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Geographic Differences in Sex and Racial Distributions Among Orthopaedic Surgery Residency Programs in the South Less Likely to Train Women and Minorities

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Abstract

Introduction: Women and minorities have been reported to be underrepresented in orthopaedic residency programs. The main goal of this study was to describe the representation of women and minorities in orthopaedic surgery residency programs and to identify any geographic differences across the United States.

Methods: Data for active residents within the United States during the academic year 2013 to 2014 were obtained from the American Medical Association. According to the US census method, the program regions were divided into Northeast, Midwest, South, and West.

Results: The representation of female residents markedly varied by the geographic region with the lowest female representation in the South and the highest female representation in the West and the Northeast ($P = 0.034$). Orthopaedic residency programs in the South were less likely to include racial minorities, whereas racial minorities were more commonly represented in residency programs in the West and the Northeast ($P < 0.001$).

Discussion: Our study demonstrates geographic differences in sex and minority representations in orthopaedic residency programs. Training programs in the South are less likely to train women and minorities compared with training programs in the West and the Northeast region. Both applicant-related factors and program-related factors may contribute to this finding.

Racial and ethnic minorities make up approximately 36% of the current US population, and Hispanics and Asians represent the fastest growing populations.¹ African Americans and Hispanics, respectively, make up approximately 12.6% and 16.3% of the US population. However, African

Americans and Hispanics only represent approximately 7.1% and 8.5% of the US medical school matriculants, respectively.² In contrast, Asians only constitute approximately 4.8% of the general population, but represent approximately 22.3% of medical school matriculants. These data

emphasize that despite the notable representation of the minorities within the US population, there remain notable ethnic and racial disparities regarding their representation within the medical workforce.

Women make up approximately half of medical students and seem to be well-represented within the medical workforce.² However, regarding female representation within the orthopaedic workforce, notable sex disparities have been reported in previous investigations.³⁻⁵ Moreover, there remain notable discrepancies between orthopaedic training programs regarding the percentage of enrolled female residents. An investigation by Van Heest et al⁶ revealed that several orthopaedic residency programs did not have any female residents enrolled. These data emphasize the need for investigating further obstacles to attracting women and minorities into orthopaedic residency programs. The main goal of this study was to describe the representation of women and minorities in orthopaedic surgery residency programs and to identify any geographic differences across the United States. The secondary goal of this study was to compare the rates of women and minorities in orthopaedic residency programs with other surgical specialties. We hypothesized that geographic differences exist regarding women and minority representation in orthopaedic surgery and that the representation of women and minorities in orthopaedic surgery residencies is lower than in other surgical specialties.

Methods

This study was exempt from review by the institutional review board as it

was a secondary data analysis of sufficiently de-identified data. Data for all active residents within programs accredited by the Accreditation Council for Graduate Medical Education (ACGME) for orthopaedic surgery, neurologic surgery, urology, general surgery, plastic surgery, and otolaryngology in the United States during the academic year 2013 to 2014 were obtained from the American Medical Association. The study population consisted of active residents within these ACGME accredited orthopaedic surgery training programs and all active residents in ACGME accredited programs for the other surgical specialties. Residents were categorized as white, black, Asian, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander, and Other/Unknown. Minority in our study was defined as any of the following racial categories: black, American Indian/Alaskan Native, Native Hawaiian/Pacific Islander.

Training programs were classified according to their respective geographic regions based on the United States Census Bureau's defined regions of Northeast, Midwest, South, and West (www.census.gov). According to the US census, these four regions include the following states: Northeast (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey, New York, and Pennsylvania); Midwest (Illinois, Indiana, Michigan, Ohio, Wisconsin, Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota); South (Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, West Virginia, Alabama, Kentucky,

Mississippi, Tennessee, Arkansas, Louisiana, Oklahoma, and Texas); and West (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming, Alaska, California, Hawaii, Oregon, and Washington).

Descriptive statistics were used to calculate frequency counts and percentages. Chi-square tests were used to determine differences between group proportions. All statistical analyses were performed using SPSS (21.0). Statistical significance was considered at the level of $P \leq 0.05$.

