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# The Evolving Status of Fellowships and Mini-Fellowships in Diagnostic Radiology: A Survey of Program Directors and Chief Residents

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**Rationale and objectives:** Recent changes in radiology fellowships include musculoskeletal radiology adopting a match system, interventional radiology transitioning away from diagnostic radiology to offer direct-entry programs, and a common fellowship application timeline created by the Society for Chairs of Academic Radiology Departments (SCARD). The concept of mini-fellowships has also emerged with the elimination of the oral American Board of Radiology examinations that had been administered in the final year of residency training prior to 2014. This paper seeks to assess the opinions of fellowship program directors, residency program directors, and chief residents regarding these recent changes.

**Materials and methods:** This is a cross-sectional study using a web-based survey posed to fellowship program directors, residency program directors, and chief residents in 2020. Questions sought to explore current attitudes toward the following topics: (1) a common fellowship application timeline; (2) a common fellowship match; and (3) the status of mini-fellowships in diagnostic radiology. In addition, the number of fellowship positions for each subspecialty was estimated using subspecialty society directories, Accreditation Council for Graduate Medical Education (ACGME) data, and individual program websites.

**Results:** Deidentified responses were collected electronically and aggregated. The three respondent groups preferred a common fellowship application timeline at rates of 67% among fellowship program directors, 80% residency program directors, and 74% residents. A common match system across all subspecialties was preferred at rates of 50% fellowship program directors, 74% residency program directors, and 26% chief residents. There was widespread reported compliance with the SCARD fellowship timeline policy. Subspecialty programs using the match system reported interviewing greater numbers of applicants per position. Fellowship directors and chief residents reported that the most common duration of mini-fellowship experiences was 2 to 3 months.

**Conclusion:** There is a division between chief residents and program directors regarding the preference for a common radiology match. Adopting a radiology-wide fellowship match would increase the number of interviews required. The SCARD fellowship timeline policy has been successful, and there is support across stakeholders regarding the common timeline. Mini-fellowships are highly variable in length and structure.

**Key Words:** Radiology Fellowships; Radiology Mini-Fellowships.

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**Abbreviation:** **A3CR2** American Alliance of Academic Chief Residents in Radiology, **ABR** American Board of Radiology, **ACGME** Accreditation Council for Graduate Medical Education, **APDR** Association of Program Directors in Radiology, **ASER** American Society of Emergency Radiology, **AUR** Association of University Radiologists, **DR** Diagnostic Radiology, **ESIR** Early Specialization in Interventional Radiology, **IR/DR** Interventional Radiology/Diagnostic Radiology, **NRMP** National Resident Match Program, **PGY** Post-Graduate Year, **RRA** Radiology Research Alliance, **SAR** Society of Abdominal Radiology, **SBI** Society of Breast Imaging, **SCARD** Society of Chairs of Academic Radiology Departments, **SSR** Society of Skeletal Radiology, **STI** Society of Thoracic Imaging

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## INTRODUCTION

The structure of diagnostic radiology curricula changed when the ABR Core examination was launched (1). The first ABR Core examination was administered in October of 2013 for the graduating class of 2014 with the exam to take place late in the PGY-4 year for the class of 2015 and those classes that followed (2). This change in board exam structure allowed for the introduction of tailored rotations during the PGY-5 year of training after most residents have chosen an eventual fellowship (3). Many residency programs capitalized on this opportunity by offering “mini-fellowships,” but this term is not officially defined or sanctioned by the ABR, ACGME, APDR or AUR. These mini-fellowships represent longer blocks in the year after the Core exam, and there is little information in the literature about the state of current practice. Residents may use these to help prepare for fellowships, improve areas of weakness, or make themselves more marketable in the future by stating they have further training in certain areas.

The radiology fellowship application process, certification, and accreditation vary widely among subspecialties with DR fellowships demonstrating flux in recent years. IR has segregated from DR into its own specialty (4–7). Musculoskeletal and breast radiology opted for fellowship match processes through the NRMP with adoption of “all-in” policies in 2019 and 2017, respectively (8–10). Emergency radiology moved to an NRMP match in 2021 (10).

Radiology has become subject to an “arms race” effect in that fellowship programs have been pressured to interview and accept residents earlier and earlier to fill, with musculoskeletal radiologists noting that this was a reason for adopting the match (11–13). Without a match, residents can feel pressured to accept positions before completing all interviews, and programs may feel the need to accept fellows before interviewing all interested applicants. Likewise, residents may back out of fellowship positions if they find that their interests change which has the potential to leave fellowship programs unfilled. Smaller fellowship programs may be disproportionately affected, as a single resident backing out may have a greater effect on the program.

To neutralize the “arms race” effect of fellowships offering interviews and positions earlier and earlier in residency, SCARD created an agreement in which fellowship programs would be held to a common timeline for applicants applying from other institutions (14). This policy created an embargo blocking interviews and acceptances from external applicants until November 1 and required a 7-day grace period for applicants to accept or decline an offer. Exceptions are allowed for internal candidates and those with relevant factors related to spouses and domestic partners (14).

