



Gender Inequality in Surgical Training Selection: A Systematic Review

Mwipatayia BP^{1*}, Armaric E², Mwipatayid MT³, Wonga J⁴, Dame HV⁵, Chetritf S⁶, Bennettg S⁷ and Vaughanh B⁸

¹Department of Vascular Surgery, Royal Perth Hospital, Perth, Australia

²School of Surgery, Dentistry and Health Sciences, University of Western Australia, Perth, Australia

³Department of Obstetrics & Gynecology, King Edward Memorial Hospital, Perth, Australia

⁴University of Buckingham Medical School, Hunter Street, Buckingham, UK

⁵Department of Plastic Surgery, Royal Perth Hospital, Perth, Australia

⁶Department of Medical Education, Royal Perth Hospital, Perth, Australia

⁷Executive Director Royal Perth Bentley Group, Perth, Australia

⁸Department of Clinical Education, University of Melbourne, Melbourne, Australia

Abstract

Background: This study aimed to evaluate gender inequality within the Surgical Education and Training (SET) programmer selection process to identify barriers to gender equality and to outline solutions to bridge this divide.

Methods: A systematic review was conducted using Medical Subject Headings, Emtree terms, subject headings, and key terms. Quality assessments were performed using the Critical Appraisal Skills Program Qualitative Checklist and the Joanna Briggs Institute Critical Appraisal Checklist. Since some studies included quantitative and qualitative data, we used the Mixed Methods Appraisal Tool to assess this subcategory of papers.

Results: The literature search produced 191 citations: 81 in PubMed, 23 in EMBASE, 40 in ERIC, 16 in PsycINFO, and 31 in Medline. The records identified through other sources (e.g., grey literature, cross-referencing, and Royal Australasian College of Surgeons abstracts) produced 35 additional citations. The full texts of a total of 156 non-duplicated potential articles were obtained for closer inspection, of which 13 were included in the final analysis. Lack of female leadership and surgical role models, passive bullying and gender discrimination, lack of positive mentorship and flexible surgical training programs were identified as potential barriers to gender equality in surgical training.

Conclusion: Despite more females entering the medical profession, obvious gender imbalances persist across all surgical training fields. Gender inequality continues to exist amongst trainees. There is a paucity of publications addressing this topic and a prevailing inclination among females to make alternative career choices despite best efforts to make surgical training more appealing.

Keywords: Surgical training; Gender equality; Discrimination; Career choice; Trainee selection

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*Correspondence:

Bibombe P Mwipatayi, Department of Vascular Surgery, Royal Perth Hospital, Level 2, MRF Building, Royal Perth Hospital, Perth, 6000, Australia, Tel: +61-8-9224 0228; Fax: +61-8-9224 0204;

E-mail: bibombe@iinet.net.au

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Abbreviations

SET: Surgical Education and Training; RACS: Royal Australasian College of Surgeons; PRISMA: Preferred Reporting Items for Systematic reviews and Meta-Analyses; EMBASE: Excerpta Medica Database; CASP: Critical Appraisal Skills Program; JBI: Joanna Briggs Institute; MMAT: Mixed Methods Appraisal Tool

Background

Medicine has traditionally been a male-dominated profession; however, in the last decade, there has been an influx of females into medical schools [1,2]. Despite 51% of Australian medical students and 40% of doctors being female, there is still an imbalance in the representation of women within medical specialties [3,4]. High rates of gender inequality in the surgical profession have been consistently demonstrated in the Australian and international literature [5,6]. In 2015, only 9.2%

of consultant surgeons were female [7]. However, the proportion of female surgical fellows had increased from 7.7% to 9.8% since 2009 [7]. In 2017, nearly 30% of the successful Surgical Education and Training (SET) candidates in Australia were women, which was an increase of 6% from 2016 [8,9].

There is no doubt that a perceived incompatibility between surgical training and work-life balance deters both males and females from choosing careers as surgeons [10-12]. The long work hours, inflexible training options, and discouragement of training interruptions are accepted realities of SET trainees. Full-time Royal Australasian College of Surgeons (RACS) surgical fellows currently works an average of 51 h per week [13]. Only five trainees were permitted to undertake part-time SET in 2016, all of whom were from the general surgery subspecialty stream [13]. Moreover, with 98% (n=314) of active female SET trainees being under the age of 44 years, the demands of surgical training are likely to coincide with important decisions surrounding family planning and pregnancy [13].

