

Staying Close to Home: The Effects of COVID-19 on the Plastic Surgery Residency Match

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Background: The 2019 novel coronavirus created unique challenges for the integrated plastic surgery match. The goal of this study was to evaluate the trends of the 2020 and 2021 integrated plastic surgery match specifically related to the 2019 novel coronavirus.

Methods: Three separate individual surveys were designed for integrated plastic surgery program directors and applicants from the 2021 to 2020 match. The surveys were distributed to the email addresses of applicants that applied to our institution's integrated residency program. Information of current interns and newly matched applicants from program websites and certified social media accounts were recorded.

Results: We received completed surveys from 19 of the 69 program directors for a response rate of 27.5%. The survey for the 2020 and 2021 match applicants was completed by 25 and 68 applicants, respectively, for a response rate of 6.1% and 21.9%. There was a significant difference in the average number of completed virtual sub-internships between applicants that did and did not successfully match into plastic surgery (1.48 versus 0.36, $P = 0.01$). The rate of students matching at their home institution was the highest in 2021 at 26% compared to 2020 (18%) and 2019 (15%).

Conclusions: The results of this study demonstrate that applicants were more likely to match at programs with which they had established previous connections, including home institutions. Applicants also had a higher likelihood to match if they completed a virtual subinternship during the 2021 match. Learning points can be applied to the upcoming application cycle to improve the overall experience. (*Plast Reconstr Surg Glob Open* 2021;9:e3864; doi: [10.1097/GOX.0000000000003864](https://doi.org/10.1097/GOX.0000000000003864); Published online 28 September 2021.)

INTRODUCTION

The integrated plastic surgery residency training model was first recognized by the Accreditation Council for Graduate Medical Education in 1992.¹ Since then, the number of training programs offering positions in integrated plastic surgery has rapidly expanded to 84 programs in 2020 with 180 total positions.² The plastic surgery match was the most competitive program of all specialties in 2020, with the lowest match rate of 72.1% for all graduating US medical seniors. The competitive application cycle creates a difficult challenge for medical students and program directors navigating the match. This process has

previously relied heavily on in-person student visiting sub-internships (also known as away rotations) and letters of recommendation for evaluation of potential candidates.^{3,4}

The 2019 novel coronavirus (COVID-19) pandemic has impacted medical school and residency education for more than a year. The Association of American Medical Colleges (AAMC) released a statement in May 2020 that recommended an entirely virtual interview process and strongly discouraged medical students from participating in visiting rotations.⁵ These constraints created a unique experience for programs, as well as for applicants seeking to match into an integrated plastic surgery residency. Applicants receiving virtual interviews were less satisfied with the overall interview experience and reported feeling less familiar with prospective programs.⁶

A previous study has demonstrated that the COVID-19 plastic surgery match was associated with increased home match rate of applicants compared to previous years.⁷ No studies to date have evaluated applicant and program perspectives on the 2021 match and perspectives of the virtual interview process. The goal of this study was to evaluate the trends of the integrated plastic surgery 2021

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National Resident Matching Program match cycle specifically related to COVID-19. We hypothesized that more applicants would match at their home institution than previous years.

METHODS

Three separate surveys were designed for integrated plastic surgery program directors, integrated plastic surgery applicants from the 2021 match, and applicants from the 2020 match. The surveys were distributed via Qualtrics. The surveys were distributed via email to applicants that applied to our institution’s integrated plastic surgery residency program in 2020 and 2021. A publicly obtained list of integrated plastic surgery program directors was used to distribute the program director survey. The surveys were emailed three times over the course of 3 weeks to encourage response. In addition, information of current interns and newly matched applicants from program websites and social media accounts was collected. Applicants’ home medical schools were compared to their current institutions to calculate the total rate of applicants that matched at their home institution.

Applicant survey results were compared between the 2020 and 2021 match class. The results of the publicly obtained match information were compared between the 2019, 2020, and 2021 match classes. Programs were excluded from the home match rate analysis if they did not have an associated medical school. Statistical analysis was performed using IBM SPSS 10.0 version 26 and Microsoft Excel. Categorical variables were analyzed using chi-square analysis. Independent student t-test was utilized for analyzing the difference between means of continuous variables. The threshold for statistical significance was set at a *P* value less than 0.05. The study was approved by the institutional review board of Duke University.