Neuroradiology, pediatric radiology, and nuclear radiology are predominantly accredited fellowships that result in eligibility for the corresponding ABR subspecialty exams. Abdominal radiology and musculoskeletal radiology have both accredited and non-accredited fellowships, with

musculoskeletal radiology recently opting for a match system. Fellowship training in an ACGME-accredited environment carries additional administrative oversight, and accredited fellowships require that fellows have faculty supervision while issuing reports in that subspecialty. Breast imaging is a non-accredited fellowship that now participates in the match. Cardiothoracic and emergency radiology programs are not accredited and did not use a match system as of 2020.

In 2019, the RRA organized a task force to examine the state of radiology fellowships and mini-fellowships in light of these recent changes, as this topic was felt to be important by the various stakeholders in radiology. This paper describes the results of a cross sectional study of United States fellowship and mini-fellowship opportunities in diagnostic radiology conducted by the task force. Similar in design to other published surveys of program directors and chief residents (2,11,15–25), this survey aims to summarize current trends and opinions about fellowships and mini-fellowships in DR.

## METHODS AND MATERIALS

This study was approved by the Institutional Review Board of the lead author’s institution and exempted from further review and monitoring. This was a survey of different stakeholders performed during the 2019–2020 academic year. The total number of DR fellowships, number of fellowship positions, and program director contact information were obtained from the ACGME directory for neuroradiology, pediatric radiology, and nuclear radiology programs. For accredited abdominal and musculoskeletal radiology programs, this information was acquired from the ACGME and cross-referenced to the program directories of the Society of Abdominal Radiology and Society of Skeletal Radiology, respectively. Data from the nonaccredited fellowships in these subspecialties were acquired from relevant society websites as noted in Table 1. Abdominal radiology fellowships included body MRI and women’s imaging as described on the Society of Abdominal Radiology (SAR) directory. Program data for breast imaging, emergency radiology, and cardiothoracic radiology were obtained from online directories published by the American Society for Emergency Radiology, Society of Breast Imaging, and Society of Thoracic Radiology, respectively. For programs in which the directory was incomplete or inaccurate, program websites were reviewed to locate this data.

A directory of DR residency program directors was obtained from the ACGME as of March 2020. In cases in which program directors were not listed with the ACGME, individual program websites were used to obtain the data. A list of chief resident email addresses was compiled from the American Alliance of Academic Chief Residents in Radiology (A3CR2) database as of March 2020.

To investigate current practices and opinions regarding the radiology fellowships and mini-fellowships, three survey instruments were created using a cloud-based survey program (SurveyMonkey, Palo Alto, CA). Separate surveys were created which were applicable to individual fellowship program

**TABLE 1. Fellowship Program Director Response Rate.**

Radiology Subspecialty	Source	Positions	Programs	Responses (Rate)
Abdominal Radiology	ACGME/SAR	234	72	39 (54%)
Breast Imaging	SBI	121	92	39 (42%)
Cardiothoracic Radiology	STR	64	46	19 (41%)
Emergency Radiology	ASER	24	15	9 (60%)
Musculoskeletal Radiology	ACGME/SSR	202	87	34 (39%)
Neuroradiology	ACGME	351	87	31 (36%)
Nuclear Radiology	ACGME	36	17	5 (29%)
Pediatric Radiology	ACGME	127	48	19 (40%)
All Fellowship Programs		1159	464	195 (42%)

directors, residency program directors, and chief residents, included in the appendix. Only the individual designated as the program director of the residency or fellowship program was surveyed. Associate and former program directors as of March 2020 were not surveyed. The initial survey was sent in April 2020 with follow-up reminders provided May 2020 and June 2020. When asked about the SCARD fellowship timeline, respondents were directed to the SCARD policy online (14).

