Underrepresented Minorities are Underrepresented Among General Surgery Applicants Selected to Interview

Benjamin T. Jarman, MD, FACS,[*] Kara J. Kallies, MS,[*] Amit R.T. Joshi, MD,[†] Douglas S. Smink, MD,[‡] George A. Sarosi, MD,[§] Lily Chang, MD,[‖] John M. Green, MD,[¶] Jacob A. Greenberg, MD,[#] Marc L. Melcher, MD,[**] Valentine Nfonsam, MD,[††] Luis D. Ramirez, MPH,[*] Andrew J. Borgert, PhD,[*] and James Whiting, MD[‡‡]

[*]Gundersen Health System and Gundersen Medical Foundation, La Crosse, Wisconsin; [†]Einstein Healthcare Network, Philadelphia, Pennsylvania; [‡]Brigham & Women's Medical Hospital, Boston, Massachusetts; [§]University of Florida, Gainesville, Florida; [‖]Virginia Mason Medical Center, Seattle, Washington; [¶]Carolinas Medical Center, Charlotte, North Carolina; [#]University of Wisconsin, Madison, Wisconsin; [**]Stanford University, Stanford, California; [††]University of Arizona, Tucson, Arizona; and [‡‡]Maine Medical Center, Portland, Maine

OBJECTIVE: Diversity is an ill-defined entity in general surgery training. The Accreditation Council for Graduate Medical Education recently proposed new common program requirements including verbiage requiring diversity in residency. "Recruiting" for diversity can be challenging within the constraints of geographic preference, type of program, and applicant qualifications. In addition, the Match process adds further uncertainty. We sought to study the self-identified racial/ethnic distribution of general surgery applicants to better ascertain the characteristics of underrepresented minorities (URM) within the general surgery applicant pool.

DESIGN: Program-specific data from the Electronic Residency Application Service was collated for the 2018 medical student application cycle. Data were abstracted for all participating programs' applicants and those selected to interview. Applicants who did not enter a self-identified race/ethnicity were excluded from analysis. URM were defined as those identifying as Black/African American, Hispanic/Latino/of Spanish origin, American Indian/Alaskan Native, or Native Hawaiian/Pacific Islander-Samoan. Appropriate statistical analyses were accomplished.

SETTING: Ten general surgery residency programs—5 independent programs and 5 university programs.

PARTICIPANTS: Residency applicants to the participating general surgery residency programs.

RESULTS: Ten surgery residency programs received 10,312 applications from 3192 unique applicants. Seven hundred and seventy-eight applications did not include a self-identified race/ethnicity and were excluded from analysis. The racial/ethnic makeup of applicants in this study cohort was similar to that from 2017 to 2018 Electronic Residency Application Service data of 4262 total applicants to categorical general surgery. Programs received a median of 1085 (range: 485−1264) applications each and altogether selected 617 unique applicants for interviews. Overall, 2148 applicants graduated from US medical schools, and of those, 595 (28%) were offered interviews. The mean age of applicants was 28.8 ± 3.8 years and 1316 (41%) were female. Hispanic/Latino/of Spanish origin, Black, and American Indian/Alaskan Native/Hawaiian/Pacific Islander-Samoan applicants constituted 12%, 8%, and 1% of total applicants, but only 8%, 6%, and 1% of those selected for interview. Overall, 29% of applicants had United States Medical Licensing Examination (USMLE) Step 1 scores ≤220; 37 (6%) of those selected for interviews had a USMLE Step 1 score of ≤220. A higher proportion of URM applicants had USMLE scores ≤220 compared to White and Asian applicants. Non-white self-identification was a significant independent predictor of a lower likelihood of interview selection. Female gender, USMLE Step 1 score >220, and graduating from a US medical school were associated with an increased likelihood of being selected to interview.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Correspondence: Inquiries to Benjamin T. Jarman, MD, FACS, Department of General and Vascular Surgery, Gundersen Health System, 1900 South Avenue C05-001, La Crosse, WI 54601; fax: (608) 775-7327; e-mail: btjarman@gundersenhealth.org

  1931-7204/$30.00 https://doi.org/10.1016/j.jsurg.2019.05.018

CONCLUSIONS: URM applicants represented a disproportionately smaller percentage of applicants selected for interview. USMLE Step 1 scores were lower among the URM applicants. Training programs that use discreet USMLE cutoffs are likely excluding URM at a higher rate than their non-URM applicants. Attempts to recruit racially/ethnically diverse trainees should include program-level analysis to determine disparities and a focused strategy to interview applicants who might be overlooked by conventional screening tools. (J Surg Ed 76:e15−e23. © 2019 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: underrepresented minorities, surgery residency, diversity, graduate medical education

