



# Gender gap in articles published in *European Radiology* and *CardioVascular and Interventional Radiology*: evolution between 2002 and 2016

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Received: 22 May 2019 / Revised: 16 July 2019 / Accepted: 23 July 2019 / Published online: 10 September 2019

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## Abstract

**Objectives** To evaluate gender differences in the authorship of articles published in two major European radiology journals, *European Radiology* (EurRad) and *CardioVascular and Interventional Radiology* (CVIR).

**Methods** A retrospective bibliometric analysis was performed of 2632 papers published in EurRad and CVIR sampled over a period of 14 years (2002–2016). The authors' gender was determined. The analysis was focused on first and last authors. In addition, the characteristics of the articles (type, origin, radiological subspecialty, and country) were noted.

**Results** Overall, 23% of first authors and 10% of the last authors were women. The proportion of women significantly increased over time in EurRad from 22% in 2002 to 35% in 2016 for first authors ( $p > 0.001$ ), and from 13% in 2002 to 18% in 2016 for last authors ( $p = 0.05$ ). There was no significant increase in the proportion of female authors in CVIR over time. Female authors were more frequently identified in breast imaging (48%), pediatrics, and gynecological imaging (29%). There were more female authors in articles from Spain (34%), the Netherlands (28%), France, Italy, and South Korea (26%). Forty-one percent and 21% of women were first authors with a woman or man as last author, respectively ( $p < 0.001$ ).

**Conclusion** There was a significant increase in female authorship in original diagnostic but not interventional imaging research articles between 2002 and 2016, with a strong influence of the radiological subspecialty. Women were significantly more frequently first authors when the last author was a woman.

## Key Points

- There was a significant increase in female authorship in original diagnostic but not interventional imaging research articles between 2002 and 2016.
- There is a strong influence of the radiological subspecialty on the percentage of female authors.
- Women are significantly more frequently first authors when the last author is a woman.

**Keywords** Female · Authorship · Radiology · Bibliometrics · Publishing/statistics

**Electronic supplementary material** The online version of this article (<https://doi.org/10.1007/s00330-019-06390-7>) contains supplementary material, which is available to authorized users.

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## Abbreviations

CVIR *CardioVascular and Interventional Radiology*  
EurRad *European Radiology*

## Introduction

Over the past several decades, the participation of women in the field of medicine has increased dramatically. In 2011 and 2012, women represented 47.8% of medical school graduates in the USA, a significant increase from 6.9% in 1965 [1].

Reports are similar in European countries. Women represented 30% of first-year medical students in France in 1990 and 80% in 2015 [2], as well as 26% and 35% of radiologists in 1999 and 2017, respectively [2]. Overall, the percentage of female medical students and doctors in most European countries is now well within the 40–60% gender balance zone. Nevertheless, women are still under-represented in radiology [3] and among other specialists and significantly so among senior doctors and full professors [4].

Publishing articles is an important aspect of academic activity, and trends in female authorship could help understand the current status and future direction of women in academic medicine. Indeed, the first author of an article is usually a junior physician who is directly in charge of performing the research study, while the last or senior author is usually the head of the research team, who not only acts as a coordinator but also as a guarantor of study quality. Thus, the proportion of female first authors can provide an image of the overall involvement of women in research, while last authors represent the overall role of women in the structure and network of academic research. Thus, monitoring the evolution of the proportion of female authors over time and in different countries can provide valuable insight into the changing role of women in academic radiology.

Several recent studies have shown that women remain a minority among authors in various medical specialties [5–13]. Other studies in radiology have reported a significant increase in the number of female authors in academic publications [14–23]. Most of these studies have analyzed the North American academic radiology community or focused on American journals [14, 15, 18]. Data from European journals are scarce [20, 21].

The aim of this study was to evaluate the recent trends in gender differences in articles published in two major European radiology journals, *European Radiology* and *CardioVascular and Interventional Radiology*.

## Materials and methods

### Study setting and data analysis

This study was approved by the local IRB. Consent was not necessary due to the nature of the study. We performed a retrospective bibliometric analysis to evaluate the number of female and male authors in articles published in *European Radiology* (EurRad) and *CardioVascular and Interventional Radiology* (CVIR) from 2002 to 2016. We chose to evaluate these journals because they are highly visible, prestigious, widely circulated peer-reviewed publications with articles in both diagnostic and interventional imaging.