## RESULTS

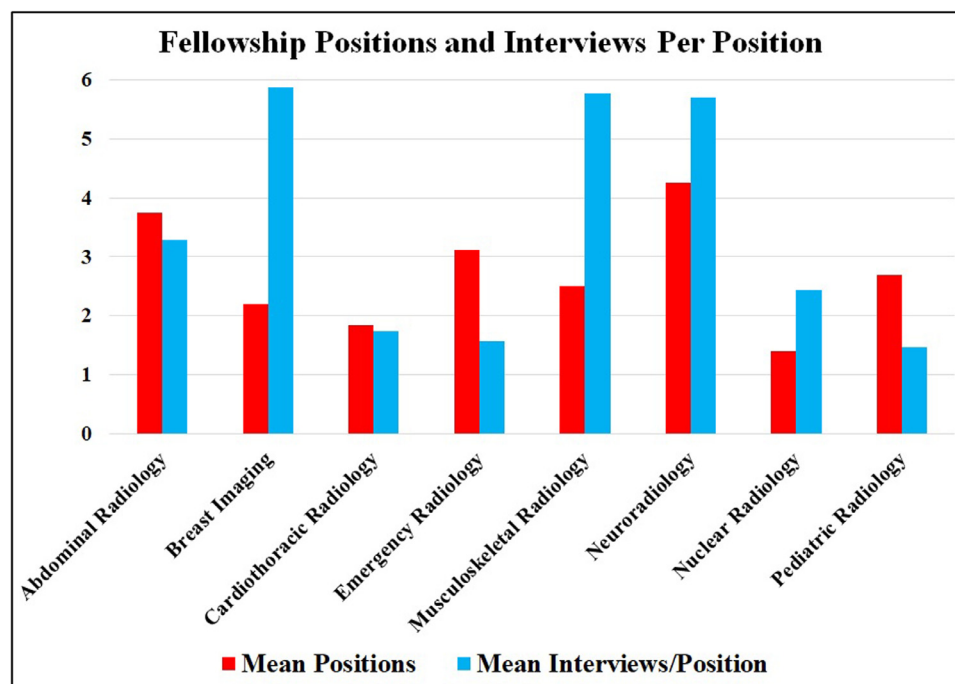
The total number of US fellowship positions was 1159 (Table 1). The fellowship program director response rate was 42% (195/464). The program director response rate was 34% (67/195). The chief resident response rate was 26% (27/104).

## Fellowship Program Director Survey

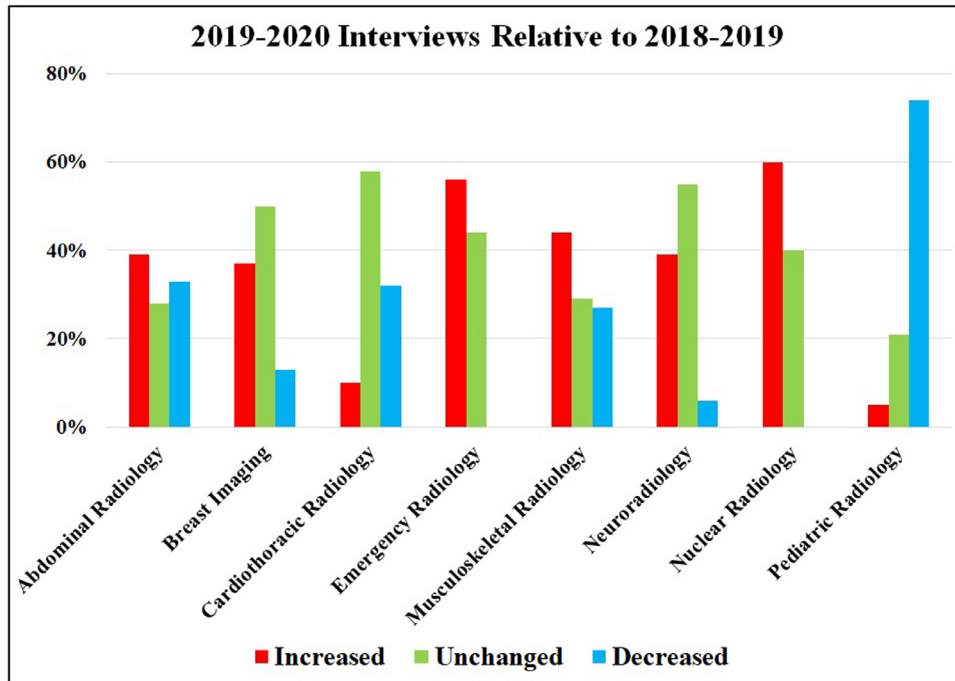
On average, fellowship programs interviewed an average of 4.25 applicants per fellowship position with the highest ratios in the fellowships that participate in the NRMP match (breast, musculoskeletal, and neuroradiology at 5.87, 5.78, and 5.77 interviews per position, respectively (Figure 1). Otherwise, the ratios ranged from 1.47 (pediatric) to 3.28 (abdominal).

Abdominal, musculoskeletal, and nuclear radiology program directors reported increases in interviews over the year prior (Figure 2). Pediatric radiology exhibited the largest proportion of program directors reporting declines in interviews.

There was 67% overall approval for a common application timeline (Figure 3), ranging from nuclear at 40% to emergency radiology at 89%. Of all fellowship program directors surveyed, 95% reported compliance with the SCARD policy. Support for a common match for all radiology subspecialties



**Figure 1.** The mean number of positions per program and mean interviews per position as reported by radiology fellowship program directors are shown.