A lack of female role models for aspiring female surgeons may have an impact on the surgical specialty choice of female trainees [14,15]. Fewer female surgeons have a steady and smooth progression in their surgical careers compared with their male peers, and a higher attrition rate is observed among female surgeons compared with male surgeons [16,17]. In 2016, nearly 80% of trainees who withdrew from SET training were female [9]. Early experiences of gender discrimination and sexual harassment significantly deter female residents from applying to surgical specialty training [18]. While there are numerous and unique factors that deter females from initially applying to the SET program, there may also be aspects of the selection process that add to this gender imbalance. The aim of this paper was to conduct a systematic review to investigate the potential gender biases in the current SET training selection processes, to identify potential explanations for this inequality, and to explore solutions to overcome this issue.

Methods

This systematic review of gender inequality in surgical training selection followed the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines [19,20].

Research questions

The following questions were asked to explore the concept of gender inequality in the surgical trainee selection process in Australia and New Zealand:

1. What is known about gender inequality in the selection of surgery trainees worldwide, but particularly in the Australasian setting?
2. What factors can result in gender inequality, and what impact can these factors have in the surgical trainee selection and in the Australasian surgical workforce?
3. What strategies can be implemented to address gender inequality during the selection process for surgical trainees?

Inclusion and exclusion criteria

Articles considered irrelevant based on their title were excluded. Following the removal of duplicate records, all titles and abstracts were screened according to the criteria in Table 1. Studies that focused on gender differences in the governance hierarchy of different surgical colleges and medical schools with a focus on the 'glass ceiling theory'

were included for evaluation in our analysis.

Search strategy

A literature search was conducted in May 2017 by the lead author and two senior librarians from two independent libraries, which involved a comprehensive and robust electronic database search using PubMed, Medline, PsycINFO, EMBASE, and ERIC. A combination of controlled terms (MeSH, Emtree, or Thesaurus, and/or keywords) combined with Boolean operators (Table 2) and free-text terms in Google Scholar were used to search for articles published only in English. Unpublished studies, theses, conference proceedings, presentations, government documents, and any other relevant documents not published in journals were included. Finally, a manual search of all the abstracts of the annual meetings of the RACS in the area of gender inequality and disparity in surgical trainee selection and workplace experience was undertaken. Data collection and quality assessment Studies that included only qualitative data were assessed using the Critical Appraisal Skills Program (CASP) Qualitative Checklist and the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Qualitative Research [21-26]. If a paper scored <6 on both the CASP and JBI checklists, it was excluded from the final analysis. As some studies included both quantitative and qualitative data, we used the Mixed Methods Appraisal Tool (MMAT) to assess this subcategory of papers [27]. Studies with scores $\geq 60\%$ on the MMAT checklist (i.e., in the moderate-to-excellent quality range) were retained for further analysis [27-29]. Given the considerable heterogeneity amongst the included studies and the wide variety of outcome measures used, the results could not be pooled. Thus, all of the data extracted from the included qualitative, quantitative, or mixed studies were tabulated, and the evidence was synthesized in a narrative review.

Results

Study selection

The literature search produced 191 citations: 81 in PubMed, 23 in EMBASE, 40 in ERIC, 16 in PsycINFO, and 31 in Medline. Additional records identified through other sources, such as grey literature, cross-referencing, and RACS abstracts, produced an additional 35 citations. After screening all the titles and abstracts for potentially relevant articles, the full texts of 156 non-duplicated potential articles were obtained for closer review. Of these, 70 were found to be relevant and were then evaluated using the relevant quality assessment tools. Ultimately, a total of 13 articles met the selection criteria.

Study characteristics

The characteristics of each of the included studies are presented in Table 3. In 2010, Brunner and Campbell [30] surveyed senior female dental students and program directors to examine the origin and perception of bias against women while considering oral and maxillofacial surgery as a career choice. The majority (>80%) of program directors viewed female residents favorably and considered female residents as equally qualified as male residents, while female students reported their enjoyment of the dental rotation. However, this perspective was not reflected in the number of females continuing in the oral surgery specialty. The reasons provided for these discrepancies included the continued perception of bias against women, the prioritization of family and quality of life, and a lack of female role models in the field.

Santamaria et al. [31] examined workplace data from two Spanish hospitals to determine inequity with respect to reaching senior

Table 1: Inclusion criteria.

Inclusion Criteria	Justification
Conducted between 1974 and the present	EMBASE (Excerpta Medica database) includes journal abstracts from 1974 onwards. Since it is necessary to read the abstracts to decide whether to include the studies, all studies published before 1974 were excluded.
Examines different gender experiences in surgical trainee selection, with a focus on female trainees	Female trainees' experiences during trainee selection and in the workplace had to be the primary aim of included studies. Studies with mixed topics or with insufficient clarity regarding the subject population were excluded.
Relates to surgical trainees and the situation of female surgeons or surgical academic staff	All studies that considered high-school populations were excluded.
Original qualitative, quantitative, or mixed data	The data collected by each study had to be original. Any commentaries or discussions on the topic were excluded. The data from mixed-methods studies were also included.
Published in English	Studies published in languages other than English were excluded because there were no resources to translate them for their inclusion in this review.

