Is There Color or Gender Behind the Mask and Sterile Blue? Examining Gender and Racial Demographics within Academic Surgery

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INTRODUCTION

Academic surgery has a noted deficiency in the number of underrepresented minority (URM) residents, junior faculty, and tenured professors. Underrepresented minorities comprise a small percentage of medical school graduates, and with each successive step along the academic surgical career pathway, their representation dwindles.

This lack of diverse representation in the surgical workforce is concerning for several reasons. There are well-described advantages to having a diverse physician workforce, including higher patient satisfaction scores, superior patient compliance with physician recommendations, and increased participation in clinical research studies for URM patients. In addition, minority healthcare professionals are more likely than their White peers to treat patients of color, and to practice in medically underserved communities.

Unfortunately, the demographics of the surgical workforce are lacking in multiple areas. Gender representation has been a persistent issue in the surgical fields. Women are now entering medical school at higher rates than men; however, they are less likely to pursue surgical disciplines, advance in rank or achieve leadership roles. In 2017, only 16% of all medical school deans and department chairs across all medical specialties were women.

To date there have been 31 female chairs of Departments of Surgery nationally. At this time, there has never been a Black female chair of a Department of Surgery in the United States. Black females face the unique challenge of being a minority in both race and gender. However, there has been scant literature looking directly at the status of Black females in surgery.

We believe that delineating the demographics of the U.S. surgical workforce and trainee pipeline could provide substantial information and insight into the reasons behind the underrepresentation of certain groups. As authors, we predict that the number of minority (namely Hispanic and Black) medical students, residents and faculty will be underrepresented and that these deficits will likely be even more prominent for female URM trainees and faculty.

METHODS

The AAMC data files were used to collect demographic information on all medical school applicants, accepted students, matriculants, and medical school faculty in US allopathic medical schools. Combined data on race and gender for active residents is not publicly available and had to be requested specifically from the AAMC.

Race/ethnicity, defined by the AAMC as American Indian or Alaskan Native, Asian, Black/African American, Hispanic/Latino or of Spanish origin, Native Hawaiian or other Pacific Islander, White, Other, multiple race or unknown, were extracted from the data base. To simplify the analysis the very small Native and Hawaiian Americans’ groups were combined with the Other group. The small unknown racial group was excluded from analysis.
Data from the AAMC on medical students was broken down into several categories: applicants to medical school, students accepted to a U.S. medical school, and matriculated students. Surgical specialties included in our analysis were Obstetrics and Gynecology, Otorhinolaryngology, Ophthalmology, Orthopedic Surgery and General Surgery. The category “General Surgery” includes Neurosurgery, Cardiothoracic Surgery, Vascular Surgery, Urologic Surgery, Plastic Surgery, General Surgery, and General Surgery subspecialties. AAMC data from 2017-2018 was used for our analysis.13

In effort to determine whether medical students, residents and surgical faculty were reflective of the U.S. population, information was collected from the 2018 U. S. Census Bureau population projections.14 The U.S. Census data was broken down into the following racial groups: Hispanic, White, Black, Asian, American Indian/Alaskan Native and Other/Mixed Race. The AAMC data was grouped using the same categories to allow for comparison to the census in Figure 1. For the remainder of the analysis, the mixed-race group was separated from the Other group.

Data was analyzed for medical students, surgical residents and faculty in comparison with the overall U.S. population using \( \chi^2 \) tests. Race and gender breakdowns of the different surgical subspecialties was also analyzed using \( \chi^2 \) tests assuming mutual independence of the variables gender, race and subspecialty. Statistical significance was noted if the \( P \) value was <.01.

RESULTS

Racial Demographics of Medical Students, Surgical Residents and Surgical Faculty

(Figure 1)

Racial and Gender Demographics of Medical Students, Surgical Residents, and Surgical Faculty

Matriculated medical students were then compared to surgical faculty and found to be significantly different in their racial/ethnic composition (\( P < .01 \)). Black medical students made up 7.4% of the matriculated student population, meanwhile Black faculty only comprised 4.2% of surgical faculty. Whites comprised 51.5% of matriculated medical students and 69.8% of surgical faculty. Asians made up 22.8% of the matriculated medical student population and 17.7% of the surgical faculty. Hispanic students were 6.4% of matriculated students with only 3.4% represented in the surgical faculty.
Women overall made up a higher percentage of accepted and matriculated medical students than men (51.7% and 51.6%, respectively). When broken down into race and gender subgroups, we found that White men were the largest individual of both accepted and matriculated students, at 25.9%. Black women were 4.7% of both accepted and matriculated students. Black men represented 2.8% of accepted and matriculated students. Hispanic men and women each equally comprised 3.2% of accepted and matriculated students.

