

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

Effects of COVID-19 and the Interview Process for Internal Medicine Residency Applicants

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Abstract

Research Question: What was the impact on residency match placement in the 2020-2021 virtual interview cycle compared to the previous years of in person interview cycle Match placements?

Background, Significance, and Rationale: Virtual recruiting of medical students for residency programs was implemented on a national scale at 444 internal medicine residency programs during the 2020-21 application cycle due to the COVID-19 pandemic. For the first time in the National Resident Matching Program (NRMP) Match, applicants ranked programs without having visited their institutions. While residency programs have invested significant time and effort developing virtual interview days, there are undoubtedly components of the interview day that cannot be adequately experienced virtually, such as direct interactions with staff or touring facilities. The lack of in person interactions with programs prior to ranking was likely to affect both applicants and programs in their rank list process. We hypothesized that for the 2020-2021 Match, a larger proportion of applicants matched to the school-affiliated institutions relative to the prior application cycles.

Materials and Methods: Data was aggregated from publicly available websites of Internal Medicine Residency Programs across the United States, obtaining information about the medical school alma mater of each internal medicine resident for the residency graduating classes of 2021-2025. A repeated measures ANOVA was used to determine whether the proportion of individuals who remain affiliated with the same institute for both medical school and residency differs significantly for the 2020-21 application cycle relative to prior years. All data was stored on a password protected computer and on the TCU cloud to be worked on with all research team members.

Results: Initial analysis of a convenience sub-sample of residency programs indicates that fewer medical students who interview virtually are staying at internal medicine residency programs affiliated with their alma mater than did when interviewing occurred in person. However, there was a statistically significant increase in the number of matriculants that stayed in the same state and region as their medical school.

Conclusion: Much attention has been paid to the social inequity that resulted as medical students, on top of the debt for their education, were required to spend thousands of dollars traveling for residency interviews. We posited that students, unable to travel and visualize alternative residencies, would decide to match in the school and hospital systems that they knew. Instead, we find that, in internal medicine, the ability to visit virtually has led to increased choices and a decrease in the number of students matching locally. We posit that the increase in applications, possibly due to the decreased travel costs, may demonstrate a willingness on the part of students to actively consider a broader range of programs that would previously have been out of reach due to financial constraints. Further studies should determine whether this is replicated in other specialties, and whether the effect is more pronounced in economically disadvantaged students.

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

Research Question

Research Question: Did the virtual residency interview process increase the number of students who matched to programs affiliated with their medical school?

Hypothesis: We hypothesized that due to the virtual interview platform more categorical internal medicine residency applicants would match to programs affiliated with their medical school than in previous years with in person interviews. We also hypothesize this to be true across all subsections; academic vs community based and the south vs non-south region programs.

Introduction and Significance

Introduction

COVID-19 is a respiratory illness caused by a coronavirus that was first discovered in Wuhan, China in 2019. COVID-19 spread around the world rapidly and was declared a global pandemic on March 11, 2020. Since its discovery, there have been over 120 million cases globally of which almost 30 million cases have been in the United States ¹. The COVID-19 pandemic undoubtedly changed the way we live, including our social gatherings, work environments, and the methods by which we participate in day-to-day activities. Education, and especially US medical education, had to adjust rapidly following the onset of the pandemic in March 2020.

For the first time in the NRMP Match, 2020-2021 applicants ranked programs without having visited the institutions they would be spending the next several years of their lives training at due to only participating in a virtual interview process as a result of the COVID-19 pandemic. Moreover, there were a barrier to additional in person points of contact an applicant may have had with a program that would have historically been available through the application process. This included a reduced number of away rotations that took place for those students during their 3rd and 4th years of medical school in efforts to reduce the spread of COVID-19 and encourage social distancing as well as no ability to go to the hospitals on their own time if they choose to visit a potential city that they were interested in moving to for residency as the hospitals were closed to all outside visitors. This however quickly created a problem for applicants as they had very limited exposure to the aforementioned residency programs that they were applying to that particular cycle.

