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Home Field Advantage: Assessing the Geographic Trends of the Plastic Surgery Residency Match during the COVID-19 Pandemic

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OBJECTIVE: In previous plastic surgery residency match cycles, in-person activities at other institutions, such as away rotations, have facilitated matches outside of an applicant's home program or region. The COVID-19 pandemic, however, limited these in-person opportunities. Therefore, we hypothesized that applicants of the 2021 cycle would be more likely to match into programs with which they have existing geographic connections when compared to previous years.

DESIGN: Residency websites and social media accounts were searched for resident names and educational information for those matching in 2021 and 2015 to 2020. Outcomes included proportion of applicants matching at the program affiliated with their medical school ("home program"), or matching in the same state or United States Census Map region as their medical school or undergraduate institution. Subgroup analyses were stratified by program region, incoming resident class size, and Doximity residency reputation ranking.

SETTING: Columbia University (New York).

PARTICIPANTS: For the 2015 to 2020 residency cycles, 963 residents were identified from 78 (95.1%) programs. For 2021, 159 incoming interns were identified from 70 (82.3%) programs.

RESULTS: 2021 applicants matched into their home program at higher rates than 2015-2020 applicants (36.0% vs. 24.1%, $p = 0.019$). This trend was similar regardless of program region or size. This increase was significant for

programs ranked outside of the top 30 (41.5% vs. 26.4%, $p = 0.032$), but not for the top 30 programs (32.1% vs. 22.3%, $p = 0.128$). Excluding those who matched at their home program, 2015 to 2020 and 2021 applicants matched in the same state or region of their medical school or undergraduate institution at similar rates ($p > 0.05$ for all).

CONCLUSIONS: During the COVID-19 pandemic, plastic surgery residency programs matched more applicants from affiliated medical schools than in previous years. This may result from lack of in-person opportunities for applicants at other programs. Alternative relationship-building opportunities may facilitate broader geographic connections in the 2022 cycle. (J Surg Ed 78:1923–1929. © 2021 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: Integrated Plastic Surgery Match, Geography, COVID-19

COMPETENCIES: Practice-Based Learning and Improvement, Systems-Based Practice, Professionalism

INTRODUCTION

Studies of the integrated plastic surgery match process have indicated the influential presence of geographic bias.¹ Silvestre et al. demonstrated that 15.5% of applicants match at the program affiliated with their medical school ("home program") and that significantly higher rates of applicants match in the same region as their medical school when compared to all other regions.¹ This geographic trend is also present for other surgical subspecialties.^{2,3} Silvestre reasons that existing professional networks incentivize these regional trends.¹

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Professional relationships likely play an influential role in the match process.

In a standard match cycle, away clinical rotations and in-person interviews enable prospective applicants to form new professional relationships outside of their home institution and region. Most plastic surgery applicants complete 2 or 3 away clinical rotations with over 90% completing at least one.⁴ Further, nearly half of all applicants match at an institution where they performed a clinical rotation, highlighting the influence of these in-person experiences on the match process.^{4,5} Thus, away rotations grant medical students an opportunity to distinguish themselves at a geographically distant program and facilitate a match outside of their home program and region.

During the 2021 integrated plastic surgery match cycle, the COVID-19 pandemic required suspension of in-person away rotations for most medical students.⁶ This development may have placed further geographic constraints on where 2021 applicants may have matched compared to previous years. Given that most applicants of the 2022 match cycle are only allowed to complete one away rotation,⁶ understanding the geographic trends of the 2021 cycle may be useful for both residency programs and future applicants.

The purpose of this study is to analyze the geographic outcomes of the plastic surgery match cycle during the COVID-19 pandemic and compare them with previous cycles. We hypothesized that during the 2021 match cycle, there would be an increase in medical students matching into institutions and regions with which they have an existing geographic connection when compared to 2015-2020 match cycles.

METHODS

A list of accredited integrated plastic surgery residency programs for 2020 was acquired from the American Council of Academic Plastic Surgeons website.⁷ The Fellowship and Residency Electronic Interactive Database was used to generate a list of integrated plastic surgery residency programs for the application cycle ending in the 2021 match.⁸ Names of current residents and incoming residents were obtained from program websites and official program social media platforms, respectively. Current residents included individuals who matched in years 2015 to 2020 and incoming residents were those who matched in 2021.