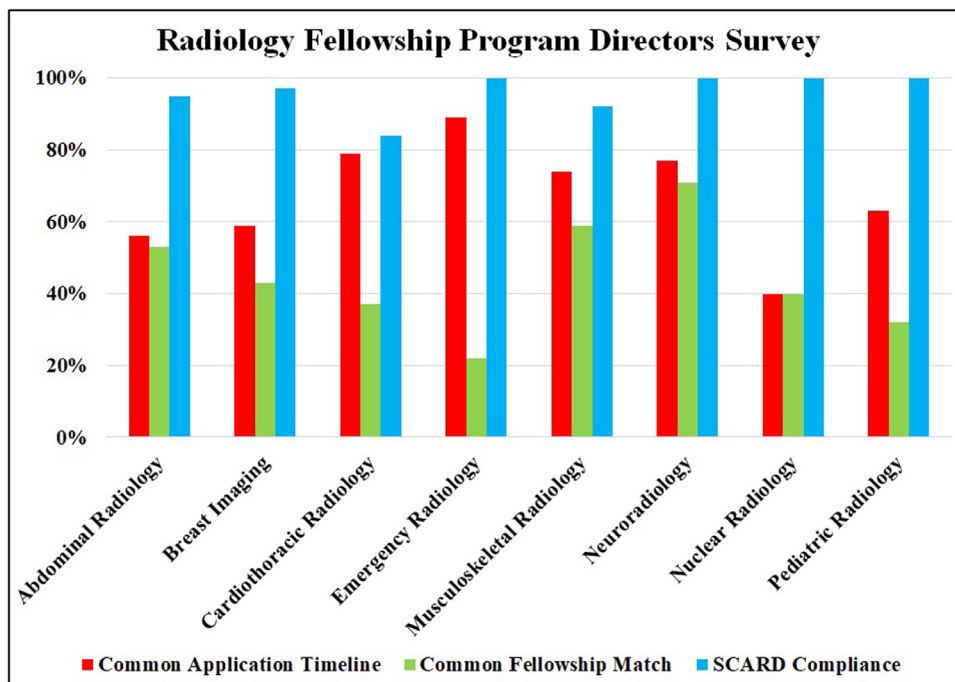
**Figure 2.** Radiology fellowship program directors were asked if interviews in 2019-2020 had increased, decreased, or were unchanged, compared to the prior year.

was less common and ranged from emergency at 22% to neuroradiology at 77% (Figure 3).

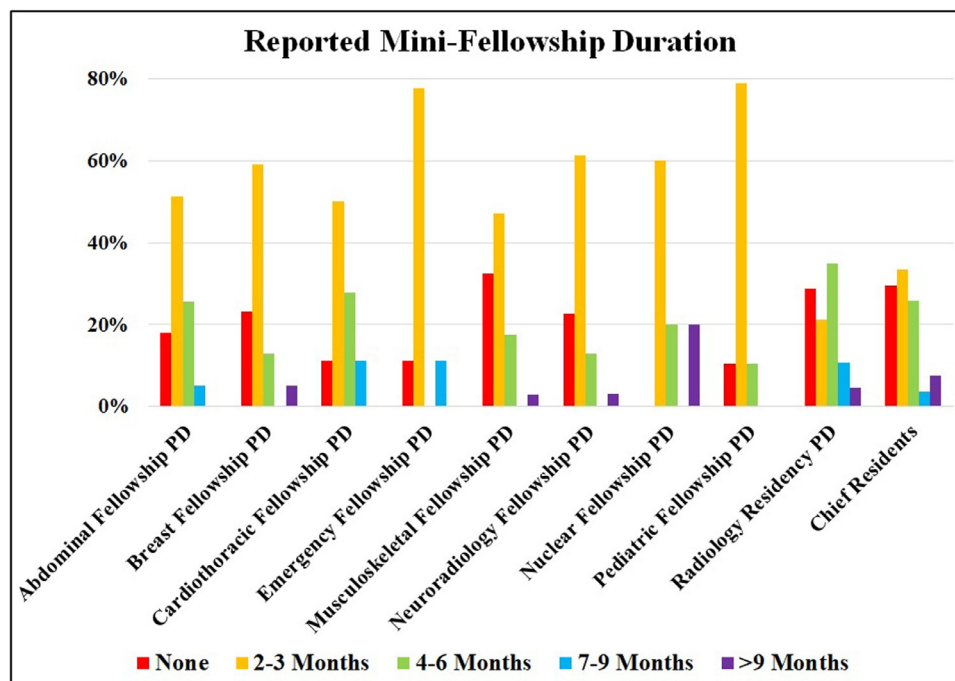
The most common duration of mini-fellowship opportunities observed by fellowship program directors surveyed was 2 to 3 months (Figure 4). Nuclear radiology programs observed greater than 9-month mini-fellowship experiences

at a higher rate, though it should be noted that nuclear radiology is the lone subspecialty in which a resident may become board certified in nuclear radiology by utilizing a 16-month dual certification pathway during residency (26).

