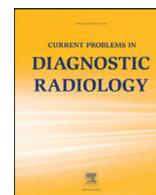




Current Problems in Diagnostic Radiology

journal homepage: www.cpdjournal.com



Do Interventions Intended to Increase Female Medical Student Interest in Radiology Work? Preliminary Findings



Elizabeth D. Yuan^a, Joseph Makris, MD^{a,b},Carolynn M. DeBenedictis, MD^{a,b,*}

^a University of Massachusetts Medical School, Worcester, MA

^b Department of Radiology, University of Massachusetts Medical School, Worcester, MA

Purpose: The purpose of this study is to share the preliminary findings after initiation of interventions at the medical school level, which have been suggested by the literature to increase female medical student interest in radiology at one institution. Additionally, the paper provides discussion of how to better future interventions for increasing female medical student interest.

Methods: Interventions to increase medical student exposure to radiology were implemented at the University of Massachusetts Medical School in 2012. Radiology was incorporated into the preclinical curriculum; flexible clinical experiences stressing patient contact were created for early exposure to radiology during third-year clerkships; and a 'Women in Radiology' panel was held to promote visibility of female radiologists. In addition, female radiology faculty became more involved in medical school activities and events.

Results: Our results suggest that early exposure in the preclinical curriculum and patient-centered electives increase overall student interest in radiology but only minimally increase female interest. Simply offering the patient-centered electives is not enough as it resulted in more male student enrollment than female (60% vs. 40%, respectively). Just one event promoting visibility of female radiologists changed female medical student perception of patient contact within radiology by a statistically significant amount. Examination of current UMass faculty radiologists by gender demonstrates that full-time, junior female radiologists—the demographic suggested to have the biggest impact on female medical students—only accounted for 4% of faculty.

Conclusion: This article may be informative for radiology departments looking to increase female medical student interest. Required visibility of female radiologists and active publicity of female radiologists from the first preclinical year are likely to have the biggest impact in increasing female medical student interest.

© 2017 Elsevier Inc. All rights reserved.

Introduction

Since the 1970s, there has been a dramatic increase in the percentage of female medical school matriculates (11%–47% in 2015).^{1,2} This change led to a subsequent increase in female physicians in previously male-dominated fields of medicine. Yet, the percentage of women in diagnostic radiology has remained stagnant. In 1990, 25.5% of U.S. radiology residents were women compared to 26.9% in 2013.³ These unchanging numbers have prompted research to determine why this discrepancy persists.

Many studies have been conducted to examine medical student interest in radiology and many interventions have been proposed. First, it has been suggested that earlier exposure to the field of radiology will lead to greater interest in the specialty.⁴ The literature regarding how to get more female medical students interested in radiology also suggests that early exposure is key to recruiting women to the specialty.^{5,6} Radiology is traditionally a field that gets introduced to medical students in their third or fourth year of medical school. By that time, many students have developed and begun pursuing interests in other

fields of medicine. These established interests create biases that make students less likely to explore radiology electives or consider a career in radiology. Early exposure to radiology and visibility to faculty radiologists help prevent such biases from forming. While one study has demonstrated an increase in interest after introduction of radiology into the preclinical curriculum, no study to date has demonstrated how this has affected match rates.⁴ Of note, this proposed hypothesis may explain overall lower interest in radiology in comparison to other subspecialties; however, there is no evidence to suggest that lack of early exposure should preferentially affect female medical students. That being said, if female medical students are not exposed to radiology early, like male counterparts, they will not have interest in the specialty, so early exposure is important for recruitment.

Second, studies that look at medical students' reasons for not considering radiology indicate that there are many misconceptions of the field of radiology. In one study, 95% of female students, who had chosen a specialty other than radiology, stated lack of direct patient contact as a reason they did not choose radiology.⁷ In fact, this perception was the biggest deterrent for female medical students. For the minority of radiology subspecialties, lack of patient contact is a reality; however, most of the subspecialties within radiology have ample patient contact. The

* Reprint requests: Carolynn M. DeBenedictis, MD, Department of Radiology, University of Massachusetts Medical School, 55 Lake Ave North, Worcester, MA 01655.

