

ORIGINAL ARTICLE

Women occupying preferential authorship positions for articles in the journal *Emergencias*: an analysis of authorship during the last decade

Julia González¹, Daniel Hernández-Vaquero^{2,4}, Aida T. Igarreta-Herraz¹, Rocío Díaz^{2,3}, Virginia Domínguez-González⁵, Alberto Domínguez-Rodríguez^{1,6,7}

Objective. To analyze gender disparity in scientific productivity reflected by the authorship of articles in the journal *Emergencias* over the past decade.

Methods. Retrospective longitudinal study. We included articles in all issues published between January 2011 and December 2020, analyzing the number of authors, their gender, article type, year of publication, and preferential authorship credit (first author, corresponding author, and last author positioning). The percentages of women named in each position were calculated, and the trend over time was analyzed.

Results. A total of 1240 articles signed by 5213 authors were collected; a woman was named in 1889 of the cases (36.2%). A woman was the first author of 384 articles (31%), the corresponding author of 352 (28.4%), and the last author of 358 (28.9%). The number of female authors of original research articles or meta-analyses tended to increase over time ($P = .047$), but no statistically significant gender trends were observed in the authorship of editorials, narrative reviews, scientific letters or short communications, letters to the editor, or any other publication category.

Conclusions. The publication of articles by women in *Emergencias* has increased over the past decade. However, women continue to author fewer articles than men.

Keywords: Gender bias. Authorship. Scientific publication. Emergency medicine.

Mujeres ocupando autorías preferenciales de artículos en la revista EMERGENCIAS: análisis de la última década

Objetivos. Analizar la desigualdad de género en la producción científica de la revista EMERGENCIAS en la última década.

Método. Estudio longitudinal retrospectivo que revisó los números publicados entre enero de 2011 y diciembre de 2020. Se analizaron el número de autores, género, tipo y año de publicación y autoría preferencial (primera autoría, autoría de correspondencia o última autoría). La participación de la mujer se calculó en base a valores porcentuales y se analizó la tendencia existente a lo largo de los años.

Resultados. Se recogieron 1.240 artículos con un número total de 5.213 firmantes, 1.889 de ellos (36,2%) mujeres. En 384 (31%) artículos, una mujer asumió la primera autoría, en 352 (28,4%) fue autora para correspondencia y en 358 (28,9%) la última autora. A lo largo de la década, se identificó una tendencia creciente en los que una mujer fue primera autora en los artículos originales o metanálisis ($p = 0,047$). En los editoriales, revisiones, cartas científicas o comunicaciones breves, cartas al editor y otros no existió una tendencia creciente significativa en las autorías preferenciales.

Conclusión. La participación de autoras en la producción científica de la revista EMERGENCIAS ha aumentado en la última década. No obstante, comparado con la de hombres, sigue existiendo una menor participación.

Palabras clave: Sesgo de género. Autoría. Publicaciones científicas. Emergencias.

Introduction

Women make up a high percentage of professionals in both health care and biomedical research.¹ In Spain, the number of female physicians has increased steadily over the last decade and will reach 52.2% by the year 2020.² Scientific production has acquired great importance in the progression of the healthcare professional career, and the studies carried out in this respect demonstrate the existence of a gender gap in

the authorship of scientific production.³ Recently in Spain, Tornero-Patricio et al. analyzed gender inequality in the scientific production of 24 Spanish medical journals during 2017.⁴ The results showed large differences; depending on the journal, between 26% and 64% of the authors were women. In this evaluation, the journal EMERGENCIAS was not evaluated despite being the official journal of the Spanish Society of Emergency Medicine (SEMES) and being a journal included in the Journal Citation Reports and

Author Affiliations:

¹Cardiology Service, Hospital Universitario de Canarias, San Cristóbal de La Laguna, Santa Cruz de Tenerife, Spain.

²Heart Department, Hospital Universitario Central de Asturias, Oviedo, Asturias, Spain.

³Instituto de Investigación del Principado de Asturias (ISPA), Oviedo, Asturias, Spain.

⁴Department of Functional Biology, Department of Physiology, University of Oviedo, Oviedo, Asturias, Spain.

⁵Facultad de Medicina, Universidad de La Laguna, San Cristóbal de La Laguna, Santa Cruz de Tenerife, Spain.