COMPETENCIES: Medical Knowledge, Professionalism, Systems-Based Practice

INTRODUCTION

"Diversity" is inclusive of a broad range of considerations including age, gender, geographic upbringing, religious preference, race, and ethnicity. Common program requirements by the Accreditation Council for Graduate Medical Education (ACGME) to mandate diversity in graduate medical education (GME) are expected to take effect in July 2019.[1] They state: *"CPR 1.C. The program, in partnership with its Sponsoring Institution, must engage in practices that focus on mission-driven ongoing, systematic recruitment and retention of a diverse workforce inclusive of residents, fellows (if present), faculty members, senior administrative staff members and other relevant members of its academic community."*[1] The metrics for diversity within GME, specifically at the resident level, has not been developed and it is unclear what definitions or criteria would be utilized to assess training program diversity and to determine compliance. This is concerning given the nature of the resident selection process and the uncontrolled environment provided by the ranking and match process.

Underrepresented minority (URM) applicants are considered to be those identifying as Black or African American (AA), Hispanic, Latino or of Spanish origin (HLS), American Indian or Alaskan Native (AIAN), or Native Hawaiian or Pacific Islander (NHPI). A group of general surgery program directors noted a paucity of URM applicants to their residency programs for the 2018 to 2019 academic year, and a further decline of these populations within their selected to interview lists. It is notable that each of these program directors (PDs) uses different selection criteria, but that each PD studies applications that do not meet their initial screening cut-offs to identify applicants with interesting stories, divergent backgrounds, URM status, or situational hardships. Despite those measures, the URM applicants selected to interview appeared to be underrepresented as compared to the percentage of total applicants.

We sought to describe the URM applicants in the general surgery resident applicant pool for the 2019 recruitment cycle by determining the percentage of URM applicants selected to interview and identifying applicant characteristics associated with an increased likelihood of being selected to interview. Additionally, we were interested in the impact of applicant selection based on applications to independent or university programs only or a combination thereof during the application process.

METHODS

Ten general surgery residencies (5 independent academic medical centers and 5 university centers) submitted program-specific Electronic Residency Application Service data for the 2018 medical student application cycle. Data including Association of American Medical Colleges (AAMC) ID, age, gender, self-identified race, birth place, medical school of graduation, and United States Medical Licensing Examination (USMLE) Step 1 and Step 2 test scores for applicants to categorical general surgery residency positions were aggregated between October 31 and November 1, 2018. The study was approved by the AAMC and the Institutional Review Board of the primary author. Applicants were considered US medical school graduates if the medical school of graduation was accredited by the Liaison Committee on Medical Education or the American Association of Colleges of Osteopathic Medicine.[2,3] Geographic data was characterized according to US Census regions (West, South, Midwest, and Northeast).[4] Statistical analysis included descriptive statistics for baseline characteristics of all applicants, those who graduated from US schools, and those who were selected for interview. Univariate analyses included chi-square tests, independent *t* tests, and Fisher's exact tests. A multivariate logistic regression model was developed to assess the relationship between applicant selection for interview adjusted for US medical school graduates, USMLE Step 1 score, age, gender, and race. A p value <0.05 was considered significant. All statistical analyses were performed using SAS 9.4 (Cary, North Carolina).

RESULTS

A total of 3192 unique applicants submitted 10,312 applications to the 10 participating residency programs.

There were 861 (27%) applicants who applied to only one of the participating programs, while 1986 (62%) applied to 2 to 5 programs, and 345 (11%) applied to 6 or more. There were 778 applications that did not include a self-identified race/ethnicity and were excluded from analysis. The overall distribution of race/ethnicity among applicants to the participating residency programs was similar to that of the 2018 National Graduate Medical Education census of 126,910 trainees (Fig. 1).[5,6] The applicant cohort was composed of the following self-identified race/ethnicities; White (50%), Asian (25%), HLS (12%), AA (8%), and AIAN/NHPI (1%). One hundred and twenty-five (4%) applicants self-identified as "Other" race/ethnicity.

Overall, 41% of applicants were female, 2148 (67%) graduated from a US school, and 617 (19%) were selected to interview at one of the programs in the study (Table 1). There were 1129 (35%) applicants whose birthplace was outside of the United States and 1044 (33%) who attended a non-US medical school. Fifty-seven percent of overall applicants and 68% of those selected for interview applied to both an independent and university program (Table 1). USMLE Step 1 and 2 scores were available for 3079 and 2854 applicants, respectively (Table 1). Those that were selected to interview had a significantly larger increase from their Step 1 to Step 2 scores (12.1 ± 10.8 vs 10.5 ± 13.2) than those not selected to interview ($p = 0.004$). The mean USMLE Step 1 score was lower among applicants who applied to independent programs only versus university programs only (225.8 ± 16.3 vs 232.7 ± 18.9; $p < 0.001$). Applicants who applied to both program types had a higher mean USMLE Step 1 score than those applying to only one program type (231.8 ± 16.0 vs 229.6 ± 18.1; $p < 0.001$). Across all applicants, USMLE Step 1 scores were, on average, approximately 3 points lower for female versus male applicants (229.1 ± 16.7 vs 232.0 ± 17.0, respectively [$p < 0.001$]); this difference did not change depending on the applicants' selection status.

