

Is Plastic Surgery Training Equitable? An Analysis of Health Equity across US Plastic Surgery Residency Programs

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Background: Achieving health equity includes training surgeons in environments exemplifying access, treatment, and outcomes across the racial, ethnic, and socioeconomic spectrum. Increased attention on health equity has generated metrics comparing hospitals. To establish the quality of health equity in plastic and reconstructive surgery (PRS) residency training, we determined the mean equity score (MES) across training hospitals of US PRS residencies.

Methods: The 2021 Lown Institute Hospital Index database was merged with affiliated training hospitals of US integrated PRS residency programs. The Lown equity category is composed of three domains (community benefit, inclusivity, pay equity) generating a health equity grade. MES (standard deviation) was calculated and reported for residency programs (higher MES represented greater health equity). Linear regression modeled the effects of a program's number of training hospitals, safety net hospitals, and geographical region on MES.

Results: The MES was 2.64 (0.62). An estimated 5.9% of programs had an MES between 1–2. In total, 56.5% of programs had an MES between 2 and 3, and 37.7% had an MES of 3 or more. The southern region was associated with a higher MES compared with the reference group (Northeast) ($P = 0.03$). The number of safety net hospitals per program was associated with higher MES ($P = 0.02$).

Conclusions: Two out of three programs train residents in facilities failing to demonstrate high equity healthcare. Programs should promote health equity by diversifying care delivery through affiliated hospitals. This will aid in the creation of a PRS workforce trained to provide care for a socioeconomically, racially, and ethnically diverse population. (*Plast Reconstr Surg Glob Open* 2023; 11:e4900; doi: 10.1097/GOX.0000000000004900; Published online 5 April 2023.)

INTRODUCTION

Underserved and minority populations in the United States experience higher rates of traumatic injury,

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delayed treatment of surgical disease, disease recurrence, and lower health outcomes.^{1–3} These disparities are linked to the unequal distribution of social and political determinants in our society, which include systemic factors that propagate racism, poverty, education, employment, lack of access to care, and limited diversity in the healthcare workforce. In plastic surgery specifically,^{4,5} research has elicited health disparities across subspecialties, including breast reconstruction,^{6–8} hand surgery,^{9,10} traumatic facial injuries, and gender-affirming surgery.¹¹

Although extensive research exists demonstrating health disparities across surgical fields, as recently as 2016, an American College of Surgeons online survey reported that only 12% of surgeons believed there were disparities in their practices, and only 37% reported any institutional initiatives to mitigate these disparities.^{12,13} Recognizing the lack of diversity among medical providers, much emphasis has been made to increase efforts

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to address disparities in graduate medical education (GME).¹⁴⁻¹⁶ Within plastic surgery, health disparities research has recommended interventions relating to legislation, care coordination, physician training, or patient education.^{4,5} Robust analyses are still needed to both fully understand causes of disparities and effectively produce interventional efforts.⁴ The field of plastic and reconstructive surgery lags behind in addressing inequities and educating trainees about existing healthcare disparities in the field.¹⁷⁻²⁰

The Lown Institute Hospital Index (LIHI) provides a ranking of the social responsibility of US hospitals based on health outcomes, value, and equity metrics.²¹ The LIHI equity category is composed of three components: community benefit (charity care, Medicaid revenue, community investment); inclusivity (by race, income, education); and pay equity (executive compensation versus worker compensation). We sought to determine the mean health equity score (MES) across training hospitals of plastic and reconstructive surgery (PRS) residency programs in the United States.

