Emerg Radiol (2017) 24:641–644
DOI 10.1007/s10140-017-1510-x

ORIGINAL ARTICLE

Assessing the gap in female authorship in the journal *Emergency Radiology*: trends over a 20-year period

Kristopher McKenzie[1] · **Milita Ramonas**[2] · **Michael Patlas**[3] · **Douglas S. Katz**[4]

Received: 21 February 2017 / Accepted: 20 April 2017 / Published online: 12 May 2017
© American Society of Emergency Radiology 2017

Abstract
Purpose To examine trends in female authorship in the journal *Emergency Radiology* from January 1994 to December 2014.
Methods We obtained institutional review board approval for our study. We retrospectively reviewed a total of 1617 articles published in the journal *Emergency Radiology* over a 20-year period. Original articles, case reports, review articles, and pictorial essays were included. The first and last position author's gender was categorized as female or male. We analyzed trends by comparing the first and last position authors of original articles from the first and last year reviewed. We utilized Chi-square test for statistical analysis, with a p value <0.05 noted as significant.
Results One thousand four hundred twenty articles met our inclusion criteria. There were 1420 first position authors and 1295 last position authors. There were 125 articles that had a sole author—these authors were considered as first position authors only. We determined, as best as possible, the gender of 96% of the authors. Overall, female authors were 21% of first position authors (290 of 1368) and 15% of last position authors (183 of 1246). Thirty-two percent of articles with female last position authors also had female first position authors (58 of 183). There was a statistically significant increase in female last position authors, from 12.9% in 1994 to 21.3% in 2014 ($p = 0.026$), a non-significant increase in female first position authors, from 17.5% in 1994 to 20.9% in 2014 ($p = 0.514$), and a non-significant increase in articles with both a first and last female author, from 25% in 1994 to 35% in 2014 ($p = 0.593$).
Conclusion Over the last 20 years, there has been a statistically significant upward trend in female last position authors publishing in the journal *Emergency Radiology*.

Keywords Gender · Authorship · Emergency radiology

Introduction

Women comprise almost half of all medical school graduates in the USA [1], and greater than half of all medical school graduates in Canada. However, as of 2004, women represented only 27% of residents in US radiology training programs [2]. In Canada, the proportion is similar [3]. In 2010, the overall percentage of practicing US female radiologists was 27% [4]. Additionally, the proportion of women that hold faculty positions at US medical schools is also lower than would be expected. For example, in 2012, women comprised only 28% of all US medical school faculty members [5].

Despite increases in the number of women practicing medicine, previous studies have shown that women continue to lag behind their male counterparts when it comes to involvement in academia and advancement to senior faculty positions [6, 7]. Baker et al. found that the percentage of chairwomen at US training programs barely increased from 8% in 2001 to 10% in 2014 [8]. Additionally, the overall proportion of women in

✉ Michael Patlas
patlas@hhsc.ca

[1] Department of Radiology, St Joseph Mercy Oakland Hospital, Pontiac, MI, USA

[2] Department of Radiology, McMaster University, Hamilton, ON, Canada

[3] Division of Emergency/Trauma Radiology, Department of Radiology, McMaster University, Hamilton General Hospital, 237 Barton Street East, Hamilton, ON L8L 2X2, Canada

[4] Department of Radiology, NYU Winthrop Hospital, Mineola, NY, USA

radiology has remained stagnant over the past several decades [9]. Nonetheless, there has been a corresponding trend of increasing authorship of radiology publications by women [9].

In 2015, Yun et al. demonstrated that in the *American Journal of Roentgenology* and in *Radiology*, there has been a significant increase in female authorship of original articles between the time periods of 1991–1993 and 2011–2013 [9]. Also in 2015, Liang et al. found similar trends when they reviewed four general radiology journals: *Radiology*, the *American Journal of Roentgenology*, *European Radiology*, and *Investigative Radiology*, and found that women constituted 20% of overall authors, including 24.7% of first position authors and 15.2% of last position authors [10]. Thus, in radiology, the proportion of women actively publishing, as demonstrated by first position authorship, has closely mirrored their presence in the radiology workforce, whereas last position or senior authorship has remained lower [10]. First position authors are typically younger radiologists or radiologists in training, whereas last position authors typically hold more advanced faculty positions. Last position authors tend to already have established research portfolios and are well suited to serve as mentors for younger radiologists.

