

ORIGINAL RESEARCH

Female leadership in oncology—has progress stalled? Data from the ESMO W4O authorship and monitoring studies

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Background: Exploratory research showed that female oncologists are frequently under-represented in leadership roles. European Society for Medical Oncology (ESMO) Women for Oncology (W4O) therefore implemented gender equality programs in career development and established international studies on female representation at all stages of the oncology career pathway.

Methods: For 2017-2019, data were collected on (i) first and last authorship of publications in five major oncology journals and (ii) representation of women in leadership positions in oncology—as invited speakers at National/International congresses, board members or presidents of National/International societies and ESMO members. The 2015/2016 data from the first published W4O Study were incorporated for comparisons.

Results: Across 2017-2019, female oncologists were significantly more likely to be first than last authors ($P < 0.001$). The proportion of female first authors was similar across years: 38.0% in 2017, 37.1% in 2018, 41.0% in 2019 ($P = 0.063$). The proportion of female last authors decreased from 30.4% in 2017 to 24.2% in 2018 ($P = 0.0018$) and increased to 28.5% in 2019 ($P = 0.018$). Across 2015-2019, invited speakers at International/National oncology congresses were significantly less likely to be female than male ($P < 0.001$; 29.7% in 2015 to 36.8% in 2019). Across 2016-2019, board members of International/National oncology societies were significantly less likely to be female than male ($P < 0.001$; 26.8% in 2016 to 35.8% in 2019). There were statistically significant increasing trends in female speakers and board members across the study periods ($P < 0.001$ for both). Societies with a female president had a higher proportion of female board members across these periods ($P = 0.026$).

Conclusions: Reported progress towards gender equality in career development in oncology is real but slow. Women in leadership positions are essential for encouraging young women to aspire to and work towards similar or greater success. Therefore, continued monitoring is needed to inform ESMO W4O initiatives to promote gender balance at all stages of the career pathway.

Key words: gender gap, gender equality, ESMO Women for Oncology, female leadership, women representation

INTRODUCTION

Gender disparity in leadership roles in science and medicine is well documented, with women less likely than men to hold senior positions in academic departments^{1,2} and professional organisations,³ to be invited speakers at congresses⁴ or to publish research.⁵

While some gains have been made in female representation in leadership roles over the last decades, recent

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evidence suggests that progress may have stalled. Between 1970 and 2004, UK female first authorship in five high impact journals increased from 10.5% to 36.5%, though female senior authorship only increased from 12.3% to 16.5%.⁶ An analysis of female authorship in six high impact general medical journals between 1994 and 2014 showed an increase from 27% to 37%, respectively, but female first authorship appeared to have plateaued, with no increase between 2009 and 2014.⁷

A comparison of leadership positions occupied by women in US medical schools showed little change between 2003 and 2004 and 2013 and 2014, with the proportion of women in department chairs rising from 10% to 15% and female medical school deans from 10% to 16%.⁸

Similarly, an analysis of presidents of 39 major specialist medical societies between 2008 and 2017 failed to show any sustained increase in female representation in this leadership role, with the overall proportion of women presidents exceeding 20% only in 2013 and 2017.⁹

As the proportion of female doctors in many medical specialties continues to increase, there is growing urgency to maintain and build on previous gains in female representation at senior levels. Latest analyses of European Society for Medical Oncology (ESMO) membership data show that 47.5% of members are now female, with >55% of those under 40.¹⁰ Questions remain, however, over the leadership opportunities available to these women and ESMO is committed to shining the spotlight on the global gender gap in oncology and addressing the challenges of current and future generations of female oncologists.¹¹

The ESMO Women for Oncology (W4O) initiative was established in 2013 to raise awareness of gender inequalities in oncology and promote equal access to career development opportunities for female oncologists. Exploratory research showed that female oncologists were under-represented in leadership roles in clinical teams. A first investigation of female representation in leadership positions in oncology—as invited speakers at congresses, board members or presidents of societies and ESMO members—was conducted in 2015-2016. In 2018, a 3-year, international study ('W4O Study; 2018') was set up to explore female leadership in the years 2016-2019. This study collected annual data on female representation in activities at all stages of the oncology career pathway, including as first and last authors of publications, invited speakers at congresses and board members or presidents of professional organizations. This research was conducted during a time when the ESMO W4O initiative was implementing projects to raise awareness of the importance of gender balance in oncology and encourage and support female oncologists at key stages of their career pathway. In this paper, we report gender data from the 'W4O Study (2018)' which includes two components; a study on authorship ('Authorship Study') in five high impact oncology journals (2017-2019) and a study ('Monitoring Study') recording female representation as invited speakers at National and International congresses (2016-2019), board members or presidents of National and International oncology societies

(2017-2019) and ESMO members (2016-2019). To make comparisons over time more informative, data from the earlier study are also considered, including information on congress presentations for 2015 (or 2014 if 2015 congress information was not available) and societies for 2016.

METHODS

For the 'Authorship Study', data were collected from 2017 to 2019, on senior authorship of publications (first as well as last authors) in the five oncology journals with the greatest SCImago journal rank (SJR) indicator, as a measure of impact, influence or prestige.

Journal sections analyzed were Articles, Comments, News, Reviews, Special and Other. Affiliations were Academic Institution, Cancer Research Organisation, Journal (editors), General Hospital (with teaching function), General Hospital (without teaching function), University, University Hospital, Other.

As part of the authorship analysis, the h-index of the first authors was collected from Scopus (<https://www.scopus.com>). The h-index measures both the productivity and citation impact of the publications of an author (<https://en.wikipedia.org/wiki/H-index>).

