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Racial, Ethnic, and Gender Diversity in Academic Orthopaedic Surgery Leadership

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Racial, Ethnic, and Gender Diversity in Academic Orthopaedic Surgery Leadership

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Background: Multiple investigations in the past 50 years have documented a lack of racial/ethnic and gender diversity in the orthopaedic surgery workforce when compared with other specialties. Studies in other industries suggest that diversification of leadership can help diversify the underlying workforce. This study investigates changes in racial/ethnic and gender diversity of orthopaedic surgery leadership from 2007 to 2019 and compares leadership diversity to that of other surgical and nonsurgical specialties, specifically in terms of chairpersons and program directors.

Methods: Demographic data were collected from *The Journal of the American Medical Association* and the Association of American Medical Colleges. Aggregate data were utilized to determine the racial, ethnic, and gender composition of academic leadership for 8 surgical and nonsurgical specialties in 2007 and 2019. Comparative analysis was conducted to identify changes in diversity among chairpersons between the 2 years. Furthermore, current levels of diversity in orthopaedic leadership were compared with those of other specialties.

Results: A comparative analysis of diversity among program directors revealed that orthopaedic surgery had significantly lower minority representation (20.5%) when compared with the nonsurgical specialties (adjusted $p < 0.01$ for all) and, with the exception of neurological surgery, had the lowest proportion of female program directors overall, at 9.0% (adjusted $p < 0.001$ for all). From 2007 to 2019, orthopaedic surgery experienced no change in minority representation among chairpersons (adjusted $p = 0.73$) but a significant increase in female representation among chairpersons, from 0.0% (0 of 102) to 4.1% (5 of 122) (adjusted $p = 0.04$). Lastly, a significant decrease in minority and female representation was observed when comparing the diversity of 2019 orthopaedic faculty to orthopaedic leadership in 2019/2020 ($p < 0.05$ for all).

Conclusions: Diversity in orthopaedic surgery leadership has improved on some key fronts, specifically in gender diversity among chairpersons. However, a significant decrease in minority and gender representation was observed between 2019 orthopaedic faculty and 2019/2020 orthopaedic leadership ($p < 0.05$), which was a trend shared by other specialties. These findings may suggest a more pervasive problem in diversity of medical leadership that is not only limited to orthopaedic surgery.

For half a century, the need for racial/ethnic and gender diversity in medicine has permeated the medical profession[1-9]. During its 1968 annual meeting, the Association of American Medical Colleges (AAMC) was among the first to address the need for diversity among physicians, which has been shown to yield better patient-physician communication, higher patient satisfaction, and more physicians working in underserved communities[1-5,10-15]. With the AAMC's diversity task force, many medical schools initiated efforts starting in the 1970s to diversify their student bodies through affirmative action, minority undergraduate student outreach, and increased scholarship aid to minority, female, and rural physicians in training[1-4,16-23]. Another approach to increasing minority and female representation among physicians is top-down diversity, which includes using diversification of leadership to diversify the workforce[24-30]. Diverse representation has not been uniform across sectors of the medical profession, despite the improvements in diversity among medical students[31-44].

Orthopaedic surgery has demonstrated some of the most substantial gaps in racial and gender representation and has frequently "lagged" behind other surgical and nonsurgical specialties[11,35,45-59]. In the early 2000s, the American Academy of Orthopaedic Surgeons (AAOS) and the American Orthopaedic Association (AOA) made commitments to improving leadership

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJS/H34).

diversity through various initiatives[33,60-64]. However, research into the diversity of orthopaedic leadership was limited throughout prior decades, despite national recognition of the problem by the AAOS and AOA. The existing studies have mostly evaluated racial and gender diversity among orthopaedic residents and faculty[20,45-49,54-59]. However, to our knowledge, a full investigation into the diversity of orthopaedic surgery program directors and chairpersons has not been performed.

The purpose of this study was to investigate the diversity of academic orthopaedic surgery leadership using a snapshot comparison of data from 2007, 2019, and 2020. The 2 objectives were to (1) compare the proportional growth of orthopaedic leadership diversity and (2) determine the current state of diversity among orthopaedic surgery program directors and chairpersons in comparison to other surgical and nonsurgical fields.

Materials and Methods

Allopathic and osteopathic demographic data were collected from sources including a publication from *The Journal of the American Medical Association (JAMA)* titled "Graduate Medical Education, 2006-2007,"[65] the AAMC's FACTS Database[66], and specialized AAMC Faculty Roster snapshot reports for 2007, 2019, and 2020 that were provided to us upon request[67-69]. These sources utilize the Graduate Medical Education (GME) Track and IND.IND data tables, which collect self-reported data from Accreditation Council for Graduate Medical Education (ACGME)-accredited residency programs participating in the GME Track Residency Survey. The response rate for this survey was 89.6% in 2007 and 94.8% in 2019[67,68]. Both summary-level resident data on gender[66] and faculty/leadership data[67-69] were obtained from the AAMC; meanwhile, summary-level resident data on race/ethnicity were obtained from *JAMA*[65] because of a lack of 2007 AAMC resident data for race/ethnicity. Fellowship data were not included. Orthopaedic resident and faculty data were curated to analyze the baseline pool from which directors and chairpersons can be selected. Data from these sources were utilized to determine the proportional racial, ethnic, and gender composition of residents, faculty, program directors, and chairpersons at U.S. ACGME-accredited residency programs in 4 surgical fields and 4 nonsurgical primary care fields. The specialties chosen were based on previous publications on diversity in orthopaedic surgery, which allows for more consistent analysis[47,54,55,70,71]. Specifically, orthopaedic surgery, neurological surgery, otolaryngology (ear, nose, throat [ENT]), and general surgery were the analyzed surgical specialties, while internal medicine, family medicine, pediatrics, and obstetrics/gynecology (OB/GYN) were the analyzed nonsurgical specialties.