METHODS

Setting

A list of all 85 Accreditation Council for Graduate Medical Education-accredited US integrated PRS residency programs was obtained in February 2022. A dataset of the training hospitals affiliated with each residency program was created using residency program websites and Doximity, Inc., a website which contains aggregated residency program information. All pages and subsections of the available residency program websites were reviewed to create a complete list of residency program associated training hospitals. This list was cross-referenced using the Doximity, Inc. website, which provides a list of all residency program training hospitals at each PRS residency program and a breakdown of the distribution of training locations across program years.²² Nonhospital training facilities, such as private practice locations and ambulatory surgery centers, were excluded. In the event of a discrepancy between residency program websites and Doximity, Inc., the list of training hospitals available on the residency program website was favored. The list of training hospitals was collected using the PRS residency program specific website for 64 programs. In total, 21 programs did not have their list of training hospitals available on their program website, and thus, the program's page on the Doximity, Inc. website was accessed to collect this information.

Residency Program Training Hospitals

Each residency program website and associated Doximity, Inc. website was reviewed. Five researchers (P.C., U.A., T.J., T.K., B.M.) conducted the website review for primary data collection. The research team met before initiating review and throughout the process to discuss any discrepancies or clarifications. The complete list of

Takeaways

Question: Is plastic surgery training equitable?

Findings: Our study shows that two-thirds of PRS residency programs train residents in facilities that fail to demonstrate high equity healthcare.

Meaning: Programs should promote health equity by diversifying care delivery through affiliated hospitals. This will aid in the creation of a PRS workforce trained to provide care for a socioeconomically, racially, and ethnically diverse population.

training sites (n = 392) was reviewed by one researcher (PC) for consistency and data auditing.

LIHI, Safety Net Hospitals, and Equity Grading

Once the list of all PRS residency program training sites was assembled, this new dataset was merged with the 2021 LIHI dataset, which consists of 3709 US hospitals, excluding nonacute care, federal, specialty, and Medicare Advantage Program run hospitals. Of the original 392 PRS training sites, 54 Veterans Affairs hospitals, 51 children's hospitals, and 48 specialty care centers were excluded for a study cohort of 239 training sites. The LIHI dataset included information for 98% of the study cohort (n = 235 training sites). The LIHI equity grades and safety net hospital designations for each PRS residency program training hospitals were retrieved. Equity grades within the LIHI dataset are comprised of three components: (1) community benefit (charity care, Medicaid revenue, community investment); (2) inclusivity (by race, income, education); and (3) pay equity (executive compensation vs worker compensation). These components are weighted in a ratio of 2:2:1, respectively, to generate a health equity grade for each hospital.²¹ LIHI equity grades were reported per facility from A to D with A being the highest grade a hospital could receive.

Data Collection, Management, and Analysis

The median number of training hospitals and safety net hospitals (minimum, maximum) was reported for all US integrated PRS residency programs. The geographical percentage distribution of US integrated PRS residency programs for the Northeast, South, Midwest, and West was also reported. This geographic delineation of the United States was previously used by Glenner et al²³ and is consistent with the way in which the United States Census Bureau categorizes the regions of the United States.

Categorical LIHI equity grades were converted to numerical scores (A = 4, B = 3, C = 2, D = 1), and reported as mean equity score (MES) with standard deviations overall, and by PRS residency program, with a higher MES indicating a higher equity grade on the A to D scale.

The number of PRS residency programs and affiliated training hospitals were reported by US geographical region (Northeast, South, Midwest, West²³) and by MES categories (1-2, 2-3, 3-4, 4). A geomap was created to depict MES by PRS residency program geographical

region based on program zip codes using Tableau software. A generalized linear regression, modeled on R Studio, was used to assess the associations between the number of residency training hospitals, number of safety net hospitals, and geographical region (reference group was Northeast) on MES. All assumptions for valid linear regression were met. A level of 0.05 was used to assess statistical significance. Beta coefficients, 95% confidence intervals, and *P* values were calculated and reported.

RESULTS

Characteristics of PRS Residency Programs

Among the 85 US integrated PRS residency programs, the median number of training hospitals was four (min 2, max 10); the median number of safety net hospitals was zero (min 0, max 5) (Table 1). The US geographic regions varied by number of integrated PRS residency programs, with 34.1% (n = 29) in the South, 24.7% (n = 21) in the Northeast, 23.5% (n = 20) in the Midwest, and 17.7% (n = 15) in the West (Table 2).

