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Trends in Diversity in Integrated Cardiothoracic Surgery Residencies

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ABSTRACT

BACKGROUND Integrated cardiothoracic surgery residencies began 2006 to address workforce shortages in cardiothoracic surgery. As more attention has been given to racial and gender disparities, our goal was to examine trends in diversity among integrated cardiothoracic residents.

METHODS All US accredited integrated cardiothoracic programs that had accepted residents through 2020 were included. A resident list was collected through online websites and direct institutional contact. Gender, race, and year of entry were recorded. Linear regression models were used to evaluate racial and gender trends over time.

RESULTS From 2006 through 2020, 321 residents were accepted into integrated cardiothoracic training programs. Men comprised 72% (232/321) of the cohort. The racial distribution was 66.4% White (213/321), 26.2% Asian (84/321), 5.3% Hispanic (17/321), and 2.2% African American (7/321). Over the study period the time slope for Whites was -2.95 ($P < .01$), indicating an approximately 3% decrease each year. The time slope for Asians was 1.60 ($P < .01$), whereas the time slope did not change significantly for African Americans (0.10 , $P = .94$) or Hispanics (0.13 , $P = .91$). Adjusting for the number of integrated programs each year as a covariate did not change trends for any race. The time slope did not change significantly over the time period for men (-0.25 , $P = .71$).

CONCLUSIONS Gender and racial diversity have not improved over time in integrated cardiothoracic residencies. Institutions should strive to recruit medical students from underrepresented backgrounds and increase their focus on gender diversity.

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Integrated cardiothoracic surgery residencies began 2006 to create a focused training pathway to train future cardiothoracic surgeons.¹ In the traditional pathway trainees complete a general surgery residency followed by 2 or 3 years of cardiothoracic training. In integrated programs residents complete 6 years of combined general surgery and cardiothoracic clinical training. In some programs an additional 2 years after the second or third year is allotted for dedicated research or to pursue a professional degree. The number of US accredited integrated programs has gradually increased to 35 as of 2021.

Previous studies have highlighted a lack of diversity among surgical trainees.²⁻⁶ The benefits of diversity in medicine and medical training are numerous, including

increased productivity, increased creativity, and a better ability to relate to a broader segment of the population.^{7,8} In addition medical students of all races reported an improved educational experience as the level of diversity increased in their student body.⁹ The level of gender and racial diversity has improved over time in surgical residencies, but there is still a considerable diversity gap.¹⁰

Although prior literature has examined traditional cardiothoracic programs,¹¹ no studies have investigated the level of gender and racial diversity among integrated cardiothoracic trainees. Our goal was to study the level of diversity among entering integrated cardiothoracic residents and to compare diversity in integrated cardiothoracic programs with other surgical service lines.

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TABLE 1 Demographic Data for Integrated Cardiothoracic Residents (N = 321)

Demographics	Percentage of cases (n/N)
Male sex	72.3 (232/321)
Race/ethnicity	
White	66.4 (213/321)
Asian	26.1 (84/321)
Hispanic	5.3 (17/321)
African American	2.2 (7/321)

MATERIAL AND METHODS

All US integrated cardiothoracic surgery trainees who had begun their residencies were included in the study. All trainees who had entered from the first year of integrated cardiothoracic programs in 2006 until 2020 were included. A list of all trainees was obtained through residency websites, program directors, and direct contact with different institutions. Initially each program's public website was reviewed to get a list of trainees at that program over time. When trainee information was not complete or available online, the program director or member of that program was contacted directly for the trainee information. Contact occurred through phone calls and emails. Institutional review board approval for this study was obtained before performing the online search or contacting any program directly.

Gender, race, and year of entry were obtained for each trainee. To categorize race we used the "Standards for maintaining, collecting and presenting federal data

on race and ethnicity" by the Office of Civil Rights and the US Department of the Interior.¹² Race was assigned based on review of the website or directly from information from the institutions. To compare integrated cardiothoracic programs with other types of surgery residencies, data about racial and gender trends were obtained from the Accreditation Council for Graduate Medical Education and the Graduate Medical Education Data Resource Book.¹³ Applicant information was obtained from the Association of American Medical Colleges and Electronic Residency Application Service.