Race was defined as White, Asian American, Black/African American, or "Other," per the AAMC's Faculty Roster categorization and FACTS Glossary[66,72]. Ethnicity was categorized as Hispanic/Latino or Non-Hispanic/Latino, in accordance with the AAMC's FACTS Glossary[66] and the United States Census Bureau (USCB)[73]. In order for a racial/ethnic category to be individually represented in data analysis, the proportion of individuals for the given race or ethnicity must have exceeded a 5% representation threshold within the general U.S. population, according to the USCB[74,75]. Racial and ethnic groups falling below this threshold were often those with small sample sizes within the investigated populations. As a result, these underrepresented groups, including American Indian/Alaska Native, Native Hawaiian/Pacific Islander, multiracial, Non-Hispanic/Latino, other, and unknown, were combined into the aggregate category "Other." Furthermore, a "Minority" category, defined by the Population Reference Bureau as anyone who identifies with a racial or ethnic group other than non-Hispanic White, was utilized throughout data analysis as a generalized indicator of racial/ethnic diversity[75]. As a result, our "White" category was always defined as non-Hispanic and was thus mutually exclusive to the "Minority" category. Following classification by the AAMC's FACTS Glossary, sex/gender was categorized as male or female, as defined by each subject's self-reported sex[66].

We began with an examination of racial and gender diversity among residents in ACGME-accredited orthopaedic surgery programs in 2007, since program directors and chairpersons were likely chosen from a residency pool that was at least 10 years prior to the 2019 leadership data. Three analyses of diversity of orthopaedic surgery leadership were conducted. First, the most recently available AAMC demographic data were used to analyze the current state of diversity within orthopaedic surgery faculty (2019), program directors (2020), and chairpersons (2019) in comparison to that within the other surgical and nonsurgical specialties. Second, a snapshot comparison of diversity metrics between 2007 and 2019 for chairpersons was conducted to identify any significant changes in female and minority representation. Third, the proportional growth of diversity among orthopaedic surgery chairpersons was compared with the other specialties.

For statistical analysis, comparisons between proportions were completed using a chi-square, or with a Fisher exact test when ≥25% of the sample counts were <5. A Benjamini-Hochberg adjustment was applied to relevant p values, controlling the type-I error rate, and adjusted p values were noted as such. To compare the proportional growth of diversity from 2007 to 2019 between 2 specialties, a Breslow-Day test was used to assess the homogeneity of the odds ratio for comparing 2×2 contingency tables. Significance was set at a p value of <0.05. All analyses were performed using SAS 9.4 (SAS Institute).

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Results

Current Diversity of Leadership in Orthopaedic Surgery Versus Other Specialties

An analysis of current diversity among orthopaedic surgery program directors (2020) and chairpersons (2019) yielded several key findings. Orthopaedic surgery program directors were shown to be 79.5% White and 20.5% minority in 2020 (Table I). Despite no significant differences in minority

TABLE I Diversity of Orthopaedic Surgery Faculty and Leadership (2007 Versus 2019)*

	Faculty			Program Directors	Chairpersons		
	2007	2019	P Value†	2020	2007	2019	P Value†
Race/ethnicity of orthopaedic leadership							
White	79.3%	75.0%	**<0.001**	79.5%	89.1%	87.7%	0.725
Minority	20.7%	25.0%	**<0.001**	20.5%	10.8%	12.3%	0.725
Asian American	10.5%	13.4%	**<0.001**	11.3%	2.0%	4.9%	0.235
Black/African American	2.2%	2.6%	0.302	4.6%	5.8%	3.3%	0.347
Hispanic/Latino	2.0%	2.0%	0.998	3.3%	2.0%	1.6%	0.856
Other	6.0%	7.0%	0.112	1.3%	1.0%	2.5%	0.405
Female	13.9%	19.9%	**<0.001**	9.0%	0.0%	4.1%	**0.039**
Total *(no.)*	2,654	4,355		390 (race/ethnicity), 444 (sex)	102	122	

*AAMC Faculty Roster, December 31, 2007/2019/2020 snapshots[67-69] †Bold indicates a significant difference in the racial/ethnic proportions between the 2 years for the given category ($p < 0.05$). All p values are adjusted using a Benjamini-Hochberg test.

representation among program directors in the 4 surgical subspecialties analyzed ($p > 0.05$ for all) (Fig. 1), orthopaedic surgery had a significantly lower percentage of minority program directors, at 20.5%, compared with the 4 nonsurgical specialties ($p < 0.01$ for all) (Table II). With the exception of neurological surgery, at 9.3% ($p = 0.92$ compared with orthopaedic surgery) (Fig. 1), orthopaedic surgery had a significantly lower percentage of female program directors, at 9.0%, compared with each of the subspecialties analyzed ($p < 0.001$ for all) (Table II).

Furthermore, an analysis of diversity among chairpersons in 2019 revealed that orthopaedic surgery chairs were

