Original Investigation

Resident Perspective of the Virtual Diagnostic Radiology Residency Interview Process: A National Survey From the Association of Program Directors in Radiology

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Rationale and Objectives: The purpose of this study was to assess differences in first-year radiology resident perception of the match process and early satisfaction with residency programs between those who matched in 2020 versus 2021, the first virtual application cycle after the start of the COVID-19 pandemic.

Materials and Methods: A 33-question survey was distributed to first-year diagnostic radiology residents at programs throughout the United States through the Association of Program Directors in Radiology. Responses were collected in June of 2022 from residents who matched in 2020 and in July of 2022 from residents who matched in 2021. Questions were designed to assess applicant demographics, outcomes and attitudes towards the interview process. Comparison was made between the two cohorts.

Results: Of the 2231 matched residents in the 2020 and 2021 match years, 108 residents (4.8%) received, responded, and met inclusion criteria for the survey. Forty-three of 46 (92.5%) respondents that matched in 2020 interviewed in-person compared to one of 60 (1.7%) that matched in 2021 ($p < 0.0001$). There was no difference in satisfaction of match results, current training programs, work culture, satisfaction with facilities, and depiction of residency structure. Applicants from the 2021 cohort were more likely to express concerns about interview hoarding, having enough time to ask questions on interview days, and ability to accurately present themselves in interviews but were more likely to favor virtual interviews for future cycles.

Conclusion: The virtual interview process is perceived neutrally or positively by most early diagnostic radiology residents and produced similar satisfactory results compared to applicants that interviewed in person. Attention should be given to concerns of those who matched virtually if the virtual interview process is to be continued.

Key Words: Residency; Education; Match; Virtual.

INTRODUCTION

Constraints imposed by the COVID-19 pandemic resulted in an abrupt pivot to virtual site visits and interviews for the 2020-2021 radiology residency application cycle following recommendations from the Coalition for Physician Accountability (1). Residency programs and applicants alike were challenged to navigate a novel virtual landscape and put their best foot forward to achieve mutually beneficial matches. How this transition to virtual interviews has affected medical student applicants and radiology residents is uncertain.

Since the implementation of virtual recruitment, applicants have faced uncertainties in their ability to portray themselves in interviews, assess the setting and culture of a program, and ultimately choose a best fit. Elimination of in-person visits and interviews similarly challenged residency programs to adapt and find creative ways to brand themselves, structure interview days, and evaluate candidates (2–5). Programs responded with creative solutions such as establishing more comprehensive

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digital content (6,7), virtual open houses (8,9), in-person second look visits after program rank list submission (10), and digital social events around interview days (11).

As residency programs prepare to enter their third season of virtual interviews, the future of recruitment remains a subject of debate among both program directors and applicants (12,13). With many perceived pros and cons to returning to in-person interviews, little data exists describing the effects of virtual recruitment on the candidates' application experience and ultimate satisfaction with their matched training programs.

Applicants from the first cohort of virtual recruitment are now in their first year of radiology residency at their matched program. The purpose of this study was to assess if there are differences in first-year radiology resident perception of the match process and early satisfaction with their residency programs between those interviewed in-person during the 2019-2020 interview cycle (matched in 2020) and those that interviewed virtually during 2020-2021 (matched in 2021).

MATERIALS AND METHODS

A survey of 33 questions was created through the web-based platform Qualtrics (Qualtrics, Provo, Utah). Respondents were asked about topics including demographic information, perceptions of the application process, and satisfaction with various aspects of the program at which they matched. Question formats included multiple choice, Likert scales, and open response. No identifiable information was collected and no compensation was provided.

The survey was distributed by email to 997 members of the Association of Program Directors in Radiology. The email requested that members forward the survey to first-year diagnostic radiology residents (post-graduate year 2). Survey responses were collected between June 21st 2022 and July 31st 2022. The study was designed to survey residents in diagnostic radiology (DR) programs. Respondents enrolled in combined diagnostic-interventional radiology (DR/IR) programs or match years other than 2020 and 2021 were excluded.