Women made up 43.8% of all surgery residents. Broken into subgroups, White males were again the largest group at 37.6%. Of note, Hispanic females were only 2.1% and Hispanic males 2.4%. Men made up a higher percentage in every racial category, as compared to women, except for the Black group. Black men made up only 1.9% of all surgical residents while Black women made up 2.6%.

Even though women made up the majority of matriculated medical students, only 34.3% of surgical faculty were female. As seen in the demographics of surgical residents, women comprised a smaller percentage than men in almost every racial category for faculty. White men were the largest group at 46.9%, whereas White women, the second largest group, comprised 22.9% of surgical faculty. Hispanic women made up the smallest subgroup with only 1.1% represented. Hispanic men were 2.3%. The only racial group where women outnumbered men was Blacks with men comprising 2.1% and women comprising 2.2%.

Surgical Faculty Demographics Broken Down by Surgical Subspecialty

(Figure 2)
(Table 3)

The racial and gender demographics of the surgical faculty was then broken down by individual subspecialties (Obstetrics and Gynecology, Otorhinolaryngology, Ophthalmology, Orthopedic Surgery and General Surgery). Obstetrics and Gynecology (Ob/Gyn) was found to have significantly different demographics than the other subspecialties, as seen in Figure 2 ($P<.01$). Ob/Gyn had the highest representation of Black women of any surgical subspecialty where they made up 6.2% of faculty. Hispanic women comprised 2.6% of Ob/Gyn and White women 43.1%.

Black women made up only 1.3% of the General Surgery faculty. Hispanic women were the least represented group in General Surgery with just 0.7%. White men made up the largest group in the General Surgery group with 52.6%. The second largest group was White women with 16.9%, followed by Asian men at 13.3%.

The specialty with the smallest percentage of Black women was Orthopedic Surgery with only 0.6%. The smallest representation of any subspecialty was Hispanic women in Orthopedic Surgery, making up only 0.4% of faculty.

The specialty with the highest representation of Black men was General Surgery with 2.4%. Ophthalmology had the lowest percentage of Black men at 0.8%. White men were the largest group of
every specialty except Ob/Gyn where White women were the largest group. White men had the highest representation in Orthopedic Surgery with 62.8% and the lowest in Ob/Gyn with 25.3%.

Demographics of Surgical Faculty at Different Academic Ranks

(Figure 3)

(Table 4)

Faculty data was then broken down by academic rank. Categories included: instructor, assistant professor, associate professor, full professor and other. The racial and gender demographics of each of these rank groups were then analyzed. Overall, there was a clear underrepresentation of Black and Hispanic faculty at the higher ranks of associate professor and professor.

With each increase in professional rank, the percentage of Black women fell. Black women made up 2.8% of assistant professors, but only 1.6% of associate professors and 0.7% of full professors. Black men were underrepresented, however there was less attrition in representation at the higher ranks. Black men made up 2.1% of assistant professors, 2.4% of associate professors and 2.1% of full professors.

Hispanic women had the least representation of any individual group, comprising 1.1% of assistant professors, 0.9% of associate professors and 0.6% of full professors. Similar to Black women, Hispanic women also had attrition in percentage with each increase in rank. White men were by far the largest group in each category; with each successive increase in rank, White male representation increased. White men made up the majority of professors (65.4%).

As seen in Table 3, Ob/Gyn had significantly higher representation of Black women as compared to other specialties. Given the fact that Ob/Gyn was significantly different, subsequent analysis was performed both including Ob/Gyn in the grouped data, and excluding it as an outlier as shown in Table 4.

With the Ob/Gyn data removed, we see that Black women make up only 1.6% of assistant professors, 0.9% of associate professors and 0.4% of full professors. Similarly, the same trend was noted with regards to Hispanic women. Without Ob/Gyn, Hispanic women made up 0.8% of assistant professors, 0.6% of associate professors and 0.3% of professors. White male representation increased to 68.5% at the level of full professor. Black male representation remained stable.