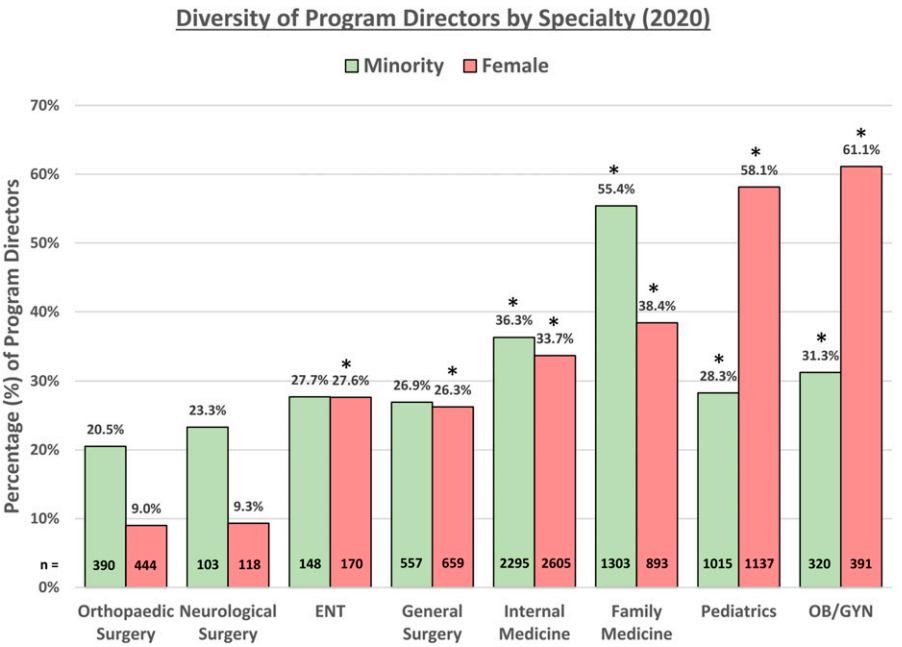

Fig. 1

A bar graph showing the minority and female representation of program directors in 2020 for 8 specialties. Program director sample sizes are included at the bottom of each bar. An asterisk (*) indicates a significant difference between orthopaedic surgery and the comparative specialty for minority or female proportions. For the comparisons of minority representation, the adjusted p values from left to right (starting with orthopaedic surgery versus neurological surgery) are as follows: $p = 0.537$, $p = 0.148$, $p = 0.069$, $p < 0.001$, $p < 0.001$, $p = 0.012$, and $p = 0.005$. For the comparisons of female representation, the adjusted p values from left to right are as follows: $p = 0.916$ for neurological surgery versus orthopaedic surgery, and $p < 0.001$ for each of the comparisons of the 6 other specialties versus orthopaedic surgery. (AAMC Faculty Roster, December 31, 2020 snapshots[69].)

TABLE II Diversity of Medical Faculty and Leadership by Specialty (2019/2020)*

Specialty	Faculty (2019)				Program Directors (2020)				Chairpersons (2019)			
	Minority	P Value†	Female	P Value†	Minority	P Value†	Female	P Value†	Minority	P Value†	Female	P Value†
Orthopaedic surgery	25.0%	—	19.9%	—	20.5%	—	9.0%	—	12.3%	—	4.1%	—
Neurological surgery	35.0%	**<0.001**	22.1%	**0.043**	23.3%	0.537	9.3%	0.916	21.4%	0.086	4.1%	0.995
Otolaryngology (ENT)	30.9%	**<0.001**	35.2%	**<0.001**	27.7%	0.148	27.6%	**<0.001**	21.2%	0.086	3.5%	0.995
General surgery	33.4%	**<0.001**	27.7%	**<0.001**	26.9%	0.069	26.3%	**<0.001**	26.5%	**0.014**	8.5%	0.351
Internal medicine	41.4%	**<0.001**	41.1%	**<0.001**	36.3%	**<0.001**	33.7%	**<0.001**	24.7%	**0.048**	16.9%	**<0.001**
Family medicine	33.4%	**<0.001**	53.1%	**<0.001**	55.4%	**<0.001**	38.4%	**<0.001**	24.1%	0.065	31.0%	**<0.001**
Pediatrics	35.1%	**<0.001**	59.5%	**<0.001**	28.3%	**0.012**	58.1%	**<0.001**	22.7%	0.086	30.5%	**<0.001**
OB/GYN	33.8%	**<0.001**	65.6%	**<0.001**	31.3%	**0.005**	61.1%	**<0.001**	21.8%	0.086	28.8%	**<0.001**

*AAMC Faculty Roster, December 31, 2019/2020 snapshots[68,69] †P values from comparisons of each specialty with the corresponding proportion for orthopaedic surgery. Bold indicates a significant difference ($p < 0.05$). All p values are adjusted using a Benjamini-Hochberg test.

87.7% White and 12.3% minority (Table I). Despite lacking statistical significance when compared to most other specialties, orthopaedic surgery had the lowest proportion of minority chairpersons, at 12.3% (adjusted $p > 0.05$ for all except general surgery [adjusted $p = 0.01$] and internal medicine [adjusted $p = 0.048$]) (Table II). In regard to gender diversity, orthopaedic surgery showed no significant difference in its proportion of female chairpersons compared with the other surgical specialties (adjusted $p > 0.05$ for all) (Table II). Nonetheless, orthopaedic surgery had the lowest proportion of female chairpersons, at 4.1%, compared with the 4 nonsurgical specialties (adjusted $p < 0.001$ for all) (Table II).

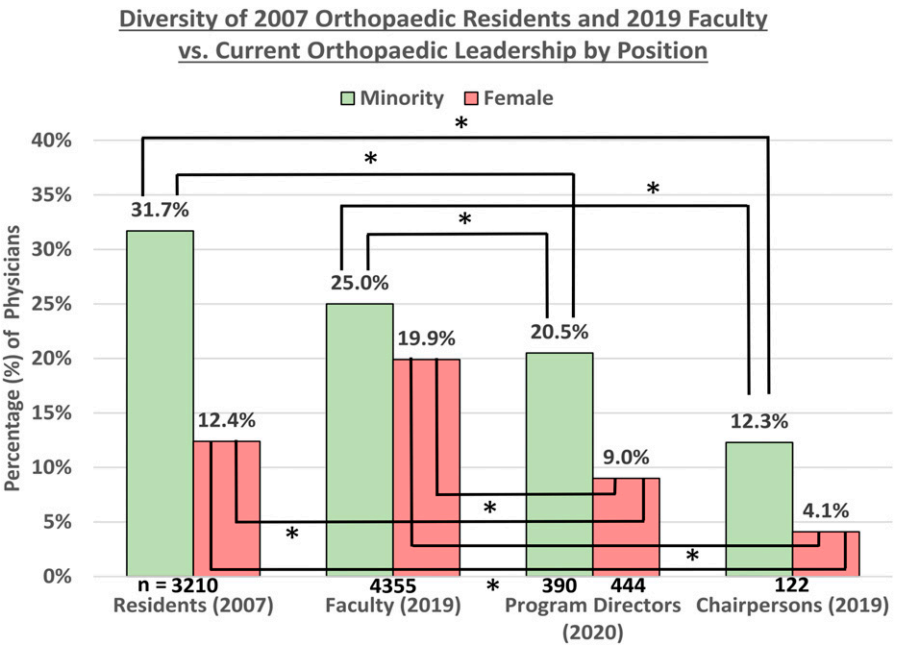

Fig. 2

A bar graph illustrating minority and female representation across various positions in orthopaedic surgery during the years of 2007, 2019, and 2020. Sample sizes are included at the bottom of each bar. Asterisks (*) indicate a significant difference when comparing diversity proportions between 2 different cohorts of physicians. For comparisons between 2007 minority residents and orthopaedic leadership (minority program directors and chairpersons), $p < 0.001$ for both. For comparisons between 2007 female residents and orthopaedic leadership (female program directors and chairpersons), $p = 0.038$ and $p < 0.001$, respectively. For comparisons between 2019 minority faculty and orthopaedic leadership (minority program directors and chairpersons), $p = 0.047$ and $p = 0.001$, respectively. For comparisons between 2019 female faculty and orthopaedic leadership (female program directors and chairpersons), $p < 0.001$ for both. (AAMC Faculty Roster, December 31, 2019/2020 snapshots[65,68,69].)

