OPEN

PRS GLOBAL OPEN

ORIGINAL ARTICLE
Education

Independent Plastic Surgery Match Regional Trends Comparing In-person and Virtual Interview Cycles

Sarah A. Mullen, BS*
Haris M. Akhter, MD*
Lauren E. Weis, BS*
Kaeli K. Samson, MA, MPH†
Heidi H. Hon, MD‡

Background: There is a trend toward matching in a different region than previous training for the independent plastic surgery match cycles from 2019 to 2021, which differs from the trend to match within the same region for integrated plastic surgery programs. Notably, residency interviews transitioned from in-person to virtual in 2020 due to the coronavirus pandemic. Therefore, we compared in-person versus virtual interview match trends from 2019 to 2023.

Methods: Zip codes and regions of each successfully matched plastic surgery applicant's medical school, residency, and plastic surgery program were gathered from publicly available data for the 2019 and 2020 in-person interview cycles and 2021, 2022, and 2023 virtual interview cycles.

Results: Although regions did not differ significantly in the proportions of positions each year ($P = 0.85$), there was a trend toward fewer positions in each region from 2019 to 2022. Overall, applicants were more likely to match in a different region as their medical school or residency during virtual compared with in-person interviews ($P = 0.002$ and $P = 0.04$). Applicants matched to programs further from their medical school zip code in virtual interview years ($P = 0.02$). There was no significant difference in distance between surgical residencies and plastic surgery residencies between the two time periods ($P = 0.51$).

Conclusions: Trends toward matching into a different region than prior training after the switch to virtual interviews could be attributed to applicant accessibility to interview broadly. However, this could also be due to the decreased number of independent residency positions over the years, requiring applicants to move regions and travel further from where they began their training. *(Plast Reconstr Surg Glob Open 2024; 12:e5691; doi: 10.1097/GOX.0000000000005691; Published online 25 March 2024.)*

INTRODUCTION

Unlike many specialties, plastic surgery has two potential residency pathways. One, being the more traditional route, involves completing an initial residency program in a surgical specialty followed by a three-year plastic surgery residency. This program, termed the "independent" pathway, may take anywhere from 8 to 10 years after completion of medical school. The second pathway combines basic surgical training and plastic surgery training into one 6- to 7-year program. This "integrated" pathway is becoming more popular, with the number of positions increasing from 172 in 2019 to 207 in 2023.[1] While becoming more popular, it is also becoming increasingly difficult to match in, with the 2023 match rate being 62%.[1,2] Compared with nine other competitive specialties, the matched 2020 integrated plastic surgery applicants had the highest average USMLE Step 1 score (249), highest average USMLE Step 2 score (tied at 256), and second highest average number of abstracts, presentations, and publications (19.1).[3] Due to the competitive nature of these programs, personal and professional connections are crucial to receiving an interview and ultimately matching.[4] Two avenues by which these connections are made are "away" subinternships and in-person interviews—both of which were affected in the 2021 cycle due to the COVID-19 pandemic.

*From *University of Nebraska Medical Center, College of Medicine, Omaha, Neb.; †Department of Biostatistics, University of Nebraska Medical Center, Omaha, Neb.; and ‡Division of Plastic and Reconstructive Surgery, University of Nebraska Medical Center, Omaha, Neb.*

Received for publication October 12, 2023; accepted February 2, 2024.

Presented at Nebraska Chapter of the American College of Surgeons Annual Meeting 2023, and at Midwestern Association of Plastic Surgeons 61st Annual Scientific Meeting 2023.

DOI: 10.1097/GOX.0000000000005691

Disclosure statements are at the end of this article, following the correspondence information.

