



Trends in Pulmonary Critical Care Fellowship Applications and Match Rates before and after the Onset of the COVID-19 Pandemic

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ABSTRACT

Background: Because of the coronavirus disease (COVID-19) pandemic, fellowship interviews for pulmonary disease and critical care medicine (PCCM) switched from an in-person to virtual interview format.

Objective: This study aimed to examine the changes that resulted from this switch (appointment year 2021 and beyond) for both the individual applicants and the match process as a whole.

Methods: This cross-sectional study used longitudinal data from the Electronic Residency Application Service and the National Resident Matching Program from appointment years 2017 to 2022. Data from the Electronic Residency Application Service included the number of programs applicants applied to, and National Resident Matching Program data included the number of fellowship positions available, number

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entering the match, match rate, and the number of applicants who matched within the same region/program as their core residency training program. Descriptive and summary statistics and unadjusted linear models were used to identify if trends appeared in post-COVID-19 appointment years (2021 and beyond).

Results: The number of PCCM positions increased by 33 (95% confidence interval, 26.2, 39.8) yearly between 2017 and 2022, with almost twice as many applicants (62.6; 95% CI confidence interval, 37.8, 87.4) entering the PCCM fellowship match during that same period. There was a decrease in the percentage of applicants matched each year, a trend unchanged before and after COVID-19, by an average of -2.15% . Comparing before and after COVID-19 appointment years, there was no significant change in same-region or same-program matches.

Conclusion: Our analysis shows steadily rising interest in application rates for PCCM fellowships through the onset of the pandemic. However, a lack of proportionate increase in fellowship positions led to a decrease in overall match rates for applicants. To mitigate this, an increase in PCCM fellowship positions should be considered, and surveillance of these trends should continue.

Keywords:

virtual interview; recruitment; pulmonary disease and critical care medicine fellowship; demographic trends

The coronavirus disease (COVID-19) pandemic brought swift changes to many aspects of life, including the medical trainee recruitment process. Fellowship programs in pulmonary disease and critical care medicine (PCCM) adopted the use of virtual interviews (VIs) because of travel and safety recommendations resulting from the COVID-19 pandemic. The VI format was initially recommended by the Association of American Medical Colleges and the Alliance for Academic Internal Medicine for the 2020 recruitment season, and the Alliance for Academic Internal Medicine renewed this recommendation for the 2021 season as well (1, 2). Studies have investigated applicants' and fellowship programs' attitudes toward the VI experience, noting the importance of the interview process and the impact it has on an applicant's impression of programs and consequently how they rank programs (3–5).

However, questions have remained regarding whether the transition to a VI format has changed more than just attitudes. So far, analyses of data focusing on the behavior of applicants when it comes to their application strategy or differences in outcomes of the match process have been lacking. A recent analysis demonstrated a significant increase compared with previous years in the number of overall fellowships that internal medicine residents applied to when interviews were switched to a VI format (6). However, our research team believed that a full accounting of the fellowship placement process from application to interviewing to matching was necessary to identify consistent changes.

Lacking outcome data, much has been written on the purported effects of the pandemic and VI format. On the basis of

findings in the existing literature, benefits of the VI format include the lack of travel necessary for applicants, resulting in cost savings and reduced burden on residency programs to provide clinical coverage. However, this format results in lack of in-person interactions between applicants and prospective faculty and cofellows. This led to hypotheses that applicants would be applying to more programs as the interview process became more cost effective and that applicants and programs would prefer local or internal applicants they had met in-person over those with only virtual interactions. These changes could have implications for the fellowship recruitment process.

In addition, there was concern that the unique stress put on critical care medicine practitioners in the face of the COVID-19 pandemic (7, 8) may have influenced trainees' interest in pulmonary disease and/or critical care medicine. This could have implications on already understaffed intensive care units (ICUs) and the national intensivist shortage (9, 10).