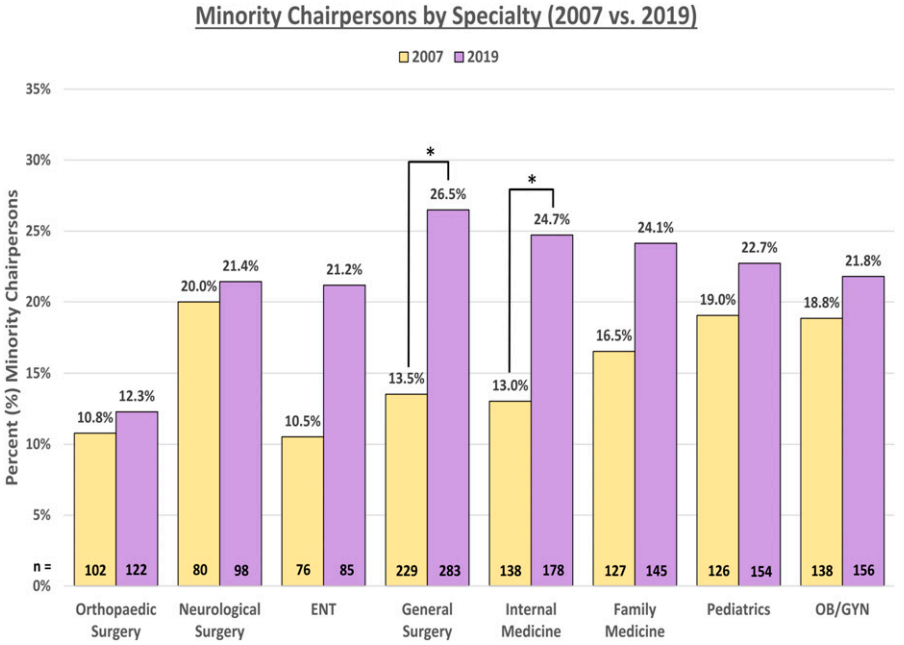

Fig. 3

A bar graph showing the change in minority representation among chairpersons from 2007 to 2019 for 8 specialties. Chairperson sample sizes are included at the bottom of each bar. An asterisk (*) indicates a significant change in minority representation between the 2 years. Two specialties showed significant growth (general surgery: 96% increase [adjusted $p < 0.001$] and internal medicine: 90% increase [adjusted $p = 0.010$]), while the remaining 6 specialties experienced no significant change between the 2 years (orthopaedic surgery: 14% increase [adjusted $p = 0.725$], neurological surgery: 7% increase [adjusted $p = 0.815$], otolaryngology: 102% increase [adjusted $p = 0.668$], family medicine: 46% increase [adjusted $p = 0.122$], pediatrics: 19% increase [adjusted $p = 0.453$], and OB/GYN: 16% increase [adjusted $p = 0.530$]). (AAMC Faculty Roster, December 31, 2019 snapshots[67,68].)

Diversity Among Orthopaedic Surgery Residents (2007) and Faculty (2019) Versus Current (2019/2020) Orthopaedic Leadership

Because the diversity of orthopaedic leadership is directly impacted by the diversity of the pools from which program directors and chairpersons are potentially chosen, a comparative analysis of diversity among both 2007 orthopaedic surgery residents and 2019 orthopaedic surgery faculty versus current orthopaedic surgery leadership was performed. In terms of minority and female representation, there was a significantly lower proportion of minority and female orthopaedic surgery program directors in 2020 and chairpersons in 2019 compared with the proportions of minority and female orthopaedic residents in 2007 and orthopaedic faculty in 2019 ($p < 0.05$ for all comparisons) (Fig. 2). When analyzing each racial/ethnic group, there was a significantly lower proportion of Asian American orthopaedic surgery chairpersons in 2019 (4.9%) compared with the proportion of Asian American faculty in 2019 (13.4%) ($p = 0.006$) and orthopaedic residents in 2007 (12.0%) ($p = 0.02$). Moreover, this difference in the proportion of Asian American chairpersons was the primary contributor to the overall significant difference found between minority representation in orthopaedic faculty, at 25.0%, and chairpersons, at 12.3%, as the proportions of chairpersons who were Black/African American, Hispanic/Latino, or Other were not significantly different than their respective faculty representation in 2019 ($p > 0.05$ for all) (Table I). When compared with 2019 faculty, orthopaedic program directors had significantly higher Black/African American representation but significantly lower Other representation ($p < 0.05$ for both) (Table I). However, there were similar proportions of those who were Asian American and Hispanic/Latino in the orthopaedic program director position when compared with the 2019 faculty pool ($p > 0.05$) (Table I).

Comparative Growth of Diversity in Orthopaedic Surgery Leadership from 2007 to 2019

When comparing the changes in diversity among leadership, orthopaedic surgery revealed no significant change in minority representation among chairpersons from 2007 to 2019 (10.8% to 12.3% [+1.5%]; adjusted $p = 0.725$) (Fig. 3). When analyzing each race/ethnicity individually, no significant changes were observed between those 2 years (adjusted $p > 0.05$ for all) (Table I). Meanwhile, 5 of the 7 other specialties similarly experienced no significant changes in their proportions of minority chairpersons, despite many of them displaying a larger raw percentage-point increase than orthopaedic surgery (ranging from +1.4% to +10.7%) (adjusted $p > 0.05$ for all) (Fig. 3). In contrast, both general surgery and internal medicine experienced significant increases in their proportions of minority chairpersons (adjusted $p < 0.001$, adjusted $p = 0.01$, respectively) (Fig. 3). Nevertheless, comparative growth analysis revealed that the proportional growth of minority chairpersons in