Like the rest of the world, medical and postgraduate medical education was turned upside down during the pandemic and forced to adapt. A field dependent upon hands on work and physical interaction with patients was required to do so from a distance. This had a significant impact on both the quantity, as well as quality, of educational experiences.[5–7] One study showed a decrease in surgical procedures by 44% per week during the pandemic for plastic surgery residents.[5] This reduction posed a significant risk not only to the development of skill, but also to meeting volume-based thresholds for board certification. Aside from direct contact with patients, COVID-19 threatened to revoke all in-person learning opportunities should a medical student/resident contract COVID-19 and require isolation.[7] The United States continued to be a major contributor to plastic surgery research during the pandemic, but only contributed 6.2% of the world's COVID-19-related plastic surgery research form 2020 to 2021, suggesting a strain on research resources and incentives during the health crisis.[8] However, this pandemic not only affected development of the skills required to examine and treat patients, but also the relationships needed to succeed within the field and open doors to further training.

During this year, residency programs and medical schools put a halt on away rotations and shifted interviews to a virtual platform.[9] Virtual interviews had multiple disadvantages from applicants' perspectives. Almost half of integrated plastic surgery applicants felt virtual interviews led to an inequitable distribution of interview offers, nearly one-third felt the instructions for virtual interviews provided by programs lacked clarity and did not abide by the American Council of Academic Plastic Surgeons guidelines, and applicants felt they were less informed during interview day.[9–11] However, applicants saved an average $5486 on interview costs compared with in-person interviews.[12] Program directors of integrated programs reported offering more interview invitations per position during virtual interviews but no decrease in their ability to assess an applicant's professionalism, communication skills, and "fit" for the program.[13] After 1 year in their matched program, applicants who interviewed virtually were satisfied with where they ranked their program, but program directors were less satisfied with where they ranked their current residents during virtual compared with in-person interview seasons[11]

Before virtual interviews, a survey of applicants to three integrated programs from 2014 to 2020 found that only 44.4% of matched applicants had a home program and 66.7% matched at a program that was neither their home nor a program where they did an away rotation.[14] Then, virtual interviews led to an increase in match rates at home institutions for those applying to the integrated pathway.[15–19] One study showed that 2021 applicants were 2.24 times more likely to match at their home institution when compared with pre-COVID-19 years.[19] During this time, there was also a decrease in match rate for students without home plastic surgery programs.[5,18] Of integrated applicants without a home program, less than half were able to access resources at an institution with an integrated residency program, but half of those who could make these connections felt it helped their chance to match.[20] However, when looking at those applying to the independent pathway, there was no significant change in match rate to home program or within the same region of the country in 2021 as compared with 2019 and 2020 pre-COVID-19 years.[21] This study expands upon this trend by including more virtual interview cycle years.

Previous studies have suggested a strong geographic bias from programs within the match even before virtual interviews.[22,23] As the burden of COVID-19 has diminished, away subinternships have been reinstated. Subsequently, there was a reversal of many of the trends previously mentioned, such as the trend in home program match rate

Takeaways

Question: Did regional trends for the independent plastic surgery match change when interviews switched from in-person to virtual?

Findings: This retrospective analysis using publicly available data from 2019 to 2023 revealed a trend towards matching to a program in a different region than an applicant's medical school or residency when interviews were virtual compared with in-person. Applicants traveled further from their medical school, but not their residency program, during virtual interview years.

Meaning: Applicants to independent plastic surgery residency programs are more likely to match to a different region than their prior training during virtual interviews, and thus may consider applying broadly.

Table 1. Plastic Surgery Matched Applicant Numbers by Year

	Sex		Matching within Same Region as:	
Match Year	Male (*N* = 174), n (%)	Female (*N* = 81), n (%)	Residency (*N* = 103), n (%)	Medical School (*N* = 86), n (%)
2019	41 (64.1)	23 (35.9)	34 (53.1)	26 (40.6)
2020	48 (80.0)	12 (20.0)	24 (40.0)	28 (47.5)
2021	37 (63.8)	21 (36.2)	21 (36.2)	17 (30.9)
2022	34 (70.8)	14 (29.2)	14 (29.2)	7 (15.2)
2023*	14 (56)	11 (44)	10 (38.5)	8 (30.8)

*2023 data are not complete because of delay in website updates on newly matched residents.

