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The distribution of underrepresented minorities in U.S. orthopaedic surgery residency programs

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Topics in Training

The Distribution of Underrepresented Minorities in U.S. Orthopaedic Surgery Residency Programs

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Background: Orthopaedic surgery has generally lagged behind other surgical subspecialties with respect to racial and ethnic diversity in its U.S. residency programs. Efforts have been made to increase the number of underrepresented minorities (URMs) applying to orthopaedic surgery residencies; however, the impact on diversity at the residency program level is unknown. The purpose of this study was to determine whether orthopaedic surgery residency programs have become more racially diverse over time.

Methods: The Graduate Medical Education Track database was queried for individual racial/ethnic identification of orthopaedic surgery residents in U.S. Accreditation Council for Graduate Medical Education (ACGME)-accredited programs for 15 consecutive years (2002-2003 through 2016-2017). The number of URMs in each residency program during each academic year was recorded. The number of programs per year with no URMs, 1 URM, 2 URMs, and >2 URMs was recorded, and the change over time was assessed.

Results: The number of programs per year with >1 URM resident decreased over time, from 61 programs in 2002 to 53 programs in 2016, with the trough being 31 programs in 2010 ($p < 0.0001$). The number of programs per year without any URM residents increased over the period of study, from 40 programs in 2002 to 60 programs in 2016, with the peak being 76 programs in 2011 ($p < 0.0001$).

Conclusions: The number of residency programs with >1 URM resident has decreased significantly over time, suggesting that diversity at the program level is limited. Program-level diversity should be further examined as a potential barrier to the recruitment of URMs to orthopaedics. Difficulty attracting URM residents to certain programs may have the unintended consequence of effectively limiting potential positions for these candidates, which can decrease the odds of minority students matching into orthopaedics and, therefore, perpetuate the cycle of lack of diversity in our field.

Orthopaedic surgery in the United States lags behind other specialties with respect to racial and ethnic diversity among both residents and academic faculty[1-3]. Minorities have been underrepresented in orthopaedics relative to the number of medical students who are underrepresented minorities (URMs)[1,4]. In 2006, African Americans and Hispanics/Latinos represented 13.8% of medical school graduates but only 7.8% of orthopaedic surgery residents and 4.9% of orthopaedic surgery faculty[1]. Previously, it has been demonstrated that the proportion of minority residents in orthopaedics did not significantly increase over time, with African Americans, Hispanics, and Native Americans constituting 8.8% of orthopaedic residents in 1995 and 9.1% of residents in 2010[2].

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TABLE I URM Representation Among U.S. Orthopaedic Residency Applicants and Programs

	2002	2003	2004	2005	2006	2007
No. of applicants to orthopaedic surgery residency programs				1,300	1,373	1,420
No. of URM Orthopaedic Surgery Residency Applicants (%)				173 (13.3%)	182 (13.3%)	202 (14.2%)
No. of orthopaedic surgery residency programs	154	154	154	155	152	154
No. of orthopaedic surgery residents	3,074	3,094	3,152	3,198	3,237	3,293
No. of URM orthopaedic surgery residents (%)	287 (9.3%)	278 (9.0%)	296 (9.4%)	262 (8.2%)	236 (7.3%)	211 (6.4%)

In order to improve diversity, some have advocated for increased early exposure to orthopaedic surgery through pipeline programming and clerkships in medical school[5]. A strategic pipeline initiative called Nth Dimensions demonstrated that participation in its Orthopaedic Summer Internship Program increased the odds of minority medical students applying to orthopaedic surgery residencies by 14.5 times[6]. Required musculoskeletal clerkships also have led to substantial increases in orthopaedic residency application rates among minorities. A single-institution study demonstrated that the application rate for minority students doubled after the introduction of a mandatory third-year musculoskeletal medicine rotation[7]. A survey of all U.S. medical schools demonstrated a 35% increase in the rate of application to orthopaedic programs among minorities following the institution of dedicated coursework in musculoskeletal medicine[8].

The success of such programming has been based on global metrics at the applicant level, such as the number of URM applicants. However, the impact at the residency program level is unknown. It is unclear whether these efforts have led to an increase in the number of URMs throughout all orthopaedic surgery residency programs. One study demonstrated that 5% to 20% of residency programs in the United States trained the majority of female orthopaedic surgery residents between 2004 and 2009, while one-third of residency programs trained few or no women[9]. Sex diversity in orthopaedic residencies has been limited to a relatively small number of programs. It is possible that a similar phenomenon is occurring with URMs.

