Women in surgery: a systematic review of 25 years

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ABSTRACT
The number of women entering medicine significantly increased over the last decades. Currently, over half of the medical students are women but less than half are applying to surgery and even less go on to surgical specialties. Even fewer women are seen in leadership roles throughout the profession of surgery and surgical residency. Our purpose of the literature review is to identify any themes, which would provide insight to the current phenomenon. We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses method for a systematic review of the literature over a 20-year period (1998–2018). Five broad themes were identified: education and recruitment, career development, impact of/on life around the globe and surgical subspecialties as areas of barriers for women entering or considering surgery. The systematic review suggests there are opportunities to improve and encourage women entering the profession of surgery as well as the quality of life for surgeons. Creating systems for mentorship across programmes, having policies to support work–life balance and recognising surgical training overlaps with childbearing years are key opportunities for improvement. Improving the current status in surgery will require direction from leadership.

INTRODUCTION
The number of women in the workforce increased over the last century from 10% to over 50%, contributing significantly to the economy. 1 Consistently, and steadily women enter and succeed at professions historically deemed for men.1 2 Despite the inherent barriers and biases women face, women excel in their chosen professions.1 3–5 Medicine has experienced tremendous growth in the number of women entering and excelling in the profession. In the USA, more than half of all medical residents are women.6 However, in sharp contrast is the number of women surgical residents.7 Less than half of all the residents in surgical residency and surgical specialties are women.4–8 It is unclear why general and specialty surgery do not see an increase in the number of women. After examining these articles, we identified five broad themes: education and recruitment, career development, impact of/on life around the globe and surgical subspecialties.

METHODOLOGY
This study systematically reviewed qualitative and quantitative studies relating to women in surgery. We conducted a systematic literature search using different electronic databases including Medline, PubMed, ScienceDirect, Wiley Online Library, Google Scholar and Cumulated Index to Nursing and Allied Health Literature (CINHAL). These databases were searched using various combinations of the key terms which included Boolean phrases (and, or) “Women surgeons”, “Work-life balance and female surgeons”, “Career development for women surgeons, education and women surgeons, recruitment and women surgeons, women and surgical specialties”.

We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).9 The initial search using the terms female or women in surgery resulted in 244 094 citations over 25 years (1993–2018). We then further refined the search using the Boolean phrases (and, or) identified and limiting to humans and English resulting in 100 046 articles.

We reviewed the first 100 articles in full after screening for titles with and without abstracts and removing duplicate titles. From the review of the first 100 articles, studies which met the following six criteria: (1) journals published in English in the last 20 years; (2) women in surgery; (3) women in surgical specialties; (4) women’s experience in surgery; (5) women’s professional growth in surgery; (6) women’s experience in surgery around the globe was included in the systematic review. Exclusion criteria included: (1) editorials; (2) opinion pieces; (3) studies not focused on women in surgery; (4) studies not published in English; (5) studies published before 1995; (6) case reports; (7) personal experiences and (8) articles regarding women having surgery. Based on the above criteria 48 articles were included for review (figure 1).
the problem is the minimal representation by women surgeons or visibility of women surgeons.\textsuperscript{10}

To facilitate women’s decision to consider a surgical residency, structured surgical experiences during undergrad with 50% women surgeon faculty have a positive impact.\textsuperscript{10} Undergrads and medical students identified favourably with a career in surgery if they have a positive experience through exposure to women surgeon faculty and mentorship.\textsuperscript{11–14} Overwhelmingly, the literature points to positive mentorship experience facilitated by women surgeons as a vessel to overcome the low number of women applicant rates to surgery and gearing learning objectives to domains appreciated by women surgeons.\textsuperscript{13, 15} Although surgical residents identified knowledge-based and skill-based learning goals in their final years of residency, the women surgical residents leaned towards attitudinal learning goals and knowledge base (table 1).

**Career development**

Women surgeons have increased in number and encouraged women colleagues to overcome barriers such as stereotyping.\textsuperscript{4–8, 16–19} The harsh stereotyping of women surgeons has historically pigeonholed their career and imposed a glass ceiling.\textsuperscript{4–8, 16–19} Talented surgeons felt held back and treated unfairly based on their sex.\textsuperscript{6, 16–17} And this feeling among women surgeons is justified by the low number of women in tenured faculty, full professorship and programme directors positions across the country.\textsuperscript{4–8, 16–19}

Despite the increasing number of women in medicine and surgery, there are low numbers of women in senior faculty and clinical roles across all of medicine.\textsuperscript{10} The theme of women surgeons not equally represented in higher-ranking positions is consistent in the articles over the last three decades.\textsuperscript{5, 7, 8, 16–18} Lack of mentorship, feelings of exclusion, demands of childrearing, poor accommodations during childbearing years and tenure all contribute to the barriers.

