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Factors Influencing Choice of Radiology and Relationship to Resident Job Satisfaction

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ABSTRACT

Purpose: Identify when current radiology residents initially became interested in radiology, which factors influenced their decision to pursue a career in radiology, and which factors correlate with job satisfaction.

Methods: An online survey was distributed to United States radiology residents between December 7, 2016 and March 31, 2017. Respondents identified the most appealing aspects of radiology during medical school, identified experiences most influential in choosing radiology, and scored job satisfaction on visual analog scales. Relative importance was compared with descriptive statistics. Satisfaction scores were compared across factors with analysis of variance and post-hoc Tukey tests.

Results: 488 radiology residents responded (age 30.8 ± 3.2 years; 358 male, 129 female, 1 unknown; 144 PGY2, 123 PGY3, 103 PGY4, 118 PGY5). The most influential aspects in choosing radiology were the intellectual ($n = 187$, 38%), imaging ($n = 100$, 20%), and procedural ($n = 96$, 20%) components and potential lifestyle ($n = 69$, 14%). Radiology clerkship reading room shadowing ($n = 143$, 29%), radiologist mentor ($n = 98$, 20%), non-radiology clerkship imaging exposure ($n = 77$, 16%), and radiology clerkship interventions exposure ($n = 75$, 15%) were most influential. Choosing radiology because of potential lifestyle correlated with less job satisfaction than choosing radiology for intellectual ($p = 0.0004$) and imaging ($p = 0.0003$) components.

Conclusion: Recruitment of medical students into radiology may be most effective when radiology clerkships emphasize the intellectual and imaging components of radiology through reading room shadowing and exposure to interventions. Choosing radiology for lifestyle correlates with less job satisfaction, at least during residency.

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Introduction

Diagnostic radiology was at one time considered one of the most highly competitive medical specialties. However, there has been an overall decline in the number of United States residency applicants to diagnostic radiology over the past decade, with the lowest number noted in 2015, with only a recent uptrend in the past 2 years.^{1–4} Although this decline was likely multifactorial, including an uncertain job market, misconceptions, and misinformation about radiology—such as perceived monotony of daily practice and lack of patient contact—may deter medical students from considering a career in diagnostic radiology.^{2,5,6}

To ensure the future of diagnostic radiology, it is important to not only attract the most outstanding and qualified medical student applicants, but to ensure that these medical students make an informed career choice, so they may find sustainable and fulfilling careers.⁷ Similarly, radiology resident burnout has been a topic of

recent concern^{8–10} and could perhaps be minimized if medical students enter radiology for reasons most compatible with job satisfaction in this field. It is therefore important to fully understand when and why medical students become interested in radiology, and more importantly, which factors are ultimately associated with job satisfaction.

The purpose of this study was to understand when current radiology residents initially became interested in radiology, identify which factors influenced their decision to ultimately pursue a career in radiology, and correlate those factors with job satisfaction. Such information could help improve radiology residency recruitment efforts.

Methods

This study was exempted by our institutional review board. Informed consent was implied by voluntary completion of the anonymous survey. Respondents were able to opt out of answering specific questions if they chose to do so.

Subjects and Recruitment

An e-mail with a link to the survey was distributed to members of the Association of Program Directors in Radiology by the Association

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TABLE 1
Survey items

(1) When did you first develop an interest in radiology? (choose 1)
(a) Before medical school
(b) Medical school: preclinical years
(c) Medical school: clinical years
(d) Medical school: research/PhD years
(e) After medical school (eg, during different residency)
(2) What initially interested you in radiology? (choose all relevant)
(a) Family member
(b) Exposure to radiology before medical school (nonfamily)
(c) Radiology interest group
(d) Senior medical students going into radiology
(e) Resident or attending role model
(f) Anatomy course
(g) Radiology clerkship/elective
(h) Looking at imaging on nonradiology clerkships
(i) Exposure to interventional radiology
(j) Hands-on ultrasound
(k) Research
(l) Associated opportunities to work as an educator
(3) To which aspects of radiology were you drawn? (choose all relevant)
(4) To which aspect of radiology were you most drawn? (choose one)
(a) Intellectual component (learn pathologies throughout all ages and organ systems)
(b) Imaging component (enjoy looking at/interpreting images)
(c) Procedure component (enjoy performing minimally invasive procedures and patient care)
(d) Associated research opportunities
(e) Potential income
(f) Potential lifestyle
(g) Job market
(h) Limited direct patient contact
(5) What helped you decide on radiology? (choose all relevant)
(6) What most influenced your decision to choose radiology? (choose 1)
(a) Voluntary shadowing radiologist unrelated to clerkship
(b) Radiology clerkship/elective: resident/attending shadowing in reading room
(c) Radiology clerkship/elective: radiology resident conference attendance
(d) Radiology clerkship/elective: interventional radiology exposure
(e) Radiology research project
(f) Mentor (radiologist)
(g) Mentor (nonradiologist)
(h) Resident or attending role model
(i) Exposure to imaging on nonradiology clerkships
(7) What aspects of your radiology clerkship/elective were influential? (choose all relevant)
(8) What aspect of your radiology clerkship/elective was most influential (choose 1)
(a) Shadowing in reading rooms
(b) Resident noon conference
(c) Medical student didactic lectures
(d) Assigned projects (case presentations, etc)
(e) Mentoring
(f) Small group tutorials
(g) Interventions
(h) Hands-on ultrasound
(i) Simulation center
(j) Did not have radiology clerkship/elective
(9) How satisfied are you with your current job? (visual analog scale: 0 = entirely dislike my current job to 100 = entirely love my current job)
(10) How closely does your current job match the expectations you had as a medical student? (visual analog scale: 0 = completely different than I expected to 100 = exactly as I expected)
(11) Why/how does your current job meet/not meet your medical school expectations? (free text)
(12) Sex (male/female)
(13) Age
(14) Residency graduation year
(15) Are you training/did you train in the United States? (yes/no)
(16) Please share any related thoughts or comments. (free text)