Articles were retrieved from online tables of content. The sample study period began in 2002, so that articles from 2002, 2006, 2011, and 2016 were analyzed. The gender of all

authors was determined for each of the articles. The author was considered to be both the first and last author in articles with a single author.

Gender was determined based on authors' first names, because many names are associated with one gender only (for example, Catherine for a woman and William for a man). When the first name was not available (initials only), unknown (due to the origin), or could correspond to either woman or man, the following steps were taken. First, we performed a Google search for the designated author using author affiliations. We searched for other publications from the same group of authors. We also visited institutional websites which sometimes include photographs or author's résumés. If an author's gender was still unidentified, we sent an email to the corresponding author. Finally, in the absence of a response, we asked colleagues from similar countries and language for help. Authors were excluded if their gender could not be determined at the end of this process.

We also determined the radiological subspecialty for each article from among the following categories: abdominal imaging, neuroradiology and ENT, musculoskeletal imaging, gynecological imaging, breast imaging, oncology imaging, chest imaging, cardiac imaging, genitourinary imaging, pediatric imaging, vascular and interventional imaging, and miscellaneous (including radiation protection, forensics, whole-body imaging, nuclear medicine, physics, basic science, radiation oncology, contrast media, endocrinology and hematology). "Oncologic imaging" corresponded to an article dealing with cancer without favoring one organ (e.g., diffuse metastatic disease or pre-clinical tumor models). The country of the authors was noted.

One hundred articles were first independently reviewed by two radiologists (CB, RP) to ensure the consistency of data abstraction. These two radiologists then extracted data from the retrieved articles. Difficult cases were decided by consensus under the supervision of the study coordinator (MR).

### Statistical analysis

Categorical variables are expressed as count and percentages, and continuous variables as means and standard deviations. We analyzed the evolution of the gender of the first and last authors over time, the ratio of women to men, and the proportion of female authors for each journal during each study period by radiological subspecialty and country of origin. We also examined the association between the gender of the first and last authors. All statistical analyses were performed using the chi-square test with SPSS software (version 19.0 for Windows, SPSS), and  $p < 0.05$  was considered to be statistically significant.

## Results

A total of 2632 articles were identified (1722 in *European Radiology* and 910 in CVIR). Two hundred ninety-five (11.2%) of these were excluded because the gender of both the first and last authors could not be identified. Thus, a total of 2337 articles were included in the study, 1466 from *European Radiology* and 871 from CVIR. There were 383, 581, 591, and 782 articles from 2002, 2006, 2011, and 2016, respectively. Table 1 summarizes the articles.

### Gender of the first and last authors

The gender of 2315 first authors and 2208 last authors was determined. The gender of both authors was determined in 2186 articles. The gender of all authors was determined in 2325 articles. For the entire study period, 532/2315 (23%) and 265/2208 (12%) first and last authors were women, respectively. The proportion of female first author was significantly higher than that of female last author ( $p < 0.001$ ). In particular, 406/1453 (28%) and 222/1386 (16%) first and last authors, respectively, were women in *European Radiology*, and 126/862 (15%) and 43/822 (5%) first and last authors were women, respectively, in CVIR. There were significantly more female authors in *European Radiology* than in CVIR ( $p < 0.001$  and  $p < 0.001$  for first and last authors, respectively).

The proportion of female first authors increased significantly from 19% (72/383) in 2002 to 28% (216/770) in 2016 ( $p < 0.0001$ ) in both journals combined, while the increase in female last authors (from 11% (38/353) to 14% (103/754) ( $p = 0.10$ )) was not significant (Table 2). The increase in the proportion of female authors was found to be significant for both the first and last authors in *European Radiology* (increasing from 22% (63/291) and 13% (35/266) in 2002 to 35% (172/491) and 18% (90/488) in 2016, respectively;  $p = 0.0001$  and  $p = 0.050$ ). There was no significant difference in the proportion of female authors in CVIR over time, with 10% (9/92) and 3% (3/87) in 2002, and 16% (44/279) and 5% (13/266) of female first and last authors in 2016, respectively ( $p = 0.50$  and  $p = 0.65$ ) (Fig. 1, Table 2).

