

REVIEW ARTICLE

Women in anaesthesia: a scoping review

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Summary

Despite an increase in the proportion of women anaesthesiologists over time, women remain under-represented in academic and leadership positions, honour awards, and academic promotion. Current literature has identified several reasons for the observed gender disparity in anaesthesiology leadership and faculty positions, including unsupportive work environments, lack of mentorship, personal choices, childcare responsibilities, and active discrimination against women. A scoping review design was selected to examine the nature and extent of available research. Our review provides an overview of the literature that explores gender issues in anaesthesiology, identifies gaps in the literature, and appraises effective strategies to improve gender equity in anaesthesiology. We searched PubMed, MEDLINE, and EMBASE up to July 2019, and included 30 studies for analysis. Most reports used retrospective or survey methodologies. The review shows that women anaesthesiologists face gender biases in the work environment, are under-represented in various positions of leadership or influence, and as authors. Work–life demands may impose a challenge. Motivation and interest in career advancement of women anaesthesiologists have not been well studied. Several strategies have been proposed, ranging from an individual to administrative level, which may help anaesthesiologists achieve equal representation of women in the field.

Keywords: academia; anaesthesia; awards; gender equality; gender equity; leadership; women in medicine

An important milestone in medicine was reached in the past decade: gender parity was achieved in medical school admissions and graduations. Currently, women make up 50% of medical school graduates in the USA and Canada,¹ with a similar trend observed in Europe over the past decade.^{2,3} According to the Association of American Medical Colleges (AAMC), women represent 36% of all full-time faculty in academic anaesthesiology in the USA.¹ Similarly, women represent 33% of Canadian anaesthesiologists⁴ and 32% of consultants in the UK,⁵ in 2018 and 2015, respectively.

Despite an increase in the proportion of women anaesthesiologists over time, women remain under-represented in

positions of academic leadership and as recipients of honour awards or academic promotions.⁶ In 2014, women represented 18% of full professors and 10% of department chairs in academic anaesthesiology in the USA.¹ This trend remains unchanged from a decade earlier, according to the recent report by Bissing and colleagues.⁷ In UK medical schools, only four of the 29 anaesthesia department chairs were women in 2011,⁸ approximately 14%. The Australian and New Zealand College of Anaesthetists (ANZCA), in an effort to achieve gender equity, frequently shares data on women anaesthesiologists' representation in leadership positions: in 2018, women represented 24% of heads of departments, up from 20% in 2017.⁹

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Several factors have been cited to explain the gender disparity in positions of leadership in academic medicine. These include: unsupportive work environments, lack of mentorship, personal choices, childcare responsibilities, and active discrimination against women.^{10,11} Carr and colleagues¹¹ interviewed 18 women physicians in academic medicine across 13 institutions; 40% ranked gender discrimination as the primary factor responsible for limiting their academic career advancement. In addition, women tend to receive less credit for an equal number of academic citations compared with men when applying for funding or grants.¹² For example, it has been reported that for women scientists to earn the same application score as their men colleagues when applying for grant funding, they needed to publish three additional papers in high impact journals, or 20 additional papers in a top journal in their specialty.¹² Furthermore, the prevailing views on leadership characteristics may also hinder women's professional development. Using role congruity theory, Eagly and Karau¹³ suggest that traditional leadership characteristics align well with 'masculine' behaviours, such as competitiveness, ambition, and confidence. Women are not expected to display these 'masculine' behaviours, and if they do, they may be unfavourably judged as more hostile and less rational.¹³

Given the continued interest in gender equity in medicine, the complexity of the topic, and the varied approaches to its research, we conducted a scoping review of the current literature on women in anaesthesiology. Scoping reviews aim to 'systematically map the literature on a particular topic and identify key concepts and gaps in research' with aspirations of guiding the trajectory of future projects and policies.^{14,15}

The objectives of this scoping review were threefold. First, we aimed to provide a blueprint of available and current research on gender issues in anaesthesiology. Second, the identification of gaps in the current literature could guide future research in this field. Third, we aimed to explore reports about effective strategies employed or recommended towards achieving gender equity in academic anaesthesiology. These insights could, in turn, inform faculty development programmes and help guide institutional change.

Methods

This study was conducted using Arksey and O'Malley's¹⁴ framework for scoping reviews, as described by Levac and colleagues,¹⁵ and it unfolds in five stages as described in the following section. A sixth stage is described as optional, whereby stakeholders' input is sought to complement the literature review.¹⁵ The dissemination of this review through publication aligns with that stage.

Stage 1: identifying the research question

We identified a broad research question in order to capture a wide range of publications relevant to gender and anaesthesiology: how is the status of women in anaesthesiology described and explained across the current literature? Our population included anaesthesiologists at any stage of training or practice and our primary comparator was gender. We included studies that examined any dimension of gender issues amongst anaesthesiologists, including those related to representation,

discrimination, and barriers to career progression amongst female anaesthesiologists.

Stage 2: identifying relevant studies

We performed a search of PubMed, MEDLINE, and EMBASE on May 31, 2019 and updated it on July 17, 2019 (see Supplementary data). We used a broad search strategy, with the terms 'women', 'anesthes-', and 'anaesthes-'. We limited our search to articles published within the past 10 yr inclusively to ensure the data coincided with the more current social climate surrounding the promotion of women in the workplace. Next, we performed Google Scholar and Google Web searches using the same terms and dates. Finally, we reviewed the bibliographies of the articles to identify any additional relevant publications. The details of the literature search are described in the Results section.

Stage 3: study selection

The authors selected the study inclusion criteria to maximise sensitivity. All studies that focused on anaesthesiology staff or trainees and that discussed issues related to gender were included in this review. Only articles and abstracts published in English were eligible for full review. Titles, abstracts, and full texts were independently reviewed by two authors (LB and GRL). Studies were excluded if the full text was not available or if the article described a protocol of an ongoing study. Discrepancies were resolved by consensus among the authors at the completion of the review stage.

Stage 4: charting the data

For each study, we extracted author names, year of publication, journal, study title, study location, article type, methodology used, outcome assessed, population, results, gender/sex definition, leadership definition, awards definition, promotion definition, and factors mentioned regarding the gender discrepancies in the specialty. To aid in this review, a theoretical framework was used to classify the factors that affect the career paths of anaesthesiologists into four categories: environmental, structural, situational, and motivational. This theoretical framework was first described in the context of political activism¹⁶ and has been applied when studying women's perceptions toward leadership in academic medicine.¹⁷ Environmental factors encompass cultural and gender-related issues, such as work environment acceptance and general support of women careers. Structural factors refer to organisational infrastructure such as mentoring, presence of role models, training, and workshops. Situational factors refer to the balance of social and family responsibilities, including the availability of a supportive network. Finally, motivational factors reflect the interest in achieving leadership positions and in career advancement.¹⁷

Stage 5: synthesis of results

Studies were assessed for gender analysis amongst an anaesthesiology population. Studies were then analysed qualitatively using the aforementioned theoretical framework for factors affecting career advancement. Guided by each category, we provided a narrative synthesis to frame our findings and to help guide future research.

