



From the American College of Epidemiology

## Gender equity in epidemiology: a policy brief

Melinda C. Aldrich, PhD, MPH <sup>a, b, c, \*</sup>, Anne E. Cust, PhD, MPH (Hons) <sup>d, e</sup>,  
Camille Raynes-Greenow, PhD, MPH <sup>d</sup>, on behalf of the International Network for  
Epidemiology in Policy



<sup>a</sup> Department of Thoracic Surgery, Vanderbilt University Medical Center, Nashville, TN

<sup>b</sup> Division of Epidemiology, Department of Medicine, Vanderbilt University Medical Center, Nashville, TN

<sup>c</sup> Department of Biomedical Informatics, Vanderbilt University Medical Center, Nashville, TN

<sup>d</sup> Sydney School of Public Health, The University of Sydney, Sydney, Australia

<sup>e</sup> Melanoma Institute Australia, The University of Sydney, Sydney, Australia

### ARTICLE INFO

#### Article history:

Received 30 August 2018

Accepted 15 March 2019

Available online 2 April 2019

#### Keywords:

Women  
Epidemiology  
Inequity  
Bias

### ABSTRACT

The under-representation of women in leadership in scientific fields presents a serious problem. Gender diversity is integral to innovation and productivity, and inequality leads to loss of gender talent in science including epidemiology. This policy brief summarizes some of the key dimensions and determinants contributing to gender-equity gaps in epidemiology and other scientific fields, relevant to developed countries where there is more published evidence. Women in scientific fields hold fewer positions on editorial boards, lack equal representation in speaking engagements at conferences, and are less likely to publish or receive top tier grant funding. Reasons for these inequities range from unconscious bias, biased promotion systems, and traditional norms in the division of family life and labor in our society leading to the attrition of women in academia. Addressing the problem of gender inequity, as a component of gender inequality, will provide an ethical basis to advance innovation. Data on gender equity in the field of epidemiology are sparse. We call on academic institutions, professional societies and associations, and editorial boards relevant to epidemiology (as well as other academic disciplines more broadly) to take meaningful action to build an evidence base as to the extent of gender inequities in epidemiologic research, teaching, policy, and practice. We outline some of the necessary steps required to achieve gender equity, such as career development and mentoring programs, institutional support, and programs to address bias.

© 2019 Elsevier Inc. All rights reserved.

### Executive summary

Women hold more than 40% of research positions in developed nations including the United States, European Union, Canada, Australia, and Brazil. Yet most of these positions are among early career faculty. In epidemiology and other scientific fields, women hold fewer positions on editorial boards, lack equal representation in conference speaking engagements, publish fewer articles, submit fewer grant proposals, and are less likely to receive top tier grant funding from the submitted proposals. A global comprehensive report examining research in 12 countries and in 27

subject areas over 20 years highlights the gender inequality across scientific disciplines. Reasons for these inequities range from unconscious bias, biased promotion systems, and traditional norms in the division of family life and labor in our society leading to the attrition of women in academia. Addressing the problem of gender inequity, as a component of gender inequality, will provide an ethical basis to advance innovation. Overall, data on gender equity in the field of epidemiology are sparse. We call on academic institutions, professional societies and associations, and editorial boards relevant to epidemiology (as well as other academic disciplines more broadly) to take meaningful action to build an evidence base as to the extent of gender inequities in epidemiologic research, teaching, policy, and practice. Career development and mentoring programs, institutional support, and programs to address bias are some of the necessary steps required to achieve gender equity.

\* Corresponding author. Vanderbilt University Medical Center, 609 Oxford House  
1313 21st Avenue South, Nashville, TN 37232-4682. Tel.: +1-615-875-2627; fax:  
+1-615-936-7003.

E-mail address: [melinda.aldrich@vumc.org](mailto:melinda.aldrich@vumc.org) (M.C. Aldrich).

### *Context and importance of the problem*

The under-representation of women in leadership or esteemed positions in scientific fields presents a serious problem because diversity is integral to innovation and creativity and provides new context for interpreting research relevance [1]. Gender is a key component of diversity and yet gender inequity is an injustice and violation of human rights, leading to loss of gender talent in epidemiology, as well as in other fields. The following, although not intended as a comprehensive review, summarizes some of the key dimensions and determinants contributing to gender equity gaps, particularly in developed countries and among white-collar professions. Our goal is to recognize these issues and begin work to address them. We acknowledge a lack of published data describing gender inequity in epidemiology and the extent of the problem in our discipline; thus, we draw on evidence from related fields in science and academia to support our case. Importantly, we accept and support the fact that gender identity and gender expression are fluid. Our analysis describes gender primarily as a binary concept. To be complete and inclusive, this fact will need to be brought into focus as the profession addresses gender inequity.

