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Influence of Author's Gender on the Peer-Review Process in Vision Science

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INTRODUCTION

Inadequate diversity, equity and integration in ophthalmology and the vision sciences has been recently documented.[1–3] However, promoting a workforce that better resembles the demographics of the population helps reduce the inequalities in health care.[4]

It has been suggested that, when delving into the causes of the underrepresentation of women in science, that “society is trying to solve problems of the past that are no longer valid at present”.[5] Nevertheless, while the increase in women ophthalmologists in the US from the 1960s to 2009 was parallel to that of the female first authors, the trend for last authors has increased more slowly.[6] A decade later, the gap in senior positions lingers,[7–9] and articles with female key authors have fewer citations than their male counterparts.[8,10] Moreover, men win a greater proportion of prizes and awards,[11] instrumental in career development.[12] Women are given fewer opportunities to gain surgical competence during ophthalmology training,[13] and disparate recommendation letters.[14] They are perceived as being unlikely to succeed in the predominantly-male-run tasks,[15] such as the role of scientist, and funding awarded to women in Ophthalmology is lower.[16] Finally, to complicate matters, the gender gap in vision science research has been intensified during the SARS-CoV-2 pandemic.[17] While these factors may not completely account for women’s underrepresentation in science, they undoubtedly do not facilitate the closure of this gap.

Whereas overt gender discrimination is banned by law in most countries, we wonder whether or not differences still persist in our field in spite of this. The main purpose of our study was to determine whether the first/last author’s gender affects the time it takes for a manuscript to be reviewed, accepted, and published in PubMed. The gender gap per country, subspecialties, journal and in Editors-in-Chiefs were studied as well. To this end, the PubMed records from the top 30 journals in ‘*Ophthalmology’* category of the Journal Citation Reports (JCR) ranking were analyzed. This subset includes ophthalmology and optometry journals, and reflects the diversity of the multidisciplinary researchers in vision science.

METHODS

This was an observational retrospective study. The PubMed records of the first and second Ophthalmology JCR quartiles —Q1, Q2— were exported for analysis in February-March 2021. Only publications indexed in PubMed from 2016 to 2020 were included for analysis (n=35,644).

Inclusion and Exclusion Criteria

Each PubMed record includes a variable number of fields as described on the PubMed website. Errata, Letters, Biographies, Comments, Directories, News, and Retractions of publication, as specified in Publication Type field (PT), were not considered as research publications and were excluded. Records belonging to conferences or congresses were also omitted since many of them are likely to be published as full articles thereafter, thereby creating duplicated records for the same investigation. Finally, records in which the First Author Field (FAU) was not filled were not considered either, since no information about the author’s gender could be obtained.

It is common practice in medical research that "the first author is the person whose work underlies the paper as a whole", whereas the last authorship "indicates a person whose work or role made the study possible without necessarily doing the actual work",[18] and is normally given to a person in a senior position. Since those were considered the most relevant positions to our purpose, only the first and last author's gender and country of affiliation were analyzed. The influence of a First Author Female (FAF) and Last Author Female (LAF) was studied.

Country assignment

Affiliation Field (AD) was explored to assign first and last author's country of affiliation. When this included more than one country (e.g., overseas fellowships), the one with the lower gross domestic product per capita (more likely the author's country of origin)[19] was assigned.

Since US authors tend not to include their country of affiliation, a second search for the state and largest cities (>100,000 inhabitants) was performed in the unassigned records. Finally, a manual search was carried out for the rest of the unidentified affiliations.

From what we observed, the way in which the affiliation field is filled in PubMed records depends upon the journal itself. Some journals do not provide the affiliation, whereas others enlist the affiliation for each author listed, even when shared. When the affiliation field was filled exclusively for one of the authors, we automatically assigned it to both the first and last authors.

Finally, countries were classified as majority English speaking based on the specifications of the Government of the United Kingdom,[20] to determine whether that could be a confounding factor.

Gender assignment

To increase the accuracy of the gender classification, this was performed at three levels. First, the Gender API (Gender-API.com, Germany) was used to classify all of the possible combinations of Name/Country (where available).[17] As suggested by the API provider, including country increases the accuracy of the gender prediction. Only those predictions with ≥ 95% accuracy, and based on at least 10 samples, were considered as possibly correct, while the rest were rejected.

Registers of given birth names and their frequency are publicly available from many national statistics services (e.g., US, Spain, etc.) and were compiled to create lists of male/female names. Only the names used at least 10 times, and with a frequency >95% for one of the genders were included (e.g., Diana was used for females 99.7% of the times; Michael was used for males 99.5% of the times) and the whole dataset was classified using these lists. Records classified as belonging to different genders by the API and lists were set as undetermined.

Finally, to reduce the number of unidentified records, authors were searched for in professional profiles (hospital/lab websites, Google Scholar, ResearchGate, LinkedIn, Aminer, etc.) using their names, affiliations and/or the title of their publications. Authors were manually searched until at least either the first or last author was identified for 90% of records in each journal; however, 90% could not be reached for *Eye (London)*, since in many cases this journal provides initials instead of full names. A large percentage of these manually searched records corresponded to authors with a Chinese affiliation, since the romanization of Chinese names tends to make it difficult to assign a gender.