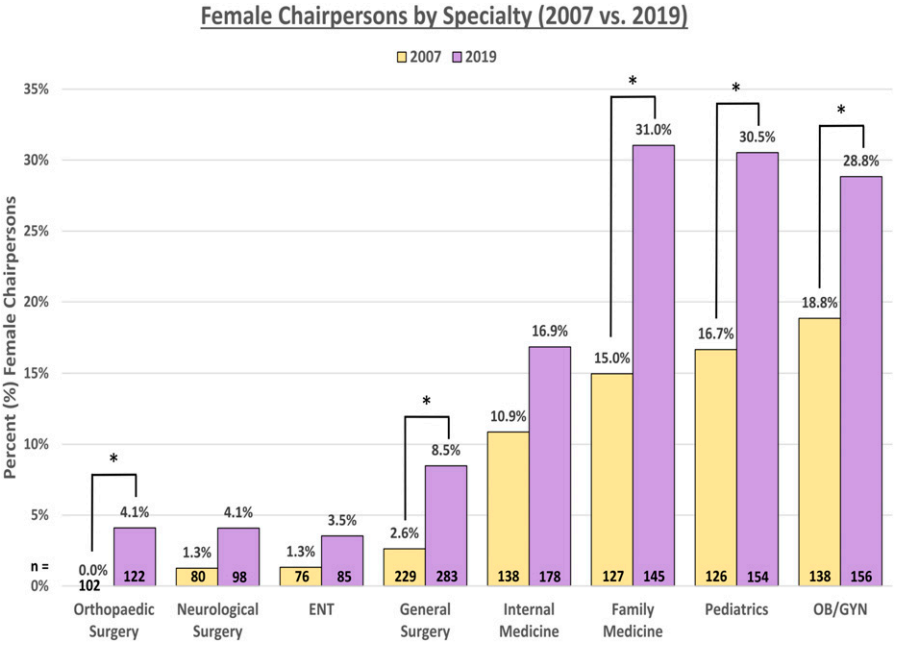

Fig. 4

A bar graph showing the change in female representation among chairpersons from 2007 to 2019 for 8 specialties. Chairperson sample sizes are included at the bottom of each bar. An asterisk (*) indicates a significant change in female representation between the 2 years. Five specialties showed significant growth (orthopaedic surgery, by +4.1% percentage points [adjusted p = 0.039]; general surgery, by +5.9% percentage points [adjusted p = 0.005]; family medicine, by +16.0% percentage points [adjusted p = 0.002]; pediatrics, by +13.8% percentage points [adjusted p = 0.006]; and OB/GYN, by +10.0% percentage points [adjusted p = 0.045]), while the remaining 3 specialties experienced no significant changes between the 2 years (neurological surgery, by +2.8% percentage points [adjusted p = 0.255]; otolaryngology, by +2.2% percentage points [adjusted p = 0.368]; and internal medicine, by +6.0% percentage points [adjusted p = 0.131]). (AAMC Faculty Roster, December 31, 2019 snapshots[67,68].)

orthopaedic surgery (14.0% growth) was statistically comparable with the proportional growth experienced by all other specialties ($p > 0.05$ for all) (Fig. 3).

With respect to changes in female representation among chairpersons, the analysis of orthopaedic surgery chairpersons showed a significant increase between 2007 and 2019 (0.0% [0 of 102] to 4.1% [5 of 122]) (adjusted $p = 0.039$) (Fig. 4). Likewise, 4 of the 7 other specialties experienced significant increases in their proportions of female chairpersons (adjusted $p < 0.05$ for all) (Fig. 4). Meanwhile, neurological surgery, otolaryngology, and internal medicine experienced no significant changes in their proportion of female chairpersons (adjusted $p > 0.05$ for all) (Fig. 4). Ultimately, the comparative analysis of gender diversity growth showed that the proportional growth of female chairpersons in orthopaedic surgery was statistically comparable with the proportional growth experienced by all other specialties ($p > 0.05$ for all).

Discussion

One important contribution of leadership diversity is its potential to diversify a workforce[24-30]. Along these lines, orthopaedic surgery has made observable improvements in racial and gender representation in certain aspects of the profession[20,46-49,59]. When assessing the changes in diversity of program directors and chairpersons from 2007 to 2019/2020, only an increase in female representation of chairpersons was observed. When compared with the other specialties, however, diversity in orthopaedic leadership mostly paralleled the other surgical specialties, while remaining behind the nonsurgical specialties.

The difficulties in improving diversity in orthopaedic leadership may be attributed to the lack of diversity among faculty members[46-49,55]. If that were the case, however, we would then anticipate no difference between the diversity composition of orthopaedic faculty members and leadership. Yet, when we compared 2019 orthopaedic faculty and orthopaedic leadership, we instead observed orthopaedic leadership to have significantly less minority and female representation ($p < 0.05$), which was a trend shared by a majority of the other specialties. When analyzing each race/ethnicity individually, a significant decrease in Asian American representation from orthopaedic faculty to chairpersons (13.4% to 4.9%) was the primary contributor to the overall significant difference between minority representation in orthopaedic faculty, at 25.0%, and chairpersons, at 12.3% ($p < 0.05$ for both comparisons). Nonetheless, the proportional growth of minority and female diversity in orthopaedic leadership was statistically comparable with the growth experienced in other specialties ($p > 0.05$ for all). The lack of significance in the chairperson analysis was likely due to the small chairperson sample sizes.

In medicine, increasing diversity in leadership to increase diversity in a workforce is a relatively new approach; however,

industries outside of health care have already substantiated the positive impact of diverse leadership[24-29]. A 2001 study at Tulane University determined that racial diversity in leadership was associated with greater racial diversity among metropolitan workers (6.9 to 19.8 times more likely, depending on race)[25]. In regard to gender diversity, a 2014 study at a North American technology firm revealed a moderate correlation (correlation coefficient of 0.21 to 0.28; $p < 0.05$) between a gender-diverse senior management and women nominated for future leadership positions[28]. Overall, these findings are consistent with those of several studies that have demonstrated the ability of diverse leadership teams to enhance the diversity of future leadership and the underlying workforce[24-30].