### *Salary*

Gender pay inequities are common worldwide in scientific, academic, and clinical fields. For example, the Workplace Gender Equality Agency in Australia conducted an analysis of national salary data and found a 25% pay inequality in the “professional, scientific, and technical services” fields [2]. A significant gender inequality was also identified among newly trained physicians in the United States and has been growing over time; in 2008, newly trained male physicians made \$16,819 more, on average, than newly trained female physicians, compared to a \$3600 difference in 1999 after adjusting for inflation [3]. This difference could not be explained by specialty choice, practice setting, work hours, or other characteristics.

A survey conducted by a leading professional society of engineers and scientists in Australia found among full-time scientists “a significant relationship between responsibility level and gender and their effect on remuneration. While female respondents tended to be paid equivalent to their male peers in lower level roles, male respondents were better remunerated in middle career roles” [4]. Childbearing and childrearing only partly explain the gender pay inequality, as even women without children who have worked full-time continuously have been shown to experience substantial salary disadvantages after PhD [5].

### *Leadership positions, funding, and academic advancement*

A recent survey (weighted for nonresponders) of epidemiology departments found that fewer women held faculty positions overall (48%) and only 32% of full professors were female [6]. This has a flow-on effect for other aspects of leadership in epidemiology such as board and committee membership [6]. With respect to publication metrics in epidemiology, females were more likely to be first authors, but less likely to be last authors, and were less likely to have highly cited articles, after adjusting for potential confounders including seniority [6]. This inequity in authorship opportunities may begin as early as graduate school, which can strongly influence the establishment of a productive career path [7].

Women faculty also face additional obstacles to receiving research funding, exacerbated by women holding fewer prestigious postdoctoral positions or institutional start-up resources, receiving less credit for team-science contributions, receiving fewer invitations to peer review and being cited less frequently than equally positioned male authors [8]. Women also tend to have higher service-related workload and are less likely to negotiate for their

own interests [8]. A study using recent data from the Canadian Institutes of Health Research showed that gender inequality in grant success rates were significantly larger when there was an explicit review focus on the principal investigator rather than on the science [9]. One study showed that an intervention of a grant-writing boot camp for women in the STEM fields run over an 18-month period led to a substantial increase in the number of grants and total funding awarded [8].

### *Board and committee membership*

There are little data on the gender distribution of board membership broadly across academic fields, including epidemiology. A recent study examined the gender distribution across U.S. epidemiology societies and editorial boards [6]. The authors found that women constituted just over half (54%) of society members but, among the reviewed editorial boards of six journals, only males held the editor-in-chief position, only 25% of editorial board members were women, and only 31% of associate editors were women. This is in stark contrast to the graduating epidemiology doctoral students (between 2013 and 2015) who were mostly female (73%) [6].

Gender equity issues related to board membership in business and commercial fields are well documented. Women have very low representation in some countries with board membership ranging from about 2% to 42% [10]. Gender inequality does not appear to be improving quickly as a recent report found that the rate of increase of female representation on Australian boards has not exceeded 2% per year since 2011 [11]. Internationally, countries that have enacted government quota legislation with dissuasive sanctions provide evidence that these quotas work to improve gender equity in board membership [11]. The main justifications that have been put forward for improving female board membership are three-fold: (1) ethical, because women are 50% of the workforce and therefore should be represented proportionally, (2) functional reasoning, because boards are more efficient when women are included, and (3) improved financial performance and governance [11].

### *Invited speaking opportunities at scientific conferences*

Invited speaker roles for scientific conferences and meetings are critically important to scientists and academics as they provide opportunities to improve the visibility of the presenter and allow for wide and efficient distribution of their research [12,13]. These speaker roles are used for career and professional advancement and are a recognized measure of esteem. However, research has shown that men dominate conference visibility, even in fields that have a higher proportion of women membership [12]. Based on a review of 21 years of annual meeting data in the field of physical anthropology, it was found that, despite a higher percentage of women in the field, men gave more symposium presentations, with only 47% of symposium presentations given by women [14]. A three-year review of the evolutionary biology field found that women were significantly underrepresented among all speaker roles [15]. Invited speaking engagements were biased toward men compared with regular speaking opportunities [15]. However, the presence of women on conference planning committees improves the number of women presenting [14]. A 3-year retrospective analysis (2011–2013) of 460 symposia in the field of microbiology found that inclusion of at least one woman among the conveners increased the proportion of female speakers by 72% compared with those convened by men alone [13]. Issues around speaker gender balance are complex and diverse [12,15]; however, several interventions have been proposed, such as developing a speaker policy, collecting and reporting the gender data, being family-friendly, and responding to resistance and supporting women at meetings [16]. Implementation of such approaches has been shown to be effective [17].