### Proportion of female authors per article

The average proportion of female authors per article in the 2325 articles in which the gender of all authors was identified was  $19.7 \pm 22\%$ . This percentage was  $23.3 \pm 24\%$  in *European Radiology* and  $13.6 \pm 17\%$  in CVIR ( $p < 0.001$ ). The distribution of the number of articles was highly skewed towards articles with the lower rates of female authors (skewness  $1.95 \pm 0.69$ ). Indeed, 61 % of the articles had fewer than 20% female authors. There were more female than male authors in 6.3% of all articles. Table 3 summarizes the number of

**Table 1** Characteristics of the 2337 articles included in the analysis

Journal	
<i>European Radiology</i>	1463 (62.7%)
<i>CardioVascular and Interventional Radiology</i>	871 (37.3%)
Year	
2002	381 (16.3%)
2006	586 (25.1%)
2011	589 (25.2%)
2016	778 (33.3%)
Gender of first author identified ( $n = 2305$ )	
Female	532 (23%)
Male	1783 (77%)
Gender of last author identified ( $n = 2208$ )	
Female	265 (12%)
Male	1943 (88%)
Gender of first and last authors ( $n = 2186$ )	
Female + female	107 (4.9%)
Female + male	408 (18.6%)
Male + female	157 (7.2%)
Male + male	1514 (69.3%)
Type of article ( $n = 2331$ )	
Original study	1414 (60.6%)
Review article	200 (8.6%)
Editorial	66 (2.8%)
Case report	339 (14.5%)
Letter	157 (6.7%)
Guidelines	15 (< 1%)
Other	155 (6.6%)
Radiology subspecialty	
Interventional	508 (21.7%)
Abdominal	476 (20.4%)
Neuro/head and neck	260 (11.1%)
Musculoskeletal	193 (8.3%)
Genitourinary	157 (6.6%)
Cardiovascular	136 (5.8%)
Other	116 (5.0%)
Breast	105 (4.5%)
Pediatrics	77 (3.3%)
Chest	162 (2.7%)
Gynecological	57 (2.4%)
Radiation	49 (2.1%)
Oncology	31 (1.3%)
Endocrinology	5 (< 1%)
Forensic	5 (< 1%)

articles per decile of female proportion (i.e., per increment of 10% of female author).

The average proportion of female authors was associated with the gender of the first and last authors. Indeed, 107, 565, and 1514 articles had women as both first and last, either first or last, and neither first nor last authors, respectively

**Table 2** Evolution of the proportion of female authors in article published in *European Radiology* and CVIR from 2002 to 2016

	2002	2006	2011	2016	<i>p</i> value
<i>European Radiology</i>					
First author	63/291 (22%)	73/351 (21%)	98/320 (31%)	172/491 (35%)	< 0.001
Last author	35/266 (13%)	41/325 (13%)	56/307 (18%)	90/488 (18%)	0.05
<i>p</i> value first vs. last	0.010	0.005	< 0.001	< 0.001	
CVIR					
First author	9/92 (10%)	31/224 (14%)	42/267 (16%)	44/279 (16%)	0.50
Last author	3/87 (3%)	10/210 (5%)	17/259 (7%)	13/266 (5%)	0.65
<i>p</i> value first vs. last	0.134	0.002	< 0.001	< 0.001	
Comparison between <i>European Radiology</i> and CVIR					
First author	0.010	0.035	< 0.001	< 0.001	
Last author	0.009	0.002	< 0.001	< 0.001	

( $p < 0.001$ ). The average proportion of female authors was found to be  $63 \pm 23\%$ ,  $36 \pm 17\%$ , and  $12 \pm 15\%$  in these three categories, respectively ( $p < 0.001$ ).

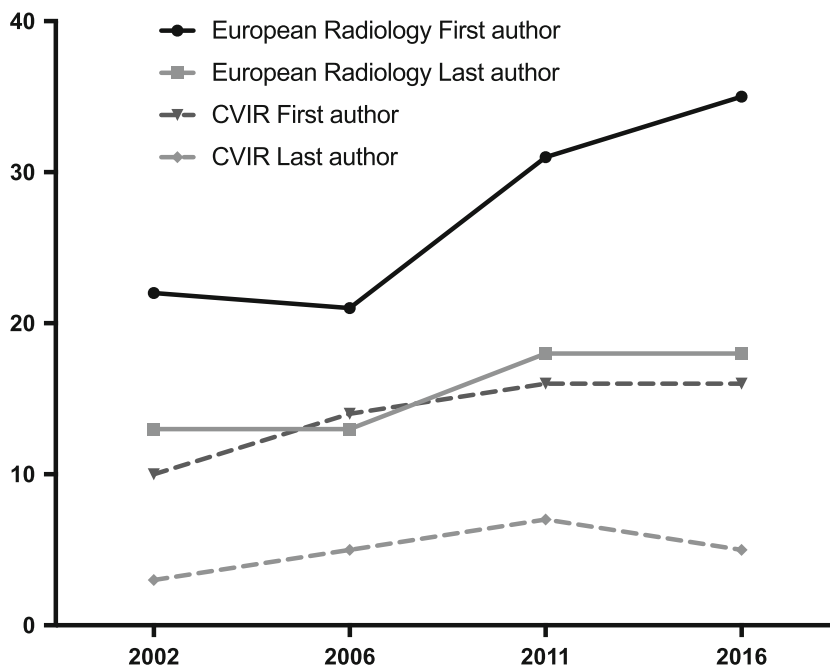
### Association between the gender of the first and last authors