Studies relating to diversity in medical academic settings have highlighted the strong influence of orthopaedic faculty diversity on orthopaedic applicant and resident diversity[20,30,46,57,58]. On the basis of these findings, the same principle may apply to diversity among orthopaedic chairpersons, who are typically in a position to hire a more diverse body of program directors, faculty, and residents. For example, the Yale New Haven Hospital Orthopaedic Residency program consists of a diverse faculty and staff, including the recent appointment of a female chairperson and female program director, which has contributed to an increasingly diverse residency class, well above its previous classes[76].

Despite the novelty of the investigation's findings, this study has several limitations. First, the data sources utilized rely on self-reporting of race, ethnicity, and sex/gender, which is susceptible to self-report bias and errors in self-reporting. However, this should equally affect all specialties, thereby minimizing any specialty-specific discrepancies. Second AAMC and *JAMA* data sources collect information through GME Track surveys, in which respondents are not prohibited from selecting multiple races or ethnicities. Because of this, the sums of the individual races and ethnicities were greater than the AAMC and *JAMA* reported totals. To standardize data aggregation, we utilized the sum of the responses for each race and ethnicity as the total sample size for each population. Third, changes in demographic data between 2007 and 2019 provide a snapshot comparison with limited ability to reveal trends over time; nevertheless, we believe 12 years to be a substantial enough time lapse to allow for meaningful analysis of changes in diversity. Fourth, because of overlap between race/ethnicity and gender data sets, we never aggregated racial/ethnic and gender data sets to prevent double counting.

In summary, orthopaedic surgery has made observable strides in improving leadership diversity, mainly in regard to female chairperson representation; however, for minority and female representation, the specialty's rate of diversity growth is comparable with growth rates experienced by other surgical and nonsurgical specialties, thus limiting its ability to bridge diversity gaps. Moreover, the significant decrease in minority and gender representation from orthopaedic faculty to leadership, which was a trend shared by a majority of the other specialties, may suggest a more pervasive problem in the diversity of medical leadership that is not isolated to orthopaedic surgery. Although it is possible that the representation in leadership will naturally improve over time as the early stages of the pipeline diversify (ground-up approach), in this study, we observed minimal progress in the diversity of orthopaedic leadership from 2007 to 2019. On the basis of our findings, other relevant research, and AAMC initiatives[77], we recommend 3 potential solutions to help bridge diversity gaps: (1) incorporation of the "Rooney Rule" in the leadership selection process, whereby at least 1 minority applicant and 1 female applicant are interviewed for every position[78], (2) commitment to having diverse membership on the selection committee for orthopaedic leadership; if needed, the selection committee may need to include diverse leaders from other specialties, and (3) active encouragement from the dean or chief executive officer of an organization to communicate the importance of diversity of leadership in the academic health system. ■

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References

1. Sleeth BC, Mishell RI. Black under-representation in United States medical Schools. N Engl J Med. 1977 Nov 24;297(21):1146-8.

2. Association of American Medical Colleges Task Force on Minority Student Opportunities in Medicine. Association of American Medical Colleges COTH Administrative Board Meeting. Association of American Medical Colleges; 1978. p 1-13.

3. Shea S, Fullilove MT. Entry of black and other minority students into U.S. medical schools. Historical perspective and recent trends. N Engl J Med. 1985 Oct 10; 313(15):933-40.

4. Steinbrook R. Diversity in medicine. N Engl J Med. 1996 May 16;334(20):1327-8.

5. Reede JY. A recurring theme: the need for minority physicians. Health Aff (Millwood). 2003 Jul-Aug;22(4):91-3.

6. Powe NR, Cooper LA. Diversifying the racial and ethnic composition of the physician workforce. Ann Intern Med. 2004 Aug 3;141(3):223-4.

7. Saha S, Guiton G, Wimmers PF, Wilkerson L. Student body racial and ethnic composition and diversity-related outcomes in US medical schools. JAMA. 2008 Sep 10;300(10):1135-45.

8. Nunez-Smith M, Ciarleglio MM, Sandoval-Schaefer T, Elumn J, Castillo-Page L, Peduzzi P, Bradley EH. Institutional variation in the promotion of racial/ethnic minority faculty at US medical schools. Am J Public Health. 2012 May;102(5):852-8.

9. O'Keefe RJ. Embracing Differences to Improve Success: American Orthopaedic Association Presidential Address, Boston, Massachusetts, June 23, 2017: AOA Critical Issues [published correction appears in J Bone Joint Surg Am. 2019 Jun 19; 101(12):e60]. J Bone Joint Surg Am. 2019 May 1;101(9):e37.

10. Komaromy M, Grumbach K, Drake M, Vranizan K, Lurie N, Keane D, Bindman AB. The role of black and Hispanic physicians in providing health care for underserved populations. N Engl J Med. 1996 May 16;334(20):1305-10.

11. White AA 3rd. Resident selection: are we putting the cart before the horse? Clin Orthop Relat Res. 2002 Jun;(399):255-9.

12. Cooper LA, Roter DL, Johnson RL, Ford DE, Steinwachs DM, Powe NR. Patient-centered communication, ratings of care, and concordance of patient and physician race. Ann Intern Med. 2003 Dec 2;139(11):907-15.

13. Hanley EN Jr. Leading beyond the shadow-line. J Bone Joint Surg Am. 2004 Nov; 86(11):2554-9.

14. Hewlett SA, Marshall M, Sherbin L. How Diversity Can Drive Innovation. 2013 December. Accessed March 2020. https://hbr.org/2013/12/how-diversity-can-drive-innovation

15. Marrast LM, Zallman L, Woolhandler S, Bor DH, McCormick D. Minority physicians' role in the care of underserved patients: diversifying the physician workforce may be key in addressing health disparities. JAMA Intern Med. 2014 Feb 1;174(2): 289-91.

16. Wharton CR Jr. Leadership in medical education: the challenge of diversity. J Med Educ. 1987 Feb;62(2):86-94.

17. Nickens HW, Ready TP, Petersdorf RG. Project 3000 by 2000. Racial and ethnic diversity in U.S. medical schools. N Engl J Med. 1994 Aug 18;331(7):472-6.

18. Mason BS, Ross W, Ortega G, Chambers MC, Parks ML. Can a Strategic Pipeline Initiative Increase the Number of Women and Underrepresented Minorities in Orthopaedic Surgery? Clin Orthop Relat Res. 2016 Sep;474(9):1979-85.