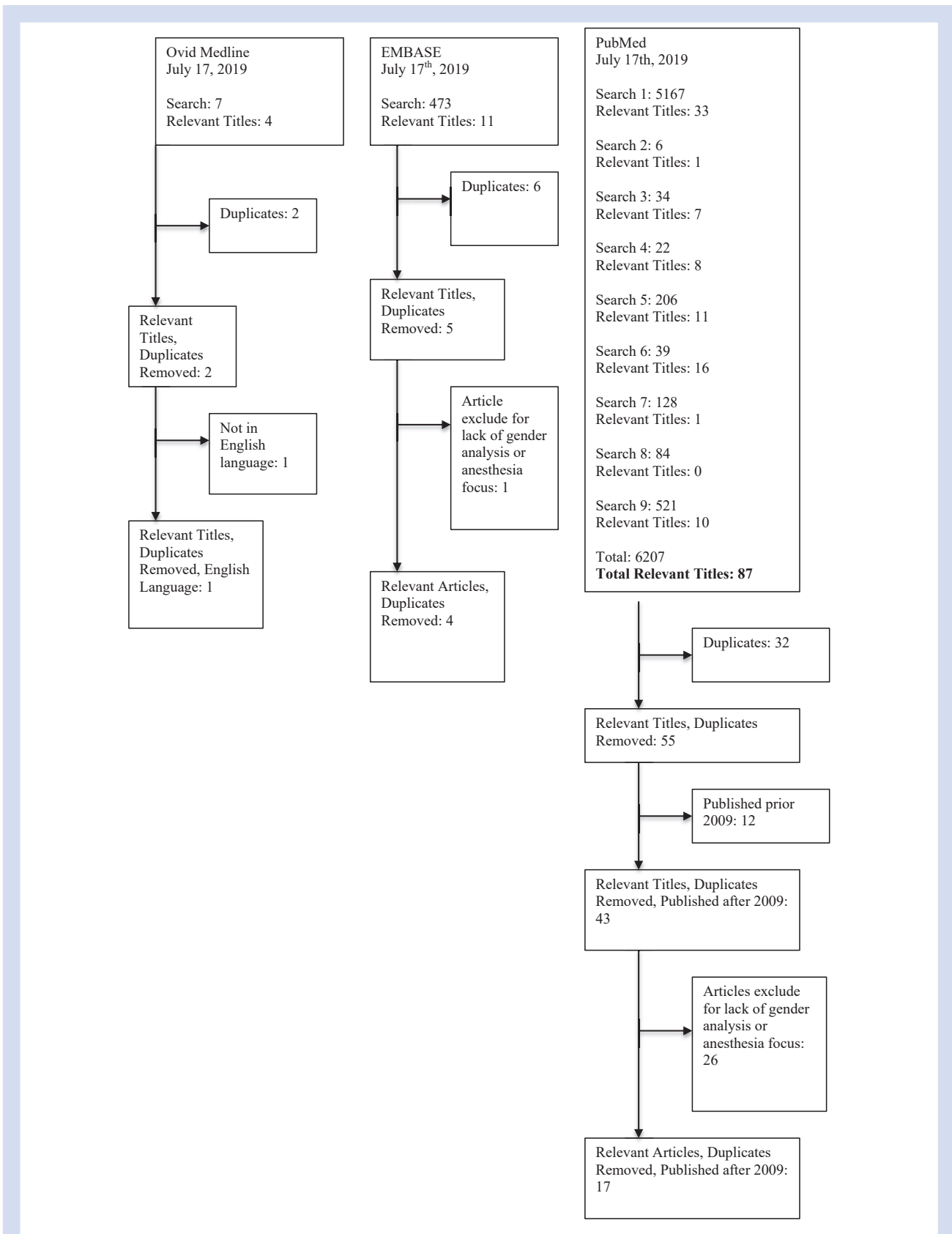
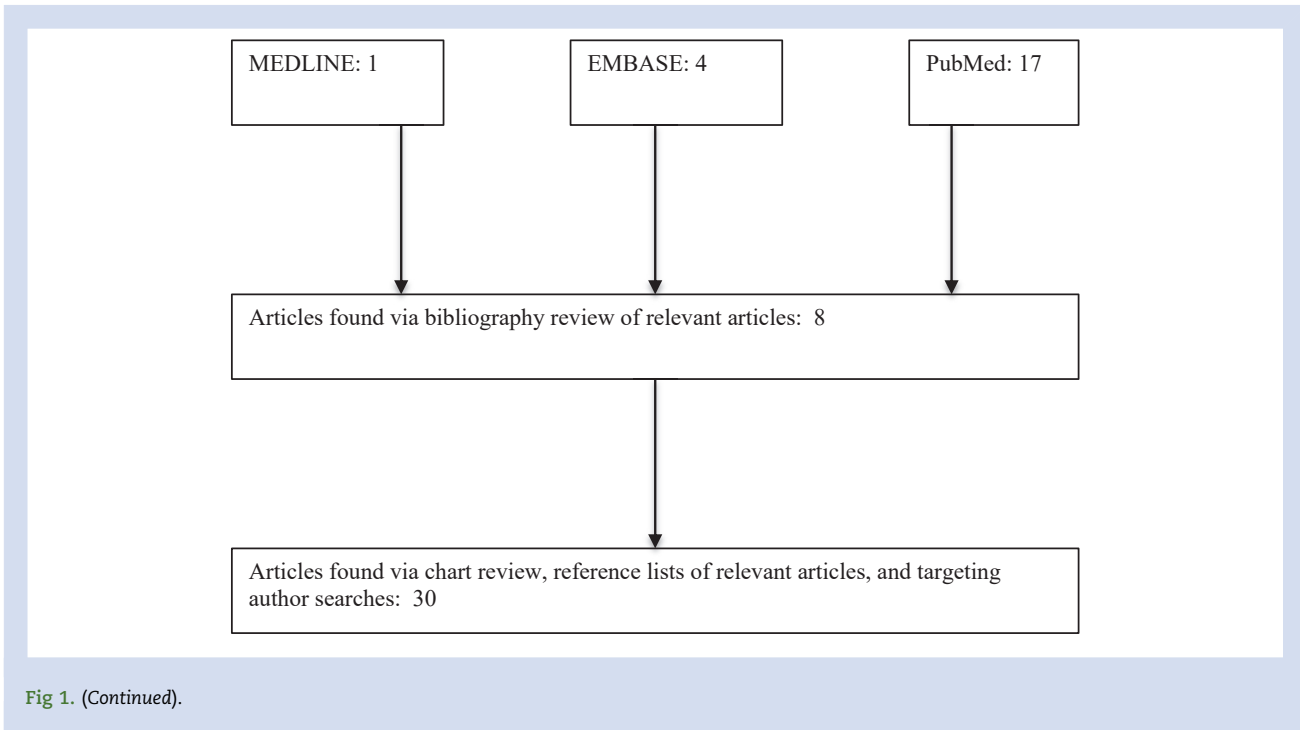


Fig 1. Identification of included studies. The inset shows articles identified from a review of the reference lists.



Results

Sources of evidence selection

We identified 104 relevant titles using our initial search strategy. After duplicate deletion, and more detailed review, 35 studies remained. We excluded articles based on language other than English without available translation ($n=1$) and publication date before January 1, 2009 ($n=12$). Accordingly, 22 articles were identified from the original search. The reference lists of those articles were reviewed, and eight additional articles were identified, yielding a total of 30 articles included in this scoping review (Fig 1).