We sought to determine whether the trends observed by others in general radiology was also true when looking at female authorship in subspecialty radiology. By examining the first and last position authors of publications in the journal *Emergency Radiology*, we also attempted to gain insight into the landscape of the specialty of radiology in general.

Methods

We obtained institutional review board approval for our study. We then retrospectively reviewed a total of 1617 articles published in the journal *Emergency Radiology* from 1994 to 2014. Original articles, case reports, review articles, and pictorial essays were all included. Letters, acknowledgements, communications, commentaries, editorials, status reports, book reviews, technical notes, annual meeting reports, proceedings, point counterpoints, clinical quizzes, challenge cases, and abstract reviews were excluded from analysis. Each author's gender for the included articles was categorized as male or female using the knowledge of basic names that are commonly associated with gender such as Anna for female and John for male. For less common names, a Google search was performed with each such author's name. The first 30 search listings were examined in an attempt to determine the gender of the author. If the gender was still uncertain, the author was excluded. We analyzed trends by comparing the first and last position authors of original articles from the first and last year reviewed. Statistical tests were performed using a standard, commercially available statistical package (SPSS, Armonk, NY) and Microsoft Excel (Microsoft, WA). Analysis was performed using Chi-square analysis. A p value <0.05 was considered statistically significant.

Results

Of the 1617 articles we reviewed, there were 1420 articles fulfilling the inclusion criteria. There were a total of 1420 first position authors and 1295 last position authors. There were 125 articles that had a sole author—these authors were considered as first position authors only. We were able to determine, as best as possible, the gender of 96% of first position authors (1368 of 1420) and 96% of last position authors (1246 of 1295). Of the articles we reviewed, 44% were original research articles (601 of 1368), 37% were case reports (500 of 1368), 11% were review articles (149 of 1368), and 8% were pictorial essays (118 of 1368). Overall, female authors were 21% of first position authors (290 of 1368) and 15% of last position authors (183 of 1246). Thirty-two percent of the articles with female last position authors also had female first position authors (58 of 183). The increase in female first position authors throughout the 20 years examined did not reach statistical significance, from 17.5% in 1994 to 20.9% in 2014 ($p = 0.514$) (Fig. 1). There was, however, a statistically significant increase in female last position authors, from 12.9% in 1994 to 21.3% in 2014 ($p = 0.026$) (Fig. 2). There was a non-significant increase in the number of articles that had both a first and last position female author, from 25% in 1994 to 35% in 2014 ($p = 0.593$) (Fig. 3).

Discussion

To the best of our knowledge, we have performed the first study investigating female representation in a subspecialty radiology journal, and in particular in emergency radiology. We chose to review articles specifically in emergency radiology, as it is a growing area of interest among newly trained

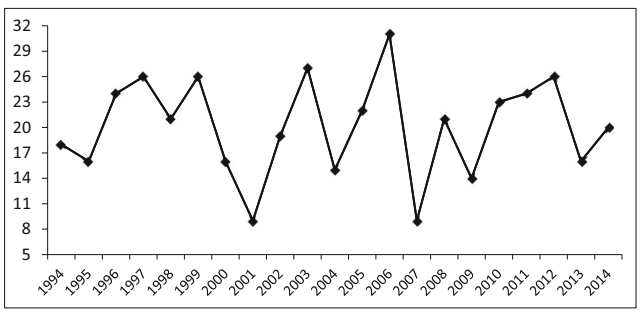

Fig. 1 The percentage of original articles with female first position authors published in the journal *Emergency Radiology* from 1994 to 2014. Each *box* represents the percentage of female authors in that given year. The *vertical axis* represents the percentage of female authors. The *horizontal axis* represents the year