Results

During the academic year 2013 to 2014, a total of 3,402 orthopaedic residents were enrolled in an ACGME accredited orthopaedic training program within the United States. This included 472 female residents (13.9%) and 2,930 male residents (86.1%). In 141 residents, the race was categorized as unknown/others. Of the remaining 3,261 orthopaedic residents, 2,611 (80.1%) were whites and 650 (19.9%) were categorized as one of the racial minorities (Table 1).

Regarding geographic differences in sex representation among orthopaedic residents during the academic year 2013 to 2014, it was recorded that the representation of female residents markedly varied by the geographic region, with the lowest female representation in the South and the highest female representation in the West and the Northeast ($P = 0.034$) (Table 1). In addition, we recorded notable geographic differences in racial distributions (Table 2). Thus, orthopaedic residency programs in the South were less likely to include racial minorities overall, despite the relatively strong representations of blacks

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and unknown/others in the South. Racial minorities were more commonly represented in residency programs in the West and the Northeast ($P < 0.001$). No notable regional differences were recorded for the ethnic distribution among orthopaedic residents during the academic year 2013 to 2014 ($P = 0.153$) (Table 3).

Regarding the comparison of sex distribution, notable differences were recorded among different surgical specialties (Table 4). Orthopaedic residency programs trained markedly less female residents than other surgical specialties during the academic year 2013 to 2014 ($P < 0.001$). Similarly, this study identified notable differences among the surgical specialties regarding the racial distribution of their residents (Table 5). Among the different surgical specialties, orthopaedic surgery showed the lowest representation of racial minorities ($P < 0.001$).

Discussion

This study demonstrated geographic variations in the representation of women and minorities among orthopaedic surgery residents. In particular, orthopaedic surgery residency programs in the South are less likely to train women and minorities. In contrast, orthopaedic residency programs

Table 1

Regional Sex Distribution During the Academic Year 2013-2014

Region	Regional Sex Distribution			P Value
	Male	Female	Total	
Northeast	800 (84.57%)	146 (15.43%)	946 (27.81%)	0.034
Midwest	763 (86.12%)	123 (13.88%)	886 (26.04%)	
South	945 (88.48%)	123 (11.52%)	1,068 (31.39%)	
West	422 (84.06%)	80 (15.94%)	502 (14.76%)	
Total	2,930 (86.13%)	472 (13.87%)	3,402 (100.00%)	

in the Northeast and the West seem more likely to enroll women and minorities. Compared with other surgical specialties, orthopaedic surgery continues to have a low representation of women and minorities.

Our study has both strengths and limitations. The residency enrollment data were provided by the American Medical Association, which represents an accurate data source. However, in particular, the data on race and ethnicity rely on self-reporting by the enrollees. Although this is widely felt to be the most appropriate method to document the race and ethnicity, self-reporting remains subject to potential bias. Another limitation includes the grouping into the different geographic regions. We feel that the differences between the respective geographic regions were not only statistically significant, but

also show a relevant magnitude (approximately 28% racial minorities in the West versus less than 20% in the South). When grouping the orthopaedic residency programs into the different geographic regions, we used the best available and most widely used method as suggested by the US census (www.census.gov). However, it may certainly remain subject to debate how the US map should be divided into different regions. Finally, we were able to demonstrate geographic differences as well as a persistent under-representation of women and minorities in orthopaedic surgery residencies. However, our study design does not allow us to make any conclusions about the reason for this finding. Thus, it remains unclear if the differences in the geographic distribution are caused by applicant-related factors (female

Table 2

Regional Distribution by Race During the Academic Year 2013-2014

Region	Regional Distribution by Race					Total	P Value
	White	Black	Asian	Native Hawaiian/ Pacific Islander and American Indian/ Alaskan Native ^a	Other/ Unknown		
Northeast	694 (73.36%)	44 (4.65%)	161 (17.02%)	2 (0.21%)	45 (4.76%)	946 (27.81%)	<0.001
Midwest	696 (78.56%)	33 (3.72%)	107 (12.08%)	8 (0.90%)	42 (4.74%)	886 (26.04%)	
South	859 (80.43%)	58 (5.43%)	84 (7.87%)	3 (0.28%)	64 (5.99%)	1,068 (31.39%)	
West	362 (72.11%)	14 (2.79%)	93 (18.53%)	2 (0.40%)	31 (6.18%)	502 (14.76%)	
Total	2,611 (76.75%)	149 (3.38%)	445 (13.08%)	15 (0.44%)	182 (5.35%)	3,402 (100.00%)	

^a Native Hawaiian/Pacific Islander and American Indian/Alaskan Native were combined because of their relatively small representation.

