Differences in Gender Representation in the Altmetric Top 100

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INTRODUCTION

Female physicians are less likely than their male counterparts to become full professors.[1] They receive less grant funding, are more likely to leave a research career,[2,3] and are less likely to engage in self-promotion.[4,5] The Altmetric Top 100 is an annual list of research that garnered the most public attention in a given year. We examined gender differences in Altmetric attention score components and the representation of female authors among the Altmetric Top 100.

METHODS

Data on authorship, journal, Altmetric attention score, Google Scholar citations, and news and social media mentions were retrieved for all studies included on the 2015–2019 Altmetric Top 100 lists. The first and last authors of each study were classified as male, female, or unknown based on publicly available data. In certain instances, no gender was assigned to one or both positions (e.g., single author manuscripts, research collaboratives without individual author names). Differences in the proportions of female compared to male first and last authors were assessed using Pearson's chi-squared test with Yates's continuity correction. Differences in the number of authors, journal impact factor, Altmetric attention score, citation counts, and media mentions by gender of first author, last author, and gender concordant first/last author pairs were assessed using the Mann-Whitney-Wilcoxon test. Strengths of associations between author gender and Altmetric scores, journal impact factor, citation counts, and news and social media mentions were calculated via point-biserial correlations. Associations of select variables with citation counts and Altmetric scores were examined using Poisson and linear regression, respectively.

RESULTS

Five hundred manuscripts were featured in the 2015–2019 Altmetric Top 100 lists. First and last author gender were classified for 498 and 489 manuscripts, respectively. Significantly fewer studies were authored by female than male first authors (151 vs. 347, $p<0.01$), female than male last authors (111 vs. 378, $p<0.01$), and female first-last author pairs than male first-last author pairs (44 vs. 273, $p<0.01$). Manuscripts with female first authors, last authors, or female first-last author pairs had significantly fewer Google Scholar citations than those with male first authors ($p=0.01$), last authors ($p=0.04$), or male first-last author pairs ($p<0.01$), respectively (Table 1). Female authors had significantly fewer blog mentions than male authors, and in some cases, fewer Google mentions. There were significant negative associations between having a female first author and Altmetric attention scores, Google Scholar citations, and blog mentions, as well as between having a female last author and blog or Google mentions ($p<0.05$ for all comparisons) (Fig. 1).

On multivariable Poisson regression adjusted for number of authors, impact factor, and year, having a female first or last author was associated with having fewer Google Scholar citations (incidence rate ratio [IRR]=0.71, SE=0.005, $p<0.001$). In a linear regression model adjusted for the same factors, having a female first or last author was associated with having lower Altmetric scores ($\beta=-0.08$, SE=0.04, $p=0.03$).

DISCUSSION

This analysis demonstrated significant gender authorship differences among studies in the Altmetric Top 100, with significantly fewer manuscripts with female first and last authors. There were also gender differences in citations and other metrics such as blog posts and Google mentions for studies by female authors. Our findings corroborate a gap in attention to research produced by female authors, both in formal

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Table 1 Manuscript Attention Score Metrics Stratified by Gender of First Author, Last Author, and Gender Concordant First/Last Author Pairs

Variable	First author			Last author			First and last author		
	Female (*n* = 151)	Male (*n* = 347)	*p*	Female (*n* = 111)	Male (*n* = 378)	*p*	Females (*n*=44)	Males (*n*=273)	*p*
Number of authors	8 (4–16)	28 (13–61)	0.14	32 (16–48)	29 (14–45)	0.16	45 (29–49)	29 (13–45)	0.002
Journal impact factor	21 (10–42)	28 (10–79)	0.42	20 (9–42)	22 (10–42)	0.29	17 (7–37)	23 (10–42)	0.14
Altmetric attention score	2341 (1826–2936)	2638 (1890–13557)	0.32	2337 (1844–2934)	2340 (1794–2934)	0.97	2370 (1826–2930)	2353 (1888–2974)	0.96
News mentions	200 (87–278)	199 (85–619)	0.58	202 (114–274)	200 (84–282)	0.76	209 (118–272)	203 (81–284)	0.85
Blog mentions	18 (12–26)	22 (12–86)	0.01	15 (9–24)	19 (13–27)	0.003	13 (9–20)	20 (13–28)	0.0002
Twitter mentions	1266 (656–2601)	2570 (674–61671)	0.15	1216 (676–2656)	1237 (635–2565)	0.96	960 (607–2410)	1269 (665–2732)	0.57
Peer review mentions	0 (0–0)	0.3 (0–45)	0.53	0 (0–0)	0 (0–0)	0.46	0 (0–0)	0 (0–0)	0.44
Facebook mentions	31 (14–59)	44 (13–332)	0.12	30 (14–56)	31 (14–59)	0.56	30 (16–44)	29 (13–55)	0.99
Wikipedia mentions	1 (0–2)	2 (0–109)	0.02	0 (0–2)	1 (0–2)	0.90	0 (0–2)	1 (0–2)	0.08
Google Scholar citations	189 (67–471)	527 (75–9911)	0.01	147 (52–397)	202 (77–495)	0.04	89 (37–212)	224 (80–533)	0.001
Google mentions	7 (1–14)	14 (1–235)	0.82	4 (0–11)	7 (2–16)	0.003	3 (0–7)	7 (1–15)	0.01