A significant association was found between the gender of the first and last authors in the 2186 articles in which the gender of both the first and last authors was identified (Table 4). Overall, 41% and 21% of first authors were women when the last author was a woman or a man, respectively ( $p < 0.001$ ). This association was strong in articles published in *European Radiology* ( $p < 0.001$ ) but not in CVIR ( $p = 0.51$ ).

### Influence of country

We limited this analysis to countries with at least 30 published articles. Sixteen countries met this criterion and are listed in Table 5. Female authors had the highest representation of first and last authors in the Netherlands (33%), China (30%), South Korea (28%), France (23%), Austria (22%), Spain (22%), and Turkey (20%). Female authors had the lowest representation in Japan (8%), Switzerland (12%), Germany (13%), Italy (14%), and the USA (15%) (Table 5). Figure 2 shows the proportion of women among all authors in these countries. There is no relationship between the number of published articles and the proportion of women among authors.

**Fig. 1** Proportion of first female authors and last female authors among articles published in *European Radiology* and CVIR between 2002 and 2016. The evolution was found to be statistically significant for first authors for *European Radiology* ( $p < 0.001$ ) but not for CVIR ( $p = 0.50$ ). The evolution was found to be statistically significant for last authors for *European Radiology* ( $p = 0.05$ ) but not for CVIR ( $p = 0.65$ )



**Table 3** Articles per decile of average female proportion per article published in *European Radiology* and CVIR

	Decile									
	0–10%	11–20%	21–30%	31–40%	41–50%	51–60%	61–70%	71–80%	81–90%	91–100%
<i>European Radiology</i>										
Total (n = 1457)	517 (36)	262 (18)	200 (14)	185 (13)	147 (10)	53 (4)	35 (3)	26 (2)	10 (1)	22 (2)
2002 (n = 289)	134 (46)	51 (18)	20 (7)	32 (11)	28 (10)	8 (3)	3 (1)	5 (2)	–	0 (3)
2006 (n = 354)	152 (42)	72 (20)	43 (12)	40 (11)	27 (8)	9 (3)	4 (1)	3 (1)	2 (< 1)	2 (< 1)
2011 (n = 321)	107 (33)	59 (18)	45 (14)	46 (14)	30 (9)	9 (3)	12 (4)	2 (< 1)	4 (1)	(7 2)
2016 (n = 493)	124 (25)	80 (16)	92 (18)	67 (14)	62 (13)	27 (6)	16 (3)	16 (3)	4 (1)	5 (1)
CVIR										
Total (n = 868)	449 (52)	182 (21)	102 (12)	78 (9)	32 (4)	4 (< 1)	8 (1)	9 (1)	–	4 (< 1)
2002 (n = 91)	54 (59)	14 (15)	11 (12)	9 (10)	2 (2)	–	–	–	–	1 (1)
2006 (n = 227)	126 (56)	48 (21)	21 (9)	19 (8)	9 (4)	2 (1)	2 (1)	–	–	–
2011 (n = 268)	138 (52)	57 (21)	34 (13)	23 (9)	11 (4)	–	2 (< 1)	2 (< 1)	–	1 (< 1)
2016 (n = 282)	131 (47)	63 (22)	36 (13)	27 (10)	10 (4)	2 (< 1)	4 (1)	7 (3)	–	2 (< 1)

Only articles with gender identified for all authors are included here

CVIR, CardioVascular and Interventional Radiology

Number in brackets are percentages

### Influence of imaging subspecialty

The proportion of female authors in diagnostic and interventional radiology publications differed. Indeed, there were significantly more female authors in diagnostic radiology articles, with 29% and 16% of first and last authors, respectively, than in interventional radiology publications with 15% and 6% of first and last author authors, respectively ( $p < 0.001$ ).