of University Radiologists on December 7, 2016 with a request that members forward the e-mail to current residents. In addition, diagnostic radiology residency program director, program coordinator, and chief resident e-mail addresses were gathered from all publicly

available United States radiology residency program internet pages. In an effort to improve the number of survey responses, an e-mail with a link to the survey was then distributed to this collated e-mail list on March 5, 2017, again with a request to forward the e-mail to current residents. A final reminder e-mail was distributed on March 12, 2017. The survey was closed on March 31, 2017.

Survey

The survey consisted of 16 items including 8 items aimed at identifying factors associated with the choice of radiology as a specialty, 3 items about job satisfaction, and 5 demographic items; questions were written in multiple choice form (some questions allowing for 1 answer, others allowing for multiple) and others with a visual analog scale (Table 1). The influential factor "Potential Lifestyle" was not specifically defined and was therefore open to interpretation by the respondents. Survey data were collected and managed using REDCap electronic data capture tools hosted by Partners HealthCare Research Computing Enterprise Research Infrastructure and Services (ERIS) group. REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies.¹¹

Statistical Analysis

Descriptive statistics were performed to evaluate relative factor importance. Analysis of variance with post hoc Tukey honest significance difference test was performed to compare job satisfaction scores across factors. The significance level was set at 0.05. All analyses were performed in R 3.2.3¹² with tables generated using the ggplot2 package.¹³

Results

There were a total of 512 respondents. Radiologists who had completed training were excluded, as were trainees in programs outside the United States, resulting in a total of 488 United States radiology resident respondents. The mean age of the United States radiology resident respondents was 30.8 ± 3.2 years. There were 358 males (73%) and 129 females (27%) respondents, with 1 respondent declining to identify sex. Number of respondents stratified by postgraduate year was: 144 PGY2 (30%), 123 PGY3 (25%), 103 PGY4 (21%), and 118 PGY5 (24%).

Timing of First Interest in Radiology

Over half of the respondents first became interested in radiology during the clinical years of medical school (51%), whereas others became interested before the clinical years (39%) with only a small minority becoming interested during research years or after medical school (9%) (Fig 1).

Factor Initiating Interest in Radiology (Item 2)

The experiences that most respondents reported as initially sparking an interest in radiology included exposure to imaging on nonradiology clerkships (45%), a radiology clerkship or elective (44%), resident or attending role model (36%), exposure to interventional radiology (36%), or an anatomy course (25%) (Fig 2).

Aspects of Radiology to Which Respondents Were Drawn (Items 3 and 4)

When asked to identify which aspects drew respondents to radiology (they were asked to choose all relevant factors), a large proportion of medical students were drawn to the potential lifestyle (86%), imaging (85%), and intellectual (84%) aspects of radiology, whereas