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

While residency programs invested significant time and effort into developing virtual interview days, there were undoubtedly components of the interview day that could not be adequately experienced virtually, such as direct interactions with staff or touring facilities². Several studies published since this interview cycle have examined both the applicant and program's perceptions on the virtual interview process³. Of note, the majority of applicants and programs agree that the virtual process reduces the overall cost of the interview^{4,5,6}, as well as cut down on time necessary to allocate to the interview due to no travel time and an overall shorter interview day.⁷ Both applicants and programs alike have expressed concerns about being able to adequately get to know an applicant or program from solely a virtual interaction.^{7,8} In the 2022 article by Simmons, they found that program directors prefer in person interactions to the virtual environment yet they acknowledge there are a lot of benefits to the virtual platform including the reduced cost and time investment for a given interview day⁹. In addition to the cost aspect of changing to a virtual interview process some have argued that having a virtual interview promotes greater diversity among elite programs as they are able to interview a wider number of applicants from a wider range of backgrounds.^{7,10} Cotner's 2022 survey which, although similar to our study, examined only allopathic applicants and found a small increase in applicants staying in the same state as their medical school compared to previous cycles.³

There has been limited research done surrounding the impact of virtual interviews in the field of plastic surgery^{11,12,13} that suggests that match rates were unchanged in the virtual environment in regards to matriculants leaving the state or region they attended medical school. Also limited research has been done examining if fellowship interviews should

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

continue to be conducted in a virtual platform which majority of research published suggests that the virtual interview platform is superior for fellowship interviews both reducing time away from patient care and having limited impact on applicant and program abilities to make decisions on rank list formation.¹⁴ However, there has been no additional research into specifically the field of internal medicine residency applications and the impact that the virtual interview process had on both allopathic and osteopathic applicants.

As the medical community has moved into the post-pandemic era, many specialties have kept the virtual interview process, internal medicine included, despite there not being a clear understanding on how that process may be impacting the Match. We examined both allopathic and osteopathic internal medicine applicants on if they were more likely to stay at a geographically similar program for residency when virtual interviews were utilized compared to previous years. Our hope is that this will provide additional data so that residency programs can make informed decisions on how virtual interviews may have and continue to impact their resident selection process.

Significance

The transition from medical student to resident is one that is often challenging, even in the best of circumstances. Ensuring that a residency program is the best fit for both the applicant and the program is vital to the success of the training of that individual. This made the question of how virtual interviews were going to impact the Match process even more important, as the effects may not be fully realized for 3 years once those that interviewed virtually complete their training. The cost and time saving measures of virtual

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

interviews are very apparent. If the virtual interview process hinders applicants and programs from being able to adequately explore and understand a program or student prior to the Match, then there could be unintentional negative impacts on applicants as they apply and subsequently Match at a more narrowed selection of programs around the country.

Editorials and papers have suggested that using the virtual interview process as a permanent change to the residency interview process would be helpful.¹⁰ However, there is little data analyzing the ways that virtual interviews impacted the Match of those applicants except for limited research done looking at plastic surgery residents, the fellowship match process and allopathic applicants in internal medicine.^{5,13,14,15} Examining the impact of the virtual applicant process on internal medicine applicants, both osteopathic and allopathic, will help to inform the residency application process for the future as well as help programs strategize about the best ways to engage with applicants now as we navigate the post pandemic era.

Research Materials and Methods

Materials

This project was conducted primarily through online data collection and therefore the only materials used with researcher's password-protected laptops and the TCU password-protected and encrypted cloud server for data sharing among researchers. All data collected was taken from publicly available websites.

Methods

Data was primarily collected using the American Medical Association FRIEDA database and the associated residency program websites. On the FRIEDA website, a filter to view accredited internal medicine categorical residency programs in the United States was applied before beginning program selection. All the AAMC southern region internal medicine categorical residency programs were included in the data collection in addition to 100 of the non-southern region internal medicine categorical residency programs. The total number of programs included was 192.

Southern Region Internal Medicine Program Selection

The AAMC defines the south region as programs in the following states or territories: Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Oklahoma, Puerto Rico, South Carolina, Tennessee, Texas, Virginia, and West Virginia. All programs from the above-listed states were attempted to be included in the data collection. Programs were excluded from the southern region category if they did not list their residents or their resident alma mater on their website, the website link on FRIEDA was

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

broken or did not go to the appropriate residency program website. Inside of specific programs, individual residents were excluded if they were preliminary residents or were in joint programs such as Medicine/Pediatrics, Medicine/ Psychiatry, etc. On occasion, residents attended medical schools with multiple campuses that were not noted on the residency website. When this happened, LinkedIn and other social media platforms were used to try to identify that resident's specific campus. If a campus could be determined, then that resident's campus was classified as the main medical school campus for that medical school. Data was obtained on residents from the matriculating classes of 2019, 2020, and 2021.