DISCUSSION

This is the first national cross-sectional survey of medical students, surgical residents, and academic surgical faculty that examines the combination of both race and gender demographics in the full surgical workforce. Moreover, we feel that these results are robust because we have included the full population of medical trainees from medical students through academic faculty. Our results highlight the dramatic underrepresentation of certain groups and offer a compelling call to action.

Figure 1 highlights that the racial breakdown of applicants and matriculants to medical school do not mirror that of the US population. Black and Hispanics are significantly underrepresented as
compared to the general US population, and Whites and Asians are conversely overrepresented. These disparities are further amplified within surgery, as we see the numbers of Black and Hispanic surgical residents decrease when compared to medical school matriculants.

While it is well known that Blacks are underrepresented in the surgical workforce, the authors find it striking to see the difference between Black men and women in regards to academic rank. Black men, as a percentage, remained stable at the various ranks with 2.1%, 2.4% and 2.1% for assistant, associate and full professor respectively. However, Black women had a dramatic decrease in representation with increase in rank, sometimes by more than half, with 2.8%, 1.6% and 0.7% for assistant, associate and full professor respectively. This trend was exacerbated when Ob/Gyn was excluded. Again, Black men remained stable with 2.1%, 2.2% and 2.0% at each escalating rank, while Black women fell with each step, 1.6%, 0.9% and 0.4%.

Black women outnumber Black men in medical school and surgical residency; however, Black women account for less than half of the representation of Black males at the level of full professor. If Ob/Gyn is excluded, Black women comprise less than a quarter of their male counterparts. These findings are corroborated by the recent work by Berry et al. which similarly found a dearth of Black female representation at the highest levels of surgical leadership.

Additionally, the degree to which Hispanics were underrepresented was striking. At the faculty level, Hispanic women comprised only 0.4% of full professors (0.3% without Ob/Gyn), making them the least represented subgroup at the highest levels of leadership. The Hispanic population in the US is the fastest growing ethnic or racial group in the country. This demonstrated lack of diversity highlights how the US surgical workforce is not representative of US demographics, and likely not optimally equipped to handle the needs of our increasingly diverse patient population.

Differences Between Subspecialties

Black women were significantly overrepresented in Ob/Gyn when compared to the other surgical fields at 6.2%. As a percentage, this was more than three times higher than any other surgical field. One possible explanation for this observation is that Ob/Gyn has the highest representation of women of any surgical specialty. Given that there are more female Black medical students (female 4.5% and 2.9% male), if all else is held equal, there will be more Black female surgeons in Ob/Gyn than in any other surgical specialty. Another hypothesis is that there are more diverse and female mentors to serve as role models to incoming medical students. However, overall, there is scant literature examining why Ob/Gyn in particular has higher female URM representation when compared to the other surgical fields and is an area that warrants future research.

As a trend, both Blacks and Hispanics were very poorly represented within Ophthalmology, Orthopedic surgery and Otorhinolaryngology. One possible explanation is that minority students have traditionally scored lower on the United States Medical Licensing Examination (USMLE). It is also worth noting that the cause of lower USMLE scores among Black and Hispanic students is likely multifactorial, but beyond the scope of this current project. Competitive subspecialties such as Ophthalmology, Orthopedic surgery and Otorhinolaryngology often use USMLEs to screen applicants during the residency application process. Thus, the use of rigid screening criteria can create barriers for minority
students. Alternatively, the use of more holistic screening criteria may yield more diverse resident populations. The AAMC defines holistic review as a flexible and individualized way of assessing an applicant’s capabilities. Traditional approaches have relied heavily on standardized testing, grades and class ranking. Holistic review has already been implemented in many medical schools and has demonstrated a significant increase in racial diversity of accepted and matriculated medical students. This approach is especially appealing given the recent announcement that the USMLE Step 1 exam is shifting to pass/fail grading. This change gives program directors an opportunity to reevaluate their selection criteria. Opponents to holistic review often state that the elimination of objective metrics may compromise acceptance standards; however, this may not be valid. The USMLE may not be an accurate predictor of later success; for example, surgical residents with lower than average USMLE scores often go on to be successful residents and pass their surgical boards.

Why the Lack of Diversity at the Top?