To verify the accuracy of the gender assignment strategy, a random subset of 265 authors classified unanimously by both the API and the names lists were searched manually. After verification that the API and the name list agreed in ≥95% cases —discrepancies were rare (<0.3%)— and that the accuracy of the prediction was around 95%, a classification by only the API or the lists (based on at least 10 samples and 95% accuracy/frequency) was deemed sufficient to assign the gender.

Finally, the current gender of the Editors-in-Chief in the JCR top-30 was also analyzed.

Research Topics

To analyze authors' interests and contributions in the field, 30 research topics were scrutinized. Records were assigned to one or more topics based on their MeSH terms and keywords (fields MH and OT, where available).

Timing

Dates of receipt, review, acceptance and publication in PubMed were extracted and the intervals received-reviewed (t_{REV}), received-accepted (t_{ACC}) and received-published (t_{PUB}) were calculated for each record. Not all records contained all of the dates and so the statistical analysis for each interval was only performed on the subsets for which the interval was available. Timing analysis was performed for all records and in various predefined subgroups (i.e. English names, Asian names, specific topics).

Statistics

Matlab R-2020b (The MathWorks Inc., Natick, MA) was used for data curation and analysis and JMP Pro 15 (SAS Institute Inc., Cary, NC, USA) was used for statistical analyses. The cut-off for significance was considered to be 0.05.

Mixed models were used for the analyses, and the full factorial equation was:

$$t_{XXX} = \beta_0 + \beta_1 * Gender1st[F] + \beta_2 * GenderLast[F] + \beta_3 * Gender1st[F] * GenderLast[F]$$

where t_{XXX} corresponds with t_{REV}, t_{ACC} or t_{PUB}. After verification that being a native-English author had a significant impact on the timing, a variable including the continent of the last author and whether the authors were or not native-English speakers was considered as random factor. Continent was included to ensure proper clustering and a random factor with more than 5 levels. These models are equivalent to a full factorial 2-way ANOVA when the random factor was not significant (Wald test p>0.05) and thus trimmed. The General Linear Mixed Model Power and Sample Size (GLIMMPSE) website (https://glimmpse.samplesizeshop.org/) was used to calculate sample sizes for mixed linear models. The samples sizes on the overall analysis guaranteed the detection of 4–5 days in each gender factor with a power >80% under the more restrictive condition (the random factor is not significant). English and Asian names analyses ensured the detection of a 7-day and 10-day difference between groups with at least 80% power respectively.

The study was designed and carried out in compliance with the tenets of the Declaration of Helsinki. The Ethical Committee of the Antwerp University Hospital waived institutional board approval and the requirement for informed consent since the study only assessed publicly available resources.

RESULTS

Initially, 35,644 PubMed records were exported, of which 30,438 remained after applying the exclusion criteria. Since names may be more commonly assigned to a gender depending on the country, the 19,046 unique combinations of name/affiliation country were checked. The API classified 11,760 combinations with an accuracy ≥95%, each based on ≥10 samples. Of these, 4,653 were females. The results for the 265 authors previously identified and manually searched confirmed the expected 95% confidence. The first author's gender was identified for 26,831 records (88%) while last author's gender was identified for 28,286 publications (93%).

The percentages of male/female found online for first and last authors was in the order of the percentages obtained using the API and lists for both first and last authors (41.6% vs 39.9% for FAF and 27.4% vs 26.6% for LAF).

Analysis by Country

The country of the first or last author could not be obtained for 1,744 (5.8%) and 1,706 (5.6%) publications respectively. Globally, 1,680 records (5.5%) did not include any affiliation.

The geographical distribution of publications can be found in Figure 1; the gender distribution in the top 40 publishing countries in Figure 2.

Both first and last native English-speaking author as determined by their affiliation country had a significant influence in t_{REV}, t_{ACC} and t_{PUB}. Having at least one native English last or first author reduced times by 9, 21 and 24 days respectively (t-Student test, all of them $p<0.0001$), thus they were considered as control factors in the models where needed.

Peer-review timeline

The intervals to get a manuscript reviewed, accepted and published were analyzed over all publications, controlling for native English as mentioned above (Table 1). Significant gender-based differences were found for t_{REV} and t_{ACC}, but this did not affect t_{PUB}. For example, the average time to get an article reviewed was 108.4 days. Having a FAF adds-up 3.7 extra days to the review time; having a LAF adds-up 5.8 days, a total of 9.5 days if both are female.

Since the gender of English names is more easily recognized worldwide, the same analysis was repeated using only US, UK, and Australian records; the significant delay in reviewing times persisted for LAF (Table 1) and both FAF and LAF had a significant influence on t_{ACC}. Meanwhile, it is difficult to allocate Chinese names written in the Latin alphabet to specific gender groups —even for native Chinese speakers— thereby making it a suitable, unbiased reference. Hence, records with both Chinese affiliations were analyzed separately, resulting in a nonsignificant influence of gender in t_{REV}, t_{ACC}, or t_{PUB}. When publications from top east Asian publishers —China, Japan, India, Singapore, Thailand, Taiwan, Hong-Kong, South Korea, Pakistan, and Malaysia— were analyzed altogether, FAF even showed a significantly reduced time to publish of -10.3 days (Table 1).