Statistical analysis was performed within the Qualtrics platform with chi-squared, t-test, and Fisher exact test comparisons. Statistical significance was defined as a p-value of less than 0.05.

Approval was sought from the Institutional Review Board of the sponsoring institution and an exemption was granted.

RESULTS

Demographics

A total of 152 survey responses were received (Fig 1). Exclusion of 28 responses from residents in match years other than 2020 and 2021 and 16 responses from residents enrolled in DR/IR programs left a total of 108 responses as the study sample. Forty-six (43%) matched in 2020 and 62 (57%) matched in 2021. Of these respondents, 99 (91.7%) completed the entire survey. Given the total of 1111 DR program matches from the 2020 match year and 1120 from the 2021 match year reported by the National Residency Matching Program (14,15), the study sample of 108 represents 4.8% of the 2231 total matches from these years (4.1% of 2020 matches and 5.5% of 2021 matches), a relatively small fraction. A margin of error of 9.2% was calculated for our study population based on a 95% confidence interval.

Full demographic information is presented in Table 1. Between the 2020 and 2021 cohorts, there was no significant difference in age, sex, race, or ethnicity. A similar percentage of applicants from each match year matched into a residency program in the same state as their medical school and hometown (defined as where applicants reported having grown up). Respondents comprised of residents enrolled in programs from 30 states, 17 in 2020, and 26 in 2021, with 13 states shared between the cohorts.

Application Process

In both the 2020 and 2021 match year cohorts, most candidates applied to more than 40 programs (61% in 2020 and 67% in 2021) and most interviewed at 11-20 programs (75% in 2020 and 66% in 2021) (Table 2). Most applicants from the 2020 cohort interviewed in-person at their matched residency program (43/46, 94%) compared to most from the 2021 cohort who interviewed remotely (59/60, 98%, $p < 0.001$) (Table 2).

Applicants from the 2021 cohort were more concerned with interview hoarding compared to the 2020 cohort (Likert average and standard deviation of 2.7 out of 5 $\pm$ 1.3 in 2020 and 3.8 out of 5 $\pm$ 1.2 in 2021, $p < 0.0001$) (Fig 2). The survey defined interview hoarding as applicants accepting many interviews, even at programs where they do not have an active interest, with sufficient number of interviews already booked at programs where they have more interest, and potentially preventing other interested applicants from accepting those interview spots.

Most applicants from the 2021 cohort reported interviewing at more or many more programs than they had planned or been counseled (55% in 2021 vs 39% in 2020), however this was not significantly different than the 2020 cohort (Likert average and standard deviation of 3.3 out of 5 $\pm$ 0.8 in 2020 and 3.6 out of 5$\pm$ 1.0 in 2021, $p = 0.11$) (Fig 2).

Interview Experience

Respondents from both the 2020 and 2021 cohorts reported being satisfied with their ability to accurately present themselves on interviews, however the Likert average was greater in the 2020 cohort compared to the 2021 cohort (Likert average and standard deviation of 4.4 out of 5 $\pm$ 0.6 in 2020 and 3.9 out of 5 $\pm$ 1.0 in 2021, $p < 0.002$) (Fig 2).

A similar number of respondents from each cohort reported attending social events (either in-person or virtual)