Non-Southern Region Program Selection Methods

A filter was added to the search on FRIEDA to exclude programs from the states listed above to exclude the southern region from the search parameters. Then a random number generator was used to select 100 random programs from the remaining programs on FRIEDA. The programs were numbers based on their default order on FRIEDA. Programs were excluded from non-southern region categories if they did not list their residents or their resident alma matter on their website. Programs were also excluded if their website link FRIEDA was broken or did not go to their residency program website. Inside of specific programs, individual residents were excluded if they were preliminary residents or were in joint programs such as Medicine/Pediatrics, Medicine/ Psychiatry, etc. On occasion, residents attended medical schools with multiple campuses that were not noted on the residency website. When this happened, LinkedIn and other social media platforms were used to try to identify that resident's specific campus. If a campus could be determined,

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

then that resident's campus was classified as the main medical school campus for that medical school. Data was obtained on residents from the matriculating classes of 2019, 2020, and 2021.

After all eligible programs were selected for inclusion in the study, individual alma mater data was extracted into an Excel spreadsheet collecting the following fields of information Resident Program, Residency program state, AAMC residency program region, Medical School State, Medical School AAMC region, Medical School, # of matriculants from that medical school at that residency program, and type of residency program as classified by FRIEDA (community, university based, or community/university based). Residents from residency classes 2021-2024 were included in the data collection. A total of 3142 resident data from 2019, 3245 resident data from 2020, and 3416 resident data from 2021 were collected.

Data Analysis

Data was analyzed using a repeated measure ANOVA. A total of 192 programs from each year (matriculating class of 2019, 2020, and 2021) were included which equaled 3142, 3245, and 3416 matriculants for each respective class. A P value of < 0.05 was used to designate significance. Data was analyzed by the following groupings, matriculants that stayed in the same state, matriculants that stayed in the same AAMC region, AAMC Southern region applicants that stayed in the same state, AAMC Southern vs Non-Southern region applicants that stayed in the same AAMC region. The power of this study comparing matriculants that stayed in the same state and those that stayed in the same AAMC region

SPT Thesis – Sarah Person

Research Mentor: Dr. Hilary Ryder

is 1.0 given the large sample size. However, the power of the study drops as the groups are further subdivided. This was considered as the data was being analyzed and may have been part of the reason that some of the data was not found to be statistically significant when comparing the smaller sub-groupings.

Results

A total of 192 programs were included in the study totaling 3142, 3245, and 3416 individual residents for 2019, 2020, and 2021 matriculating classes respectively. The table below summarizes the demographics of the data collected.

	2019	2020	2021
# of Programs	192	192	192
Region			
South	94	94	94
Non-South	98	98	98
Type			
University	57	57	57
Community	40	40	40
Combined	95	95	95
# of Matriculants	3142	3245	3416
Region			
South	1628	1681	1720
Non-South	1514	1564	1696
Type			
University	1564	1614	1680
Community	395	406	430
Combined	1183	1225	1306

Table 1: Summary of Internal Medicine Resident Data collected

The first set of data analysis looks at all residents from southern and non-southern residents who matriculated in 2019, 2020, and 2021. The figure below shows the proportion of matriculates that stayed in the same state for residency as their medical school when comparing 2019 and 202 matriculated to 2021 matriculants. The p-value comparing 2019 and 2020 matriculants to 2021 was 0.04.