Table 2. Match Trends Based on Residency Region: Comparing In-person (2019–2020) to Virtual (2021–2023) Match Cycles

	Region Applicant Completed Prior Residency		
Interview Format	Same Region (*N* = 103), n (%)	Different Region (*N* = 153), n (%)	Chi-square *P*
In-person	58 (46.8)	66 (53.2)	**0.04**
Virtual	45 (34.1)	87 (65.9)	

Significant values appear in boldface.

Table 3. Regional Match Trends Based on Residency Region: Comparing In-person (2019–2020) to Virtual (2021–2023) Match Cycles

Plastic Surgery Program Region	Interview Format	Region Applicant Completed Prior Residency		Bonferroni-adjusted *P*
		Same Region, n (%)	Different Region, n (%)	
West	In-person	2 (18.2)	9 (81.8)	1.00†
	Virtual	3 (23.1)	10 (76.9)	
South	In-person	29 (50.9)	28 (49.1)	0.05
	Virtual	16 (28.1)	41 (71.9)	
Midwest	In-person	10 (40.0)	15 (60.0)	0.84
	Virtual	5 (22.7)	17 (77.3)	
Northeast	In-person	17 (54.8)	14 (45.2)	1.00
	Virtual	21 (52.5)	19 (47.5)	

P values from chi-square tests unless otherwise specified.
†*P* value from Fisher exact test.

Table 4. Distance Traveled from Residency during In-person (2019–2020) Compared with Virtual (2021–2023) Match Cycles

Interview Format	n	Median Distance from Residency (25th–72nd Percentiles), Miles	Wilcoxon Rank Sum Test
In-person	123	583.7 (182.4–1153.9)	0.51
Virtual	131	665.6 (246.7–1143.5)	

and match rate for those without an affiliated plastic surgery program.[24,25] In 2022, these trends returned to those previously seen before the COVID-19 pandemic for those applying to the integrated program.

To the best of our knowledge, no research exists that explores these trends in the years following COVID-19 for the independent program. Therefore, this study aimed to compare pre-COVID-19, in-person interview cycles with COVID-19/post-COVID-19 virtual interview cycles to detect trends in regional matching and distance traveled by applicants. We hypothesize that independent match applicants will be more likely to move regions and travel further during virtual interview years compared with in-person interview years. This study also explores career plans of the graduating class of 2023, who started their plastic surgery residency training during COVID-19.

METHODS

Data Collection and Structure

Independent plastic surgery programs were listed by region, including west, midwest, south, and northeast. For each program, matched independent plastic surgery applicants' match year, sex, medical school (school name and zip code), and surgical residency programs (program name and zip code) were reported using publicly available data—primarily the plastic surgery program's website and social media when necessary. It was also noted whether each applicant matched to the same or different region compared with their medical school and surgical residency programs. Years included 2019–2023, labeled by match year such that the 2018–2019 cycle is denoted as 2019. The years 2019 and 2020 were in-person interview cycles, whereas 2021–2023 were virtual interview cycles. The 2023 data for some programs was incomplete when new match results were not yet updated online. From the 2019 cohort, graduates' postresidency career plans were recorded if available.

Statistical Analysis

Associations between categorical variables were assessed using chi-square tests, or Fisher exact tests when expected cell counts were low. Distances between two zip codes of interest were calculated using their geodetic distance. Descriptive statistics for distances are given as medians and interquartile ranges (IQRs, representing the range of the middle 50% of the data). Wilcoxon rank sum or Kruskal Wallis tests were used to examine differences in distances between dichotomous or three or more level grouping variables, respectively. Significant Kruskal Wallis tests were followed up using Bonferroni-adjusted Wilcoxon rank sum tests for all pairwise comparisons of subgroups. For subgroup analyses which assessed comparisons within each region, *P* values were Bonferroni adjusted. All analyses were performed using SAS software version 9.4 (SAS Institute Inc., Cary, N.C.).