Some of the strategies emphasise women surgeons mentor young women surgeons new to the profession and as early as residency or medical school.\textsuperscript{4, 19} Mentoring identifies with creating a positive environment, demystifying surgical practice and chisels away at the boy’s club mentality.\textsuperscript{4, 19} Men surgeons are equally encouraged to mentor women surgeons and contribute to a thriving, collegial environment.\textsuperscript{18}

The overlap of surgical training and childbearing years is not a barrier to career development but one that requires accommodation. Women scholars suggest extending the time to reach tenure or stopping the clock during maternity leave as suggestions to foster women surgeons seeking full professorship.\textsuperscript{6, 16} Some suggest affirmative action to help shift the balance between men and women surgeon in academia.\textsuperscript{5–7, 17} Scholars suggest supporting women surgeons’ success in career development requires a commitment from organisations, professional societies and academy (table 2).

**Impact of/on life**

Increasingly authors are identifying the barriers felt by women surgeon practising in a model that assumes there is a full-time wife at home.\textsuperscript{20–25} A change in the model to accommodate the working mom, working-wife surgeon may open opportunities and improve career satisfaction.\textsuperscript{20–25} Women surgeons report career and home life satisfaction but worried that their careers lag behind their men colleagues and this was a source of dissatisfaction.

Women in surgical residencies did not report pregnancy or marriage as a barrier during training but the perception of being a burden.\textsuperscript{22–24} In general, marriage is increasingly common in surgical residency.\textsuperscript{20–25} A recent study identified 38.9% of 5345 surgical residents were married and 23.3% of those married were women and 15% of those married women had at least one child.\textsuperscript{20–25}

Older retrospective survey studies repeatedly identified women surgeon who wished they had started their families earlier or had flexible schedules to sustain a personal life.\textsuperscript{20–21} Recent studies identify medical students valuing quality of life with work–life balance as a priority and as women choose surgical residency, starting a family is equally a priority.\textsuperscript{22–23} (table 3).
levels of surgery, despite increase number of women entering. Around the globe, authors identify the lack of women in all specialties with fewer women such as surgery. Women are choosing surgery at lower rates compared with men.

### Around the globe

Around the globe, authors identify the lack of women in all levels of surgery, despite increase number of women entering medicine. The women who chose surgery as a profession report discrimination during pregnancy, lack of support and poorly structured residency. Women are choosing surgery at lower rates compared with men.

### Table 1 Education and recruitment

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Participants</th>
<th>Type of study</th>
<th>Study objective</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ouiran et al</td>
<td>2011</td>
<td>Undergraduate students considering a career in surgery</td>
<td>Survey</td>
<td>To examine the impact of outreach at the undergraduate level in the form of a course hosted by surgeons (50% women surgeons) influence on women’s interest in medicine and surgery</td>
<td>Thirteen (100%) of the participants, 11 (85%) women found the outreach programme reaffirmed their decision to attend medical school and interest in surgery</td>
</tr>
<tr>
<td>Gifford et al</td>
<td>2014</td>
<td>Surgical residents in 13 programmes</td>
<td>Survey</td>
<td>To determine how often surgical residents consider leaving the programme</td>
<td>Women residents are more likely to consider leaving (OR 1.2; 95%; p=0.003)</td>
</tr>
<tr>
<td>Vertrees et al</td>
<td>2014</td>
<td>Graduates from the Uniformed Services University of the Health Sciences</td>
<td>Survey</td>
<td>To determine if there are disparities among civilian and non-civilian women entering surgery and surgical subspecialities</td>
<td>Women in military medical programmes enter surgical training at the same rates as civilian programmes with an increase in rates (3.9% to 39% p=0.025)</td>
</tr>
<tr>
<td>Nebeker et al</td>
<td>2017</td>
<td>MSU Goal Consortium</td>
<td>Quantitative research</td>
<td>To identify gender differences in surgical residency</td>
<td>Greater impact is year of residency with first year residents leaning towards attitudinal learning objectives and later years choosing knowledge-based and skill-based learning objectives. Residents taught by women surgeons leaned towards knowledge based objectives over skill based.</td>
</tr>
<tr>
<td>Luc et al</td>
<td>2017</td>
<td>Medical and surgical residents</td>
<td>Quantitative survey</td>
<td>To identify the role of social media as a mentoring tool for women in surgery</td>
<td>Surgical residents identified using social media to build a network of mentors (p=0.031)</td>
</tr>
<tr>
<td>Fassiotto et al</td>
<td>2018</td>
<td>Graduate Medical Evaluation</td>
<td>Quantitative survey</td>
<td>To determine the difference if any in evaluation scores for women and men faculty</td>
<td>Women scored lower across the board for specialties with fewer women such as surgery (p&lt;0.001)</td>
</tr>
</tbody>
</table>