⁶Facultad de Ciencias de la Salud, Universidad Europea de Canarias, La Orotava, Santa Cruz de Tenerife, Spain.

⁷CIBER of Cardiovascular Diseases (CIBERCV), Madrid, Spain.

Author Contributions:

All authors have confirmed their authorship in the document of author responsibilities, publication agreement and assignment of rights to EMERGENCIAS.

Corresponding Author:

Dr. Daniel Hernández-Vaquero
Instituto de Investigación del Principado de Asturias
33011, Oviedo, Spain

Email:
dhvaquero@gmail.com

Article information:

Received: 25-10-2021
Accepted: 2-12-2021
Online: 24-1-2022

Editor in Charge:

Oscar Miró

occupying the first quartile in its category. A detailed analysis of several studies shows that in the positions that could indicate more prestige, such as first author, last author (or senior author) or corresponding author, there continues to be an underrepresentation of women.⁴⁻⁷ In view of this situation, the aim of this research was to analyze the gender differences in scientific production in the different types of articles published in the journal EMERGENCIAS during the last decade.

Methods

All articles published in the journal EMERGENCIAS from the beginning of 2011 to the end of 2020 (10 years) were identified. These articles were classified into original articles, systematic reviews or meta-analyses, editorials, scientific letters, literature reviews, letters to the editor, and others. An Excel database was constructed by reviewing each issue of the journal to obtain descriptive information on the articles published. For each of the articles, the year of publication, type of article, number of authors, number of female authors, female first author, female corresponding author and female last author were collected. Gender was obtained from the full name present in the publication. In the case of uncommon names or doubts, Google, and social networks, including LinkedIn, were consulted. Preferred authorship was defined as principal authorship, corresponding authorship, or last authorship.⁸

The primary objectives were: i) percentage of women as authors of articles in the Journal; ii) percentage of articles whose first authorship is held by a woman; iii) percentage of articles whose authorship for correspondence is held by a woman; and iv) percentage of articles whose last authorship is held by a woman. As secondary objectives, we analyzed: i) the trend of female authorship over the years; and ii) the percentage of articles in which at least one preferential authorship is held by a woman.

Quantitative variables are expressed as mean and SD and categorical variables as frequencies and percentages (n; %). Student's t test was used to compare means for equal or unequal variances as appropriate. Levene's robust test was used to determine whether the variances were equal.

The comparison of proportions was performed using the χ^2 test. However, the percentage of potential female publishers in the general population is unknown and changeable and, therefore, we calculated what the minimum percentage of women in the general population would have to be to nullify statistical significance. For example, assuming that the minimum percentage calculated was 25% would indicate that if the actual percentage of women in the general population was greater than 25%, chance could not explain the results. A very low percentage would be evidence that chance cannot explain the result.

Table 1. Distribution of the types of articles in the journal EMERGENCIAS

Type of article	n (%)
Original articles or meta-analyses	275 (22.2)
Editorials	142 (11.5)
Scientific Letters	120 (9.7)
Literature review articles	73 (5.9)
Letters to the editor	385 (31.1)
Other	245 (19.8)
Total	1240 (100)

A value of bilateral $P < .05$ was considered statistically significant. STATA v.16 (StataCorp, Texas, USA) was used for statistical analysis.

Results

In total, 1240 articles were published in the journal EMERGENCIAS and 5213 authors were analyzed. Of these 1240 articles, 275 (22.2%) were original articles or meta-analyses, 142 (11.5%) editorials, 120 (9.7%) scientific letters, 385 (31.1%) letters to the editor, 73 (5.9%) literature reviews and other articles were 245 (19.8%). Table 1 shows the type of article published. The mean number of authors per article was 4.2 (SD: 3.1).

Of the 5213 authors, 1889 (36.2%) were women and 3324 (63.8%) were men ($P < .001$). The minimum percentage of women that should exist in the general population to nullify statistical significance was 37.5%. The mean number of women and men per article was respectively 1.5 (SD: 1.6) vs. 2.7 (SD: 2.3) ($P < .001$). Of these 1240 articles, 870 (70.2%) had at least one woman among the authors. In 605 (48.8%) at least one preferential authorship was assumed by a woman, compared with 1108 (89.4%) articles in which a man assumed at least one preferential authorship. In 132 (10.7%) articles all preferred authorships were held by a woman, compared to 635 (51.2%) articles in which all preferred authorships were held by men.

