedic surgery residents and fellows via an anonymous 17-item electronic questionnaire (Qualtrics, January 2023, Qualtrics, Seattle, Washington; see Supplemental Digital Appendix I) [15]. The survey included questions on demographics and focused on topics including gender identity, race/ethnicity, sexual orientation, disability, factors related to the decision to pursue orthopedic surgery, and experiences of discrimination during medical training. The institutional review board at our institution deemed this study exempt.

2.2. Survey Design

The survey was adapted from a model that was previously developed at the authors' home institution, and modified by survey specialists for language clarity and validation of questions on the topics of sexual orientation, race/ethnicity, and gender identity [16]. The institutional committee on diversity, equity, and inclusion (DEI) also was recruited to review and approve of the survey before administration.

2.3. Survey Administration

A Qualtrics survey link was sent to the emails of all allopathic and osteopathic orthopedic surgery residency program directors (PDs) and coordinators listed by the Accreditation Council for Graduate Medical Education (ACGME). These emails were publicly available on the ACGME's Accreditation Data System, and the residency officials were asked to distribute the survey to their trainees. A written statement informing survey respondents of the study aim was included. Respondents were notified that survey completion was completely voluntary, confidential, and anonymous. There was no compensation provided for completing the survey. Four email reminders were sent to program directors and coordinators. Multiple responses from the same IP addresses were excluded to prevent duplicates.

2.4. Statistics

No personal or identifying information was collected. The survey used Likert scale responses where applicable. Descriptive statistics were used to summarize participant survey responses. The proportional difference between gender and racial discrimination was tested using Chi-square. All statistical tests were two-sided. P-values < 0.05 were considered statistically significant. Statistical analyses were performed in R version 4.2.2.

3. Results

Table 1 displays the demographic characteristics of orthopedic surgery residents and fellows who participated in the survey, including their gender identity, race and ethnicity, sexual orientation, and stage in medical training (**Table 1**). There were 119 unique responses obtained. Most identified as non-Hispanic White (n = 74, 62.2%) followed by Multiracial/Other (n = 17, 14.3%), Asian (n = 11, 9.2%), Black (n = 10, 8.4%), Hispanic (n = 6, 5.0%), and Native American or Alaskan Native (n = 1, 0.8%). In terms of sexual orientation, 86.6% reported as straight/heterosexual (n = 103), and 6.7% identified as LGBTQIA+ (n = 8). Over half of the respondents self-reported as male gender (n = 72, 60.5%) and more than half were in their first, second, or third year of residency (n = 74, 62.2%). Most trainees (n = 111, 93.3%) graduated from medical school less or equal to 5 years ago.

Table 1. Demographic characteristics of participants.

Baseline Characteristic	Participants
	n (%)
Gender Identity	
Male	72 (60.5)
Female	39 (32.8)
Non-binary/Non-conforming	1 (0.8)
Prefer not to answer/Other	7 (5.9)
Race and Ethnicity	
White or Caucasian	74 (62.2)
Asian (East/Southeast/Indian)	11 (9.2)
Multiracial or Other	17 (14.3)
Hispanic or Latinx	6 (5.0)
Black or African American	10 (8.4)
Sexual Orientation	
Straight or Heterosexual	103 (86.6)
LGBTQIA+	8 (6.7)
Prefer not to answer/Other	8 (6.7)

Continued

Year in training	
PGY1	37 (31.1)
PGY2	15 (12.6)
PGY3	22 (18.5)
PGY4	18 (15.1)
PGY5	23 (19.3)
Fellow	4 (3.4)
Years from medical school graduation	
>15 years	1 (0.8)
10 - 15 years	2 (1.7)
6 - 10 years	5 (4.2)
≤5 years	111 (93.3)

N = 119. PGY: Postgraduate year; LGBTQIA+: different gender orientations.

Participants were asked to rank the importance of six factors regarding their decision to enter orthopedic surgery: income expectations, opportunities for advancement, patient interaction, role models/mentors, women/diverse faculty, and work life integration (**Figure 1**). Respondents indicated that role models/mentors were very or most important in their desire to pursue orthopedic surgery (n = 95, 79.9%). Most participants (n = 92, 77.3%) reported that patient interaction was very or most important, and 62.2% (n = 74) reported that work life integration was very or most important. Females were significantly more likely to endorse the idea that having women as faculty was very or most important when compared to males (23.1% and 4.2% respectively, p = 0.002).