### Table 2 Career development

<table>
<thead>
<tr>
<th>Author</th>
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<th>Type of study</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Jonasson5</td>
<td>1993</td>
<td>American College of Surgeons (ACS)</td>
<td>Review</td>
<td>To establish the barriers for women surgeons career advancement</td>
<td>Multiple factors impede advancement which include: stereotypes, sexism and family demands.</td>
</tr>
<tr>
<td>Jonasson4</td>
<td>2002</td>
<td>ACS Membership</td>
<td>Survey</td>
<td>To understand the representation of women in leadership roles in surgery</td>
<td>Percentage of women in societies in 2001: ACS 4.4% ASA 2.2 % Society of University Surgeons 3.3% Percentage of women among the board of directors of ABMS certifying boards 12 (6.3%)</td>
</tr>
<tr>
<td>Ahmadiyeh et al</td>
<td>2010</td>
<td>Surgeons</td>
<td>Qualitative</td>
<td>To identify elements of career satisfaction for women surgery</td>
<td>Women value a career which values the whole person beyond surgery</td>
</tr>
<tr>
<td>Zhuge et al</td>
<td>2011</td>
<td>Review</td>
<td></td>
<td>To review the glass-ceiling phenomenon in surgery and identify causes strategies</td>
<td>The glass-ceiling phenomenon is impacted by three themes: gender roles, sexism and lack of mentors.</td>
</tr>
<tr>
<td>Sexton et al</td>
<td>2012</td>
<td>Members of the American Association of Medical Colleges</td>
<td>Survey</td>
<td>To determine the distribution of men and women across professional rank and to estimate when 50% of professorship will be women</td>
<td>Rate of women surgeons progressing to full professorship is a slow slope of line of increase compared with rate of women entering medicine, and surgery (0.36 vs 0.75 vs 0.99)</td>
</tr>
<tr>
<td>Healy et al</td>
<td>2012</td>
<td>Review of literature</td>
<td></td>
<td>To understand the definition of role model, mentoring in surgery</td>
<td>Women (75%) identified role models and mentors as positive but challenging to identify a women surgeon mentor.</td>
</tr>
<tr>
<td>Weiss et al</td>
<td>2013</td>
<td>Residents in Surgical Residency in the U.S. Residents in medical schools Programme Chairs/Directors</td>
<td>Survey -cohort study</td>
<td>To determine the number of women in leadership positions as either a Chair, Programme Director (PD), Chief and Associate Director (AD)</td>
<td>Percentage of Women in the following positions: Chairs 8 (3%) PD 25 (10%) Chiefs 157 (10%) AD 35 (24%)</td>
</tr>
<tr>
<td>Cochran et al</td>
<td>2013</td>
<td>Surgical Residents and Faculty</td>
<td>Survey</td>
<td>To find out if women surgeons perceive different barriers than men counterparts in academia</td>
<td>Women surgeons feel and perceive excluded from the dominant culture in surgical departments</td>
</tr>
<tr>
<td>Seemann et al</td>
<td>2016</td>
<td>Women surgeons across Canadian Academic Centers</td>
<td>Survey</td>
<td>To explore women advancement and career satisfaction in surgery</td>
<td>Lack of gender equality, appropriate mentorship and accommodations for women</td>
</tr>
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AAOS, American Academy of Orthopaedic Surgeons; ABMS, American Board of Medical Specialties; ASA, American Surgical Association.
Women in surgical specialties

The surgical subspecialties identify several paradoxes facing women. Even though inherent barriers remain within surgical subspecialties, women report career satisfaction despite the sacrifices related to their personal lives. One of the barriers identified across the surgical subspecialties is the lack of mentorship. As seen in cardiothoracic surgery with steady growth of women sitting in director positions, without a change or a restructuring of child rearing, nurturing a family and the rigid timeline for women behind. And perhaps more damning to the profession the surgical profession needs to consider the opinions of their young leaders. However, utilisation of a national or global approach may help break the cycle of lack of mentorship and attrition.

