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The Student You Know: Orthopedic Surgery Home Program Match Rates and Geographic Relationships Before and After COVID-19

Anthony J. Nestler, MD,* Benjamin M. Feibel, MD,* Austin M. Beason, MD,* Kathryn Besserman, BS,* Samuel D. Mounce, BS,* James R. Bailey, MD,* Kristin R. Delfino, PhD,* and Donald G. Allan, MD*†

*Southern Illinois University, Springfield, Illinois; and †Orthopedic Center of Illinois, Springfield, Illinois

OBJECTIVE: In March 2020, COVID-19 was declared a pandemic by the World Health Organization. This led to the outright cancellation of away rotations and in person residency interviews for the class of 2021. This study aims to identify the geographic relationships in the orthopedic match and further explore COVID-19’s effect on these geographic relationships. Furthermore, we aim to compare the home program match rates before and after COVID-19.

SETTING: Southern Illinois University School of Medicine, Department of Orthopedic Surgery (tertiary, university-based).

DESIGN AND PARTICIPANTS: Residency websites and social media sites were used to record basic residency information as well as each resident’s year, matriculated medical school, and matriculated medical school geographic data. This information was used to evaluate the proportion of orthopedic residents from “home program” medical schools and evaluate the geographic relationship of matched orthopedic residents. 202 Orthopedic residencies were initially identified and 134 allopathic and nonmilitary residency programs met the inclusion criteria. In all, 3253 of the 3931 (82.7%) current U.S orthopedic residents were included in the analysis.

RESULTS: In the 4 orthopedic surgery residency classes before the pandemic (2017-2020), 21.8% of residency slots were filled by home program students. During the pandemic match cycle (2021), this number jumped to 28.2% (p < 0.0006). The increase was observed consistently across residency subgroup analysis: class size, doximity rank, and doximity research rank. Correspondingly, there was a statistically significant increase from 34.7% (2017-2020) to 39.3% (2021) (p = 0.0318) in residencies matching with same state medical students. Regional trends stayed consistent. Our study showed that residency programs matched applicants who went to same region medical schools during the 2020 to 2021 cycle at nearly the exact same rate as they did pre-pandemic (63.6%, up from 63.3%).

CONCLUSIONS: Our study demonstrates that despite widespread virtual away rotations and virtual open houses, residency programs showed an increased preference for their home program students. This trend was significant and widespread, highlighting the generalized nationwide hesitation of both residency programs and students on the virtual interview process. (J Surg Ed 80:476–482. © 2022 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: orthopedic surgery, residency match, COVID-19, home program, in-state, away rotations

COMPETENCIES: Interpersonal and Communication Skills, Systems-Based Practice, Professionalism

INTRODUCTION

The orthopedic surgery residency match process has remained competitive for US medical school graduates for many years, despite significant increases in the number of programs and first-year residency positions offered. In the 2021 match cycle, there were 868 PGY-1 positions. 1289 US seniors applied, and 866 matched, for a 67.2% match rate. Known factors that affect a
candidate’s chances of successfully matching include USMLE Step 1 and Step 2 scores, number of research experiences, and away rotations at other programs. Away rotations allow medical students to separate themselves from an increasing applicant pool by showcasing their skills and interacting with the residents and the specific facility. In addition, this time allows students to showcase qualities that may be difficult to convey in an interview. A 2016 study assessed the impact of away rotations, demonstrating that 56% of applicants matched at their home program or a program where they rotated. More recently, a study in 2021 demonstrated that orthopedic program directors emphasized more personal qualities such as work ethic and social interaction over the field’s knowledge. Such qualities are difficult to appreciate over virtual away rotation formats.

In March 2020, COVID-19 was declared a pandemic by the World Health Organization. This global adversity drastically impacted the away rotation process and led to outright cancellation of away rotations and in person interviews for the class of 2021. Prior to the restrictions placed on away rotations due to COVID-19, students participated in on average 2.1 away rotations. In 2018, a study evaluated the geographic relationship of the orthopedic match, indicating that 21% of applicants matched to a program affiliated with their medical school and 31% of residents matched in the same state as their medical school. To date, little work has been done to evaluate the effect of the cancellation of away rotations on the 2021 match. First, we aim to report recent geographic data regarding the orthopedic match and further explore COVID-19’s effect on matching. Second, we aim to compare the home program match rates before and after COVID-19. We hypothesize that disruptions to the standard match process caused by the COVID-19 pandemic led to increased rates of orthopedic surgery candidates matching at their home institution.

**MATERIALS AND METHODS**

A list of all Orthopedic residency programs accredited by the Accreditation Council for Graduate Medical Education (ACGME) was collected from FREIDA, an AMA sponsored residency and fellowship publicly accessible database. The number of programs reported by FREIDA is comparable with the 210 programs listed in the 2021 NRMP residency match results. 202 orthopedic residencies were initially identified and 134 allopathic and non-military residency programs met the inclusion criteria. Residency programs that did not have a home program were excluded from the study. Furthermore, neither osteopathic nor military orthopedic programs were included in the final analysis. “Home program” status was determined based off residency and medical school websites; any medical school affiliated with a residency program was considered a home program. If information was not listed for greater than 50% of the residency class, that residency was excluded from the study.