Linear regression models were used to evaluate time trends for each gender and racial group. These models determined the direction, magnitude, and significance of the changes in percentages over time. An increase was denoted statistically by a significant positive change and a decrease by a negative annual change. Otherwise the trend was considered stable. Because the number of institutions changed over time as new programs were approved, an additional linear regression analysis was performed using the number of institutions in a particular year as a time-varying covariate.

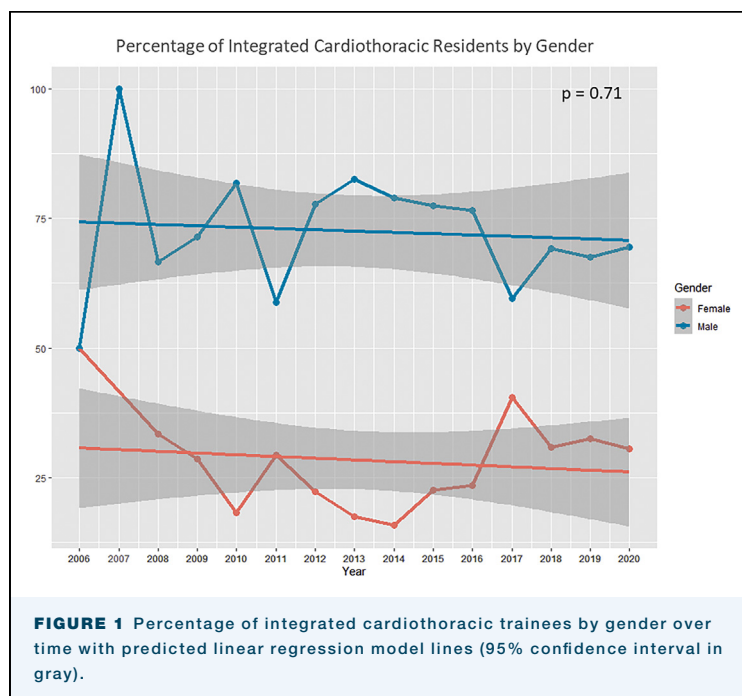
All statistical tests were 2-sided and with a significance of $P \leq .05$. All analyses were performed using R 4.0 (R Foundation for Statistical Computing, Vienna, Austria).

RESULTS

RESIDENTS. From 2006 through 2020, 321 integrated cardiothoracic residents were accepted and began training at 27 different institutions. Demographic data for the entire cohort of integrated cardiothoracic residents who began at a program is shown in Table 1. Male residents comprised 72% (232/321) of the cohort. The racial distribution was 66.4% White (213/321), 26.2% Asian (84/321), 5.3% Hispanic (17/321), and 2.2% African American (7/321).

GENDER DIVERSITY OVER TIME. The percentage of male integrated cardiothoracic residents ranged from 50% to 100% over time. Over the entire study period the time slope for men was -0.25 , indicating a nonsignificant 0.25% decrease in percentage of male integrated residents each year ($P = .71$) (Figure 1). When adjusting for the number of institutions for each particular year as a covariate, there was still no significant change in male percentage.

RACIAL DIVERSITY OVER TIME. The overall percentage of non-White integrated cardiothoracic residents each year ranged from 0 to 53% (Figure 2). The percentage of integrated residents in an individual year never rose above 11% for Hispanics or 6% for African Americans. Over the entire study period the time slope for White integrated residents was -2.95% each year ($P < 0.01$)



and for Asian integrated residents was 1.60 ($P < .01$). The time slope was not significant for African American (0.10, $P = .90$) or for Hispanic (0.13, $P = .94$) integrated residents. Adjusting for the number of institutions for each particular year as a covariate did not change racial trends.

