Gender Differences in the Authorship of Original Research in Pediatric Journals, 2001-2016

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Objectives To examine the gender of authors of original research in 3 high-impact pediatric journals between 2001 and 2016, given the importance of publishing on academic promotion, and to compare authorship gender with the percentage of women on editorial boards and with academic faculty composition.

Study design We assessed the prevalence of female first and senior (last-listed) authorship of original research articles published in 3 pediatric-focused journals Pediatrics, JAMA Pediatrics (entitled Archives of Pediatric and Adolescent Medicine until 2013), and The Journal of Pediatrics. We also examined the gender breakdown of the main editors and the broader editorial boards of these journals. In addition, we examined whether junior female faculty co-authored with male or female senior faculty.

Results Of 3895 original articles, 22 were excluded because the gender of either the first or senior author could not be determined from the name. An analysis of authorship by year showed increasing female representation across the selected journals in both first (39.8% in 2001, 57.7% in 2016) and senior (28.6% in 2001, 38.1% in 2016) authors, respectively. Editorial boards also showed increasing female representation (17.8% in 2001 to 39.8% in 2016). Junior female faculty were more likely to co-author with senior female women (female first and last author); the gap remained unchanged despite the increasing number of women entering pediatrics.

Conclusions Women are underrepresented as authors and editors, although the gap is closing. Junior women are less likely to co-author with senior current men, which may be a disservice given current gender disparities in promotion and leadership. (J Pediatr 2017;[insert page number]).

The number of female physicians has risen steadily over the past 50 years and now comprises 34% of all practicing physicians and 40% of all academic physicians in the US.1-3 However, women continue to be underrepresented in senior faculty and academic leadership positions.1,4,5 As of 2014, 24% of division chiefs, 15% of department chairs, and 16% of deans were women.6,7

Similar patterns have been seen in pediatrics, 1 of only 2 specialties (along with obstetrics and gynecology) in which the majority of physicians are women.7 As of 2013, although 32% of practicing physicians were women (an 8% increase from 2000), women made up 58% of pediatricians (a 10% increase from 2000).2 In addition, the proportion of female residents in pediatrics increased from 66% in 2000 to over 73% in 2016. Despite accounting for over 55% of all full-time pediatric faculty positions, women hold only slightly more than 40% of senior faculty positions (associate and full professorship). Although 27% of male pediatric faculty members are full professors, only 11% of female pediatric faculty members have the same rank.6 Of the 138 US members of the Association of Medical School Pediatric Department Chairs in 2015, 28 (20%) were women.7

One crucial aspect for tenure and promotion within academic medicine is grant funding and publication in high impact journals. Previous studies have shown that women are awarded fewer research dollars from the National Institutes of Health and are less likely to be refunded.3,8,9 They are also underrepresented in first authorship, senior authorship, and guest editorial authorship across a range of specialties including internal medicine, obstetrics and gynecology, surgery, otolaryngology, and ophthalmology.1,10-12 However, with the exception of the analysis of a single pediatric journal from 1970 to 2004,1 no studies to date have specifically examined gender-related disparities in pediatric peer-reviewed research publications.

In this study, we examined the prevalence of female first and senior authorship of original research in 3 high-impact pediatric journals from 2001 until 2016. We also examined the gender breakdown of editorial boards of these journals over the same time period. Finally, we compared the gender breakdown of articles published by US authors with the gender breakdown of US pediatric faculty as published by US authors with the gender breakdown of US pediatric faculty as...
determined by the Association of American Medical Colleges (AAMC).

**Methods**

We assessed the prevalence of female first authorship and senior (last-listed) authorship of original research articles published in 3 high-impact general pediatric-focused journals *Pediatrics, JAMA Pediatrics* (entitled *Archives of Pediatric and Adolescent Medicine* until 2013), and *The Journal of Pediatrics* as well as the gender congruence between first and senior authors. We also examined the gender breakdown of their main editors and their broader editorial board.