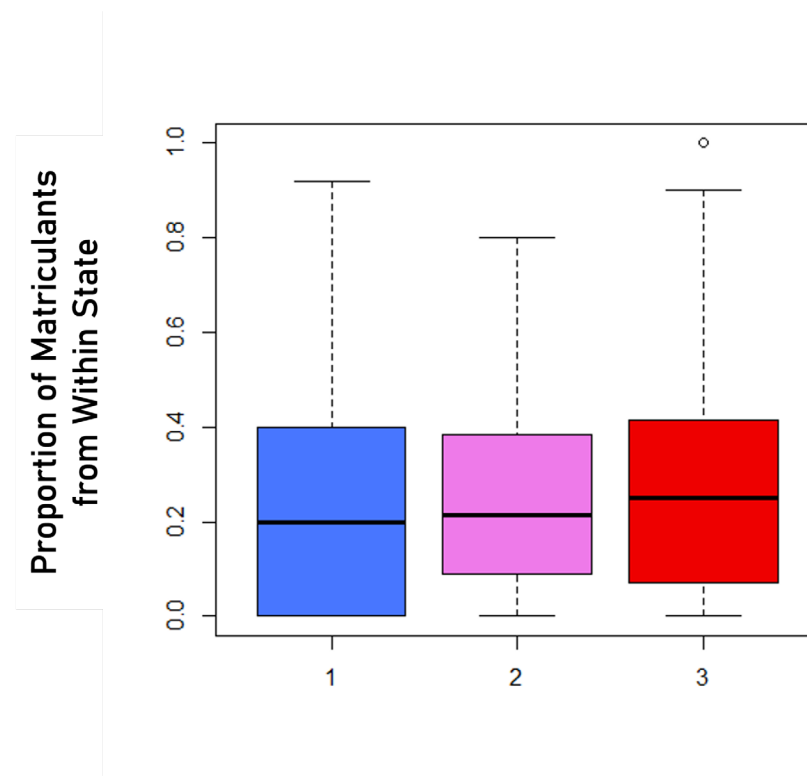


Figure 1: Proportion of matriculants from within the state; 2019 (1), 2020 (2), 2021 (3)

Figure 1 examined the proportion of matriculants that stayed within the same state as their medical school regardless of the AAMC region. The p-value comparing 2019 and 2020 to 2021 matriculants who underwent virtual interviews was 0.04.

Then, we analyzed the data by region looking to see if there was a difference in applicants leaving the same AAMC region as their medical school. The p-value for applicants leaving their AAMC region for 2021 matriculants with virtual interviews compared to 2019 or 2020 with in-person interviews was 0.02.

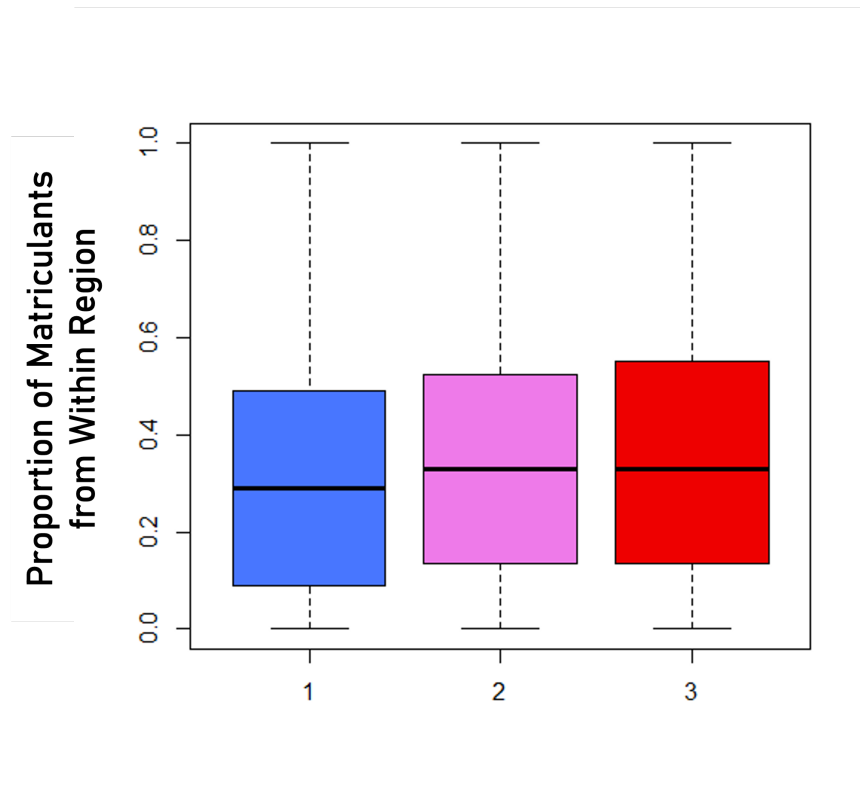


Figure 2: Proportion of matriculants from within a region; 2019 (1), 2020 (2), 2021 (3)

The next analysis breaks down the matriculants from each year by south versus non-south AAMC regions comparing within those subgroupings. Figure 3 looks at the number of matriculants that stayed within the same state for 2019, 2020, and 2021 matriculants respectively concerning being in a southern vs. non-southern region. The p-value of the southern region matriculants was 0.09 and the p-value for the non-southern matriculants was 0.34.