This study was conducted to examine the influence of COVID-19 and VI on the pulmonary fellowship applicant pool using longitudinal data from the Electronic Residency Application Service (ERAS) and the National Resident Matching Program (NRMP) from years before and after the onset of the pandemic and introduction of the VI format. The null hypothesis would follow that no significant change in match outcomes or applications would be seen when comparing pre- and post-COVID-19 applicant pools. Our research team believed that, overall, there would be no significant decrease in interest (as evidenced by a decrease in applications) in PCCM fellowship and that the number of same-region and same-program matches would remain stable.

METHODS

Data Sources and Variables of Interest

All analysis for this study was limited to PCCM fellowships, using two key data sources: ERAS and NRMP. The ERAS data included a combination of a deidentified, per-applicant database for appointment years 2017–2020 obtained through a data request from our research team and publicly available statistics released by ERAS on the Association of American Medical Colleges website. Variables included total number of applications to PCCM fellowship through ERAS, applicant demographic information (age, sex, race, and ethnicity), and medical schools (U.S. allopathic program, U.S. osteopathic program, international medical graduate).

The data from the NRMP captured the geographic region of applicants by year level and provided key data on the outcome of the PCCM fellowship match process. This included the number of positions available, the number of applicants, the number entering the match, the number matched, the number matched within the same region of their core residency training program (“same region”) and the number matched within the same institution as their core residency training program (“same program”). These data were stratified by four geographical regions (Northeast, Midwest, South, and West). More granular data requested included applicant-level results and same-city and same-state matches. However, this was not permitted because of privacy concerns. Importantly, the NRMP data only captured the final rank list of applicants, and thus those data do not include programs that applicants may have applied to but chose not to rank. The data captured spanned appointment years 2017 through 2022. Data accuracy

and integrity were confirmed by both ERAS and NRMP, which independently reviewed this article and its findings.

Statistical Analyses

The descriptive statistics included calculating the total number of fellowship positions, total number of applicants, and applicants per position both nationally and regionally from joining the ERAS and NRMP data from 2017 through 2022. First, to examine if there were meaningful changes in the number of positions, number of applicants, and the percentage matched (NRMP data), three unadjusted linear models were built, which yielded an estimate and 95% confidence interval (CI) of the change in these three outcomes. To examine changes in demographic factors over time, given the interest in examining both the trend and the potential impact of VIs, comparison of key baseline factors over time was conducted, and linear regression and logistic regression were used to build models to identify associations between key covariates and the number of programs an applicant applied to (linear regression), as well as the number entering a program (logistic regression). The number of programs was modeled as the square root because of the nonnormality of its distribution. For all analyses, an α -value of 0.05 and percentage estimates with 95% CIs were used. Data cleaning and analysis were done in R (R Foundation for Statistical Computing).

Standard Approval

This study was approved as exempt by the University Hospitals Institutional Review Board.

RESULTS

Overall, there were 7,382 applicants to PCCM fellowship programs from appointment years 2017 through 2022

(Table 1). Notably, the number of positions increased by approximately 33.0 (95% CI, 26.2, 39.8) every year, whereas the number of applicants entering the match increased by 62.6 (95% CI, 37.8, 87.4). This resulted in a corresponding decrease in the percentage of applicants matched each appointment year from 70.6% in 2017 to 60.7% in 2022 (Figure 1). The number of ERAS applicants, the number entering the NRMP match, and the number of positions for appointment years 2021 and 2022 outpaced the rate of increase seen in the 4 years preceding the onset of the COVID-19 pandemic.

The rate of same-region and same-program matches averaged 62.0% and 27.2%, respectively, during the study period (Figure 2). There were no significant changes seen in these percentages, despite the COVID-19 pandemic and the introduction of VIs starting for the recruitment season for appointment year 2021, even though there was an overall decrease in the match rate. Although there were slight differences in absolute percentages of these rates between regions, these differences were stable between before and after COVID-19 appointment years.

DISCUSSION

The onset of the COVID-19 pandemic and the VI format do not appear to have led to major changes in applicant behavior or placement through the match for PCCM fellowships. The number of trainees submitting applications through ERAS and entering the match steadily increased during the 6 years studied, and the placement through the match did not lead to an increase in the number of applicants staying at their home institution or their program's geographical area.