A lower proportion of AA, HLS, AIAN/NHPI, and Asian applicants were selected for interview compared to White applicants (Fig. 2). While the majority of all applicants selected to interview attended US schools, a higher proportion of HLS applicants attended schools outside the United States (Table 2). A higher proportion of URM applicants, overall, had a USMLE Step 1 score ≤220 (Table 2). USMLE Step 1 <220 and ≥240 were further analyzed across the cohort of applicants selected to interview. We noted a lower proportion of URM applicants with a USMLE Step 1 score >240 (62% of Asian applicants, 59% of White applicants, 50% of HLS applicants, 36% of Other race/ethnicity applicants, 29% of AA applicants, and 25% of AIAN/NHPI applicants [$p < 0.001$]). Among applicants selected for interview, there were no significant differences by racial/ethnic group and the type of program (independent versus university)

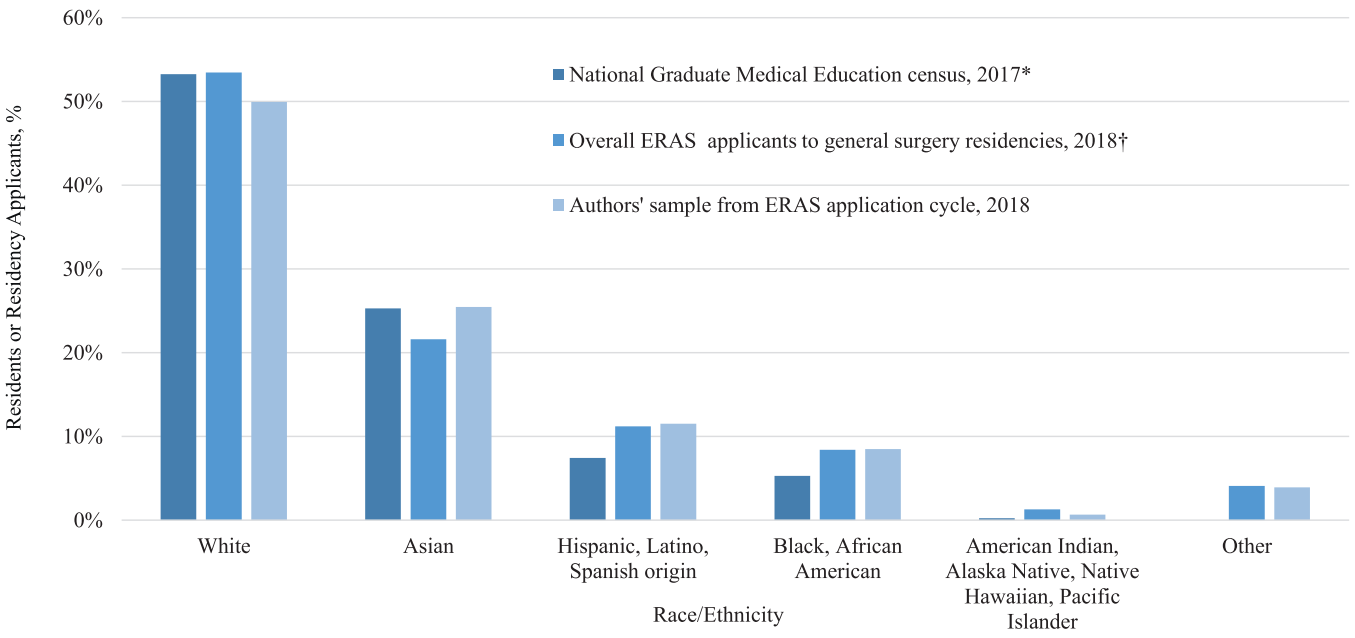

FIGURE 1. Distribution of race/ethnicity in the authors' sample compared to national reports.
*Data from the National Graduate Medical Education census for Resident Physicians on Duty December 31, 2017.[5] Resident physicians noting Hispanic ethnicity may have also identified as any race.
†Overall ERAS applicant data from the Association of American Medical Colleges.[6]
ERAS = Electronic Residency Application Service.