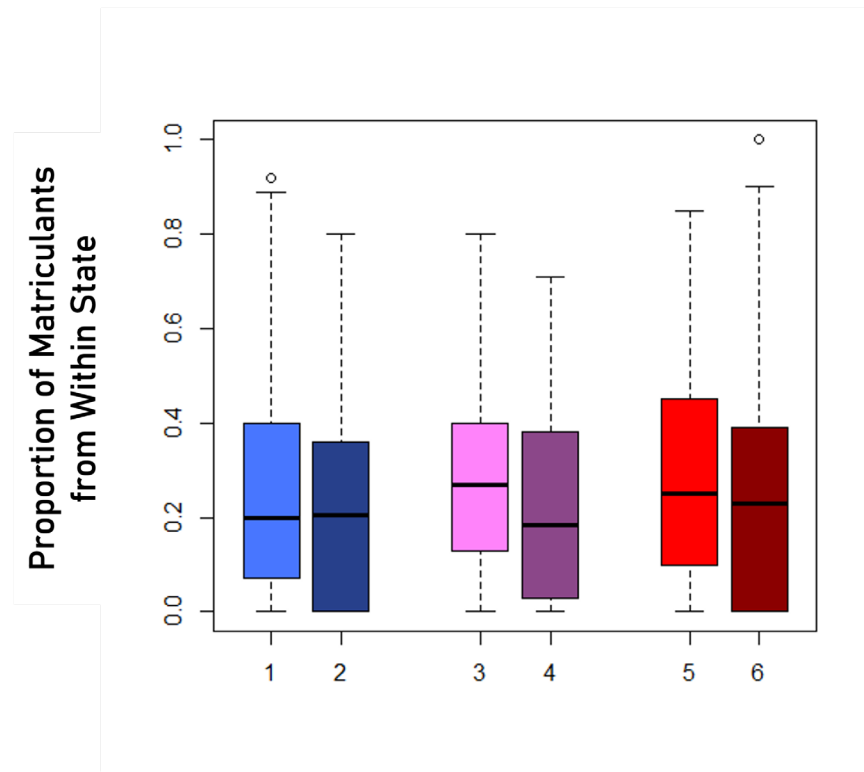


Figure 3: Matriculants stratified by AAMC region comparing those that stayed in state vs went out of state; Light = South, Dark = Non-south; 1,2 = 2019, 3,4 = 2020, 5,6 = 2021 matriculants

Figure 4 again examines the matriculants by being from the southern vs non southern region but this time looks at whether those matriculants left their region for residency in 2021 after virtual interviews compared to 2020 and 2019 matriculants who underwent traditional in-person interviews. The p-value of the southern region matriculants was 0.09 and the p-value for the non-southern programs was 0.23.

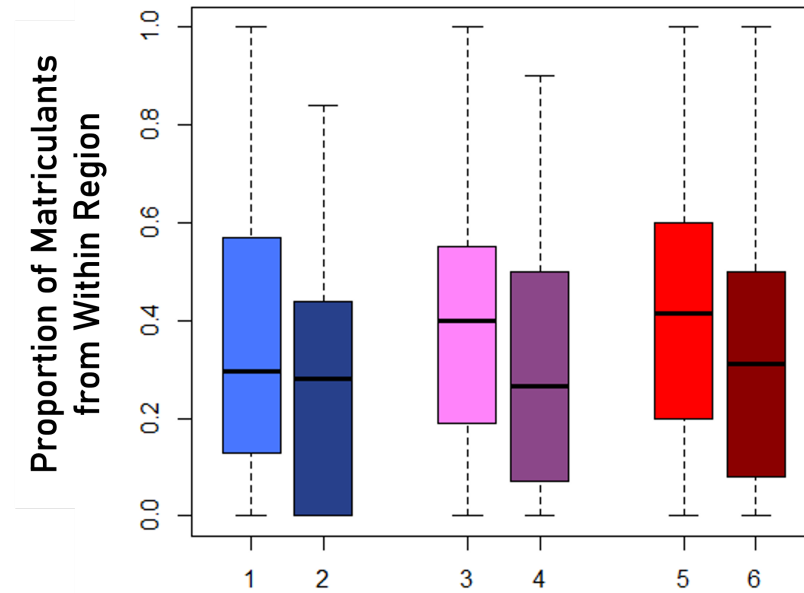


Figure 4: Matriculants stratified by AAMC region southern vs. non-southern regions comparing those that stayed within their same region to those that left their medical school's region; Light = southern, Dark = non-southern; 1,2 = 2019 matriculants, 3,4 = 2020 matriculants, 5,6 = 2021 matriculants

Lastly, we decided to examine the matriculants based on the type of resident program they choose to attend; university-based, community-based, or university/community-based as designated on the FRIEDA website. We looked at all matriculants across AAMC regions and compared the 2019 and 2020 in-person interviews to the 2021 virtual interview cohort. The p-value for the university-based matriculants who stayed in the same state was 0.45. The p-value for the community-based applicants who stayed in the same state was 0.53. The p-value for the university/community-based applicants that stayed in the same state was 0.06.