E-mail address: Carolynn.debenedictis2@umassmemorial.org (C.M. DeBenedictis).

literature suggests that early exposure to the varied experiences within these “patient contact” subspecialties (most notably pediatric radiology, breast imaging, and interventional radiology) has been proposed as a way to generate more female medical student interest.^{5,6}

Finally, female radiologist involvement in mentorship has been identified as integral to fostering female medical student interest in radiology.^{7,8} In one study, nearly 21.7% of men choosing a career in radiology did so at the suggestion of a mentor or colleague, suggesting that mentorship has a large role in shaping the careers of male medical students.⁷ Female medical students are also likely largely influenced by female mentors; however, female radiology faculty are outnumbered 2:1 by males and are 3 times less likely to obtain senior faculty positions.^{5,9,10} This means that there may be few female radiology faculty at any given institution available for teaching and mentorship, and, even when present, they may not be readily visible to the student body. The publicity of female radiologists and their subsequent involvement in mentorship are integral components to fostering female medical student interest in radiology.

To date, no study has been conducted to determine the impact of these suggested interventions once implemented. Interventions implemented at UMass aimed at increasing medical student exposure to radiology coincidentally align with those interventions that have also been suggested to increase recruitment of female medical students to radiology, thus our data provides valuable information regarding female medical student response to these interventions. These preliminary findings may be helpful to institutions looking to increase female medical student interest in radiology.

Materials and Methods

Radiology Interventions

The interventions took place between 2012 and 2016 at the University of Massachusetts (UMass) Medical School in Worcester, Massachusetts. Starting in 2012, a faculty radiologist became co-director of the anatomy course and added 15–20 imaging-driven lectures to the preclinical curriculum. That same year, 6 of the 27 cadavers were imaged by computer tomography to provide radiology-pathology correlations for the anatomy dissections. Approximately 10–12 radiology residents were present in the anatomy lab for several sessions to review CT imaging with gross cadaver findings with students. In the subsequent years, 2013–2016, approximately 81 cadavers were scanned so each anatomy group could do imaging correlation with their cadaver.

In 2012, UMass Medical School began offering flexible clinical experiences (FCEs) during the third year of medical school. The FCEs are weeklong electives that complemented the core clinical curriculum while allowing for career exploration outside of the standard core clinical rotations. The radiology department offered FCEs in pediatric and interventional radiology in 2012. In the fall of 2015, the department also implemented a breast imaging FCE. FCEs in these subspecialties were specifically chosen as they highlight opportunities for patient interaction within radiology. In addition, we also offer a general radiology elective in the fourth year where medical students are exposed to all subspecialties in radiology over 1 month.

A ‘Women in Radiology’ panel was hosted by the Radiology Interest Group to promote visibility of female radiologists during the fall semester of 2016. Three female-attending radiologists and two female residents served as panelists. All female medical students across first through third years medical school classes

were invited to attend. Medical students were encouraged to ask questions, and the bulk of the discussion was generated from topics they were interested in learning more about, including amount of patient contact within radiology and work-life balance. After the panel, female medical students voluntarily participated in an anonymous online survey about their perceptions of radiology before and after the panel. The Institutional Review Board (IRB) determined the study to be exempt by Category 2 (ie, educational survey). In addition to the panel, young female radiology faculty began to become more involved in the medical school as well. These female faculty began to serve as subspecialty mentors for medical students, hosted “dinner with doctors” through the local chapter of the American Medical Women’s Association (AMWA) (medical students have dinner at a female faculty members house to learn more about their specialty), and participated in a panel at the medical school featuring specialties in medicine where women are underrepresented. All of these additional interventions occurred in the year before the Women in Radiology panel. Additionally, a female radiology become Radiology Residents Program Director, the Radiology Interest Group Advisor, and became more active in mentoring medical students in late 2016.

Data Collection/Analysis

Match results from 2000–2016 were reviewed with attention directed at the total number of medical students who matched in radiology as well as the female to male ratio of those students. A database was created of the number of students who took part in radiology FCEs (ie, breast imaging, pediatric radiology, and interventional radiology). The FCE participants were stratified by both year in which they enrolled in the elective and gender. Of note, the data from the graduating class in 2018 reflects tentative enrollment of current third-year medical students. As students are able to add and drop FCEs, rates of actual enrollment may change. Data on student perspectives before and after the ‘Women in Radiology’ panel was analyzed by paired Student’s *t*-test, with $p < 0.05$ considered a significant difference.