Our analysis shows that there is attrition of minority women with each increasing academic rank, which results in dramatically low levels of representation at the top. This prompts the question: why this is occurring? A recent multi-institutional survey of general surgery residents found that there was no difference between men and women in their desire to hold leadership positions such as department chair, division chief or program director. This demonstrates that women enter surgical residency with the same goals as their male counterparts, but likely face unequal barriers in pursuit of these goals, this leads to poor representation at the highest levels. These barriers are likely multifactorial, rooted in years of “traditional” organizational culture that promotes male domination of surgery and are enhanced by societal pressures on women to strike a work-family balance.

Furthermore, a lack of mentorship from minority women further discourages future minority women from seeing themselves in leadership roles. Moreover, Dworkin and colleagues demonstrated gender inequity in academic citations, showing that female first and last authors are cited less frequently than would be expected when compared to male authors. This is important to note given that academic productivity is often a critical component of earning tenure or promotion.

Additionally, implicit bias may also play a role in the lack of diversity in the medical profession. Johnson et al. demonstrated that faculty members involved in the recruitment and retention of underrepresented minorities, on average, harbored slight implicit pro-White racial bias. These biases may unconsciously influence the recruiting, retention and promotion of minority physicians in academic medicine.

Strategies to Improve Gender and Racial Representation in Surgical Leadership

An important part of improving diversity and inclusion is identification of specific organizational and individual barriers. Unfortunately, different individuals, programs, or regions may have different issues at play. A baseline assessment is critical for enacting meaningful directed interventions. There are several published tools for such assessment, including the Diversity Engagement Survey.
emphasis should also be placed on faculty development and education around the structural barriers that lead to gender and racial imbalances.

Active recruitment and retention of women and minorities is imperative to creating a diverse workforce. Establishment of dedicated offices of Diversity and Inclusion can help facilitate these efforts. Institution level programming can help minority community members feel supported and encourage overall retention. For new community members, it can be especially helpful for institutions to facilitate mentorship programs, and provide resources for establishing clinical practices and research careers. Importantly, effective mentorship can be taught through providing mentorship education to attending-level surgeons, which specifically focus on how to support minority mentees. Maternity and paternity leave policies, along with other child care resources, should also be an integral part of supporting students, residents and faculty.

Transparency in compensation and promotion is another possible tool in improving minority female representation. Morris et al showed that an objective and structured compensation plan improved the gender pay gap after implementation, and equalized the rate of promotion.

One of the most vital and difficult parts of promoting diversity is in creating a culture of respect and inclusion. Surgery has long been structured as a hierarchical system. It is imperative that the individuals in positions of authority model positive behavior and promote inclusion. There is, unfortunately, a growing body of evidence that shows that bullying, sexual harassment and microaggressions are prevalent in the surgical fields. These behaviors most typically impact vulnerable groups such as women and minorities. Program leadership should take a firm stance on these behaviors to promote professionalism and encourage a safe environment for the entire community.

The Leaky Surgical Pipeline

Research on the lack of URMs pursuing medical careers identify a number of factors, including poor pre-college academic preparation, lack of financial aid, family responsibilities, lack of mentoring, faculty and peer discrimination, unconscious bias, stereotype threat and social isolation all as barriers to success. Programs such as the John’s Hopkins MERIT health leadership academy aims to address some of these issues. The MERIT program has demonstrated success in helping Black high school students raise SAT scores, placing students in research positions, and providing longitudinal mentorship. Similarly participation in the Health Equity Scholars Program has demonstrated higher rates of timely college graduation. Investment in these pipeline programs have demonstrated that breaking down barriers for minority students will be imperative in improving diversity in medicine and surgery.

As shown in Table 1, the percentages of US surgical faculty closely mirrors that of active surgical residents and fellows. This suggests that increasing the number of minority surgical faculty will require an increase in the number of minority surgical residents and fellows, and should be an area of focus for intervention. Surveys of surgical residents have demonstrated that mentorship and research experience during medical school were the strongest factors associated with plans to pursue an academic career. Formal mentorship programs like those provided by the Society of Black Academic Surgeons or the
Diverse Surgeon Initiative\textsuperscript{45} may help encourage more students to pursue academic surgical training. These types of programs can be duplicated at the local level or within single institutions.