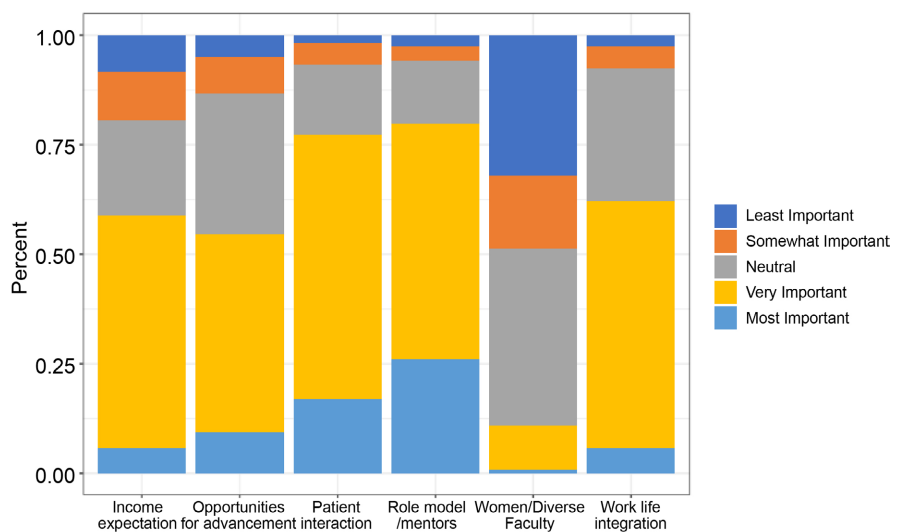


Figure 1. Importance of Factors in deciding to pursue orthopedic surgery.

Experiences of racial, ethnic, gender, or sexual orientation discrimination are noted in **Table 2**. One-fifth of respondents ($n = 24$, 20.7%) reported that they encountered discrimination during the residency application process or as a resident because of their race and ethnicity (66.7% racial and ethnic minorities and 33.3% non-Hispanic White, $p = 0.001$). Similarly, 12% ($n = 14$) reported a negative impact of their ethnic and racial background on their experience as an applicant or trainee (24.4% racial and ethnic minorities and 4.1% non-Hispanic White, $p = 0.002$).

Table 2. Discrimination encountered during the orthopedic surgery residency application process or as a resident.

Discrimination	No		Yes		p-value*
	n	%	n	%	
Due to racial or ethnic background					
Racial and ethnic minority populations	28	30.4	16	66.7	0.001
White	64	69.6	8	33.3	
Total ($n = 116$)	92	79.3	24	20.7	
Due to gender or gender identity					
Female	16	19.0	22	73.3	<0.001
Male	62	73.8	7	23.3	
Total ($n = 114$)	84	73.7	30	26.3	

Furthermore, 26.3% of trainees ($n = 30$) reported that they encountered discrimination during the residency application process or as a resident because of their gender identity. Among these, 73.3% identified as female and 23.3% as male ($p < 0.001$). Similarly, 15.4% of female respondents and 1.4% of male respondents reported that their gender identity negatively impacted their decision to pursue orthopedic surgery ($p = 0.004$). On the other hand, 2.6% of respondents reported experiencing discrimination related to their sexual orientation ($n = 3$) and 2.5% reported that their sexual orientation had a negative impact on their decision to enter orthopedic surgery.

4. Discussion

The findings of the study provide valuable insights into the motivations and discriminatory experiences of residents and fellows in orthopedic surgery, particularly from the perspective of new trainees who make up the majority of respondents. The study revealed that racial and ethnic minorities encounter discrimination during their residency application process or training significantly more often than their counterparts. Moreover, among the various factors influencing trainees' decision to pursue orthopedic surgery, role models and mentors emerged as the most significant, aligning with existing literature emphasizing their positive impact on trainees' career choices [17]-[19].

Interestingly, this study revealed that female respondents were more likely than males to view the representation of women and diverse faculty as significant. Given the current lack of women in leadership positions and the overall lack of diversity in orthopedic surgery academia, this finding may underscore the notion that visibility plays a major role in career aspirations (“if you can’t see it, you can’t be it”) [4] [9] [20]. A study investigating the professional choices of orthopedic surgeons within the Ruth Jackson Orthopaedic Society, a prominent women’s organization, found that despite lack of exposure, women practicing orthopedics were drawn to the specialty by their genuine interest in the field itself [21]. This conclusion challenges the prevailing stereotype that orthopedic surgery predominantly appeals to men, as it demonstrates that the field also interests women. It is therefore likely that initiatives to increase the visibility of diverse faculty—including racial and ethnic minorities—and women in leadership positions may help bridge the gap and attract greater diversity to orthopedic surgery.

Trainees within orthopedic surgery noted that racial, ethnic, and gender identity discrimination was widespread. The discrimination reported by underrepresented minorities (URMs) and women likely stems from a combination of factors. The underrepresentation of diverse faculty in orthopedic surgery not only reduces the visibility of role models for these groups but may also contribute to a workplace culture that is less sensitive to the experiences of minority trainees. The prevailing culture within the field may perpetuate unconscious bias, microaggressions, and a lack of supportive mentorship opportunities for URMs and women. Furthermore, the “minority tax”—the disproportionate burden placed on URM and female faculty to support diversity initiatives—can leave these individuals overextended and less able to provide the mentorship that trainees need [22]. A study highlighting the value of mentorship, particularly for women and URMs, noted the significance of sharing race and ethnicity with mentors but also highlighted existing challenges to implementing mentorship initiatives, including inadequate institutional support and the disparate burden on mentors that are women and URM [19].