Women were most strongly represented in the radiological subspecialties of breast imaging (56% and 33% of first and last authors, respectively), gynecological imaging (34% and 18%), and pediatric imaging (34% and 24%). In contrast, the lowest proportion of female authors was found in vascular

imaging (12% and 5%) and genitourinary imaging (19% and 10%) (Fig. 3). Supplemental Figures 1 and 2 show the proportion of female first and last authors per imaging subspecialty and over time.

### Discussion

We retrospectively reviewed more than 2600 articles published over a period of 14 years in two of the main European radiology journals and found that despite a significant increase in the proportion of female first and last authors over time, female authors were still in the minority. We also observed a

**Table 4** Association between the gender of the first and last authors

First author	Last author														
	2002			2006			2011			2016			Total		
	Female	Male	p	Female	Male	p	Female	Male	p	Female	Male	p	Female	Male	p
<i>European radiology</i>															
	N = 35	N = 231		N = 41	N = 281		N = 56	N = 249		N = 89	N = 391		N = 221	N = 1152	
Female	11 (31)	49 (21)	0.20	7 (17)	63 (22)	0.55	31 (55)	65 (26)	< 0.001	50 (56)	118 (30)	< 0.001	99 (45)	295 (26)	< 0.001
Male	24 (69)	182 (79)		34 (83)	218 (78)		25 (45)	184 (74)		39 (44)	273 (70)		122 (55)	857 (74)	
CVIR															
	N = 3	N = 84		N = 10	N = 197		N = 17	N = 240		N = 13	N = 249		N = 43	N = 770	
Female	0 (–)	8 (10)	1.00	1 (10)	28 (14)	1.00	3 (18)	39 (16)	0.75	4 (31)	38 (15)	0.14	8 (19)	113 (15)	0.51
Male	3 (100)	76 (90)		9 (90)	169 (86)		14 (82)	201 (84)		9 (69)	211 (85)		35 (81)	657 (85)	
Total															
	N = 38	N = 315		N = 51	N = 478		N = 75	N = 489		N = 102	N = 640		N = 264	N = 1922	
Female	11 (29)	57 (18)	0.13	8 (16)	91 (19)	0.71	34 (47)	104 (21)	< 0.001	54 (53)	156 (24)	< 0.001	107 (41)	408 (21)	< 0.001
Male	27 (71)	258 (82)		43 (84)	387 (81)		39 (53)	385 (79)		48 (47)	484 (76)		157 (59)	1514 (79)	

The 2186 articles with identified gender of both the first and last authors were included in this analysis

CVIR, CardioVascular and Interventional Radiology



**Table 5** Country-wise differences in the proportion of first and last female authors among articles published in *European Radiology* and *CVIR*

	First author	Last author	Sum
Austria	21/71 (30%)	9/65 (14%)	30/136 (22%)
Belgium	11/45 (24%)	4/39 (10%)	15/84 (17%)
China	18/40 (45%)	7/44 (16%)	25/84 (30%)
France	42/166 (25%)	32/162 (20%)	74/328 (23%)
Germany	83/413 (20%)	21/393 (5%)	104/806 (13%)
Greece	11/45 (24%)	5/44 (11%)	16/89 (18%)
Italy	31/166 (19%)	15/159 (9%)	46/325 (14%)
Japan	21/182 (12%)	9/181 (5%)	30/363 (8%)
South Korea	50/136 (37%)	24/125 (19%)	74/261 (28%)
Spain	17/72 (24%)	14/69 (20%)	31/141 (22%)
Sweden	10/33 (30%)	2/32 (6%)	12/65 (18%)
Switzerland	12/83 (15%)	8/83 (10%)	20/163 (12%)
The Netherlands	50/112 (45%)	21/106 (20%)	71/218 (33%)
Turkey	17/73 (23%)	11/68 (16%)	28/141 (20%)
UK	41/189 (22%)	27/176 (15%)	68/365 (19%)
USA	46/259 (18%)	31/251 (12%)	77/510 (15%)

Only countries with 30 articles published or more were considered

significant difference between diagnostic and interventional radiology—the former was more male-dominated than the latter—and significant differences among countries and imaging subspecialties. Finally, the gender of last authors seemed to positively influence that of the first author.