Another major theme woven throughout the articles is the lack of mentorship or role models. However, a comprehensive mentorship programme for any one surgical training programme is a challenge given the low number of practicing surgeons. A national approach to mentorship programmes may help fill the void in mentorship.

A redesign of the daily work, career advancement and scholarly demands could attract more women to surgery. Shifting the surgical profession to support a work–life balance may encourage women to enter the profession. It appears the greatest barrier is the current structure of surgical practice. Historically, the structure of surgical practice is developed by men for men. However, overwhelmingly both women and men wish for a flexible schedule to support a home life and quality of life. The surgical profession needs to consider the opinions of their young surgeons and residents to attract qualified applicants. With more than 57% of all medical residents being women but less than 50% applying to surgical residency, there is a real chance of missed candidates.

Coming full circle is the relationship between the demands of child rearing, nurturing a family and the rigid timeline for full professorships or opportunities to advance into programme director positions. Without a change or a restructuring in surgical career advancement, the profession will leave women behind. And perhaps more damning to the profession is the missed opportunities of brilliant women surgeons as leaders. However, utilisation of a national or global approach may help break the cycle of lack of mentorship and leadership opportunities.

The labour laws protecting maternity leave is too vague in relation to the needs of surgical residency. In many countries, globe verbalise their concerns about: isolation, heavy burden managing a home and career despite feeling immensely satisfied with their career. The responsibilities inherit to women managing a home and career while working is a challenge faced by many professional women but easily overcome with support from within and outside the profession.

Women in surgical specialties

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</tr>
</thead>
<tbody>
<tr>
<td>Kaderli et al 2011</td>
<td>Board certified women surgeons and surgical residents in Switzerland</td>
<td>Survey</td>
<td>To analyse women surgeons current personal and professional lives</td>
<td>189 (59.4%) surveys returned, 70% reported career satisfaction however identified discrimination towards pregnancy, rigid work hours, poor structured residency</td>
</tr>
<tr>
<td>McHugh et al 2011</td>
<td>Basic Surgical Training Residents and Royal College of Surgeons in Ireland</td>
<td>Quantitative</td>
<td>To identify modifiable factors to encourage surgical training recruitment</td>
<td>Women residents were less likely to choose a surgical career (p=0.049). Surgical role model, intellectual challenge and academic opportunities influence choosing surgical subspecialty</td>
</tr>
<tr>
<td>Kwong 2012</td>
<td>Surgeons in Hong Kong</td>
<td>Quantitative survey</td>
<td>To evaluate the attitudes of women and men towards work, personal life and work–life balance</td>
<td>Of all the surgeons women surgeons (13%) reported not enough time community (p=0.038) and rest (p=0.024). Both men and women surgeons reported satisfaction at work and life. Men surgeons reported wanting to work part-time during child rearing year (p=0.013).</td>
</tr>
<tr>
<td>Borracci et al 2013</td>
<td>Medical students at the Universidad of Buenos Aires and Surgeons</td>
<td>Observation case control analysis</td>
<td>To analyse the relationship between choosing or not choosing surgery</td>
<td>Women 74/100 students reported not choosing surgery because of limits in intellectual growth, jobs, not prestigious, poorly paid and it’s a male specialty</td>
</tr>
<tr>
<td>Okoshi et al 2014</td>
<td>Kyoto University Hospital and School of Medicine</td>
<td>Descriptive study</td>
<td>To study gender inequality in Japanese academic surgery</td>
<td>There are no women professors/associates in surgical medicine and one lecturer (2.3%).</td>
</tr>
<tr>
<td>Kerr et al 2015</td>
<td>Women Junior Doctors and Medical Students in the United Kingdom</td>
<td>Survey</td>
<td>To understand decision making process in choosing a surgical career</td>
<td>Ninety-six (96%) surveys returned and 12% of junior doctors and 30% medical students plan a surgical career with 56% citing work–life balance as the main reason for not choosing a surgical career. Thirty percent identified women surgeons dissuading a surgical career.</td>
</tr>
<tr>
<td>Yorozuya et al 2015</td>
<td>Women surgeons in Japan</td>
<td>Quantitative</td>
<td>To clarify the role of mentors among Japanese women surgeons</td>
<td>Of the survey respondents (48.7%), 67% identified mentorship as crucial for staying in a clinical position, clinical advancement and moral support but not academic advancement or work–life balance.</td>
</tr>
<tr>
<td>Cruz et al 2016</td>
<td>Graduates of the Department of Surgery University of Puerto Rico</td>
<td>Retrospective</td>
<td>To evaluate the gender distribution of General Surgery Residents between 1958 and 2014</td>
<td>Women represent 36% of surgical residents while 50% of all medical residents are women.</td>
</tr>
<tr>
<td>Steklacova et al 2016</td>
<td>European National Neurosurgery Societies</td>
<td>Survey</td>
<td>To establish the rates of gender inequality across Europe within neurosurgery</td>
<td>There are 12,985 neurosurgeons across Europe and 12% are women with 26% in Denmark and 24% in Italy. Men neurosurgeons reported higher rates of marriage and children (p=0.001)</td>
</tr>
<tr>
<td>Kerr et al 2016</td>
<td>Female Surgeons in Germany</td>
<td>Descriptive</td>
<td>To present the challenges, current climate, gender disparities facing women surgeons in Germany</td>
<td>With support for a balanced work–life and mentorship women now successful in surgery.</td>
</tr>
<tr>
<td>Retrouvey and Gdalevitch 2018</td>
<td>Women Plastic Surgeons of Canada</td>
<td>Survey</td>
<td>To explore the role of Women Plastic Surgeons of Canada in Canada, women currently represent 22.6% of practising plastic surgeons but 40.3% of all plastic surgery residents are women.</td>
<td>In Canada, women currently represent 22.6% of practising plastic surgeons but only 30% of all plastic surgeons are women. This reveals a need for increased gender representation of women in academic and surgical leadership.</td>
</tr>
</tbody>
</table>
there is a fear of missed opportunities. The remedy to enter the field of surgery and may be what women surgeons around childrearing may be the start to encourage more women accommodations for breast feeding.39–44 Changing policies to the lack of policy to support lighter call hours, time off and the negative impact of pregnancy on surgical training relates to the lack of policy to support lighter call hours, time off and accommodations for breast feeding.39–44 Changing policies around childrearing may be the start to encourage more women to enter the field of surgery and may be what women surgeons need to advance in their career.