TABLE 1. Demographic Characteristics of the Study Population

Variable	All Applicants	US Medical School Graduates	Selected to Interview
N	3192	2148	617
Mean age, years	28.8 ± 3.8	28.0 ± 3.0	27.4 ± 2.3
Gender, *n* (%)			
Female	1316 (41)	955 (44)	298 (48)
Male	1876 (59)	1193 (56)	319 (52)
Program Type, *n* (%)			
Independent	643 (20)	451 (21)	49 (8)
University	745 (23)	508 (24)	149 (24)
Both	1804 (57)	1189 (55)	419 (68)
Mean USMLE Step 1 score	230.8 ± 17.0	231.7 ± 16.4	240.8 ± 13.4
Mean USMLE Step 2 score	241.1 ± 15.8	243.8 ± 14.9	252.1 ± 11.9
US Birth Region, *n* (%)*			
West	432 (14)	366 (17)	91 (18)
Midwest	469 (15)	428 (20)	130 (25)
Northeast	496 (16)	402 (19)	122 (24)
South	629 (20)	542 (25)	169 (33)
Puerto Rico	37 (1)	18 (1)	1 (0.2)
US Medical School Region, *n* (%)*			
West	259 (12)	–	65 (11)
Midwest	542 (25)	–	160 (27)
Northeast	524 (24)	–	138 (23)
South	803 (37)	–	231 (39)
Puerto Rico	20 (1)	–	1 (0.2)

*Applicants whose birth place was outside of the United States and those who did not graduate from a US medical school not included.USMLE = United States Medical Licensing Examination.

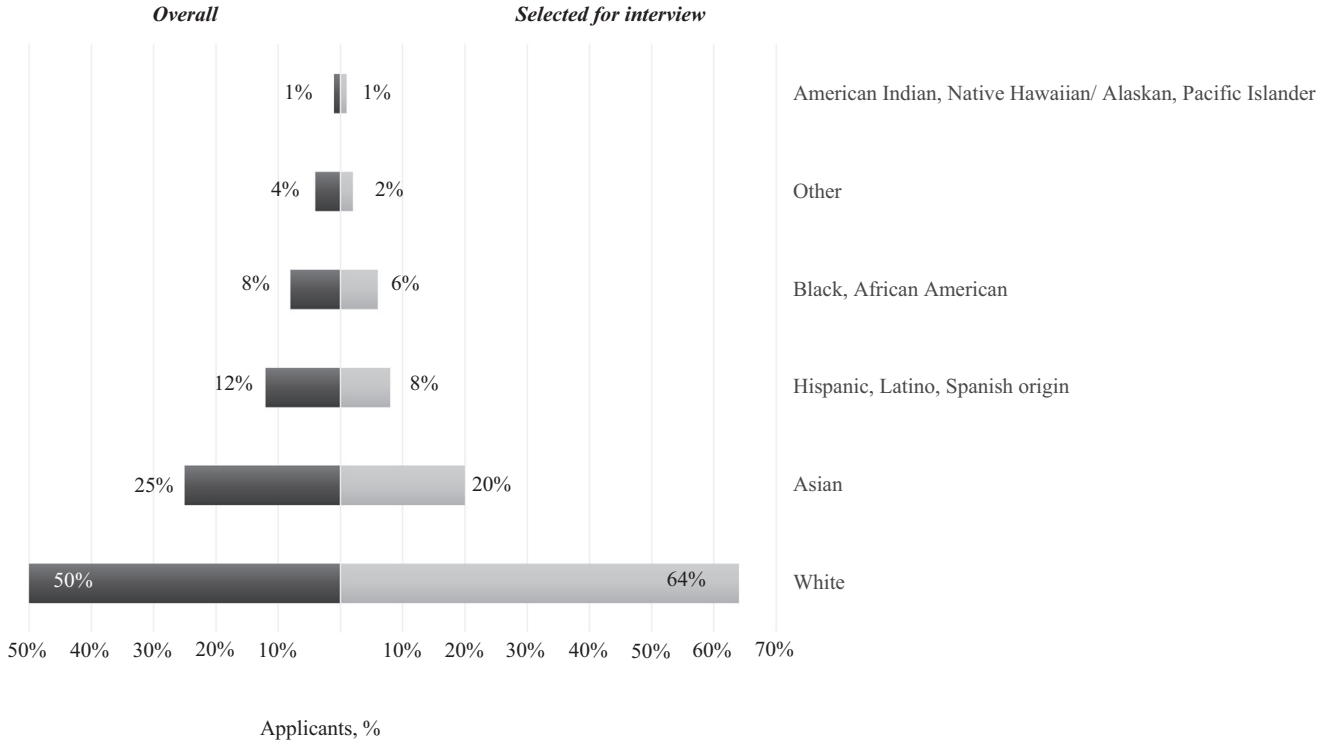

FIGURE 2. Proportion of overall applicants and applicants selected to interview by self-identified race/ethnicity.