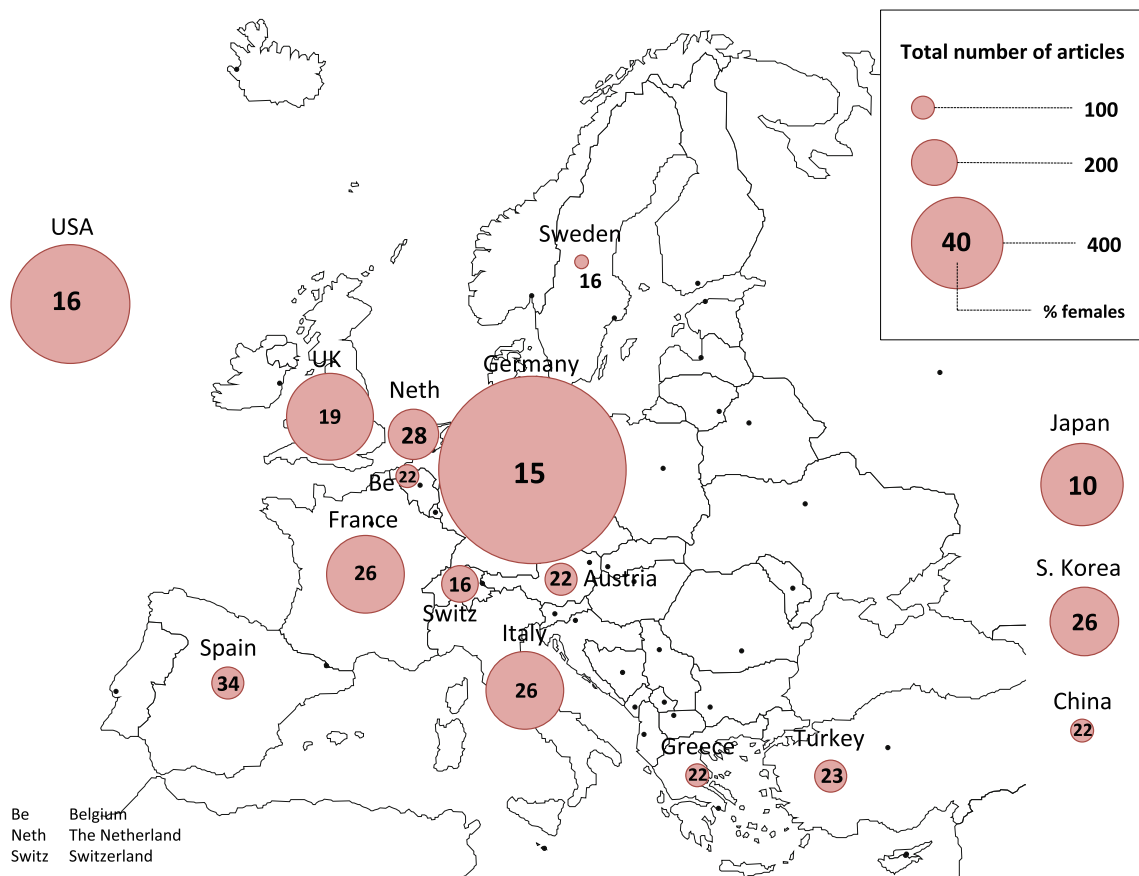
Interpreting the evolution of the proportion of female authors is not easy and must be done with caution to avoid drawing shallow conclusions. Bourdieu proposed the concept of “field” to help understand the setting in which agents and their social positions are located [24]. His field theory states that the position of each particular agent is a result of an interaction between the specific rules of the field; the agent’s habitus; and social, economic, and cultural assets put to productive use. Academic radiology is no different from any other field and is thus eligible for the same theoretical interpretation.