Topics

Distribution of LAF and FAF by topic can be found in Figure 3. Based on the percentage of LAF, topics were classified as being more strongly male- or female represented. The topics with the highest degree of female representation were *Retinopathy of Prematurity* and *Amblyopia* and the lowest were *Refractive Surgery* and *Retina;* their models can be found in Table 2. Significant delays in t_{REV} were only found in higher female representation topics. Timing was not influenced by LAF, however, having a FAF generated significant delays in t_{ACC} and t_{PUB}, with differences of over one month. No significant difference was found in *Retina* publications.

Journals & Editors

The average of FAF publications was 40.0±6.7% and the one of LAF 27.1±4.9% (Figure 4). Male/female percentages were significantly different for both first and last authorships (Pearson; $p<0.0001$) when examined over all of the journals. The proportion of FAF and LAF was significantly higher in Q1 than in Q2 journals (Fischer Exact Test; both $p<0.0001$). Overall (%LAF + %FAF), *Molecular vision* publications were the most evenly distributed by gender followed by *Ophthalmic and Physiological Optics* and *Contact Lens & Anterior Eye*. Meanwhile, *Retina, Journal of Refractive Surgery* and *Journal of Cataract and Refractive Surgery* were the ones with the lowest levels of female representation.

Furthermore, only 5 of the 41 Editors-In-Chief are female (12.2%).

DISCUSSION

For years, sociologists have struggled to identify the reasons behind women's underrepresentation in Science, Technology, Engineering, Mathematics, and Medicine (STEMM),[21] for which gender biases and a lack of female role models have often been held responsible.

Our results demonstrate that vision science is not immune to gender disparities, which vary considerably between countries (Figure 2). While some countries like Sweden, Belgium, Norway, and New Zealand have achieved parity in both FAF and LAF, percentages < 20% LAF were seen in Italy, Portugal, Iran, and Japan, and countries such as Saudi Arabia, Iran, and Japan do not reach 25% of FAF, as reported previously.[8] Thailand was the only country in which women published more than their male counterparts in 2016–2020. Since the percentage of women in the workforce may vary across countries,[1,22] parity was defined as the range 45–55%.

The gender gap considerably differed among journals (Figure 4). This heterogeneity may not necessarily be attributable to any kind of bias, but rather reflect a combination of the topics preferred by female researchers (Figure 3) with the scope of the individual journals.

Although some of these findings have been reported previously,[8,23] current analyses revealed that the intervals t_{REV} and t_{ACC} were significantly longer when the most prestigious author positions, the first and the last, were held by a woman. Longer delays were associated with LAF, rather than FAF, which might be associated with the fact that the last author position is more often held by a well-known scientist.[11] These effects were still present when only English names were analyzed, but were not significant when the authors' gender is not easily distinguishable by the name by most reviewers/editors, such as for individuals with an Asian affiliation. Nonetheless, Asian names' results and the 10-day faster time to publish —the only significant result favorable to women— should be interpreted with more caution, as those are accompanied by a lower number of records and higher variability.

Significant gender differences in t_{ACC} and t_{PUB} for FAF were found in 3 of the 4 topics analyzed, while no significant delays were seen for LAF (Table 2); t_{REV} was only significantly increased in topics with a higher female representation. Although there is insufficient information to conclude that women may be more biased against women than men, since women are less involved in peer-review compared to the rate of authors,[24] gender biases do not exclusively occur from men to women, as is often thought.[25]

The possible causes of these results are likely complex and involve several societal and personal factors. The underrepresentation of women as authors fits within a much broader underrepresentation of women in STEMM. It has been argued that this can be explained by the lack of resources in the institutions women choose —whether free or constrained— to work in.[5] This argument is unlikely to explain the detected delays, as poorly-designed research due to lack of resources is not expected to be accepted for publication in a Q1 or Q2 journal.

A similar study recently reported that in the strongly gender-biased field of Economics, the 4% female-authored articles were 5 times more likely to be delayed than to have a speedy review.[26] The author partially attributed this to women being held to higher scientific standards, which, after a few rejections, prompted them to improve their writing skills more quickly than men.[26] However, this is not an isolated finding; higher quality standards for women —better reviewer's scores required to accept— have also been reported in health science journals in 2021, whereas gender had no impact on the number of revision rounds.[24] Conversely, women have traditionally taken a risk-averse approach on multiple choice tests —although nowadays this effect may be significant but very small.[27] Whether women, trying to minimize risk of rejection or anticipating a treatment by higher standards, write also more thorough rebuttals for reviewers, thus delaying delivery, would need further investigation.

Alternatively, these delays may also be prompted by the time demands of unequal family responsibilities, which in many parts of the world still primarily fall on women, even when household chores are (partially) outsourced. Determining whether the delays are associated to editors or reviewers' bias, to the authors delaying rebuttals or to a combination of them is not possible with the information publicly available.

Are specific measures required? According to our results, the editorial process seems to be self-regulating as, in the end, there is no significant gender-based difference in time to publish. Even if the delays found were translated in a delay in time to publication (which they are not), a 10-day delay seems not clinically significant in ophthalmology research. However, when analyzed separately, *Amblyopia*, *Retinopathy of Prematurity,* and *Refractive Surgery* records showed a significant gender delay of 1–2 months to get published. These might be spurious results related to model overfitting due to insufficient data (or worse still, they may be real). A recent study also suggested that women are treated less favorably in fields of research where the ratio of women is higher.[24]

In any event, although a moderate subjectivity of the reviewers and editors can represent an added value to avoid herding and misperceptions in science,[28] we believe that subjectivity related to the author's gender —recently documented[24]— has not place in the 21st century.