Equity among PRS Residency Programs

The MES score overall was 2.64 (0.62) across all US integrated PRS residency programs. 5.9% (n = 5) of residency programs had an MES between 1 and 2, 56.5% (n = 48) had an MES between 2 and 3, 31.8% (n = 27) had an MES between 3 and 4, and 5.9% (n = 5) had an MES of 4 (Table 3). The highest MES was seen in the West with

Table 1. Geographical Distribution by US Integrated PRS Residency Programs, Number of Training Hospitals, and Number of Safety Net Hospitals by Geographical Region (Northeast, South, Midwest, West)

	PRS Residency Programs	Training Hospitals	Safety Net Hospitals
N	85	393	57
Median (min, max)	—	4 (2, 10)	0 (0, 5)
Region, N (%)			
Northeast	21 (24.7)	100 (25.5)	20 (35.1)
South	29 (34.1)	129 (32.8)	11 (19.3)
Midwest	20 (23.5)	80 (20.4)	10 (17.5)
West	15 (17.7)	84 (21.4)	16 (28.1)

Table 2. MES by PRS Residency Programs, Number of Training Hospitals, and Number of Safety Net Hospitals

	PRS Residency Programs (n = 85)	Training Hospitals (n = 393)	Safety Net Hospitals (n = 57)
MES (SD)	2.64 (0.62)	—	—
Categories, N (%)			
1–2	5 (5.9)	23 (5.9)	1 (1.8)
2–3	48 (56.5)	227 (57.8)	30 (52.6)
3–4	27 (31.8)	124 (31.6)	24 (42.1)
4	5 (5.9)	19 (4.8)	2 (3.5)

A higher MES represents greater health equity.

Table 3. Regression Coefficients (β) and 95% Confidence Intervals for Associations between MES and Number of Training Hospitals, Number of Safety Net Hospitals, and Geographical Region of US Integrated PRS Residency Programs (Northeast Was Referent Group)

	Coefficients (β)	95% Confidence Intervals	<i>P</i>
Intercept	2.62	[2.18–3.7]	<0.001
Number of training hospitals	-0.06	[-0.14 to 0.03]	0.170
Number of safety net hospitals	0.17	[0.03–0.31]	0.020
Northeast	Ref		
Midwest	-0.08	[-0.45 to 0.28]	0.660
West	0.35	[-0.04 to 0.75]	0.080
South	0.38	[0.04 to 0.72]	0.030

MES = 2.83 (0.69), followed by the South with MES = 2.80 (0.62), Northeast with MES = 2.50 (0.49), and Midwest with MES = 2.39 (0.61) (Fig. 1).

When controlling for covariates, the number of safety net hospitals and geographic region were significantly associated with MES (*P* = 0.02, *P* = 0.03, respectively). The number of training hospitals was not associated with MES (*P* = 0.17).

DISCUSSION

Almost two-thirds of all PRS programs train in hospitals with an MES less than 3, corresponding to an LIHI health equity grade between B and D. This implies that the majority of PRS residency programs train residents in hospitals that are less inclusive, provide less benefit to their communities, and have larger pay discrepancies between their workers and chief executive officers.²¹ GME influences physician career choices and practice patterns, with training in a less equitable program possibly perpetuating inequities in the access to and delivery of plastic surgery.^{24,25} Consequently, training at institutions with a low MES may do residents a disservice, including reduced exposure to a wider patient population, and diminished skillset in expertly and professionally navigating the needs of surgical patients from diverse backgrounds.^{26–28} Efforts to more adequately reflect social justice and responsibility metrics among hospital rankings have begun to highlight discrepancies between hospital reputation and measures of substantive equity efforts.²⁹ In January 2023, Harvard Medical School announced its decision to withdraw from the *U.S. News & World Report's* ranking of medical schools, citing philosophical and methodological concerns regarding the discontinuity between rankings and educational quality that may influence administrative decisions aimed at boosting rankings at the expense of more meaningful objectives, such as financial aid.³⁰ Without adjusting traditional hospital metrics to better reflect health equity, trainees will likely continue to seek residency training in health systems based on metrics that do not comprehensively account for a hospital's health equity. As research has shown that GME training influences ultimate career