Main findings

Thirty articles published after January 2009 were identified and reviewed. The articles included a combination of reports of original research ($n=20$), editorials ($n=3$), letters to the editor ($n=6$), and a review ($n=1$). Most of the articles employed retrospective data analysis methods ($n=16$); several used survey methodologies ($n=9$), and two reported a randomised design. Seventeen of the 30 identified articles had a woman first author (56.7%). A full description of all included articles is provided in Table 1. A predominant finding was a lack of representation of women anaesthesiologists in various positions of leadership in academic organisations or on journal editorial boards. Likewise, the scholarly productivity of women anaesthesiologists was lower than the productivity of men, especially in grant funding and journal article authorship. Gender biases in the workplace were identified in six articles. Few articles explored the situational and motivational challenges experienced during the career paths of women in anaesthesiology. The findings of the articles that reported different challenges are discussed in the corresponding sections.

Environmental factors (six articles identified)

Environmental factors refer to the presence of cultural and gender-related issues that are often described as challenges to academic promotion in anaesthesiology. The presence of gender bias has been well described in academic medicine.⁴⁹ However, there were few studies in anaesthesiology that directly explored the concept of gender bias.

Of the studies that explored effects of gender bias on career paths, three used survey methodologies, one used a randomised design and video reviews, one used high-fidelity simulation, and one used a narrative form. Pearson and colleagues¹⁸ reported the results of a pilot study exploring the experiences of women anaesthesiologists with childbearing and lactation. They found that less than half of the surveyed women were satisfied with their colleagues and superiors' support of their pregnancy.¹⁸ Miller and Katz¹⁹ found that among anaesthesiology residents at a single institution, women were more likely than men to report experiences of gender-based discrimination from patients, attending physicians, and residents. Pattni and colleagues²¹ used high-fidelity simulation to explore how 29 respiratory therapists responded when a man or woman anaesthesiologist made clinically incorrect decisions. They found that a 'female staff anaesthetist was challenged more often and with greater assertiveness and effectiveness' than a male staff anaesthetist.²¹

Conversely, Forkin and colleagues²⁰ did not find evidence of discrimination based on the gender of the anaesthesiologists in a randomised study of 200 patients presenting for preoperative evaluation in a single centre. The participants in that study viewed four 90 s videos of male and female anaesthesiologists displaying different body language, and were then asked to provide their perception of the physician's abilities. Participants' perceptions were positively affected by confident body language but were not related to the gender of the anaesthesiologist.²⁰

Table 1 Details of identified articles and their outcomes.

Authors	Year	Title	Country	Article type	Methodology	Outcomes
Environmental						
Pearson and colleagues ¹⁸	2018	Pilot survey of female anaesthesiologists' childbearing and parental leave experiences	USA	Original research article	Pilot survey	Experiences of women with childbearing and lactation; perceived lack of support
Miller and Katz ¹⁹	2018	Gender differences in perception of workplace experiences among anaesthesiology residents	USA	Original research article	Survey	Perception of discrimination in the workplace
Forkin and colleagues ²⁰	2019	Influence of sex and body language on patient perceptions of anesthesiologists	USA	Original research article	Prospective randomised; video-based	Patients' perceptions of anaesthesiologists' competence not affected by the anaesthesiologists' sex
Pattni and colleagues ²¹	2017	Gender, power and leadership: the effect of a superior's gender on respiratory therapists' ability to challenge leadership during a life-threatening emergency	UK	Original research article	Prospective; High fidelity simulation	Women anaesthesiologists challenged more often and more assertively than men
Workneh and Drum ²²	2018	Women practicing anesthesia around the world: similar and different challenges in Ethiopia	Ethiopia	Editorial	Narrative, autobiography	Personal and observed experiences of a woman anaesthesiologist in Ethiopia
Shams and El-Masry ²³	2015	Cons and pros of female anesthesiologists: academic vs non-academic	Egypt	Original research article	Survey	Perceptions of women anaesthesiologists of their professional path, family life and institutional factors
Structural						
Leadership—academic						
Bissing and colleagues ⁷	2018	Status of women in academic anesthesiology: a 10 yr update	USA	Original research article	Retrospective data review and analysis	Underrepresentation of women in academic leadership roles in anaesthesiology over the past decade
Leadership—societies						
Lorello and Flexman ²⁴	2019	75 yr of leadership in the Canadian Anesthesiologists' Society: a gender analysis	Canada	Letter to the Editor	Retrospective; Cross-sectional analysis	Percentage of women presidents of the Canadian Anesthesiologists' Society
Toledo and colleagues ²⁵	2017	Diversity in the ASA leadership	USA	Original research article	Survey	Percentage of women in American Society of Anesthesiologists leadership positions
Fahy and colleagues ²⁶	2018	Gender distribution of the American Board of Anesthesiology diplomates, examiners and directors (1985–2015)	USA	Original research article	Retrospective data review and analysis	Percentage of women of American Board of Anesthesiology diplomates, examiners and directors
Smith and Ashes ²⁷	2014	Gender differences in academia	Australia	Letter to the Editor	Survey results	Percentage of women of Australian Society of Anesthesiologists' members
Leadership—editorial boards						
Lorello and colleagues ²⁸	2019	Representation of women on the	Canada	Correspondence		Percentage of women on editorial board of

Continued

Table 1 Continued

Authors	Year	Title	Country	Article type	Methodology	Outcomes
		editorial board of the CJA: a retrospective analysis from 1954 to 2018			Retrospective data review and analysis	the <i>Canadian Journal of Anesthesia</i>
Miller and colleagues ²⁹	2018	Trends in authorship in anesthesiology journals	USA	Original research article	Retrospective; Cross-sectional	Gender of first and last authors; editors of <i>Anesthesia & Analgesia</i> and <i>Anesthesiology</i>
Galley and Colvin ⁸	2013	Next on the agenda: gender	UK	Editorial	Descriptive	Recommendations for increasing women's representation
Mentoring						
Flexman and Gelb ³⁰	2011	Mentorship in anesthesia	Canada	Review	Review	
Plyley and colleagues ³¹	2019	A survey of mentor gender preferences amongst anesthesiology residents at the University of British Columbia	Canada	Letter to the Editor	Survey	Mentorship preferences amongst anaesthesiology residents in one academic centre
Compensation						
Baird and colleagues ³²	2015	Regional and gender differences and trends in the anesthesiologist workforce	USA	Original research article	Survey	Remuneration and gender gap, percentage of women anaesthesiologists, differences in work arrangements
Haller and colleagues ³³	2016	Gender difference in career advancement and satisfaction in anaesthesia	Switzerland	Letter to the Editor	Survey	Percentage of women in academic role in Switzerland; difference in work arrangements; satisfaction
Scholarly productivity—funding						
Mayes and colleagues ³⁴	2018	Gender differences in career development awards in us anesthesiology and surgery departments, 2006–16	USA	Original research article	Retrospective review and analysis of data	Percentage of women K-award recipients
Pagel and Hudetz ³⁵	2015	Scholarly productivity and National Institutes of Health funding of foundation for anesthesia education and research grant recipients: insights from a bibliometric analysis	USA	Original research article	Retrospective review and analysis of data	Percentage of recipient of Foundation for Anesthesia Education and Research (FAER) grants; impact of FAER grants on future publications
Scholarly productivity—recognition award						
Mottiar ⁵	2018	Because it's 2018: women in Canadian anesthesiology	Canada	Letter to the Editor	Review of data	Women's underrepresentation in the Canadian Anesthesiologists' Society awards
Ellinas and colleagues ³⁶	2019	Distinguished service awards in anesthesiology specialty societies: analysis of gender differences	USA	Original research article	Retrospective review and analysis of data	Underrepresentation of women amongst award recipients from USA anaesthesiology societies
Scholarship—authorship						
Galley and Colvin ⁸	2013	Next on the agenda: gender	UK	See above		
Miller and colleagues ²⁹	2018	Trends in authorship in anesthesiology journals	USA	See above		Gender of first, and last authors; editor in <i>Anesthesia &</i>