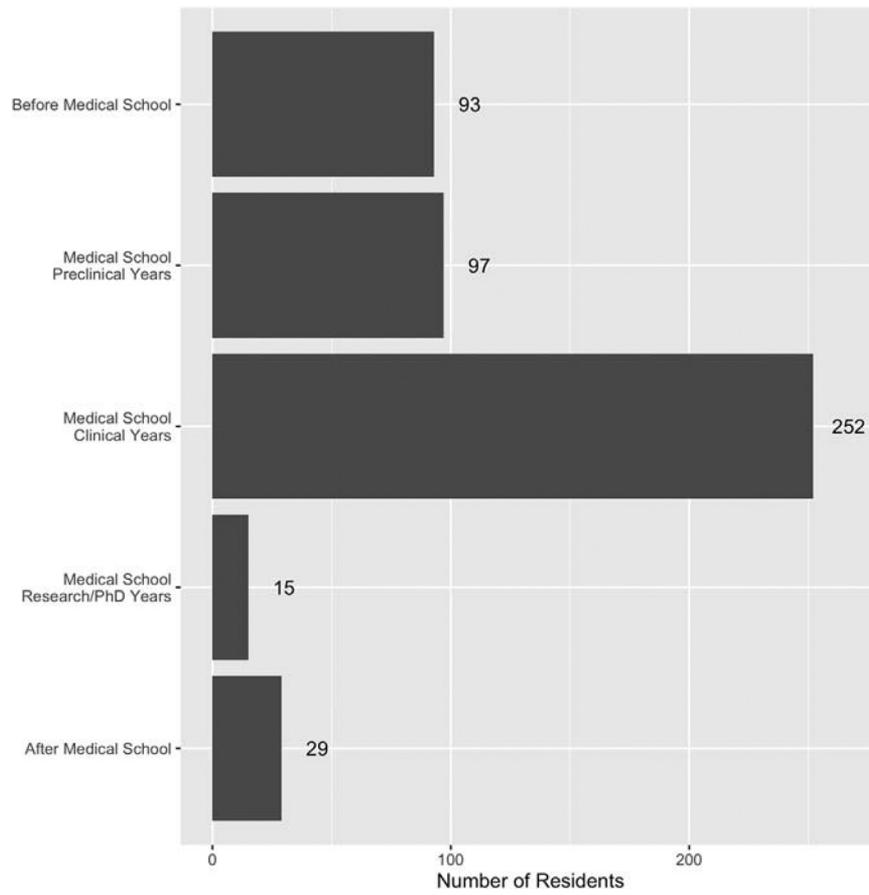


FIG 1. Response to “When did you first develop an interest in radiology?”.

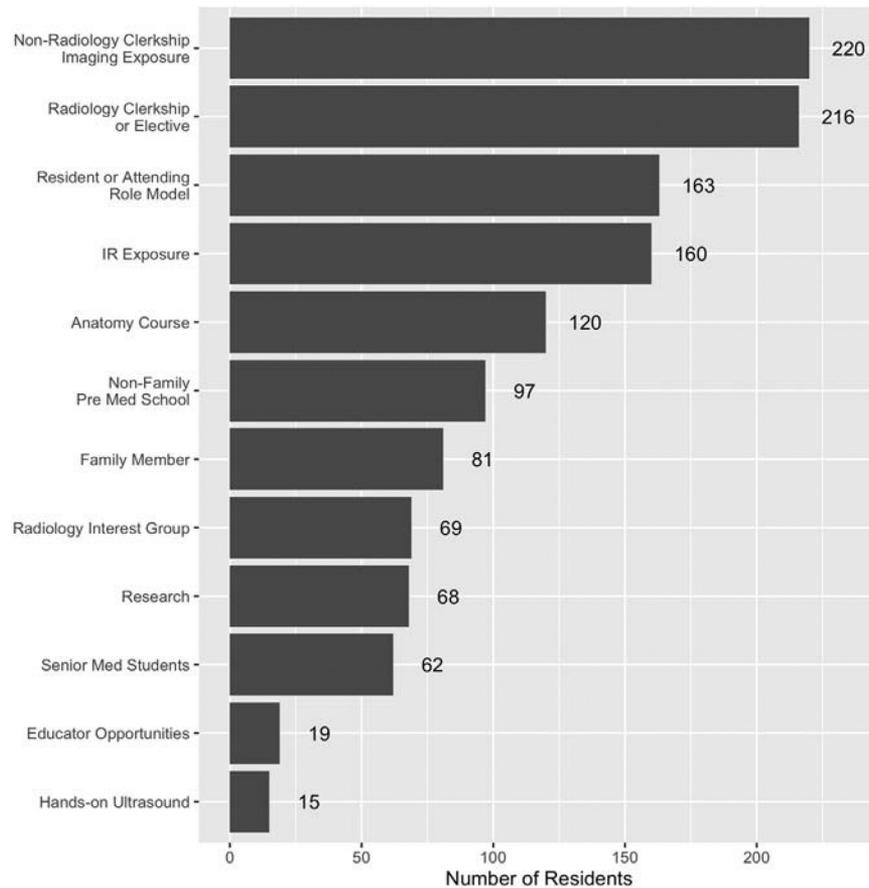


FIG 2. Response to “What initially interested you in radiology? (choose all relevant)”.

many were also drawn to potential income (66%) and the procedural component (61%) (Fig 3). However, when asked to choose which one of these factors was *most* important, the most common response was the intellectual component (38%) followed by the imaging (20%) and procedural (20%) components and potential lifestyle (14%) (Fig 4).

Factors Influencing Respondents Decisions to Choose Radiology (Items 5 and 6)

The leading factor in influencing a student to choose radiology was shadowing in the reading room during the radiology clerkship (66%) (Fig 5), with 29% citing that factor as the single most influential factor (Fig 6). Radiologist mentors (21%), exposure to imaging on non-radiology clerkships (16%), and exposure to radiology interventions (15%) were also frequently cited as the single most influential factors.

Most Influential Aspects of Radiology Clerkship or Elective (Items 7 and 8)

Just as shadowing in the reading room was the most consistent influencing factor in choice of radiology overall, it was also the most influential aspect of a radiology clerkship or elective (67%). Other influential factors during the radiology clerkship or elective included resident conference (37%), participation in interventions (36%), mentoring (34%), and medical student didactic lectures (31%) (Fig 7). Shadowing was also selected as the single most influential factor by 41% of respondents, with participation in interventions (19%) and mentoring (15%) also often reported as the most influential factor of the radiology clerkship or elective (Fig 8).