RESULTS

The study included 256 matched independent plastic surgery applicants from 42 programs. Applicants' sex and plastic surgery residency location relative to medical school and surgical residency are summarized in Table 1. Of the applicants, 174 (68.0%) were men and 81 (31.6%) were women, and there was no significant difference in the proportion of male versus female matched applicants over the years ($P = 0.15$). Regions did not differ significantly in the proportions of positions each year ($P = 0.85$), but there was an overall trend of fewer positions in each region from 2019 to 2022 (Table 1).

Surgical Residency Compared with Plastic Surgery Residency

Across regions, there were significantly fewer applicants matching within the same region as their surgical residency during virtual interview years ($P = 0.04$; Table 2). When this trend was broken down by region (Table 3), none of the regions showed a significant

Table 5. Distance Traveled from Residency during In-person (2019–2020) Compared with Virtual (2021–2023) Match Cycles: Regional Trends

Plastic Surgery Program Region	Interview Format	n	Median Distance from Residency (25th–72nd Percentiles), Miles	Bonferroni-adjusted *P* Value from Wilcoxon Rank Sum Test
West	In-person	11	1613.7 (616.8–1899.6)	1.00
	Virtual	13	1360.3 (1027.7–1977.3)	
South	In-person	56	685.0 (226.1–1169.5)	1.00
	Virtual	57	746.2 (536.2–1166.4)	
Midwest	In-person	25	489.6 (239.4–757.0)	1.00
	Virtual	22	499.0 (222.4–767.0)	
Northeast	In-person	31	231.8 (84.9–737.2)	1.00
	Virtual	39	372.3 (33.7–864.7)	

association between interview format and matching to the same region as their residency; however, the Southern region did have a trend toward having more matching to a different region than residency during the virtual period ($P = 0.05$). Overall, there was no difference in distance traveled by surgical residents to their plastic surgery residency ($P = 0.51$; Table 4), and there was no regional differences in distance traveled either (Table 5).

Medical School Compared with Plastic Surgery Residency

Across regions, applicants were more likely to match in a different region as their medical school during virtual interviews compared with in-person interviews ($P = 0.002$; Table 6). When broken down by region, this trend held true in the south ($P = 0.04$; Table 7). Overall, applicants traveled further from their medical school zip code in virtual interview years ($P = 0.02$; Table 8). However, when distance was compared within regions between the interview formats, this trend was not seen (Table 9).

Graduates' Post Plastic Surgery Residency Career Paths

The majority of the class of 2023 for whom career paths were discoverable (n = 56) went into private practice (n = 24, 42.9%), followed by fellowship (n = 20, 35.7%) and academic practice (n = 12, 21.4%; Table 10). There was only a significant difference in distance traveled to career destination within the south ($P = 0.03$; Table 11). Within the south, residents who went into academia had a shorter median distance traveled (98.8 miles, IQR: 4.7, 671.4) relative to those who went into a fellowship (1210.0 miles, IQR: 1006.2, 2287.4), but this difference is not statistically significant at the 0.05 alpha level ($P = 0.06$; Table 11).

Table 6. Match Trends Based on Medical School Region: Comparing In-person (2019–2020) to Virtual (2021–2023) Match Cycles

Interview Format	Region Applicant Completed Medical School: Same Region n (%)	Region Applicant Completed Medical School: Different Region, n (%)	Chi-square, *P*
In-person	54 (43.9)	69 (56.1)	**0.002**
Virtual	32 (25.2)	95 (74.8)	

Significant values appear in boldface.