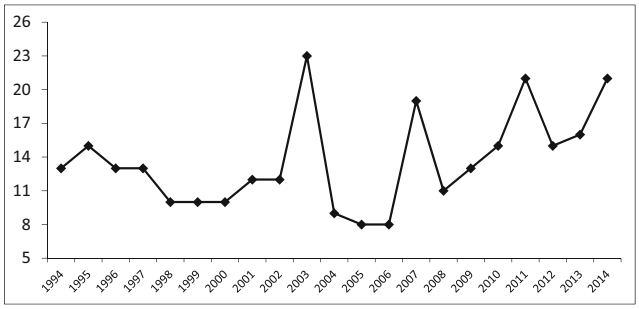

Fig. 2 The percentage of original articles with female last position authors published in the journal *Emergency Radiology* from 1994 to 2014. Each *box* represents the percentage of female authors in that given year. The *vertical axis* represents the percentage of female authors. The *horizontal axis* represents the year

radiologists, especially among women. Emergency radiology provides increased scheduling flexibility and the potential for more time to be spent during the daylight hours with children and family. Additionally, one could argue, that there is an increased collaboration with other medical specialties pertaining to emergency care, such as emergency medicine and acute care surgery, compared with the extent of collaboration other radiology subspecialties with corresponding clinical services. Finally, the acuity of the cases encountered in emergency radiology practice likely plays a role in the increasing interest among newly trained radiologists.

There was a statistically significant increase in female last position authors from 1994 to 2014. Last position authors are typically the most senior and often responsible for academic supervision of the project [11]. The last author position is regarded by many as the most prestigious author position on a published manuscript. Thus, the significant upward trend is strongly suggestive of increased advancement of women to senior academic radiology positions. Prior studies have shown a higher percentage of first authorship than senior authorship by women of radiology publications [10]. The proposed explanation for this was that there was a higher number of

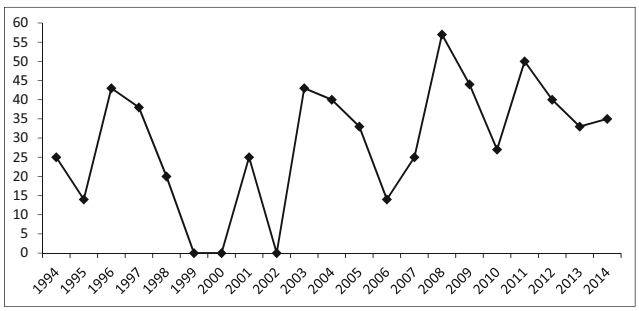

Fig. 3 The percentage of original articles with both a female first and last position author published in the journal *Emergency Radiology* from 1994 to 2014. Each *box* represents the percentage of original articles with a female first and last author in that given year. The *vertical axis* represents the percentage of articles with both a female first and last author. The *horizontal axis* represents the year

trainees serving as first position authors, and the lower proportion of female last position authors was thought to be secondary to a smaller proportion of female senior faculty members [10]. However, our study showed that first and last female authors were similar in percentage and that the percentage of female last position authors increased. The percentage of female first position authors also increased, but not at a statistically significant level. We expected that the percentage of first position authors would remain relatively stable, as the proportion of women in radiology training programs has remained largely unchanged for several years.

Although the overall proportion of female authors has increased in recent years, there remains a gap between the proportion of women in the radiology workforce (27%) and the proportion of women who are publishing [10]. The findings of our study are consistent with other studies looking at gender proportions in general radiology publications. It is difficult to understand why there still exists a gap between the percentage of women in practice and the percentage of women that are publishing.

It is becoming more common for residency programs to require residents to complete research projects as part of the required curriculum. This should lead to more resident participation in research and represents an opportunity for both senior female as well as male radiologists to mentor younger women in training. Finally, as the cohorts of younger radiologists—those with a higher proportion of female radiologists—advance through their careers, it should be expected that we will begin to see more female last position authors, as they begin to occupy more senior positions within their departments and groups.