Squazzoni et al.[24] recently analyzed 145 journals from different disciplines. They concluded that there is no systematic gender bias in the peer review process, but they still found some interesting differences, and suggested that diversity in editors and reviewers would be beneficial. Currently, the Editors-in-Chief of Q1 and Q2 journals in Ophthalmology are far from gender-balanced, with only 12.2% females.

According to the literature, the influence of double-blind peer review process on gender bias prevention is not compelling. Budden et al.[29] explored whether it might increase the number of female authors, but their results could not be replicated, generating controversy.[5] On the other hand, Squazzoni et al[24] have reported that female authored manuscripts in social sciences received worse referees' scores when the process was single-blind.

Although overt gender discrimination is banned by law in most countries, implicit biases are still problematic. For example, the selection of the corresponding author (usually the first or last) influences the perception of the first author's contribution to the study.[30] Hence, if the last author is systematically selected as corresponding author, with the reduced LAF percentages obtained here, women's contribution will very likely be undervalued. This problem could be easily remedied if journals allowed two corresponding authors. Adding mandatory CRediT statements, as is required by an increasing number of journals, is also useful, as specifying individual contributions helps avoid devaluing women's contributions.[15]

Whether there is a leaky pipeline or a vertical segregation would require further investigation, but the reduced number of LAF is concerning, especially in some countries in which concrete measures may be necessary. In the past, leadership training and education of faculty helped in women promotion and retention of women in academia,[31] but other initiatives may be convenient, such as the financial incentives offered by Hanover Medical University to the departments that attract female doctors back to work from parental leave within one year.[32]

To this point, we want to acknowledge as a limitation the undeliberated —although possible— misgendering on our paper. Based on the names and appearance, we assigned a binary gender to the authors, contributing somehow to the binary gender status quo. Authors that may have been mislabeled under these criteria are encouraged to contact the corresponding author so that their gender identity (including non-binary) can be updated in our authors database and so, be correctly assigned whether this research were carried out for a future period.

Real progress has been made towards gender parity over the last decades, but there is still work to be done. We identified slight gender differences in the review process, an issue that we believe can be minimized just by increasing awareness within the vision science community. Certainly, these slight differences should not discourage women from pursuing a career in vision science research. Risk averse or not, held by higher standards or not, female-authored manuscripts in health sciences are 5% more likely to be accepted than their male counterparts.[24]

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REFERENCES

1. Xierali IM, Nivet MA, Wilson MR. Current and future status of diversity in ophthalmologist workforce. *JAMA Ophthalmol*. 2016;134(9):1016-1023. doi:10.1001/jamaophthalmol.2016.2257
2. Fairless EA, Nwanyanwu KH, Forster SH, Teng CC. Ophthalmology Departments Remain Among the Least Diverse Clinical Departments at United States Medical Schools. *Ophthalmology*. 2021;128(8):1129-1134. doi:10.1016/j.ophtha.2021.01.006
3. Aguwa UT, Srikumaran D, Brown N, Woreta F. Improving Racial Diversity in the Ophthalmology Workforce: A Call to Action for Leaders in Ophthalmology. *Am J Ophthalmol*. 2021;223:306-307. doi:10.1016/j.ajo.2020.10.007
4. Marrast LM, Zallman L, Woolhandler S, Bor DH, McCormick D. Minority physicians' role in the care of underserved patients: Diversifying the physicianworkforce may be key in addressing health disparities. *JAMA Intern Med*. 2014;174(2):289-291. doi:10.1001/jamainternmed.2013.12756
5. Ceci SJ, Williams WM. Understanding current causes of women's underrepresentation in science. *Proc Natl Acad Sci U S A*. 2011;108(8):3157-3162. doi:10.1073/pnas.1014871108
6. Mansour AM, Shields CL, Maalouf FC, et al. Five-Decade Profile of Women in Leadership Positions at Ophthalmic Publications. *Arch Ophthalmol*. 2013;130(11):1441-1446. doi:10.1001/archophthalmol.2012.2300
7. Mimouni M, Zayit-Soudry S, Segal O, et al. Trends in Authorship of Articles in Major Ophthalmology Journals by Gender, 2002–2014. *Ophthalmology*. 2016;123(8):1824-1828. doi:10.1016/j.ophtha.2016.04.034
8. Kramer PW, Kohnen T, Groneberg DA, Bendels MHK. Sex Disparities in Ophthalmic Research. *JAMA Ophthalmol*. 2019;137(11):1223. doi:10.1001/jamaophthalmol.2019.3095
9. Efron N, Morgan PB, Jones LW, Morgan GA, Nichols JJ. Global optometrist top 200 research ranking. *Clin Exp Optom*. 2021;104(4):471-485. doi:10.1080/08164622.2021.1878863
10. Bendels MHK, Müller R, Brueggmann D, Groneberg DA. Gender disparities in high-quality research revealed by nature index journals. *PLoS One*. 2018;13(1):1-21. doi:10.1371/journal.pone.0189136
11. Lincoln AE, Pincus S, Koster JB, Leboy PS. The Matilda Effect in science: Awards and prizes in the US, 1990s and 2000s. *Soc Stud Sci*. 2012;42(2):307-320. doi:10.1177/0306312711435830
12. Frey BS. Awards as compensation. *Eur Manag Rev*. 2007;4(1):6-14. doi:10.1057/palgrave.emr.1500068
13. Gong D, Winn BJ, Beal CJ, et al. Gender Differences in Case Volume among Ophthalmology Residents. *JAMA Ophthalmol*. 2019;137(9):1015-1020. doi:10.1001/jamaophthalmol.2019.2427
14. Lin F, Oh SK, Gordon LK, Pineles SL, Rosenberg JB, Tsui I. Gender-based differences in letters of

recommendation written for ophthalmology residency applicants. *BMC Med Educ*. 2019;19(1):476. doi:10.1186/s12909-019-1910-6