Results

Although the number of fourth-year medical student matching into radiology fluctuated between 2000 and 2008, match rates between 2009 and 2012 became consistently lower than in prior years. After the educational intervention was initiated in 2012, there was a relative recovery in number of matched students. Classes with more years of intervention had a higher number of students match into radiology, suggesting that earlier intervention is more beneficial (Fig 1A). Analysis of this trend by gender demonstrates that a greater number of male medical students matched after the intervention (Fig 1B). The absolute number of female medical students was similar to in previous years.

There has been growth in the enrollment of medical students in FCEs since the initiation of the intervention (Fig 2A). Students were more likely to enroll in electives if they were exposed to educational intervention in their first preclinical year (Fig 2A). A comparison of total number of male vs. female medical students enrolled in FCEs from graduating classes 2014–2018 shows that women were less likely to participate in a clinical radiology elective (60% vs. 40%, respectively) (Fig 2B).

Following the ‘Women in Radiology’ panel, 7 of 15 female medical students completed a 7-question survey on their perceptions of radiology. The students rated their perception of patient contact within

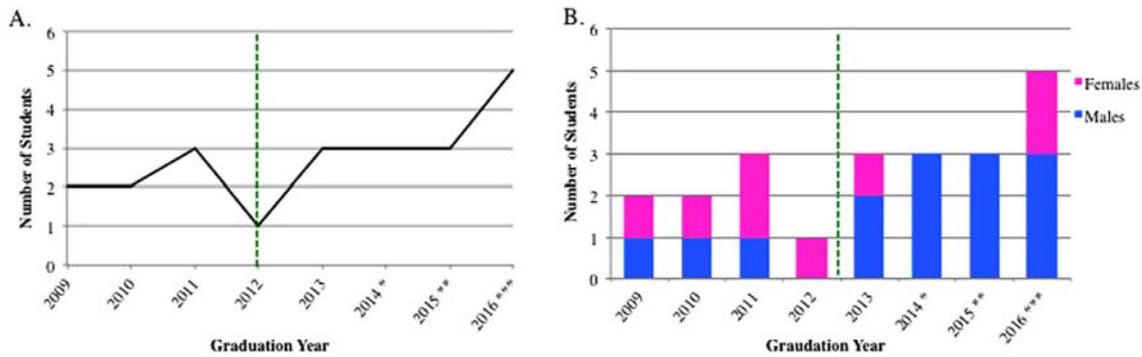


FIG 1. Interventions increase total number of students matching into radiology residency with preferential effect on males. Green dashed line represents initiation of radiology educational interventions. * indicates first class to have third-year flexible clinical experiences (FCEs) options. ** indicates first class to have second-year preclinical curriculum and third-year FCEs options. *** indicates first class to have first- and second-year preclinical curriculum and third-year FCEs options. (A) Total number of UMMS students matching into radiology residency in years before and after intervention. (B) Ratio of male and female medical students matching into radiology residency in years before and after intervention. (Color version of figure is available online.)

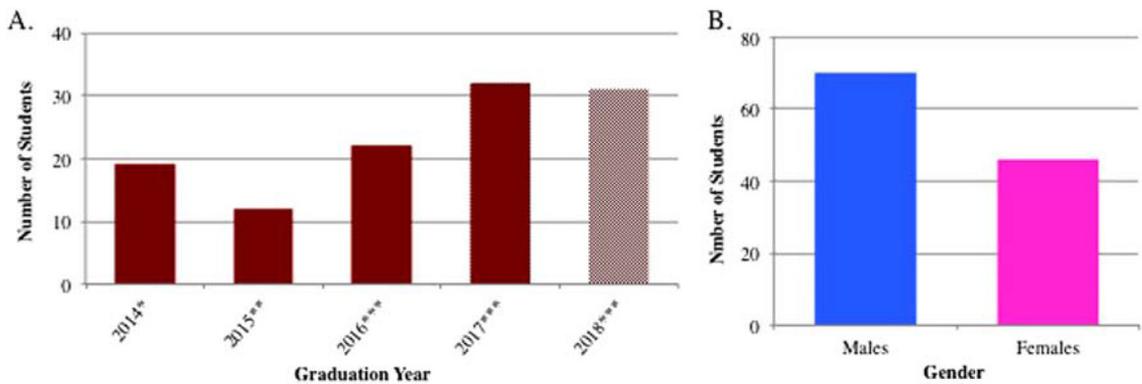


FIG 2. Interventions preferentially increase male medical student participation in flexible clinical radiology elective. (A) Number of UMMS medical students enrolling in flexible clinical experiences (FCEs) over years of intervention. * indicates first class to have third-year flexible clinical experiences (FCEs) options. ** indicates first class to have second-year preclinical curriculum and third-year FCEs options. *** indicate classes that have had first- and second-year preclinical curriculum and third-year FCEs options. Dotted pattern indicates projected enrollment data. (B) Number of male and female medical students that enrolled in FCEs from graduation years 2014-2018. (Color version of figure is available online.)