RESULTS

A total of 19 program directors out of 69 completed the survey for a response rate of 27.5%. The survey for the 2020 and 2021 match applicants was completed by 25 and 68 applicants, respectively, for a response rate of 6.1% and 21.9%. **Table 1** depicts the results for the program director survey. Sixty-three percent of program directors stated that their program interviewed more applicants during the 2021 match cycle compared to previous years. Twenty-one percent of programs stated they offered some types of virtual subinternship to medical students. Half of the programs with virtual subinternships stated they were helpful when evaluating potential applicants. Compared to previous years, program directors reported that interview experience and letters of recommendation were more impactful resources for ranking applicants to match.

Table 2 represents the survey responses between applicants from the 2020 and 2021 match process. A higher percentage of applicants matched at a program where they spent a dedicated research year during the 2021 cycle compared to 2020, although this was not statistically significant. In addition, applicants responded that they applied to a greater number of programs and completed

Takeaways

1. Medical student home program match rates have increased the past 3 years with peak during the COVID-19 match cycle at 26%.
2. Virtual subinternships provided a benefit to both programs and applicants for the 2021 match process while in-person away subinternships were not available.
3. The virtual interview process for applicants was significantly less costly compared to previous years.

more program interviews during the 2021 application cycle. There was a statistically significant reduction in cost for the interview cycle for 2021 applicants. The majority of responders (39.7%) who applied during the 2021 cycle stated they spent less than \$250 during the interview process, excluding application fees. This is in stark contrast to the 2020 match, in which 32% of applicants reported spending between \$7501 and \$10,000. There was a significant reduction in applicants who obtained a letter of recommendation outside of their home institution in 2021 (*P* < 0.001). There was also a significant increase in applicants matching into programs that held a previous connection before the match process in 2021 (63% versus 37.5%, *P* = 0.049).

Specific outcomes related to the virtual 2021 interview cycle were queried and depicted in **Table 3**. Of those

Table 1. Program Director Survey

Question	Response	Percentage
Completed responses	19/69	27.5%
Did your program interview more candidates this year?		
Less	2	11%
Same	5	26%
More	12	63%
Did you offer a virtual subinternship?		
Yes	4	21%
No	15	79%
Was virtual subinternship helpful in evaluating applicants?		
Yes, it was helpful	2	50%
No difference	2	50%
Compared to previous years, which factor was most important in 2021 match?		
USMLE step score	3	16%
Letters of recommendation	5	26%
Virtual subinternship	2	11%
Interview experience	7	37%
Research productivity	1	5%
Medical school ranking	1	5%
Average order of importance for evaluating applicants (1–10)		
Letters of recommendation	2.56	
Interview experience	3	
USMLE step score	3.22	
Research productivity	3.44	
AOA membership	5.72	
Personal statement	6.56	
Medical school ranking	6.77	
Virtual subinternship participation	7.27	
Dean’s letter	7.5	
Social media engagement	8.9	

AOA, Alpha Omega Alpha; USMLE, US Medical Licensing Exam.