Resident information was collected from program websites and social media platforms (Instagram, Facebook, Twitter, LinkedIn, and Doximity). Collected data included individuals' residency program, medical school, and undergraduate institution. Regions were assigned to each stage of education according to the United States Census map (Northeast, South, Midwest, and West), a methodology that has been used previously.^{1,2,3}

Outcomes included matching at home program or in same state or region as medical school or undergraduate institution. Home program was defined as any residency program affiliated with an applicant's medical school. Affiliations were determined from medical school and residency program websites. Applicants without a home program were excluded from home program analysis. If resident information was unavailable for any stage of education, the resident was excluded for that specific section of analysis. International medical graduates were not included in any of these analyses, although percentage of incoming resident class who graduated from an international medical school was also determined.

Sub-group analyses were conducted by dividing programs based on region, Doximity reputation ranking, and the number of available intern positions for the 2021 match cycle. Ranking was assigned using Doximity (residency.doximity.com) 2021 "reputation" rankings. The Doximity reputation ranking is statistically weighted to produce reputation values that represent the opinions of all survey-eligible physicians. Doximity rankings are valuable to applicants and have been shown to influence match list rankings.^{9,10} Prior studies have used these reputation rankings as a means of stratifying programs.^{11,12} To compare a similar number of residents in each group, the top 30 ranked programs were compared to those ranked outside the top 30. Residency program size was determined by number of available intern positions for 2021 incoming residency class and grouped into 1 to 5 positions per year.

Statistical comparisons were conducted between the 2015 to 2020 and 2021 cohorts using Fisher's exact test. $p < 0.05$ was considered significant for all testing. The odds ratio with 95% confidence intervals was reported for all significant results. Statistical tests were performed using GraphPad Prism 9.0 (GraphPad Software, San Diego CA).

RESULTS

Data Collection

The number of integrated residency programs identified for 2015 to 2020 and 2021 were 82 and 85, respectively (Table 1a). For current residents who matched in 2015 to 2020, names were obtained for 963 residents from 78 (95.1%) programs. For incoming residents who matched in 2021, 159 individuals were identified from 70 (82.3%) programs. 906 (94.1%) current and 149 (93.7%) incoming residents were found to have attended a medical school in the United States (US). 43 (4.5%) current and 4 (2.5%) incoming residents were identified as international medical graduates. In the 2015-2020 and 2021 groups, there were 685 (71.1%) and 111 (69.8%)

TABLE 1. Regional Distribution of Available Data for Programs and Residents

1a		2015-2020		2021	
Total # of programs		82		85	
# of programs with resident information available (%)		78 Programs (95.1%)		70 Programs (82.3%)	
By region					
Northeast, (%)		21/22 (95.5%)		18/21 (85.7%)	
South, (%)		24/24 (100.0%)		21/27 (77.8%)	
Midwest, (%)		21/21 (100.0%)		18/22 (81.8%)	
West, (%)		12/15 (80.0%)		13/15 (86.7%)	
Total # of Residents		963		159	

1b		Medical School Listed				Undergraduate Institution Listed	
		2015-2020		2021		2015-2020	2021
International Medical Graduates (% of total cohort)		43 (4.5%)		4 (2.5%)			
US Medical Graduates (% of total cohort)	<i>US Medical Graduates with a Home Program (% of Total Cohort)</i>	906 (94.1%)	685 (71.1%)	149 (93.7%)	111 (69.8%)	N = 695 (72.2%)	N = 99 (62.3%)
By region of Medical School/Undergraduate Institution							
Northeast, (%)		236 (24.5%)	189 (19.6%)	42 (26.4%)	29 (18.2%)	202 (21.0%)	38 (23.9%)
South, (%)		361 (37.5%)	256 (26.6%)	51 (32.1%)	37 (23.3%)	230 (23.9%)	24 (15.1%)
Midwest, (%)		217 (22.5%)	167 (17.3%)	39 (24.5%)	29 (18.2%)	144 (15.0%)	20 (12.6%)
West, (%)		92 (9.6%)	73 (7.6%)	17 (10.7%)	16 (10.1%)	119 (12.4%)	17 (10.7%)

residents with home programs, respectively. US undergraduate institution was identified for 693 (72.2%) and 99 (62.3%) residents in the 2015 to 2020 and 2021 groups, respectively. Regional distribution of available data for current and incoming residents is displayed in [Table 1b](#).