15. Heilman ME, Haynes MC. No credit where credit is due: Attributional rationalization of women's success in male-female teams. *J Appl Psychol*. 2005;90(5):905-916. doi:10.1037/0021-9010.90.5.905
16. Svider PF, D'Aguillo CM, White PE, et al. Gender differences in successful national institutes of health funding in ophthalmology. *J Surg Educ*. 2014;71(5):680-688. doi:10.1016/j.jsurg.2014.01.020
17. Nguyen AX, Trinh XV, Kurian J, Wu AY. Impact of COVID-19 on longitudinal ophthalmology authorship gender trends. *Graefe's Arch Clin Exp Ophthalmol*. 2021;259(3):733-744. doi:10.1007/s00417-021-05085-4
18. Murphy T. Authorship and Publication. In: *Case Studies in Biomedical Research Ethics*. 1st ed. The MIT press; 2004:273–305.
19. González-Alcaide G, Park J, Huamaní C, Ramos JM. Dominance and leadership in research activities: Collaboration between countries of differing human development is reflected through authorship order and designation as corresponding authors in scientific publications. Ouzounis CA, ed. *PLoS One*. 2017;12(8):e0182513. doi:10.1371/journal.pone.0182513
20. UK Government. Majority English language speaking country List. Published 2021. https://www.gov.uk/english-language/exemptions
21. Holman L, Stuart-Fox D, Hauser CE. The gender gap in science: How long until women are equally represented? *PLoS Biol*. 2018;16(4):1-20. doi:10.1371/journal.pbio.2004956
22. Gill H, Niederer RL, Shriver E, Gordon LK, Coleman AL, Danesh-Meyer HV. An eye on gender equality: A review of the evolving role and representation of women in ophthalmology. *Am J Ophthalmol*. Published online July 2021:Publish Ah. doi:10.1016/j.ajo.2021.07.006
23. Franco-Cardenas V, Rosenberg J, Ramirez A, Lin J, Tsui I. Decadelong profile of women in ophthalmic publications. *JAMA Ophthalmol*. 2015;133(3):255-259. doi:10.1001/jamaophthalmol.2014.4447
24. Squazzoni F, Bravo G, Farjam M, et al. Peer review and gender bias: A study on 145 scholarly journals. *Sci Adv*. 2021;7(2). doi:10.1126/sciadv.abd0299
25. Moss-Racusin CA, Dovidio JF, Brescoll VL, Graham MJ, Handelsman J. Science faculty's subtle gender biases favor male students. *Proc Natl Acad Sci U S A*. 2012;109(41):16474-16479. doi:10.1073/pnas.1211286109
26. Hengel E. Publishing while female. Are women held to higher standards? Evidence from peer review. *Cambridge Work Pap Econ*. 2020;2020(December):1-76. https://www.repository.cam.ac.uk/handle/1810/270621
27. Conde-Ruiz JI, Ganuza JJ, García M. Gender Gap and Multiple Choice Exams in Public Selection Processes. *Hacienda Publica Esp Public Econ*. 2020;235(4):11-28. doi:10.7866/HPE-RPE.20.4.2
28. Park IU, Peacey MW, Munafò MR. Modelling the effects of subjective and objective decision making in scientific peer review. *Nature*. 2014;506(7486):93-96. doi:10.1038/nature12786
29. Budden AE, Tregenza T, Aarssen LW, Koricheva J, Leimu R, Lortie CJ. Double-blind review favours increased representation of female authors. *Trends Ecol Evol*. 2008;23(1):4-6. doi:10.1016/j.tree.2007.07.008
30. Bhandari M, Guyatt GH, Kulkarni A V., et al. Perceptions of authors' contributions are influenced by both byline order and designation of corresponding author. *J Clin Epidemiol*. 2014;67(9):1049-1054. doi:10.1016/j.jclinepi.2014.04.006
31. Fried LP, Francomano CA, MacDonald SM, et al. Career development for women in academic medicine: Multiple interventions in a Department of Medicine. *J Am Med Assoc*. 1996;276(11):898-905. doi:10.1001/jama.276.11.898

32. Wiskow C, Albreht T, de Pietro C. *How to Create an Attractive and Supportive Working Environment for Health Professionals*. Vol 15.; 2010.

FIGURE LEGENDS

Figure 1. Geographical distribution of vision science publications (n=30,438)

Figure 2. Last author female (LAF) and First author female (FAF) percentages by country —only gender identified records (>25000) taken into account. The legend identifies how many of the last authors (LA) and first authors (FA) had an identified gender. A thicker orange line represents an inverted trend, with %LAF>%FAF.

Figure 3 Last author female (LAF) and First author female (FAF) percentages by topic —only gender identified records taken into account (>25000). The legend identifies how many of the last authors (LA) and first authors (FA) had an identified gender.