A significantly higher rate of URM individuals reported experiences with discrimination and reported that their racial and ethnic background had a negative impact on their training experience. Our findings are supported by studies that reveal URMs consistently encounter higher levels of perceived discrimination, bias, and exclusion compared to other racial groups that are more well-represented [23]-[26]. Stereotype threat, the fear of reinforcing negative stereotypes about one’s social group, is another contributing factor that disproportionately affects Asian and Black trainees [27]. This phenomenon can increase feelings of non-inclusion, negatively impacting their academic performance and sense of belonging [28]. The underrepresentation of URM and female faculty exacerbates these challenges, as trainees are more likely to experience feelings of isolation and perceive themselves as outsiders in predominantly White and male environments. These issues have been linked to higher rates of burnout mental health challenges,

and attrition in training programs [29] [30].

More than one-fourth of the respondents indicated experiencing gender-based discrimination, with the majority of those affected being females and significantly higher than males. In the literature, women surgeons are subjected to more negative feedback, less meaningful surgical autonomy, fewer educational opportunities, as well as overt workplace discrimination based on their gender identity [31]. Specifically in orthopedic surgery, gender bias has been found in letters of recommendation, and female orthopedic surgeons report experiencing higher gender-based and sexual harassment in the workplace compared to males [32] [33]. In light of these results, there is evidence of the potential for increased microaggressions and discrimination for trainees with double minority status by both gender and race [34]. The recognition of these factors highlights the importance of creating inclusive and supportive environments that cater to the various needs of female trainees.

The broader implications of these findings point to the urgent need for systemic interventions that address both institutional culture and mentorship structures. Increasing the representation of women and URM faculty is essential not only for improving diversity but also for creating a more inclusive and supportive environment that benefits all trainees. Fostering mentorship programs that connect URM and female trainees with mentors who share their backgrounds, while also reducing the minority tax on these mentors, will likely have far-reaching effects on trainee satisfaction, retention, and career development. Institutions should take proactive steps to mitigate bias through anti-discrimination policies, targeted mentorship programs, and training on unconscious bias. Regular feedback mechanisms could help institutions identify and address discriminatory behaviors early on, preventing them from becoming ingrained in the culture. Ultimately, improving diversity in orthopedic surgery will require not only increasing the recruitment of women and URM but also creating an environment where diverse trainees feel supported, valued, and empowered to succeed.

Ultimately, these findings suggest that meaningful interventions, such as improving mentorship and reducing stereotype threat, could foster more inclusive environments. Therefore, it is crucial for programs to actively engage in diversity efforts, not only for the benefit of individual trainees but to enrich the field of orthopedic surgery, potentially leading to better patient outcomes and a more dynamic and representative workforce.

This study has certain limitations that necessitate discussion. First, although convenience sampling is widely utilized, especially for its practicality and cost-effectiveness, low number of respondents limit generalizability. Based on 4,334 actively training orthopedic residents and fellows [35], our response rate was comparably low. However, determining the true response rate for this study is inherently challenging due to data tracking and monitoring. For example, out of 189 contacted orthopedic surgery programs, at least 9 declined or had outdated contact information. Similarly, the survey link was emailed to PDs and coordinators,

who then forwarded it to trainees, introducing uncertainties in email receipt, forwarding instances, and opening by residents and fellows. Although it is unclear why the response rate was low, it was comparable to previously completed surveys with similar response rate that have a good representation of the current orthopedic residents [36]-[38]. Other studies using similar methodology report comparable responses, reinforcing the validity of our findings [16] [26]. In addition, surveying physician trainees who are often pressed for time and face survey fatigue adds another layer of complexity [39]. We also cannot exclude the possibility that sampling bias affected the results; for example, our cohort had a larger representation of females than compared to the general orthopedic trainee population. It is important to note that our sample population from a national cohort, mirrors the demographics of the larger U.S. medical school graduate population [7]. Further, as the threshold for a positive response in our series was one point of discrimination, further studies that specifically evaluate the interactions or environments that are most likely to lead to discriminatory behavior would be most helpful in guiding future efforts. Our findings were also potentially limited by the survey's restricted answer choices, potentially oversimplifying the nuanced nature of respondents' experiences. Individuals' experiences are often intricate, multifaceted, and not completely captured by multiple choice questions. Furthermore, despite assuring survey respondents that their responses were optional and anonymous, the accuracy of our results relied on truthful reporting, which may have been susceptible to response bias. Additionally, although the Chi-square test was used to assess differences, the study did not adjust for multiple comparisons, increasing the potential for Type I errors. Future studies should consider statistical methods that adjust for this to further improve the validity of the findings.

5. Conclusion

Experiences of discrimination based on race, ethnicity, gender, and gender identity remain a significant concern among orthopedic surgery trainees, particularly for underrepresented minorities (URMs) and women. The data highlights that mentorship plays a pivotal role in fostering interest and retention in orthopedic surgery, especially for female trainees. To address these disparities, specific actionable recommendations are needed to cultivate a more inclusive and supportive environment. These include expanding mentorship programs, increasing representation in race, ethnicity, and gender diversity, implementing bias training and anti-discrimination policies, and monitoring and evaluating training environments for targeted interventions.

Acknowledgment

Special acknowledgment to Dr. Adam Milam.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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