Table 2. Survey Comparison between 2020 and 2021 Match

Question	2020 Applicants	2021 Applicants	Significance, <i>P</i>
Completed survey	25 (6.1%)	68 (21.9%)	
Successfully matched into PSU integrative program?			
Yes	24 (96%)	54 (79.4%)	0.127
No	1 (4%)	14 (20.6%)	
Where did you match on your rank list?			
1	9 (37.5%)	26 (48.1%)	0.177
2–3	7 (29.2%)	12 (22.2%)	
4–5	4 (16.7%)	8 (14.8%)	
6–10	2 (8.3%)	8 (14.8%)	
11–15	2 (8.3%)	0	
Did you match at a program where you completed an in-person subinternship?			
Yes	13 (54.2%)	18 (33.3%)	0.236
No	11 (45.8%)	36 (66.7%)	
Did you match at a program where you completed dedicated research?			
Yes	1 (4.3%)	9 (16.7%)	0.401
No	23 (95.7%)	45 (83.3%)	
How many PSU programs did you apply to in the match?			
20–40	2 (8%)	4 (5.9%)	0.071
41–60	8 (32%)	7 (10.3%)	
60+	15 (60%)	57 (83.8%)	
How many residency interviews did you attend?			
0–5	1 (4%)	16 (23.5%)	0.089
6–10	9 (36%)	11 (16.2%)	
11–15	8 (32%)	16 (23.5%)	
16–20	4 (16%)	14 (20.6%)	
20+	3 (12%)	11 (16.2%)	
No. PSU programs ranked to match?			
0–5	3 (12%)	12 (17.6%)	0.686
6–10	7 (28%)	14 (20.6%)	
11–15	8 (32%)	15 (23.5%)	
16–20	5 (20%)	18 (26.5%)	
20+	2 (8%)	9 (14.2%)	
How much was the total cost of the interview process (excluding application fees)?			
\$<250	0	27 (39.7%)	<0.001*
\$251–\$1000	0	19 (27.9%)	
\$1001–\$2500	4 (16%)	15 (22.1%)	
\$2501–\$5000	6 (24%)	6 (8.8%)	
\$5001–\$7500	7 (28%)	1 (1.5%)	
\$7501–\$10000	8 (32%)	0	
Did you obtain an LOR from outside your home institution?			
0	2 (8%)	38 (55.9%)	<0.001*
1	7 (28%)	15 (22.1%)	
2	10 (40%)	4 (5.9%)	
3	5 (20%)	7 (10.3%)	
4+	1 (4%)	4 (5.9%)	
Did you have a previous connection to program to where you matched?			
Yes	9 (37.5%)	34 (63%)	0.049*
No	15 (62.5%)	20 (37%)	
Family in the nearby area	7	15	
Friends in the nearby area	6	10	
Attended undergraduate at program	1	2	
Completed gap year at program/area	0	7	
Other	0	16	

*Statistically significant.

LOR, Letters of Recommendation; PSU, plastic surgery.

who completed the survey, 54.4% of applicants stated they only completed a single subinternship before the match, whereas 26.5% completed two or more. There was no significant difference in the average number of completed in-person subinternships between candidates that matched and did not match into an integrated plastic surgery residency. However, 64.7% of respondents reported participating in some form of virtual subinternship. There was a significant difference in the average number of completed virtual subinternships between applicants that did and did not successfully match into plastic surgery (1.48 versus 0.36, $P = 0.01$). Nineteen percent of applicants stated they independently traveled to gain additional insight to geographic areas to assist in ranking programs, whereas 18.5% stated that they had never physically been

to the city in which they successfully matched. Overall, applicants during the 2021 match process were less confident that they would match due to the restrictions of the application process (64.7%). The majority of applicants stated that the virtual interview process did not affect the number of applications submitted or interviews completed (82.4%).

Publicly obtained information regarding applicants' home medical schools and matched plastic surgery programs was used to calculate a home match rate for the years 2019, 2020, and 2021 (Table 4, Fig. 1). In 2019, 26 of 177 (15%) medical students matched at their home program. The rate of students matching at their home institution increased to 32 of 180 (18%) in the 2020 match. The home match rate increased to 26% in 2021 with 46 of

Table 3. 2021 Virtual Match Results

Question	Response	Percentage	Significance
Total participants	68	21.9%	
How many in-person subinternship did you complete?			
0	13	19.1%	
1	37	54.4%	
2	11	16.2%	
3	7	10.3%	
Average matched applicants	1.13		
Average nonmatched applicants	1.36		0.062
How many virtual subinternship did you complete?			
0	24	35.3%	
1	19	27.9%	
2	15	22.1%	
3	6	8.8%	
4	2	2.9%	
5	2	2.9%	
Average matched applicants	1.48		
Average nonmatched applicants	0.36		0.010*
Did you travel to any cities to gain additional information?			
Yes	13	19.1%	
No	55	80.9%	
Have you previously been to the city where you matched?			
Yes	42	77.8%	
No	10	18.5%	
How did COVID affect your confidence in matching?			
Less confident I would match	44	64.7%	
More confident I would match	3	4.4%	
Unchanged	21	30.9%	
Did virtual interviews affect the number of programs you applied to?			
Yes, I applied to fewer	1	1.5%	
Yes, I applied to more	11	16.2%	
No, I applied to the same	56	82.4%	
Did virtual interviews affect the number of programs you interviewed at?			
Yes, I interviewed at fewer	4	5.9%	
Yes, I interviewed at more	30	44.1%	
No, I interviewed at the same	34	50.0%	

*Statistically significant.