Table 2: MeSH terms used.

MeSH terms used
'Career choice' [MeSH Terms] AND 'career mobility' [MeSH Terms]
'Surgeons' [MeSH Terms] AND 'orthopaedics' [MeSH Terms]
'Career choice' [MeSH Terms] AND 'career mobility' [MeSH Terms] AND 'surgeons' [MeSH Terms]
('Prejudice' [All Fields] OR Sexism/ [All Fields] OR Sexual Harassment/ [MeSH Terms] AND Mentors/ [MeSH Terms]) AND 'Career Choice' [All Fields]
'Sexism' [MeSH Terms] AND 'career choice' [MeSH Terms]
(Sex Factors/ [MeSH Terms]) AND Clinical Competence/ [MeSH Terms]
((('Prejudice' [MeSH Terms] OR 'prejudice' [All Fields]) OR ('sexism' [MeSH Terms] OR 'sexism' [All Fields])) AND 'surgeons/trends' [Mesh Terms])

positions in the hospital hierarchy. The results demonstrated that women were disadvantaged in this system. Fewer women gained permanent positions or were eligible to apply for professional career promotions, which overall attributed to a lower number of women in higher positions [31]. This pattern is referred to as the 'leaky pipe phenomenon', whereby women struggle to progress in their careers, leading to chronic underrepresentation in senior medical positions and training boards. Vasey and Mitchell [40] noted that the perception of surgery is changing from being a traditionally masculine domain to one where females are increasingly considered capable. While exploring the obstacles in the context of this change, these authors emphasized how gender insights challenge normal practices within surgical education and the workforce. Furthermore, these authors identified a common theme underlying the low proportion of female surgeons, namely, the scarcity of female role models demonstrating a balance between family life and a successful surgical career [40].

Surgical training often coincides with women's reproductive years and may result in interruptions in training due to maternity leave. This, in combination with limited institutional policies on parental leave; surgical training may be viewed as an impractical and inflexible career path [38]. It is crucial for female trainees to have female surgical role models enabling them to envision a future career where a work-life balance is possible [41-44].

Women's surgical abilities are negatively influenced by negative stereotypical perceptions [45]. Bruce et al. [6] conducted a pilot survey of members of the Association of Women Surgeons to assess the perception and impact of gender-based discrimination in medical school, residency training, and surgical practice. Of those who reported gender-based discrimination, 89% were female. More than two-thirds of the respondents stated that discrimination occurred *via* colleagues/referrals, and 62% stated that discrimination occurred in the operating room. The authors concluded that gender-based discrimination is pervasive and not yet openly discussed or reported [6]. There are several possible explanations for the low reporting of gender discrimination. Unfortunately, it is generally accepted that gender discrimination is the 'norm' in surgical culture and that any potential surgical candidate who makes a complaint may face

ongoing repercussions to their future career. For women, there is the added difficulty that the upper hierarchy and those responsible for addressing complaints are predominantly male. As such, it is essential to consider the inherent vulnerability associated with being a junior doctor and potential surgical training applicant as an obstacle to reporting issues of gender inequality and discrimination.

A survey of final-year Canadian medical students found that 47% of the female respondents considered a career in general surgery, though only 4% selected general surgery as their first career choice [14]. The authors suggested that this disparity could be explained by the fact that 25% of all female students surveyed indicated having experienced some form of gender-based discrimination during their general surgery rotation compared with 3% of the male students. Of the female students who had experienced gender-based discrimination, surgical staff (35%) and surgical residents (25%) were the most frequent sources of discrimination. As in the study by Brunner and Campbell [30] despite a relatively equal expression of interest in general surgery as a career, many female students surveyed believed that general surgery was not compatible with a rewarding family life, a happy marriage, and/or raising children.

The literature demonstrates that gender inequality and discrimination in surgical trainee selection and career advancement continue to be barriers that must be overcome [39]. Surgery is still perceived as a male-dominated specialist, with females requiring stronger female representations and role models in the surgical hierarchy [34,37]. Provisions for maternity leave and part-time employment are the first critical steps required to facilitate increases in female representation in surgery and surgical training.