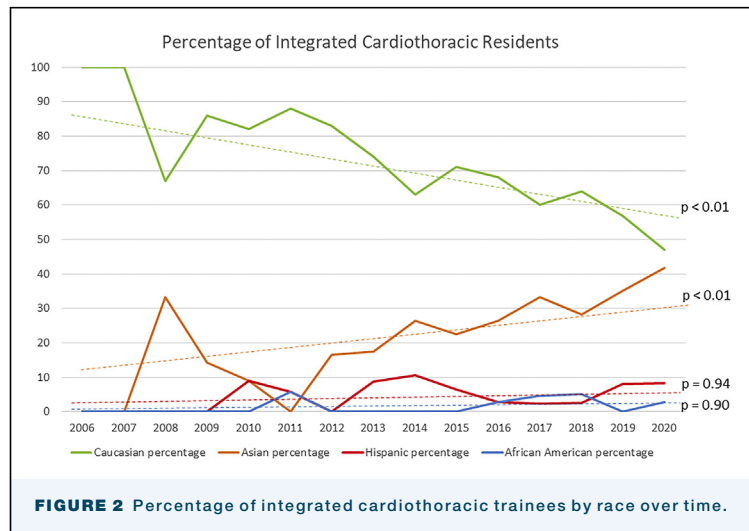
INTEGRATED CARDIOTHORACIC RESIDENCIES VS TRADITIONAL CARDIOTHORACIC FELLOWSHIPS. Data regarding gender and racial trends in traditional cardiothoracic fellowship programs were available from 2008 to the present. There was a higher percentage of female trainees in integrated cardiothoracic programs compared with traditional cardiothoracic programs (27.0% vs 19.4%, $P < .01$) (Figure 3). There were similar percentages of non-White trainees in integrated and traditional cardiothoracic programs (33.6% vs 31.4%, $P = .44$) (Figure 4).

PERCENTAGE OF APPLICANTS WHO SUCCESSFULLY MATCHED. Applicant information regarding gender and race was available from 2016 through 2020. Before 2016 this information was not collected. Over this period female applicants had a higher percentage of successfully matching into an integrated cardiothoracic program compared with male applicants (18.6% vs 13.2%, $P = .02$).

Figure 5 shows the rate of matching into an integrated program for each race from 2016 through 2020. Over this period the rate of matching successfully for Asians, Whites, Hispanics, and African Americans was 25.6%, 20.9%, 8.6%, and 7.2%, respectively.

