Women in Hand Surgery
Considerations and Support

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KEYWORDS

• Women in hand surgery • Infertility • Obstetric complications • Work-like balance • Childcare

KEY POINTS

- Female surgeons can face an increased risk of infertility and obstetric complications, and a lack of support during family planning and pregnancy.
- Breastfeeding can be considered a daunting endeavor due to the lack of available resources, time, and negative perceptions of coworkers.
- Surgical residents work approximately 80 h per week, which is often incongruous with daycare hours.

INTRODUCTION

Hand surgery training is rigorous, with its intent to create competent surgeons prepared to appropriately care for their patients. Trainees are faced with an increased risk of infertility and obstetric complications, breastfeeding difficulties, and a lack of perceived support from peers, residency leadership, and nationally from groups like the Accreditation Council for Graduate Medical Education (ACGME). These factors can deter women from pursuing a career in hand surgery or discourage them from family planning during the residency that is traditionally during the peak of women's fertility. Similarly, practicing Hand surgeons face challenges with regard to call, maternity leave policy, and financial burdens. Surgeons should not have to choose between a career and a family.

HISTORY OF WOMEN IN ORTHOPEDICS

Historically, surgical specialties have been considered "male-dominated." The first female physician in the United States was Dr Elizabeth Blackwell, who was rejected from 20 medical schools before being accepted to Geneva Medical College, after which the medical students voted on her acceptance. Her struggle for a career in medicine continued after graduating when she was unable to obtain a residency and worked as a nurse in France. Similarly, the first female surgeon in the United States was Dr Mary Edwards Walker who graduated from medical school in 1855 and was the first female surgeon in the US Army in 1863.[1] Another notable leader in the field of orthopedics was Ruth Jackson, the first female board-certified Orthopedic surgeon in the United States and first female admitted to the American Academy of Orthopedic Surgeons (AAOS). Her legacy in orthopedics lives on in the Ruth Jackson Orthopedic Society, a networking community for female orthopedic trainees and practicing surgeons. The first African American Orthopedic surgeon was Dr Claudia Thomas, who graduated from Yale medical school in 1980. She completed her fellowship at the University of Maryland and was an assistant professor at Johns Hopkins. A titan in the field and advocate for social justice in health care, throughout her career she fought against racial injustice and to increase minority medical students.

BACKGROUND

To become a board-certified Hand surgeon, one must complete medical school, a residency program in either Orthopedic Surgery, plastic and reconstructive surgery, or general surgery with

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plastic and reconstructive surgery fellowship. At minimum, this is a decade long dedication during the peak of childbearing years. The average American female gives birth to their first child at the age of 26, whereas trainees graduate from their residency programs around the age of 32.[2]

Diversity Statistics

Fifty years ago, in plastic and reconstructive surgery programs, about 2% of Plastic Surgery residents were female. Similarly, orthopedic surgery has suffered from a lack of female representation. At present, orthopedic surgery continues to have the lowest female recruitment of all surgical subspecialties.[3] Now, about half of medical students are female and diversity in Orthopedic Surgery and Plastic Surgery training programs is a goal. Approximately 38.1% of Plastic Surgery residents are female.[4] Currently, 6% of Orthopedic surgeons and 16% of orthopedic surgery trainees are female.[5] In a large survey of women in orthopedic residency and practice, the most common reasons cited for having chosen orthopedics were enjoyment of manual tasks, professional satisfaction, and intellectual stimulation.[6] Most programs lack the initiative to support female residents creating this sluggish growth in diversity.

The gender disparity in Orthopedic and Plastic Surgery training programs is likely multifactorial, some studies cite implicit gender bias and the negative stigma associated with a pregnant female as a possible reason for lack of female representation.[7] Some major assumptions about orthopedic surgery include the uncontrollable and busy lifestyle intrinsic to the specialty that prohibits a sustainable work–life balance, the necessity of immense physical strength, the "jock fraternity" or "old boys club" culture, and gender-based discrimination.[8] For medical students choosing a career, these assumptions not only discourage women from entering the field of orthopedics, but also negatively impact current female orthopedic trainees when it comes to family planning, maternity, and childcare. In one survey study, female trainees were more likely to delay starting a family until after training, which could arise later issues with infertility.[4]

Female Faculty

In leadership positions, women represent 9% of tenured professors, 12% of department chairs, and 11% of US medical school deans.[9] Based on the current growth rate of 2% per year it will take approximately 217 years for orthopedic surgery to achieve gender parity with the overall medical profession.[10] This emphasizes the need for additional support for women in orthopedics. There is more to be done with respect to acknowledging barriers and accommodating for female surgeons. Encouraging females into the male-dominated surgical specialties is one step, but similarly the workplace itself must change to accommodate this changing demographic. Some proposed solutions include mentorship and sponsorship programs for females, clear maternity leave policies, flexible work hours, lactation room convenience, and on-site childcare. The culture of surgical training and surgical practices is changing, and with it—the experience of the surgeon's mother.