Concerns have been raised that the stresses for intensivists caused by the

Table 1. Program, application, and match data by appointment year

	2017	2018	2019	2020	2021	2022
Number of programs	144	151	166	174	179	205
Number of positions	530	568	601	629	657	721
Number of applications submitted to ERAS	990	1,090	1,173	1,295	1,387	1,447
Number of applicants entering the NRMP match	742	789	848	931	1,023	1,182
Number (%) matched	524 (70.6)	565 (71.6)	595 (70.2)	627 (67.3)	655 (64)	718 (60.7)
Number (%) matched in same region as core training program	325 (62.0)	353 (62.5)	365 (61.3)	394 (62.8)	412 (62.9)	433 (60.3)
Number (%) matched in same program as core training program	138 (26.3)	143 (25.3)	168 (28.2)	170 (27.1)	189 (28.9)	195 (27.2)

Definition of abbreviations: ERAS = Electronic Residency Application Service; NRMP = National Resident Matching Program.

COVID-19 pandemic (7, 8) might sway the interests of medical residents away from PCCM fellowship training. However, data presented here do not support this hypothesis. The continued increase in applications to PCCM fellowships may suggest that trainees were not dismayed by the added burden caused by the pandemic. One possibility to explain this finding could be an increased exposure to PCCM as a result of the pandemic.

Although previous analyses have focused mainly on the negative impact on trainee education because of the pandemic, they do show that there were some trainees who believed that they had received better critical care training after the onset of the pandemic than before (9). In addition, pulmonary and critical care medicine offers an exposure to a wide array of diseases, and the shift-based work of the ICU allows predictable work schedules, both

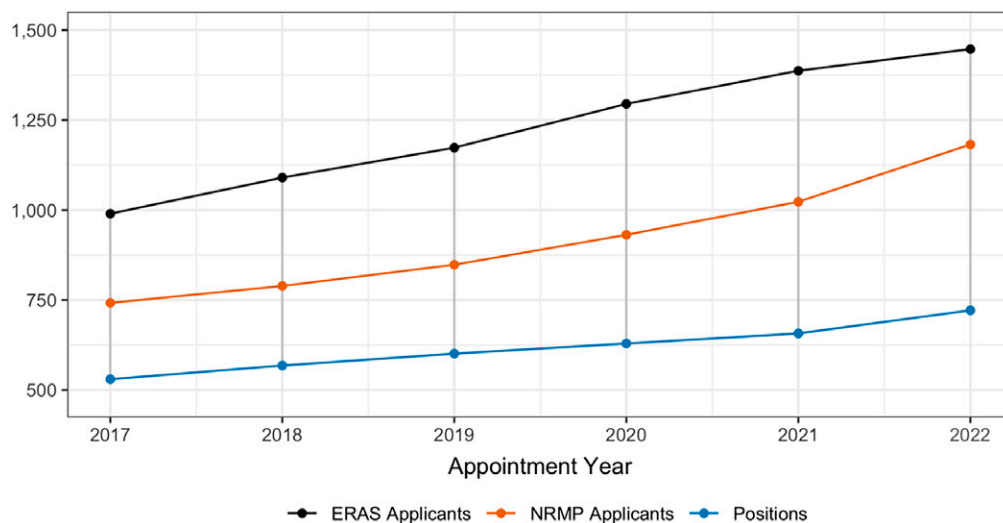


Figure 1. Differences in the number of applicants and positions by appointment year.