TABLE 2. Distribution of Unique Applicants by Self-Identified Race

Variable	Self-Identified Race in ERAS Application						p Value
	White	Asian	Hispanic, Latino, Spanish origin	Black, African American	Other	American Indian, Native Hawaiian/Alaskan, Pacific Islander	
	n (%)						
Applied (n = 3192)	**1594 (50)**	**813 (25)**	**368 (12)**	**271 (8)**	**125 (4)**	**21 (1)**	–
US Medical school graduate	1276 (80)	545 (67)	232 (63)	185 (68)	52 (42)	19 (90)	<0.001
Program type							<0.001
Independent	344 (22)	148 (18)	45 (12)	76 (28)	26 (21)	4 (19)	
University	335 (21)	202 (25)	106 (29)	62 (23)	37 (30)	3 (14)	
Both	915 (57)	463 (57)	217 (59)	133 (49)	62 (50)	14 (67)	
USMLE Step 1 ≤ 220	407 (26)	207 (25)	145 (39)	130 (48)	38 (30)	11 (52)	<0.001
Selected to interview (n = 617)	**392 (64)**	**124 (20)**	**48 (8)**	**38 (6)**	**11 (2)**	**4 (1)**	**<0.001**
US medical school graduate	378 (96)	120 (97)	44 (92)	38 (100)	11 (100)	4 (100)	<0.001
Program type							
Independent	35 (9)	6 (5)	0	6 (16)	2 (18)	0	0.081
University	87 (22)	38 (31)	12 (25)	8 (21)	3 (27)	1 (25)	
Both	270 (69)	80 (65)	36 (75)	24 (63)	6 (55)	3 (75)	
USMLE Step 1 ≤ 220	23 (6)	9 (7)	3 (6)	2 (5)	0	0	0.976

USMLE = United States Medical Licensing Examination.

to which they applied (Table 2). Among those selected for interviews, the distribution by racial/ethnic group was similar for female vs. male applicants (1% vs 1% American Indian/Alaskan native/Native Hawaiian/Pacific Islander, 21% vs 19% Asian, 6% vs 6% Black or AA, 7% vs 9% Hispanic or Latino or of Spanish origin, 2% vs 1% Other, and 63% vs 64% White).

A multivariate model was developed to assess the impact of race/ethnicity on selection for interview after adjusting for age, gender, and USMLE Step 1 score ranges. Self-identification as a non-White race/ethnicity was a significant independent predictor for decreased likelihood of interview selection (odds ratio [OR] = 0.73, 95% confidence interval [CI] 0.59−0.89; p = 0.003). Additional factors associated with a lower likelihood for interview selection included male gender (OR = 0.70, 95% CI 0.57−0.85; p = 0.001), older age (OR = 0.75 for every 5-year increase in age, 95% CI 0.61−0.92; p = 0.005), USMLE Step 1 scores ≤220, and graduation from a non-US medical school (OR = 0.06, 95% CI 0.04−0.10; p < 0.0001; Fig. 3).

DISCUSSION

In this study of surgery residency applicants to five independent and five university programs, we found that URMs were underrepresented among applicants selected to interview. The causes of this are likely multifactorial. URMs within the applicant cohort scored lower on USMLE Step 1 when compared to White applicants, and USMLE scores are a major determinate in interview selection. Individual program factors and biases were beyond the scope of this study, but all of the participating PDs strive to maintain or increase diversity in their respective programs. Our results are timely in anticipation of ACGME transitions to require diversity within our general surgery residency programs.

Our data are representative of a national sampling of applicants for surgery residency. Based on 2017 to 2018 AAMC reports, 4262 applicants applied for general surgery residency programs and 2472 attended medical schools in the United States.[6] Even though only 10 programs were included in our study, 3192 unique applicants comprised our study sample. There were 2309 individual applicants from US medical schools, which is similar to the number of applicants (*n*= 2472) who applied to general surgery residency in 2017 to 2018. This indicates that our study population is inclusive of the majority of applicants in the current academic cycle. Our study population is also similar to the National Graduate Medical Education census for 2017 to 2018 (Fig. 1).[5,6]

The benefits of diversity in the surgical workforce are well established. Patients from minority populations are more likely to seek care by physicians of the same group.[7,8] URM physicians are more likely to study socioeconomic factors and topics pertinent to URM groups.[9] Recommendations for improving diversity in surgery were recently published by Gardner et al. who noted modifications of screening tools, selecting an inclusive interview team and developing structured interviews as key components in increase diversity.[10] In addition, diversification within a surgery residency is noted to be