The proportion of women practicing in different medical specialties is currently not equal. Women more commonly prefer specialties such as family medicine, pediatrics, and obstetrics and gynecology [12, 13]. These are all specialties which place the emphasis on patient care and forming long-lasting relationships with patients. In radiology, there are fewer opportunities for such long-lasting patient interactions, but many female medical students do not necessarily realize the positive impact which radiologists can have on our patients. The common misconception that radiologists spend their entire days sitting in a dark room is easily debunked when the student is exposed to a busy emergency, musculoskeletal, pediatric, or body imaging practice. Accounting for institutional differences regarding the division of image-based procedures, there are many opportunities in each of these subspecialties for both diagnostic and therapeutic procedures which involve patient interaction. Although these interactions are usually brief, they are almost always positive. This is why it is again important to expose more medical students to radiology early in their training and to pair them with strong mentors who can allow them to truly understand why radiology is a great specialty. As they become more aware of the collaborative nature of the specialty, we should see a corresponding increase in interest by women, which should eventually translate to more

women becoming involved in academic radiology and, thus, more women publishing.

Study limitations

The publications selected for our study only included a single journal, *Emergency Radiology*. Our findings may therefore not be a representative of all imaging and clinical journals in which radiologists publish. Specifically, more data is needed to confirm if the trends we observed are similar to trends in other subspecialty radiology journals. Additionally, it is possible that gender assumption on the basis of the first names may have resulted in misclassification of a small number of authors. Furthermore, some of the authors included in our analysis may not be radiologists.

Conclusion

Over the last 20 years, there has been a statistically significant upward linear trend in female last position authorship in the journal *Emergency Radiology*, and a non-significant increase in female first authorship. This suggests advancement of women to more senior academic roles. There has also been a non-significant increase in the proportion of articles in the journal, with both a female first and last position author, which suggests increased academic female collaboration. Further study is needed to determine the trends in other radiology subspecialties.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

References

1. Barzansky B, Etzel SI (2006) Medical schools in the United States, 2005–2006. JAMA 296:1147–1152
2. Baker SR (2014) Women in radiology. Notes of a Radiology Watcher. Springer, pp 93-95
3. Canadian Medical Association (2015) Diagnostic Radiology Specialty Profile https://www.cma.ca/Assets/assets-library/document/en/advocacy/profiles/diagnostic-radiology-e.pdf. Accessed November 3, 2016
4. Boechat MI (2010) Women in pediatric radiology. Pediatr Radiol 40:484–487
5. Joliff L, Leadley J, Coakley E, Sloane RA (2012) Women in US academic medicine and science: statistics and benchmarking report, 2011–2012. Accessed July 21, 2016
6. Cydulka RK, D'Onofrio G, Schneider S, Emerman C, Sullivan L (2000) Women in academic emergency medicine. Acad Emerg Med 7:999–1007
7. Tesch BJ, Wood HM, Helwig AL, Nattinger A (1995) Promotion of women physicians in academic medicine: glass ceiling or sticky floor? JAMA 273:1022–1025
8. Baker SR, Barry M, Chaudhry H, Hubbi B (2006) Women as radiologists: are there barriers to entry and advancement? J Am Coll Radiol 3:131–134
9. Yun EJ, Yoon DY, Kim B, Moon JY, Yoon SJ, Hong SJ, Baek S (2015) Closing the gender gap: increased female authorship in AJR and Radiology. AJR 205:237–241
10. Liang T, Zhang C, Rohan K, Harris A (2015) Assessing the gap in female authorship in radiology: trends over the past two decades. J Am Coll Radiol 12:735–741
11. Katz DS, Gardner JB, Hoffmann JC, Patlas MN, Bhargava P, Moshiri M, Remer EM, Gould ES, Smith SE (2016) Ethical issues in radiology journalism, peer review, and research. Am J Roentgenol 207(4):820–825
12. Association of American Medical Colleges (2012) Center for Workforce Studies—2012 Physician Specialty Data Book
13. Potterton VK, Ruan S, Sunshine JH, Applegate K, Cypel Y, Forman HP (2004) Why don't female medical students choose diagnostic radiology? A review of the current literature. J Am Coll Radiol 1:583–590