All original articles published in the years 2001, 2006, 2011, and 2016 were included in the data set. For each article, the time of publication (year and month) and the gender of the first and senior author (female, male, unknown) were collected. Articles by a study group only with no listed authors were not recorded. We used the methods described in previous studies examining this question in other specialties and/or other time periods.1,10,11 The gender of both the first and senior author was determined by inspection of their first name. If the name was indeterminate, further attempts were made to determine the gender by visiting institutional websites, social media accounts (such as LinkedIn), and internet search engines (such as Google). Any author’s gender not clearly identifiable was labeled as “unknown,” and the article was excluded from further analysis. Articles were double coded by 2 of us to further assure accuracy of this assignment. Manuscripts with only 1 author were listed as a first authored article only.

The composition of each of the journal’s editorial boards (in January for each of the listed years) was also reviewed using the same methods. Main editors included editor and associate editors, as well as statistical editor and section editors for *JAMA Pediatrics*; deputy editor, consulting editors, assistant editors, and editorial associates for *Pediatrics*; and editor and associate editors for *The Journal of Pediatrics*.

We also collected data about the geographic location of the authors’ institution. Manuscripts in which both first and last author were at US institutions were classified as US. Manuscripts in which at least 1 of the 2 authors were at non-US institutions were classified as non-US and were excluded from the analysis in which we compared author gender with faculty rank at US medical school. We classified junior faculty as those who were identified as instructors and assistant professors and senior faculty as associate professors and full professors. Normative academic behavior presupposes that a last author holds a more senior academic rank compared with the first author. As such, we compared first author gender against junior faculty rank status and last author gender against senior faculty rank status. Data for academic rank of female pediatricians from the years 2001, 2006, 2011, and 2016 were obtained from the AAMC database books.

**Statistical Analyses**

The data were coded and stored in a Microsoft Excel database and analyzed using SPSS (v 24.0; IBM Corp, Armonk, New York) to determine the distributions of the gender of first and senior authors in the selected journals. Comparisons between journals, in addition to the effect of senior author gender on first author gender, were examined with χ² tests. The Cochran-Armitage trend test was used to evaluate for trend over time. A *P* value of .05 was taken as significant.

The University of Chicago Institutional Review Board exempted this research and waived the need for informed consent as it used only publically available databases.

**Results**

Data on a total of 3895 original articles were collected. Of these articles, 22 (0.6%) were excluded because of an inability to determine the gender of the first or senior author. There were 173 (4.5%) articles with a single author, coded as first author. The Table shows the percentages of female first and senior

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*P value represents significance of trend.*
authors of original research articles, overall, by journal, and by time of publication. Overall, 49.9% (1935/3873) of the first authors and 34.5% (1278/3700) of the senior authors were women. An analysis of female authorship by year showed increasing female representation across the selected journals (Figure 1). The proportion of women serving as authors increased from 34.3% of all first and senior authors combined in these journals in 2001 and 48.1% of all authors in 2016 combined. The proportion of women serving as first authors in the selected journals increased from 39.8% (396 of 996) in 2001 to 57.7% (53 of 931) in 2016 (P for trend <.001), while the proportion of women serving as senior authors increased from 28.6% (266 of 930) in 2001 to 38.1% (336 of 883) in 2016 (P for trend <.001).

Evaluating each journal independently, JAMA Pediatrics had the highest total proportion of female first authors (54.9%; 253/461) and senior authors (39.8%; 180/452) and The Journal of Pediatrics the lowest (first author: 48.9%; 667/1365; senior author: 31.3%; 384/1228) over all the years (Figure 1). However, JAMA Pediatrics was the only journal to not show increasing trends in female representation of first (P for trend = .21) or senior authors (P for trend = .51). Significant trends of increased female representation were seen in both The Journal of Pediatrics (P for trend <.001) and Pediatrics (P for trend <.001; Table). As of 2016 data, there was no difference between the journals in proportion of female first authors (P = .928) or senior authors (P = .290).