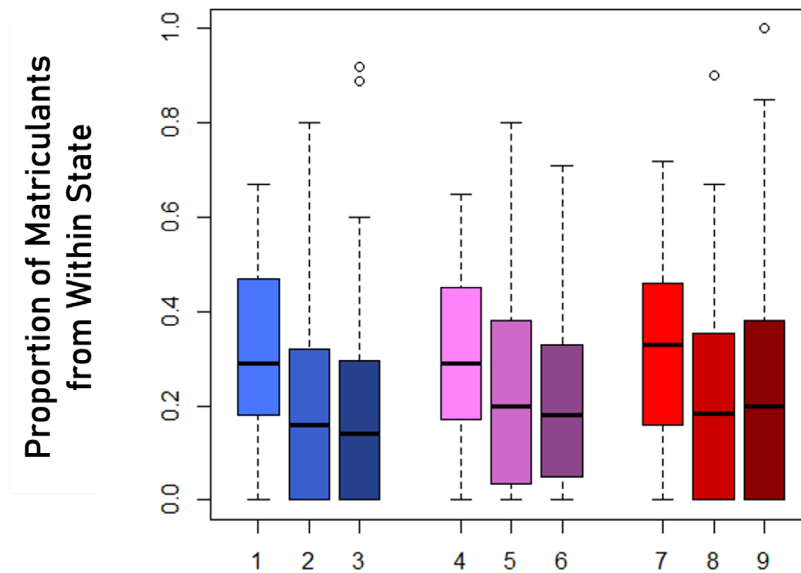


Figure 5: Matriculants Stratified by Program Type that Stayed Within the Same State: University (light) vs Community (medium) vs Community/University Affiliated (dark); 1,2,3 = 2019, 4,5,6 = 2020, 7,8,9 = 2021

Also when we examined the data based on program type, (university-based, community-based, or university/community based) we examined the number of applicants that stayed within their same AAMC region as their medical school as seen in figure 6. The p-value for university-based matriculants that stayed within their same region was 0.1. The p-value for community-based matriculants that stayed within their same region was 0.79. The p-value for university/community-based matriculants that stayed within their same region was 0.07.