Geographic Differences in Match

Among residents with home programs, a significantly higher proportion of residents matched at their home program in 2021 than in 2015 to 2020 (36.0% vs. 24.1%, $P = 0.01$, OR: 1.78, CI: 1.17, 2.74) ([Fig. 1](#)). For all residents from US medical schools, there was no difference in the percentage of applicants matching into a program in the same state as their medical school (33.6% vs. 26.9%, $p = 0.114$). However, significantly more applicants from 2021 matched into a program in the same region as their medical school (61.1% vs. 50.2%, $p = 0.017$, OR: 1.55, CI: 1.10, 2.22). Although this difference was no longer significant after excluding individuals who matched at their home program (46.8% vs. 39.3%, p

$= 0.144$). Match rates into regions where individuals attended either medical school or undergrad were also similar between 2021 and 2015 to 2020 (65.1% vs. 57.4%, $p = 0.088$) ([Fig. 1](#)). There was no difference in the proportion of applicants matching into the same state (15.2% vs. 19.3%, $p = 0.409$) or region as their undergraduate institution (44.4% vs. 44.3%, $p > 0.05$).

Residency Program Sub-Group Analyses

In each region, applicants with home programs matched into their home program at higher rates in 2021 than in 2015-20, but none of these differences were significant ([Fig. 2a](#)). The same was true for applicants from US medical schools matching into a program in the same region as their medical school ([Fig. 2b](#)). Residency programs ranked outside the top 30 matched applicants from their affiliated medical schools at higher rates in 2021 than in 2015 to 2020 (41.5% vs. 26.4%, $p = 0.032$, OR: 1.98, CI: 1.09, 3.26). Such a difference did not exist for the top 30 residencies, who matched home students at similar rates in 2021 and 2015 to 2020 ($p = 0.128$) ([Fig. 3](#)). Stratifying