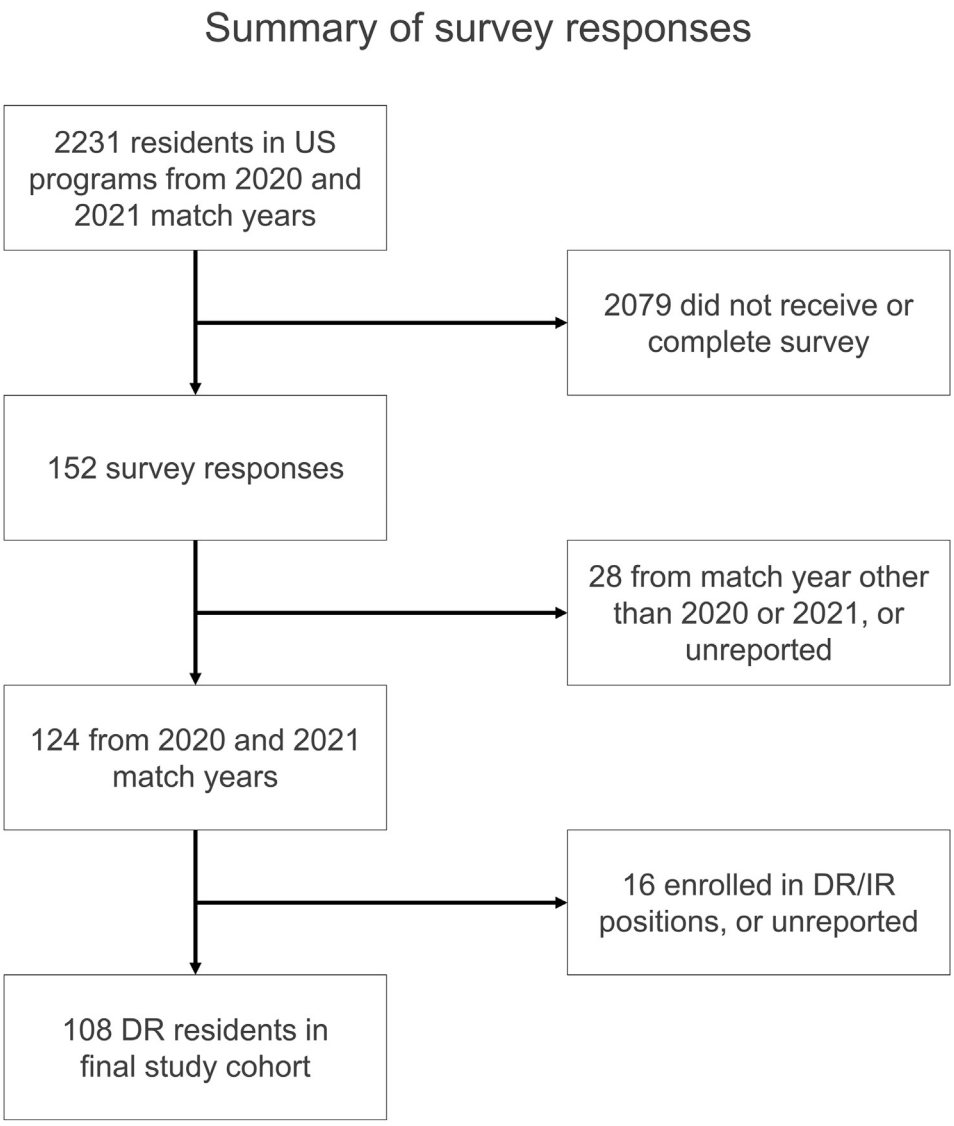

Figure 1. A total of 108 responses from residents in diagnostic radiology (DR) programs were included after exclusion of 44 responses based on study criteria. Responses from residents in integrated diagnostic-interventional radiology (DR/IR) programs were excluded. Residency location data was not reported by all respondents; location analysis was limited to respondents who reported location data.

around the time of interview at their matched program ($p = 0.44$) and receiving gifts such as meals, gift cards, or souvenirs from their matched program ($p = 0.55$) (Table 2). Most respondents from each cohort were probably or definitely satisfied with how much time they had to ask questions of the current residents on interview days or at social events (95% in 2020 and 78% in 2021), however applicants from the 2020 cohort were generally more satisfied than those from the 2021 cohort (Likert average and standard deviation of 4.5 out of 5 ± 0.6 in 2020 and 4.1 out of 5 ± 1.1 in 2021, $p < 0.002$, $p = 0.02$) (Fig 2).