We observed a slow but constant increase in the number of first and last female authors in diagnostic radiology articles. Similar results have been reported in other American and French studies [14, 18, 20]. On the other hand, the proportion of first and last authors remained unchanged in interventional radiology articles, as previously found by Yun et al in American journals [18]. While Wang et al showed that women in academic interventional radiology achieve similar publication metrics as men and are promoted to academic and leadership positions equal to their overall representation in the field but that they are still the minority in academic IR faculty across North America [22] and are under-represented in the Society of Interventional Radiology [25]. The results of our

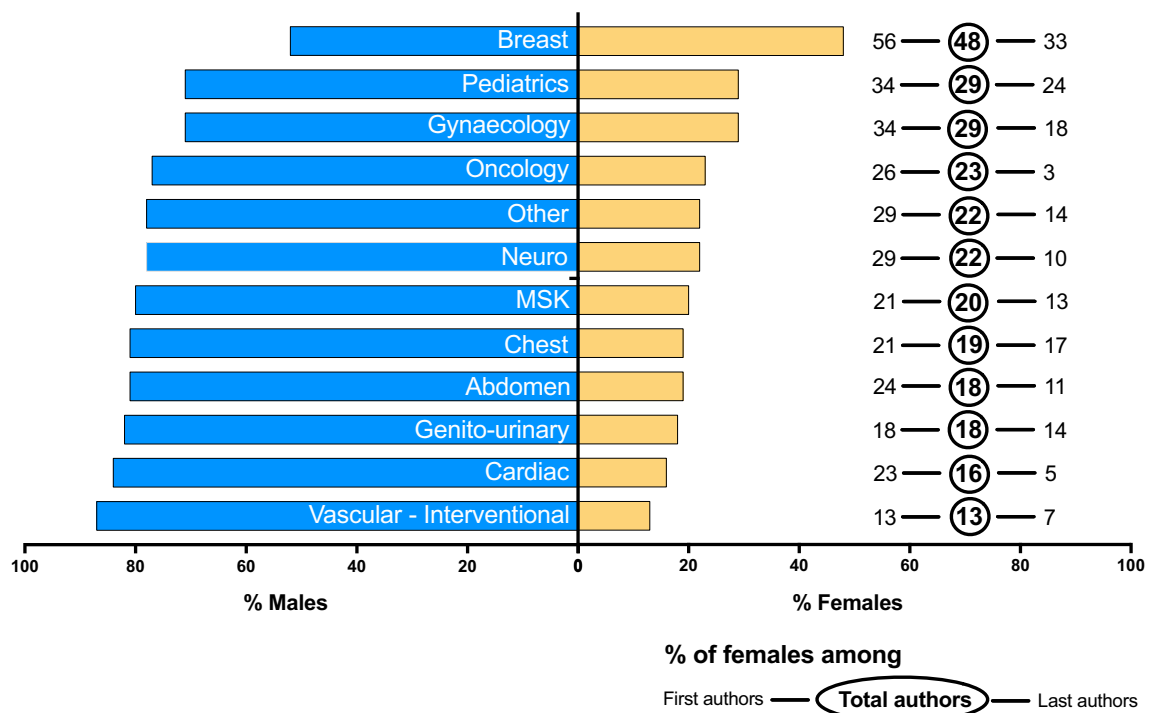
study are similar. One explanation can be found in the recent survey of 149 women members of the Cardiovascular and Interventional Radiology Society of Europe (CIRSE) [23]. This survey identified concerns by women about radiation exposure particularly during pregnancy. Also, structured and supportive training was felt to be insufficient for female IRs who wish to train or work flexibly. Finally, the male-dominated environment was found to be discouraging [23].

The number of female last authors has increased more slowly over time than that of first authors. This suggests that although the proportion of women has increased over time in academic radiology, it has not automatically resulted in a corresponding increase in the number of women holding senior positions. A study by Curtis et al evaluated women in senior post-graduate medical education roles to identify steps needed to support career progression. This study showed that senior women leaders reported having a high internal locus of control, defined as the degree to which people believe that they have control over the outcome of events in their lives. Although all women reported high levels of drive, most of them indicated that their ambition did not include a strong drive for money, prestige, recognition, or power. Social support, such as a spouse or other significant family member, was found to be particularly reaffirming and supportive of a woman’s chosen career ambition. Factors that were considered to have hindered career progression included low self-confidence and self-efficacy, the so-called glass ceiling and perceived self-limiting cultural influences. Factors indirectly linked to gender such as part-time versus full-time work were reported to be influential in a woman being overlooked for senior leadership roles [26]. Another piece of explanation may be that current funding and funding sources require the principal investigator to be an author/ investigator with high evidence of previous research. This may favor male researchers with a longer research background.

