

Women Authorship in Cardiothoracic Surgery: Gender Differences in Five High-impact Journals Through 20 Years

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ABSTRACT

Objective: This study aimed to clarify the contribution of female authors to the cardiothoracic literature by analyzing five high-impact journals.

Materials and Methods: Two authors reviewed all articles from 2000, 2010, and 2020 published in five high-impact journals in the cardiothoracic discipline. Only original articles, reviews, and meta-analyses were enrolled in the study. During the review, the first author's name, the senior author's name, and the number of female and male authors were recorded according to years. Articles were also categorized according to subspecificity and region of study.

Results: A total of 233 papers in 2000, 259 papers in 2010, and 276 papers in 2020 met the study inclusion criteria. The ratio of female authors as first author was 4.3% in 2000, 8.9% in 2010, and 9.8% in 2020, and the difference was statistically higher in favor of 2010 and 2020 ($p=0.041$). The ratio of female authors increased from 24.9% in 2000 to 35.9% in 2020 ($p=0.019$). However, the ratio of senior female authors was not statistically significant ($p=0.090$). The ratio of female first authors for original articles and the ratio of female senior authors for reviews were significantly higher in 2010 and 2020. First female authors in papers about the heart and senior female authors in papers about the thorax were significantly more common in 2010 and 2020. Finally, the ratio of female first authors and senior authors significantly increased from 2000 to 2010 and 2020 only in Europe.

Conclusion: The present study demonstrated that the proportion of female authors significantly increased over the last 20 years in cardiothoracic surgery. First female authors made progress in articles written about experimental studies, original articles, and meta-analyses, and the heart. Finally, the frequency of female senior authors was significantly increased for experimental studies, review articles, papers about the thorax, and papers from Europe.

Keywords: Author, Cardiothoracic surgery, Female, Impact factor, Journal

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INTRODUCTION

Gender-related inequalities are still an important problem for women all over the world. Women are attempting to secure their rights in the field of health, as in all areas. Currently, 20–50% of the entire healthcare workforce comprises women, varying depending on region, social norms, and medical discipline.^[1] However, women have been unable to gain an equal standing in certain fields, especially in surgical subspecialties, for several reasons, including gender discrimination, lack of female role models and mentors, and unconscious bias that questions women's surgical ability. Some studies have stated that women received less research funding, less sponsorship, and lower promotion rates in comparison to men.^[2]

Previous studies showed that although the number of female health workers has increased, women are still underrepresented in scientific areas, including speaking at and/or chairing scientific congresses, working as educators in laboratory studies, and writing articles.^[3] Scientific activities play a key role in promoting academic careers and getting scholarships. Whitley *et al.*^[4] investigated the proportion of female authors in articles among five high-impact urology journals, and stated that the proportion of female authors increased from 18.9% in 2008 to 21.4% in 2018. Furthermore, Whitley *et al.*^[4] emphasized that the frequency of the first author being female increased when the senior author was female. In another study, Filardo *et al.*^[5] investigated the role of women as first authors in original articles among six high-impact journals, and the authors stated that the ratio of female authors increased from 27% to 37% between 1994 and 2014.

Although previous studies examined the contribution of women to academic articles in different disciplines, to our knowledge, no study investigated the proportion of female authors in cardiothoracic surgery studies. In the present study, we aimed to clarify the contribution of female authors to the cardiothoracic literature by analyzing five high-impact journals.

MATERIALS AND METHODS

The data collection and article review were conducted between July 1st and July 31st, and two authors reviewed all articles from 2000, 2010, and 2020 published in five high-impact journals in the cardiothoracic discipline. The journals were the *Annals of Thoracic Surgery*, *Journal of Thoracic and Cardiovascular Surgery*, *European Journal of Cardiothoracic Surgery*, *Journal of Cardiac Surgery*, and *Thoracic Surgery Clinics*. Online archives of the five journals were used during research. All five journals were published in 2000, in 2010, and in 2020. Despite a high impact factor in 2020, journals not published in either 2000 or 2010 were excluded. Furthermore, only original

articles, reviews, and meta-analyses were enrolled in the study. Author replies, case reports, commentaries, expert opinions, and letters to the editor were excluded. We selected the years 2000, 2010, and 2020 to represent regular 10-year intervals across two decades, enabling the analysis of long-term trends while maintaining feasibility in data collection and validation.

During the review, the first author's name, the senior author's name, the number of authors, and the number of female and male authors were recorded according to year. Gender identification was primarily performed through publicly available information, including institutional profiles, research databases, and professional websites. When gender was not explicitly mentioned, it was inferred based on names and photographs when available. If gender could not be confidently determined, the article was excluded from the analysis. Furthermore, the author in single-author articles was accepted as the first author. In addition, all papers were categorized according to study type as a clinical trial or an experimental study. Articles were also categorized according to subspecificity (congenital, heart, and thorax) and region of study (Europe, America, and others).