Data are presented as median (interquartile range)

scientific terms such as citations and in popular metrics of attention. Our findings are consistent with previous work demonstrating an underrepresentation of female first authors in prestigious medical journals.[6]

The limitations of our study include characterization of gender based on publicly available information, the infeasibility of comparing the proportion of female authors on this list to the proportion of all scientists who are female and the proportion of all literature authored by female scientists, inconsistent associations between Google mentions and author gender, and the potential presence of confounders for which we did not adjust.

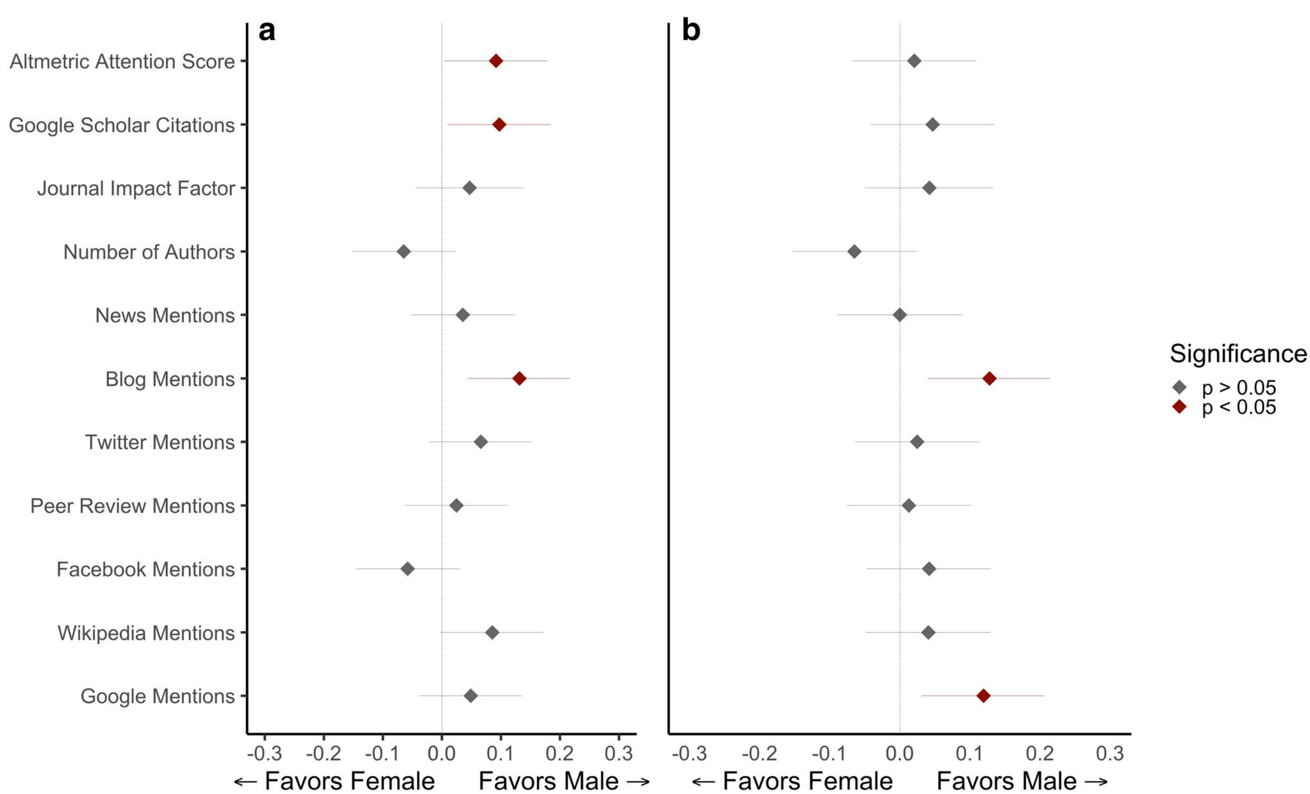

Figure 1 Point-biserial correlations between attention score metrics and a) first and b) last author gender. Positive correlations indicate that manuscripts with male first or last authors had higher scores or counts as compared to manuscripts with female first or last authors.

Causes of the gender gap in research visibility are unclear. Possible contributors include differential self-citation or promotion patterns, differential peer recognition of work, differences in societal reactions to self-promotion, biases in whose work institutional press offices highlight to the media, and biased gender representation in the media. Further work is needed to identify the individual, cultural, and societal contributors underlying gender disparities in research attention. Concerted efforts are needed to facilitate popular and scientific promotion of research produced by female scientists, and to address and modify the forces contributing to the gender gap.

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Compliance with Ethical Standards:

Conflict of Interest: *The authors report no conflicts of interest.*

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