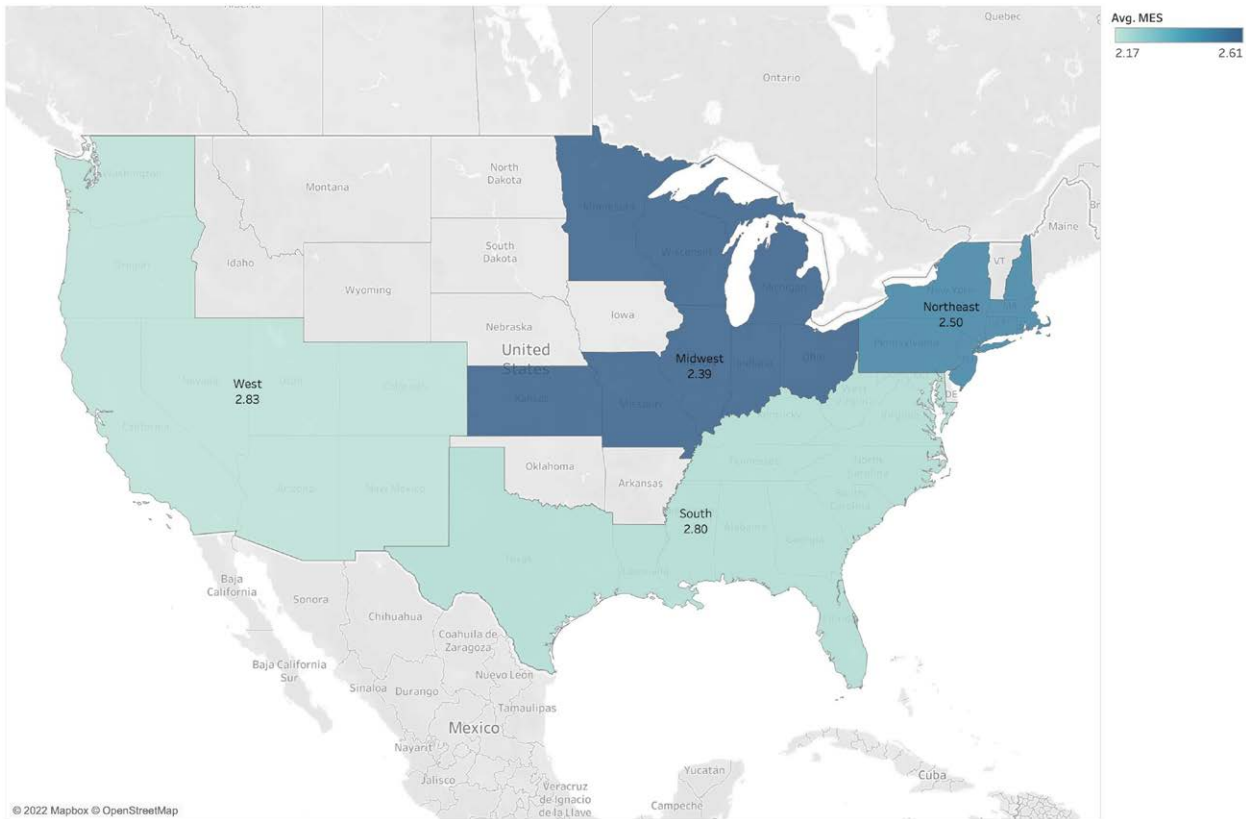


Fig. 1. MES by US integrated PRS residency program geographical region (Northeast, South, Midwest, West).

choices, obtaining inequitable PRS residency training may influence the career decisions of plastic surgeons completing residency or fellowship, possibly further contributing to inequities within plastic surgery.