Limitations

This study has several limitations. We cannot account for students, residents or faculty that identify as gender nonconforming as this data was not collected in the AAMC datasets. The multiple race category also presents certain limitations in that some minorities, while filling this category, could underestimate the true size of other demographic groups. We feel that this effect is temporized by the fact that the multiple race groups were small. As the US and surgical workforce become more diverse over time this will become an increasingly larger issue when studying race. Our manuscript also does not include geographic breakdowns or any regional information, which could be very valuable in delineating appropriate barriers and possible interventions.

This paper opens the door to many future areas of further research. Analyzing demographics over time would be a clear next step. Time trends of demographics would allow us to see if the diversity of the workforce is moving in the desired direction toward equitable representation.

Conclusions

Overall, there is a striking lack of minorities and women, and notably in minority women, in surgery. This lack is exemplified as surgeons progress throughout their careers – from student, to resident, to attending, and then to leadership positions. These disparities in representation are likely multifactorial and there is not one single-fix to even the playing field. However, this paper provides a call to action and identifies several potential areas for systemic and program level interventions.

ACKNOWLEDGEMENTS

The authors thank the AAMC for providing the data on Medical Students, Residents and Faculty for this project. We would also like to thank Ms. Nirali Shah for her statistical consultation.

TABLE LEGEND

Table 1
Demographics of Accepted Medical Students, Matriculated Medical Students, Surgical Residents/Fellows and Surgical Faculty compared to the U.S. Population

Table 2
Demographics of Accepted Medical Students, Matriculated Medical Students, Active Residents/Fellows and Surgical Faculty broken down by Race and Gender

Table 3
Different Surgical Subspecialties Broken Down by Race and Gender

Table 4
Demographics of Surgical Faculty by Rank

FIGURE LEGENDS

Figure 1
Demographics of Medical Trainees and Faculty Compared to the US Population

Figure 2
Surgical Subspecialties Broken Down by Race and Gender

Figure 3
Demographics of Surgical Faculty by Rank

REFERENCES


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**Appendix Table 1**

<table>
<thead>
<tr>
<th></th>
<th>White</th>
<th>Black or African American</th>
<th>Asian</th>
<th>Hispanic, Latino or of Spanish Origin</th>
<th>Mixed race/Other</th>
<th>Total</th>
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<td><strong>U.S. Population</strong></td>
<td>197,546,407(60.4%)</td>
<td>40,902,223 (12.5%)</td>
<td>18,728,675 (5.7%)</td>
<td>59,871,746 (18.3%)</td>
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<td>3,297 (6.6%)</td>
<td>6,185 (12.4%)</td>
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<td>11,198 (51.6%)</td>
<td>1,596 (7.3%)</td>
<td>4,948 (22.8%)</td>
<td>1,402 (6.5%)</td>
<td>2,576 (11.9%)</td>
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<td><strong>Matriculants</strong></td>
<td>10,783 (51.5%)</td>
<td>1,540 (7.4%)</td>
<td>4,787 (22.9%)</td>
<td>1,350 (6.4%)</td>
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<td>16920 (64.7%)</td>
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<td>4,458 (17.0%)</td>
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<td>2,420 (9.3%)</td>
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<td><strong>U.S. Surgical Faculty</strong></td>
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<td>626</td>
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### Table 3

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<th>White Male</th>
<th>White Female</th>
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<th>Other Female</th>
<th>Multiple Race Male</th>
<th>Multiple Race Female</th>
<th>Total</th>
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<td>OB/GYN</td>
<td>267 (4.3%)</td>
<td>550 (8.8%)</td>
<td>142 (2.3%)</td>
<td>386 (6.2%)</td>
<td>138 (2.2%)</td>
<td>160 (2.6%)</td>
<td>1584 (25.3%)</td>
<td>2707 (43.2%)</td>
<td>21 (0.3%)</td>
<td>47 (0.7%)</td>
<td>92 (1.5%)</td>
<td>179 (2.9%)</td>
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<td>Ophthalmology</td>
<td>440 (14.6%)</td>
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<td>46 (1.5%)</td>
<td>23 (0.8%)</td>
<td>1225 (40.7%)</td>
<td>643 (21.4%)</td>
<td>12 (0.4%)</td>
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<td>25 (0.6%)</td>
<td>67 (1.7%)</td>
<td>15 (0.4%)</td>
<td>2521 (62.8%)</td>
<td>591 (14.7%)</td>
<td>36 (0.9%)</td>
<td>7 (0.2%)</td>
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<td>Otorhinolaryngology</td>
<td>267 (12.2%)</td>
<td>140 (6.4%)</td>
<td>28 (1.3%)</td>
<td>16 (0.7%)</td>
<td>43 (2.0%)</td>
<td>23 (1.1%)</td>
<td>1040 (47.6%)</td>
<td>527 (24.1%)</td>
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<td>772 (4.9%)</td>
<td>369 (2.4%)</td>
<td>198 (1.3%)</td>
<td>416 (2.7%)</td>
<td>113 (0.7%)</td>
<td>8206 (52.6%)</td>
<td>2644 (17.0%)</td>
<td>117 (0.8%)</td>
<td>33 (0.2%)</td>
<td>470 (3.0%)</td>
<td>180 (1.2%)</td>
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### Table 4