Satisfaction with Matched Program

Applicants from the 2020 and 2021 cohorts reported a similar degree of satisfaction with their match result, with most respondents from each probably or definitely satisfied with their match result (83% in 2020 vs 91% in 2021, Likert average and standard deviation of 4.4 out of 5 ± 1.0 in 2020 and 4.5 out of 5 ± 1.0 in 2021, $p = 0.54$) (Fig 2). The applicants' matched program was on average at position 3.6 on their rank list for the 2020 cohort compared to 3.1 for the 2021 cohort (p=0.21) (Table 2). Most applicants from each cohort were also satisfied with their matched geographic location (80% in 2020 vs 83% in 2021, Likert average and standard deviation of 4.1 out of 5 ± 1.2 in 2020 and 4.4 out of 5 ± 1.1 in 2021, $p = 0.28$) (Fig 2).

Early Residency Experience

Respondents from each cohort were similarly satisfied with their radiology residency training program (Likert average

TABLE 1. Demographics

	2020 Match year	2021 Match year	
Number of respondents	46 (42.6%)	62 (57.4%)	
Mean age at application (median)	27.6 (27)	27.9 (28)	$p = 0.17$
Sex			
Male	28 (65.1%)	39 (66.1%)	$p = 0.29$
Female	15 (34.9%)	17 (28.8%)	
Prefer not to say	0 (0%)	3 (5.1%)	
Race			
White	26 (56.5%)	40 (64.5%)	$p = 0.39$
Asian	12 (26.1%)	9 (14.5%)	
Black or African American	1 (2.2%)	2 (3.2%)	
American Indian or Alaskan Native	1 (2.2%)	1 (1.6%)	
Native Hawaiian or other Pacific Islander	0 (0%)	0 (0%)	
Other	1 (2.2%)	3 (4.8%)	
Decline to answer	1 (2.2%)	7 (11.3%)	
Ethnicity			
Not Hispanic or Latino or Spanish Origin	36 (78.3%)	47 (75.8%)	$p = 0.22$
Hispanic or Latino or Spanish Origin	2 (4.3%)	3 (4.8%)	
Other	5 (10.9%)	3 (4.8%)	
Decline to answer	1 (2.2%)	7 (11.3%)	
Residency location			
Enrolled in residency in same state as medical school	13/34 (38%)	21/55 (38%)	$p = 0.99$
Enrolled in residency in same state as self-report hometown	10/33 (30%)	19/56 (34%)	$p = 0.72$

and standard deviation of 4.4 out of 5 ± 0.8 in 2020 and 4.5 out of 5 ± 0.8 in 2021, $p = 0.49$) (Fig 2). Most respondents from each group felt that the work culture, facilities, and residency structure of their program were probably or definitely accurately conveyed during the interview (Fig 2).

Impression of Future Application Cycles

There were differing opinions on whether future radiology residency interview cycles should be in-person or remote between those who matched in 2020 verses 2021. Most applicants (63%) from the 2020 cohort favored in-person interviews, while most from the 2021 cohort (76%) were neutral or favored virtual interviews for future cycles (Likert average and standard deviation of 2.4 out of 5 ± 0.3 in 2020 and 3.2 out of 5 ± 0.3 in 2021, $p < 0.001$) (Fig 2).

DISCUSSION

The findings support a virtual platform as a viable alternative to in-person recruitment for diagnostic radiology residencies from a first-year diagnostic radiology resident perspective as illustrated by residents from the 2020 and 2021 match years reporting a similar high degree of satisfaction in their match results and current training programs. Opinions differ among the cohorts on the validity of keeping a virtual recruitment format. Those who interviewed virtually and matched in 2021 were more likely to support the continuation of virtual interviews, while most who matched in 2020 favored returning to in-person interviews. The causal factors underlying this discrepancy are not entirely clear. Perhaps many of the perceived disadvantages of virtual recruitment were not decisive factors for those who went through the 2021 match cycle.