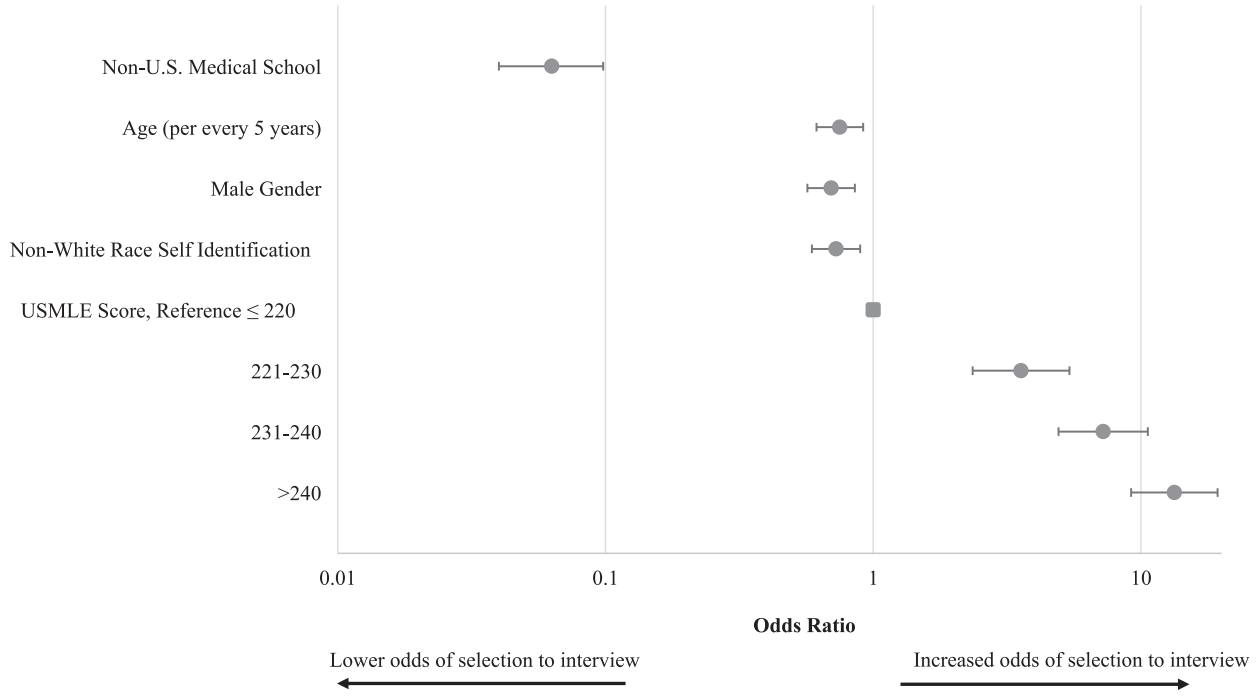

FIGURE 3. Multivariate logistic regression model for factors increasing the likelihood of selection for interview. Applicants who identified as "other" race/ethnicity are excluded from the model.

one of the key components in successfully recruiting URM applicants to a residency program.[9] Our data are disappointing as they are derived from training programs with a self-professed interest towards diversity. We noted variations in our selection of applicants to interview. For example, White applicants constituted 50% of the applicant pool but 64% of those selected to interview whereas HLS origin applicants constituted 12% of the applicant pool but only 6% of those selected to interview. This trend was observed for each URM group and Asian applicants. The absolute numbers are impactful. Among the 10 programs, there were only 4 AIAN/NHPI applicants, 38 Black/AA applicants, and 48 HLS origin applicants selected to interview. This is in comparison to 392 White and 124 Asian applicants being selected to interview. From a volume standpoint, this suggests that programs seeking to increase diversity have a limited pool of applicants to help achieve this goal.

We noted several interesting trends among the applicants who were selected for interview. Women were more likely to be selected to interview than men in a multivariate model adjusting for other factors. Women constituted 41% of the total applicant pool but 48% of the selected to interview pool whereas men made up 59% of the applicant pool but 52% of those selected for interviews ($p < 0.001$). The impact of USMLE scores on an applicant's likelihood of selection was not dependent on the applicant's gender. The vast majority of applicants selected for interview (range by race/ethnicity 92%−100%) were from US accredited medical schools. Of the 1044 applicants from non-US schools, only 22 applicants were selected for an interview which is indicative of the challenge that international medical graduates face in obtaining categorical general surgery positions at the programs studied. Applicants who applied only to university programs had slightly higher Step 1 scores than those who applied only to independent programs. Also, those that applied to both program types had higher Step 1 scores than those applying to only one type of program.