## Current policy options

Several practical ways to improve gender equity have been proposed [18–26]. However, implementation of these programs or approaches is not widespread, with many academic institutions not offering advancement opportunities that take into account gender bias. Professional skill development and mentorship are important for career advancement, yet sponsorship is a key strategy and model for advancing women to high-level leadership [20]. Universal efforts are needed to effectively advance the careers of women and remove gender inequities in academia [27,28], irrespective of discipline. We recommend that epidemiological societies, faculties, funding bodies, and journals begin to collect more comprehensive data about gender representation, publish relevant data, and actively engage in discussions so that we can reduce gender inequalities in the field of epidemiology.

## Policy recommendations

International Network for Epidemiology in Policy recommends the implementation of individual-level, institutional-level, and epidemiology board programs with appropriate incentives, relevant to epidemiology and other fields:

- Adopt the Athena Swan Charter (<https://www.ecu.ac.uk/equality-charters/athena-swan/about-athena-swan/>), paying close attention to potential pitfalls to avoid undermining the impact of the program.
- Develop and implement intentional plans to address gender inequity within academic organizations and epidemiology departments.
- Require proportional gender representation of epidemiology society membership on conference planning committees for national and international scientific meetings, and recommend that all committee members undergo training on conscious and unconscious biases related to gender discrimination and inequity.
- Monitor and report the data on gender for invited conference speaker presentations at all epidemiology and other scientific meetings.
- Implement executive leadership programs to provide leadership training for all faculty levels.
- Adopt family-friendly policies for men and women such as flexible working hours and financial resources to support individuals requiring child or elder care support.
- Spearhead career advising and sponsorship programs for women and other gender-defined professionals of mid-level and senior-level faculty to provide access to senior leaders and professional networks, until there is no longer gender inequality in promotion to senior faculty.
- Evaluate progress metrics of implemented programs in support of female and other gender-defined colleagues for academic advancement with awards for meeting goals.
- Facilitate mechanisms to monitor that funding and compensation are equitable between gender groups.

## Acknowledgments

M.C.A. is supported by NIH/NCI K07CA172294. C.R.G. is funded by a National Health and Medical Research Council (NHMRC) Career Development Fellowship (101087062). A.E.C. is funded by Career Development Fellowships by the NHMRC (1147843) and Cancer Institute New South Wales (NSW) (15/CDF/1–14).