The purpose of this study was to assess the distribution of URM orthopaedic residents in U.S. orthopaedic surgery residency programs and, specifically, to assess whether programs are becoming more racially diverse over time, as measured by the number of programs with >1 URM trainee. We expected that the number of programs with >1 URM trainee has not increased over time.

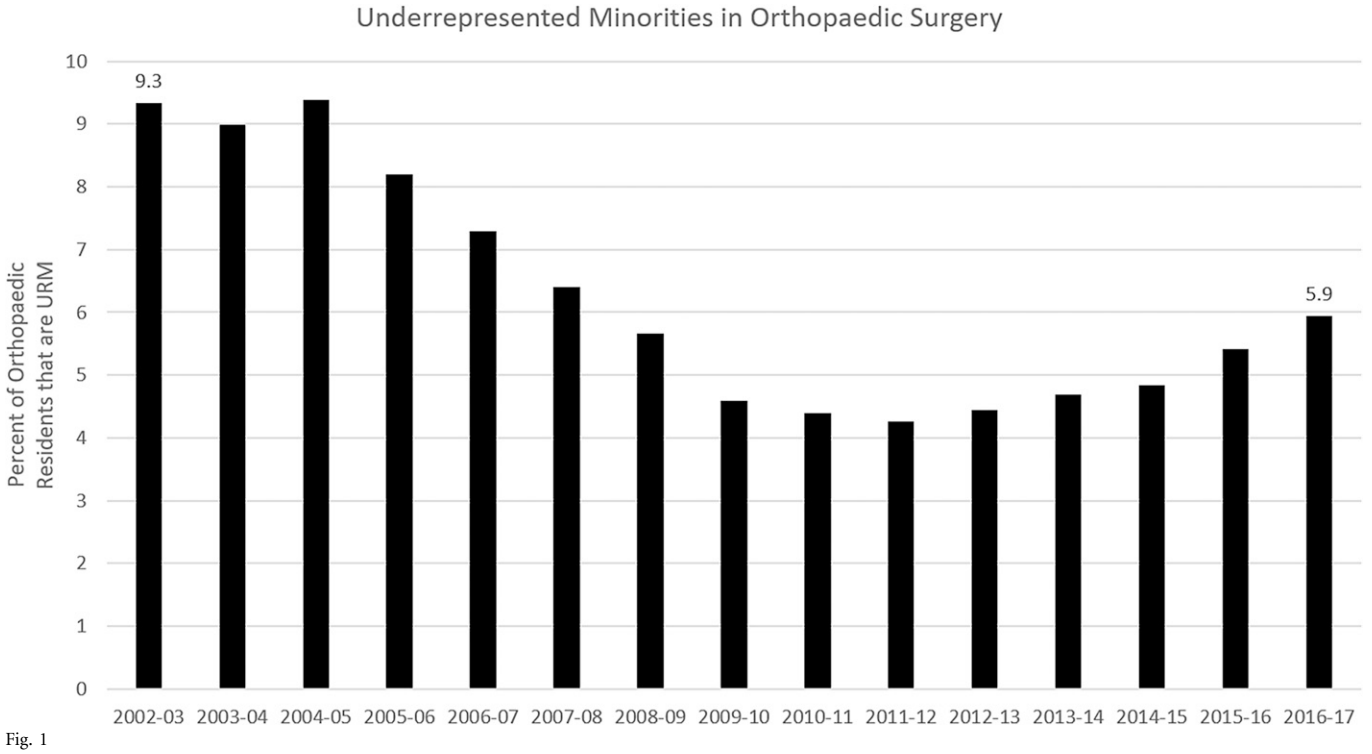

Fig. 1

Percentage of URM orthopaedic surgery residents per year in the U.S.