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<th>Rank (including OB/Gyn)</th>
<th>Asian Male</th>
<th>Asian Female</th>
<th>Black or African American Male</th>
<th>Black or African American Female</th>
<th>Hispanic, Latino, or of Spanish Origin Male</th>
<th>Hispanic, Latino, or of Spanish Origin Female</th>
<th>White Male</th>
<th>White Female</th>
<th>Other Male</th>
<th>Other Female</th>
<th>Multiple Race Male</th>
<th>Multiple Race Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assistant Professor</td>
<td>1,615 (11.5%)</td>
<td>1,114 (7.9%)</td>
<td>297 (2.1%)</td>
<td>400 (2.8%)</td>
<td>313 (2.2%)</td>
<td>160 (1.1%)</td>
<td>5,707 (40.6%)</td>
<td>3,555 (25.3%)</td>
<td>112 (0.8%)</td>
<td>60 (0.4%)</td>
<td>403 (2.9%)</td>
<td>317 (%)</td>
<td>14,053</td>
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<tr>
<td>Associate Professor</td>
<td>878 (13.4%)</td>
<td>361 (5.5%)</td>
<td>155 (2.4%)</td>
<td>105 (1.6%)</td>
<td>166 (2.5%)</td>
<td>58 (0.9%)</td>
<td>3,229 (49.4%)</td>
<td>1,323 (20.2%)</td>
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<td>152 (2.3%)</td>
<td>53 (%)</td>
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<td>Professor</td>
<td>742 (10.1%)</td>
<td>193 (2.6%)</td>
<td>153 (2.1%)</td>
<td>49 (0.7%)</td>
<td>170 (2.3%)</td>
<td>42 (0.6%)</td>
<td>4,785 (65.4%)</td>
<td>959 (13.1%)</td>
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<td>Instructor</td>
<td>199 (8.3%)</td>
<td>240 (10.0%)</td>
<td>32 (1.3%)</td>
<td>87 (3.6%)</td>
<td>47 (2.0%)</td>
<td>58 (2.4%)</td>
<td>626 (26.1%)</td>
<td>969 (40.4%)</td>
<td>19 (0.8%)</td>
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<td>77 (9.9%)</td>
<td>72 (9.3%)</td>
<td>3 (0.4%)</td>
<td>30 (0.9%)</td>
<td>14 (1.8%)</td>
<td>16 (2.1%)</td>
<td>229 (29.4%)</td>
<td>306 (39.3%)</td>
<td>4 (0.5%)</td>
<td>2 (0.3%)</td>
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<td>Hispanic, Latino, or of Spanish Origin</td>
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<td>789 (7.2%)</td>
<td>230 (2.1%)</td>
<td>172 (1.6%)</td>
<td>257 (2.4%)</td>
<td>90 (0.8%)</td>
<td>5,117 (46.8%)</td>
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<td>2,100 (19.2%)</td>
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<td>823 (15.4%)</td>
<td>259 (4.8%)</td>
<td>120 (2.2%)</td>
<td>50 (0.9%)</td>
<td>132 (2.5%)</td>
<td>34 (0.6%)</td>
<td>2,860 (53.5%)</td>
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<td>146 (2.4%)</td>
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<td>4,240 (68.5%)</td>
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<td>24 (1.4%)</td>
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Note – this is the pre-publication pdf