In 2011, 61 of 141 articles (43.3%) had at least one woman within at least one of the 3 preferred authorships, whereas in 2020 it was in 73 of 139 (52.5%) (P for trend = .23). Figure 1 shows the trend in the percentage of articles in which a woman assumed a preferred authorship. Table 2 shows the percentage of articles in which a woman held preferential authorship, the percentage of women that should exist in the general population to nullify statistical significance, and the p value for trend over the years.

In 275 original articles or meta-analyses, 1947 authors were identified. Seven hundred and twenty-one (37%) were women and 1226 (63%) were men ($P < .001$). The minimum percentage of women that should exist in the general population to nullify statistical significance is 39.2%. The mean number of women and men per article was 2.6 (SD: 2.2) vs 4.5 (SD: 3.2) ($P < .001$). In 2011, 53 (32.3%) of the authors were female, while in 2020 it was 110 (42.5%), (P for trend = .04).

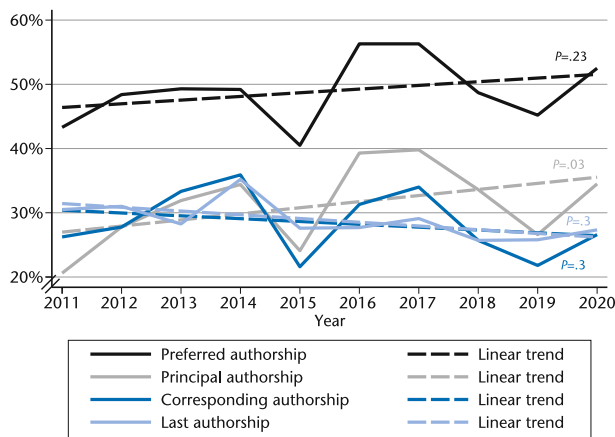


Figure 1. Trend over time in the percentage of papers in which a woman assumed preferred authorship.

Of these 275 papers, 250 (90.9%) had at least one woman among the authors. In 146 (53.1%) articles a woman was present (*P* for trend = .076; Figure 2, Table 2).

In 142 editorials, a total of 231 authors were identified and 43 (18.6%) were women (*P* < .001). The minimum percentage of women that should exist in the general population to nullify statistical significance is 23.6%. The mean number of women and men per article was 0.3 (SD: 0.6) vs 1.3 (SD: 0.9) (*P* < .001). Of

these 142 editorials, 34 (23.9%) had at least one woman among the authors. In 30 (21.1%) at least one preferred authorship position was assumed by a woman, compared with 131 (92.3%) articles in which at least one man was present. In 11 articles (7.8%) all were occupied by women, compared with 112 articles (78.9%) in which all the preferred authorships were occupied by men. No increasing trend was identified in the percentage of editorials in which a woman assumed at least one preferred authorship (*P* for trend = 0.18), nor for each of the preferred positions individually (Table 2).

In 120 scientific letters 659 authors were identified and 282 (42.8%) were women (*P* < .001). The minimum percentage of women in the population necessary to nullify statistical significance was 46.6%. The mean number of women and men per article was respectively 2.4 (SD: 1.6) vs. 3.1 (SD: 1.8) (*P* < .001). Among these 120 articles, 109 (90.8%) had at least one woman among the authors. In 71 (59.2%) a woman assumed at least one of the 3 preferred authorships, compared with 106 (88.3%) articles in which at least one man was present. In 14 articles (11.7%) all the preferred authorships were held by women, compared with 49 articles (40.8%) in which all were held by men. There was no time trend in the percentage of papers in which a woman assumed one of the 3 preferred authorships (*P* for trend = .73), nor for each of the preferred positions individually (Table 2).