radiology 28% higher after the panel compared to before the panel (77% vs. 49%, respectively). This change was a statistically significant difference ($p = 0.008$) (Fig 3A). Female medical student perceptions of work-life balance improved 14% after the panel compared to before the panel (86% vs. 71%, respectively; $p = 0.2$) (Fig 3A). After the panel, the students were 14% more likely to consider a career in radiology compared to before the panel (71% vs. 57%, respectively; $p = 0.09$) (Fig

3A). After the panel, 71% of female medical students stated that they wanted to take a clinical elective in radiology, while 29% stated they would consider it (Fig 3B).

Stratification of UMass radiology faculty by gender demonstrates that the majority of faculty were male (72% male vs. 28% female). Furthermore, separation of radiologists by both gender and seniority reveals that there were fewest numbers of female junior faculty (Fig

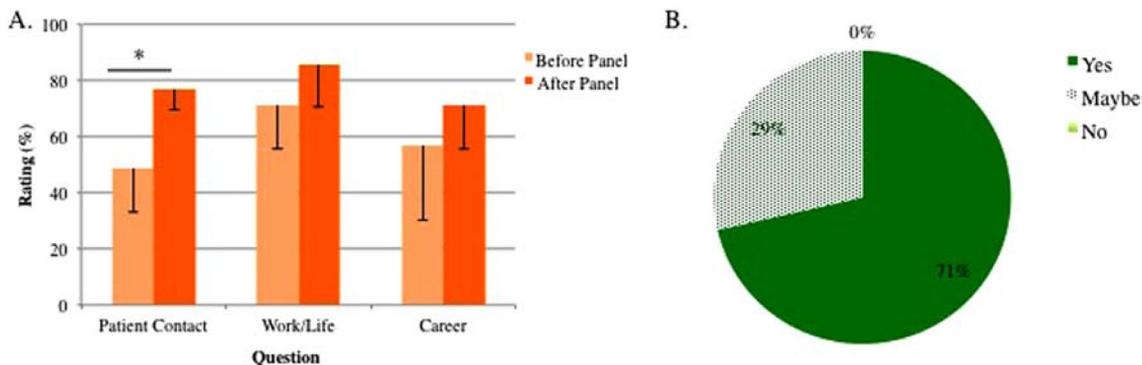


FIG 3. ‘Women in Radiology’ panel increases female medical student perception of patient contact in radiology and increases interest in clinical radiology electives. (A) Average female medical student before-panel and after-panel ratings on amount of patient contact. Work-life balance and how much they were considering a career in radiology. Mean ratings with standard deviations are shown. $n = 7$. * $P < 0.05$ by paired Student’s t -test. (B) Percentage of female medical students interested in enrolling in clinical radiology electives alter the panel. (Color version of figure is available online.)