For the 'Monitoring Study', data were collected on the representation of women in leadership positions in oncology—as invited speakers at National and International congresses for 2016-2019, as board members or presidents of National and International oncology societies for 2017-2019 and as ESMO members for 2016-2019.

Statistical analysis

All statistical analyses were carried out using R version 4.0.0 (R Foundation for Statistical Computing, Vienna, Austria) and SAS version 9.4 (SAS Institute, Cary, NC) softwares. The association between gender and several parameters of interest was explored through Fisher's exact test or chi-square test (for categorical) and Mann-Whitney *U* test (for continuous). The likelihood ratio test was used to examine if the association between gender and categorical parameters of interest remained the same across years. Logistic regression models were also used to assess the interaction of trend over time and different parameters (interaction considered significant at $\alpha = 10\%$). For each year, the difference between the percentage of females and males, as invited speakers at congresses or on society boards, was explored by the exact binomial test. The Spearman's correlation coefficient was also used to investigate the association between the proportion of female board members with the proportion of female invited speakers. A two-sided significance level of 5% was used for the statistical testing.

RESULTS

The 'Authorship Study' was based on 1581, 1440 and 1288 articles for the years 2017, 2018 and 2019, respectively. The proportion of female first authors was similar across 2017-2019, with 38.0% in 2017, 37.1% in 2018 and 41.0% in 2019 ($P = 0.063$ overall for the 3-year period, with $P = 0.025$ for

2018 versus 2019). The proportion of female last authors showed a decrease from 30.4% in 2017 to 24.2% in 2018 ($P = 0.0018$), which was followed by an increase in 2019 (28.5%, $P = 0.018$), (across years $P = 0.0043$). Of note, across the years 2017-2019, women were significantly more likely to be first authors than last authors ($P < 0.001$ for all years) (Figure 1).

For all years, there was significant variation in the proportion of women as first authors across the five journals (Figure 2A, $P < 0.001$ for each year) and across the different sections of each journal (Figure 2B, $P < 0.001$ for each year). Women were under-represented in the journal sections with the largest volume of publications (e.g. 41% female first authors in 'Articles' and 31.3% in 'Comments' for 2019), whereas they were more represented in 'Special' sections (60.2% in 2019).

Gender was significantly associated with first author's affiliation ($P < 0.001$ for each year). This was primarily driven, however, by the substantially higher proportion of female first authors whose affiliation was listed as 'Journal (editors)' than for other affiliations in all years studied [Figure 2C, with percentage of female authors who were 'Journal (editors)' ranging from 76.9% in 2017 to 61.7% in 2019]. An association of gender with first author's region was only found in 2017, with higher female representation recorded in America ($P = 0.027$), and not confirmed in more recent years (2018, 2019). Furthermore, a consistent upward trend in female first authorship was seen within each of the three geographic areas (Europe, America and Asia/Oceania), though this was significant only for Europe; $P < 0.001$) (Figure 2D).

Median h-index value among first authors was significantly higher for men than women in all 3 years (2017: 25

versus 15, 2018: 23 versus 14, 2019: 21 versus 11, all $P < 0.001$) (Supplementary Table S1, available at <https://doi.org/10.1016/j.esmooop.2021.100281>).

Subgroup analysis of female representation as last author did not reveal significant differentiations between journals, journal sections, affiliation or region (Supplementary Figures S1A-D, available at <https://doi.org/10.1016/j.esmooop.2021.100281>).

The "Monitoring Study" covered a total of 180 International and National oncology congresses during the period 2015-2019 (range: 35-38 per year) with 35 113 speakers (range: 4959-8245 per year). In each of the five years, female oncologists were significantly less likely to be invited speakers at International/National congresses than their male colleagues ($P < 0.001$ for all years). Of note, however, there was a significant, albeit small, increase across the observation period ($P < 0.001$) with 29.7% female speakers in 2015, 32.2% in 2016, 31.7% in 2017, 34.4% in 2018 and 36.8% in 2019 (Supplementary Table S2, available at <https://doi.org/10.1016/j.esmooop.2021.100281>). This significant increase in female speakers was also consistently found when looking separately at both International and National oncology congresses ($P < 0.001$ each), noting that female representation was consistently greater at International rather than at National congresses (significant for the last 3 years: 2017-2019) (Figure 3A). Furthermore, significant regional effects were observed. Within International congresses, a significant overall region effect was detected ($P = 0.0073$), with the percentage of female speakers in the USA being on average significantly higher compared with International congresses in Europe across time (Figure 3B). In addition, within National congresses, the