Figure 4. Last author female (LAF) and First author female (FAF) percentages through Journal Citations Report 2020 Ranking (top-30). The legend identifies how many of the last authors (LA) and first authors (FA) had an identified gender; only gender identified records (>25000) were considered to calculate percentages.

TABLE 1

	OVERALL			ENGLISH NAMES			ASIAN NAMES		
Received- Reviewed ([95CI] p-value)									
Nr. Publications	9899			4175			1642		
Mean	**108.4 days**	*[106.4–110.5]*	**p<0.0001**	**102.9 days**	*[99.7–106.1]*	**p<0.0001**	**111.6 days**	*[106.9–116.3]*	**p<0.0001**
FAF	**+3.7 days**	*[0.3–7.1]*	**p=0.03**	+4.2 days	*[-1.2–9.5]*	p=0.130	-4.6 days	*[-12.2–3.0]*	p=0.233
LAF	**+5.8 days**	*[1.4–10.2]*	**p=0.01**	**+10.0 days**	*[3.1–16.8]*	**p=0.004**	+1.25 days	*[-9.4–11.9]*	p=0.818
Received- Accepted ([95CI] p-value)									
Nr. Publications	13022			5415			2037		
Mean	**122.9 days**	*[120.9–124.9]*	**p<0.0001**	**111.7 days**	[108.7–114.7]	**p<0.0001**	**132.0 days**	*[127.3–136.7]*	**p<0.0001**
FAF	**+5.2 days**	*[2.0–8.5]*	**p=0.0015**	**+5.3 days**	*[0.2–10.3]*	**p=0.04**	-5.2 days	*[-12.9–2.6]*	p=0.191
LAF	+2.7 days	*[-1.4–7.0]*	p=0.116	**+6.7 days**	*[0.3–13.1]*	**p=0.04**	-0.90 days	*[-11.6–9.7]*	p=0.868
Received- Published ([95CI] p-value)									
Nr. Publications	13067			5480			2034		
Mean	**164.5 days**	*[162.3–166.6]*	**p<0.0001**	**152.2 days**	*[149.0–155.5]*	**p<0.0001**	**172.7 days**	*[167.7–177.7]*	**p<0.0001**
FAF	+2.3 days	*[-1.3 –5.8]*	p=0.208	+3.4 days	*[-2.1–8.8]*	p=0.224	**-10.3 days**	*[-18.5 – -2.0]*	**p=0.01**
LAF	-0.7 days	*[-5.2–3.9]*	p=0.781	+4.2 days	*[-2.7–11.1]*	p=0.233	-5.8 days	*[-17.2–5.5]*	p=0.312

FAF, first author female; LAF, last author female; 95CI, 95% confidence interval

Table 2. Mean time for review, acceptance and publication by topic

	RETINOPATHY OF PREMATURITY	AMBLYOPIA	REFRACTIVE SURGERY	RETINA (DETACHMENT AND OCCLUSIONS)
Received- Reviewed ([95CI] p-value)				
Nr. Publications	99	27	172	292
Mean	**80.1 days [56.6–103.6] p<0.0001**	**91.0 days [31.1–151.0] p=0.004**	**111.3 days [96.3–126.2] p<0.0001**	**97.2 days [87.0–107.4] p<0.0001**
FAF	**+47.8 days [13.0–82.6] p=0.0076**	**+84.3 days [1.1-167.4] p=0.047**	+25.2 days [-2.9–53.4] p=0.079	+6.3 days [-11.5–24.1] p=0.489
LAF	+17.2 days [-27.7–62.0] p=0.449	-7.2 days [-98.2–83.8] p=0.871	-3.0 days [-43.6–37.5] p=0.882	-7.9 days [-31.4–15.6] p=0.508
Received- Accepted ([95CI] p-value)				
Nr. Publications	125	47	195	393
Mean	**101.3 days [77.6–125.0] p<0.0001**	**98.3 days [50.0–146.5] p=0.0002**	**117.9 days [103.7–132.0] p<0.0001**	**113.9 days [103.7–124.0] p<0.0001**
FAF	**+42.0 days [7.4–76.6] p=0.018**	**+76.0 days [15.4–136.5] p=0.015**	**+32.4 days [6.2–58.5] p=0.015**	+6.3 days[-10.9–23.6] p=0.473
LAF	+23.2 days [-18.9–65.3] p=0.278	-5.44 days [-69.7-58.8] p=0.865	-2.33 days [-41.8–37.2] p=0.907	-8.4 days [-32.1–15.2] p=0.483
Received- Published ([95CI] p-value)				
Nr. Publications	124	47	193	397
Mean	**137.4 days [112.4–162.3] p<0.0001**	**132.2 days [91.2-173.1] p<0.0001**	**198.9 days [182.7–215.2] p<0.0001**	**154.4 days [143.2–165.6] p<0.0001**
FAF	**+38.7 days [2.76–74.6] p=0.035**	**+70.5 days [17.74-123.1] p=0.01**	**+31.0 days [1.0-61.1] p=0.043**	12.0 days [-6.9–30.9] p=0.214
LAF	+24.3 days [-20.4–68.9] p=0.283	+9.93 days [-46.2-66.1] p=0.723	+1.95 days [-41.1–47.1] p=0.932	-0.6 days [-26.8–25.6] p=0.964