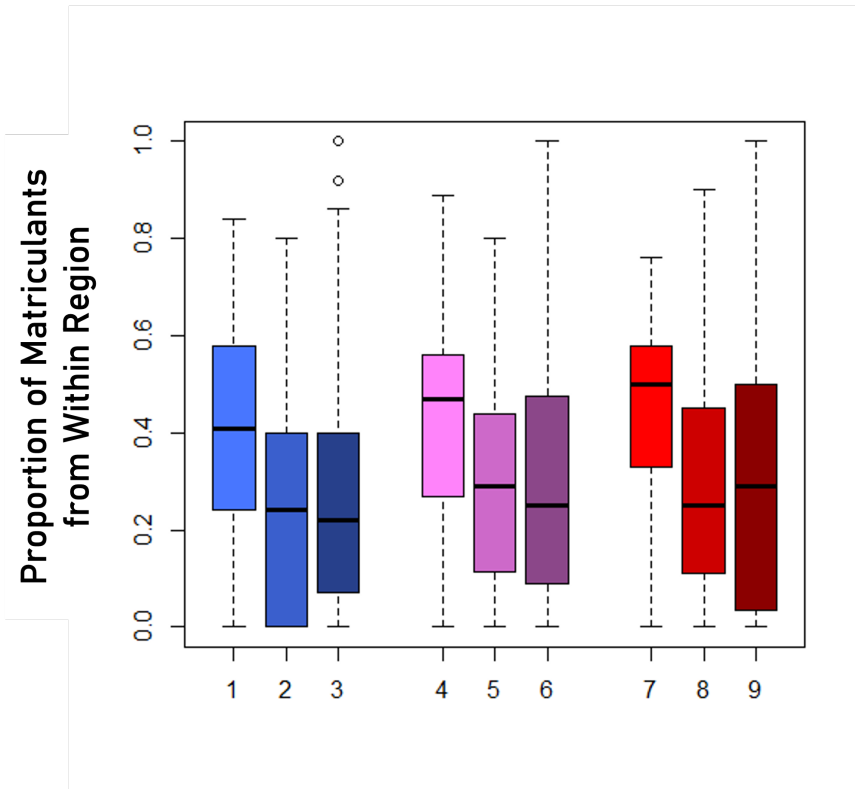


Figure 6: Stratified by Program Type that Stayed Within the Same AAMC Region: University (light) vs Community (medium) vs Community/University Affiliated (dark); 1,2,3 = 2019, 4,5,6 = 2020, 7,8,9 = 2021

Discussion

Based off our data analysis we are able to say that overall, there is a statistically significant ($p=0.02$ and $p = 0.04$) difference in the number of matriculants that stayed in their same state and region for 2021 matriculants that went through the 2020-2021 virtual interview cycle when compared to the 2019 and 2020 matriculants who participated in a traditional in-person interview model. This suggests that the virtual interview process may have hindered a medical student's ability of being able to adequately get to know and subsequently match at residency programs that were not in the same state or region as where they went to medical school. This confirms what was also found in the 2022 Cotner article that examined a smaller number of only allopathic applicants across specialties.³ However, the fact that there may have been a hindering of diversity of students matriculating to further away programs does not change the fact that many of the studies published regarding virtual interviewing highlight that there is significant time and financial burdens that are alleviated to applicants and programs by participating in a shorter virtual interview day. Domingo et al 2022 even suggests that the pros outweigh the cons, as the financial and time related hindrances that have traditionally been taken on by applicants may have had a deeper impact on applicant diversity, particularly for individuals from economically disadvantaged backgrounds that we may not have fully realized prior to the pandemic.⁷ We also feel that this study simply provides additional data to the impact that the COVID-19 pandemic had on the graduate medical education system while highlighting that no interview and recruitment process is perfect in its design. Overall, though, this study did allow for a more complete picture of the impact of the virtual

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

interviewing process on internal medicine residency geographical Match rates to be realized, than when compared to previously published research on this topic thus far.

However, looking at the match rates alone does not tell us if it was the applicants or the programs that played the larger role in matriculants staying in their same state and AAMC region for their internal medicine training. Placed into context of the surrounding literature, this makes an argument that virtual interviews, although may not need to go away entirely, should be supplemented by an in person option to increase applicant and program knowledge of each other throughout the process⁸. This would need to be done in a way that is equitable to both economically disadvantaged students and flexible around medical student's schedules so as to not interfere with medical student rotations which are required for degree completion⁷.

Also in the study, we found that there was no statistical difference (p value of 0.09 and 0.34) when matriculants were stratified by southern vs non-southern region as classified by the AAMC when looking at those that stayed in the same state or the same region as shown in figures 3 and 4. We feel that this statistics difference was not found to be significant most likely due to a type II error. As the groups were further stratified into the southern and non-southern subgroups, we lost statistical power based on sample size. However, in the southern regions we did see that there is a trend toward those matriculants staying in the same state and staying within the southern region. We believe repeating this study with a larger sample size would show a statistical difference in the southern region. The reason for why the southern region would have an increase in

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

matriculants staying within the same state as they went to medical school and staying within the southern region is not clear from our research and may be secondary to cultural differences seen within the southern region. Additionally, there are current migration trends outside of the medical field that show there is increased immigration to southern states and decreased emigration out of southern states¹⁶.

When the data was further subdivided into program type; community, academic, or community/academic based there was also not a statistically significant difference found between those sub-groups for applicants to leave the same state or AAMC region as where they went to medical school. This was also likely because as the groups were subdivided, we lost statistical power and may have caused a type II error. We believe that there may be a statistically significant difference found if this study was repeated with a larger sample size within each subgroup. We did find that although no statistically significant difference was found, there was a skew towards matriculants staying in their same state and same AAMC region in the setting of virtual interviews among the university-based programs. This skew may have been because the larger institutions that make up the university-based programs knew their students the best as well as those students feeling comfortable in that environment and subsequently not branching out to other university-based programs access the country. Also being a larger institution, they typically have a large residency class and so could keep more of their own geographical students compared to small university/community programs. Also, university-based programs have a home medical school by design that by design would have given students from that institution more rotations at their home program when away rotations were limited, possibly encouraging

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

the applicant to be more interested in that program based on repetitive exposure in their 4th year of medical school.