Continued

Table 1 Continued

Authors	Year	Title	Country	Article type	Methodology	Outcomes
Flexman and colleagues ³⁷	2019	Representation of female authors in the Canadian Journal of Anesthesia: a retrospective analysis of articles between 1954 and 2017	Canada	Original research article	Retrospective review and analysis of data	Analgesia, and Anesthesiology Underrepresentation of women as first and last authors in the <i>Canadian Journal of Anesthesia</i>
Pagel and colleagues ³⁸	2019	Gender differences in authorship in the Journal of Cardiothoracic and Vascular Anesthesia: a 28 yr analysis of publications originating from the us: 1990–2017	USA	Original research article	Retrospective review and analysis of data	Underrepresentation of women as first and last authors of the <i>Journal of Cardiothoracic and Vascular Anesthesia</i>
Pashkova and colleagues ³⁹	2013	Gender disparity among US anaesthesiologists: are women underrepresented in academic ranks and scholarly productivity?	USA	Original research article	Bibliometric analysis of data	Women have overall lower h index than men from similar departments
Pagel and HUdetz ³⁵	2015	Scholarly productivity and National Institutes of Health funding of Foundation for Anesthesia Education and Research Grant recipients: insights from a bibliometric analysis	USA	See above		
Scholarly productivity—meeting presentation						
Lorello and colleagues ⁴⁰	2019	Representation of women amongst speakers at the Canadian Anesthesiologists' Society annual meeting: a retrospective analysis from 2007 to 2019.	Canada	Original research article	Retrospective review and analysis of data	Women are underrepresented as speakers in the Canadian Anesthesiologists' Society annual meeting; differences between subspecialties
Situational						
Pearson and colleagues ¹⁸	2018	Pilot survey of female anesthesiologists' childbearing and parental leave experiences	USA	See above		
Shams and El-Masry ²³	2015	Cons and pros of female anesthesiologists: academic vs non-academic	Egypt	See above		
Wood ⁴¹	2015	Women in medicine: then and now	USA	Editorial	Narrative	
Motivational						
Smith and Ashes ²⁷	2013	Gender differences in academia	Australia	See above		
Khan and colleagues ⁴²	2015	Perspectives of anaesthesia residents training in Canada on fellowship training, research,	Canada	Original research article	Survey	Residents' decision for fellowship training and gender differences

Continued

Table 1 Continued

Authors	Year	Title	Country	Article type	Methodology	Outcomes
Capdeville ⁴³	2019	and future practice location Gender disparities in cardiovascular fellowship training among three specialties from 2007 to 2017	USA	Original research article	Retrospective review and analysis of data	Underrepresentation of women in cardiovascular, critical care and pain fellowships compared with residency and other subspecialties
Bowhay and Watmough ⁴⁴	2009	An evaluation of the performance in the UK Royal College of Anaesthetists primary examination by UK medical school and gender	UK	Original research article	Retrospective review and analysis of data	Gender differences in performance on written Royal College of Anaesthetists examination
Haller and colleagues ³³	2016	Gender difference in career advancement and satisfaction in anaesthesia	Switzerland	See above		

Workneh and Drum²² described in narrative form the experiences with gender biases of an anaesthesiologist practicing in Ethiopia. Finally, Shams and El-Masry²³ reported on the negative impact on their institutions when women were included in the workforce, a term they refer to as 'feminisation' of medicine.

Structural factors (20 articles)

Structural factors refer to the institutional and specialty-wide resources that are available. Structural factors were defined for this scoping review as positions of leadership in anaesthesiology, mentorship, compensation, and scholarly productivity.

Positions of leadership (eight articles)

Several studies have reported on the current status of women in positions of leadership in academia,⁷ in scientific organisations,^{24–27} and on editorial boards of the specialty's leading journals.^{8,28,29} The identified studies used a retrospective observational methodology exploring representation of women in leadership positions.

Academic leadership (one article)

Leadership in academic anaesthesiology can be defined to include a range of positions, including departmental chairs, directors of medical educational programmes, or clinical centres. Bissing and colleagues⁷ performed a retrospective, cross-sectional analysis of the data collected by the AAMC, comparing the results between 2006 and 2016. According to their report, women make up 36% of anaesthesiology faculty in the USA, a significant increase from 29% in 2006.⁷ However, they note that the 'percentage of women anaesthesiology department chairs remained unchanged', at 14%.⁷

Scientific organisations (four articles)

In Canada, Lorello and Flexman²⁴ examined the gender distribution of the presidents of the Canadian Anaesthesiologists' Society since 1943 and determined that by 2019, only 4.5% of presidents had been women.

Toledo and colleagues²⁵ surveyed members of the ASA leadership, and found that 21.2% of respondents were women and 6.0% were under-represented minorities, both lower than the make-up of the general USA population. Fahy and colleagues²⁶ reported the gender distribution of the American Board of Anesthesiology diplomates, examiners, and directors. They found that from 1985 to 2015, the percentage of newly certified women diplomats increased from 15% to 38%, the percentage of women oral examiners increased from 8% to 26%, and the percentage of women directors increased from 8% to 25%. The authors also reported that it took on average 10 yr for diplomates to become oral examiners; however, despite taking that time lag into consideration, there was still a representation lag in the position of an examiner.²⁶

Smith and Ashes²⁷ reported in a letter to the editor the results of a survey conducted by the Australian Society of Anaesthetists. The survey showed that the proportion of women members increased from 17% in 1993, to 24% in 2010, commensurate with the increase in fellows and trainees during the same time period.

Editorial boards (three articles)

Lorello and colleagues²⁸ conducted a focused retrospective analysis of the gender of editorial board members of the *Canadian Journal of Anaesthesia (CJA)*. Their analysis spanned the decades between 1954 and 2018 and included 146 individuals, representing 985 member positions. In the studied time period, 10% of editorial board member positions and 6% of total member positions were held by women. Women joined the CJA editorial board in 1996, and since then have held 11% of the member positions. In 2019 women represented 25% of the CJA editorial board.²⁸ Miller and Katz's²⁰ retrospective observational study found that editorial board membership across

both *Anesthesiology* and *Anesthesia & Analgesia* in 2002 comprised 9.5% women, increasing to 15.5% in 2017. A report from 2013 similarly notes the slow change in women's representation on the editorial board of the *British Journal of Anaesthesia*, which now has had one female editor-in-chief, three female editors, and a number of female editorial board members.⁸

Mentorship (two articles)

Despite the recognised importance of mentorship for career advancement and satisfaction,⁴⁵ few articles explored the topic and the impact of mentoring experiences on the career paths of women in anaesthesiology.