Job Satisfaction

Residents who chose radiology primarily for potential lifestyle recorded less job satisfaction than residents who chose radiology for its intellectual component ($P = 0.0004$) or its imaging component ($P = 0.0003$) (Table 2). There was no significant relationship of influential experiences with job satisfaction.

Discussion

This study identifies how, when, and why radiology residents training in the academic year 2016–2017 became interested in radiology and how these factors correlate with job satisfaction. The identification of these factors will allow radiology educators to provide optimal experiences in radiology to medical students in order to positively influence medical students to choose radiology for the most appropriate reasons. Given the recent improvement in the radiology job market and increasing competitiveness of both interventional radiology and diagnostic radiology programs,³ it will become increasingly important to recruit those individuals with the greatest likelihood of achieving job satisfaction in radiology.

Most residents initially became interested in radiology during medical school, with the majority becoming interested during the clinical years as compared to the preclinical years. Although prior studies have shown that students with radiology rotations are more likely to choose radiology as a specialty,^{5,14} these studies have not assessed whether those taking a radiology elective were already interested in the field. Our survey results show that a radiology clerkship was the second most common exposure resulting in initial interest in radiology, suggesting that exposure to a radiology clerkship is

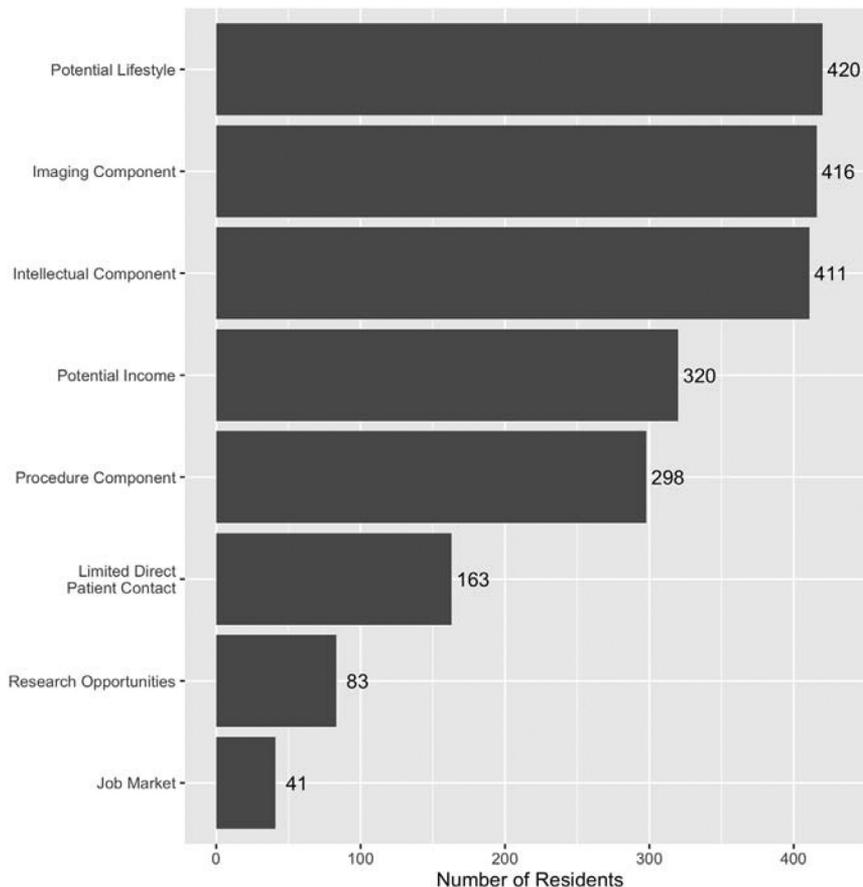


FIG 3. Response to “To which aspects of radiology were you drawn? (choose all relevant)”.

