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Editorial

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Women surgeons fighting for work-life balance: how technology might help close the gender gap

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Abstract

Despite a growing number of women choosing to pursue surgical specialties, surgery is still perceived as a woman-unfriendly career. The difficulties of conciliating a demanding career with the requirements of both personal and family life for women surgeons have been investigated by several authors. The current study aims to summarize existing evidence on the issue of work-life balance for women surgeons, particularly focusing on possible strategies to improve it. Artificial intelligence (AI) has been investigated as a possible means to close the gender gap, acting as an equalizer for women surgeons. Female surgeons have been reported to be unmarried or to have married later in life at a higher rate than their male colleagues; many of them also choose not to have children or to have fewer and to have them later in life. These disparities are partly due to the issues connected to invisible work (e.g. household management), the difficulties of managing pregnancy during surgical residency, the challenges women face when returning to work following maternity leave, and the lack of a supportive environment. Flexible work schedules, implementation of childcare facilities, introduction and encouragement of paternity leave for surgeons, and enforcement of mentorship and sponsorship for female surgeons are some of the proposed solutions for building a fair and equitable work culture for all surgeons and overthrowing old, conventional ideas concerning gender roles. Moreover, technology has been advocated as a possible solution to gender discrimination in surgical departments; technology could facilitate an objective assessment of surgical performances and advanced training for surgeons unable to attend in-person education. A healthy, thriving, organized, supportive, and culturally

transformed work environment could benefit surgeon and staff productivity and ultimately improve patient care.

Keywords: Work-life balance, women surgeons, gender equality, career, invisible work

INTRODUCTION

Despite a growing number of women choosing to pursue surgical specialties[1-4], surgery is still perceived as a woman-unfriendly career by an alarmingly high number of healthcare professionals[2-5]. One of the main reasons for this lies in the difficulties of conciliating a demanding career with the requirements of both personal and family life[6-8]. On the one hand, women have traditionally been considered responsible for childcare and household management, irrespective of their career choice[9]. It is well acknowledged that women, even working ones, often take responsibility for a number of tasks that are connected to family, house management, and caregiving[10,11]. This has been known since the eighties; in 1987, Professor Arlene Kaplan Daniels coined the term "invisible work"[12] to define this set of tasks that are both unpaid and unacknowledged. On the other hand, the choice of a surgical career should not prevent women from being partners and mothers; career choice should not limit women or be an obstacle in their path to self-realization[13-15]. Maternity leave policies remain highly variable across different countries and institutions, particularly for residents, and lack of institutional support for pregnancy and childcare has been pointed out as a possible reason for the dropout of women surgeons[16-18].

Since the nineties, many authors have attempted to investigate the main problems women face in conciliating their surgical career with personal and family life, with the dual aim of accessing the true extent of the problem and proposing solutions[19]. At first, the authors mainly focused on practical issues, advocating for the allowance of longer maternity leaves, time off for childcare, the creation of childcare facilities within hospitals and academic institutions, and the implementation of paternity leave[7,9,19-23]. Recently, women surgeons have been advocating for a further change in mentality, questioning the very way in which productivity is understood in surgical departments [24,25]. Working long hours on someone else's schedule does not allow for work-life integration and, more importantly, does not necessarily enhance patient care[6,25,26].

During the last few decades, associationism has been pivotal for women surgeons as a means to share common problems, find solutions and support their empowerment and leadership in a male-dominated field[27]. In Italy, Women in Surgery Italia (WIS Italia) has promoted female leadership in surgery since its foundation in 2015 through the implementation of many initiatives, including a mentoring program targeting female students and surgical residents[28]. A strong interest in surgical research, along with a profound involvement in the #HeforShe movement, has led the association to become a partner of Artificial Intelligence Surgery (AIS). In previous studies, the research board of WIS Italia has analyzed the potential of AI as an equalizer for women surgeons[29,30]; our results support the relevance of research and technology in reducing the gender gap, which still exists in both clinical and academic medicine. In particular, it is pivotal to create an active network of people who are passionate about promoting diversity in surgical departments, possibly through the implementation of technologies that can mitigate the numerous disadvantages and challenges still faced by both women and minorities pursuing a surgical career[31,32].

In this context, the current study aimed to summarize existing evidence on the issue of work-life balance for women surgeons, particularly focusing on possible strategies to improve it, including changes in surgical department structures and work schedules. Artificial intelligence (AI) has also been investigated as a possible means to close the gender gap, acting as an equalizer for women surgeons.