Flexman and Gelb,³⁰ in their 2011 review of mentoring in academic medicine, note the lack of data on mentoring practices in anaesthesiology. They also reported unpublished data on the faculty mentoring programme at one large academic centre in the USA.³⁰

A single site audit regarding mentoring practices for residents was performed by Plyley and colleagues³¹ and reported as a letter to the editor. In that survey-based study, respondents indicated a preference for same-gender mentorship; female residents were more likely than male residents to report a preference for having a mentor of the same gender.³¹

Compensation (two articles)

Baird and colleagues³² reported the results of a survey conducted with members of the American Society of Anesthesiologists in 2007 and in 2012. The survey was designed to explore regional and gender differences in anaesthesiologists' practice. Based on 6783 responses, the authors reported that women anaesthesiologists earned on average 29% less than men anaesthesiologists (annual average income of \$313,074 for women compared with \$403,616 for men).³² The pay gap remained significant at 7% after correcting for experience, number of hours worked, type of compensation plan, and employer characteristics.³²

Haller and colleagues³³ performed a cross-sectional survey of 413 anaesthetists practising in the French- and Italian-speaking cantons of Switzerland. They compared the job experiences and professional satisfaction of men and women and found that more women (40.2%) than men (11.3%) worked part time. In addition, women were more likely than men to be paid a fixed salary (59.2% vs 46.6%), whereas men were more likely to receive 'high-income compensations' (36.9% vs 22.9%).³³

Scholarly productivity (11 articles)

Scholarly productivity is recognised as an important factor for career advancement in academic anaesthesiology.³⁴ Scholarly productivity, a surrogate for 'success in research',⁴⁶ was reported in the literature as grant funding,^{34,35} recognition awards,^{6,36} authorship,^{8,29,35,37–39} and presentations at national or international specialty meetings.⁴⁰

Grant funding (two articles)

Mayes and colleagues³⁴ reviewed the career advancement awards granted by the US National Institutes of Health (K01, K08, and K23 awards) between 2006 and 2016. They found that women were the recipients of 29 (33%) of the total 88 career

development grants awarded to anaesthesiologists during that period. The authors concluded that this difference was not significant given the similar proportion of eligible women at the instructor and assistant professor level during the same period. Pagel and Huditz³⁵ reviewed the scholarly productivity of 397 recipients of Foundation for Anesthesia Education and Research (FAER) grants since the foundation's establishment in 1987. The authors noted that women were the recipients of 21% of the FAER grants between 1987 and 2015.

Recognition awards (two articles)

Similar to other specialties,⁴⁷ women in anaesthesiology are under-represented in the recognition awards granted by anaesthesiology specialty societies. The Canadian Anesthesiologists' Society grants several yearly honour awards in recognition of contributions to education, research or clinical practice. In a letter to the editor, Mottiar⁶ provided a brief retrospective review of the gender of CAS honour awardees. Women were under-represented in every award category, including Research Recognition (20% of awardees), Clinical Teacher (24%), Young Educator (0%), Clinical Practitioner (0%), and Gold Medal (7%) awards.⁶

Ellinas and colleagues³⁶ assessed the gender distribution of the recipients of the Distinguished Service Awards, which are granted by nine anaesthesiology societies. Women were the recipients of 25 out of the total 211 Distinguished Service Awards granted since 1945. The authors also looked at historical trends and differences between societies in award granting. They found no statistically significant difference between the percentage of women awardees between 2008–2017 and pre-2008 (17.1% and 8.9%, respectively), with significant differences between different anaesthesiology societies.³⁶ The highest proportion of women awardees (40%) was by the Society for Ambulatory Anesthesia and the Society for Education in Anesthesia. In contrast, the American Society of Anesthesiologists, the International Society for Anesthetic Pharmacology, and the Society of Cardiovascular Anesthesiologists had no women award recipients in the past 10 yr.³⁶

Authorship (six articles)

Evaluations of publications are described either through reporting of first or last authorship,^{8,29,35,37–39} or through the use of bibliometric statistics.^{35,39} Galley and Colvin⁸ performed a review of original research articles published in one anaesthesiology journal during 1 yr (*British Journal of Anaesthesia*, in 2011). Women were first authors on 30.3% of the included articles, significantly lower than the proportion of men as first authors.⁸ Miller and colleagues²⁹ reviewed the gender differences in authorship of original research articles in *Anesthesiology* and *Anesthesia & Analgesia* in 2002, 2007, 2012, and 2017. They report that 24.8% of manuscripts had women first authors, whereas 15.6% had women senior authors, with no significant differences between the journals. Women made up a higher percentage of first authors on those manuscripts with women senior authors, compared to those with men senior authors.²⁹ The authors noted a significant increase in women authorship between 2002 (20.5% first authors) and 2017 (30.2%).²⁹

Flexman and colleagues³⁷ explored the authorship distribution in the *Canadian Journal of Anesthesia* between 1954 and 2017. They reviewed all articles published in the first year of each of the past six decades (i.e. 1960, 1970, 1980, 1990, 2000,

2010), in addition to 1954 and 2017.³⁷ Overall, women were first authors of 20% of original articles (94 of 476) and 17% of editorials (16 of 95). Similarly, women were last authors on 19% of the published articles in the study sample.³⁷ Original articles with women as first authors received more citations than articles with men as first authors.³⁷ The study did not explore the content of the publications and its possible interaction with citation effect.

Similarly, Pagel and colleagues³⁸ looked at the gender of first and last authors from the *Journal of Cardiothoracic and Vascular Anesthesia* during four 3 yr periods: 1990–1992, 1999–2001, 2008–2010, and 2015–2017. The study revealed that ‘women were first, last, and corresponding authors on 22.4%, 10.3%, and 14.6%’ of the 1195 reviewed publications, respectively.³⁸ The authors noted a significant increase in women authorship (either first or last author) between 2015 and 2017, compared with 1990–1992.³⁸ In addition, the percentage of women who were first or last authors in 2015–2017 exceeded the percentage of women practising in academic cardiothoracic anaesthesiology programmes during the same time period (35% compared with 29.1%).³⁸

Pashkova and colleagues³⁹ performed a bibliometric analysis of the publications of faculty members of 25 randomly selected academic anaesthesiology departments in the USA in 2012. Using the *h* index to evaluate scholarly productivity, the authors found that overall men had a significantly higher *h* index than women.³⁹ However, there were no differences in *h* indices between genders at the assistant and associate levels.³⁹ This was similar to the findings reported by Pagel and Hudetz³⁵ on the association between female gender and lower *h* index among FAER grant recipients.

Conference speakers (one article)

Lorello and colleagues⁴⁰ reviewed the online database of the Canadian Anesthesiologists’ Society meetings between 2007 and 2019 and analysed the gender of speakers and their subspecialties. The authors found that women held 28.5% of speaker positions, similar to the proportion of women anaesthesiologists in Canada during that study period (26.7%).⁴⁰ The proportion of women speakers was greater in obstetric anaesthesia, and lower in cardiothoracic, transplant, and critical care specialties.⁴⁰

Situational factors (three articles)

Situational factors, including work–life balance, dependent care, and geographic anchoring, have been suggested as challenges for the advancement of academic careers.^{41,48} However, few articles have addressed the extent and impact of situational challenges on the careers of women in anaesthesiology during the past decade.

Pearson and colleagues¹⁸ conducted a pilot survey of 72 attendees of the Women in Anaesthesiology meeting. The survey explored timing of pregnancy relative to training, which led to extension of the period of training for 56.3% of respondents, and delayed board certification for 9.7% of respondents.¹⁸ Recognising the limitations of their study design, the authors called for additional studies on the ‘effect of parenthood on female anaesthesiologists’ careers’.¹⁸

A survey conducted in Egypt compared the experiences of 46 women anaesthesiologists based on the type of their practice. Women in academic practices were significantly more likely to report negative implications of their work on their

family life compared with those in private practice. The authors report that women in academic practices were significantly more ‘afflicted’ by their careers, leading to: delayed marriages, delayed first baby, child rearing, maternity rights, and poor fulfilment of family demands.²³ Wood⁴¹ highlighted lack of professional mobility as a challenge for women considering leadership and for their families. She noted that search committees may hold assumptions of geographic anchoring, preventing them from engaging with women candidates.