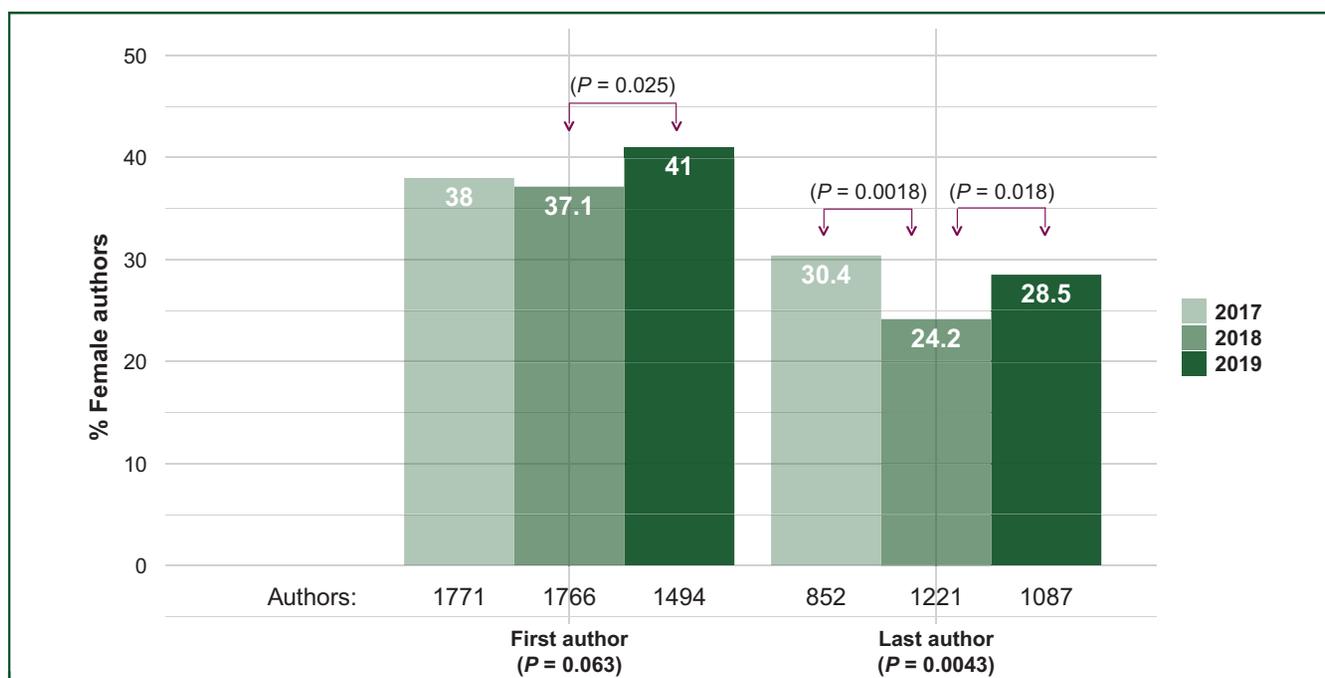


Figure 1. Female first versus last authors of publications (2017-2019).

Note 1: significant association between position and gender for all years (Fisher's exact test $P < 0.001$ for each year). The effect of position on gender does not change significantly across years (Likelihood ratio test $P = 0.060$). Note 2: P values with bold emphasis refer to the observed changes in the % of female first and last authors across years and P values provided at the top of the bars refer to the significant increases/decreases observed between years.