Although most were neutral or slightly favored virtual interviews, residents from the 2021 cohort did express concerns about virtual interviews; residents from this group were more concerned about interview hoarding, their ability to accurately portray themselves in virtual interviews, and the amount of time allotted to ask questions of current residents. Most also interviewed at more programs than they had planned or been counseled. Over-application and interview hoarding have been cited as potential obstacles for applicants resulting from the logistical ease of accepting and completing virtual interviews (12,16). Data from the Electronic Residency Application Service (ERAS) have shown a rise in the number of DR residency applicants nationally (2575 in 2021 vs 2311 in 2018) and number of applications per applicant (47.2 in 2021 vs 44.0 in 2018) (17). Program signaling and geographic preferences, implemented in previous otolaryngology, internal medicine, dermatology, and surgery matches, are being piloted in radiology for the 2022-2023 application cycle, partially in response to concerns of excessive interviewing echoed by residents in our survey (18,19). Applicants will be able to select up to six programs to communicate a signal of particular interest and select geographic regions of preference through a supplemental application, changes intended to limit applications and interviews to those of particular interest (20). How these changes affect the behaviors and attitudes of applicants in the radiology match remains to be seen.

TABLE 2. Application Process

	2020 Match year	2021 Match year	
To about how many diagnostic radiology programs did you apply?			
0-20	1 (2.3%)	6 (9.8%)	
21-30	8 (18.2%)	2 (3.3%)	
31-40	8 (18.2%)	12 (19.7%)	
>40	27 (61.4%)	41 (67.2%)	
At about how many diagnostic radiology programs did you complete an interview?			
0-5	2 (4.5%)	5 (8.2%)	
6-10	6 (13.6%)	7 (11.5%)	
11-15	21 (47.7%)	17 (27.9%)	
16-20	12 (27.3%)	23 (37.7%)	
21-25	3 (6.8%)	7 (11.5%)	
26-30	0%	1 (1.6%)	
>30	0%	1 (1.6%)	
How did you interview for diagnostic radiology residency at your matched program?			
In person	43 (93.5%)	1 (1.7%)	$p < 0.00001$
Virtually	3 (6.5%)	59 (98.3%)	
Did your matched program give you a gift during the recruitment process (free souvenirs, meals, gifts, gift cards, etc.)?			
Yes	12 (27.3%)	22 (36.7%)	$p = 0.55$
No	31 (70.5%)	36 (60%)	
Prefer not to say	1 (2.3%)	2 (3.3%)	
Did you attend a recruitment social event (i.e. happy hour, dinner, open house, etc. whether virtual or in-person) before, during or after your interview at your matched program?			
Yes	31 (70.5%)	43 (71.7%)	$p = 0.44$
No	13 (29.5%)	15 (25%)	
Prefer not to say	0 (0%)	2 (3.3%)	
What was the position matched on your rank list?			
Mean position (median)	3.64 (2)	3.13 (1)	$p = 0.21$

A purported benefit of in-person interviews is granting applicants a real-life sense for the facilities, culture, and geographic backdrop of a program, an intangible factor which may be lost in a virtual context (5). Perspectives shared through our survey suggest that virtual platforms or applicant knowledge gained outside of the formal recruitment process may adequately convey these aspects of a training program or geographic location. This may relate to the efforts made by residency programs to build their online presence and host virtual events for prospective applicants and interviewees. Applicants from the 2021 match year were no more or less likely to enroll in residency in the same state as their medical school or hometown, suggesting that virtual recruitment did not strongly influence the geographic preference for our respondents.

The data and opinions in our survey capture only a subset of the many factors in the debate of whether to continue virtual interviews. Cost of application, carbon footprint, health safety concerns, and equitable access for applicants represent additional variables which will fuel the debate in the coming years (21-23). A survey of radiology residency applicants from the 2021 match year found the average cost of application including ERAS fees and technology expenditures to be $2820 (12), far less than the average cost of $4555 for radiology applicants reported in the most recent available data for in-person interviews in the 2015 AAMC Cost of Applying to Residency Questionnaire Report (24).