At the faculty level, male and female Orthopedic surgeons in faculty leadership positions have similar research productivity. Despite this similarity in academic productivity, there still exists a large discrepancy in leadership positions.[11] In one study of 160 residency programs, women comprised 13.9% of assistant professors, 10.8% of associate professors, and 1.4% of department chair.[11] Furthermore, women in academic medicine are promoted at slower rates than men and are less likely to hold tenured academic positions. In one study, women in academic medicine felt they were not recognized or rewarded appropriately for their measurable accomplishments when compared with men in the same positions.[12] A possible theory for this disparity would be a perceived burden of balancing familial and household responsibilities during a time of career development. Other proposed ideas are that women are less likely to have mentors and sponsors who push for their career advancement. Lack of mentorship is a possible cause of the lack of female representation in Orthopedic Surgery. Programs with greater numbers of female faculty had larger numbers of female trainees, suggesting mentorship as a way to increase the recruitment of female trainees.[13]

INFERTILITY

In the past, the experience of a pregnant female hand surgery trainee has been challenging. Deferring childbearing until after residency can be an enticing option-with increased salary and more predictable, flexible hours. Waiting until training completion can avoid graduation delay, prevent guilt associated with burdening coworkers with extra work, and inhibit negative perceptions of the pregnant resident. However, wage loss during maternity leave while still being expected to support monthly overhead can be costly once in practice, on top of the medical bills associated with childbirth, possible lack of support from colleagues or not making a partner can create different yet equally stressful risks to having

children once in practice. Ultimately, there is no perfect time to have children during one's career.

However, for most trainees, residency takes place during prime reproductive years. The average female hand surgery trainee completes residency at age 31 and enters hand fellowship training. Therefore, females need to be educated about the impact surgical training may have on fertility, childbearing, breastfeeding, and family planning. For many residents and practicing surgeons, the decision to defer childbearing until after training can be difficult due to the age-related fertility decline. Trainees may consider fertility preservation or desire infertility treatment. Infertility is defined as the inability to conceive after 1 year of regular unprotected sexual intercourse for women younger than 35 years of age and after 6 months for women older than 35 years of age. In one study of 327 US female physicians, 24% of respondents reported infertility.[14] The probability of pregnancy is twice as high for women aged 19 to 26 years compared with women aged 35-39 years.[15] Average age at first pregnancy in a survey of female Plastic and Reconstructive surgeons was 30.3 years of age $\pm$ 3.6 years. At age 35 a woman is considered to be of advanced maternal age (AMA). A pregnant woman with AMA is considered a geriatric pregnancy, with an inherent increased risk for miscarriage, low birth weight, gestational diabetes, chromosomal and abnormalities, congenital anomalies, and neonatal mortality.[16,17] Delaying pregnancy until completion of training may not be a realistic expectation for many surgeons.

Furthermore, there is a pervasive lack of strong support for our female surgeons by leadership both on a residency level and by the academies of Orthopedic surgery and Plastic surgery. The discussion, transparency, and formal policy is lacking. In a 2019 survey of 299 program directors (PDs), over half of PDs (55.2%) estimated less than 5% of their residents were facing recurrent pregnancy loss or infertility.[15] This prediction is staggeringly low based on recent survey responses of female physicians. The most common resources offered to surgical trainees were moral support from PDs, time off for appointments, and insurance coverage.[15] However, this is the tip of the iceberg of support that is needed by our female surgeons. This includes infertility support, family planning resources, access to lactation rooms, time off for child care and postpartum along with support for affordable childcare.