First, we analyzed the ratio of female first authors and senior authors, and the proportion of all female authors in papers according to years for all journals. Furthermore, the first and senior female author ratio was compared according to journal, study type, article type, subspecificity, and region between 2000, 2010, and 2020.

This study analyzed publicly available published articles only and did not involve human participants or patient data. Therefore, ethics committee approval and informed consent were not required. This study did not involve human participants or patient-level data; therefore, informed consent was not required.

Statistical Analysis

The Statistical Package for the Social Sciences (SPSS) version 22 (SPSS IBM Corp., Armonk, NY, USA) program was used. The Shapiro–Wilk test and Q-Q plots analysis were done to check the normality of variable distribution. Fisher's exact test and χ^2 test were used to compare categorical data. The statistical parameters were evaluated at 95% confidence level, and $p < 0.05$ was considered statistically significant.

RESULTS

Impact factors of the reviewed journals are listed in Table 1. In total, 233 papers in 2000, 259 papers in 2010, and 276 papers in 2020 met the study inclusion criteria. The ratio of female authors as first author was 4.3% (10 papers) in 2000, 8.9% (23 papers) in 2010, and 9.8% (27 papers) in 2020, and

Table 1. Characteristics of the evaluated top 5 journals

Journal	Origin	Impact factor (2021)
The annals of thoracic surgery	The Netherlands	4.330
The journal of thoracic and cardiovascular surgery	USA	6.195
European journal of cardiothoracic surgery	United Kingdom	4.534
Journal of cardiac surgery	United Kingdom	1.620
Thoracic surgery clinics	The Netherlands	1.750

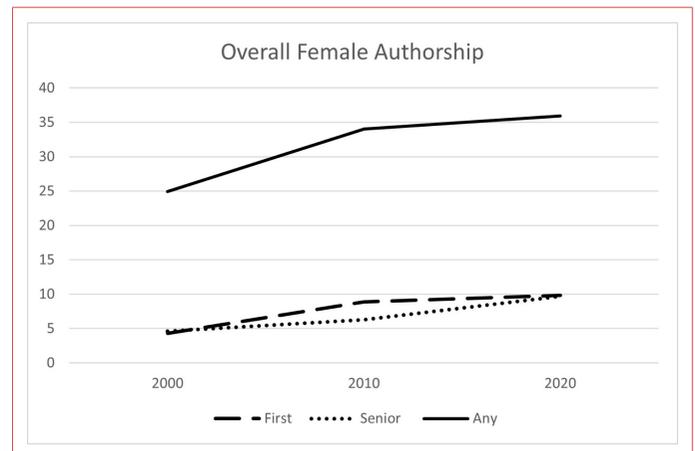
Table 2. Evaluation of female authors according to their order in the article and the years of the articles

	2000	2010	2020	<i>p</i>
First author, <i>n</i> (%)				
Male	223 (95.7)	236 (91.1)	249 (90.2)	
Female	10 (4.3) ^a	23 (8.9) ^b	27 (9.8) ^b	0.041
Total	233	259	276	
Senior author, <i>n</i> (%)				
Male	207 (95.4)	222 (93.7)	243 (90.3)	
Female	10 (4.6)	15 (6.3)	26 (9.7)	0.090
Total	217	237	269	
In any order, <i>n</i> (%)				
Male	175 (75.1)	171 (66.0)	177 (64.1)	
Female	58 (24.9) ^a	88 (34.0) ^b	99 (35.9) ^b	0.019
Total	233	259	276	

Lower-case letters are used to identify the group that causes the difference. The same letters (such as a-a) indicate that there is no difference, different letters (such as a-b) indicate that there is a difference

the difference was statistically significant in favor of 2010 and 2020 ($p=0.041$). In addition, the ratio of female authors increased from 24.9% in 2000 to 34.0% in 2010 and 35.9% in 2020 ($p=0.019$). However, though the ratio of senior female authors continuously increased from 2000 (4.6%) to 2010 (6.3%) and 2020 (9.7%), the difference was not statistically significant ($p=0.090$) (Table 1). Overall, female authorship is presented in Figure 1.