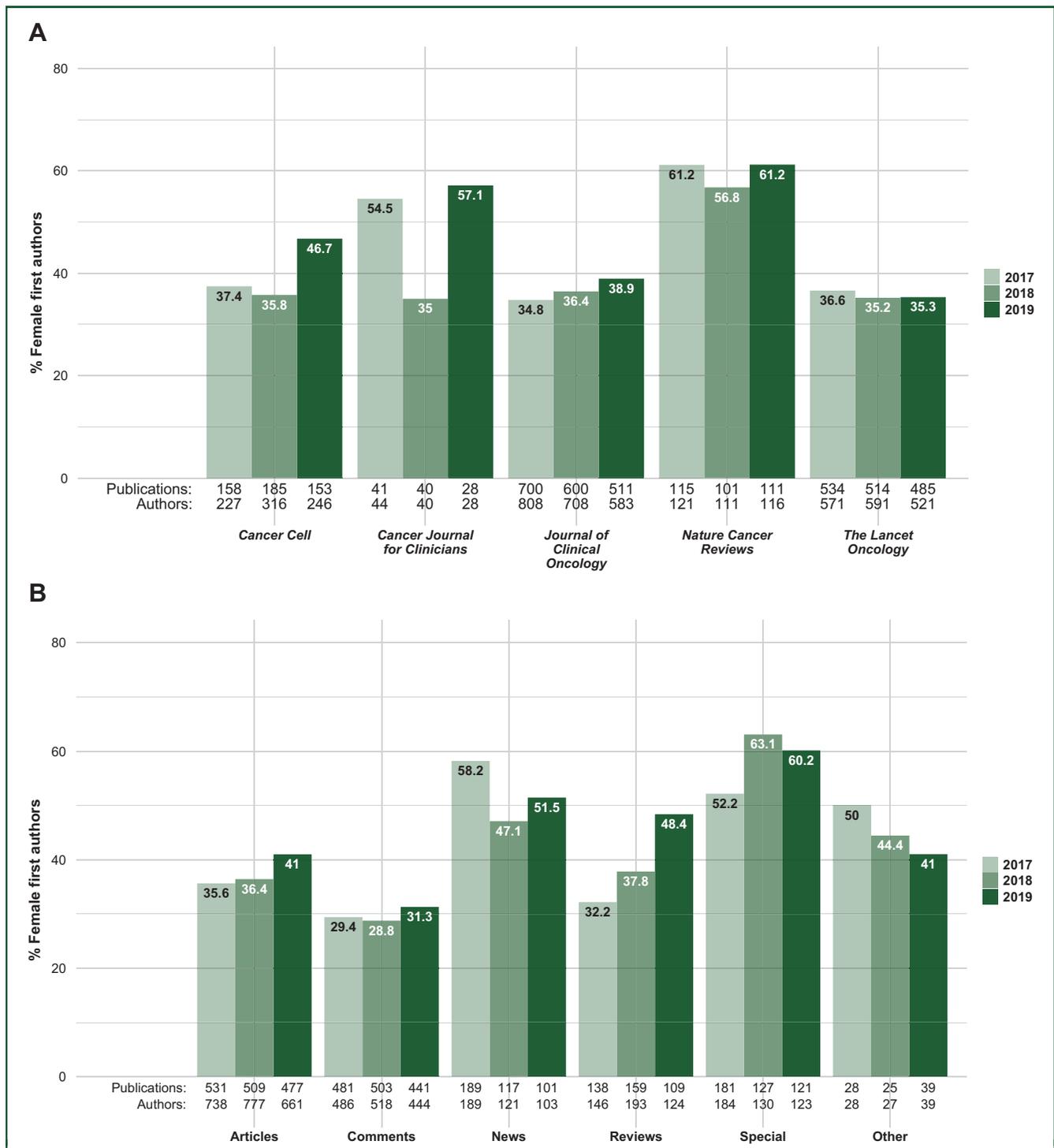


Figure 2. (A) Female first authors by journal (2017-2019). Note: significant association between journal and gender for all years (Fisher’s exact test $P < 0.001$ for each year). The effect of journal on gender does not change significantly across years (likelihood ratio test $P = 0.23$). (B) Female first authors by journal section (2017-2019). Note: significant association between journal section and gender for all years (Fisher’s exact test $P < 0.001$ for each year). The effect of journal section on gender does not change significantly across years (likelihood ratio test $P = 0.15$). (C) Female first authors by affiliation (2017-2019). Note: significant association between affiliation and gender for all years [Fisher’s exact test $P < 0.001$ for each year; significance is lost when ‘Journal (Editors)’ are excluded]. The effect of affiliation on gender changes significantly across years [likelihood ratio test $P = 0.037$; significance is lost when ‘Journal (Editors)’ are excluded]. (D) Female first authors by region (based on primary affiliation) (2017-2019). Note: significant association between region and gender only in 2017 (Fisher’s exact test $P = 0.027$). The effect of region on gender does not change significantly across years (likelihood ratio test $P = 0.33$). According to logistic: significant upward trend in Europe only ($P < 0.001$).

percentage of female speakers in Asia/Oceania was significantly and systematically lower compared with National congresses in Europe and South America ($P < 0.001$ for all years) (Figure 3C).

Female oncologists were also significantly less likely to be board members of International/National societies than their male counterparts throughout the study duration ($P < 0.001$) (Supplementary Table S3, available at

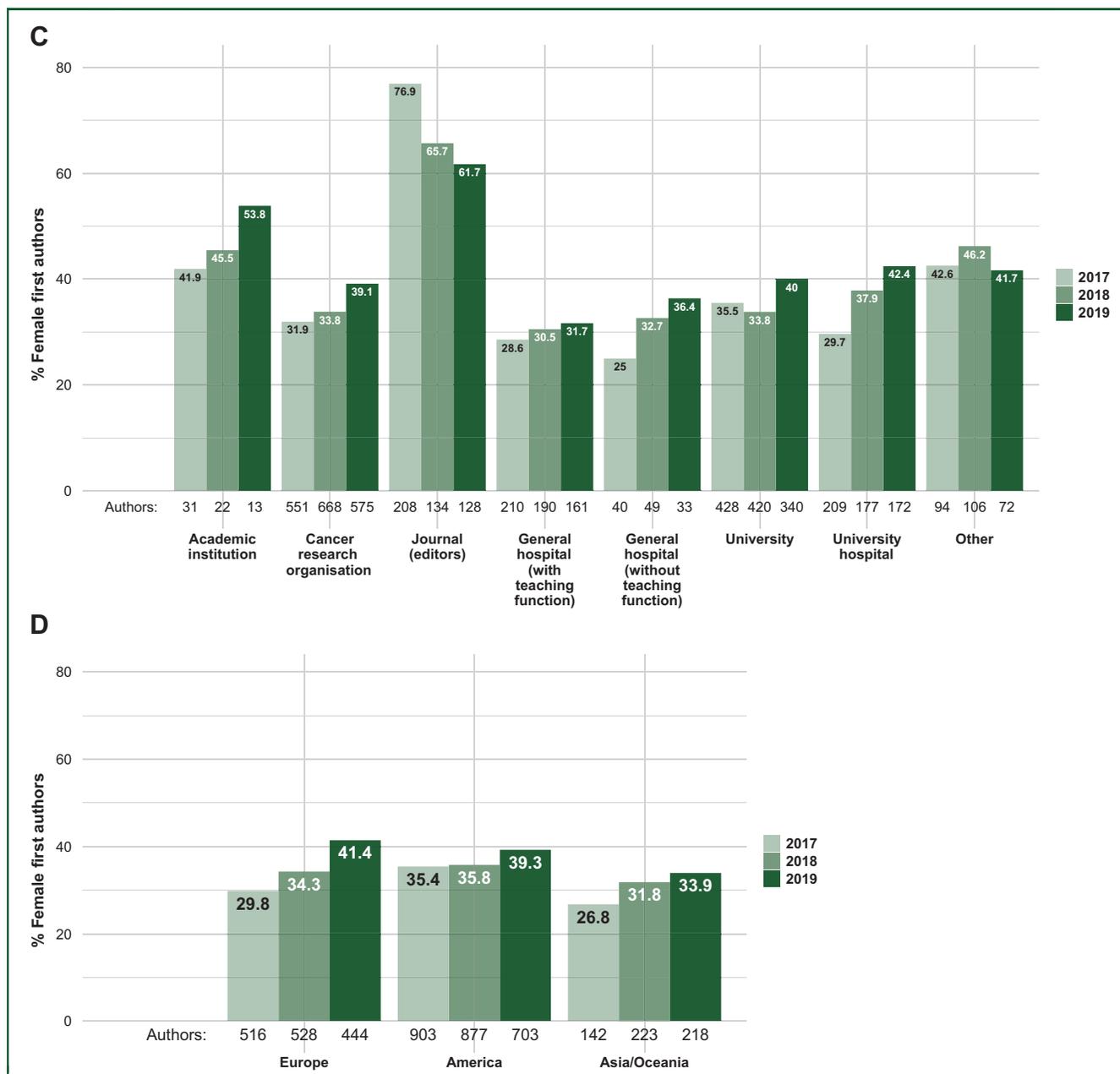


Figure 2. Continued.