Besides the possible daily sexism of academic institutions, women are also often forced into traditional gender roles and stereotypes. For instance, in most countries, women still take on many of the responsibilities of family and domestic life. This can force women to limit their presence at work or favor a clinical career rather than academic research. This can explain in part the differences among countries. A comparison of Germany (15% of female authors) and France (26%) offers an interesting example. Despite the general similarity in the socioeconomic systems of these two countries, the fertility rate and workload are markedly different for women [27]. The greatest contrast can be found in women with higher education between 35 and 40 years old. In Germany, 40% of these women have no children, compared with 24% in France [28]. The employment situation of women is also quite different in the two countries. In Germany, part-time and precarious work plays an important role since 39% of women have part-time jobs, compared with only 24% in France



**Fig. 2** Comparison of the proportion of female authors according to the country of submission. The size of the circles represents the total number of published articles, and the number at the center of each circle is the proportion of female among all authors



**Fig. 3** Proportion of female authors per radiology subspecialty. The left and right numbers represent the proportion of female authors among first and last authors. The circled one represents the average proportion of female per article. MSK, musculoskeletal

[29], with the greatest contrast found among mothers. Forty-six percent of mothers whose youngest child is under the age of six have part-time employment in Germany compared with 23% in France. Part-time employment among mothers whose youngest child is between 6 and 14 years old is 59% and 28%, respectively. Germany has long considered family responsibilities as falling within the private sphere while France has a long tradition of an institutionalized family policy.

Another important result was the significant difference in imaging subspecialties. In particular, there are more female authors of breast, pediatric, and gynecological imaging articles. This reflects the overall overrepresentation of women in the corresponding clinical specialties, especially among younger radiologists. This is in line with the study published by Campbell et al that showed that radiology researchers publish more often on topics related to their own gender [30]. Once again, these choices can be explained by general considerations—such as the early socialization of young girls towards gender stereotypes—and also because it is easier to combine career and family responsibilities in these subspecialties. Finally, a less male-dominated environment may be seen as more encouraging.

This brings us to the last important finding of our study, the role of female mentoring. Indeed, the proportion of female first authors in articles with a female last author was twice as high as that of female first authors in articles with a male last author. This result, which has already been reported in prior studies [18, 20, 31], emphasizes the importance of women academics in motivating younger women to participate in research. This significant difference might also be due to a better knowledge of authorship protocols regarding the significance of one's value or time contribution in the study, and to the fact that younger female researchers may find it easier to defend their position of authorship if the last author is also a woman. This is to be considered in light of the study published by Macaluso et al that showed that women are significantly more likely to be associated with performing experiments, while men are more likely to be associated with all other authorship roles, regardless of academic age [32]. The limited number of women occupying senior positions may prevent younger colleagues from seeing themselves as potential leaders. Dutta et al also showed that active mentoring programs for female academics may improve aspects of job-related well-being, self-esteem, and self-efficacy over 6 months, with further improvements seen after 1 year for female academics [33]. In the study by Curtis et al discussed above, senior women leaders reported that women were under-represented in senior leadership positions and that high-quality female mentorship was particularly important in rectifying this imbalance [26]. Nevertheless, it is important to stress that the quality of mentoring is probably more important than the gender of the mentor as shown by Levine et al [34].

There were several limitations to our study. Firstly, the selected articles were limited to two radiology journals that may not

fully reflect all published radiology articles. Secondly, the gender of an author was initially determined based on his/her first name which might result in a misclassification of ambiguous names in certain cases. In addition, the gender of certain authors could not be determined. However, this concerned a limited number of authors, and we do not believe that it significantly influenced our results. Finally, the analysis of articles published in *European Radiology* in 2002 was incomplete because 42% of the articles contained only the initials of the authors' first names.

In conclusion, this study shows that despite a significant increase in the proportion of first and last female authors over time, female authors are still in the minority in European radiology journals. There was a significant difference between diagnostic and interventional radiology and the former was more male-dominated than the latter. Finally, the gender of the last author seemed to positively influence that of the first one.

**Funding** The authors state that this work has not received any funding.

## Compliance with ethical standards

**Guarantor** The scientific guarantor of this publication is Maxime Ronot.

**Conflict of interest** The authors of this manuscript declare no relationships with any companies, whose products or services may be related to the subject matter of the article.

**Statistics and biometry** No complex statistical methods were necessary for this paper.

**Informed consent** Not applicable

**Ethical approval** Not applicable

## Methodology

- retrospective
- cross-sectional study
- performed at one institution

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