FERTILITY PRESERVATION

For surgical trainees who wish to defer childbearing, oocyte cryopreservation has been used by increasing numbers of surgical trainees. In one survey, only 5% of Plastic Surgery trainees underwent oocyte cryopreservation. In a survey PDs, 55% of PDs felt their program's support level was aligned with their personal support for residents undergoing fertility preservation. However, 19% of PDs felt the program was less supportive.[15]

This procedure can offer the busy female resident an option for childbearing in a delayed fashion. However, this procedure can be timely, unsuccessful, expensive, and often painful. It involves hormonal injections, frequent labs, and multiple ultrasounds to ensure optimal egg maturation. These procedures are not conducive to a busy surgeon practice with an unpredictable schedule. A woman undergoing the harvesting process needs flexibility provided by leadership to allow a focus on her medical needs. In addition, the process of egg retrieval involves risks to neurovascular structures and other complications. It is a daunting and costly process to consider that is generally not covered by insurance and is estimated to cost $10,000–$20,000 with storage fees of $300–$500 per year.[18,19]

For women pursuing in vitro fertilization, the percentage of in vitro fertilization cycles that result in a baby declines from about 40% for women aged 32 and younger, to about 20% for 40-year-old women.[11] Infertility is an acutely painful reality for many surgeons and surgical trainees. A supportive environment for female residents pursuing fertility preservation is crucial. Flexible hours and time for doctors' appointments may ease the toll of fertility preservation amidst training and practice.

OBSTETRICAL COMPLICATIONS

Female Orthopedic surgeons are twice as likely to suffer from complications during pregnancy as women in the general population (31% vs 15% respectively).[20] In one survey, female plastic surgery trainees reported a complication rate of four times the general population. Complications during pregnancy were reported in 56.6% of female plastic surgery trainees.[21] The most common complication was hyperemesis gravidarum, which was experienced by 16.7% of female plastic surgery trainees, the second most common being preterm labor.[22] Obstetric complications place significant stress on the female surgeon, compounded by the stress associated with time away from practice or for surgeons in training away from crucial educational experiences and in some cases, delay in completion of training. The practicing Hand surgeon faces challenges related to call burden, guilt of redirecting patient care, and ease of transition to full-time practicing surgeon.

Knowledge of these obstetric complications can be discouraging for surgeons who wish to become pregnant. Specifically, long hours within the work week, sleep deprivation, >6 h a day spent on ones' feet may can place undue stress.

Effect of Stress

Physical and emotional stress is often encountered in the pregnant surgeon. Often, they must rely on their colleagues for support. For some pregnant residents, the stress associated with burdening coworkers can be as daunting as the stress associated with carrying a heavy workload. Therefore, residents are hesitant to share the load to avoid the guilt of burdening a coworker. A pregnant woman's stress has been shown to cause catecholamine release that could negatively impact the pregnancy. In a study by Holzman and colleagues,[23] in midpregnancy higher levels of urinary catecholamines were associated with a greater risk of spontaneous preterm delivery. In addition, women who underwent premature delivery were found to have elevated levels of inflammatory cytokines in amniotic fluid.[24]

Work hours

In one survey of 1020 female surgeons, there was an increased risk of preterm labor and preterm delivery among women who reported working more than 60 h per week.[20] Therefore, reducing the work hours and night call for pregnant residents is an important consideration. In addition, long work hours upright in the operating room can cause postural alterations in uterine blood flow which can lead to increased uterine contractility and potentially, preterm labor.[25]

Effects of Sleep on Pregnancy

For most surgeons, sleep is a last priority when it comes to balancing a heavy workload and familial responsibilities. Sleep deprivation has been shown to increase the risk of errors and workplace accidents, as well as cause metabolic abnormalities that can negatively affect a developing fetus.[26] The National Sleep Foundation recommends 7-8 h of sleep in a 24-h period for the average adult. Chronic sleep deprivation impairs glucose and fat metabolism and increases inflammatory processes. As a result, cognitive functioning is impaired, and job performance, mental health, and overall quality of life suffers.[26]

Unfortunately, there is an increased risk of prolonged labor and higher rate of cesarean births when averaging less than 6 h of sleep per night during the last month of pregnancy.[27] For medicine trainees, one-half of female residents averaged at least one night per week without sleep during the first and second trimesters, and 44% averaged one night per week without sleep during the third trimester.[28] In addition, women residents experience a higher rate of preterm labor and preeclampsia compared with the wives of their male co-residents.[29] In one study of 19 healthy women, higher levels of pro-inflammatory cytokines were found in women who reported short sleep duration and poor sleep efficiency in mid- and late-pregnancy. Furthermore, the rate of obstetrical complications among residents who had up to six nights on call per month (26.4%) was significantly lower than those who had more than six nights on call per month (49.3%).[22] These are similar effects one would expect with attending surgeons who participate in surgeries and work-weeks without any work hour restrictions.