<https://doi.org/10.1016/j.esmooop.2021.100281>). Still, a significant positive time trend was observed in the percentage of female board members for both International ($P = 0.031$) and National societies ($P = 0.0024$), increasing around 10 percentage points for both types of society during the study period (2016-2019; Figure 4). In National societies, a significant region effect was also detected ($P < 0.001$) (Supplementary Figure S2B, available at <https://doi.org/10.1016/j.esmooop.2021.100281>), with the percentage of female board members in Asia/Oceania being significantly and systematically lower compared with European and South American societies (consistent with the result mentioned above for female speakers at National congresses).

Of note, a statistically significant positive association between the proportion of female board members and the proportion of female invited speakers was observed throughout the study duration (Supplementary Figure S3, available at <https://doi.org/10.1016/j.esmooop.2021.100281>).

Furthermore, over the observation period, female oncologists were generally more likely to be board members if societies had a female president ($P = 0.026$) (Figure 5).

Overall, the percentage of female presidents was significantly lower than the percentage of male presidents for all years ($P < 0.001$ for each year), but increased steadily across time from 10.4% in 2016 to 22.0% in 2019 (Supplementary Table S4, available at <https://doi.org/10.1016/j.esmooop.2021.100281>).

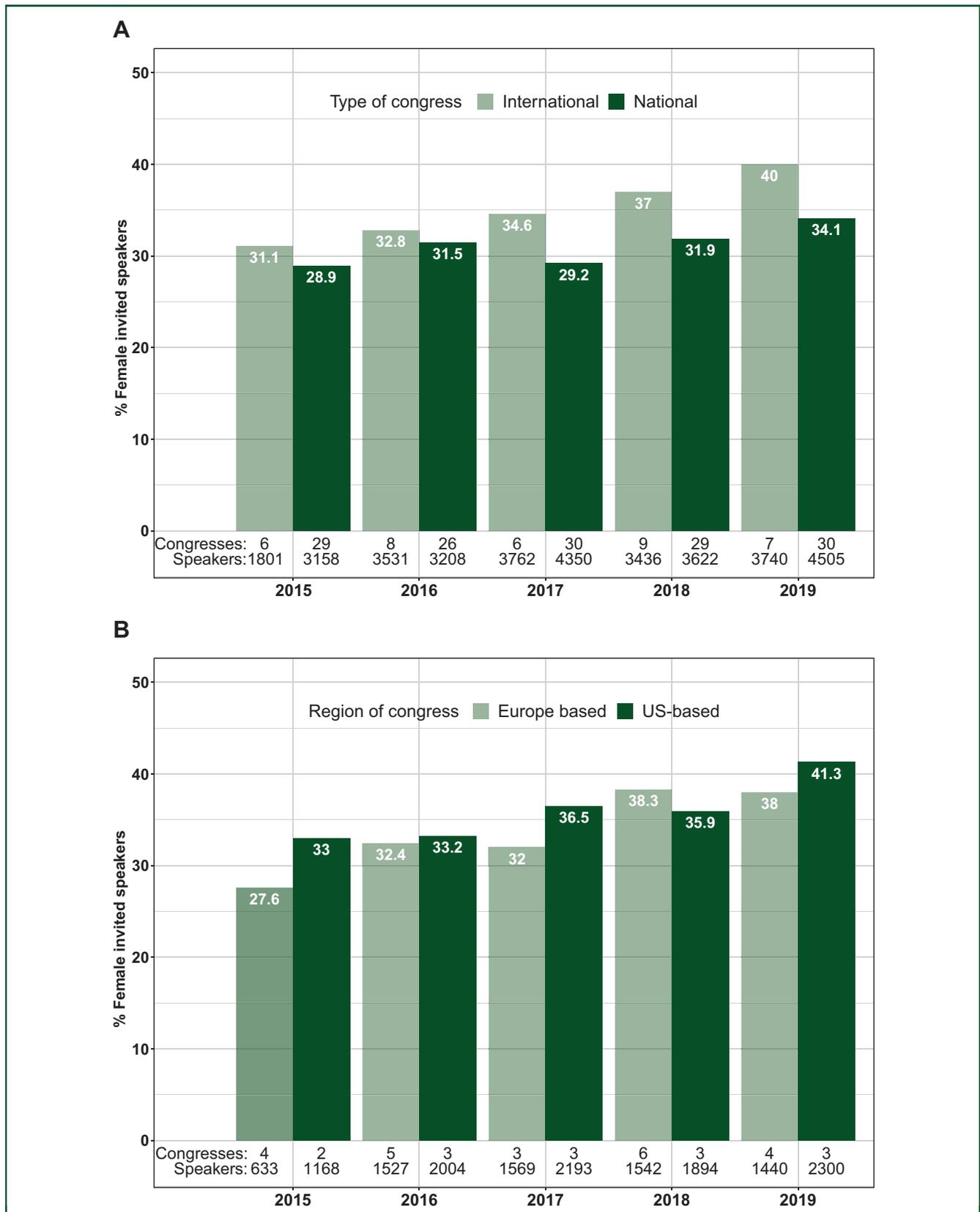


Figure 3. (A) Female speakers by type of congress (2015-2019). Note: significant association between congress type and gender only in 2017, 2018 and 2019 (Fisher's exact test $P < 0.001$ for each year). According to logistic: significant interaction between congress type and time ($P = 0.0068$), with significant time trend for both international and national congresses ($P < 0.001$). (B) Female speakers by region of international congress (2015-2019). Note: significant association between region of international congress and gender only in 2015, 2017 and 2019 (Fisher's exact test $P = 0.019$, $P = 0.0044$ and $P = 0.047$, respectively). According to logistic: significant overall time trend and region effect ($P < 0.001$ and $P = 0.0073$, respectively).