Basic residency geographic information was collected from the FREIDA database. Each residency’s department website was accessed via an internet search from which much of the information needed for this study was obtained. It is common practice for orthopedic programs to list their residency roster with the resident’s corresponding medical school on the program’s website. The residency rosters were used to collect the following data for each resident: resident’s initials, PGY-year, and medical school attended. If this information could not be found on the residency website, residency program Instagram and Facebook accounts were examined to pull more information. This information was gathered for the 2017 to 2021 orthopedic residency classes.

A subgroup analysis of home program match rates was performed based on region, residency class size, doximity reputation rank, doximity research output rank. The medical school and residency programs were categorized regionally based on the U.S. census map which divides the regions into Northeast, Southern, Midwest, and West. Furthermore, class size was based off the PGY-1 class. Doximity reputation rank and research output rank was based off the doximity website access in March 2021.

General geographic and summative statical information was evaluated. A statistical comparison was conducted between the 2017 to 2020 and the 2021 class cohorts using a fisher exact T test. A p < 0.05 was considered statistically significant.

**RESULTS**

FREIDA AMA lists 202 orthopedic surgery residencies programs. Of the 202, 134 allopathic, non-military, were included in the final analysis. Sixty-eight were not included. Of the 68 omitted, 27 were primarily osteopathic, 36 did not have their residents listed or they were not associated with a medical school, and 5 were unaccounted for. In all, 3253 of the 3931 (82.7%) current U.S orthopedic residents were included in the final analysis. Of this, 659 are PGY1s and 2594 are PGY2-5s.

**Geographic Trends in Orthopedics**

Orthopedic residency programs appear to have strong preference for applicants who trained within the same geographic region as the residency program. Overall, 63% of total residents matched in the same region as their medical school. This relationship is most apparent in the geographic south, with 71.2% of the orthopedic
residency slots filled by region students. This relationship is least apparent in the west, with only 42.1% of orthopedic residency slots filled by regional students (Fig. 1). Furthermore, 55.4% of residency slots were filled by medical students of the same state. Texas was an outlier, with 65.5% of their orthopedic residents being from Texas medical schools. A breakdown of in-state match rates can be seen in Figure 2.

The regional bias did not appear to be affected during the 2021 match cycle, with only a 0.2% increase (63.2% from 63%) of same region match rates when comparing the 2021 match cycle to the 2017 to 2020 cycles. There was no statistically significant change in any region analyzed pre vs post pandemic (Fig. 3). However, there was a statistically significant increase from 34.7% (2017-2020) to 39.3% (2021) (p = 0.0318) in residencies matching same state medical students in 2021 (Fig. 4).

Home Program Match Rates

In the 4 orthopedic surgery residency classes before COVID-19, 2017 to 2020, 21.8% of residency slots were filled by home program students; during the 2021 cycle this number jumped to 28.2% (p < 0.0006) (Fig. 5).

Subgroup analysis was performed on region, class size, doximity reputation ranking, and doximity research ranking. The increased home program preference was observed for both top 50 ranked doximity programs and programs ranked outside the top 50, with both showing a statistically significant increased match rate of the home program students (Fig. 6). The top 50 ranked residency programs matched 27.3% of home program students, whereas before the pandemic they matched only 20.5% (.0155). Similarly, the doximity reputation 51+ orthopedic programs matched 28.9% of home program students vs 22.6% the 4 years prior (.0121). This trend was broken when looking at the doximity ranked top 50 orthopedic research programs, which showed no statistically significant increased preference for home program applicants, matching 23.4% in 2021 vs 19.3% the years prior (.1299). In comparison, the orthopedic programs ranked 51+ for research continued to show a preference for home program students, matching 31.6% in 2021 compared to 23.2% in the years prior (.0001). Statistically significant increases in home program match rates were observed for both residency program with 1 to 5 residents and 6+ residents (Fig. 6). Additionally, this jump was consistent across all regions, with every region in the U.S. showing an increased preference for...
home program applicants (Fig. 5). However, there was only statistical significance in the Northeast.

**DISCUSSION**

Matching into orthopedic surgery is a daunting task for even the most qualified applicants. From 2008 to 2018 the average number of applicants for 1 residency position increased from 54.1 to 85.7. Away rotations or “sub-internships” have been a fundamental part of the orthopedic matching system and a way for medical students to make an impression on the residents, faculty, and attendings. However, on May 11, 2020, at the onset of the COVID-19 pandemic, the AAMC wrote an executive summary discouraging in person away rotations and recommending virtual interviews. The lack of in person interviews and away rotations led programs to focus increasingly on their online presence; Between the 2019 to 2020 and the 2020 to 2021 application cycle there was a 355% increase in orthopedic surgery social medial utilization by residency programs. Approximately three fourths of orthopedic programs began offering virtual open houses to showcase their program. In place of in person away rotations, 32% of programs offered virtual away rotations, of which 52% of programs reported them as “extremely important.”