Effect of Operating Hours

For trainees and practicing Hand surgeons, the workday often consists of several surgeries in which the surgeon may or may not be able to sit. Long hours standing in the operating room, whereas often wearing heavy lead for radiation protection, is considered as a physiologic stressor in pregnant residents. In one study, operating more than 8 h per week was associated with an increased risk of obstetric complications in pregnant residents.[22] Unfortunately due to the strenuous demands of being an Orthopedic surgeon, 23.2% of pregnancies are associated with activity restriction, and 10% associated with bedrest.[30]

Occupational Hazards

Some Orthopedic surgeons are exposed to ionizing radiation on a regular basis (several times a week to daily), with fluoroscopy being a frequently used tool for intraoperative fracture care. Ionizing radiation has the greatest detrimental effects on a developing fetus at 3-8 weeks. Though there are no clear limitations on radiation exposure, the American Obstetricians and Gynecologists Committee Opinion states that <5 rads is not harmful to the fetus. However, cumulative doses of radiation are associated with higher rates of childhood cancer. To decrease radiation exposure, surgeons wear lead aprons. However, these are costly, ranging from several hundred to thousands of dollars. For many residency programs, cost coverage is not provided for personal lead aprons. Therefore, female residents are forced to either cover the cost themselves or use hospital-owned, scarce, and often ill-fitting lead aprons. Also, maternity lead aprons are heavier than

standard and can be rather uncomfortable to wear during long surgeries.

For trainees and practicing surgeons, occupational hazards place the pregnant surgeon at undue risk. Percutaneous injury can lead to bloodborne exposure to Hepatitis C, Hepatitis A, and human immunodeficiency virus. These viruses have possibility of vertical exposure and post-exposure prophylaxis may be detrimental to a breastfeeding infant or fetus.[30] In addition, nitrous oxide and other anesthetic gases can cause chromosomal abnormalities. Methylmethacrylate (MMA), commonly used in bone cement, is a known to be associated with fetotoxicity and the Environmental Protection Agency recommends exposure level <1000 ppm over an 8-h period based on animal studies.[30] Accommodations need to be made to minimize exposure to these dangers. Absence during intubation and extubation of patients and cementing of prosthesis is an option for pregnant surgeons though may not be realistic.

BREASTFEEDING

Returning to work after childbirth can be a very difficult period. Physicians are burdened with new family responsibilities on top of clinical duties. Breastfeeding during can be considered a daunting endeavor due to lack of available resources, time, and negative perceptions of coworkers.

Breastfeeding postpartum is mutually beneficial for both mother and baby. Mothers experience less postpartum blood loss, and lower rates of postpartum depression, diabetes, and breast and ovarian cancer. Infant benefits include decreased rates of allergies, infections, obesity, and sudden infant death syndrome. It has also been shown to improve neurodevelopment and provide gastrointestinal benefits for infants.[31]

Despite these proven benefits, lactating surgeons are more likely to stop breastfeeding or pumping earlier than intended. In one survey of Plastic Surgery residents, female trainees were dissatisfied with the length of time breastfeeding.[4] The average duration of breastfeeding was training 4.7 months vs. 8.3 months. Inability to breastfeed one's child for the desired duration is often due to workplace time constraints and lack of privacy. Professional pressure to maintain the same workload before maternity leave results in inflexible schedules and inability to take the necessary time to expel milk from breasts. On average breastfeeding or pumping adds as average of 35 h per week without built-in pump breaks during the clinic and operating days, surgeons may experience mastitis and loss of milk supply. In addition, access to proper location rooms with a locked door and appropriate arrangements continues to be a problem despite laws set in place nationwide. Location can be hard and add the lack of support or accommodations for these working mothers, their personal goals cannot be met by the demands of their professional goals. There is no reason these goals need to be mutually exclusive.

In a survey of PDs from 2000, 20% defined allowances for breastfeeding on return to clinical duties. Furthermore, of 178 ACGME accredited orthopedic surgery programs, only 2.8% had written breastfeeding policies available for review on the orthopedic surgery residency-specific website.[31] In this same study, dedicated lactation facilities were listed as available for only 1.7% of programs. Accessible and available lactation rooms in the workplace and clear information regarding breastfeeding policies would certainly ease the transition from maternity leave to full-time surgeon and parent. In addition, making a clear and visible policy would assist in normalizing breastfeeding or pumping during the workday. Without stated and visible policy and convenient lactation rooms, physicians and coworkers may view breastfeeding as abnormal behavior or a workplace inconvenience. In one study, 82% of surgical trainees reported being uncomfortable asking attending surgeons for permission to step away from the operating room to regularly express milk.[7] Trainees and surgeons alike need to feel empowered to take time to breastfeed, and formal policy with accessible lactation facilities, not bathrooms, would be beneficial.