Note: significant association between region of national congress and gender for all years (Fisher's exact test $P < 0.001$ for each year). According to logistic: significant interaction between national congress region and time ($P = 0.032$), with significant time trend for Asian/Oceanian ($P = 0.020$) and European congresses ($P < 0.001$).

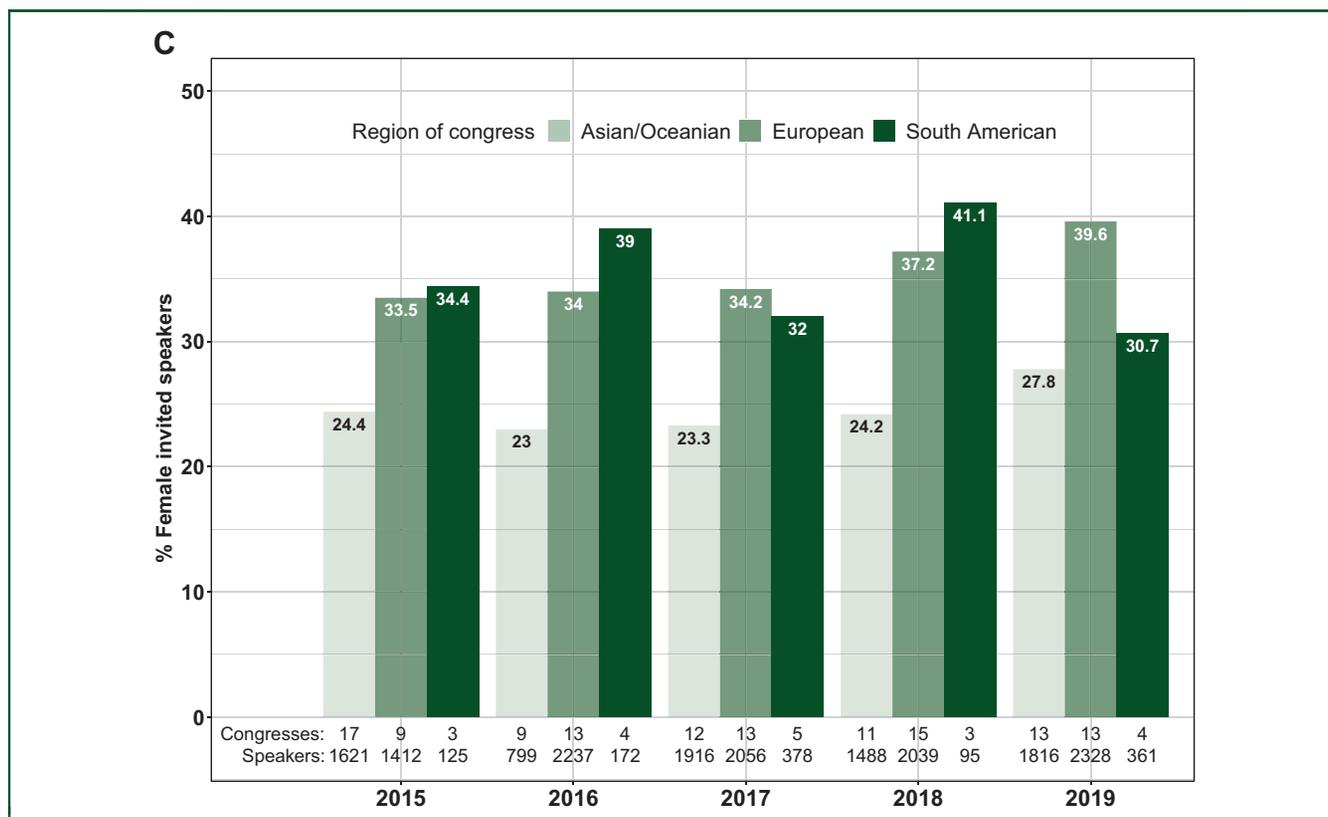


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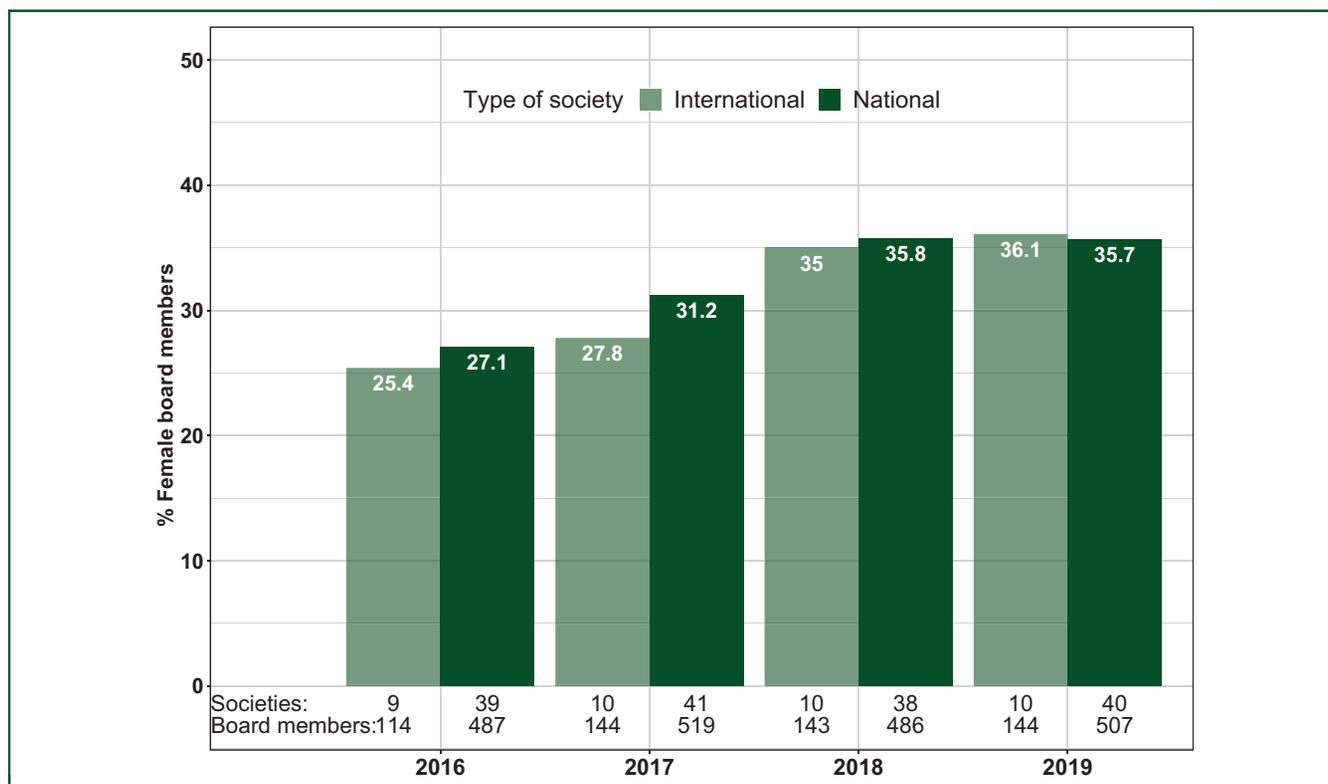