The process of screening surgery resident applicants by USMLE Step scores varies by program. Program directors who face an enormous volume of applications often view score cut-offs as imperative. While a significant number of URMs did not meet typical screening criteria based on their USMLE Step 1 score, self-identification as a non-White race/ethnicity was an independent predictor of lower likelihood for interview selection across the entire range of USMLE Step 1 scores, including Step 1 scores >240. There is wide variation in how programs review resident applications. Common themes voiced at national surgical education meetings and among the authors of

this study are that screening USMLE Step 1 scores of 220 and above is commonplace, 240 and above is less common and only 1 program in the study used 250 as an initial screening criterion. USMLE Step 2 score cut-offs are not as common but anecdotally, a decrease in Step 2 score when compared to Step 1 is viewed poorly. We noted that applicants with a statistically higher increase in their step 2 score were more likely to be selected to interview. Poorer performance on Step 1 is associated with lower American Board of Surgery (ABS) In-Training examination scores and is a well-established risk factor for failure on the ABS Qualifying Exam.[11] Maker et al. reviewed risk factors for failure of the ABS Certifying Exam and noted USMLE Step 2 scores of less than 225 were associated with failure on the first attempt.[12] Gauer et al. noted a significant association between USMLE Step scores and residency specialty in a review of medical school graduates over a 5-year period.[13] The mean Step 1 and Step 2 scores for general surgery programs among applicants who successfully matched were 230 and 238, respectively. As each surgery residency must maintain a high ABS examination pass rate to maintain ACGME accreditation, the justification for heavily weighting applicants' standardized scores is understandable. Similar challenges with USMLE scores have been noted in other specialties. Edmond et al. reported on AA applicants to internal medicine programs and noted that a disproportionate number of the applicants were not offered interviews when USMLE Step 1 scores were used to screen applications.[14] Potential reasons for this association have been attributed to decreased resources, less mentorship, and less focused attention on high-stakes standardized tests in high school and undergraduate education among URMs.[15] These challenges are the subject of national programs to improve URM representation; mentoring of high school and college students probably being the most impactful followed by mentorship in medical school to encourage surgery as a career.

URM representation in medical school has not kept pace with their increasing populations in the United States nor the expansion of available medical school positions. The AAMC has been dedicated to increasing diversity in undergraduate medical education since the 1960s with intermittent success as reviewed by Nickens et al.[15] Between 1980 and 2014, there have been notable increases in AA, HLS, and AIAN students enrolling in US colleges (11.7%−26.2%) and earning bachelor's degrees (9.2%−21.6%) but these trends have not led to comparable increases in medical school matriculants.[16,17] A recent publication by Acosta et al. reviewed AAMC data between 1980 and 2016.[9] In 2016, there were 1986 applicants from AIAN, AA, and HLS racial/ethnic groups. They noted marginal increases in AA (7.0%−8.2%) and HLS applicants (5.0%−6.2%) and a decrease in AIAN applicants (0.4%−0.2%) while the total number of medical school matriculants increased by 26.8%. Notably, only 35.4% of AA applicants were accepted to medical school in 2014 compared to 41.6% of AA applicants in 1980. As medical schools serve as the pipeline for GME programs − there must be further increases in URM students if adequate racial/ethnic diversity is anticipated at the GME and physician level. Several programs have been established for undergraduate and junior medical students to provide opportunities for URM students to build relationships and gain exposure to a surgical career.[18-20] Diversity committees within GME programs also emphasize the importance of recruiting URM students and may help to increase the proportion of URM trainees and surgeons in the future.[21]

Given our findings, it is unlikely that more than 280 general surgery residencies will meet their diversity goals until the pool of URMs in medical school is dramatically increased. Meanwhile, we suggest that PDs should consider recruiting applicants from non-US medical schools as they produce a disproportionate number of URM applicants. PDs also should evaluate their applicant screening criteria and consider de-emphasizing USMLE Step 1 scores as a cut-off variable in the process for URM applicants. The potential increased liability of matching applicants with Step 1 scores <220 would have to be monitored and mitigated aggressively by the corresponding program. Timely intervention with performance improvement plans or other educational adjuncts beyond a standard curriculum may be necessary if the resident's in-training service examinations or clinical assessments supported a need for intervention. Our data suggest that these steps could result in increased URM applicants selected to interview. In addition, PDs need clear direction on how "diversity" will be defined in the new paradigm of ACGME attention to this aspect of surgery residency measurement. Clarification as to how diversity is measured and what the ramifications will be for programs that struggle to meet the expectation are needed.

There are notable limitations to our study. Applicants selected to interview may not be reflective of the applicants who ultimately interviewed nor those selected for ranking. Also, percentages of URM applicants selected for interview may not be indicative of match outcome or distribution. Applicant selection for interview was not standardized across the involved residency programs and we did not investigate notable elements of applications (class rank, letters of reference, personal statements, etc.) which could impact the selection process. Selection bias is inherent in the study design as programs were selected for participation based on a voiced interest in the study model and subject matter. While our study population is remarkably similar to the anticipated overall applicant pool, we represent only 10 of the over 280 general

surgery residency programs. The "other" race/ethnicity population represents a broad range of racial, ethnic or geographic descriptions (i.e., "Other: Middle Eastern," "Other: Greek," "Other: Multiracial") or combination thereof and would potentially contribute to the volume of URM applicants selected to interview. COMLEX scores were not reviewed and thresholds of screening applicants based on results of this exam have not been studied. The participating programs require USMLE exams for application review and this was the area of focus.