Motivational factors (five articles)

Motivational factors refer to the interests, aspirations, and self-efficacy of women toward career advancement and leadership. In a letter to the editor, Smith and Ashes²⁷ report the findings of a survey conducted by the Australian Society of Anaesthetists in 1993 and in 2010. The authors note that although ‘fewer women than men were serving on professional committees’ in both surveys, women in 2010 were significantly more likely to have been asked and to have declined to serve on such committees compared with women in 1993 (27% vs 8%).²⁷

Khan and colleagues⁴² examined the survey responses of 241 residents enrolled in accredited Canadian anaesthesiology residency programmes. The survey, designed to explore interest in fellowship training, in research, and in type of future practice, revealed that 70% of all trainees were interested in pursuing fellowship training. Of the studied factors, ‘only male sex was associated with wanting to pursue fellowship training’.

Capdeville⁴³ reviewed trends in fellowship training in anaesthesiology in USA programmes between 2007 and 2017 using publicly available data registries. Women represented a third of trainees in fellowships programmes, consistent with the proportion of women in anaesthesiology residency training. Relative to the proportion of women in residency (36%), women accounted for a larger proportion of trainees in obstetrics (53–70%) or paediatrics (50%) fellowships, and smaller proportion of trainees in adult cardiothoracic anaesthesiology (about 30%), critical care medicine, (about 25%), and pain medicine (about 20%).⁴³

Bowhay and Watmough⁴⁴ reviewed the databases of the Royal College of Anaesthetists (RCoA) on the written part of the Fellowship of the Royal College of Anaesthetists (FRCA) examination. They compared test performance of anaesthesia graduates based on their medical school and on their gender. They reported that women’s performance in the written examination was lower than men’s performance, and that women were less likely to pass the examination on the first attempt. The authors conjecture that the design of the examination may be one of the causes of women’s underperformance. The test aims to ‘correct for guessing’ by penalising wrong answers. The authors propose that women are less inclined to take risks than men, and are therefore more likely than men to skip answering when in doubt.⁴⁴ Since then, the RCoA has changed their scoring practice to count correct answers only.⁴⁴

In the survey conducted by Haller and colleagues³³ among anaesthesiologists practising in Switzerland, there were no gender differences in professional satisfaction, regardless of compensation, professional position, practice patterns, or family situation. The majority of respondents indicated being somewhat or very satisfied with their jobs.

Discussion

We performed a scoping review of the literature published in the past decade, related to women in anaesthesiology. The aims of this review were to provide an overview of the current literature on gender issues in anaesthesiology, identify gaps in knowledge to guide future research, and provide insights into effective strategies for mitigating the effect of gender issues on career paths in anaesthesiology.

Review of current literature

The current literature exploring gender issues in anaesthesiology supports the existing body of literature on gender in medicine. Based on this review, women in anaesthesiology experience a variety of challenges on their career paths, including gender bias in the workplace, unequal representation in positions of leadership and in positions of influence such as on editorial boards, and lower scholarly productivity. Similar to other specialties, women in anaesthesiology are juggling work–life demands, including motherhood and pregnancy. These factors may affect their career and choices for additional training and choice of specialty.

The challenges identified in this scoping review have been described as micro- and macro-inequities. Micro-inequities, in contrast to micro-affirmations, may be daily, intrusive gender biases in the workplace.⁵⁰ The accumulation of micro-inequities can weigh down on women's experiences, like a 'ton of feathers',¹¹ potentially affecting women's motivations and perceptions of self-worth.⁵⁰ Macro-inequities, in contrast, are related to systemic problems such as compensation plans, promotion criteria, and positions of leadership.⁵¹

Research gap

The review revealed several gaps in our knowledge of women's status in anaesthesiology. Most studies have described the 'what' and the 'how', but few studies have explored the 'why' of women's under-representation in positions of leadership or in positions of influence. To answer the 'why' question will require a different choice of research methodologies aligning with objectivist, subjectivist, constructivist, and/or interpretivist epistemology. It is not surprising that medical professionals who favour evidence-based approaches have focused on reporting measurable outcomes, querying databases, and statistics. Most of the studies described in this review used a survey design or retrospective database analysis. The studies have effectively demonstrated the presence of gender-based differences in representation across positions of influence in anaesthesiology. This is an essential first step to the next stages of research: exploring the systemic, societal, and personal drivers of such outcomes and provides a baseline upon which to measure progress. We did not find any articles that used qualitative research methodologies, such as interviews or focus groups. Two of the included reports were written using a first-person narrative, which allowed for a compelling illustration of the respective authors' experiences.^{22,41}

There is also a need for more comparative studies of the experiences of men and women in anaesthesiology. Dependent-care obligations may, for example, affect both men and women's career paths. In addition, motivational factors

are not well explored in the available literature. Capdeville⁴³ notes the paucity of data on factors that influence anaesthesiologists' career choices, namely fellowship choice.

Recognising the challenges

Neither gender parity nor equity has been achieved in anaesthesiology to date. Silver and colleagues⁵² describe three general attitudes or 'errors in critical thinking' that serve to perpetuate the presence of inequities: perpetuating myths (or stereotypes), blaming the targets, and deliberately ignoring the data.

There are persistent academic and societal assumptions about women's professional aspirations and about their conformation to societal gender-role expectations. One report, written by two men, declares that 'we cannot deny that rearing and caring at home are the primary role for any woman whatever her level of education...'.²³

Some authors warn about the impact of 'feminisation' of medicine on revenue and productivity.⁵³ The projected increase in the number of women physicians in the workforce has been interpreted by some not as an opportunity, but rather as a problem.^{46,53,54} In these analyses, women physicians are more likely to opt for part-time positions, or to leave the workforce 'pipeline' altogether,^{46,55} resulting in a workforce that is understaffed to meet the challenges of the healthcare systems. The census report of the RCoA suggested that approximately '17% of female consultants are working less than full-time compared to 4.6% of males'.^{5,56} Women physicians have also been less engaged in research as evidenced by fewer authorships and grant funding awards. Academic productivity and recognition as an expert are often important milestones on a career path toward leadership in academic medicine.^{36,46} Others continue to ignore the evidence of the challenges faced by women and instead urge women physicians to 'lean-in'.⁵⁷

Recommended strategies

It may be prudent to heed the advice of the European Union's report, as quoted by Pfliegerer and colleagues,⁴⁶ and to make the focus 'no longer fixing women but fixing institutions'.⁵⁸ Four gatekeepers to academic advancement have been identified: medical schools/academic centres, medical societies, journals, and funding agencies.⁵¹ Recommendations are inferred from the current literature and presented for the four recognised gatekeeping entities.

Despite recommendations by the AAMC, 40% of medical schools in 2017 did not have programmes for 'recruiting, promoting, or retaining' women faculty members.⁵⁹ However, the benefits of well-designed faculty development programmes, including gender bias training, on satisfaction of women faculty and their promotion, have been reported.^{10,60}

Search committees, the gatekeepers to leadership positions, play an important role in recruitment and promotion of women physicians.^{41,60,61} In order to achieve increased representation of women in leadership positions, we ought to first increase their representation on the relevant search committees.⁶² Similarly, medical societies can adopt a deliberate plan to reduce gender inequities on their boards by increasing the number of female recipients of their excellence awards and in their keynote speakers.