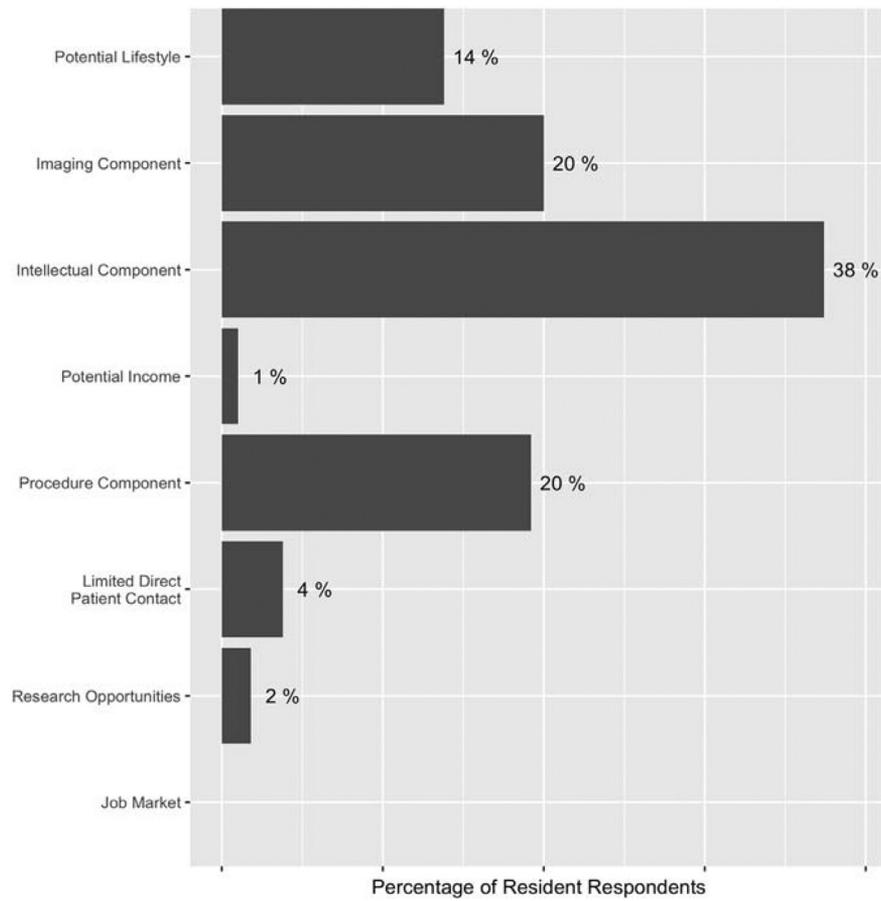


FIG 4. Response to “To which aspect of radiology were you most drawn? (choose 1).”

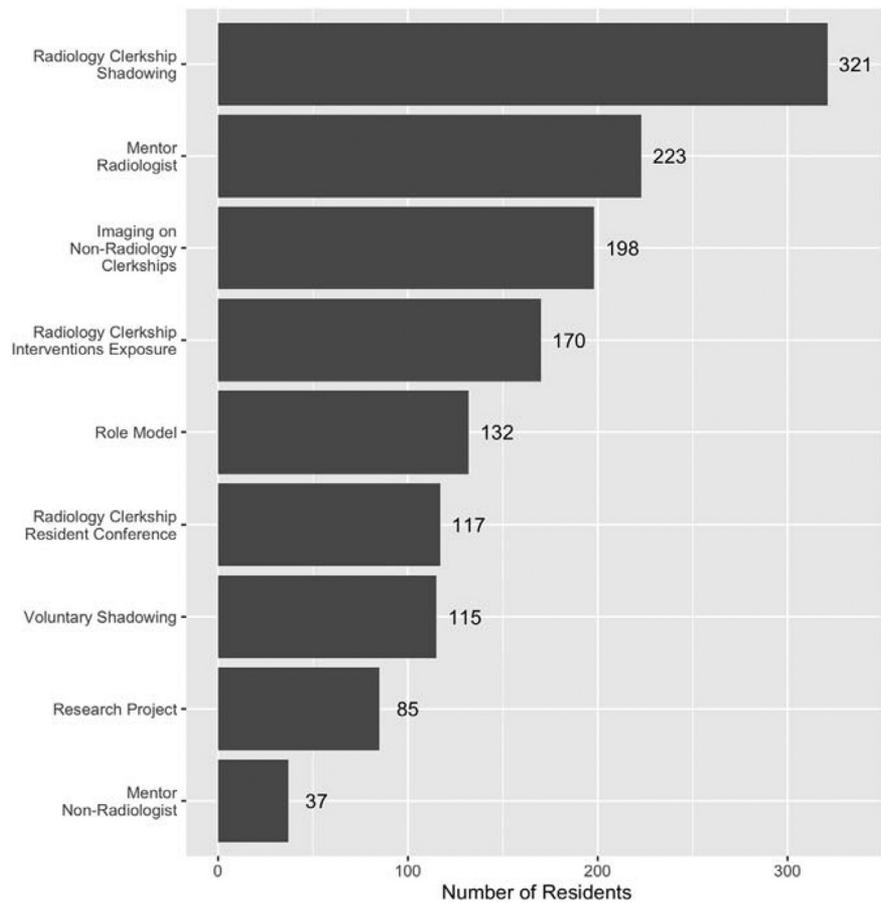


FIG 5. Response to “What helped you decide on radiology? (choose all relevant)”.