Our study provides a cross-section of the attitudes of trainees at a specific juncture in the early stages of diagnostic radiology residency. Residents from the inaugural post-COVID-19 match year in 2021 have only just begun their diagnostic radiology training years; respondents from this cohort were in their first month of radiology training at the time of the survey. As these residents progress through the first year of radiology training, perspectives on their training programs and the application process may evolve. Follow-up studies of residents who matched in 2021 and beyond would be helpful to assess their long-term satisfaction with the application process, training at their matched program, fellowship placements and future employment opportunities.

Several factors in the design of our study limit generalizability and comparison between cohorts of applicants. Inherent to our survey methodology are limitations including sample size, selection bias and recall bias, especially given that the survey was distributed over a year after the 2021 match day and 2 years after the 2020 match day. Our method of survey distribution limited our sample size, as many program leaders who received the email through the APDR listserv likely did not forward the survey to their residents. Due to our method of survey distribution, it was not possible to

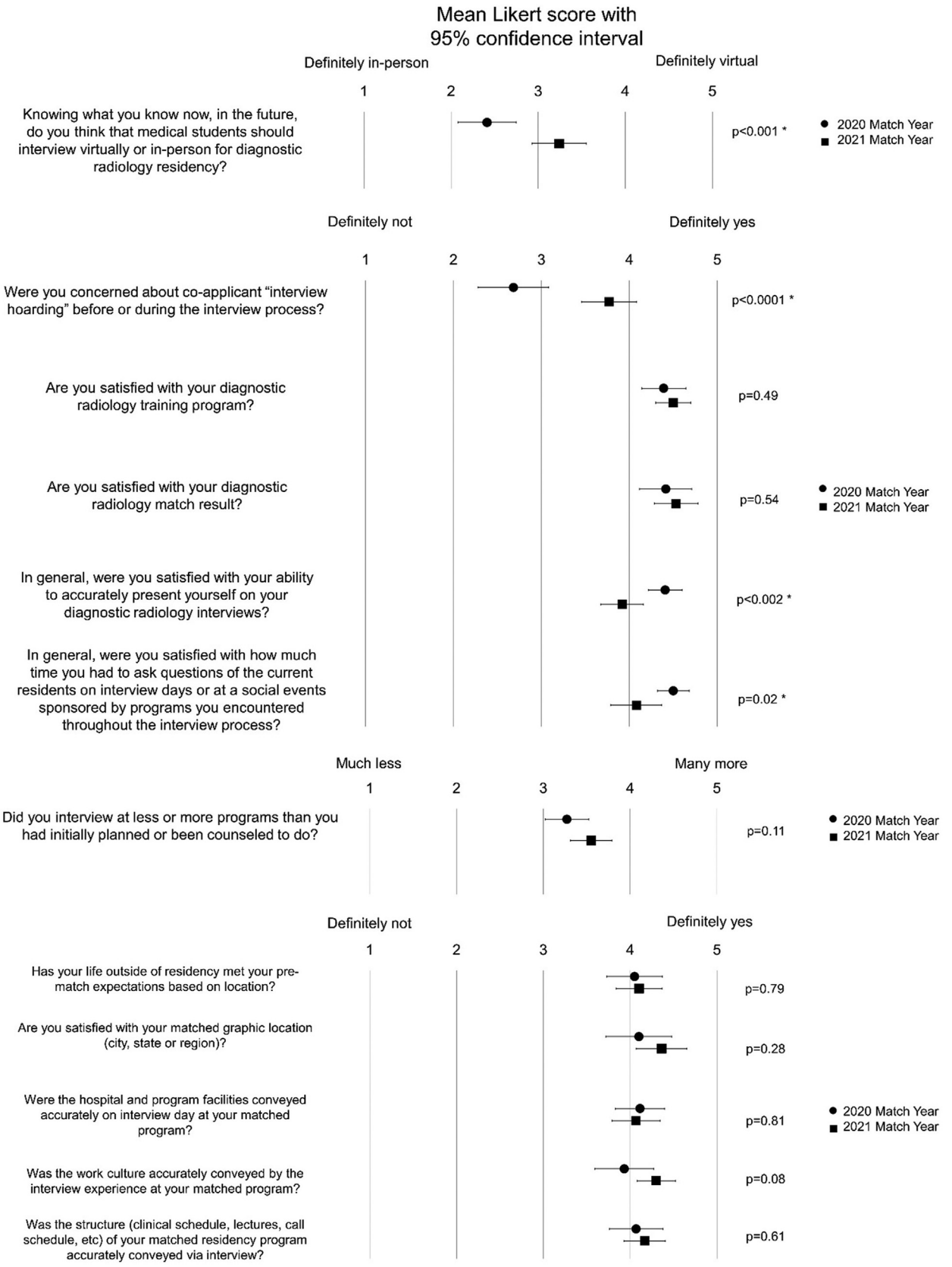

Figure 2. Diagram illustrating resident perceptions of the application process with comparison of mean Likert scores for the 2020 and 2021 match year cohorts. *, statistically significant.

determine how many members went on to forward the survey to residents in their program or accurately assess the response rate; the most conservative response rate is therefore reported as number of survey respondents divided by the sum of the number of matches reported in 2020 and 2021. Even so, the margin of error of the survey and notable differences in response to several important survey questions between the cohorts may add validity to the study and argue for future more highly powered analyses. A small minority of applicants from the 2020 match cohort reported interviewing virtually at their matched program, and one applicant from the 2021 match cohort reported interviewing in-person. The circumstances of these few applicants is unclear, however they were nonetheless included in our analyses in order to provide a complete comparison between the 2020 and 2021 match cohorts. Our survey was not intended or adequately powered to perform dedicated analysis of residents enrolled in