TABLE I (*continued*)

2008	2009	2010	2011	2012	2013	2014	2015	2016
1,360	1,368	1,539	1,520	1,370	1,312	1,582	1,324	1,309
218 (16.0%)	213 (15.6%)	235 (15.3%)	224 (14.7%)	209 (15.3%)	170 (13.0%)	215 (13.6%)	207 (15.6%)	174 (13.3%)
155	156	155	154	160	159	159	160	161
3,360	3,425	3,461	3,500	3,537	3,581	3,615	3,625	3,621
190 (5.7%)	157 (4.6%)	152 (4.4%)	149 (4.3%)	157 (4.4%)	168 (4.7%)	175 (4.8%)	196 (5.4%)	215 (5.9%)

Materials and Methods

The Graduate Medical Education (GME) Track database contains data from residency programs accredited by the Accreditation Council for Graduate Medical Education (ACGME) that elect to participate in the GME Track Resident Survey. The response rate has varied over time, from 76% in 2002 to 95% in more recent years. The GME Track was queried for individual racial/ethnic identification of orthopaedic surgery residents in U.S. programs for 15 consecutive years (2002-2003 through 2016-2017). The number of residents in each racial/ethnic category in each residency program, identified by a unique code, during each academic year was recorded.

The number of applicants by race to orthopaedic surgery residencies every year between 2005 and 2016 was obtained from the Electronic Residency Application Service (ERAS)[10]. No data on applicant race were collected by ERAS before 2005. The average number of applications submitted per applicant in each racial category per year also was obtained. Additionally, the overall number of medical students by race every year between 2002 and 2016 was obtained from the Association of American Medical Colleges (AAMC).