Women surgeons and family life

Marital status

According to a survey distributed to members of the American Society of Plastic Surgeons, the results of which were published in 2010[33], female plastic surgeons are more often unmarried compared with their male colleagues. In line with this study, Ridgway *et al.* produced a survey investigating the private life of women plastic surgeons and found that a significant rate of them had deliberately postponed marriage, with 14.0% of survey respondents declaring that they were single mainly due to job constraints[34]. Another survey published by Ponzio *et al.* confirmed these results: compared to their male colleagues, female surgeons were more often unmarried (12.4% *vs.* 2.6%; $P < 0.001$) or married later in life (30.2 +/- 4.7 *vs.* 28.3 +/- 3.9 years; $P < 0.001$)[11]. The results of these studies should be carefully interpreted; the number of respondents was limited, and the risk of selection and response bias was real. Nevertheless, such results underline the struggle of women surgeons to find a balance between their personal and professional lives.

Pregnancy and childcare

A significant proportion of female trauma surgeons were divorced or unmarried, according to a survey distributed in 2014 among members of the Eastern Association for the Surgery of Trauma. The same study reported that 48.0% of women surgeons, *vs.* 13.0% of men, did not have children[35]. These results are consistent with those reported by Rogers *et al.*, who distributed a survey among Irish residents and found that approximately 22.5% of female surgical trainees, whose mean age was 30.8 +/- 3.8 years, had children, compared to 40.0% of their male counterparts ($P = 0.0215$); no significant difference between sexes could be identified among non-surgical trainees[10]. Similarly, American female head and neck surgeons have been reported to have a lower number of children compared to their male counterparts (mean, median 1.18, 1 *vs.* 2.29, 2)[36]. Likewise, female facial plastic surgeons[37] have been reported to be less likely to have children (52.0%) compared to male peers (89.0%) and more likely to have fewer children ($P < 0.0001$).

While for some women surgeons, the choice not to have children is personal and heartfelt, many of them choose to postpone pregnancy or even abandon the project of having children due to multiple and complex reasons. As Dr. Mia Fahlen rightly said in a commentary on a study by Kawase *et al.*[7] addressing work-life balance and comparing the experiences of women surgeons from different countries and cultural backgrounds, the surgical profession "*serves as a magnifying glass for structures hidden or diluted in the rest of the society*"[6]. The author underlined the most relevant issue of invisible work: women tend to include the work they do at home in their total workload, while men very rarely do so. This is probably because women are held responsible for household management, both by themselves and their partners. In a survey distributed to all surgical trainees (residents, clinical fellows) and faculty in different surgical specialties of the Indiana University School of Medicine, most women faculty declared that they were responsible for childcare planning ($P < 0.001$), meal planning ($P < 0.001$), grocery shopping ($P < 0.001$) and vacation planning ($P = 0.003$) in their households[38]. Similar results were reported by Rogers *et al.*, with approximately 75% of male doctors delegating to their partner the majority of domestic tasks[10], and by Ponzio *et al.*, who found that female surgeons were more often considered responsible for parenting and home duties ($P < 0.001$) compared to their male counterparts[11]. A cross-sectional survey[38] conducted among US surgeons and published in 2020 also reported that women were more often in charge of meal preparation (46.0% *vs.* 12%) and housekeeping (24.0% *vs.* 5.0%). Similar results were reported by Japanese surgeons where, according to a survey distributed among members of the Japan Surgical Society in 2014, both men and women surgeons considered women to bear primary responsibility for the family[39].

Another reason for women surgeons having fewer children is linked to the issues connected to pregnancy during a surgical residency or the early years of a physician's career. According to the study by Rogers *et al.*, adverse pregnancy events were more likely to occur among pregnant surgical trainees compared to the

partners of their male colleagues (65.0% *vs.* 11.5%, $P = 0.0002$) or female non-surgical residents ($P = 0.0329$)[10]. The authors attributed the results to variable compliance with maternity leave policies among surgical schools, with residents often working beyond their due hours to "spare" time to spend with the newborn after childbirth. Similar results have been reported among Japanese[40] and American women surgeons: 63.0% of the respondents to a survey distributed among residents who had a child during surgical school reported concern that their work schedule could affect their health or the health of their unborn child[41].

These factors may contribute to the postponement of pregnancy among women surgeons, with the inevitable implication of fertility-related issues[42]. Ponzio *et al.* reported a higher need for fertility treatment in female orthopedic surgeons (32.0% *vs.* 11.9%; $P < 0.001$) compared with males and/or their partners, along with a higher requirement for fertility drugs (19.6% *vs.* 7.2%; $P = 0.001$) and in vitro fertilization (17.6% *vs.* 4.1%; $P < 0.001$)[11].