The majority of authors and editors of academic journals are men. Lundine and colleagues⁶³ state that 'the gendered

system of academic publishing is both a reflection and a cause of women's underrepresentation'. Academic journals can commit to decreasing gender biases by tracking and publishing their gender data for authors, reviewers, and editors.⁶⁴

As noted by McKeen and colleagues,⁶⁵ 'research funding impacts the ability to publish'. However, research fund allocation frequently takes into consideration previous publications. To break the cycle of gendered funding, research funding allocation can be redesigned to place more emphasis on the content of the proposal rather than on its antecedents.⁶⁵ In addition, funding opportunities for advancing the diversity of the workforce are needed. The National Science Foundation, through its ADVANCE programme, supports research 'to increase representation and advancement of women in academic science and engineering careers' in the USA. Likewise, the US National Institute of Health supports a Diversity Program Consortium to promote the recruitment and professional development of 'individuals from under-represented backgrounds in biomedical research careers'.⁶⁶

Limitations

Limitations of this review include the criteria used for identification of relevant articles, namely the selected time frame and the language of publication. A 10 yr time frame was selected to allow a detailed review of the recent literature. The design of a scoping review necessitated inclusion of articles regardless of their study design, methodology, or outcomes. The recommendations made are therefore limited by the inherent quality of these studies. In addition, we did not generate sufficient evidence to support clear recommendations in all areas, and we instead referred to previously reported best practices. Furthermore, our study was not designed to explore the intersectionality of gender, race, sexual orientation, or cultural and ethnical background (as well as all other social constructs) in anaesthesiology although this would be an important area for future research.

Conclusions

Similar to women in other academic specialties, women in anaesthesiology are faced with numerous challenges on their career paths. In the past decade, there have been several reports exploring the nature of those challenges and their extent. However, there remains a gap in our understanding of what drives gender differences in anaesthesiology and their impact on individuals as well as on the specialty. Given the lack of specialty-specific data, recommendations were inferred from the current literature and from other successful programmes in medicine. Women in medicine have been 'leaning-in',⁶⁷ with little success, into a system that is rife with implicit and explicit gender biases. As women continue to lean-in, it is time for academic organisations and societies to do their part and lean-in as well.

Authors' contributions

All authors abide by ICMJE criteria for authorship

Study conceptualisation: all authors

Study design: all authors

Data acquisition and analysis: GRL, LB, MJH

Drafting of manuscript: all authors.

Manuscript critical revision for intellectual content: all authors

Administrative, technical, and material support: all authors

Study supervision: all authors

Manuscript final approval: all authors

Declaration of interest

The authors declare that they have no conflicts of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.bja.2019.12.021>.

References

- Lautenberger DM, Dandar VM, Raezer CL, Sloane RA. *The state of women in academic medicine: the pipeline and pathways to leadership*. Washington, DC: Association of American Medical Colleges; 2014
- Jagsi R, Guancial EA, Worobey CC, et al. The "gender gap" in authorship of academic medical literature — a 35-year perspective. *New Engl J Med* 2006; **355**: 281–7
- Eurostat. *Healthcare personnel statistics — physicians*. Brussels: EU: European Commission; 2019
- Canadian Medical Association. *Anesthesiology profile*. Ottawa, ON, Canada: Canadian Medical Association; 2018
- Royal College of Anaesthetists. *Medical workforce census report 2015*. London: The Royal College of Anaesthetists UK; 2016
- Mottiar M. Because it's 2018: women in Canadian anesthesiology. *Can J Anesth* 2018; **65**: 953–4
- Bissing MA, Lange EMS, Davila WF, et al. Status of women in academic anesthesiology: a 10-year update. *Anesth Analg* 2019; **128**: 137–43
- Galley HF, Colvin LA. Next on the agenda: gender. *Br J Anaesth* 2013; **111**: 139–42
- Australian and New Zealand College of Anaesthetists (ANZCA). *Gender equity metrics*. Melbourne: ANZCA; 2019. Available at, <http://www.anzca.edu.au/about-anzca/gender-equity/gender-equity-metrics>. [Accessed 14 January 2020]
- Girod S, Fassiotto M, Grewal D, et al. Reducing implicit gender leadership bias in academic medicine with an educational intervention. *Acad Med* 2016; **91**: 1143–50
- Carr PL, Szalacha L, Barnett R, Caswell C, Inui T. A "ton of feathers": gender discrimination in academic medical careers and how to manage it. *J Womens Health* 2003; **12**: 1009–18
- Wenneras C, Wold A. *Nepotism and sexism in peer-review. Women, science, and technology*. Routledge; 2010. p. 64–70
- Eagly AH, Karau SJ. Role congruity theory of prejudice toward female leaders. *Psychol Rev* 2002; **109**: 573
- Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005; **8**: 19–32
- Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci* 2010; **5**: 69
- Costantini E. Political women and political ambition — closing the gender-gap. *Am J Polit Sci* 1990; **34**: 741–70
- Hastie MJ. *Perceptions of leadership among women in academic medicine: a case study comparing the perspectives of full-time faculty with and without institutionally defined leadership titles*. Teachers College: Columbia University; 2019
- Pearson AC, Dodd SE, Kraus MB, et al. Pilot survey of female anesthesiologists' childbearing and parental leave experiences. *Anesth Analg* 2019; **128**: e109–12