19. American Academy of Orthopaedic Surgeons. Diversity Award. Accessed 2020 March. https://www.aaos.org/about/meet-the-aaos/aaos-member-recognition-awards/diversity-award/

20. Okike K, Phillips DP, Swart E, O'Connor MI. Orthopaedic Faculty and Resident Sex Diversity Are Associated with the Orthopaedic Residency Application Rate of Female Medical Students. J Bone Joint Surg Am. 2019 Jun 19;101(12):e56.

21. Sullivan LW, Mittman IS. Keynote address: The need for greater racial and ethnic diversity in orthopaedic surgery. Clin Orthop Relat Res. 2011 Jul;469(7):1809-12.

22. O'Connor MI. Medical School Experiences Shape Women Students' Interest in Orthopaedic Surgery. Clin Orthop Relat Res. 2016 Sep;474(9):1967-72.

23. Rao RD, Khatib ON, Agarwal A. Factors Motivating Medical Students in Selecting a Career Specialty: Relevance for a Robust Orthopaedic Pipeline. J Am Acad Orthop Surg. 2017 Jul;25(7):527-35.

24. Alire CA. Diversity and Leadership: The Color of Leadership. J Libr Admin. 2001; 32(3-4):99-114.

25. Elliott JR, Smith RA. Ethnic matching of supervisors to subordinate work groups: Findings on "bottom-up" ascription and social closure. Soc Probl. 2001;48(2): 258-76.

26. Skaggs S. Producing Change or Bagging Opportunity? The Effects of Discrimination Litigation on Women in Supermarket Management. Am J Sociol. 2008; 113(4):1148-82.

27. Stainback K, Tomaskovic-Devey D. Intersections of Power and Privilege: Long-Term Trends in Managerial Representation. Am Sociol Rev. 2009;74(5):800-20.

28. Virick M, Greer CR. Gender diversity in leadership succession: Preparing for the future. Hum Resour Manage. 2012;51(4):575-600.

29. Cook A, Glass C. Diversity begets diversity? The effects of board composition on the appointment and success of women CEOs. Soc Sci Res. 2015 Sep;53:137-47.

30. Lewis T, Tolbert J, Jones BL. Increasing Resident Racial and Ethnic Diversity through Targeted Recruitment Efforts. J Pediatr. 2020 Jan;216:4-6.

31. Martin SC, Parker RM, Arnold RM. Careers of women physicians. Choices and constraints. West J Med. 1988 Dec;149(6):758-60.

32. Walters BC. Why don't more women choose surgery as a career? Acad Med. 1993 May;68(5):350-1.

33. Phillips TJ. Women in dermatology. Challenges and recommendations. Arch Dermatol. 1994 Sep;130(9):1177-84.

34. Xierali IM, Nivet MA, Pandya AG. US Dermatology Department Faculty Diversity Trends by Sex and Underrepresented-in-Medicine Status, 1970 to 2018. JAMA Dermatol. 2020 Mar 1;156(3):280-7.

35. Chen A, Shinkai K. Rethinking How We Select Dermatology Applicants-Turning the Tide. JAMA Dermatol. 2017 Mar 1;153(3):259-60.

36. Pandya AG, Alexis AF, Berger TG, Wintroub BU. Increasing racial and ethnic diversity in dermatology: A call to action. J Am Acad Dermatol. 2016 Mar;74(3): 584-7.

37. Imadojemu S, James WD. Increasing African American Representation in Dermatology. JAMA Dermatol. 2016 Jan;152(1):15-6.

38. Bae G, Qiu M, Reese E, Nambudiri V, Huang S. Changes in Sex and Ethnic Diversity in Dermatology Residents Over Multiple Decades. JAMA Dermatol. 2016 Jan;152(1):92-4.

39. Rourke LL, Rourke J, Brown JB. Women family physicians and rural medicine. Can the grass be greener in the country. Can Fam Physician. 1996 Jun;42:1063-7: 1077-82.

40. Thorne S. Women show growing preference for treatment by female physicians. CMAJ. 1994 May 1;150(9):1466-7.

41. Crowley AE, Etzel SI, Shaw HA. Graduate medical education in the United States. JAMA. 1987 Aug 28;258(8):1031-40.

42. Xierali IM, Nivet MA, Gaglioti AH, Liaw WR, Bazemore AW. Increasing Family Medicine Faculty Diversity Still Lags Population Trends. J Am Board Fam Med. 2017 Jan 2;30(1):100-3.

43. Chang JC, Odrobina MR, McIntyre-Seltman K. The effect of student gender on the obstetrics and gynecology clerkship experience. J Womens Health (Larchmt). 2010 Jan;19(1):87-92.

44. Rayburn WF, Schrader RM, Fullilove AM, Rutledge TL, Phelan ST, Gener Y. Promotion rates for assistant and associate professors in obstetrics and gynecology. Obstet Gynecol. 2012 May;119(5):1023-9.

45. Hill JF, Yule A, Zurakowski D, Day CS. Residents' perceptions of sex diversity in orthopaedic surgery. J Bone Joint Surg Am. 2013 Oct 2;95(19):e1441-6.

46. Sobel AD, Cox RM, Ashinsky B, Eberson CP, Mulcahey MK. Analysis of Factors Related to the Sex Diversity of Orthopaedic Residency Programs in the United States. J Bone Joint Surg Am. 2018 Jun 6;100(11):e79.

47. Shah KN, Ruddell JH, Scott B, Reid DBC, Sobel AD, Katarincic JA, Akelman E. Orthopaedic Surgery Faculty: An Evaluation of Gender and Racial Diversity Compared with Other Specialties. JB JS Open Access. 2020 Jun 26;5(3): e20.00009-e20.00009.

48. Jarman BT, Borgert AJ, Kallies KJ, Joshi ART, Smink DS, Sarosi GA, Chang L, Green JM, Greenberg JA, Melcher ML, Nfonsam V, Whiting J. Underrepresented Minorities in General Surgery Residency: Analysis of Interviewed Applicants, Residents, and Core Teaching Faculty. J Am Coll Surg. 2020 Jul;231(1):54-8.