Delaying childbearing is just another facet of the difficulties faced in managing work-life balance. An interview conducted among vascular surgery trainees and program directors on the impact of pregnancy[43] on life and career pointed out the many and complex reasons why women surgeons often choose to postpone pregnancy. Among others, the negative impact of a child on professional advancement was reported by 42.0% of women *vs.* 14.0% of men ($P < 0.001$), the lack of time for children by 60.0% of women *vs.* 39.0% of men ($P = 0.001$) and the regret for career choices by 22.0% of women *vs.* 12.0% of men ($P = 0.028$). Female vascular surgeons also more often reported that their choice to delay pregnancy was partly due to a desire to avoid increasing their colleagues' workload (36.0% women *vs.* 13.0% men; $P < 0.001$), the amount of stress it could bring into their lives (67.0% women *vs.* 30.0% men; $P < 0.001$), the negative perception of peers and program directors towards pregnancy (29.0% of women *vs.* 1% of men; $P < 0.001$) and the pressure not to have children from peers or attendings (15.0% women *vs.* 2.0% men; $P < 0.001$). For all of these reasons, most studies reported that women surgeons were more likely to postpone pregnancy after completing surgical training[38,44,45].

The challenges women face when returning to work following maternity leave are another powerful deterrent to motherhood. The requirement to preserve surgical skills and high-performance expectations, regardless of months of absence, were only some of the unsettling issues surgeon mothers have to face, according to the narrative inquiry by Offiah *et al.*[46]. The absence of a supportive surgical system, difficulties in maintaining an effective work-life balance, the need to make career sacrifices and extend the training period, loss of respect from colleagues and the feeling of exclusion from the team were other highlighted issues.

Overall, 24.0% of female and 11.0% of male parent surgeons reported a belief that their work environment did not support having a family, with women surgeons fearing the negative impacts of childbearing on their professional growth ($P = 0.004$); when asked to rethink their career path, 21.0% of female surgeons, compared to 13.0% of male surgeons, declared a willingness to choose another occupation[17].

Burnout among women surgeons

The difficulty of conciliating professional and family life is not without consequences for women surgeons. A survey distributed among members of the American College of Surgeons, the results of which were published in 2011, showed that more than half of women surgeon respondents experienced conflict with their spouse or partner regularly. Burnout and depressive symptoms were reported by 43.3% and 33.0% of women surgeons, respectively, and were mainly attributed to work-home conflict and high workload

requirements[46].

Burnout among surgeons and surgical trainees was also recently assessed by Sauder *et al.* and was found to be most frequent in younger and female surgeons[16]. Factors including being a woman, childcare responsibilities, and perceived poor work-life balance were reported to be responsible for reduced quality of life and burnout.

A recent survey distributed among members of the American College of Surgeons[38], the results of which were published in 2020, also exposed alarmingly high burnout rates affecting US surgeons, particularly female surgeons, identifying difficulties in work-life balance as a big part of the issue.

Several solutions have been proposed to address such issues; overall, minimizing the impact of work duties on work-life balance has been pointed out as a pivotal goal in the management of burnout for both men and women surgeons[47]. Moreover, surgeons seem to be at greater risk of developing compassion fatigue, a state of physical and emotional distress caused by repeatedly caring for those experiencing traumatic episodes[48]. All of this can ultimately lead to a higher risk of dropout, negatively affecting patient care; it is well acknowledged that a diverse workplace environment can better meet the needs of a diverse patient population[49] and that women can provide unique professional traits, ultimately enhancing the team's productivity and empathetic capacity[50]. The dropout of women surgeons represents a loss not only for healthcare systems but also for patients and their quality of care[51,52].

Strategies to break the glass ceiling and promote gender equity in work-life balance

Although insufficient to dismantle the main challenges women face in conciliating career, family, and personal life, awareness of those hindrances is the first mandatory step to overthrow them and to change the many misperceptions to which women surgeons are exposed.

To build a fair and equitable work culture, Rusch *et al.* identified three main goals: overcoming obstacles, especially in poorly represented specialties; creating supportive work-life balance policies; and closing the gap in economic compensation and professional advancement[20]. Flexible work schedules[7], the introduction and encouragement of paternity leave for male surgeons[9], and the enforcement of mentorship and sponsorship for female surgeons are some of the proposed solutions for building a fair and equitable work culture for all surgeons and overthrowing old, conventional ideas concerning gender roles.

In a national survey by Troppmann *et al.* distributed among American Board of Surgery-certified surgeons, most male and female interviewees confirmed the importance of childcare facilities within the work environment[19]. Childcare facilities, especially when available for extended hours and sick children, have been widely acknowledged to facilitate work and family balance for both male and female surgeons, but they are still lacking in many work environments.