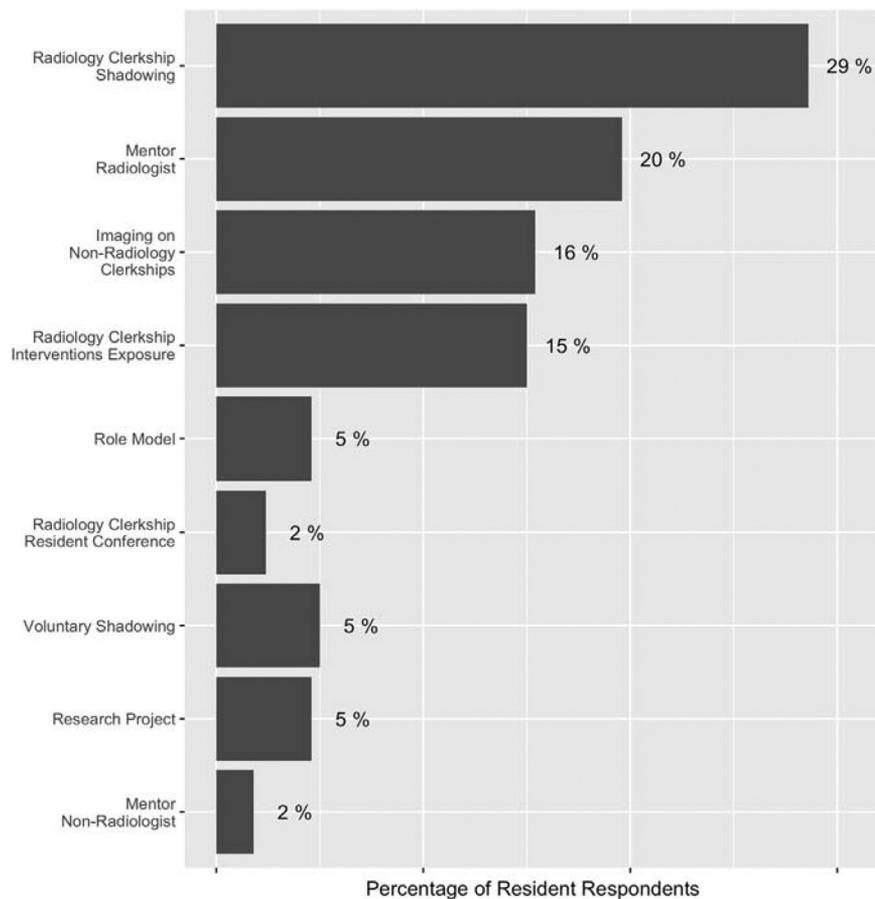


FIG 6. Response to “What most influenced your decision to choose radiology? (choose 1)”.

highly important in sparking initial interest in radiology. However, an interesting and unexpected result of our study was that a majority of current residents *first* became interested in radiology during nonradiology clerkships. This is an important observation, as it suggests we have the potential to positively influence students to become interested in radiology regardless of whether or not a medical school has a dedicated radiology clerkship.

Unfortunately, a survey of radiology chairs and medical school deans found that imaging in preclinical and clinical settings is commonly taught by nonradiologists, although an exact percentage could not be calculated.¹⁵ They also found that 75% of deans believed that nonradiologists could adequately teach basic imaging skills. Our survey results combined with these prior findings suggest that radiologists should increase engagement of medical students in preclinical curricula and nonradiology clerkships. Successful models include offering to teach introductory lectures or holding imaging or multidisciplinary rounds, as well as becoming more closely involved in the preclinical curricula, such as integration in the anatomy laboratory and pathophysiology courses, when possible.^{16,17}

Our study confirmed previous observations that the intellectual component was the single most important aspect of radiology to which current residents were drawn.^{5,18,19} Even further, and perhaps more importantly, we found that residents that chose radiology for its intellectual component had significantly more job satisfaction—at least during residency—than those who chose radiology for potential lifestyle. Although not the *most* important factor, potential lifestyle was the most *frequently* cited of all factors drawing respondents to radiology (80% of respondents). Lifestyle is an important consideration for medical students and should not be discounted, as they must consider mounting debts, as well as future goals for themselves, their families and their communities in making career decisions.

However, while there is certainly no shame in considering potential lifestyle in choosing a future career, promoting the intellectual component of imaging may help attract medical students that will most appreciate a career in radiology.

Shadowing in the reading room was not only the most influential aspect of the radiology clerkship or elective, but it was also the most influencing factor in choosing radiology as a future specialty. Interestingly, despite these trends, the comment section of the survey demonstrated a wide spectrum of reading room shadowing experience: while some residents reflected that shadowing gave them “a good sense of what being a radiology resident would be like,” many acknowledged “nothing can truly expose you to a job except doing the job yourself. . . therefore, [as a student shadowing], you are limited in your firsthand experience of the work.” One resident remarked, “shadowing in the reading room is almost always a passive experience, making it a poor educational model and recruiting technique. Being able to actually evaluate images and answer questions was much more stimulating, and for me this only happened during medical student lectures.” Unfortunately, we did not assess the specific details of residents’ experiences in the reading room as medical students, including whether they were primarily doing passive shadowing or if they were actively engaged, which would presumably lead to a more positively received and enriching experience. Given that the majority of residents felt shadowing in the reading room was the most influential factor (and likely a common component of most radiology clerkships), we must make an effort to provide them insight into “the life of a radiologist” during this time.