Figure 4. Female board members by type of society (2016-2019).

Note: non-significant association between society type and gender for all years (Fisher's exact test $P = NS$). According to logistic: significant time trend for international ($P = 0.031$) and national societies ($P = 0.0024$).

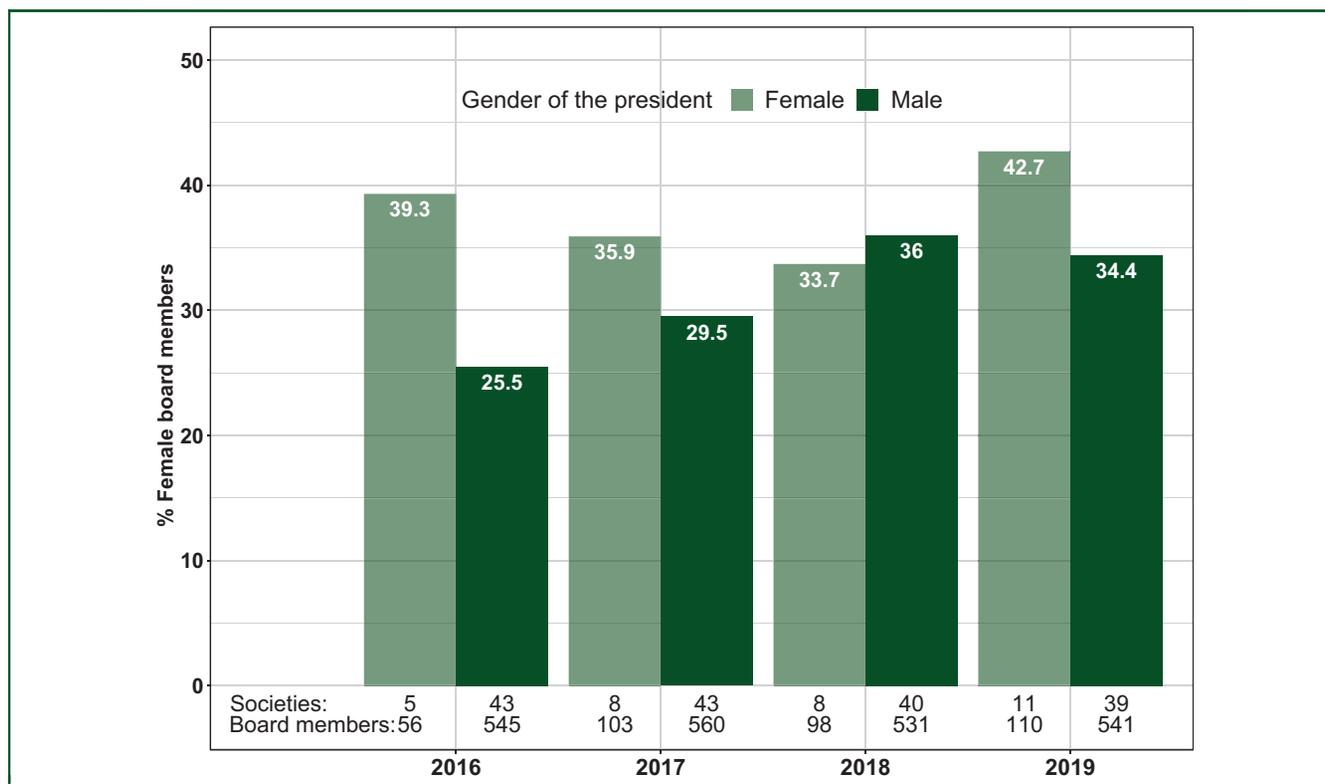


Figure 5. Female board members by the gender of society's president (2016-2019).