## References

- [1] Elsevier, *Gender in the Global Research Landscape*. USA: Elsevier; 2017. p. 96.
- [2] Workplace Gender Equality Agency. Gender pay gap statistics. 2017. [Accessed 2017 February].
- [3] Lo Sasso AT, Richards MR, Chou CF, Gerber SE. The \$16,819 pay gap for newly trained physicians: the unexplained trend of men earning more than women. *Health Aff (Millwood)* 2011;30(2):193–201.
- [4] Association of Professional Engineers Australia and Professional Scientists Australia. The gender pay gap in engineering and science, Office of the Chief Scientist Australia's STEM Workforce, Editor. 2016.
- [5] Kahn S, Ginther DK. The salary gender gap in academic biomedical salaries, in National Institutes of Health Causal Factors and Interventions Workshop. 2012.
- [6] Schisterman E, Swanson CW, Lu Y, Mumford SL. The changing face of epidemiology, gender disparities in citations? *Epidemiology* 2017;28:159.
- [7] Feldon DF, Peugh J, Maher MA, Roksa J, Tofel-Grehl C. Time-to-credit gender inequities of first-year PhD students in the biological sciences. *CBE Life Sci Educ* 2017, 1–9;16(1).
- [8] Smith JL, Stoop C, Young M, Belou R, Held S. Grant-writing bootcamp: an intervention to enhance the research capacity of academic women in STEM. *Bioscience* 2017;67(7):638–45.
- [9] Witteman HO, Hendricks M, Straus S, Tannenbaum C. Are gender gaps due to evaluations of the applicant or the science? A natural experiment at a national funding agency. *Lancet* 2019;393:531–40.
- [10] d'Hoop-Azar A, Sancho E, Martens K, Papolis P, Institutional Shareholder Services Inc. Gender parity on boards around the world, in Harvard Law School Forum on Corporate Governance and Financial Regulation. Cambridge: Harvard Law School; 2017.
- [11] Stary K. Gender diversity quotas on Australian boards: Is it in the best interests of the company? *UniMelb*; 2015. p. 43. [http://law.unimelb.edu.au/\\_data/assets/pdf\\_file/0004/1709500/2-KateStary-CorporateGovernanceandDirectorsDutiesPaper2.pdf](http://law.unimelb.edu.au/_data/assets/pdf_file/0004/1709500/2-KateStary-CorporateGovernanceandDirectorsDutiesPaper2.pdf).
- [12] Jones TM, Fanson KV, Lanfear R, Symonds MRE, Higgie M. Gender differences in conference presentations: a consequence of self-selection? *PeerJ* 2014;2:e627.
- [13] Casadevall A, Handelsman J. The presence of female conveners correlates with a higher proportion of female speakers at scientific symposia. *MBio* 2014;5(1):e00846–913.
- [14] Isbell LA, Young TP, Harcourt AH. Stag parties linger: continued gender bias in a female-rich scientific discipline. *PLoS One* 2012;7(11):e49682.
- [15] Schroeder J, Dugdale HL, Radersma R, Hirsch M, Buehler DM, Saul J, et al. Fewer invited talks by women in evolutionary biology symposia. *J Evol Biol* 2013;26(9):2063–9.
- [16] Martin JL. Ten simple rules to achieve conference speaker gender balance. *PLoS Comput Biol* 2014;10(11):e1003903.
- [17] Casadevall A. Achieving speaker gender equity at the American Society for Microbiology General Meeting. *MBio* 2015;6(4):e01146–215.
- [18] Spalluto LB, Spottswood SE, Deitte LA, Chern A, Dewey CM. A leadership intervention to further the training of female faculty (LIFT-OFF) in radiology. *Acad Radiol* 2017;24(6):709–16.
- [19] Thorndyke LE, Gusic ME, George JH, Quillen DA, Milner RJ. Empowering junior faculty: Penn State's faculty development and mentoring program. *Acad Med* 2006;81(7):668–73.
- [20] Roy B, Gottlieb AS. The career advising program: a strategy to achieve gender equity in academic medicine. *J Gen Intern Med* 2017;32(6):601–2.
- [21] Bauman MD, Howell LP, Villablanca AC. The women in medicine and health science program: an innovative initiative to support female faculty at the University of California Davis School of Medicine. *Acad Med* 2014;89(11):1462–6.
- [22] Butkus R, Serchen J, Moyer DV, Bornstein SS, Hingle ST. Achieving gender equity in physician compensation and career advancement: a position paper of the American College of Physicians. *Ann Intern Med* 2018;168:721–3.
- [23] Caffrey L, Wyatt D, Fudge N, Mattingley H, Williamson C, McKevitt C. Gender equity programmes in academic medicine: a realist evaluation approach to Athena SWAN processes. *BMJ Open* 2016;6(9):e012090.
- [24] Helitzer DL, Newbill SL, Cardinali G, Morahan PS, Chang S, Magrane D. Narratives of participants in national career development programs for women in academic medicine: identifying the opportunities for strategic investment. *J Womens Health (Larchmt)* 2016;25(4):360–70.
- [25] Travis EL, Doty L, Helitzer DL. Sponsorship: a path to the academic medicine C-suite for women faculty? *Acad Med* 2013;88(10):1414–7.
- [26] Magrane D, Helitzer D, Morahan P, Chang S, Gleason K, Cardinali G, et al. Systems of career influences: a conceptual model for evaluating the professional development of women in academic medicine. *J Womens Health* 2012;21(12):1244–51.
- [27] Carr PL, Gunn C, Raj A, Kaplan S, Freund KM. Recruitment, promotion, and retention of women in academic medicine: how institutions are addressing gender disparities. *Womens Health Issues* 2017;27(3):374–81.
- [28] Jaggi R. Gender equity in epidemiology: miles to go. *Epidemiology* 2017;28(2):169–71.