The ratio of first female author and senior author did not change for the Annals of Thoracic Surgery and Journal of Thoracic and Cardiovascular Surgery from 2000 to 2020. The ratio of first authors in the European Journal of Cardiothoracic Surgery and Journal of Cardiac Surgery was significantly higher in 2010 and 2020 than in 2000. In addition, the ratio

**Figure 1.** Overall female authorship.

of first authors in Thoracic Surgery Clinics was significantly higher in 2020 compared to 2000 and 2010. Furthermore, the ratio of senior authors was significantly higher in 2020 for the European Journal of Cardiothoracic Surgery and in 2010 and 2020 for thoracic surgery clinics. The ratio of female first and senior authors was not significantly different in 2000, 2010, and 2020 for clinical trials. However, the ratio of the first author was significantly higher in 2010 and 2020, and the ratio of the senior author was significantly higher in 2020 for experimental studies. The ratio of female first authors for original articles and the ratio of female senior authors for reviews were significantly higher in 2010 and 2020. Furthermore, the presence of a female author for meta-analysis papers was significantly more common in 2020. First female authors in papers about the heart and senior female authors in papers about the thorax were significantly more common in 2010 and 2020. Finally, the ratio of female first author and senior author significantly increased from 2000 to 2010 and 2020 only in Europe (Table 2). Table 3 shows a comparison of journal article characteristics and the percentage of female authors by region. The ratio of the total number of female authors to the total number of authors by years (separated by journals) and the ratio of the total number of female authors to the total number of authors by years (separated by regions) are presented in Figure 2a and b.

DISCUSSION

Providing women with equal opportunities is one of the most important issues of the last century. Revealing a problem with scientific data not only increases awareness of the problem but also contributes to efforts to solve the problem. Thus, we conducted a study that investigated the contribution of women to the cardiothoracic literature. The ratio of female first authors and the proportion of female authors significantly increased from 2000 to 2020. Furthermore, the ratio of first female

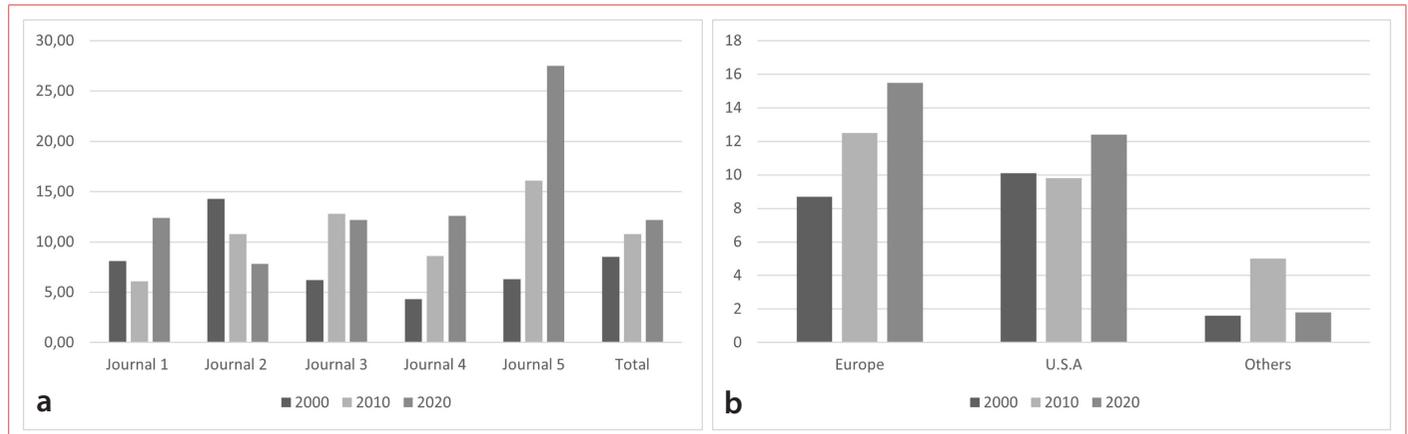


Figure 2. (a) The ratio of the total number of female authors to the total number of authors by years (separated by journals). **(b)** The ratio of the total number of female authors to the total number of authors by year (separated by regions)

Table 3. Comparisons of female author rates by journal, article features, and region

Journals	Percentage of female authors							
	First author				Senior author			
	2000	2010	2020	<i>p</i>	2000	2010	2020	<i>p</i>
1	4.5	6.0	8.1	*	5.6	4.4	10.0	*
2	9.7	7.8	8.9	*	7.4	3.2	5.5	*
3	2.9 ^a	11.4 ^b	8.3 ^b	**	0 ^a	3.8 ^a	13.0 ^b	**
4	0 ^a	16.1 ^b	6.1 ^b	**	0	8.0	6.1	*
5	2.4 ^a	5.7 ^a	22.2 ^b	**	4.3 ^a	34.6 ^b	24.2 ^b	**
Study type								
Clinical trial	4.7	8.6	9.4	*	5.0	6.8	9.2	*
Experimental trial	3.2 ^a	12.5 ^b	18.0 ^b	**	3.4 ^a	6.7 ^a	22.2 ^b	**
Article type								
Original article	2.7 ^a	6.3 ^b	9.2 ^b	**	5.5	3.7	7.7	*
Review	7.0	11.9	9.8	*	2.8 ^a	10.4 ^b	10.4 ^b	**
Meta-analysis	0 ^a	0 ^a	16.7 ^b	**	0	0	0	*
Sub-specificity								
Congenital	5.6	0	0	*	6.9	0	0	*
Heart	3.5 ^a	11.5 ^b	8.3 ^b	**	5.2	2.4	7.4	*
Thorax	5.6	6.4	13.4	*	1.9 ^a	10.8 ^b	17.7 ^b	**
Region								
Europe	2.0 ^a	11.3 ^b	10.9 ^b	**	1.2 ^a	7.1 ^b	11.9 ^b	**
America	7.0	7.8	11.6	*	10.2	7.6	10.8	*
Others	0	0	0	*	0	0	0	*