A weakness of this study however was that it gathered a larger sample size of the southern matriculants compared to the rest of the United States. This was primarily because it was too time consuming for us as a research team to be able to go through all the program matriculants from those three years in a timely manner. Since three of the four research team members were physically located in the southern US it made the most sense to focus the project on the southern AAMC region. Expanding the project in the future to include a more representative sampling of the entire US internal medicine residency programs would be beneficial for accessing the trends more holistically. This is particularly true when examining the further subclasses as earlier described.

Although this study had limitations, it did show a statistically significant difference that virtual interviews resulted in more students staying in the same state and AAMC region that they went to medical school in compared to the in-person interview cycles. There are many reasons why this may be and will require further investigation to fully understand the forces that guided this result. These results suggest that virtual interviews alone when not supplemented with away rotations or other in person opportunities may hinder a student's ability to move out of the state and region, they attend medical school among internal medicine applicants which should be kept in mind when moving forward with future application cycles.

Future Directions

Our team has two project interests that have developed following this study. Although this study showed that there were more internal medicine resident matriculants that stayed in the same state and region as their medical school in the setting of virtual interviews, it did not investigate if this was due to applicant preference, program preference or both. One way that we would like to further our research to investigate this is through a qualitative survey for applicants. This survey will be given to the matriculants who participated in a virtual interview cycle to assess if they felt that the virtual interviews impacted their decision-making and if they felt they needed to stay at a program closer to home due to the lack of exposure or knowledge about programs outside of their medical school's state or region. This will allow us to further our research and give a qualitative approach to understanding how the resulting impact came to be and give us insight to the matriculants application and subsequent ranking process for The Match.

Secondly now that we are in the 3rd residency application cycle that is utilizing virtual interviews, we believe it would be beneficial to look at the data again and see if these trends have held in the 2 additional virtual interview year. Given that students are now able to do away rotations at multiple institutions throughout their 4th year of medical school, as well as many programs have created a second look weekend that is an in-person opportunity for applicants to tour the hospital and get to know the team better in person.

A further study investigating the qualitative response of applicants and program directors would shed more light on why this trend was the case. This should also be studied to see if

SPT Thesis – Sarah Person

Research Mentor: Dr. Hilary Ryder

this same result can be replicated across specialties or if it is more prominently seen by economically disadvantaged students.

Conclusions

The major findings of this research highlighted that there is a statistically significant increase in the number of matriculants that stayed in the same state and region as their medical school following the change in interview format to virtual interviews. However, there was not a statistical difference found among the southern vs non-southern matriculants although there was a trend in the south that southern applicants were more likely to stay in the same state and region. This lack of a statistically significant increase shown among the southern matriculants is most likely due to a type II error. Lastly, there was a non-statistically significant increase in the university-based program matriculants who chose to stay within the same state and region as their medical school.

Overall, these findings were not particularly surprising based on the recent studies that have been coming out, particularly the Cotner 2022 paper that showed the same results.³ However, having this data at a larger scale than the Cotner paper allows for a larger argument that there is likely a need to have some in-person components to the application process to allow applicants to have broader options outside of their medical school's state and AAMC region. Additionally, we have expanded our project to now be looking at the matriculant's attitude toward the virtual interview process and seeking to understand if the applicants felt that their decision was impacted by only having the virtual platform available to them in their decision-making process. We hope that additional projects are done to examine the impact of virtual interviewing on The Match of other specialties as well as to reexamine the data following the 2022 and 2023 matriculants; many of them have in-person 2nd look weekend options available to them.

SPT Thesis – Sarah Person
Research Mentor: Dr. Hilary Ryder

This study provides a platform to inform the best next steps as we navigate the post-pandemic residency application process. Given that there was a statistically significant increase in the number of matriculants that did stay in their same state and region as their medical school we feel that more efforts need to be taken to ensure that applicants and programs have equal opportunities to engage in a meaningful way providing students with the greatest number of opportunities regardless of where they attended medical school. We hope that this study gave the medical education community more data to guide the next best steps forward in the era of virtual interviewing.

Compliance

This project was an exempt study from Human Subjects Research IRB due to only using data that was publicly available on websites. All data was kept on password-protected computers and care was taken to ensure that only the team working on the project had access to the collected data.

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