Table 7. Regional Match Trends Based on Medical School Region: Comparing In-person (2019–2020) to Virtual (2021–2023) Match Cycles

Plastic Surgery Program Region	Interview Format	Region Applicant Completed Medical School: Same Region, n (%)	Region Applicant Completed Medical School: Different Region, n (%)	Bonferroni-adjusted *P* Values
West	In-person	1 (9.1)	10 (90.9)	1.00†
	Virtual	1 (7.7)	12 (92.3)	
South	In-person	25 (44.6)	31 (55.4)	**0.04**
	Virtual	12 (21.8)	43 (78.2)	
Midwest	In-person	14 (56.0)	11 (44.0)	0.11
	Virtual	5 (23.8)	16 (76.2)	
Northeast	In-person	14 (45.2)	17 (54.8)	1.00
	Virtual	14 (36.8)	24 (63.2)	

P values from Chi-square tests unless otherwise specified. Significant values are in boldface.
†*P* value from Fisher exact test.

Table 8. Distance Traveled from Medical School during In-person (2019–2020) Compared with Virtual (2021–2023) Match Cycles

Interview Format	n	Median Distance from Medical School (25th–72nd Percentiles), Miles	Wilcoxon Rank Sum Test
In-person	98	482.6 (175.7–921.4)	**0.02**
Virtual	105	696.3 (306.6–1171.6)	

Significant values appear in boldface.

DISCUSSION

In this cohort, there was a trend to match into an independent plastic surgery residency in a different region than residency or medical school and further from previous medical school training during virtual interview cycles. These trends were significant, which is a new finding relative to the prior study of only the 2019–2021 interview cycles.[21] For integrated programs, there was a transient increase in home program matches (25.12%) during the first COVID-19 cycle of 2021, which was higher than 2016–2020 and 2022 cycles' home program match average (17.69%).[25] In contrast, independent program match trends did not transiently change during the 2021 cycle, and instead there is a sustained trend towards matching into a different region when interviews are virtual

Table 9. Distance Traveled from Medical School during In-person (2019–2020) Compared with Virtual (2021–2023) Match Cycles

Plastic Surgery Program Region	Interview Format	n	Median Distance from Medical School (25th – 72nd Percentiles), Miles	Bonferroni-adjusted *P* from Wilcoxon Rank Sum Test
West	In-person	7	1895.2 (824.9–2176.6)	1.00
	Virtual	13	1464.5 (1159.5–1854.9)	
South	In-person	45	680.5 (218.1–1048.7)	1.00
	Virtual	42	714.5 (414.2–1051.5)	
Midwest	In-person	19	245.3 (118.5–528.3)	0.72
	Virtual	18	470.0 (130.3–1009.9)	
Northeast	In-person	27	271.5 (88.1–749.0)	0.63
	Virtual	32	422.2 (222.3–1056.5)	

Table 10. Plastic Surgery Graduates' Future Career Paths*

Career Type	Frequency (%)
Private	24 (42.9%)
Academic	12 (21.4%)
Fellowship	20 (35.7%)

*Class of 2023 only.

(2021–2023 cycles). Perhaps, away rotations for surgical residents were not as influential for match results than for medical school graduates, such that the loss of these rotations during the pandemic did not affect the independent match. Independent applicants may be moving further away from prior training after the switch to virtual interviews due to applicant accessibility to interview broadly or decreasing independent residency positions over the years. This trend is likely to continue to evolve as protocols for applying to residency, such as geographic and program preference signaling, continue to change. Further, it is yet to be determined if interviews will remain virtual in the future, and so trends should continue to be reported as some programs transition back to in-person interviewing.