184 applicants matching at their home institution. There was a significant difference between the home student match rate for all 3 years ($P = 0.027$). Analysis of adjusted standardized residuals demonstrated that the match rate for 2021 was significantly higher than its expected value (adjusted standardized residual = 2.590). Comparison of individual years (using a corrected P value of $\alpha/3 = 0.017$ for significance) demonstrated that the 2021 home match rate was significantly higher than the 2019 match rate ($P = 0.010$). However, significance was not found in comparing the 2019 and 2020 home match rates ($P = 0.429$) or the 2020 and 2021 rates ($P = 0.072$).

DISCUSSION

The COVID-19 pandemic placed unique constraints on the integrated plastic surgery residency application cycle for 2021. The results of this study demonstrate the change in trends in the 2021 match. The virtual process made it challenging for programs and applicants

Table 4. Home Institution Match Rate Results

Year	Home	Away	Total	%	AR
2019	26	150	176	15	-1.94
2020	32	147	179	18	-0.68
2021	47	136	183	26	2.59

AR, adjusted standardized residual.

to perform a thorough evaluation compared to previous years. A previous study of surgery program directors argued that letters of recommendation were more critical during a virtual process for evaluating an applicant.^{6,8} The results of this survey reinforced the importance of letters of recommendation within the virtual application cycle. This perspective underscores the significant disadvantage of prospective applicants who do not have an established home plastic surgery residency program. The applicants of the 2021 cycle received statistically significant fewer letters of recommendation from outside institutions compared to the previous year. This limited the opportunity to obtain letters from familiar sources that interviewers recognize, which has previously been reported as an important factor.⁹ A standard format for letters of recommendation was shown to be a beneficial adjunct during the interview process.¹⁰ This standardization can be used to compare applicants with varying styles of letters from unfamiliar authors.

In-person away rotations have been shown to be important for evaluations of both programs and applicants.^{3,11,12} A previous study by Atashroo et al in 2015 quoted a 42% rate of students matching into programs that they completed an away rotation.¹³ In-person away rotations were strongly discouraged by the AAMC for the 2021 match process. This eliminated the applicant's ability to interact with potential programs to demonstrate strengths that are not as easily elucidated from short interviews or a resume. Virtual subinternships were used by some programs as a surrogate for the 2021 match. These ranged in format and comprehensiveness between various institutions. Virtual subinternship regimens included activities, such as attending educational conferences, one-on-one discussions with faculty and residents, and/or oral presentations.

Participation in a virtual subinternship was on average the eighth most important criteria for applicant evaluation. This result may be artificially low considering some programs did not use this as a tool for the 2021 cycle. Of note, 64.7% of 2021 applicants reported completing a virtual subinternship. Students that successfully matched into plastic surgery completed a significantly higher number of virtual subinternships compared to those that did not match. Although virtual subinternships are not a perfect construct and can take effort to organize, they may have provided a role to expose both applicants and programs to each other in an otherwise limited year. Virtual rotations have been found to help expand diversity, offer program insight, and create equitable opportunity for applicants.¹⁴⁻¹⁶

The AAMC's most recent statement recommends limiting medical students to a single away rotation for the 2021-2022 application cycle.¹⁷ This restriction and results of this study should encourage programs and applicants