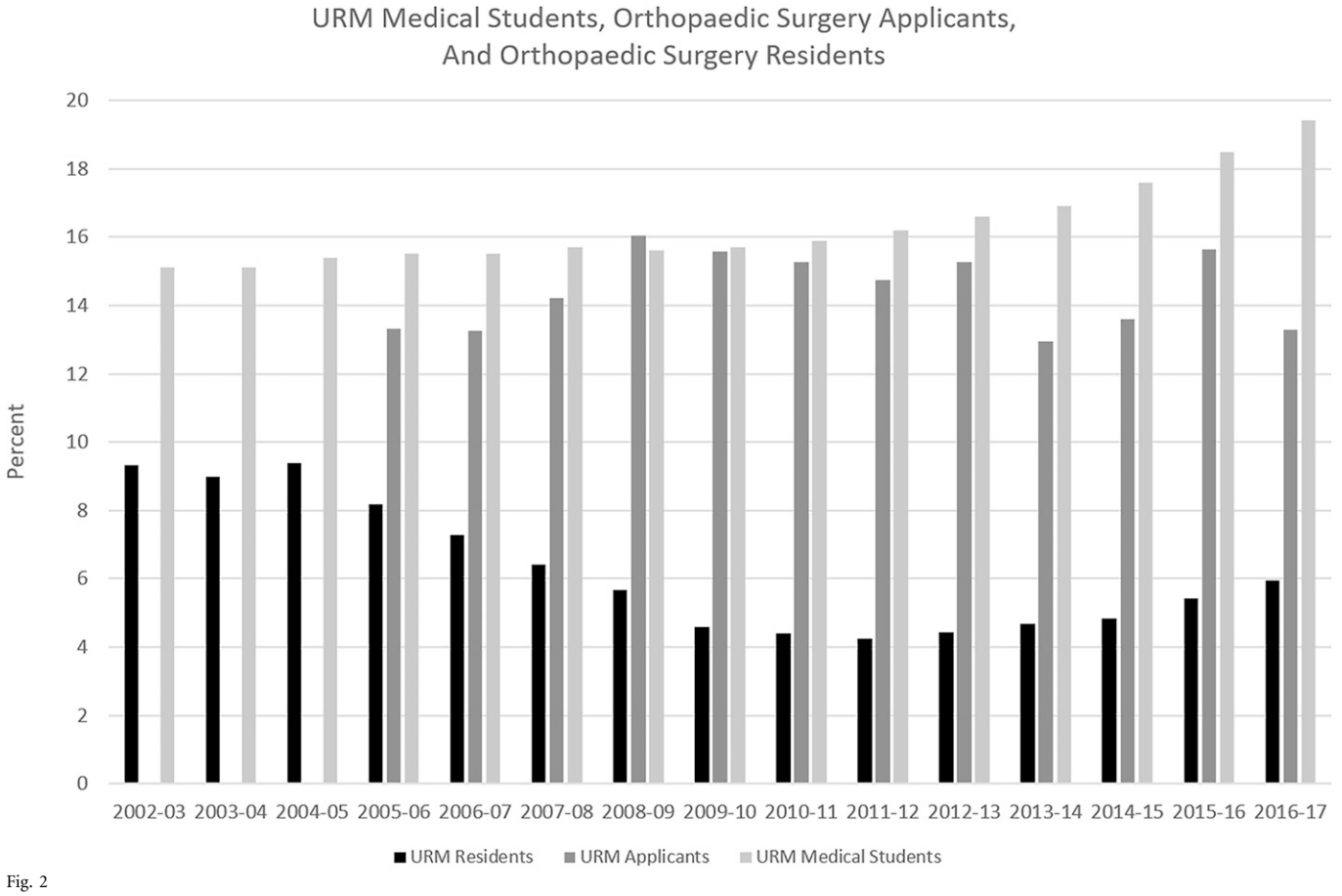

Fig. 2

Percentage of URM medical students, orthopaedic surgery applicants, and orthopaedic surgery residents per year in the U.S.