Geographic Distribution of Resident Matches is Affected by COVID

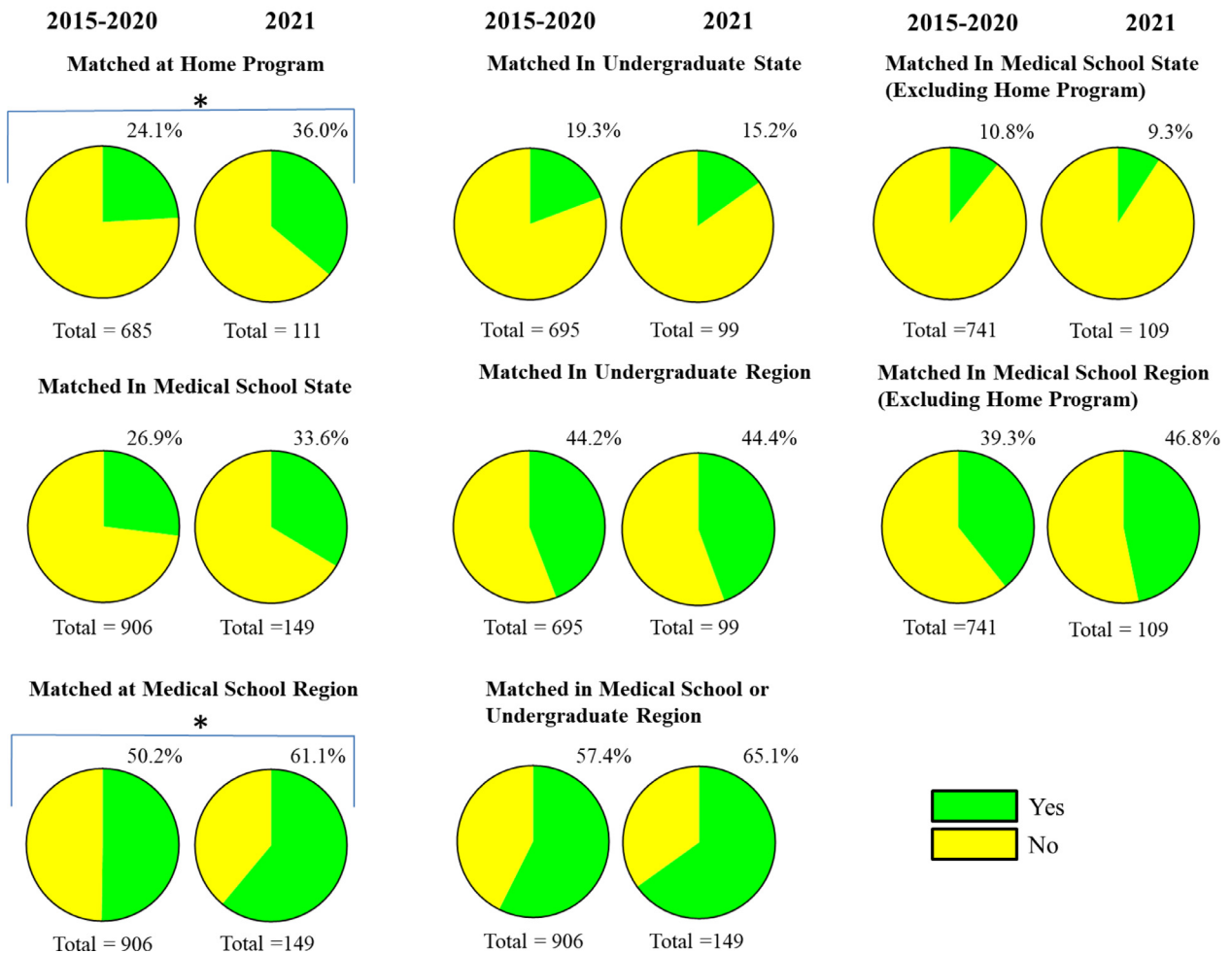


FIGURE 1. Geographic Distribution of Resident Matches is Affected by COVID. Temporal differences between the 2015 to 2020 and 2021 residency match cycles. Resident match rates (%) into their home program, state, and region of their medical or undergraduate school are compared between groups. Asterisks indicate $p < 0.05$.

based on size of incoming residency class, there was no significant differences between 2021 and 2015 to 2020 for any sized program ($p > 0.05$ for all sizes) (Fig. 4)

DISCUSSION

Studies have shown geography to play a prominent role in the plastic surgery residency match. In past years, applicants were more likely to match at their home program and in the same region as their medical school.¹ However, as a result of the COVID-19 pandemic, the traditional residency match cycle underwent numerous changes for 2021, most notably the suspension of away rotations and in-person interviews.⁶ This development denied students and programs possible opportunities to

form personal connections between individuals from geographically distant institutions. To our knowledge, no study has examined the possible effects of the COVID-19 pandemic on the geography of the 2021 match for any specialty. For integrated plastic surgery residency, we compared those who matched in 2021 versus 2015 to 2020 and found that following the COVID-19 pandemic 1) plastic surgery residency spots were more likely to be filled by applicants from an affiliated medical school; 2) this trend was similar across programs in different geographic regions and of different residency class sizes; and 3) this difference was significant for programs ranked outside of the Doximity reputation top 30 ranking but not for those in the top 30.

In our study, 24.1% of residents who matched in 2015 to 2020 matched at their home program. Silvestre et al.