Supplemental questions were given to program directors of these 2 subspecialties (appendix). 28% of abdominal radiology



**Figure 3.** Displayed here are the percentage of radiology fellowship program directors favoring a common application timeline across specialties and a common fellowship match. The percentages reporting compliance with the SCARD timeline are also indicated.



**Figure 4.** The duration of mini-fellowships are reported from each of the survey respondent groups.

program directors reported having accredited fellowship positions. The most common reason for abdominal radiology program directors to seek or not seek accreditation was the need to supervise accredited fellows (54%) followed by the administrative workload of maintaining ACGME requirements (51%). 16% of abdominal radiology fellowships offered positions that contain experience outside of abdominal radiology. 32% of musculoskeletal radiology program directors reported offering accredited positions. The need to supervise accredited fellows was the most cited reason (58%) affecting the decision to become accredited, while the second most was administrative workload of ACGME-related tasks (55%). 15% of musculoskeletal radiology program directors reported that they offer a musculoskeletal radiology experience combined with another subspecialty.

### Diagnostic Radiology Program Director Survey

Of the 67 program directors responding, 33 were from programs with 5 or fewer residents/class, and 34 were from programs with 6 or greater residents per class. 74% of DR program directors prefer a common NRMP match while 80% stated a preference for a common application timeline (Figure 5). 67% of DR program directors reported that residents currently choose their fellowship programs too early. 63% of DR program directors felt that the number of residents leaving for fellowship interviews was an impediment to training. There were 6 DR programs (9%) with no fellowships. The following percentages of radiology PD's reported having the indicated fellowships offered at their institutions: 51% abdominal radiology, 57% breast imaging, 37% cardiothoracic imaging, 24% emergency radiology, 54%

musculoskeletal imaging, 57% neuroradiology, 45% nuclear radiology, and 37% pediatric radiology. 85% of DR programs offer ESIR training. 14 Programs reported 2 to 3 month mini-fellowship experiences, 23 reported 4 to 6 month mini-fellowship experiences, 7 reported 7 to 9 month mini-fellowship experiences, and 3 reported mini-fellowship experiences of greater than 9 months. 6% reported that they only offer mini-fellowships in subspecialties in which they offer fellowships while 3% reported that they only offer mini-fellowships in subspecialties in which there are no fellows. 7% stated that limited case volume limits ability to offer mini-fellowships. 10% reported that there was competition for mini-fellowships. 10% stated that the mini-fellowship has a structured curriculum, and 10% provide certificates for mini-fellowship completion. 30% of mini-fellowships consisted of consecutive months in a subspecialty while 37% of PD's stated that their mini-fellowship experiences consist only of extra rotations in a subspecialty which may or may not be consecutive. When surveyed as to whether they feel potential employers value a mini-fellowship, 30% reported yes, 27% reported no because the training is not standardized, 15% reported no because employers are unaware of the concept of the mini-fellowship, and 27% answered that they did not know.

### Chief Residents Survey

Of the chief residents responding, 26% preferred a common match across radiology subspecialties, and 74% preferred a common application timeline. On average, residents applied to 5.3 programs (range 1-15), and residents participated in an average of 4.4 interviews (range 0-11). Residents reported spending an average of \$1,371 on interviews (range \$0-

\$5,000). The average spent according to those participating in a subspecialty with a match was \$1,750, while the average spent according to those participating in a non-match subspecialty was \$350. 84% stated that their first interview was after November 1. 52% of residents responded that they felt like they had to choose a fellowship too early. Among those residents who did not participate in a match, 14% responded that they felt the need to accept a position before exploring other programs. Among mini-fellowships offered, 52% reported abdominal radiology and breast imaging, 48% cardiothoracic imaging, 22% emergency radiology, 56% musculoskeletal radiology and neuroradiology, 44% reported nuclear radiology, and 33% pediatric radiology. ESIR was available for 93% of residents responding. The duration of mini-fellowships as reported by residents was 30% no mini-fellowship, 33% 2-3 months, 26% 4-6 months, 4% 7-9 months, and 7% greater than 9 months. 33% reported that potential employers ascribe value to the mini-fellowship. 26% disagreed because the mini-fellowship lacks structure, and 7% stated no because employers are unaware of it. 33% were undecided regarding the value of mini-fellowships. 29% chose a mini-fellowship that was the same subspecialty as their eventual fellowship. 71% chose a subspecialty different from their eventual fellowship. 11% reported that they only have mini-fellowships in subspecialties in which a fellowship is offered. 7% indicated that their mini-fellowships have a structured curriculum. 7% stated that there was not enough volume to offer a mini-fellowship. 22% stated that their mini-fellowships consisted of consecutive rotations, and 44% indicated that their mini-fellowships were extra rotations in a single subspecialty. 15% were eligible for a certificate based on the mini-fellowship. When asked if they knew of any fellowship program that broke the SCARD-approved timeline, only 1 resident reported that he/she had witnessed a break from the SCARD policy.