Discussion

Gender stereotyping and harassment continue to detract women from education and opportunities in medical training [35]. Despite the increasing number of female medical students, data from the Australian Institute of Health and Welfare show that female graduates continue to enter traditionally female-dominated specialties, such as family medicine, pediatrics, psychiatry, and obstetrics/gynecology [46]. Comparatively, fewer women enter surgery; thus, there are

Table 3: Studies on gender inequality and discrimination in surgical trainee selection and career.

Primary Author	Year	Participants	Type of study	Study objective	Findings	Bias Quality Assessment
Brunner and Campbell [30]	2010	Female dental students and oral and maxillofacial surgery programme directors	Survey	To investigate the reasons for low numbers of women entering oral and maxillofacial surgery training.	Bias against women in oral surgery is still perceived by female dental students. The number of women in oral surgery is low, but this reflects career desires rather than serious gender barriers.	E
Santamaria et al. [31]	2009	Workplace statistics from two Spanish hospitals	Retrospective cohort study	To determine whether invisible barriers for women had been broken or whether the glass ceiling still exists in medicine.	There is a significant difference between medical positions held between men and women, particularly in leadership positions.	E
Zahid [32]	2015	Medical students	Survey	To examine the experience of medical students during a clinical attachment in obstetrics and gynaecology.	Gender bias exists in clinical settings, with male students gaining less experience in pelvic examination skills and experiencing higher levels of discrimination by senior medical staff.	S
Yedidia and Bickel [33]	2001		Literature review	To examine recent data on women's experiences as medical students.	There are equal numbers of male and females at medical school; however, there is still a disparity in the number of women entering surgery and many subspecialties.	S
Kwong et al. [34]	2017	Members of the Society of Vascular Surgery who completed training in last 10 years	Survey	To evaluate gender differences in career paths that influence career decisions amongst young vascular surgeons.	Career satisfaction remains higher amongst male vascular surgeons. Female vascular surgery graduates are more likely to pursue academic positions than are men with mentorship.	E
Okoshi et al. [35]	2014	Employment data date from Kyoto Hospital	Case-control study	To examine gender inequality and the difficulties faced by female surgeons in Japanese academic surgery.	There are gender differences in leadership opportunities in Japanese academic surgery. There are fewer females than males in senior or tenured positions.	S
Amoli et al. [36]	2016	Members of Paediatric Orthopaedic Society of North America	Survey	To examine how gender impacts job selection and practice models.	Men and women choose different types of practices. There are more opportunities for women leaders and role models to develop in major paediatric orthopaedic centres now.	S
Kawase et al. [37]	2016	Female surgeons in Japan, US, Finland, Hong Kong, and China	Survey	To identify the qualifications necessary to become leaders in surgery and the career barriers faced by women surgeons in various cultural environments.	Female surgeons in different countries perceive different challenges. Japanese female surgeons identify lack of family support, US female surgeons cite latent gender discrimination, Finnish female surgeons are less likely to need to sacrifice work-life balance in leadership positions.	S
Weiss and Teuscher [38]	2014	US national employment data from female medical students, residents, and faculty members	Case-control study	To evaluate the percentage of women in Chair and Programme Director positions.	There is a higher rate of women in Programme Director positions than in Department Chair positions.	S
Bruce et al. [6]	2015	Members of the Association of Women Surgeons	Survey	To determine women's perceptions of gender-based discrimination within surgical training and working environments.	Gender-based discrimination was experienced at medical school, during residency, and in practice, with perceived sources including superiors, physician peers, clinical support staff, and patients, with 40% of cases emanating from women and 60% from men.	E
Park et al. [14]	2005	Fourth-year medical students	Survey	To explore factors contributing to the low application rates of female students to general surgery residency.	Real barriers, including sex-based discrimination and lack of female role models, deterred women from a career in general surgery.	S
Cochran et al. [16]	2013	Senior surgical residents and early-career surgical faculty members	Survey	To test the hypothesis that female surgeons perceive different barriers to academic careers relative to their male colleagues.	Women experience gender as a barrier to the development of a career in academic surgery.	S
Ferris et al. [39]	1996	Female surgeons registered at Royal College of Physicians and Surgeons of Canada	Survey	To assess female surgeons' perceptions of discrimination against them as women during training selection, residency, and career advancement.	No discrimination in selection for residency and no hindrance to career development or advancement are perceived. However, there is a perception of discrimination during surgical training.	S

fewer female surgeons at the consultant level, which is exacerbated by a higher rate of attrition of females from the training programmer [47,48]. Additionally, women continue to be the minority in most surgical subspecialties, from 3% in orthopedics to approximately 12% in general surgery [46].