FAF, first author female; LAF, last author female; 95CI, 95% confidence interval

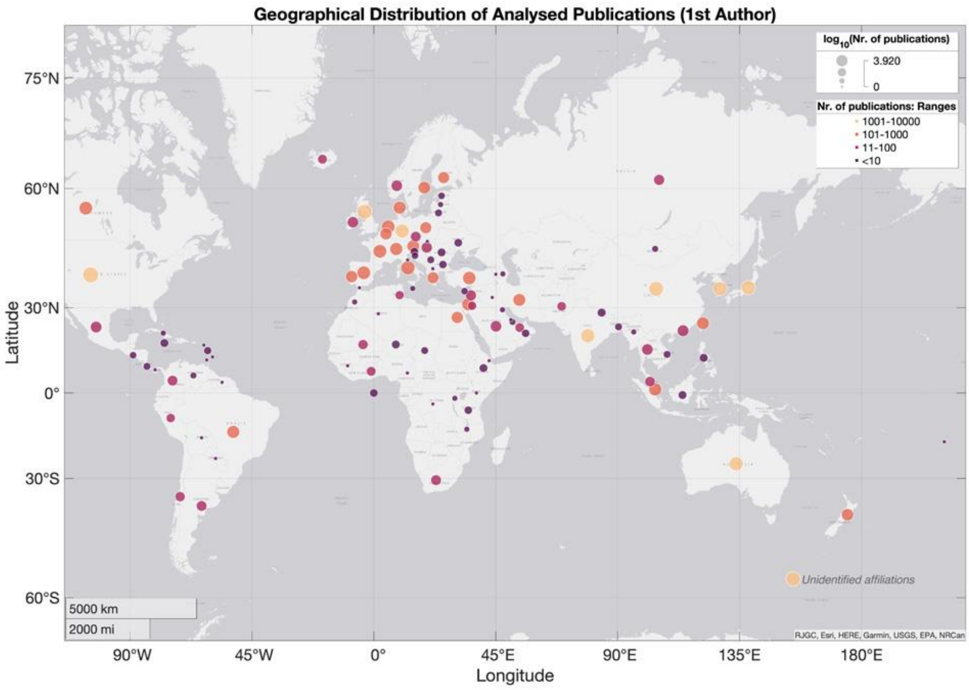

Figure 1