## DISCUSSION

In 2020, there were more DR fellowship positions (1,159) available in the United States than DR residency positions (123 PGY-1 positions and 990 PGY-2 positions as of the 2020 NRMP match, not including IR positions). Glover and Patel estimated the minimum total of non-IR fellowship positions at 770 in 2016 (12), but the method employed here is more comprehensive and likely closer to the true number.

This study utilized a novel DR residency program director database which was created specifically for this survey. Prior surveys of the APDR database achieved a similar response rate. For instance, the response rates of the annual APDR surveys were 33% in the fall of 2013 to 36% in the spring of 2015 (20). The response rate for the APDR annual survey in 2017 was also 36% (23). This design has the advantage of limiting each program to one program director opinion. In contrast, prior APDR surveys encompassed the breadth of APDR membership which includes over 300 residency and fellowship program directors and associate program directors.

Opinions from institutions that have fellowships and multiple associate program directors due to size are thus potentially over-represented using that method.

The survey of chief residents was specifically targeted for the end of the academic year, as this is near the time of the annual AUR/A3CR2 meeting when participation peaks and before participation drops due to the graduation of chief residents at the end of the academic year. The number of available chief residents to survey was likely impacted by the cancellation of the in-person 2020 AUR meeting. Nonetheless, use of A3CR2 membership was felt to represent the best cross section of upper-level residents.

There was a preference for a common fellowship application timeline, and this survey suggests that most fellowship programs comply with the SCARD policy which endorses the common timeline concept. Interestingly, only 43% of breast imaging program directors are in favor of using a common NRMP match despite implementing the match for breast imaging only recently. This is likely a reflection of the suboptimal outcome of the first breast imaging match (9). Neuroradiology, which has had a longstanding tradition of using the NRMP, has the strongest predominance of program directors in favor of a common NRMP match.

Despite the SCARD fellowship guidelines and compliance with it, over half of residents felt like they were forced to apply too early, and 67% of radiology residency program directors agreed. Despite the fact that DR program directors largely (63%) felt that absences due to fellowship interviews negatively affected the educational experience, the institution of a common match system would increase the number of interviews accepted by residents since a common match increases uncertainty for both residents and fellowship programs. If fellowship programs take advantage of virtual interview experiences, there may be less of an impact on the educational experience during residency, provided that the total number of interviews does not experience a concordant increase. A cap on the total number of interviews per fellowship position may help to address the impact on the residency experience.

Among all fellowship program directors responding, half were in favor of a common match among all radiology subspecialties. A common radiology fellowship match was strongly preferred (74%) by diagnostic radiology program directors, but a common fellowship match across radiology subspecialties was less preferred by residents. This may be related to the high cost of fellowship interviews cited by residents, and it was shown in this survey that those subspecialties utilizing a match interview more applicants per position. It was also shown that residents in match-participating subspecialties spend more on their interviews. The disparity between residency program directors and fellowship program directors may relate to the fact that fellowship program directors incur greater costs if they must interview more applicants in the case of a match system. Under the current system, residents potentially interested in both a subspecialty that participates in the match and a subspecialty that does not use the



match must decide before the non-match subspecialty begins to make offers. This can create a disadvantage for fellowships that opt for an NRMP match which does not assign matched applicants until the end of the R3 year. This was described as a possible factor affecting breast imaging in its adoption of the match (9).

Pediatric radiology program directors were more likely to report that the number of interviews had declined since the prior year. Since the number of interviews per position is the lowest for pediatric radiology, it is likely that the drop in number of interviews is due to a lack of interest rather than increased selectivity among program directors. This corresponds to a trend in which the A3CR2 showed that pediatric radiology showed a 6-year low in graduating resident interest in 2019 (27), prompting a growing demand for pediatric radiologists (28). As of 2017, 54% of fellowship positions throughout the country were unfilled and nearly half of trainees concentrated into only 3 programs (29). Pediatric radiology thus seems unlikely to benefit from a common match, but this highlights the differential effect a match would have on less preferred subspecialties.