This study is the first to systematically review the literature on

gender inequality in the surgical context. The literature suggests that current selection processes for surgical training appear to place women at a disadvantage. Under the current system, doctors are expected to commit to a chosen specialty within only 2 or 3 years of qualification. During this time, females may choose to start or prioritize a family over their previous training commitments. While

parental leave is accessible during SET training, trainees are only eligible once they have completed at least 12 months of service at the college before the date or expected date of birth or adoption, therefore excluding first-year trainees [49].

Between 2011 and 2016, there was an increase of almost 20% in female SET trainees returning to work within 6 weeks of childbirth, which may reflect a perceived pressure to limit disruptions to training [9]. Negative attitudes towards being pregnant during training and difficulties when returning to work have been well documented across various surgical fields. In a small survey of Australian Obstetrics and Gynecology trainees and fellows (n=261), 26.8% reported being asked about their future pregnancy intentions during the training application processes, and almost 45% received negative comments about this issue from consultants in their workplace [50].

Rangel et al. [51] conducted a national survey with 347 general surgeons in the United States who had at least one pregnancy during their surgical training. Universal themes of unmitigated work schedules, negative attitudes towards pregnant trainees, and the need for greater female mentorship regarding work-life balance were emphasized. Moreover, 39% of the participants had seriously considered leaving training, and 30% reported that as consultants, they would advise a female medical student against pursuing a career in surgery.

While there are multiple unique challenges for an aspiring female surgeon, the current review identified three key factors likely to contribute to females not choosing surgery as a specialization:

1. Lack of female leadership, surgical role models and positive mentorship.
2. Ongoing passive bullying and gender discrimination in surgery, which often result in under-reporting due to fear of repercussions.
3. Lack of flexible surgical training programs with perceived negative attitudes towards interruptions in training due to pregnancy and/or parental leave.

Positive gender discrimination has been proposed as a solution to the issue of gender bias and inequality [52]. However, partiality towards a gender might result in the lowering of standards and skill level of the surgeons who qualify at the end of the program. Female candidates might feel that positive discrimination would create the misconception that they had not earned their place based on merit. Positive gender discrimination has not been generally implemented nor accepted by the discriminated gender [53]. Breaking the 'glass ceiling' that seems to exist would be another solution to this issue but would require longstanding behavior changes amongst the leaders in the surgical training program and the establishment of an egalitarian society, where all candidates are free to express themselves and achieve their goals in life without any preconceived opinions amongst their peers. Establishment of such a society would require strong leadership amongst those in senior positions.

There are no quick fixes to the issue of gender disparity in the process of surgery trainee selection. As part of the solution, a partnership with government and educational collegial authorities should be established. A twofold approach that addresses policies and practical strategies is imperative for change. A practical approach must provide the formulation and implementation of specific solutions to Discrimination, Bullying and Sexual Harassment (DBSH). Future research should focus on the identification of factors

that preclude women from entering specific surgical subspecialties where females are underrepresented. Addressing identified barriers may improve issues that confront the surgical community while supporting female candidates in their career choices. A large-scale qualitative study across Australia and New Zealand evaluating all of the identified barriers using focus groups and surveys of female surgery registrars and female and male trainees could improve our understanding of the patterns of gender inequality in surgical trainee selection. Any intervention to correct the underrepresentation of women in surgery would need to be multifaceted and should begin in the early stages of medical training [54,55]. Proposed solutions include the promotion of female networking and the role of positive mentorship, the active provision of leadership opportunities and time for research and teaching to women, the acknowledgement that pregnancy is unique to women and a working environment where an open dialogue regarding gender discrimination is encouraged despite the sensitivity of the topic.

Limitations

Although the studies identified demonstrated a low risk of bias, the main limitation of this review is the lack of robust studies from Australia and New Zealand focusing on gender bias and discrimination in the selection of trainees into surgical programs. Additionally, most of the studies included in the final analysis are surveys that are subject to response biases and that may be somewhat limited in the data collected. Finally, some of the surveys included demonstrated low response rates, which may limit the generalizability of the results.

Conclusion

This review suggests that gender discrimination is present in surgical trainee selection. Although there is a gender imbalance amongst the trainees selected for the SET training programmer, there is limited research exploring the topic using robust methodologies. Females continue to make alternative career choices to surgery despite more females entering the medical profession than ever before. Gender equality in surgical trainee selection is essential to ensure that the highest merit candidates are selected and that patients are treated by an exceptional workforce.

Authors Contribution

BPM conducted the review and analysis and interpreted the results as well as contributing to the writing of the manuscript. JW performed analysis, interpreted the results and was a major contributor in writing the manuscript. EA was a major contributor in writing the manuscript. MTM, HvD, SC, LB, and BV all substantively revised the manuscript and critiqued the content. All authors read and approved the final manuscript.

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