The class of 2023 career plans were primarily private practice, followed by fellowship and academia. The percentage pursuing academic careers is lower compared with prior reports that 29%–35% of plastic surgery residents pursue academia, although these reports are at least a decade old.[26,27] However, a different study of only independent program graduates reported 10% entering academia, 30% attending fellowship, and 56% pursuing private practice, which are similar rates to those reported here (21.4% academia, 35.7% fellowship, and 42.9% private).[28] The number of graduates going into academia can be placed in a larger context of increasing evidence demonstrating increasing academic output in the field of surgery, especially plastic surgery, both in the United States and globally. In the field of surgery, there was a 25.3% increase in global surgery publications during the COVID-19 pandemic compared with the previous 10-year average.[29] There has been a significant rise in the amount of globally published plastic surgery research since 2010.[30,31] The number of global publications in 2021 was 72% higher compared with the number in 2015. Within the United States, research output increased from 1553 publications in 2015 to 2530 publications in 2021.[30] The United States remained the nation with the highest human capital and productivity in plastic surgery research during the COVID-19 pandemic.[8] While there is an increase in academic plastic surgery publications, this analysis does not report a trend in graduates pursing academia, since the data are limited to one graduating class. A more up-to-date analysis of the trends in graduates' career paths after plastic surgery residency would be needed to understand this change over time. The number of graduates attending fellowship can be considered in the context of decreased training for residents training during the pandemic. Specifically, an international survey of plastic surgery residents found a 44% decline (ranging from negative 79% to 10%) in surgical procedures per week and an 18% decline (ranging from negative 76% to 151%) in seminars per week. Among residents, 74% expected a negative impact on their surgical skills and 43% expected a negative impact on their scientific knowledge because of this.[5] A similar survey of Italian plastic surgery residents found that residents reported a significant decrease in elective procedures with concordant increase in didactic education during lockdown, both of which they felt would be detrimental to their professional growth.[32] Jinka et al reports that the percentage of integrated plastic surgery graduates completing fellowship increased from 17.65% to 40.68% from 1998 to 2006, respectively.[33] Herrera et al had reported 30% of their independent plastic surgery graduate cohort from 2010 to 2015 attended fellowship, whereas 35.7% of our cohort attended fellowship, suggesting an increase in interest in fellowship amongst trainees during the COVID-19 pandemic.[28] A more specific study would be needed to relate graduates' motivations for fellowship to a lack of training during the pandemic or to identify alternative explanations.

Limitations of this study are primarily related to use of publicly available data, such as missing demographics information, match results, or career plans. Also, the authors acknowledge that sex of applicants was not always self-reported, and thus, this variable should be considered cautiously. The study was limited to publicly available data because of protection of residents' personal data by their residency program. Specifically, the study's data were not collected via survey because residents' contact information is protected. Also, the results here may be different if alternative regional geographic distribution was assigned. However, the regional divisions used were based on a publicly available map and generally agreed upon by the team. The number of applicants within each region were already small, making it difficult to reach statistical significance

Table 11. Distance Traveled from Plastic Surgery Residency to Future Career Path

Plastic Surgery Program Region	Career Type	n	Median Distance from Medical School (25th–72nd Percentiles), Miles	Bonferroni-adjusted Kruskal-Wallis Test *P*
West	Private	2	1276.0 (11.0 – 2540.9)	1.00
	Academic	2	884.5 (6.8 –1762.1)	
	Fellowship	2	1713.0 (1505.0–1921.0)	
South	Private	11	727.0 (99.5–904.1)	**0.03***
	Academic	7	98.8 (4.7–671.4)	
	Fellowship	7	1210.0 (1006.2–2287.4)	
Midwest	Private	4	435.6 (6.9–994.2)	1.00
	Academic	1	216.1 (216.1 –216.1)	
	Fellowship	4	439.4 (157.5–609.5)	
Northeast	Private	5	173.3 (100.0–399.6)	1.00
	Academic	1	712.3 (712.3–712.3)	
	Fellowship	5	820.8 (187.2–1246.9)	

Significant values are in boldface.
*Although none of the Bonferroni-adjusted post-hoc pairwise comparisons within the Southern region were statistically significant, the *P* value for the comparison between Academic and Fellowship was 0.06.

when performing subgroup analyses within a region. If the regions had been further divided, the power of the regional analyses would have even further decreased. Finally, these trends do not encompass all variables relevant to applicants' match results, such as personal or professional connections to other programs. These connections could have only been assessed via survey, which was not chosen due to previously stated limitations.