Table 3**Regional Distribution of Non-Hispanics Versus Hispanics During the Academic Year 2013-2014**

Region	Regional Distribution of Ethnicity			P Value
	Non-Hispanic	Hispanic	Total	
Northeast	901 (95.24%)	45 (4.76%)	946 (27.81%)	0.153
Midwest	859 (96.95%)	27 (3.05%)	886 (26.04%)	
South	1,014 (94.94%)	54 (5.06%)	1,068 (31.39%)	
West	480 (95.62%)	22 (4.38%)	502 (14.76%)	
Total	3,254 (95.65%)	148 (4.35%)	3,402 (100.00%)	

Table 4**Comparison of Sex Distribution Between Orthopaedic Surgery and Other Surgical Specialties During the Academic Year 2013-2014**

Variables	Male	Female	P Value
Orthopaedic surgery	2,930 (86.1%)	472 (13.9%)	<0.001
Neurologic surgery	956 (83.6%)	188 (16.4%)	
Otolaryngology	932 (65.7%)	486 (34.3%)	
Plastic surgery	526 (66.8%)	261 (33.2%)	
General surgery	3,729 (59.4%)	2,554 (40.6%)	
Urology	848 (76.5%)	261 (23.5%)	

Table 5**Racial Differences in Orthopaedic Surgery Versus Other Surgical Specialties**

Variables	White	Racial Minority	P Value
Orthopaedic surgery	2,611 (80.1%)	650 (19.9%)	<0.001
Neurologic surgery	729 (66.2%)	373 (33.8%)	
Otolaryngology	980 (72.4%)	374 (27.6%)	
Plastic surgery	540 (71.6%)	214 (28.4%)	
General surgery	4,310 (71.3%)	1,738 (28.7%)	
Urology	759 (71.9%)	297 (28.1%)	

and minority candidates less interested in programs in the South) versus program-related factors (programs in the South giving less consideration to female and minority candidates). We can only speculate that both factors may have contributed to the findings recorded in this study.

To the best of our knowledge, geographic differences in sex and minority distributions among orthopaedic

residency programs has not been reported in the orthopaedic literature and thus, we cannot compare or contrast this finding with previous reports. Previous authors have emphasized the underrepresentation of women and minorities in orthopaedic surgery residencies.^{3-5,7-11} Substantial efforts by various leadership organizations have been made to increase the diversity among ortho-

paedic residents. These include the Nth Dimensions Program, an initiative to attract more women and minorities to the field of orthopaedic surgery.¹² In addition, the American Academy of Orthopaedic Surgeons has made attempts to emphasize the importance of diversifying the orthopaedic workforce, for example, through the implementation of the Diversity Advisory Board (www.aaos.org). Moreover, the ACGME has contributed to this effort, for instance, by establishing diversity as a core value in orthopaedic residency training (www.acgme.org). Additional efforts have been made on the medical school level, and it has been shown that implementation of a musculoskeletal curriculum during the third year medical school curriculum may lead to a notable increase in the proportion of female and minority applicants.¹³ However, the effect of these efforts within the ACGME, American Academy of Orthopaedic Surgeons, and on the medical school level remains to be seen in the years to come. Although it has been shown that over the last decades, the diversity in orthopaedic residency programs has increased,¹⁴ our study is in line with previous reports, indicating that women and minorities remain underrepresented in orthopaedic residencies.^{3-5,7-11} Future efforts should target increasing the acceptance of women and minorities in orthopaedic residency programs during the residency match and interview process. A notable focus should also include increasing the interest level of women and minorities in an orthopaedic career. This should include efforts on the medical student level as well as earlier educational stages.

In conclusion, our study demonstrates geographic differences in sex and minority representations in orthopaedic residency programs. Training programs in the South are less likely to train women and minorities compared with training

programs in the West and the Northeast region. We speculate that both applicant-related factors and program-related factors contribute to this finding. Moreover, we demonstrated that despite multiple efforts, women and minorities still show a lower representation than they do in other surgical residencies.

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