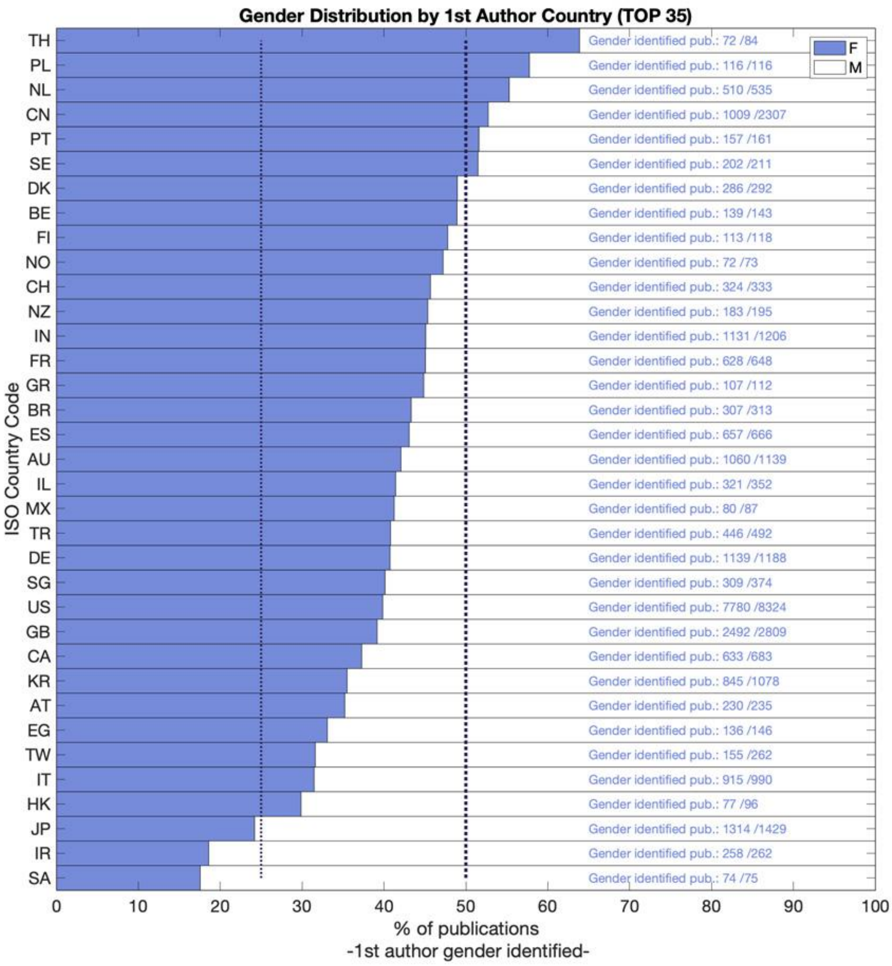

Figure 2

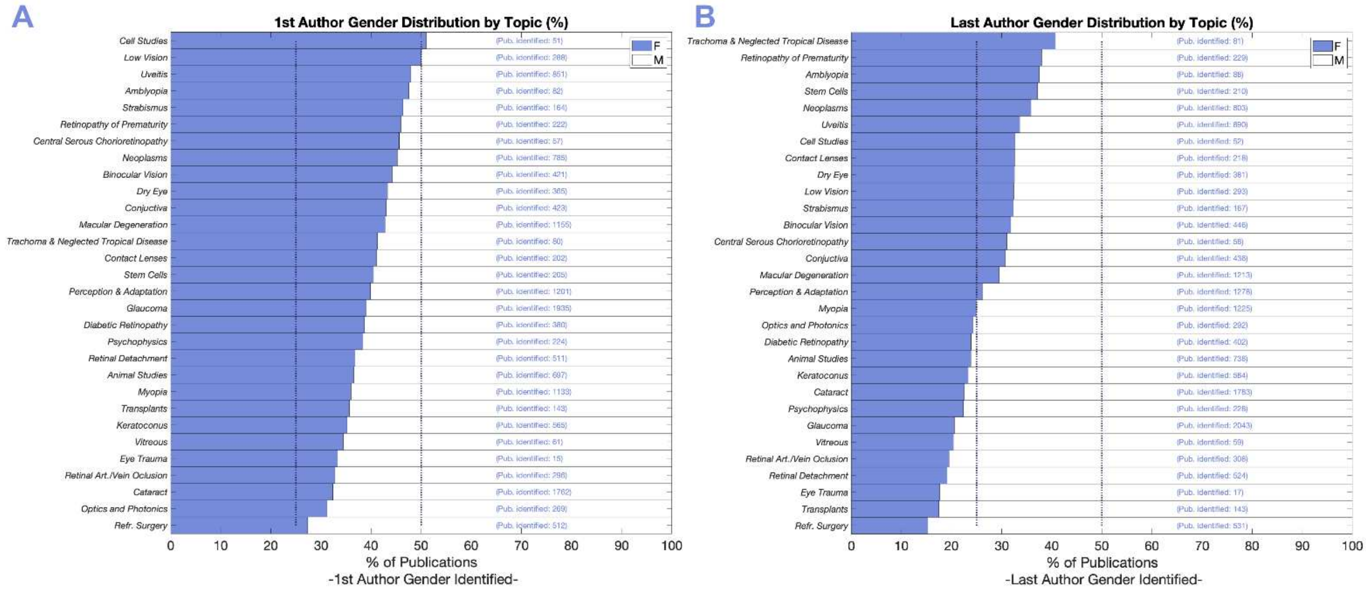

Figure 3

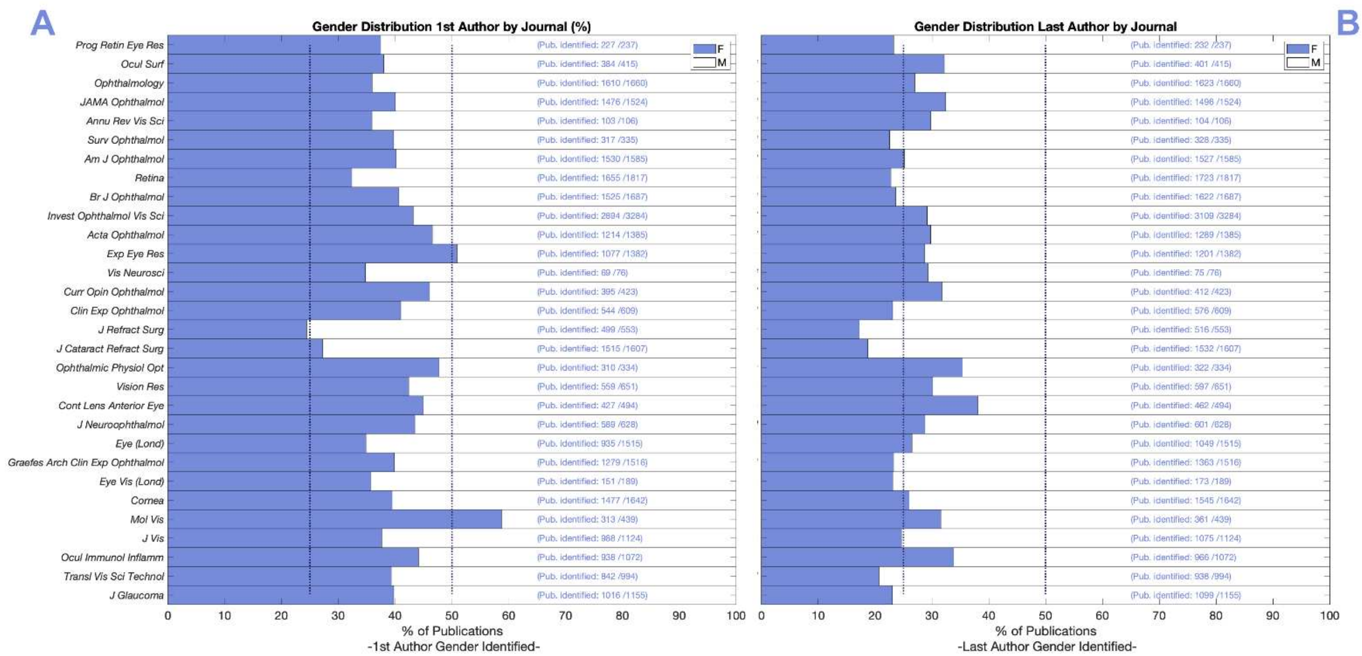

Figure 4