During this unusual application cycle, applicants were presented with a unique opportunity. No longer facing financial or logistical barriers, applicants were able to be virtually present at any residency program throughout the country regardless of their geographic location. Interestingly, this did not result a greater dispersion of orthopedic medical students throughout the country. Our study showed that residency programs matched applicants who went to medical school in the same region during the 2020 to 2021 cycle at nearly the exact same rate as they did pre-pandemic (63.6% vs 63.3%). Despite the increased virtual opportunities, residency programs appeared to turn geographically inward, matching in-state applicants at a rate of 39.3% during the 2020 to 2021 cycle, up from 34.7% during the years prior (.0323). This phenomena reinforces an observation made by Wang et al. that performance on a virtual away rotation carried significantly less weight than performance on in-person away rotations during the years
Furthermore, a survey by Blood et al. showed that program directors place the greatest emphasis on work ethic and social interactions, both of which are difficult to extrapolate via the virtual format.

We hypothesize that the underlying reason for increased in-state match rates is an increase in the home program match rate. In our study, 21.7% of residents who matched from 2017 to 2020 matched at their home program. Cox et al. conducted a similarly designed study, which evaluated the geographic trends in orthopedic surgery match in 2018. They noted an almost identical home program match rate of 21%. Interestingly, during the 2021 match cycle, the orthopedic home program match rate jumped to 28.2%. A similar phenomenon was observed in the plastic surgery match. The plastic surgery 2015 to 2020 home program match rate was 24.1%, while the 2021 home program match rate increased to 36%. We hypothesize that since residency programs were only exposed physically to home program students, they were more likely to rank those students highly compared to students whom they had never met. From a medical student perspective, students were only exposed physically to their home program, making it all the more likely that they would become more familiar with the program and thus rank it more highly.

**FIGURE 5.** A regional breakdown of orthopedic residency programs depicting the percent of the current residents who were “home program” students both before and after COVID-19. The far-right hand “total” column shows the percent of current residents who were “home program” students before and after COVID-19 across all regions. *p < 0.05, **p < 0.001.

**FIGURE 6.** A subgroup analysis of Doximity rank, Research rank, and PGY-1 Class size illustrating the respective percent of the current residents who were “home program” students both before and after COVID-19. *p < 0.05, **p < 0.001.
On subgroup analysis, increased rates of home program matching were seen consistently across doximity rank, research rank, and class size. Holderread et al. showed that top tier (1-40) residency programs had a broader social media following during the 2021 application cycle. Despite this, the top 50 doximity ranked programs and the 51+ doximity ranked programs showed a statistically significant increase in home program match rates. Similarly, home program match rates did not differ between small (1-5) and large (6+) orthopedic programs, as both demonstrated a statistically significant increased rate of home program matched students (Fig. 6). The top 50 ranked research programs showed a 4.1% increase in home program match rates, though this was not statistically significant. However, the programs ranked 51+ did show a statistically significant increase. This could be due in part to the ability of large research institutions to quickly mobilize online forums, webinars, and away rotations. Additionally, substantial increases in home program match rates were observed across all regions, although it was only statistically significant in the Northeast.

This study highlights the importance of in-person relationships when it comes to the orthopedic match. Our study demonstrates that despite widespread virtual away rotations and virtual open houses, residency programs showed an increased preference to students they had seen in person, which in this case was their home program students. During the COVID pandemic, students were more likely to stay at their home institution regardless of essentially all subgroup analysis. This trend was significant and widespread, highlighting the generalized nationwide hesitation of residency programs and students on the virtual interview process. Increased home program match rate is an excellent example of the “mere exposure effect,” which states that mere repeated exposure of the individual to a stimulus object enhances one’s attitude towards it. We hypothesize that in the coming 2023 match, which has no away rotation limitations, we will see home program match rates return to previous levels.

There are several limitations to this study. First, the data collection process relied entirely on publicly accessible residency websites and the assumption that residency websites were up to date for the 2021 to 2022 residency year. To examine the timeliness of updating residency rosters, 100 random orthopedic residency programs were re-evaluated for the 2022 to 2023 academic year and compared to the recorded roster for the 2021 to 2022 academic year. Of the 100 residency rosters evaluated, 84 of the 100 programs had their roster updated just 4 months into the academic year. This demonstrates that the vast majority of online residency rosters were updated in a timely manner; however, we acknowledge that a small percentage of the residency rosters recorded may have not been updated by the time of collection and could serve as a potential compromise to the integrity of the data collected. Second, the geographic relationships were studied by the arbitrary assignment of states to geographic regions but did not consider geographic distance. Third, this study was unable to evaluate other geographic ties that the students had with the residency program, such as undergraduate school or hometown. Fourth, a true “home program” can be difficult to determine, as states with multiple orthopedic programs and medical schools have a web of interconnectedness that is hard to quantify. Fifth, not all residency programs were included in this study, as many did not have a full roster accessible.

**CONCLUSION**

Our study demonstrates that despite widespread virtual away rotations and virtual open houses, residency programs showed an increased preference for their home program students during the 2021 orthopedic surgery match cycle. This trend was significant and widespread, highlighting the generalized nationwide hesitation of both residency programs and students on the virtual interview process.

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