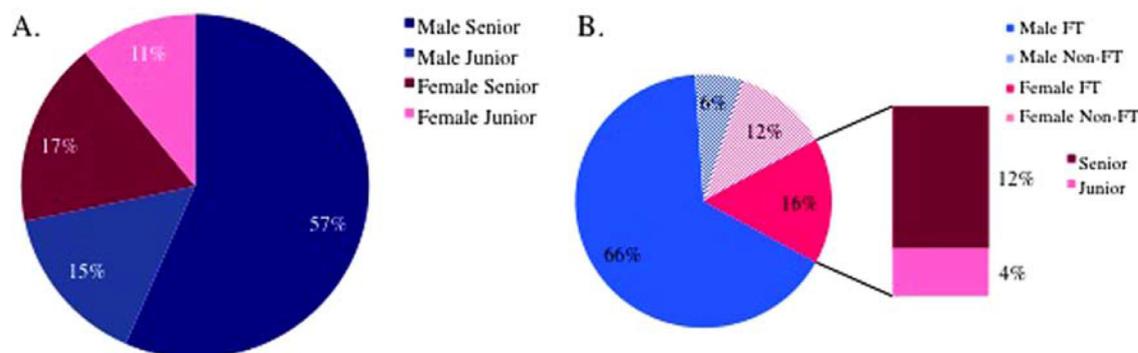


FIG 4. Fewer UMMS female faculty radiologist are both junior faculty and work full-time. (A) Percentages of male and female faculty radiologists by senior and junior faculty position. “Junior” faculty position is defined 5 years or less as an attending physician. (B) Percentages of male and female faculty radiologist by full-time (FT) and non-full-time (non-FT) employment. “Full-time” is defined as 40+ hours per week employment. “Non-full-time” is defined as less than 40 hours per week or per diem employment. Female full-time faculty are further stratified by senior or junior position. (Color version of figure is available online.)

4A). Junior faculty was defined as 5 years or less as an attending physician. Stratification of radiology faculty by full-time or non-full-time designation demonstrates that men were much more likely than women to be full-time employees (66% vs. 16%, respectively) (Fig 4B). Full-time employment was defined as 40 hours or more of work per week. Of the female radiologists that were full-time employees, only 5% were junior faculty (Fig 4B).

Discussion

The preliminary findings suggest that early exposure during preclinical education increases overall medical student interest in radiology. This interest is evidenced by a relative increase in number of medical students matching into radiology and greater medical student participation in radiology electives. Medical school classes with intervention starting in the first year of medical school saw the greatest impact in increasing interest and match rates. Not surprisingly, early preclinical exposure did not affect female students more than male students. In fact, early exposure to radiology appears to have actually affected male medical students preferentially. A greater number of male medical students have matched into radiology since the intervention, while the number of female students remains similar to that of previous years.

Although FCEs stressing patient contact were predicted to increase female interest in radiology, our preliminary findings demonstrate that male students are more often enrolling in these electives. This may have been the unintentional effect of one male radiologist leading the majority of preclinical lectures. Visibility of a male radiology attending may cause gender bias among medical students and lead more males to seek out opportunities in radiology. This bias may also be responsible for the increase in male medical students matching into radiology since the start of the intervention. Overall, this data suggests that simply offering “patient-centered” electives is not enough, despite what is suggested in the literature, rather, more needs to be done to actively address female medical student concerns about radiology.^{5,6} A noticeable drop in enrollment occurred in the class of 2015. As this occurred throughout different types of electives and in isolation to this class, the drop in enrollment can be attributed to a general disinterest in radiology for this cohort of students (Fig 2). As data from other classes demonstrates a consistent trend in increased participation, this class’ participation was considered outlier data. It is important to note that female faculty visibility (as outlined in the method and materials section) did not increase in the medical school until during the 2015 year.

The ‘Women in Radiology’ panel was the first event held at this institution to explicitly promote female radiology faculty. Just one event highlighting and sharing female radiologists’ experiences statistically significantly improved female medical student

perspectives on patient contact within radiology ($p = 0.008$) (Fig 3). As lack of patient contact was cited the greatest barrier to choosing a career in radiology, this change has potentially important downstream ramifications. In fact, female medical students who attended the panel were more interested in taking radiology clinical electives and overall interest in a career in radiology increased, although not by a statistically significant margin. This lack of statistical significance may be due to selection bias. Female medical students who chose to attend this type of event may have already had an interest in a career in radiology. Of note, the average before-panel rating of interest in a career in radiology was 57%, which is high, particularly when compared to another study, which showed 12 of 123 (9.7%) women ultimately pursuing radiology.⁴ Female medical students had a relatively positive perspective on work-life balance in radiology before the panel. Hearing about female radiology faculty’s day-to-day lives further improved female students’ perspective of work-life balance in radiology ($p = 0.2$). Additionally, 71% of female medical students who attended the panel stated they wanted to take a clinical radiology elective in the future – while the other 29% stated they were considering it. In order to reach a broader population, visibility of female radiologists geared toward all female medical students is needed. Future endeavors may include integration of female radiologist lecturers into the standard medical student curriculum. In addition to the increased female faculty presence in AMWA events that already began occurring in 2015, more collaborative events between female radiologists and female-oriented medical student organizations (eg, AMWA, AAMC’s group for women in medicine, and Association of Women Surgeons) need to occur to further female medical student recruitment to radiology. Further studies are needed to continue to quantify the effects of female radiologist visibility and evaluate the effect on future match rates of female medical students. A 3-year long study has already been initiated at UMass to see the effect of increase visibility of female radiology to medical students has on their perceptions and interest in radiology.