Geographic region is an important predictor of differences in MES for PRS residency programs. The South was associated with better equity scores in the model when adjusting for differences in a program's number of training hospitals and number of safety net hospitals. This finding does not imply the South is more equitable with respect to healthcare in general. Previous studies have noted that patients in the South are the least likely to regularly see a healthcare provider and are the most likely to be uninsured.³¹ Important metrics like HIV and infant mortality are worse in Southern states.^{31,32} Similarly, most of the southeastern states have not adopted Medicare's expansion to provide healthcare access to marginalized patients.³³ The LIHI equity grades ranking by state designate Hawaii, Delaware, Washington D.C., Oregon, and Colorado among states that include the most socially responsible hospitals, with Kentucky, Kansas, Alabama, Mississippi and Arkansas among the least equitable overall.²⁹ Instead, this finding suggests that the PRS residency programs in the South train residents among hospitals that are more racially and socioeconomically inclusive, provide greater levels of financial and care-based benefits to their local communities, and have smaller pay discrepancies between their workers and chief executive

officers compared with the PRS residency programs in the Northeast, Midwest, and West. Future studies are needed to understand the differences in region-specific equity scores, such as how PRS residency programs in the South and their teaching facilities may be actively taking steps to overcome the intrinsic health inequity in the region.

A PRS residency program's number of training hospitals may influence applicant decision-making throughout the residency match process, with either the perception that a greater number of training hospitals provides more exposure to different care settings of varying equity or that equity scores are decreased by fewer training hospitals. This study finds that the PRS residency program's number of training hospitals is not significantly associated with the program's equity score. However, it is difficult to assess the impact of individual training hospitals on the equity of a residency program. For instance, the time spent at a given training location impacts how much exposure to equity a resident receives throughout their training. The MES constructed in this study, while necessary for the purposes of analysis, ignores this possibility. A weighted MES based on the amount of time spent at each training hospital could account for this, providing an opportunity for future exploration.

Safety net hospitals in the United States serve to bridge the gap in disparities in geographic and socioeconomic access to healthcare. A growing body of literature suggests that students and residents who are exposed to patients

in safety net settings, such as critical access hospitals, federally qualified health centers, and rural health clinics, are more likely to practice in these settings.^{34,35} Our finding that the number of safety net affiliated PRS residency training hospitals is associated with MES is not surprising but speaks to one avenue by which PRS residency programs can improve equity exposure within their training portfolio.

This study focuses on the nature of the training environment by which residents gain exposure to health equity issues. While this area remains under-explored in the literature, residency programs have started to formally recognize the necessity of establishing diversity, equity, and inclusion (DEI) training as part of GME to help confront existing disparities in medicine and train healthcare providers to be advocates for improving care of diverse patient populations.³⁶ Such efforts have gained traction in many primary care residency programs. Resident led health equity retreats and similar didactic sessions built into GME have proven successful in shaping resident perceptions of DEI conversations and their desire to continue involvement in addressing health equity.^{37,38} The pace of the implementation of these changes has been critiqued, and often, residents do not perceive this training as meaningfully impacting their perception of the quality of their education.^{39,40} Although surgical residencies lag behind in these efforts, national surgical bodies have taken steps to recognize and create didactic curricula surrounding disparities in order to empower surgeons to enter the discourse on surgical equity in recent years.⁴¹ These efforts include endowed lectureships, group discussions, cross-institution collaborations, program-sanctioned research, skill-building sessions, and resident-led initiatives focused on research, advocacy, and education.^{5,28,42,43} Khetpal et al provide recommendations to incorporate concepts of health equity and healthcare disparities into the different settings of plastic surgery GME, such as didactics, journal clubs, and case conferences.⁴⁴ More work is required, with many surgical training programs lacking baseline DEI statements and absent language addressing health equity training and education as explicit foci of their programs.⁴¹ Importantly, although efforts to improve health equity training by focusing on resident didactics, program DEI efforts, and quality improvement projects are applauded, they cannot be used in isolation without also examining a resident's training environment.⁴