CONCLUSIONS

URM applicants represented a disproportionately smaller percentage of applicants selected for interview at 10 general surgery residency programs for the 2018 to 2019 application cycle. USMLE Step 1 scores were lower among the URM applicants. Applicants with USMLE Step 1 scores >220, who are female, and who attend US medical schools are more likely to be selected for interviews at the programs studied. Self-identification as a non-White applicant was an independent predictor of a lower likelihood of selection for interview when adjusting for other factors. Training programs that use discreet USMLE cut-offs are likely excluding URM applicants at a higher rate than their non-URM applicants. Attempts to recruit racially/ethnically diverse trainees should include program-level analysis to determine disparities and a focused strategy to interview applicants who might be overlooked by conventional screening tools.

REFERENCES

1. Accreditation Council for Graduate Medical Education. Common Program Requirements (Residency) Available at: https://www.acgme.org/Portals/0/PFAssets/ProgramRequirements/CPRResidency2019.pdf. Accessed February 13, 2019.
2. Liaison Committee on Medical Education. Accredited MD Programs in the United States. Available at: http://lcme.org/directory/accredited-u-s-programs/. Accessed February 12, 2019.
3. American Association of Colleges of Osteopathic Medicine. Available at: https://www.aacom.org/become-a-doctor/us-coms. Accessed February 12, 2019.
4. United States Census Bureau. Regions. Available at: https://www.census.gov/geo/reference/webatlas/regions.html. Accessed February 12, 2019.
5. Brotherton SE, Etzel SI. Graduate Medical Education, 2017-2018. *JAMA*. 2018;320:1051–1070.
6. Association of American Medical Colleges. Historical specialty specific data. Available at: https://www.aamc.org/download/362126/data/generalsurgerycategorical.pdf. Accessed February 11, 2019.
7. Saha S, Taggart SH, Komaromy M, Bindman AB. Do patients choose physicians of their own race? *Health Aff (Millwood)*. 2000;19:76–83.
8. Traylor AH, Schmittdiel JA, Uratsu CS, Mangione CM, Subramanian U. The predictors of patient-physician race and ethnic concordance: a medical facility fixed-effects approach. *Health Serv Res*. 2010;45:792–805.
9. Acosta DA, Poll-Hunter NI, Eliason J. AAMC analysis in brief. Trends in racial and ethnic minority applicants and matriculants to U.S. Medical Schools, 1980−2016. Available at: https://www.aamc.org/download/484966/data/november2017trendsinracialandethnicminorityapplicantsandmatricu.pdf. Accessed February 13, 2019.
10. Gardner AK. How can best practices in recruitment and selection improve diversity in surgery? *Ann Surg*. 2018;267:e1–e2.
11. de Virgilio C, Yaghoubian A, Kaji A, et al. Predicting performance on the american board of surgery qualifying and certifying examinations: a multi-institutional study. *Arch Surg*. 2010;145:852–856.
12. Maker VK, Zahedi MM, Villines D, Maker AV. Can we predict which residents are going to pass/fail the oral boards? *J Surg Educ*. 2012;69:705–713.
13. Gauer JL, Jackson JB. The association of USMLE Step 1 and Step 2 CK scores with residency match specialty and location. *Med Educ Online*. 2017;22:1358579.
14. Edmond MB, Deschenes JL, Eckler M, Wenzel RP. Racial bias in using USMLE step 1 scores to grant internal medicine residency interviews. *Acad Med*. 2001;76:1253–1256.
15. Nickens HW, Ready TP, Petersdorf RG. Project 3000 by 2000. Racial and ethnic diversity in U.S. medical schools. *N Engl J Med*. 1994;331:472–476.
16. National Center for Education Statistics. Digest of education statistics. Available at: https://nces.ed.gov/programs/digest/d16/tables/dt16_306.30.asp. Accessed February 14, 2019.
17. U.S. Department of Education. National center for education statistics. status and trends in the education of racial and ethnic groups 2017. Available at: https://nces.ed.gov/pubs2017/2017051.pdf. Accessed February 14, 2019.

18. Stanford Medicine. Samuel L. Kountz diversity fellowship. Available at: https://med.stanford.edu/gensurg/education/clerkship/kountzdiversityfellowship.html. Accessed March 21, 2019.

19. Harvard Medical School. Office for diversity inclusion and community partnership visiting clerkship program. Available at: https://mfdp.med.harvard.edu/vcp. Accessed March 21, 2019.

20. Medical University of South Carolina. Underrepresented in medicine visiting student program. Available at: https://education.musc.edu/colleges/medicine/diversity/students/underrepresented. Accessed March 21, 2019.

21. Stanford Medicine. Graduate medical education GME diversity committee. Available at: https://med.stanford.edu/gme/diversity.html. Accessed March 21, 2019.