Table 2. Percentage of articles whose preferential authorship is held by women

	Percentage of articles by a woman	<i>P</i> value (assuming a 50% proportion of women in the population)	Minimum percentage of women in the general population to nullify statistical significance	<i>P</i> value for trend over the years*
All articles (n = 1240)				
Principal authorship	384 (31%)	<.001	33.6%	.03
Corresponding authorship	352 (28.4%)	<.001	30.9%	.30
Last authorship	358 (28.9%)	<.001	31.4%	.30
Original articles or meta-analyses (n = 275)				
Principal authorship	97 (37.3%)	<.001	40.9%	.047
Corresponding authorship	79 (28.7%)	<.001	34.1%	.22
Last authorship	70 (25.5%)	<.001	30.6%	.99
Editorials (n = 142)				
Principal authorship	17 (12%)	<.001	17.4%	.08
Corresponding authorship	17 (12%)	<.001	17.4%	.74
Last authorship	24 (16.9%)	<.001	23.1%	.74
Scientific letters (n = 120)				
Principal authorship	44 (36.7%)	<.001	45.4%	.48
Corresponding authorship	38 (31.7%)	<.001	40.1%	.33
Last authorship	43 (35.8%)	<.001	44.5%	.53
Reviews (n = 73)				
Principal authorship	19 (26%)	<.001	36.3%	.83
Corresponding authorship	15 (20.6%)	<.001	30%	.81
Last authorship	16 (21.9%)	<.001	31.6%	.55
Letters to the editor (n = 385)				
Principal authorship	119 (30.9%)	<.001	35.5%	.10
Corresponding authorship	125 (32.5%)	<.001	37.2%	.24
Last authorship	123 (32%)	<.001	36.6%	.28
Other works (n = 245)				
Principal authorship	88 (35.9%)	<.001	42%	.48
Corresponding authorship	78 (31.8%)	<.001	37.7%	.29
Last authorship	82 (33.5%)	<.001	39.4%	.31

*In all cases where there was statistical significance, the trend was upward.

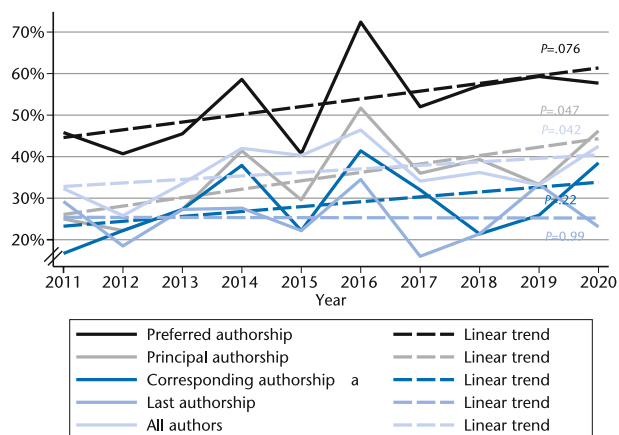


Figure 2. Trend over time in the percentage of original articles or meta-analyses in which a woman assumed preferred authorship or any authorship.

In 73 articles, 285 authors were identified and 77 (27%) were women ($P < .001$). The minimum percentage of women in the population required to nullify statistical significance was 32.2%. The mean number of women and men per article was respectively 1.1 (SD: 1.2) vs. 2.8 (SD: 2.2) ($P < .001$). Of these 73 papers, 42 (57.5%) had at least one woman among the authors. In 30 (21.1%) a woman assumed at least one of the 3 preferred authorships, compared with 63 (86.3%) articles in which at least one man was present. In 10 articles (13.7%) all the preferred authorships were held by women, compared to 49 articles (67.1%) in which all were held by men. There was no increasing trend over time in the percentage of reviews in which a woman assumed at least one preferred authorship (P for trend = .99), nor for each of the preferred positions individually (Table 2).

In the 385 letters to the editor, 1278 authors were identified and 472 (36.9%) were women ($P < .001$). The minimum percentage of women in the population required to nullify statistical significance was 39.6%. The mean number of women and men per article was respectively 1.2 (SD: 1.1) vs 2.1 (SD: 1.2) ($P < .001$). Of these 385 articles, 271 (30.4%) had at least one woman among the authors. In 204 (53%) at least one woman assumed at least one of the 3 preferred authorships, compared with 347 (90.1%) articles in which at least one man was present. In 38 articles (9.9%) all preferred authorships were held by a woman, compared with 181 articles (47%) in which all preferred authorships were held by men. There was no time trend in the percentage of papers in which a woman assumed at least one of the 3 preferred authorships (P for trend = 0.58), nor for each of the preferred positions individually (Table 2).