* $p > 0.05$, ** $p \leq 0.05$. Lower-case letters are used to identify the group that causes the difference. The same letters (such as a-a) indicate that there is no difference, different letters (such as a-b) indicate that there is a difference.

authors significantly increased for experimental studies, for original articles and meta-analysis, for papers about the heart, and for papers from Europe from 2000 to 2020. In addition, the ratio of female senior authors significantly increased for experimental studies, for review articles, for papers about the thorax, and for papers from Europe.

Previous reports stated that women are much less involved in academic papers than men. Yue and Khosa analyzed the contribution of female authors in academic papers about orthopedic surgery, and the authors stated that women were underrepresented in terms of academic position and academic productivity.^[6] In another study, Weiss *et al.*^[7] demonstrated that only 2% of women were first and senior authors in urologic journals in 1974, with rates of 16.4% female first author rate and 8.5% senior author in 2009. Similarly, we found significant increments in female first-author and female total author rates from 2000 to 2020. In addition, our findings showed that female first authors for original articles and meta-analyses, and female senior authors for reviews, were significantly increased. The increased proportion of female first authors for original articles could be explained by the increased number of female physicians in cardiothoracic clinics, and the increased proportion of female authors for reviews could be explained by the increase in the number of women with academic positions.

The number of articles investigating women's inequality according to article type is limited. Vranas *et al.*^[8] investigated 40 highly-cited journals between 2008 and 2018, and found that the percentage of female first authors was significantly higher for basic science papers compared to clinical studies. However, Vranas *et al.*^[8] emphasized that the female senior author rate was similar for basic science articles. However, our findings demonstrate a clear upward trend in both female first and senior authorship in experimental studies between 2000 and 2020, suggesting a field-specific shift within cardiothoracic surgery.

The sociocultural development rate and the society's perspective on women can affect women's place in the health sector and their academic career. Vranas *et al.*^[8] investigated the role of region on gender inequality in academic papers, and found the highest female first author rates in articles from Europe and New Zealand, and the lowest rates in articles from Asia. However, Pinho-Gomes *et al.*^[9] reviewed papers about COVID-19 to analyze gender inequalities. Pinho-Gomes *et al.*^[9] found the highest female author ratio in Oceania and the lowest in Africa, but the difference was not statistically significant. In the present study, we found that female first and senior author ratios significantly increased in 2010 and in 2020.

Our study has some limitations. First of all, there is a risk of gender misclassification and publication type misclassification. To minimize the possible misclassification, two independent authors analyzed articles, and they made a joint decision in case of conflict. Secondly, academic ranks of the authors (e.g., resident, specialist, associate professor, or full professor) could not be evaluated due to the unavailability of this information in most articles. This limitation may introduce potential bias in interpreting the true academic advancement of female authors, as authorship alone may not fully capture their academic position or progression. One of the limitations of this study is the selection of only three specific years at 10-year intervals. While this approach allowed us to capture long-term shifts in authorship trends and reduce data processing burden, it may have missed short-term fluctuations or unique trends in intervening years. Another limitation of our study lies in the methodology of gender classification. Gender was inferred using publicly available data, which may result in misclassification and excludes authors who identify outside the gender binary.

CONCLUSION

The present study demonstrated that the ratio of female authors significantly increased over the last 20 years in cardiothoracic surgery. Furthermore, our study showed that the first female authors made progress in articles written about experimental studies, original articles, and meta-analyses, and in papers from Europe over the last 20 years. Finally, the frequency of female senior authors was significantly increased for experimental studies, review articles, papers about the thorax, and papers from Europe.

DECLARATIONS

Ethics Committee Approval: This study analyzed publicly available published articles only and did not involve human participants or patient data. Therefore, ethics committee approval and informed consent were not required.

Informed Consent: This study did not involve human participants or patient-level data; therefore, informed consent was not required.

Conflict of Interest: None declared.

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Peer-review: Externally peer-reviewed.

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