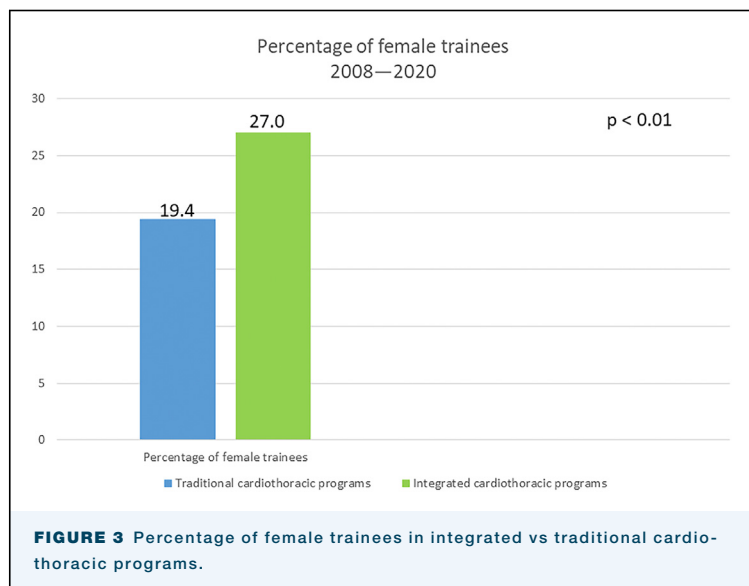
COMMENT

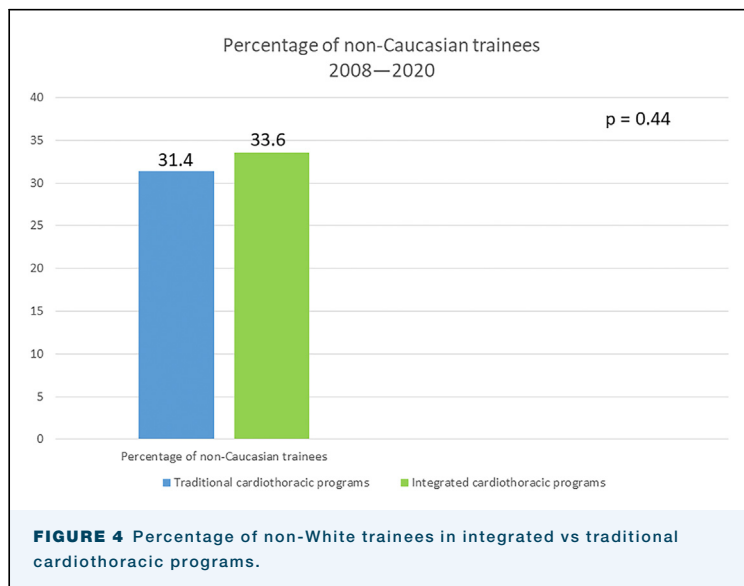
Our study showed that when time trend analyses are used, gender diversity or representation of African Americans and Hispanic residents in integrated cardiothoracic programs has not improved. Other studies have had comparable findings when analyzing the demographic makeup of trainees in cardiothoracic training programs.¹⁴ Interestingly gender diversity in integrated programs was better than in traditional cardiothoracic programs. One result of the adoption of the 80-hour work week has been the lack of exposure of general surgery residents to cardiothoracic surgery.¹⁵ In many institutions general surgery residents do not participate in any cardiac rotations. As a result most medical students get no exposure to cardiothoracic surgery. A study showed that 60% of female medical students would have increased interest in cardiothoracic surgery if they were exposed to a female cardiothoracic surgeon.¹⁶ Additionally surgery residents have expressed that finding a role model in cardiothoracic surgery is more important than in other specialties.¹⁷ Based on these studies exposing female trainees to female



cardiothoracic surgeons may improve gender diversity in the future.

Inadequate representation of African American and Hispanic physicians has been a chronic issue. According to the Association of American Medical Colleges, among active physicians in 2018 only 5.8% identified as Hispanic and 5.0% as Black or African American.¹⁸ The data from this survey are consistent, highlighting the fact that African American and Hispanic trainees make up less than 10% of cardiothoracic surgery trainees in integrated programs. One likely issue is a lack of awareness among premedical and medical students. Although integrated programs have been active since 2006, premedical and medical students who are not in institutions where these programs exist may not be exposed to integrated programs as an





option. The leadership within these programs needs to prioritize identifying premedical students through local community outreach, medical schools, and student groups such as the Thoracic Surgery Medical Students Association. There is a need to foster relationships that build pipelines to aid students in progressing toward integrated programs.¹⁹