In the 245 articles classified in other categories, 813 authors were identified and 294 (36.2%) were women ($P < .001$). The minimum percentage of women in the population needed to nullify statistical significance was 39.5%. Of these 245 articles, 164 (66.9%) had at least one female author. The mean number of women and

men per article respectively was 1.2 (SD: 1.2) vs 2.1 (SD: 2.1) ($P < .001$). In 130 papers (53.1%), a woman assumed at least one of the 3 preferred authorships, compared with 205 articles (83.7%) in which at least one man was present. In 40 articles (16.3%) all the preferred authorships were held by women, compared to 115 articles (46.9%) in which all were held by men. There was no time trend in the percentage of articles in which a woman assumed one of the 3 preferred authorships (P for trend = .32), nor for each of the preferred positions individually (Table 2).

Discussion

The results of this investigation show differences in the percentage of men and women as authors of the publications of the journal *EMERGENCIAS* during the last decade. The number of female authors was lower than that of male authors both when analyzed by total number of signatories of all publications and when only preferential authorship was analyzed. Analysis by type of article and sex showed a higher frequency of female authors than male authors in all types of publications. The results of the present study are in agreement with publications carried out in Spain and other countries on gender inequality in the authorship of medical articles.^{1,4,5,7,9,10}

A review of publications over 35 years in 6 high impact factor journals showed that there was a lower proportion of women authors with preferential authorship.⁷ In our study, it is evident that there is, throughout the period analyzed (2011-2020), an increasing propensity for women to occupy preferential authorship in relation to original articles or meta-analyses. However, in the remaining types of articles, this positive trend was not observed in relation to preferential authorship. Likewise, we should highlight the lower frequency of female authors with respect to male authors in the publication modalities of editorials and review articles. In relation to the latter, our study adds to the scientific evidence demonstrating that the number of female authors of papers commissioned by journals (editorials or reviews) continues to be considerably lower than that of authors, rarely exceeding 20%.^{7,9-11}

Original articles are the most important and influential at the curricular or academic level. In our study, there has been an increasing trend in the percentage of female authors with respect to the total number of authors throughout the period analyzed. This trend is parallel to the percentage of articles in which a woman is the principal author, with no trend in the rest of the preferential authorships. The increasing tendency for a woman to take principal authorship in this type of work may suggest a progressive role of women in leading research projects.¹² This trend did not occur in the rest of the preferred authorships. The reason remains unknown. We could speculate whether this was due to a lower negotiation effort to occupy preferential positions or whether this growing leadership in research projects

has not yet translated into a higher percentage of leadership or positions of responsibility.^{13,14}

Several studies have investigated the possible causes of the differences in the percentage of men and women in scientific production.^{3,9,10,13} Among them is the lack of balance between professional and family life, a primary concern of women in medicine.³ The predominant responsibility of women for childcare makes it difficult to compete, and it is even possible that they do not seek academic promotion in the same proportion as men.¹² In Spain, scientific publications are usually published outside working hours. Time devoted to research during working hours could reduce the differences. Other reasons for this detrimental situation of women authors (in number and position) in publications could be the lower participation in collaborative studies.¹⁵ Likewise, in editorial and review articles, women are clearly underrepresented, and a reflection would be necessary to favor equitable participation in this type of article.

Among the strengths of this study, the first of its kind in the journal *EMERGENCIAS*, are the large number of authors, the number of articles analyzed, the absence of missing values, and the long period of time studied. The analysis of both the total number of authors and the preferred authorship provides information on the scientific production by gender in the different types of publications of the journal *EMERGENCIAS*.

Among the limitations of our study is that the number of women potentially publishing in the journal *EMERGENCIAS* cannot be known. It should be taken into account that the journal receives publications from many nations. In addition, the percentage of potential female publishers changes over the years. However, we calculated the minimum percentage of women that should exist to nullify statistical significance and it is evidently too low. Therefore, it is highly unlikely that the differences are due to a lower number of potential female publishers.

As a general rule, the *P* value is a conditional probability that answers the following question: having had these results, what is the probability that they are due to chance or sampling. In this paper we have tried to explain that the *P* value should be interpreted with caution, especially its usual cut-off point of 0.05, since we do not know what the percentage of women and men in the population is. On the other hand, the type of preferential authorship allows for differentiated weightings, since it is not the same to be first, last or corresponding author.