Applicants Matching into their Home Program and Medical School Region

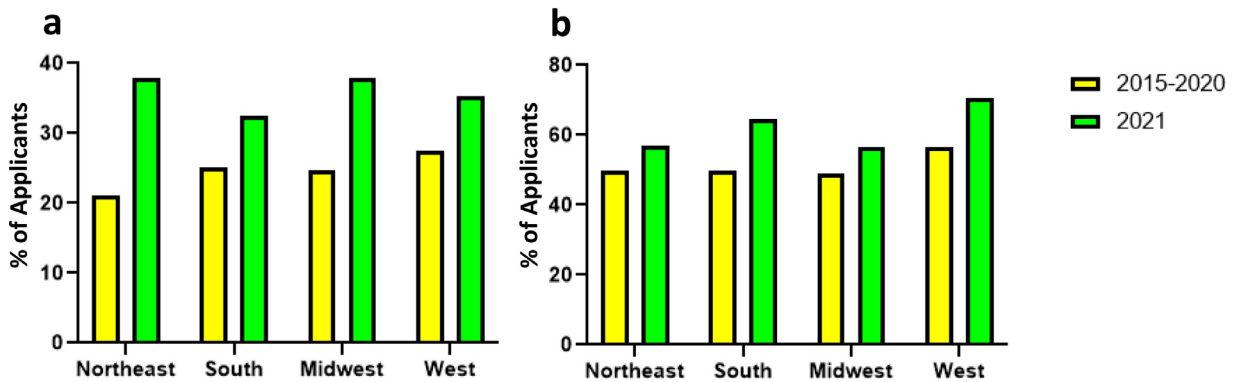


FIGURE 2. Applicants Matching into their Home Program and Medical School Region. Match rate (%) of applicants into their a) home program and a, b) residency in their medical school region, from the years 2015 to 2020 (yellow) compared to the year 2021 (green) in different regions of the United States.

conducted a similar study of the 2011 to 2015 plastic surgery match cycles and found a rate of 15.5%. However, it is unclear if they excluded residents from medical schools without a home program as we did in ours.¹ Studies of the 2013 to 2014 otolaryngology and 2015 to 2016 orthopedic surgery match cycles, which only analyzed residents at programs affiliated with a medical school, found 20.9% and 21.0% of these individuals matched at their home programs, respectively.^{2,3} Silvestre suggests that professional relationships, which develop through clinical rotations and research, offer an institutional advantage for medical students at their “home” program.¹ These relationships allow for a more holistic assessment of an applicant rather than one focused on standardized metrics. Additionally, if a program is more familiar with a student, they may be more

confident that the student will rank the program highly, leading to an increased chance for the program to fill its residency spots.

For 2021 plastic surgery applicants, however, we found the rate of applicants matching at their home program to have significantly increased to 36.0%. In our sub-group analysis, this trend did not appear to be driven by residency programs of any particular size or from any particular region. There are multiple possible explanations for the increased match rate of applicants at their home program, some of which may have resulted from changes due to the COVID-19 pandemic. From the program’s perspective, the decrease in in-person opportunities likely made it more difficult for programs to get to know outside applicants to the same degree as their home students. This may have led to programs ranking home students higher than in previous years. Likewise, applicants may have ranked their home programs higher than normal due to an inability to gauge how “good of a

Doximity Program “Reputation” Ranking and Match Rates

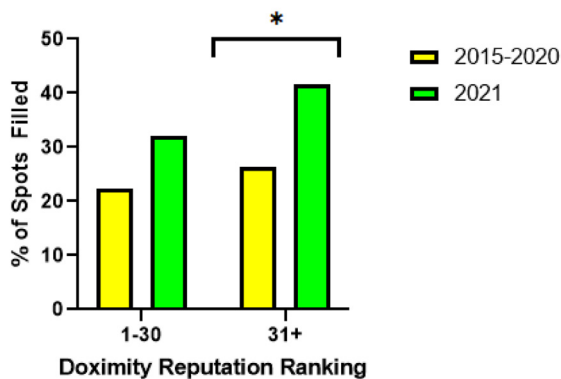


FIGURE 3. Doximity Program “Reputation” Ranking and Match Rates. Residency spots (%) filled by applicants from home program by Doximity reputation ranking of program between the years 2015 to 2020 (yellow) and the year 2021 (green). Asterisks indicate $p < 0.05$.