Of note, one limitation to these efforts is the low number of female faculty (28% female vs. 72% male) available to participate in these events. The analysis of radiology faculty at UMass recapitulates the national trend of limited female faculty. Furthermore, it has been suggested that junior faculty in particular are more likely to successfully engage in mentorship, as female medical students see them as more approachable.⁸ Thus, relatively low numbers of female junior faculty (11% of total faculty) may also be a significant barrier. This issue of underrepresentation of female faculty radiologists is compounded when accounting for full-time vs. non-full-time employment. With only two full-time female junior faculty radiologists at UMass, visibility of these radiologists without active publicity is extremely low and

opportunities for teaching and mentorship are limited. Although analysis of faculty radiologists was only performed for the 2016–2017 academic year, these findings highlight the need for future interventions to have active female junior faculty visibility.

Other limitations of the study include the short duration of intervention, the inclusion of tentative enrollment data for the class of 2018 and the multifaceted interventional approach. As the electives were established only 2 years ago and only one ‘Women in Radiology’ event has been held, the impact of the intervention is likely not fully realized. This initial report of findings is aimed at sharing the immediate findings of intervention and guiding future modifications to the educational plan. The tentative data for the class of 2018 was included in this study because it was thought to be reflective of student interest for the upcoming year; however, it is important to note that tentative enrollment is subject to change throughout the year and may alter final. A multifaceted educational intervention was implemented to yield more significant change to the current medical student perception of radiology; however, the multiple changes simultaneously limit our understanding of which aspect of intervention was most effective in increasing interest. Further studies are needed to more fully understand female medical student interest and their response to female-directed interventions.

Conclusion

The preliminary findings suggest that early exposure during preclinical education increases overall medical student interest in radiology, not specifically female interest. This increase in interest occurred preferentially in males despite the fact that the “patient-centered” electives were intended to appeal to female medical students – demonstrating that simply offering the electives is not

enough, as suggested in prior studies. As one event highlighting female radiologists had a statistically significant impact on female medical student perspectives on patient contact within radiology, these type events are crucial to exposing female medical students to the field of radiology. Required visibility and active publicity of female radiologists are likely to have the biggest impact in increasing female medical student interest. Further studies are needed to continue to quantify the effects of female radiologist involvement and evaluate the effect on future match rates of female medical students.

References

1. Young A, Chaudhry HJ, Pei X, et al. “A census of actively licensed physicians in the United States, 2014”. *J Med Regulat* 2014;101(2):8–23.
2. Lautenberger DM, Dandar VM, Raezer CL, et al. “The State of Women in Academic Medicine: the Pipeline and Pathways to Leadership”. Association of American Medical Colleges; 2014.
3. Frank E, Vydareny K. “Characteristics of women radiologists in the United States”. *Am J Roentgenol* 1999;173(3):531–6.
4. Branstetter BF, Faix LE, Humphrey AL, et al. “Preclinical medical student training in radiology: the effect of early exposure”. *Am J Roentgenol* 2007;188(1):W9–W14.
5. Grimm LJ, Ngo J, Pisano ED, et al. Men (and women) in academic radiology: how can we reduce the gender discrepancy? *Am J Roentgenol* 2015;206(4):678–80.
6. Potterton VK, Ruan S, Sunshine JH, et al. “Why don’t female medical students choose diagnostic radiology? A review of the current literature”. *J Am Coll Radiol* 2004;1(8):583–90.
7. Fielding JR, Major NM, Mullan BF, et al. “Choosing a specialty in medicine: female medical students and radiology”. *Am J Roentgenol* 2007;188(4):897–900.
8. Hoffmann JC, Flug JA. “A call to action for medical student mentoring by young radiologists”. *Curr Probl Diagn Radiol* 2016;45(2):153–4.
9. National Resident Matching Program, Results and Data: 2015–2009 Main Residency Match®. Washington, DC: National Resident Matching Program, 2015–2009.
10. Gunderman RB, Houk JL. “The importance of role models in increasing women in radiology”. *Acad Radiol* 2017;24(2):230–1.