In conclusion, the participation of women authors

in the scientific production of the journal *EMERGENCIAS* has increased in the last decade. However, there are still gender differences (to the detriment of women) in terms of the total percentage of authors and preferential authorship.

Conflict of Interests Disclosure: None reported.

Funding/Support: The authors declare that they have no financial support for this article.

Ethical responsibilities: All the authors have confirmed the maintenance of confidentiality and respect for patient rights in the document of author responsibilities, publication agreement, and assignment of rights to emergencies.

Article not commissioned by the editorial committee and with external peer review.

References

- 1 Padilla-Navas I, Soler Sempere MJ, Zamora Molina L, García-Pachón E. Desigualdad de género en la autoría de artículos médicos: análisis de Medicina Clínica en 1999 y 2014. *Med Clin (Barc)*. 2015;145:e31-e32.
- 2 Instituto Nacional de Estadística. Profesionales sanitarios colegiados por sexo. 2020. (Consultado 29 Octubre 2021). Disponible en <https://www.ine.es/jaxi/Datos.htm?tpx=30719>.
- 3 Shannon G, Jansen M, Williams K, Cáceres C, Motta A, Odhiambo A, et al. Gender equality in science, medicine, and global health: where are we at and why does it matter? *Lancet*. 2019;393:560-9.
- 4 Tornero Patricio S, Alonso Rueda IO, García Gozalbes J, Domínguez Domínguez JA, Charris-Castro L, González Soria MD, et al. Desigualdades de género en la autoría de las principales revistas médicas españolas durante el año 2017. *An Pediatr (Engl Ed)*. 2020;93:84-94.
- 5 González-Torres L, Mayo-Yáñez M. Analysis of gender in the authorship of the scientific publications of the Acta Otorrinolaringológica Española in the last decade. *Acta Otorrinolaringol Esp*. 2021;72:230-7.
- 6 Yeung C, Baranchuk A. Gender equity trends in academic productivity and influence by subspecialties of Cardiology. *J Am Coll Cardiol*. 2018;72:3228-9.
- 7 Jagši R, Guancial EA, Worobey CC, Henault LE, Chang Y, Starr R, et al. The "gender gap" in authorship of academic medical literature--a 35-year perspective. *N Engl J Med*. 2006;355:281-7.
- 8 Agencia Nacional de Evaluación de la Calidad y Acreditación (ANECA). Programas de evaluación. (Consultado 23 Octubre 2021). Disponible en: <http://www.aneca.es/Programas-de-evaluacion/Evaluacion-de-profesorado/ACADEMIA/Baremos-aplicados-en-cada-comision/Baremos-aplicados-por-las-comisiones-de-Ciencias-de-la-Salud>
- 9 Filardo G, da Graca B, Sass DM, Pollock BD, Smith EB, Martinez MA. Trends and comparison of female first authorship in high impact medical journals: observational study (1994-2014). *BMJ*. 2016;352:i847.
- 10 Williams WA, Garvey KL, Goodman DM, Lauderdale DS, Ross LF. The role of gender in publication in the journal of pediatrics 2015-2016: Equal reviews, unequal opportunities. *J Pediatr*. 2018;200:254-60.
- 11 Rexrode KM. The gender gap in first authorship of research papers. *BMJ*. 2016;352:i1130.
- 12 Larivière V, Ni C, Gingras Y, Cronin B, Sugimoto CR. Bibliometrics: global gender disparities in science. *Nature*. 2013;504:211-3.
- 13 West JD, Jacquet J, King MM, Correll SJ, Bergstrom CT. The role of gender in scholarly authorship. *PLoS One*. 2013;8:e66212.
- 14 Bernardi K, Lyons NB, Huang L, Holihan JL, Olavarria OA, Martin AC, et al. Gender disparity in authorship of peer-reviewed medical publications. *Am J Med Sci*. 2020;360:511-6.
- 15 Whitelaw S, Thabane L, Mamas MA, Reza N, Brethett K, Douglas PS, et al. Characteristics of heart failure trials associated with under-representation of women as lead authors. *J Am Coll Cardiol*. 2020;76:1919-30.