One model for achieving this goal that has been growing in popularity is to have medical students serve as radiology call triage assistants.^{20–24} In this role, third- and fourth-year medical students volunteer and are paid to help residents manage both clinical and

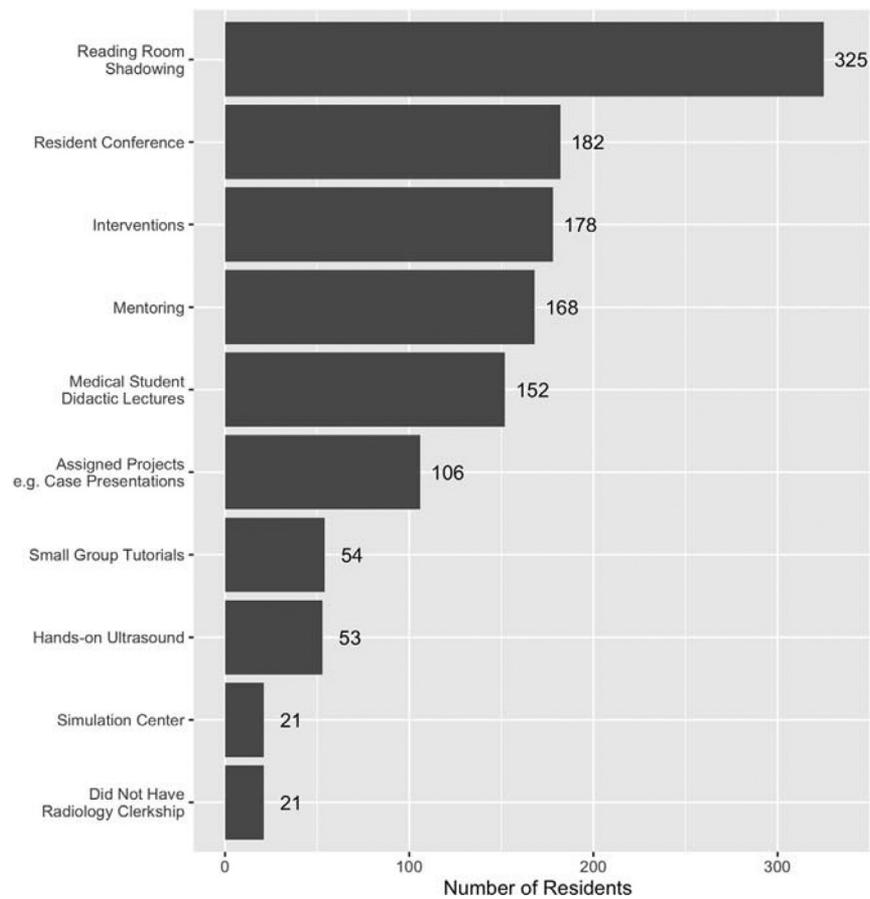


FIG 7. Response to "What aspects of your radiology clerkship/elective were influential? (choose all relevant)".

administrative tasks during call. At our institution, medical students in the triage program assist the resident in the emergency room reading room after hours by answering phone calls, discussing not critical results with ordering providers and placing preliminary protocols. In addition to financial and educational benefits of such programs,²⁰⁻²³ a survey of former and current participants of a similar program found that 32% of respondents had applied to diagnostic radiology, more than any other field.²³ A recent article by Ngo et al²⁴ found that although a triage assistant is currently being utilized by 20 of the 88 radiology programs in the United States, only 6 programs currently utilize medical students as the triage assistants.

Additionally, there has been a push to provide medical students with a more hands-on experience during radiology rotations, using real or simulated sessions with picture archiving and communication systems.^{25,26} At our institution, the abdominal imaging component of the radiology clerkship allows the medical students to review several anonymized radiology cases using a Digital Imaging and Communications in Medicine (DICOM) viewer and then to discuss their findings with the supervising attending, mimicking a radiology residents' experience in the reading room.

Although a proportion of residents were drawn to radiology due to limited direct patient contact, a larger number of residents were drawn to the procedural component, which inherently involves direct patient contact. Prior studies have shown that perceived limited patient interaction was a reason medical students choose not to apply in radiology⁵ and that high patient contact were major influences on choice of medical specialty in general.¹⁹ Given that most students' radiology exposure may be primarily or entirely limited to diagnostic imaging, it is important to advertise and expose students to the procedural aspects of radiology, particularly in light of the recently established integrated interventional radiology or diagnostic radiology residency.

Approximately 27% of respondents were females, concordant with reports of the current radiology resident and practicing radiologists sex breakdown.^{18,27} Although we did not stratify results based on sex, Kattapuram et al¹⁸ also found that the most influential factor for choosing radiology for women was also intellectual simulation.

