

Your grandchildren may retire before we achieve gender equality in STEMM

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The gender gap is very striking in the STEMM workforce. Credit: Jarmoluk on Pixabay

Researchers from the University of Melbourne analysed the numbers of men and women authors listed on more than 10 million academic papers,

allowing them to calculate the gender gap among researchers, as well as its rate of change for most disciplines of science and medicine.

The team comprised Dr Luke Holman, Associate Professor Devi Stuart-Fox and Dr Cindy Hauser from the University of Melbourne's School of Biosciences.

Dr Holman used computational methods to gather data from the citation databases PubMed and arXiv, and then estimated the gender of 36 million authors based on their names. The 15-year dataset covers more than 6000 academic journals, spans almost all STEMM disciplines, and includes authors from over 100 countries.

The study data has been made publically available through an [online tool](#), in order to help researchers, employers and policy makers identify fields of science that need new initiatives and reforms if they are ever to reach gender parity and is published in *PLOS Biology*.

Results showed that:

- 87 of the 115 disciplines examined had significantly fewer than 45% [women](#) authors, 5 had significantly more than 55%, and the remaining 23 were within 5% of gender parity.
- Topics such as physics, computer science, mathematics, surgery and chemistry had the fewest women, while health-related disciplines like nursing, midwifery, and palliative care had the most.
- The [gender gap](#) is very striking in some areas. For example, Physics presently has around 13% women in senior positions, and this gap is predicted to take 258 years to close
- Junior researchers were more likely to be women and senior researchers more likely to be men, relative to the overall gender ratio of the discipline in question.

- Prestigious journals have fewer women authors than do standard journals.
- Men were estimated to be invited by journals to submit papers at approximately double the rate of women. Wealthy countries, notably Japan, Germany and Switzerland, had fewer women authors than did poorer countries.
- The PubMed categories Social Sciences (predominantly Social Work journals) and Speech-Language Pathology currently have more than 50% of women authors, and are becoming significantly more female-biased.
- A small minority of journals bucked the overall trend and had fewer women first authors than expected rather than more; these journals were predominantly well-known, prestigious titles such as *Nature*, *Lancet*, *New England Journal of Medicine*, and *BMJ*.

Dr Cindy Hauser said that highly male-biased disciplines tended to show especially slow improvement in the gender ratio with time.

"Of the gender-biased disciplines, almost all are moving towards parity, though some are predicted to take decades or even centuries to reach it."

Associate Professor Devi Stuart Fox said that they chose to focus on academic publications as they are currently the primary means of disseminating scientific knowledge and the principal measure of research productivity, thereby influencing the career prospects and visibility of women in STEM.

"Author lists of these publications also provided information on the gender ratio of people working in a given field as well as seniority. In most disciplines represented in the dataset, the conventions regarding authorship order mean that first authors are typically junior researchers, while last authors tend to be more senior. "

The team note that the underrepresentation of women in senior authorship positions probably has multiple, complex causes, but that several practical measures that could help to close the gender gap have already been identified, and are awaiting implementation.

These could include reforming academic publishing and peer review, ensuring women have equal access to informal professional networks, affording greater recognition of the extra demands outside the workplace that traditionally fall on women when assessing researchers' achievements, ensuring women receive equal resources at work, better access to parental leave and career break provisions, striving for a representative gender ratio of invited speakers at conferences, and affirmative action during hiring.

Dr Holman said that the new dataset provides new opportunities to evaluate the effectiveness of some of these strategies.

"For example, one could measure the impact of double-blind peer review or invitation-based submission models, which have been proposed to affect the proportion of female authors publishing in a given [journal](#). Additionally, the data could be used in sociological studies to help determine why some countries have a huge shortage of women in STEMM, while others have already achieved [gender](#) parity."

More information: Holman L, Stuart-Fox D, Hauser CE (2018) The gender gap in science: How long until women are equally represented? PLoS Biol 16(4): e2004956. [DOI: 10.1371/journal.pbio.2004956](https://doi.org/10.1371/journal.pbio.2004956)

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