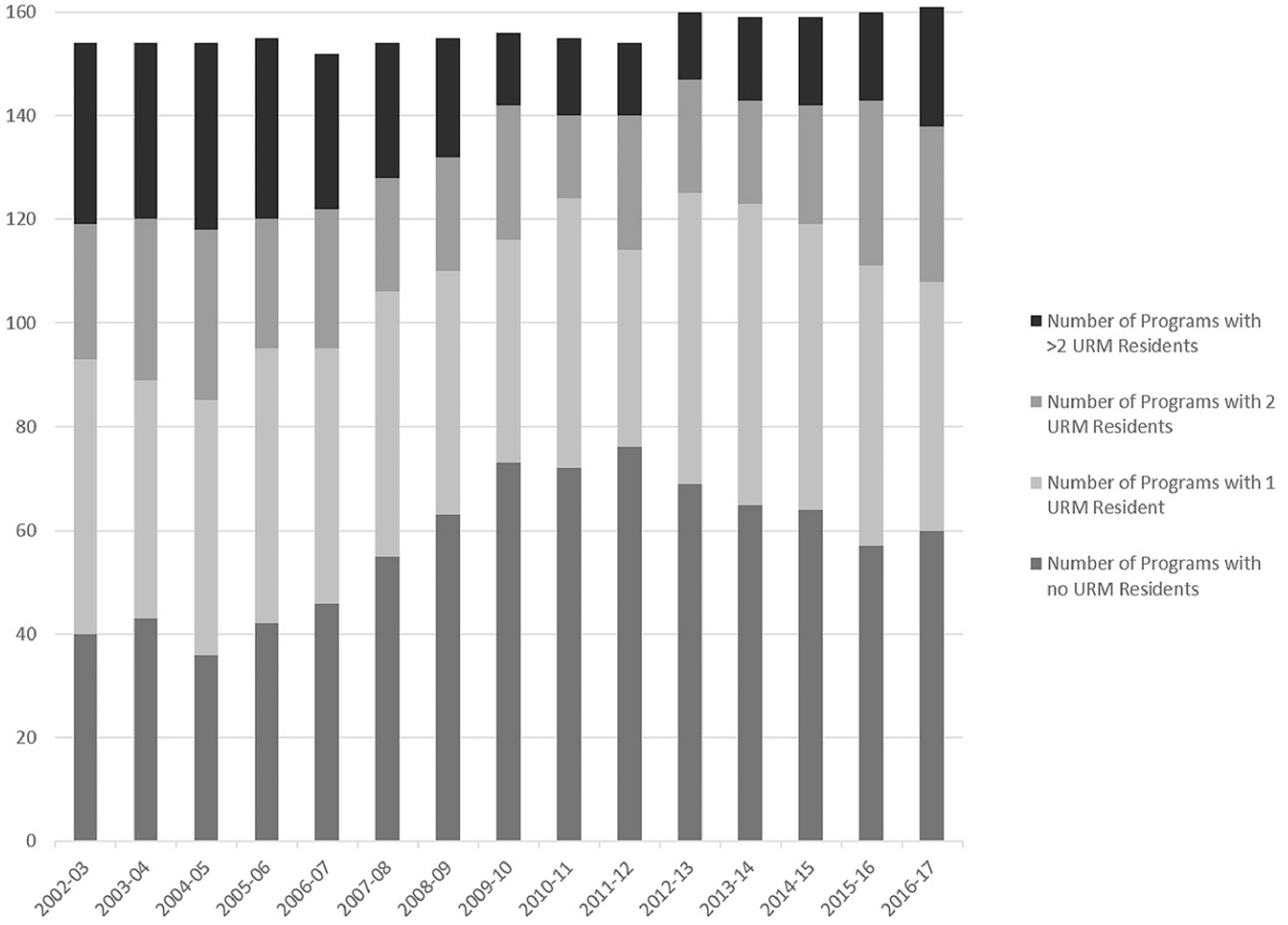

Fig. 3

Number of URMs per U.S. orthopaedic surgery residency program per year.

Prior to 2012 in both the GME Track and ERAS databases, individuals identified their ethnicity (Hispanic or non-Hispanic) and race separately, with 1 response to each question. From 2013 onward, individuals were asked to self-identify race and ethnicity in response to 1 question, which allowed them to select multiple responses, including an additional option of "other." For the purpose of this study, each individual response was utilized; therefore, those with multiple responses who identify, at least in part, with an underrepresented group were identified as a URM. URMs were defined by the historical definition from the AAMC as (1) Black or African American; (2) Hispanic, Latino, or of Spanish origin; (3) American Indian or Alaska Native; and (4) Native Hawaiian or other Pacific Islander[11]. Any responses in 1 of these racial/ethnic categories in the GME Track, ERAS, or AAMC databases were considered to represent a URM.

The number of programs per year with no URMs, 1 URM, 2 URMs, and >2 URMs was recorded. Additionally, the number of programs per year with 0% URM residents, 0.1% to 5% URM residents, 5.1% to 10% URM residents, and >10% URM residents was recorded. The change over time in the number of URMs per program and in the percentage of URMs per program was assessed with the Cochran-Armitage trend test, with $p < 0.05$ considered to be significant.

Results

Data were compiled from 152 to 161 orthopaedic surgery residency programs per year during the period of study (Table I). The overall percentage of URMs in orthopaedic surgery residencies per year averaged 6.3% over the period of study. This decreased over time, from 9.3% in 2002 to 5.9% in 2016, with the peak being 9.4% in 2004 and the trough being 4.3% in 2011 (Fig. 1). During this time, the percentage of URMs in medical school averaged 16.3% per year (Fig. 2). The percentage of applicants to orthopaedic surgery residencies who were URMs averaged 14.4% per year (Fig. 2). On average, during the period of study, African American, Hispanic/Latino, and American Indian/Alaska Native applicants applied to fewer programs each year than the national average (45.3, 46.9, and 49.5, respectively, versus 50.4). Native Hawaiian/other Pacific Islander applicants averaged more applications per year than