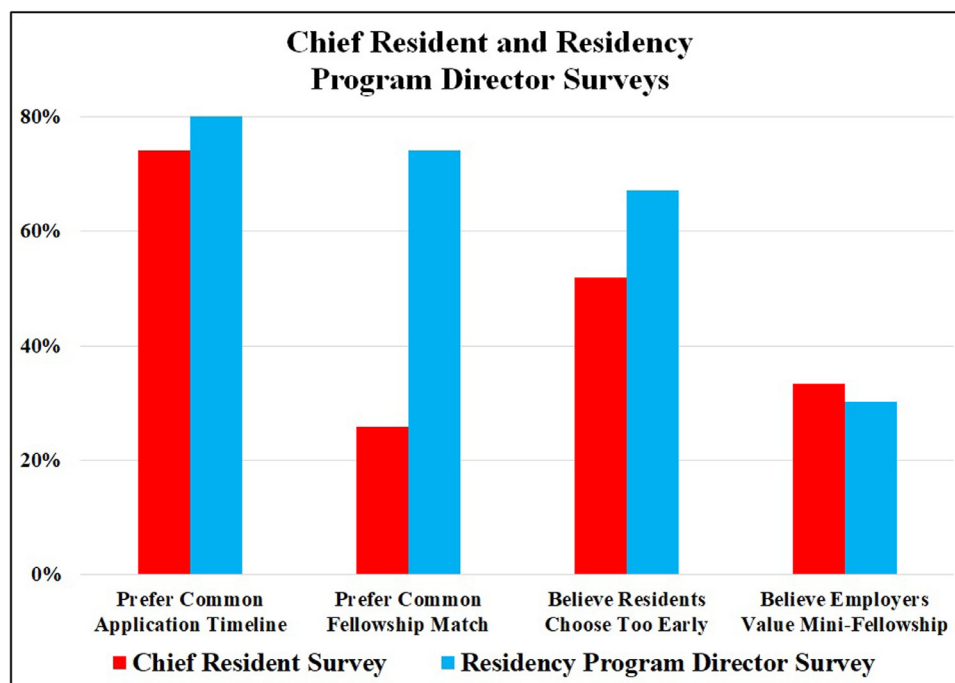
The concept of the mini-fellowship remains highly variable among radiology training programs with fellowship program directors, residency program directors, and residents reporting that most of these experiences are 6 months or less in duration. A plurality of residents and DR program directors reported that mini-fellowships are unlikely to be structured and more likely to be a collection of extra rotations that may or may not be consecutive. Most responding residents chose mini-fellowships outside of their eventual fellowships. Mini-fellowship heterogeneity may make it difficult for

employers to gauge its value given lack of standardization. 30% of radiology program directors and 33% of residents reported that the mini-fellowship was valuable to future employers.

Some limitations to this study are noteworthy. The end of the 2019 to 2020 academic year was chosen to capture opinions at the end of a recruiting season while maximizing the size of the number of chief residents in the A3CR2 database, as many chief residents graduate in June of each year. This period was affected by the COVID-19 pandemic which may have affected the response rate, though the response rate seen here was similar to other surveys of the APDR. The lack of an in-person 2020 AUR meeting may have resulted in fewer chief residents in the A3CR2, as A3CR2 membership is commonly sought while registering for the meeting.

This paper relies on the ability for program directors to recall some of the elements asked which may limit precision somewhat. Fellowship programs that do not advertise with relevant societies are not included, nor are less commonly undertaken fellowships (research, informatics, PGY-7 fellowships, etc.). It was nonetheless felt that the method demonstrated here was the best way to capture the state of fellowships. This study did not look specifically at the number of applicants to each fellowship, as it was felt that fellowship program directors would interview applicants using similar criteria from one year to the next. Relative fellowship interest among residents has also been well captured in chief resident surveys over several years by the A3CR2 (27), so we did not wish to duplicate this effort.

Fellowship application is dynamic, and it is possible that fellowships opt to cease compliance with the SCARD



**Figure 5.** Responses of chief residents are compared to radiology residency program directors regarding preferences for a common timeline, a common match, whether they believe that residents choose fellowships too early, and whether future employers value mini-fellowships.

timeline or abandon the NRMP in future cycles. The results of this survey reflect the state of fellowships and mini-fellowships as of mid-2020, and fellowship interviews and opinions may have changed in the meanwhile. Emergency radiology, for instance, opted for a match to begin in 2021, after this survey was conducted. There was some movement toward breast imaging programs opting out of the match in 2020 to 2021 which was not captured in this study.

Virtual interviewing was not common during the year that this survey was given, but it has emerged with the COVID-19 pandemic. If programs take advantage of greater virtual interviewing capabilities now that these technologies have blossomed in acceptance, this may change attitudes in favor of embracing greater interview numbers which may have an effect on attitudes toward a match system.

## CONCLUSION

The results of this survey show a prevalent acceptance of a common fellowship application time, but opinions vary over embracing a common match program involving all specialties. Mini-fellowships remain heterogeneous and variably structured.