Data on the gender breakdown of 12 sets of editorial boards (3 journals in each of the 4 years) was collected (Table). Overall the editorial boards grew in size from 90 members of editorial boards in 2001 to 103 editorial board members in 2016. Increased female representation was seen, rising from 17.8% (16 of 90) in 2001 to 39.8% (41 of 103) in 2016 (P for trend <.001; Figure 1). The number of main editors also
increased from 20 in 2001 to 32 in 2016 with a concurrent increase in female representation, rising from 15.0% in 2001 (3 of 20; \( P = .039 \)) to 37.5% in 2016 (12 of 32; \( P \) for trend = .039). As of 2016, there is no difference between the journals in proportion of editorial board members (\( P = .997 \)).

The proportion of female first authors on manuscripts with male senior authors and female senior authors (collapsed across journals) was also examined (Figure 2). Overall, females represented a higher proportion of first authors on female senior author papers (58.9%; 752 of 1277) than male senior author papers (46.1%; 1115 of 2418; \( P < .001 \)). The proportion of female first authors on manuscripts with a male senior author significantly increased (\( P \) for trend <.001) from 37.0% (245 of 663) in 2001 to 52.8% (288 of 545) in 2016. Female first author representation on manuscripts with female senior authors also significantly increased (\( P \) for trend <.001) from 49.2% (131 of 266) in 2001 to 67.0% (225 of 336) in 2016.

Of the 3873 articles, 2604 (67.2%) had only US authors (either a sole US author or both first and last author from US institutions). The percentage of only US authors decreased from 71.0% to 65.3% from 2001 to 2016. Although the proportion of female first and senior authors from both US and international institutions has increased from 2001 to 2016, the gap between first and senior authorship representation has widened in both US and international institutions (\( P \) for trend <.005 for all 4 authorship groups). Of note, the proportion of female senior authors from international institutions has decreased since 2011 (38.1% in 2011 to 34.5% in 2016; Figure 3; available at www.jpeds.com).

AAMC data were obtained for the 4 time periods in which journal articles were reviewed (2001, 2006, 2011, and 2016). Overall, the percentage of women increased from 44% of all US pediatric faculty in 2001 to 55% in 2016 (11% increase) (Figure 4, A). The percentage of women increased in each faculty rank: from 64% to 74% of instructors (10%); from 53% to 61% of assistant professors (8%); from 37% to 49% of associate professors (12%) and from 22% to 33% of full professors (11%). We compared the proportion of women that made up junior and senior faculty within pediatric faculty in the US from 2001 to 2016 to the proportion of female first and senior US authors of original research from pediatric journals from the same time period. We found that female first authors were underrepresented relative to female junior faculty at all time periods, although the gap is decreasing (from 14.6% to 6.8%; Figure 4, B). Female senior authors show a similar representation to that of female senior faculty (Figure 4, B).

**Discussion**

Our findings of increasing female authorship in the field of pediatrics is in line with previously reported trends from Jagsi et al who examined articles from *The Journal of Pediatrics* and articles from other specialty journals.\(^1,10-12\) These data may reflect, in part, the increase in female physicians in academic medicine overall since 2000,\(^2,3,6\) and more specifically, the increase in female pediatricians in academic pediatrics. And yet, although US female researchers accounted for 35.6% and 48.8% of all authors combined in 2001 and 2016, respectively, they made up 44.1% of all US pediatric faculty in 2001 and 55.3% of all US pediatric faculty in 2016. Thus, women were underrepresented as authors in both time periods.

These findings, along with data from the AAMC,\(^3\) suggest narrowing of the gender gap in US female first authorship...
compared with their proportion as junior pediatric faculty in high-impact general pediatric journals over the past 15 years. The 16.2% increase in female first authors outpaces the 8.4% increase in junior faculty women (instructors and assistant professors). These findings, at least in part, reflect the continued increase in the number of women entering pediatrics.