49. McDonald TC, Drake LC, Replogle WH, Graves ML, Brooks JT. Barriers to Increasing Diversity in Orthopaedics: The Residency Program Perspective. JB JS Open Access. 2020 May 11;5(2):e0007-e0008.

50. England SP, Pierce RO Jr. Current diversity in orthopaedics. Issues of race, ethnicity, and gender. Clin Orthop Relat Res. 1999 May;(362):40-3.

51. Grant RE, Banks WJ Jr, Alleyne KR. A survey of the ethnic and racial distribution in orthopedic residency programs in the United States. J Natl Med Assoc. 1999 Sep; 91(9):509-12.

52. Thomas CL. African Americans and women in orthopaedic residency. The Johns Hopkins experience. Clin Orthop Relat Res. 1999 May;(362):65-71.

53. Mankin HJ. Diversity in orthopaedics. Clin Orthop Relat Res. 1999 May;(362):85-7.

54. Van Heest AE, Fishman F, Agel J. A 5-Year Update on the Uneven Distribution of Women in Orthopaedic Surgery Residency Training Programs in the United States. J Bone Joint Surg Am. 2016 Aug 3;98(15):e64.

55. Day CS, Lage DE, Ahn CS. Diversity based on race, ethnicity, and sex between academic orthopaedic surgery and other specialties: a comparative study. J Bone Joint Surg Am. 2010 Oct 6;92(13):2328-35.

56. Daniels EW, French K, Murphy LA, Grant RE. Has diversity increased in orthopaedic residency programs since 1995? Clin Orthop Relat Res. 2012 Aug;470(8):2319-24.

57. Emery SE; Carousel Presidents. Diversity in Orthopaedic Surgery: International Perspectives: AOA Critical Issues. J Bone Joint Surg Am. 2019 Nov 6;101(12):e113.

58. Trikha R, Keswani A, Ishmael CR, Greig D, Kelley BV, Bernthal NM. Current Trends in Orthopaedic Surgery Residency Applications and Match Rates. J Bone Joint Surg Am. 2020 Mar 18;102(6):e24.

59. Adelani MA, Harrington MA, Montgomery CO. The Distribution of Underrepresented Minorities in U.S. Orthopaedic Surgery Residency Programs. J Bone Joint Surg Am. 2019 Sep 18;101(18):e96.

60. Jimenez RL. Current activities in orthopaedic culturally competent care education. J Am Acad Orthop Surg. 2007;15(Suppl 1):S76-9.

61. American Academy of Orthopaedic Surgeons. AAOS Leadership Institute (ALI). Accessed 2022 March 25. https://www.aaos.org/about/governance-overview/aaos-leadership-institute/

62. American Orthopaedic Association. Annual Meeting Symposia. Accessed 2020 March. https://www.aoassn.org/AOAiMIS/AnnualMeeting/AnnualMeeting/Agendas/AOA_Symposia.aspx

63. American Academy of Orthopaedic Surgeons. Board approves committee appointments, EMTALA compendium development protocol for cooperative ventures. 2002 June. Accessed 2020 March. http://www2.aaos.org/bulletin/jun02/acdnws6.htm

64. Misovic K. Annual meeting diversity programs have much to offer. 2005 October. Accessed 2020 March. http://www2.aaos.org/bulletin/oct05/acdnws6.asp

65. Brotherton SE, Etzel SI. Graduate medical education, 2006-2007. JAMA. 2007 Sep 5;298(9):1081-96.

66. Association of American Medical Colleges. FACTS Database and Glossary. Accessed 2020 March. https://www.aamc.org/data-reports/students-residents/interactive-data/facts-glossary

67. Association of American Medical Colleges. Faculty Roster: December 31, 2007 snapshot, as of September 30, 2020 (AAMC Special Report 2007 Faculty and Chairs by Sex, Race/Ethnicity,, and Department).

68. Association of American Medical Colleges. Faculty Roster: December 31, 2019 snapshot, as of September 30, 2020 (AAMC Special Report 2019 Faculty and Chairs by Sex, Race/Ethnicity,, and Department).

69. Association of American Medical Colleges. Faculty Roster: December 31, 2020 snapshot, as of January 28, 2021 (AAMC Special Report 2020 Program Directors by Sex, Race/Ethnicity,, and Department).

70. Blakemore LC, Hall JM, Biermann JS. Women in surgical residency training programs. J Bone Joint Surg Am. 2003 Dec;85(12):2477-80.

71. Poon S, Kiridly D, Mutawakkil M, Wendolowski S, Gecelter R, Kline M, Lane LB. Current Trends in Sex, Race, and Ethnic Diversity in Orthopaedic Surgery Residency. J Am Acad Orthop Surg. 2019 Aug 15;27(16):e725-33.

72. Association of American Medical Colleges. Faculty Roster. Accessed 2020 September. https://www.aamc.org/data/facultyroster/

73. U.S. Census Bureau. Hispanic or Latino Origin. 2020. Accessed 2020 March. https://www.census.gov/quickfacts/fact/note/US/RHI725219

74. U.S. Census Bureau. Race. 2020. Accessed 2020 March. https://www.census.gov/quickfacts/fact/note/US/RHI625219

75. Population Reference Bureau. Percent of the Population That Are Racial/Ethnic Minorities. Accessed 2020 March. https://www.prb.org/usdata/indicator/race-ethnicity/snapshot

76. McFarling UL. Orthopedic surgeons pride themselves on fixing things. Can they fix their own field's lack of diversity? 2021 December 14. Accessed 2021 December 18. https://www.statnews.com/2021/12/14/orthopedic-surgeons-fixing-their-fields-lack-of-diversity/

77. Association of American Medical Colleges. AAMC 2020 Annual Meeting: Learn Serve Lead. 2020. Accessed 2022 March 25. https://www.cvent.com/events/learn-serve-lead-2020-the-virtual-experience/event-summary-91e0769fce644654802a6a63de8b32d4.aspx?RefID=LSL2020+ammc.org&_ga=2.73773783.435055087.1646766980-591127889.1646766980

78. Garber G. Thanks to Rooney Rule,, doors opened. 2007 February 1. https://www.espn.com/nfl/playoffs06/news/story?id=2750645