Residency Class Size Variation And Match Rates

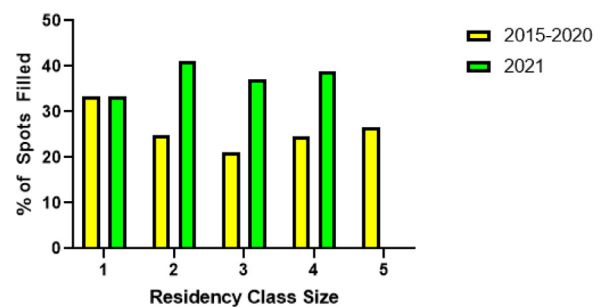


FIGURE 4. Residency Class Size Variation and Match Rates. Residency spots (%) filled by applicants from home program by size of incoming program class between the years 2015 to 2020 (yellow) and the year 2021 (green).

fit” other programs would be. When surveyed, 48.8% of plastic surgery program directors indicated that “finding a good fit program” should be the chief objective of students while on away rotations, indicating the potential importance of in-person experiences for ranking programs in a match list.⁴

Our study also highlighted that programs ranked outside of the Doximity top 30 reputation rankings matched a significantly higher proportion of affiliated applicants in 2021 versus 2015-2020. However, this relationship was not seen for the top 30 ranked programs. One possible explanation is that programs that are highly regarded in the field may receive more applications than those with less “reputation.” Therefore, it would be easier for students affiliated with programs with less name recognition by Doximity to distinguish themselves because the applicant pool is smaller. Another possibility is that, in the absence of away rotations, more highly ranked programs created more opportunities to form professional relationships with students outside of their institution. For example, Serebrakian et al. describes the creation of a webinar held by the Harvard Plastic Surgery Residency Training Program during the pandemic to educate applicants on the upcoming match process.¹³ Similarly, Egro et al. describes a virtual sub-internship created by the University of Pittsburgh plastic surgery program.¹⁴ Both Harvard and Pittsburgh have a Doximity reputation ranking in the top 30. Further studies are needed to characterize the adoption of these virtual programs and the effects that they may have on building relationships with applicants at different institutions.

For 2022, students are now being limited to a single in-person away rotation,⁶ so our findings may have a number of possible implications for the upcoming application cycle. Some students may desire to match outside of their home program, and some programs may desire an influx of students from non-affiliated medical schools. For these applicants and programs, the creation of virtual activities will increase opportunities for personal interaction and may prove beneficial. One option are webinars, such as the one described by Serebrakian et al.,¹³ which have been demonstrated as effective tools for medical education.^{15,16} These opportunities would enable direct communication between the applicants and the residency program faculty and housestaff directing the webinars. Prior studies have also highlighted social media accounts, such as Instagram, Facebook, and Twitter, as a medium for student outreach in plastic surgery.^{17,18} We found that 82% of programs actively used these outlets to announce their match list. Further use of these accounts could provide students with up to date information on remote learning opportunities and increase applicant involvement with the program. More formal programs like virtual sub-internships could also

be more widely established in plastic surgery. For urology, the Society of Academic Urologists created guidelines to encourage the widespread adoption and standardization of virtual sub-internships.¹⁹ National organizations in the field of plastic surgery could follow suit for the 2022 cycle. Doing so will allow applicants to expand their professional networks, and hopefully limit the greater restraints that geography appeared to place on matching during the COVID-19 pandemic.

This study has several limitations. First, data was collected from program websites and social media accounts, which may not be entirely complete or accurate. Despite these limitations, we were able to collect information for a large proportion of programs and residents with no apparent regional bias. Second, our assessment of regional bias in the match was based on arbitrary assignment of states using a US Census map. Although this methodology has been used previously,¹ it may place geographically nearby locations in separate geographic regions. Third, we were unable to factor applicants’ hometowns into our analysis, which may be a particularly important geographic factor in the match process. Fourth, applicants without access to plastic surgery training in their affiliated hospital were allowed to complete away rotations during the 2021 cycle, which may confound the study’s findings. Finally, our subgroup statistical analyses may have been limited by the small sample size of the 2021 cohort.

CONCLUSIONS

In the absence of in-person opportunities to form new professional relationships during the COVID-19 pandemic, residency programs matched applicants from affiliated medical schools at a higher rate than in previous years. Rates of matching students from affiliated medical schools at higher ranked programs appeared to be less affected, which may be due to the wider adoption of virtual alternatives to form relationships with new applicants. With in-person opportunities also limited in the upcoming cycle, residency programs may consider adopting similar virtual opportunities.

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