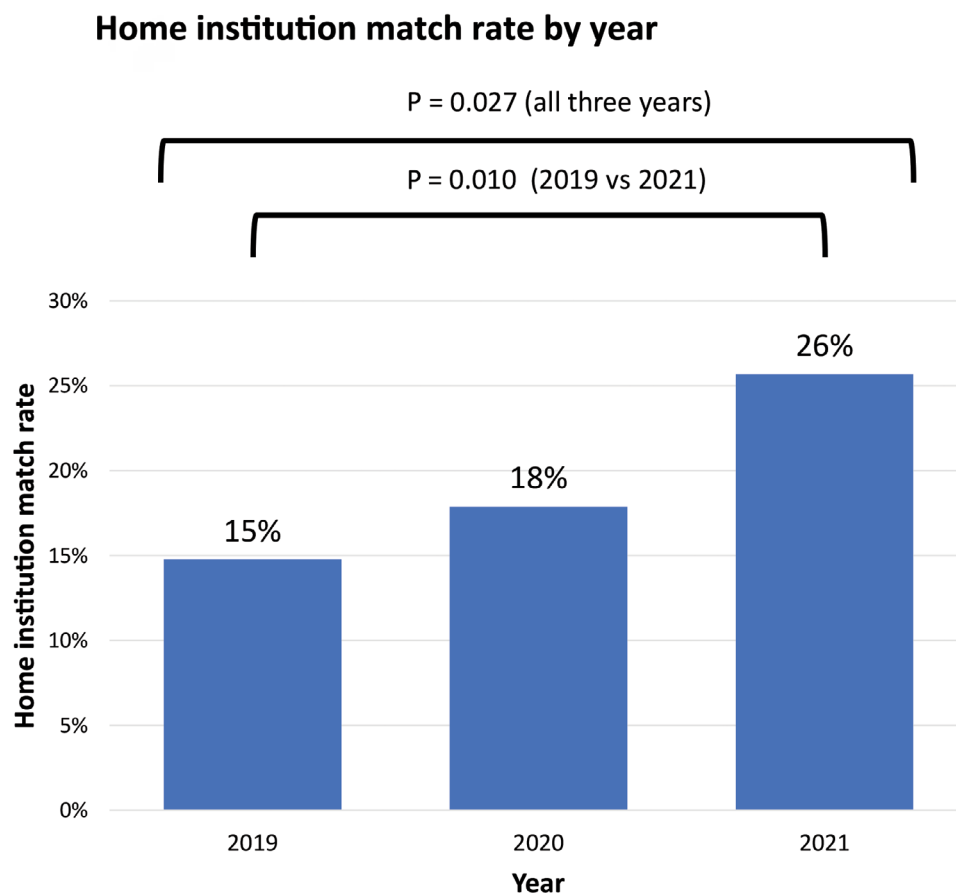


Fig. 1. Comparison of the rate of medical students matching to their home program between the years 2019, 2020, and 2021.

to participate in virtual subinternships for the upcoming year. This recommendation to participate in virtual subinternships may not be feasible for all programs. This may favor larger programs with more administrative support and resources that are able to build a virtual subinternship curriculum. However, with all interviews being virtual, the experience from an applicant perspective is less influenced by hospital facilities or desirable locations. This may level the playing field for all programs from the perception of applicants.

The interview process is a financial burden on applicants. A 2010 study reported that most applicants spent between \$5000 and \$7500 throughout the application cycle.¹⁸ There was a significant reduction of cost for the 2021 match. The large cost difference can be attributed to reduced travel expenses. Applicants of the 2021 cycle reported no difference in number of applications applied to or interviews attended, with a majority applying to more than 60 programs total. Undoubtedly, the reduced cost was a significant benefit to applicants during the virtual interview process, especially for students of lower socioeconomic background. The high costs of interviewing will most likely return along with in-person interviews at the resolution of COVID-19 restrictions.

In-person interactions and experiences greatly affected applicants' perceptions of programs.¹⁹ Compared

to virtual interviews, in-person interviews were viewed as a more positive experience.⁶ Interestingly, a moderate portion of applicants traveled outside the match to gain further insight to potential cities. In addition, applicants were more likely to match at programs with which they had a previous connection. Applicants with previous connection before interviews has been shown to have a positive influence on the match.^{18,20} With the restrictions of the application process, more programs were likely to match applicants from their home program. The rates of students matching to their home program increased from 15% to 18% from 2019 to 2020. The year 2021 showed the highest rate of home program match with a rate of 26%. This preference for home students placed students without an integrated plastic surgery residency at their home institution at a disadvantage for the 2021 match year. The limitations of being able to complete in-person subinternships most likely compound this effect.

There are several limitations within our study. As a survey-based study, there is inherent selection bias with the results. In addition, the low response rate may not accurately reflect the entire cohort of applicants. Applicants from the 2020 match process had the lowest response rate, as they were less likely to respond to emails employed from the previous academic year. The survey recipients were only those that applied to our institution through the

match. There is also subjectivity in interpretation of some questions that may lead to variability in survey responses.

CONCLUSIONS

The 2021 plastic surgery match presented difficult challenges for both applicants and programs during the COVID-19 pandemic. The results of this study demonstrate that applicants were more likely to match at programs with which they had established previous connections, including home institutions. Applicants who completed a virtual subinternship during the 2021 cycle had a significantly higher match rate. The virtual process significantly reduced the financial burden on applicants, but it did not reduce the burden of applicant volumes received by program directors. These learning points can be applied to the upcoming application cycle to improve the overall experience and results of programs and medical students.

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