Future studies are needed to determine the measures taken by PRS residency programs to include equity training. To further understand the impact of the implementation of such training, qualitative interviews with residents and faculty members at different PRS programs may guide actionable practices for residency programs, regardless of their MES. Further efforts may include developing an equity training program that is delivered to PRS residency programs. GME should equip residents with the ability to recognize and address health inequity, but also teach residents how this work translates into interventions that promote health equity. Additionally, although this study used MES generated from aggregated LIHI equity grades, future studies could seek to define how different

components of the MES/LIHI grades vary across other factors, including area deprivation index. Lastly, our study can be extended to other surgical residency specialties and fellowship programs. Future work in this area should work to assess not only how residency programs use their online presence to publicly portray themselves to potential applicants and how this information differs from exclusive, paid-for-access content, but also should aim to contact residency directors to directly be a part of information sourcing. This may further facilitate the creation of a weighted MES based on time spent at individual centers in future efforts.

Limitations

This study relied on information from PRS residency websites and Doximity, Inc. to determine the hospital locations in which residents complete their training. The accuracy of our study relies upon the frequency by which PRS residency programs maintain their virtual presence. These websites are representative of publicly accessible information often utilized by prospective residency applicants seeking to inform their decision-making for residency applications, interviews, and rank lists. This online information, although perhaps not always accurate, is a realistic window into the public understanding of the structure of different residency programs. Discrepancies in this study regarding a program's up-to-date affiliated training sites should motivate PRS residencies to maintain accurate information online. If the information listed on websites such as Doximity and PRS residency websites is not valid, applicants cannot be expected to make informed decisions about residencies and the type of training they will receive. While certain databases, such as American Medical Association (AMA) FREIDA, contains mandatory, self-reported program affiliate training sites, these databases themselves present an issue of equity and access, as they require monetary investments and AMA membership. In contrast, Doximity, Inc and PRS residency program websites are public and free-of-charge, representing a more equitable and universal resource by which residency programs present themselves to potential applicants.

The study is further limited by the types of hospitals captured in the LIHI dataset. Specialty centers (eg, plastic surgery centers) and federal facilities (eg, Veterans Affairs and children's hospitals) are excluded, precluding analysis of these training facilities. Additionally, this study assumed the equity scores of an entire hospital to be representative of the PRS care in that facility, failing to capture any variability in overall equity scores to specialty-specific equity scores within a hospital. This speaks to a need for specialty-focused equity metrics to serve as benchmarks.

Finally, while this study assigns equity scores using a nonvalidated scale to individual PRS residency programs, hospitals are often under administrative leadership with priorities that may differ from those of individual residency program directors.⁴⁵ Despite the potential benefits of health equity training during residency, given the different players involved in hospital leadership, the ability of GME to influence hospital systems may be limited regarding feasibility and misalignment of priorities in

residency training between parties. Although this study postulates about the benefits of health equity in GME, the reality of making program adjustments may depend on hospital leadership, which can serve as a barrier for the practical implementation of equity training in residency programs.⁴⁶ Additionally, given that executive compensation compared with worker compensation is a measure of health equity utilized by the LIHI dataset, this represents another possible avenue for improvement in health equity outside the direct control of PRS residency programs.

CONCLUSIONS

This is the first study to leverage the LIHI dataset to examine the equity of PRS residency programs and create a framework to analyze residency training among specialties. Underserved and minority groups in the United States face systemic factors significantly impacting their quality of healthcare. One way to address this inequity is to improve health equity among training programs to better equip future practicing physicians. The MES of training hospitals provides insight into the residency exposure of health access, treatment, and outcomes across the racial, ethnic, and socioeconomic spectrum. Our study finds that US PRS residency programs have an opportunity to improve health equity among our patients by examining the level of resident training and exposure to health equity issues. Pursuing such an improvement will result in training a workforce of plastic surgeons ready to provide more equitable healthcare for all patient populations. Future studies are required to understand how best to improve health equity in PRS residency programs and affiliated training hospitals.

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