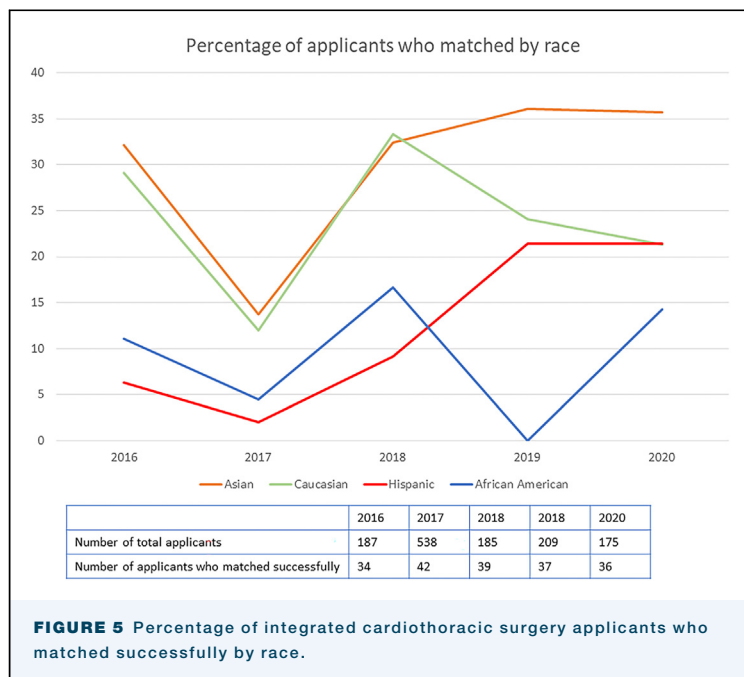
Another contributing factor, even for trainees who are familiar with integrated programs, is that students are unaware of the resources available for those interested in cardiothoracic surgery. Resources such as summer programs, internships, clinical rotations, and shadowing

opportunities are a necessity for those entering the field of surgery. Programs targeting African American/Black or Hispanic applicants are available.²⁰⁻²² However if premedical students are not aware of these programs, they are unable to take advantage of them. It would be beneficial if starting at the high school level students are purposefully identified and informed of these resources, with mentors identified to assist them in navigating the process. In addition social media and other electronic platforms can be used by training programs to reach out to underrepresented students.

Recently, another reason for lack of diversity in cardiothoracic surgery is that many outside the field have discouraged our service line. General surgery residents and medical students have been dissuaded from pursuing cardiothoracic surgery by noncardiothoracic mentors. Reasons cited have included a lack of jobs, cardiothoracic surgery regarded as a dying field, and concerns about the shifting of procedures to cardiology. Although this trend is not specific to Black/African American and Hispanic trainees, it is likely an important component of the lack of diversity in the field. These inclinations suggest a need for early and consistent exposure of premedical students of African American and Hispanic descent to cardiothoracic surgery by those within the field who can provide accurate information regarding current and future prospects in the field. The fact that African Americans and Hispanics make up, respectively, only 2.2% and 5.3% of trainees is alarming. This low representation highlights a significant need to increase efforts to improve diversity. It is important to note the percentage of underrepresented medical students at these institutions as well.

In our study we discovered racial disparities at the applicant level as well. This lack of underrepresented trainees is an example of the “leaky pipeline” phenomenon, in which underrepresented trainees are less likely to continue toward specialties beginning as early as kindergarten.²³⁻²⁶ Most scientific studies regarding this phenomenon have shown that early exposure to specialty fields can reduce the impact of the leaky pipeline. In our situation exposing undergraduate and medical students to cardiothoracic surgery may likely improve diversity.

It is important to note that although there are some common reasons for gender disparities and racial disparities, there are stark differences in gender vs racial issues. As an example slightly over 50% of current medical students are women. In comparison only 3% are African American. Themes such as unconscious bias, lack of role models, and societal expectations may influence gender disparities differently from how they influence racial disparities. Understanding these influences will help to reduce these disparities going forward.



One notable limitation of our study is that the qualifications of applicants were not known. Because integrated cardiothoracic positions are very competitive, understanding components of the resume such as test scores would give additional background into the lack of diversity in integrated programs. Our study did show that Hispanic and African American trainees were less likely to apply to integrated cardiothoracic programs. Hispanics and African Americans also had a lower percentage of matching successfully when they did apply. Having data such as board scores, number of publications, and other similar information would be helpful to analyze

reasons for the lower percentage of matching successfully among these applicants. Furthermore future interventions can include mentoring underrepresented applicants at the early stages in their training to have “stronger” resumes.

Our study showed a lack of diversity in integrated cardiothoracic surgery training programs. This lack of diversity is especially profound among African American and Hispanic trainees, with no significant changes in representation among these groups. Because the benefits of diversity have been noted in many professions, our service line should have a focus on reducing this disparity and retaining underrepresented staff.

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