19. Miller J, Katz D. Gender differences in perception of workplace experience among anesthesiology residents. *J Educ Perioper Med JEPM* 2018; **20**: E618
20. Forkin KT, Dunn LK, Kaperak CJ, et al. Influence of sex and body language on patient perceptions of anesthesiologists. *Anesthesiology* 2019; **130**: 314–21
21. Pattni N, Bould MD, Hayter MA, et al. Gender, power and leadership: the effect of a superior's gender on respiratory therapists' ability to challenge leadership during a life-threatening emergency. *Br J Anaesth* 2017; **119**: 697–702
22. Workneh RS, Drum ET. Women practicing anesthesia around the world: similar and different challenges in Ethiopia. *Int Anesthesiol Clin* 2018; **56**: 121–7
23. Shams T, El-Masry R. Cons and pros of female anesthesiologists: academic versus nonacademic. *J Anaesthesiol Clin Pharmacol* 2015; **31**: 86
24. Lorello GR, Flexman AM. 75 years of leadership in the Canadian Anesthesiologists' Society: a gender analysis. *Can J Anesth* 2019; **66**: 843–4
25. Toledo P, Duce L, Adams J, Ross VH, Thompson KM, Wong CA. Diversity in the American society of anesthesiologists leadership. *Anesth Analg* 2017; **124**: 1611–6
26. Fahy BG, Cully DJ, Sun H, Dainer R, Lutkoski BP, Lien CA. Gender distribution of the American board of anesthesiology diplomates, examiners, and directors (1985–2015). *Anesth Analg* 2018; **127**: 564–8
27. Smith N, Ashes C. Gender differences in academia. *Br J Anaesth* 2014; **112**: 588–9
28. Lorello GR, Parmar A, Flexman AM. Representation of women on the editorial board of the *Canadian Journal of Anesthesia*: a retrospective analysis from 1954 to 2018. *Can J Anesth* 2019; **66**: 989–90
29. Miller J, Chuba E, Deiner S, DeMaria Jr S, Katz D. Trends in authorship in anesthesiology journals. *Anesth Analg* 2019; **129**: 306–10
30. Flexman AM, Gelb AW. Mentorship in anesthesia. *Curr Opin Anesthesiol* 2011; **24**: 676–81
31. Plyley T, Cory J, Lorello GR, Flexman AM. A survey of mentor gender preferences amongst anesthesiology residents at the University of British Columbia. *Can J Anesth* 2019; **66**: 342–3
32. Baird M, Daugherty L, Kumar KB, Arifkhanova A. Regional and gender differences and trends in the anesthesiologist workforce. *Anesthesiology* 2015; **123**: 997–1012
33. Haller G, Delhumeau C, Mamie C, Zoccatelli D, Clergue F. Gender difference in career advancement and job satisfaction in anaesthesia: a cross-sectional study. *Eur J Anaesthesiol* 2016; **33**: 588–90
34. Mayes LM, Wong CA, Zimmer S, Fernandez-Bustamante A, Bartels K. Gender differences in career development awards in United States' anesthesiology and surgery departments, 2006–2016. *BMC Anesthesiol* 2018; **18**: 95
35. Pagel PS, Hudetz JA. Scholarly productivity and national Institutes of Health funding of foundation for anesthesia education and research grant recipients: insights from a bibliometric analysis. *Anesthesiology* 2015; **123**: 683–91
36. Ellinas EH, Rebello E, Chandrabose RK, Shillcutt SK, Hernandez M, Silver JK. Distinguished service awards in anesthesiology specialty societies: analysis of gender differences. *Anesth Analg* 2019; **129**: e130–4
37. Flexman AM, Parmar A, Lorello GR. Representation of female authors in the *Canadian Journal of Anesthesia*: a retrospective analysis of articles between 1954 and 2017. *Can J Anesth* 2019; **66**: 495–502
38. Pagel PS, Freed JK, Lien CA. Gender differences in authorship in the *Journal of Cardiothoracic and Vascular Anesthesia*: a 28-year analysis of publications originating from the United States, 1990–2017. *J Cardiothorac Vasc Anesth* 2019; **33**: 593–9
39. Pashkova A, Svider P, Chang C, Diaz L, Eloy J, Eloy J. Gender disparity among US anaesthesiologists: are women underrepresented in academic ranks and scholarly productivity? *Acta Anaesthesiol Scand* 2013; **57**: 1058–64
40. Lorello GR, Parmar A, Flexman AM. Representation of women amongst speakers at the Canadian Anesthesiologists' Society annual meeting: a retrospective analysis from 2007 to 2019. *Can J Anesth* 2019: 1–7
41. Wood M. Women in medicine: then and now. *Anesth Analg* 2015; **120**: 963–5
42. Khan J, Gilbert J, Sharma A, LeManach Y, Yee D. Perspectives of anesthesia residents training in Canada on fellowship training, research, and future practice location. *Can J Anaesth* 2015; **62**: 956–63
43. Capdeville M. Gender disparities in cardiovascular fellowship training among 3 specialties from 2007 to 2017. *J Cardiothorac Vasc Anesth* 2019; **33**: 604–20
44. Bowhay AR, Watmough SD. An evaluation of the performance in the UK Royal College of Anaesthetists primary examination by UK medical school and gender. *BMC Med Educ* 2009; **9**: 38
45. DeCastro R, Sambuco D, Ubel PA, Stewart A, Jagsi R. Batting 300 is good: perspectives of faculty researchers and their mentors on rejection, resilience, and persistence in academic medical careers. *Acad Med* 2013; **88**: 497–504
46. Pfeleiderer B, Bortul M, Palmisano S, Rodde S, Hasebrook J. Improving female physician's careers in academic medicine: chances and challenges. *Best Pract Res Clin Anaesthesiol* 2018; **32**: 15–23
47. Silver JK, Slocum CS, Bank AM, et al. Where are the women? The underrepresentation of women physicians among recognition award recipients from medical specialty societies. *PM R* 2017; **9**: 804–15
48. Meghen K, Sweeney C, Linehan C, O'Flynn S, Boylan G. Women in hospital medicine: facts, figures and personal experiences. *Ir Med J* 2013; **106**: 39–42
49. Moss-Racusin CA, Dovidio JF, Brescoll VL, Graham MJ, Handelsman J. Science faculty's subtle gender biases favor male students. *Proc Natl Acad Sci U S A* 2012; **109**: 16474–9
50. Rowe M. Micro-affirmations and micro-inequities. *J Int Ombuds Assoc* 2008; **1**: 45–8
51. Silver JK. Understanding and addressing gender equity for women in neurology. *Neurology* 2019; **93**: 538–49
52. Silver JK, Rowe M, Sinha MS, Molinares DM, Spector ND, Mukherjee D. Micro-inequities in medicine. *PM R* 2018; **10**: 1106–14
53. Khan M. Medicine—a woman's world? *BMJ* 2012; **344**: d8234
54. McKinstry B. Are there too many female medical graduates? Yes. *BMJ* 2008; **336**: 748
55. Sleeman KE, Koffman J, Higginson IJ. Leaky pipeline, gender bias, self-selection or all three? A quantitative analysis of gender balance at an international palliative care research conference. *BMJ Support Palliat Care* 2019; **9**: 146–8
56. Carey C. Securing the future anaesthetic workforce. *Best Pract Res Clin Anaesthesiol* 2018; **32**: 25–37

57. Ward PA. Female anaesthetists: lean in. *Br J Anaesth* 2014; **112**: 588
58. The European Commission. *Report on equality between women and men, 2004. Report from the commission to the council, the European parliament, the European economic and social committee and the committee of the regions*. Luxembourg: Office for Official Publications of the European Communities; 2004
59. 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 Issue* 2017; **27**: 374–81
60. Valentine HA, Grewal D, Ku MC, et al. The gender gap in academic medicine: comparing results from a multifaceted intervention for Stanford faculty to peer and national cohorts. *Acad Med* 2014; **89**: 904–11
61. Sheridan JT, Fine E, Pribbenow CM, Handelsman J, Carnes M. Searching for excellence & diversity: increasing the hiring of women faculty at one academic medical center. *Acad Med* 2010; **85**: 999–1007
62. Leslie K, Hopf HW, Houston P, O'Sullivan E. Women, minorities, and leadership in anesthesiology: take the pledge. *Anesthes Analg* 2017; **124**: 1394–6
63. Lundine J, Bourgeault IL, Clark J, Heidari S, Balabanova D. The gendered system of academic publishing. *Lancet* 2018; **391**: 1754–6
64. Lundine J, Bourgeault IL, Glonti K, Hutchinson E, Balabanova D. "I don't see gender": conceptualizing a gendered system of academic publishing. *Soc Sci Med* 2019; **235**: 112388
65. McKeen DM, Bryson GL, Lundine J. Underrepresentation of women in *Canadian Journal of Anesthesia* publications: no surprise—take the pledge! *Can J Anaesth* 2019; **66**: 485–90
66. Valentine HA, Lund PK, Gammie AE. From the NIH: a systems approach to increasing the diversity of the biomedical research workforce. *CBE Life Sci Educ* 2016; **15**: fe4
67. Sandberg S. *Lean in: women, work, and the will to lead*. 1st Edn. New York: Alfred A. Knopf; 2013

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