CONCLUSIONS

Independent plastic surgery program applicants are more likely to match in different regions than residency or medical school and further away from medical school training when interviews are virtual. It appears this trend did not change with return of away rotations and withdrawal of COVID-19 pandemic restrictions during the 2022 and 2023 cycles, suggesting the virtual format of interviews as contributing to applicants' abilities to interview broadly. Although this could represent decreased preference of programs for their home applicants, it may also represent broader opportunities to match into an independent program outside of an applicant's institution. This trend should continue to be updated in the setting of future application cycle regulation changes, such as preference signaling and return of in-person interviews. A more direct questionnaire to residents, both independent and integrated, could further explain the rational for pursuing education in a new program or geographic location as opposed to a prior program or nearby. Finally, a more in-depth analysis of graduates' career plans across the past decade would provide context for the data provided from the class of 2023 in this study.

Heidi H. Hon, MD
Nebraska Medical Center
Omaha, NE 68198-3270
E-mail: heidi.hon@unmc.edu

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

REFERENCES

1. National Resident Matching Program: Main residency match data and reports. Available at https://www.nrmp.org/match-data-analytics/residency-data-reports/. Published 2023. Accessed July 22, 2023.
2. Sarac BA, Janis JE. Matching into plastic surgery: insights into the data. *Plast Reconstr Surg Glob Open*. 2022;10:e4323.
3. Asserson DB, Sarac BA, Janis JE. A 5-year analysis of the integrated plastic surgery residency match: the most competitive specialty? *J Surg Res*. 2022;277:303–309.
4. Drolet BC, Brower JP, Lifchez SD, et al. Away rotations and matching in integrated plastic surgery residency: applicant and program director perspectives. *Plast Reconstr Surg*. 2016;137:1337–1343.
5. Karamitros G, Kontoes P, Wiedner M, et al. The impact of COVID-19 on plastic surgery residents across the world: a country-, region-, and income-level analysis. *Aesthetic Plast Surg*. 2023;47:2889–2901.
6. Weinstein DF. Reengineering GME in a pandemic — looking back, and forward. *N Engl J Med*. 2022;386:97–100.
7. Goldhamer MEJ, Pusic MV, Co JPT, et al. Can COVID catalyze an educational transformation? competency-based advancement in a crisis. *N Engl J Med*. 2020;383:1003–1005.
8. Karamitros G, Goulas S. Human capital and productivity in plastic surgery research during COVID-19: an artificial intelligence approach. *J Plast Reconstr Aesthet Surg*. 2023;78:29–32.
9. Hemal K, Sarac BA, Boyd CJ, et al. Applicant preferences for virtual interviews: insights from the 2020–21 integrated plastic surgery application cycle. *Plast Reconstr Surg Glob Open*. 2021;9:e3732.
10. Shen AH, Shiah E, Sarac BA, et al. Plastic surgery residency applicants' perceptions of a virtual interview cycle. *Plast Reconstr Surg*. 2022;150:930–939.
11. Sarac BA, Janis JE. Perspectives of virtual residency interviews in plastic surgery: results following 1 year of training. *Plast Reconstr Surg Glob Open*. 2023;11:e4746.
12. Gordon AM, Sarac BA, Drolet BC, et al. Total costs of applying to integrated plastic surgery: geographic considerations, projections, and future implications. *Plast Reconstr Surg Glob Open*. 2021;9:e4058.
13. Sarac BA, Shen AH, Nassar AH, et al. Virtual interviews for the integrated plastic surgery residency match: the program director perspective. *Plast Reconstr Surg Glob Open*. 2021;9:e3707.
14. Patel AA, Wong MS, Nguyen VT, et al. Analysis of reapplications to integrated and independent plastic surgery residency. *Plast Reconstr Surg Glob Open*. 2021;9:e3508.