However, despite the substantial strides, a gender gap remains, particularly in senior pediatric faculty and leadership. Over the past 15 years, there have been slower gains of female senior authorship (9.9% increase) compared to gains in female senior faculty (12.0% increase).

Our data show that female first authors are less likely to co-author with a male last author than are their male counterparts. Although our data show a trend of more male senior authors collaborating with female first authors, the same trend is seen in female senior authors and their collaboration with female first authors; that is, the gap did not change over the 15 years. This may be by choice as the literature shows preference for gender concordance, even though concordance does not affect mentee satisfaction. Male senior faculty are more likely to hold positions of leadership and, therefore, may have greater influence on promotions and other academic opportunities such that crossing the gender line, either as a sponsor or as part of a mentorship team, may be critical for promoting women’s success.

Our examination of the composition of editorial boards revealed that female representation has increased significantly in the time period studied (from 17.8% to 39.8%). The proportion of female main editors is now similar to that of senior authorship but again is below their senior faculty representation (41.9%). As others have shown, male editors are more likely to assign manuscripts to male reviewers and reviewers are more likely to reject manuscripts authored by the opposing gender. Thus, the underrepresentation of women as main editors, as well as on the editorial boards overall, may explain, at least in part, the gender gap in authorship, in addition to powerful downstream effects on their career paths.

Our manuscript has several limitations. First, although our study used similar methods to determine gender as those reported in previous investigations of authorship and gender, the potential for misclassification may have occurred because of androgynous names. To minimize this error, we attempted to determine gender by locating biographies with gendered pronouns, and by locating images on institutional web pages, social media sites, or internet search engines. We also double-coded to ensure accuracy and all differences were reviewed and resolved. Second, our data did not adjust for study type (experimental/nonexperimental), subspecialty/topic, location, academic disciplines and authors’ degrees, total number of authors, or whether an author had only 1 or multiple publications that were part of our data set. Third, our data present only the representation of female authorship in published journal articles, without examining whether there is gender bias in the acceptance and rejection of submitted female first or senior authored manuscripts. Fourth, our data focused specifically on research in pediatric focused journals and should not be extrapolated into other medical specialties, although previous studies have shown similar underrepresentation of women in other fields.

Figure 4. Comparison of full-time faculty positions and US first and senior authorship in pediatrics, according to gender. A, Proportion of women that make up instructors, assistant professors, associate professors, full professors, and overall within pediatric clinical faculty from 2001 to 2016. Data from the AAMC reveals increasing female representation across all positions over the time span, along with underrepresentation in senior faculty positions. B, Proportion of women that make up junior and senior faculty within pediatric faculty from 2001 to 2016 (data from AAMC) compared with the proportion of female first and senior authors from US institutions of original research from pediatric journals from the same time period. Female first authors are underrepresented relative to female junior faculty although the gap is decreasing. Female senior authors show similar representation with female senior faculty. Both female senior faculty and senior authors have risen slower than female junior faculty and first authors.
In sum, research is needed to further understand the causes for the persistent gender gap of women in research publishing, achievement of senior faculty rank, and leadership positions in pediatrics. Future studies should examine the effect of reviewer gender in high-impact pediatric journals to determine if there is a bias in the acceptance and rejection of manuscripts, which may lend support for a double blind peer review process rather than the current more common single blind review.

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References

Figure 3. Comparison of female first and senior authorship at US institutions vs international institutions. Proportion of women that make up first and senior authors of original research from US institutions and international institutions. Both within the US and internationally, female representation as senior authors lags behind female first authorship representation. Although female representation has increased in both first authorship and senior authorship of original research from 2001 to 2016, the gap between first authorship and senior authorship has widened, with the gap growing wider at international institutions compared with US institutions.