integrated DR/IR programs. The application process and interview day procedures are different in many ways for DR/IR candidates, and the viewpoints of these residents may not parallel those of applicants to DR programs (25). The unique training structure of DR/IR programs may also have implications for the relative value of in-person and virtual interview experiences (26). Further, factors outside of the residency selection process may have been different between the cohorts that interviewed during the depths of the COVID-19 pandemic and those who interviewed just prior to the pandemic.

In light of the findings in this study, the question of how to improve the virtual application experience may be more relevant than the debate of virtual versus in-person interviews. The 2020-2021 application cycle was a crash course for radiology residency programs which were thrust into an unfamiliar territory of virtual interviews at a scale never before seen with little time and few resources to prepare (21). Lessons learned from the inaugural post-COVID-19 cycle will help residency programs improve their virtual recruitment and interview procedures for future cycles. As they refine their approach to virtual interviews based on early experience, residency program leaders must be mindful of the concerns expressed by applicants from the 2021 match year in our survey regarding the logistics of the virtual interview process. Some of these are already being addressed with applicant signaling being introduced for the 2022-2023 recruitment season. It remains to be seen how the changes made to the virtual application process at the national and local level will affect the match experience in future cycles from both the program and candidate perspectives.

In sum, the virtual application process is perceived neutrally or positively by most early diagnostic radiology residents and produced similar satisfactory results compared to applicants that interviewed in person. If the virtual interview process is to be continued, the concerns of those who matched virtually should continue to be addressed in order to improve future cycles.

AUTHOR CONTRIBUTIONS

All authors contributed to the manuscript's conception, design, data analysis, drafting, revising, final approval, and all agree to be accountable for all components of the work.

DATA STATEMENT

The authors declare that they had full access to all data in this study and the authors take complete responsibility for the integrity of the data and the accuracy of the data analysis.

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