15. Faletsky A, Zitkovsky H, Guo L. The impact of COVID-19 on plastic surgery home program match rates. *Ann Plast Surg.* 2022;88:4–6.
16. Om A, Losken A. Effect of COVID-19 on geographic distribution of the integrated plastic surgery match. *Plast Reconstr Surg Global Open.* 2021;9:e3676.
17. Asadourian PA, Murphy AI, Marano AA, et al. Home field advantage: assessing the geographic trends of the plastic surgery residency match during the COVID-19 pandemic. *J Surg Educ.* 2021;78:1923–1929.
18. Egan KG, Nauta A, Butterworth JA. Effect of COVID-19 restrictions on 2021 integrated plastic surgery match outcomes. *J Surg Educ.* 2022;79:249–252.
19. Antezana LA, Rode M, Muro-Cardenas J, et al. Home sweet home: the integrated plastic surgery residency match during the COVID-19 pandemic. *Plast Reconstr Surg.* 2022;150:492e–494e.
20. Keane CA, Akhter MF, Sarac BA, et al. Characteristics of successful integrated plastic surgery applicants from US allopathic medical schools without a home integrated program. *J Surg Educ.* 2022;79:551–557.
21. Akhter HM, Weis L, Huang C, et al. Regional trends for the 2021 COVID-19 independent plastic surgery match cycle. *Cureus.* 2022;14:e29172.
22. Nagarkar PA, Janis JE. Unintended bias and unintended consequences: geographic bias in the plastic surgery residency match. *Plast Reconstr Surg Glob Open.* 2022;10:e4063.
23. Nagarkar PA, Janis JE. Eliminating geographic bias improves match results: an analysis of program preferences and their impact on rank lists and results. *Plast Reconstr Surg.* 2018;142:82e–88e.
24. Sinik LM, Egan KG, Bagwell AK, et al. Evaluating the importance of sub-internships on the 2022 integrated plastic surgery match during continued COVID-19 regulations. *J Surg Educ.* 2022;79:1435–1440.
25. Kebede S, Marxen T, Om A, et al. COVID-19 and the integrated plastic surgery match: an update on match trends by applicant location. *Plast Reconstr Surg Global Open.* 2022;10:e4527.
26. Song EH, Shirazian A, Binns B, et al. Benchmarking academic plastic surgery services in the United States. *Plast Reconstr Surg.* 2012;129:1407–1418.
27. Zetrenne E, Kosins AM, Wirth GA, et al. Academic plastic surgery: a study of current issues and future challenges. *Ann Plast Surg.* 2008;60:679–683.
28. Herrera FA, Chang EI, Suliman A, et al. Recent trends in resident career choices after plastic surgery training. *Ann Plast Surg.* 2013;70:694–697.
29. Goulas S, Karamitros G. Human capital and productivity in surgery research during a pandemic: an artificial intelligence approach. *Br J Surg.* 2023;110:1218–1220.
30. Karamitros G, Goulas S. Human capital and productivity in plastic surgery research across nations. *Aesthetic Plast Surg.* 2023;47:1644–1657.
31. Liechty AE, Sherpa JR, Trejo JS, et al. Globalization of plastic and reconstructive surgery: a continent, country, and state-level analysis of publications. *Plast Reconstr Surg Global Open.* 2020;8:e3202.
32. Zingaretti N, Contessi Negrini F, Tel A, et al. The impact of COVID-19 on plastic surgery residency training. *Aesthetic Plast Surg.* 2020;44:1381–1385.
33. Jinka SKA, Sarac BA, Seaman AP, et al. Trends in integrated plastic surgery applicant, resident, and junior attending research productivity. *J Surg Res.* 2023;285:129–135.