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## REFERENCES

1. Becker GJ, Bosma JL, Guiberteau MJ, et al. ABR examinations: the why, what, and how. *Radiology* 2013; 268:219–227.
2. Shetty AS, Grajo JR, Decker S, et al. ABR Core examination preparation: results of a survey of fourth-year radiology residents who took the 2013 examination. *Acad Rad* 2015; 22:121–129.
3. Nicholson BT, Sizemore AW, Gay SB. The new radiology residency fourth year under the new curriculum: a survey of current residents' thoughts and suggestions about its purpose. *J Am Coll Radiol* 2010; 7:294–298.
4. LaBerge JM, Anderson JC. Radiology Review Committee. A guide to the Interventional Radiology residency program requirements. *J Am Coll Radiol* 2015; 12:848–853.
5. Marx VM, Sabri SS. Interventional radiology residency: steps to implementation. *J Am Coll Radiol* 2015; 12:854–859.
6. Mandel JE, Makary MS, Fleming JW, et al. The integrated IR residency curriculum: current state of affairs. *J Vasc Interv Radiol* 2020; 31:176–178.
7. Niekamp AS, Hoffmann JC, Patel PJ, et al. The emerging integrated IR residency: analysis based on 2017 and 2018 medical student surveys. *J Vasc Interv Radiol* 2020; 31:692–696.
8. Demertzis JL, Backer JC, Friedman MV, et al. Musculoskeletal radiology fellowship application and selection process: perceptions of residents, fellows, and fellowship directors. *Acad Rad* 2018; 25:1219–1226.
9. Pfeifer CM. Breast imaging match highlights the need to unify the approach to fellowship. *Acad Radiol* 2018; 25:543.
10. NRMP. Radiology Match. Available at: <https://www.nrmp.org/fellowships/radiology-match/>. Accessed February 14, 2021.
11. Gyftopoulos S, Demertzis JL, Casagrande B. 2019 musculoskeletal radiology fellowship match process: initial experiences and lessons learned. *Skeletal Radiol* 2020; 49:1109–1114.
12. Glover M, Patel TY. The radiology fellowship arms race cannot be won. *J Am Coll Radiol* 2016; 13:461–464.
13. Pfeifer CM. The fellowship arms race revisited. *J Am Coll Radiol* 2016; 13:891–892.
14. SCARD. 2020 SCARD fellowship policy. Available at: <https://scardweb.org/about/policies>. Accessed February 1, 2021.
15. Deloney LA, Rozenshtein A, Deitte LA, et al. What program directors think: results of the 2011 annual survey of the Association of Program Directors in Radiology. *Acad Rad* 2012; 19:1583–1588.
16. Shetty A, Hammer M, Gould J, et al. Results of the 2014 survey of the American Alliance of Academic Chief Residents in Radiology. *Acad Radiol* 2014; 21:1331–1347.
17. Rozenshtein A, Mullins ME, Deitte LA, et al. "What program directors think" II: results of the 2013 and 2014 annual surveys of the Association of Program Directors in Radiology. *Acad Rad* 2015; 22:787–793.
18. Hammer MM, Shetty AS, Cizman Z, et al. Results of the 2015 survey of the American Alliance of Academic Chief Residents in Radiology. *Acad Radiol* 2015; 22:1308–1316.
19. Lam CZ, Nguyen HN, Ferguson EC. Radiology resident satisfaction with their training and education in the United States: effect of program directors, teaching faculty, and other factors on program success. *AJR Am J Roentgenol* 2016; 206:1–10.
20. Rozenshtein A, Heitkamp DE, Mohammed TLH, et al. "What program directors think" III: results of the 2014/2015 annual surveys of the Association of Program Directors in Radiology. *Acad Rad* 2016; 23:861–869.
21. Shenoy-Bhangle AS, Eisenberg RL, Fineberg T, et al. Residency min-fellowships in the PGY-5 year: is there added value? *Acad Rad* 2018; 25:708–713.
22. Kasales C, Peterson C, Gagnon E. Interview techniques utilized in radiology resident selection—a survey of the APDR. *Acad Rad* 2019; 26:989–998.
23. Rozenshtein A, Griffith B, Mohammed TLH, et al. "What program directors think" IV: results of the 2017 annual survey of the Association of Program Directors in Radiology. *Acad Rad* 2019; 26:1102–1109.
24. Milburn JM, Heitkamp DE, Jay AK, et al. Hirsch. Should radiology delay the start of fellowships? A survey of the APDR. *Acad Rad* 2019; 26:1550–1554.
25. Jordan SG, Robbins JB, Sarkany D, et al. The Association of Program Directors in Radiology well-being 2019 survey: identifying residency gaps and offering solutions. *J Am Coll Radiol* 2019; 16:1702–1706.
26. Ruddell JH, Eltorai AEM, Tang OY, et al. The current state of nuclear medicine and nuclear radiology: workforce trends, training pathways, and training program websites. *Acad Radiol* 2020; 27:1751–1759.
27. Ballard DH, Summers D, Hoegger MJ, et al. Results of the 2019 survey of the American Alliance of Academic Chief Residents in Radiology. *Acad Radiol* 2020; S1076-6332(20). 30275-0. doi: 10.1016/j.acra.2020.04.042. Available online ahead of print.
28. Pfeifer CM. The impact of decreased interest in pediatric radiology. *J Am Coll Radiol* 2020; 17:72–74.
29. Pfeifer CM. Declining interest in pediatric radiology prompts a call to action. *J Am Coll Radiol* 2018; 15:490–492.