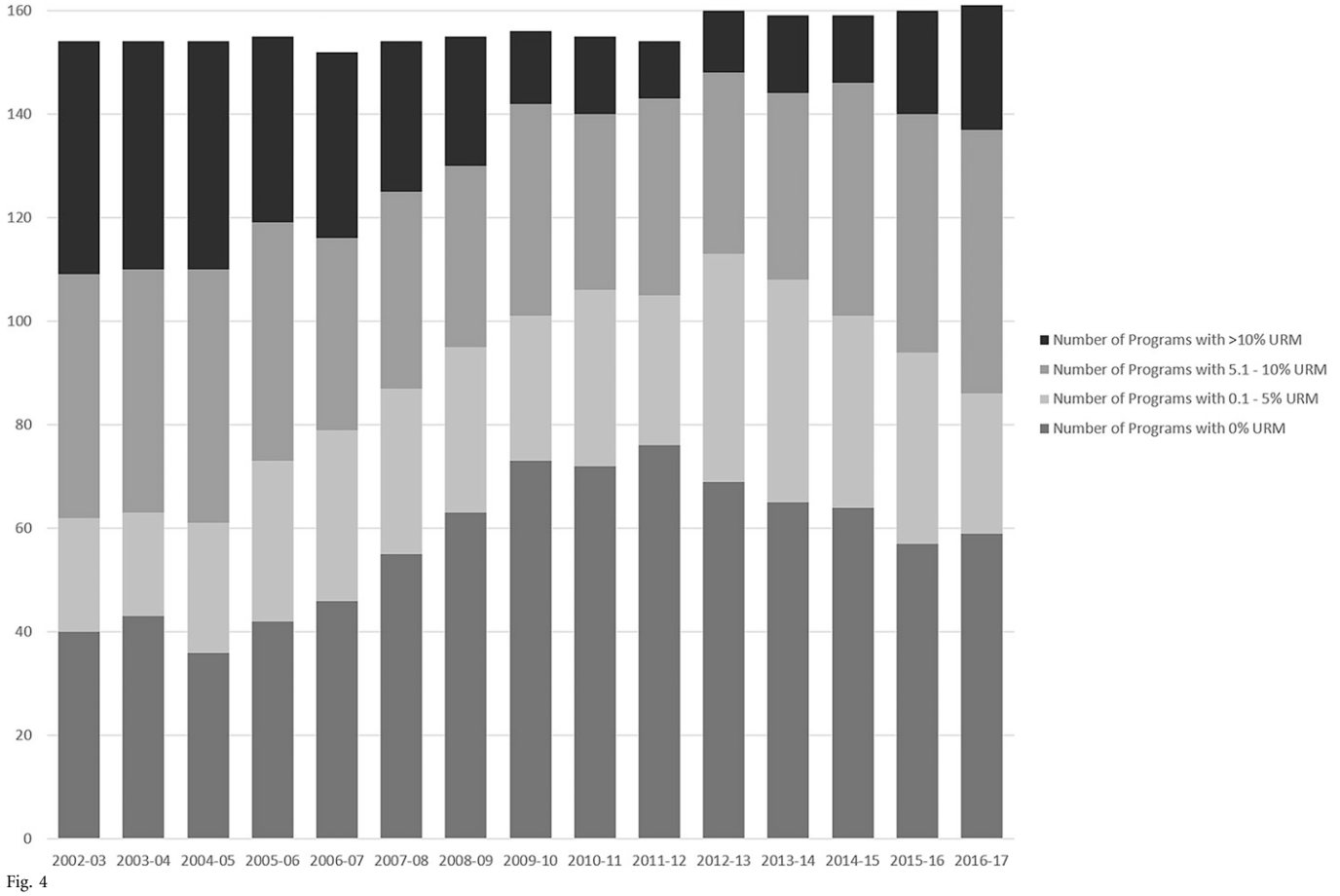

Fig. 4

Percentage of URMs per U.S. orthopaedic surgery residency program per year.

the national average over the period of study (57.5 versus 50.4); however, there were no more than 4 applicants in this category per year, so the average number of applications may be skewed by a single outlier.

Overall, 150 (93%) of the programs had at least 1 year during the study period without a URM resident. Eighteen (11%) of the programs did not report training any URMs during the entire period of study. The number of U.S. residency programs per year without any URMs increased over the period of study, from 40 programs in 2002 to 60 in 2016, with the peak being 76 programs in 2011 ($p < 0.0001$) (Fig. 3).

The majority (89%) of programs trained at least 1 URM resident during the period of study. The number of programs per year with >1 URM decreased over time, from 61 programs in 2002 to 53 in 2016, with the trough being 31 programs in 2010 ($p < 0.0001$) (Fig. 3). There were only 2 programs that consistently trained a high proportion of URMs: 1 program had an average of 65% URMs per year, and the other program had an average of 52% URMs per year. All of the remaining programs had <20% URMs per year during the period of study. The number of programs per year in which >5% of residents were URMs decreased over the period of the study, from 92 in 2002 to 75 in 2016, with the trough being 47 in 2012 ($p < 0.0001$) (Fig. 4). The number of programs per year in which ≤5% of residents were URMs increased from 62 in 2002 to 86 in 2016, with the peak being 113 in 2012 ($p < 0.0001$).

Discussion

This study demonstrates a significant decrease in the number of programs per year with >1 URM resident and a concomitant increase in the number of programs per year with no URM residents during the period of study. Additionally, there are proportionally fewer URMs in orthopaedic surgery residency programs than there are URM medical students and applicants to these programs.