There are several limitations to this study. To our knowledge, there is no public database of radiology resident e-mail addresses, requiring the use of program directors, program coordinators, and chief residents to act as intermediaries for survey distribution. Extrapolating from the number of current radiology residents (approximately 4000),¹ we estimate our response rate to be approximately 13%. However, due to our survey distribution methodology requiring intermediaries, we were unable to calculate a true response rate and suspect that it is actually higher than this estimation, as it is likely that not all current residents received access to the survey. Our total number of responses was higher than similar survey-based studies targeting current radiology residents.^{28,29} Our higher numbers may be related to the targeting of multiple intermediaries (program directors, coordinators, and chief residents) to increase likelihood that the survey would be shared with current residents. It was also not possible to ensure that any given respondent did not submit multiple responses. In regard to the survey items, we did not ask whether a radiology clerkship was mandatory or elective and whether residents had formal radiology-based preclinical experience as medical students, factors that may theoretically influence the timing and experience of their radiology exposures. However, it has been shown in the past that application rates to radiology are not associated with education program characteristics.³⁰ Additionally, although choosing radiology for potential lifestyle was associated with decreased job satisfaction, we acknowledge that our survey only evaluated current radiology residents, whose salaries and work hours

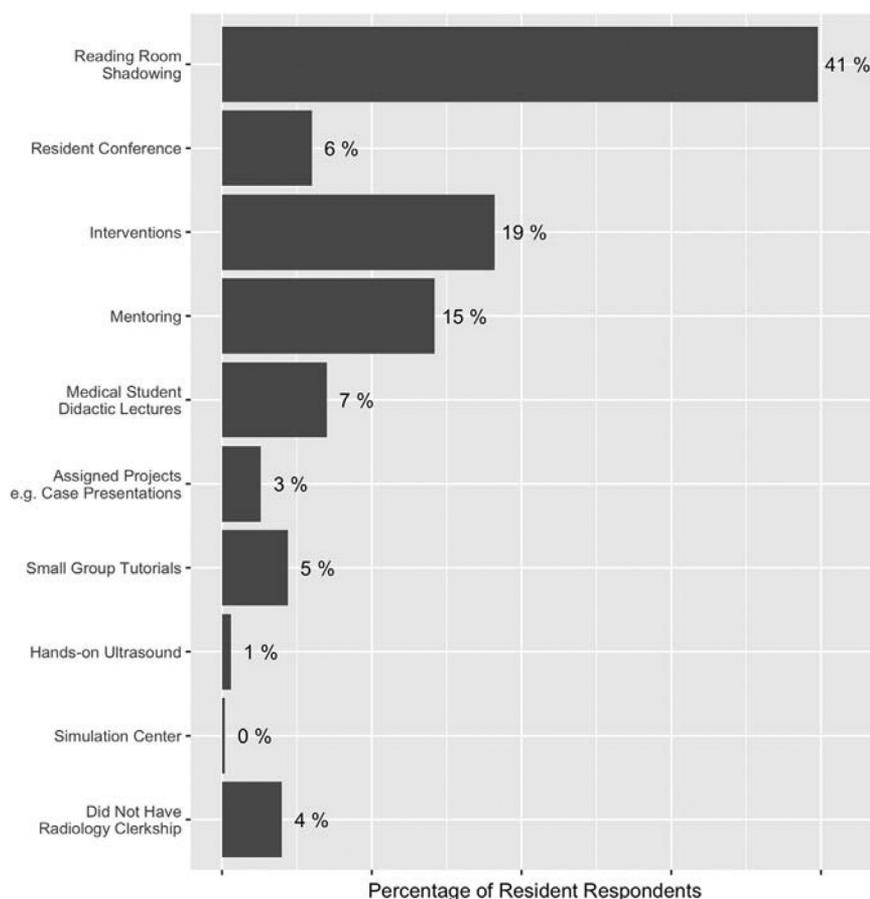


FIG 8. Response to “What aspect of your radiology clerkship/elective was most influential? (choose 1)”.

differ considerably from practicing radiologists, who may have a preferable lifestyle. Future studies should evaluate factors correlating with career satisfaction in practicing radiologists. Finally, although the survey was anonymous and therefore respondents may be more likely to answer truthfully, it is possible that our current academic culture biases students not to pursue careers for financial benefit, or

TABLE 2

Differences in job satisfaction scores (item 9 responses) between aspects of radiology to which respondents were most drawn (item 4 responses)

Item 4 responses compared	Mean difference	P (adjusted)
b-a	1.439	0.996
c-a	-4.774	0.386
d-a	-8.885	0.801
e-a	-16.307	0.456
f-a	-11.372	0.0004*
h-a	-11.107	0.168
c-b	-6.212	0.230
d-b	-10.323	0.685
e-b	-17.745	0.364
f-b	-12.810	0.0003*
h-b	-12.545	0.101
d-c	-4.111	0.996
e-c	-11.533	0.826
f-c	-6.598	0.275
h-c	-6.333	0.824
e-d	-7.422	0.992
f-d	-2.487	0.999
h-d	-2.222	0.999
f-e	4.935	0.998
h-e	5.200	0.998
h-f	0.265	1.000

No respondents chose factor “g”.

*P < 0.05.

at least not to openly say so, potentially decreasing the number of respondents acknowledging lifestyle this as a potential factor.

Conclusions

There are many factors involved in how medical students choose radiology, and it is helpful to know which factors are associated with job satisfaction. Those who choose radiology for potential lifestyle appear less likely to have job satisfaction, at least during residency. By engaging medical students early and throughout their medical school curricula and by emphasizing the intellectual, imaging, and procedural components of radiology, we can ensure a bright future of our field by recruiting those individuals with the greatest likelihood of achieving job satisfaction in radiology.

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