Note: significant association between gender of society's president and gender of board members only in 2016 (Fisher's exact test $P = 0.038$). According to logistic: significant overall time trend and president's gender effect ($P < 0.001$ and $P = 0.026$, respectively).

DISCUSSION

This study of women in leadership roles showed only slow increases in female representation as first or last authors of research papers, invited speakers at oncology congresses, board members or presidents of oncology societies during the respective years. Although incentives to increase female representation have been initiated, the present data underscore that gender equality has not yet been achieved in oncology and that continuing focus on female empowerment is needed.

Our data are in line with other recent research showing that, despite an encouraging rise in female first authorship in many oncology journals during the last 30 years, women continue to be under-represented as authors, particularly as senior authors.^{5,7} In a recent study, only 26% of 558 publications in two of the leading oncology journals of India had women lead authors.¹² The senior author position indicates leadership in the conception and design of the published research, and our data and those of other researchers therefore indicate that the proportion of female research leaders has plateaued and progress has stalled. A researcher's growing publications record and increasing h-index lead to opportunities to act as peer reviewer and editorial board member on oncology journals. As women struggle to achieve research opportunities and prominent last authorship positions, however, they may also be overlooked for editorial roles that may enable them to influence journal strategies aimed at restoring gender balance in oncology publishing. Indeed, much can be accomplished

when publishers take positive steps towards gender balance. Journals with larger numbers of women in leadership roles also have more women on journal editorial and advisory boards,¹³ and female authors are more likely to recommend female peer reviewers than men.¹⁴ Between 2018 and 2020, the *Lancet* group increased the proportion of women on the editorial advisory boards of its publications from 30.0% to 50.6%. Across 16 of 19 journals, more than 50% of board members are now women. This progress has not yet been reflected in increases in female authorship. Thirty per cent of research papers have female authors—a figure that has not changed for a number of years in *The Lancet*. Looking ahead, the #LancetWomen initiative aims to put gender and diversity into the mainstream of *Lancet* content and editorial practices, recognizing the links between health, women's rights and gender equality, gender norms and bias, female leadership and the intersection of gender with other categories of disadvantage such as race, ethnicity, sexual orientation, class and poverty.¹⁵

Nevertheless, the number of female first authors, who are frequently younger and earlier in their career than senior authors, showed a small but steady increase within the observation period of our research. The goal of the oncology community must now be to ensure that this upcoming new generation of female authors achieves the transition to research leaders.

Our findings about female oncologists in leadership roles are also in line with results from other recent research. In a

study of gender representation in academic oncology in the USA, only 31.4%, 17.4% and 11.1% of program director and chair positions in medical oncology, radiation oncology and surgical oncology, respectively, were occupied by women.¹ Another recent US study showed that although more female than male medical graduates now become assistant professors, women are less likely than men to be promoted to associate or full professor or to be appointed department chair, with no apparent narrowing of the gap over the 35 years of the analysis.¹⁶ A similar trend was noted in the recent Indian study which showed that only 32.7% of 324 respondents had a woman manager and even in predominantly female teams, only 15.4% of women were in lead roles.¹²

The visibility of women in leadership positions is important for strengthening the career path of upcoming generations. The existence of women in leadership positions is needed to inspire young women to aspire to and work towards similar or greater success. Further, female leaders are needed to give dedicated mentoring and advice on the career route in a field that is currently male dominated. The amount of time that women in leadership positions can mentor and collaborate with younger colleagues may be limited, however, by competing demands. For example, female academic physicians have been found to spend 8.5 h per week more on domestic and childcare activities than their male counterparts.¹⁷ Nevertheless, the empowerment of the upcoming generation of female oncology leaders is essential if we are to achieve future gender equality in oncology.

A realistic target could be to aim for constant progress towards a 50:50 balance in female and male leadership positions with that goal reached in, for example, 5-10 years. Our remit, however, is not just about numbers but about gender equality, which is a much broader concept with far-reaching implications throughout the oncology workforce.

The ESMO W4O authorship and monitoring studies are ongoing research running in 3-year cycles which will, in the longer term, collect sufficient data to reliably assess changing trends. The current analysis points out recent differences and future analyses will show whether these are reduced as a result of our ongoing efforts.

Although the present study has the advantage of allowing monitoring of trends over time, rather than producing a 'snapshot', there are some limitations in the interpretation of its findings. The parameters measured in our study were chosen as indicators of progress or of achieving gender balance, but they have not been formally validated. As described, female authorship has been measured in other studies as indicative of the progress of women towards leadership roles, and those who do achieve Assistant Professor, Professor and other influential roles in oncology are likely to have a large body of publications in high impact journals. Fewer studies have focused on the gender of invited speakers at major congresses, but this parameter also appears to be a good indicator of likely current or future leadership in oncology. Our studies did not relate author gender to the proportion of female and male

members of the editorial advisory boards of the journals we included. This could be a useful association to explore in future ESMO W4O research.

In conclusion, the present studies by the W4O Committee address the development of female leadership in oncology over time rather than just providing a single moment analysis. Although the W4O Committee has implemented initiatives to improve gender balance in oncology, progress is slow and major gender gaps remain in multiple areas of leadership. Only continued review of female leadership development will facilitate W4O initiatives to specifically highlight areas of slow progress or lack of progress and provide the basis for female empowerment in oncology leadership.

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