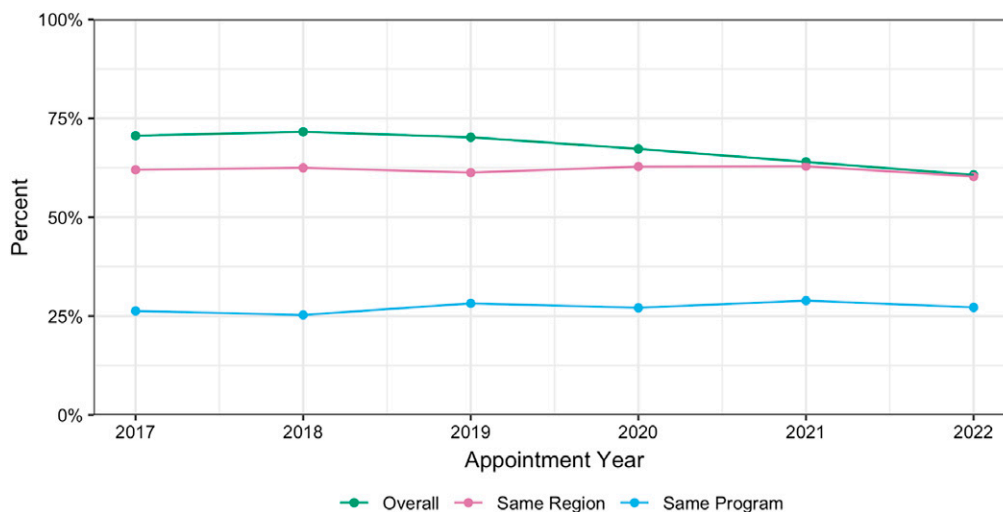


Figure 2. Overall, same-region, and same-program match rates by appointment year.

of which have previously been identified by trainees as important factors in subspecialty selection (10). This is welcome news in the face of a national intensivist shortage, leading to chronically understaffed ICUs, a problem exacerbated by the pandemic (11, 12). With increased applications to PCCM fellowship programs, medical trainees appear to have enthusiastically stepped in to fill these gaps.

Unfortunately, the increase in PCCM fellowship applications was not matched with increased fellowship positions. In fact, the rate at which new fellowship positions were created was nearly half that of the increase in applications. This resulted in a larger proportion of trainees applying to PCCM fellowships who are not being matched to a position, a trend predating the onset of the pandemic (13). The discrepancy between the higher number of applicants who applied through ERAS and those who actually entered the NRMP match may be due to applicants dual applying to other subspecialties or choosing not to participate in the match (because of lack of interviews or other reasons). Whatever the underlying cause of this disparity, the increasing demand

and decreasing supply of PCCM fellowship positions must be addressed to avoid additional stressors on the critical care medicine system.

Our study has some limitations. It used two different datasets from two different organizations that were unable to be matched at the individual level. The lack of granularity limits the statistical analyses and conclusions that can be drawn. In addition, the NRMP data did not include all the programs that applicants interviewed for; it included only those that they ranked to match. This makes it difficult to assess with high certainty why certain individuals did not successfully match. In addition, these data looked only at PCCM fellowship programs and did not include critical care medicine-only fellowships, which limits its generalizability. Moreover, the data presented here only include 2 years of data from ERAS NRMP after the onset of the COVID-19 pandemic and VIs, which limits the conclusions that can be drawn. The nature of the time required to collect and deidentify the confidential datasets used by ERAS and NRMP led to a delay in analysis. To assess long-term changes in trends, ongoing data collection and analysis will be required.

Despite these limitations, we believe our analysis shows steady interest in PCCM and stable trends in many aspects of the fellowship recruitment process that could be expected to have changed in response to the pandemic and its effects on the practice of PCCM and the interview process. Individuals involved in training the next generation of pulmonologists and intensivists should be heartened by the stability of the training system, but vigilance is necessary to address the supply and demand mismatch of fellowship positions and to ensure that, over time, the VI format does not significantly change the placement of trainees. In addition, future analyses should address diversity, equity, and inclusion in the recruitment process and ensure that no demographic groups are disproportionately affected (14, 15).

CONCLUSION

The onset of the COVID-19 pandemic does not appear to have significantly affected preexisting trends in PCCM applicants' behavior or placement through the match. There has been a steady increase in the number of applicants interested in PCCM fellowship, predating the appearance of COVID-19 and even continuing despite the pandemic. However, the rate at which new fellowship positions were created was nearly half that of the increase in applications. This has led to a decrease in overall match rates for applicants to PCCM fellowships, despite a growing intensivist shortage. Professional societies and graduate medical education programs should work to address this gap.

Author disclosures are available with the text of this article at www.atsjournals.org.

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