According to a survey conducted among 3,807 practicing surgeons in the US in 2018[38], career satisfaction was tightly linked with the support of work-life integration efforts by colleagues. Collegial support of work-life integration efforts was significantly associated with major contentment for both male and female surgeons ($P < 0.001$), highlighting the impact of a supportive work environment on lowering burnout and conflicts, particularly for women. On-site, extended-hour childcare, formal leaves, career sharing, and flexible vacation time have also been proposed to facilitate work-life integration and reduce burnout.

Along with these structural changes, a profound change in mentality is warranted, starting with the engagement of men in the fight for gender equality. In recent years, the global movement HeForShe brought together several leaders from different backgrounds, including government, business, non-profit, and academia, to "*accelerate progress toward gender equality*" in a five-year span, starting from 2021[53]. In the context of surgical departments, men can be allies by advocating for equal opportunities for their female co-workers, offering advice and guidance on their clinical and academic careers, sponsoring and mentoring them, and creating a safe and beneficial relationship that ensures reciprocal support and personal and professional growth. Moreover, those who occupy leadership positions should be willing to guarantee equal access to career opportunities, academic advancement, promotion, and remuneration and to provide supportive work schedules for both men and women to create a healthy, thriving, organized and supportive work environment. This will benefit both men and women surgeons, ultimately affecting patient care. As stated by Dr. Wood in a recent review on gender equality for women in thoracic surgery: "*Men have as much to gain as women from a modernization of our specialty and mitigation of gender disparities that undermine equal opportunity for career advancement*"[54].

The role of artificial intelligence

A useful tool to overcome disparities could also be found in AI. The use of AI in medicine and surgery has been growing consistently over the years, enhancing knowledge and helping to optimize technical skills and clinical care[55]. In surgery, AI application varies from pre-operatory evaluation to intra-operatory decision making, to prediction of postoperative complications, to enhancing surgical skills and supporting surgical training[55].

Even though the application of AI in everyday clinical practice is still limited, most surgeons have been reported to believe that the implementation of AI technologies will improve both training and patient care[56].

In recent studies, AI has been found to improve the management of peri-operative patients, as well as intra-operative decision-making. Along with several tools improving diagnosis and pre-operative work-up, AI-based platforms have been developed to help assess operative risk in both elective and emergency surgery settings and to predict the occurrence of major complications[57]. Moreover, AI can help identify the real-time automatic surgical phase during complex laparoscopic procedures, favoring teaching and shortening the learning curve[57].

AI can enhance surgical skills beyond the operating theatre through digital technology, video case review, and telementoring[58-61]. In this setting, AI can be used to obtain an objective assessment of surgical performances, eliminating both implicit and explicit bias, as well as offer advanced training to surgeons unable to attend in-person education or practice in a rural/low-income setting[42,62-65]. Moreover, various authors underline the efficacy of skill transfer between clinicians through mentored training and digital tools[66-69].

Given the ability of AI to provide universal access to high-grade educational tools, technology could help to not only equalize training possibilities for female surgeons or trainees, especially when those possibilities are not yet guaranteed inside the operating theatre, but also maintain or enhance already-acquired skills during pregnancy or maternity leave. It should be noted that in a recent survey among members of the World Society of Emergency Surgery, male and female respondents showed no differences in ability, interest in training, or expectations regarding AI, thus confirming its potential role as an equalizer[56].

CONCLUSION

The increasing number of female surgeons and the fight for equity in surgical workplaces highlight the need to close the gender gap, address the enduring, career-long difficulties women encounter in work-life balance and unravel the many biases at their root.

The increasing awareness of these issues over the years has led to an increase in publications unveiling data, characteristics, and causes of gender disparity, together with possible solutions. Childcare programs, flexible working hours, maternity and paternity leave, mentorship and sponsorship programs, and a supportive work environment are just a few of the proposed solutions to the major obstacles women surgeons face when pursuing work-life balance. Even more importantly, old and deeply rooted ideas concerning gender roles should be gradually overcome to pursue gender equality in all fields of medicine and society. Digital technology and telementoring can help in building a more diverse and inclusive environment, minimizing explicit and implicit bias and offering solutions to practical challenges.

A healthy, thriving, organized, supportive, and culturally transformed work environment could benefit surgeon and staff productivity and ultimately improve patient care.

DECLARATIONS

Authors' contributions

Made substantial contributions to the conception and design of the study and performed data analysis and interpretation: Capelli G, Glavas D

Performed data acquisition, as well as provided administrative, technical, and material support: Ferrari L, Verdi D

Conducted several reviews of the manuscript improving forms and content and is responsible for the multi-institutional team: Splverato G

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Conflicts of interest

All authors declare that there are no conflicts of interest.

Ethical approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

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