Throughout the articles reviewed regardless of locations and specialty, there is a fear of missed opportunities. The remedy echoed in each article is a push for increased visibility of women surgeons in higher academia and leadership in general. The dismal numbers of less than 10% of women surgeons in leadership positions across the board in academia and acute care is an area for tremendous growth.4 6–8 19 27 There needs to be a deliberate shift within the profession of surgery so that both men and women entering the profession do not feel they have to choose between living a life and training to save a life.

With the increasing number of women entering medicine but stagnant number of women entering surgical practice, there is a clear signal for change. The current structure of surgical practice and residency is not desirable or conducive to a sustainable practice and quality of life for both women and men. The surgical profession continues to make people choose between living a fulfilled life and committing to saving lives, when there is an opportunity for the surgical profession to model how to live a life while saving lives.
CONCLUSION

Our systematic review of the literature identifies that women have forged their way through surgery and surgical specialties. Fearless women have overcome the challenges of not having mentors, being limited in roles, juggling home and work life to be pioneers in their field. All the while, there is a constant hum that women feel choosing a life of surgery means sacrificing a life that has space for self-interests. Woven throughout the themes is the need to acknowledge surgical residency coincides with prime childbearing years and asking women and men to sacrifice starting a family for the practice of surgery is no longer acceptable. There is a great opportunity for the profession of surgery to increase the number of women entering surgery while simultaneously improving overall career satisfaction by developing policies to accommodate a work–life balance. It may take healthcare leaders to foster the change process which supports a balance in the profession of surgery.

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Patient consent for publication

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Provenance and peer review

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Data availability statement

All data relevant to the study are included in the article or uploaded as supplementary information. Data for this study were from published articles which are included in the systematic review.

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REFERENCES

50 Kossek EE, Buzzanell PM. Women’s career equality and leadership in organizations: creating an evidence-based positive change. *Hum Resour Manage* 2018;57:813–22.
52 O’Neil DA, Brooks ME, Hopkins MM. Women’s roles in women’s career advancement: what do women expect of each other? *Career Development International* 2018;23:327–44.