The reasons for the decrease in URMs within residency programs are unknown. Previous research on sex diversity demonstrated that U.S. orthopaedic surgery residency programs do not train women at equal rates to men[9,12]. The most recent data demonstrated that 30 programs had no female trainees, while 49 programs had >20% female trainees in at least 1 year between 2009 and 2014[12]. Those authors postulated that some programs may simply be more successful in attracting and graduating women[9]. It also is plausible that female applicants seek out programs with other women, which may be viewed as evidence of a more comfortable or supportive environment. Female applicants to surgical programs have been shown to value sex composition more than their male counterparts when selecting a

residency program[13-15]. Despite the uneven distribution of female trainees, overall sex diversity in orthopaedic surgery residency programs has increased over time—68% of programs had ≥2 female trainees per year between 2009 and 2014, compared with 61% between 2004 and 2009[12].

The opposite trend has been observed with URM representation. The percentage of URMs in orthopaedic surgery residency programs has decreased over time. Overall, 93% of programs had ≥1 year during the study period without a URM resident. Eleven percent of programs had no URM residents at all during the period of study, while only 2 programs consistently had a high proportion of URM residents. There are several potential reasons for this that are worth exploring.

First, the relatively low number of URMs in medical school has previously been suggested as a potential reason for low numbers in residency programs[2]. However, the current study shows that the number of URM orthopaedic surgery applicants is relatively proportional to the number of URM medical students, which suggests that there may be a barrier at the residency selection level. Another possible contributor to decreasing diversity may be that URMs, on average, applied to fewer programs than the mean number of applications per applicant nationally. This finding is consistent with a previous study[1]. The reasons for fewer applications are unknown. It is possible that the lower number of applications submitted by URM applicants decreases the odds of matching into an orthopaedic surgery residency. Another possibility is that the limited number, or absence, of URM residents actually acts as a deterrent for URMs applying to certain residency programs. Similar to sex diversity and female residency applicants, racial diversity has been shown to be important to minority applicants when ranking residency programs[15]. If minority applicants actively seek programs with other minorities, given the relatively low number of programs with >1 URM resident per year, these applicants may feel that fewer programs are suitable for them. Difficulty attracting URM residents to certain programs may have the unintended consequence of effectively limiting potential positions for these candidates, which can decrease the odds of URM students matching into orthopaedics and, therefore, perpetuate the cycle of lack of diversity in our field.

This study is limited by the fact that the GME Track database consists of census data from voluntary residency program participants, with lower response rates early in the period of study. However, in more recent years, the response rate approached 100%. There are also limitations of the racial/ethnic identification data that should be noted. The methodology for acquiring race/ethnicity data in these surveys changed during the period of study, which could mean that data that were collected prior to 2012 may not be directly comparable with data that were collected after 2012. However, race continued to be a self-identified variable following this change. Furthermore, our use of each individual response, rather than identifying those who selected >1 category as "multiracial," may further mitigate any problems caused by this methodological change by continuing to classify those who identify, at least in part, with any given race/ethnicity as a member of that category. This may have led to some individuals being counted multiple times; however, the effect of this was expected to be minimal. Only 4% of the residents in this study identified with multiple races/ethnicities. The database did not identify the racial/ethnic categories that are included in the responses of those who identified as multiracial, so the exact number of potential duplicates is unknown. Furthermore, it is unknown whether multiracial respondents identified with any URM category. Nevertheless, the maximum number of potential duplicate URMs could be estimated by cross-referencing program years that had respondents identifying as multiracial with program years that had respondents in >1 URM racial/ethnic category (i.e., African American and Hispanic). There were an estimated maximum of 873 potential duplicate URMs, which would be just 1.7% of all residents in this study. This would not be expected to change the conclusions of the study. In fact, there could be up to 873 fewer URMs, and the actual underrepresentation of minorities in residency programs would be even more exaggerated than what is presented in this study. Finally, this study is limited by the absence of qualitative data that reflect the perspectives of minority residents in orthopaedic surgery. Although the current data demonstrate that the number of programs that have >1 URM resident at a time has decreased over time, feelings of isolation by residents can only be assumed. It is possible that, despite no other URMs within their programs, URM orthopaedic surgery residents are able to find support from others in their institutions. A qualitative study is needed to further assess the experiences of URM residents in orthopaedic surgery.

This study expands on previous work in diversity in orthopaedic surgery by examining the distribution of URM residents at the program level. The number of residency programs with >1 URM resident has decreased significantly over time, suggesting that diversity at the program level is limited. Program-level diversity should be further examined as a potential barrier to the recruitment of URM residents to orthopaedics. ■

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