MATERNITY LEAVE POLICY

Experience of Maternity Leave in Training

The American Council of Graduate Medical Education (ACGME) starting July 1, 2022 required all ACGME accredited programs to offer 6 weeks of paid leave for all residents and fellows for medical, parental, and caregiver leave. Before this update, the ACGME did not have specific leave requirements, only that "the contract/agreement must contain or provide a reference for leave."[32] To put this in perspective, women who deliver via Cesarean section are told to refrain from lifting anything heavier than her baby for 6 weeks. With most women taking 4 to 6 weeks of maternity leave, they are pressured to disregard their own postoperative restrictions to rejoin the workforce—putting themselves at increased risk.[33]

Previously, there was significant variability in the duration of maternity leave in orthopedic surgery training, and the AAOS did not provide a standardized policy for parental leave. Based on a survey of

plastic and reconstructive surgery residents, the mean maternity leave during training was 5.5 weeks. 62.2% of residents were unhappy with the amount of maternity of leave they took and 47% of trainees reported that their program had a formal maternity leave policy.[4]

In a 2017 survey of 88 Plastic and Reconstructive surgery PDs in the United States, 38% of respondents reported their program had a maternity leave policy. Of the programs that did not have maternity leave policies, 26% believed a maternity leave policy would leave to gaps in resident training, and 12% reported a small class size would lead to insufficient workload coverage.[34]

In a survey of 2188 general surgery and surgical subspecialty residents examining the perception of parental leave in the United States, about one-third of residents, regardless of sex, reported that they did not feel supported when they took parental leave.[35]

There have been recent updates allowing more flexible requirements to complete surgical training. The American Board of Orthopedic Surgeons (ABOS) time requirement to sit for boards is 46 weeks per year averaged over 5 years with a minimum completion of 1000 cases over the course of training.[36] The American Board of Plastic Surgery (ABPS) requires a minimum of 5 years of general surgery training followed by three years of Plastic Surgery training, or 6 years of training at an integrated Plastic Surgery program with maternity leave taken when necessary and not just during elective time.[37]

Maternity Leave in Practice

In addition to the previously stated dangers of a truncated maternity leave, there exists a significant financial burden for women Hand surgeons in practice. The average cost for the practicing surgeon is $45,350. It is estimated that each additional week of unpaid leave costs the surgeon $3,252.[38] Also, in certain practices, women surgeons remain responsible for the cost of overhead expenses. With building a new practice, women surgeons are significantly impacted by loss of financial stability and times of decreased practice growth. The average surgeon in practice takes 9.6 weeks of maternity leave. If they take leave before their first year in practice, they may not have short-term disability to support them and protect their job. In addition, this may impact their ability to make partner and revenue to support their building overhead and medical bills alike. The call during maternity leave is generally considered burdensome by partners that add stress on the pregnant surgeon to work double the call before delivery or postpartum. Either scenario adds extra undue stress on the pregnant or postpartum mother that can easily be avoided with a more tolerant and accepting culture adapted by orthopedic surgeons and a collaboration to support female surgeons.

CHILDCARE

Surgeons work about unpredictable and long hours, which is often incongruous with daycare hours. It is difficult to obtain convenient, affordable, and reliable childcare that is forgiving of a surgeon's long and changing hours. Although on call or during a regular workday, unforeseen changes in childcare can cause residents and attendings schedule adjustments or cancelations. Access to affordable and flexible childcare can be a obstacle to career progression and could be one possible reason for less women in leadership positions or end up leaving medicine early in their careers. For few lucky trainees, a village of family, partners or friends can share childcare responsibilities.

There has been a call for on-site childcare which some institutions provide; however, this is the minority. This allows convenient drop-off and pick-up, along with hours that better align with the parents whose children attend the childcare center. This direct access and support by the institution provides stability for surgeons while showing buy-in for their working mothers.

Other options include preferential daycare enrollment, monetary support for childcare or work hour, or access to backup daycare services. Allowing clinic hours and operating room block time around daycare hours helps alleviate some of the stress but understanding this fine balance and importance of the surgeon's personal life is monumental for building a long-term commitment.

WORK–LIFE BALANCE

Now, more than ever, work–life balance has become a reason to choose one career over another. In a 2016 survey of corporate life by Deloitte, 16.8% of millennials surveyed evaluated career opportunities by good work–life balance, 13.4% work for opportunities to progress, and 11% seek flexibility (remote working and flexible hours). Family and professional success are not mutually exclusive. There is a perception that a career in Orthopedic Surgery would be more difficult for a woman to balance than a man. This may be due to the increased household responsibilities women hold over men at home, in general women spend nine more hours a week on household

duties. This can be overwhelming. Mentorship and sponsorship are very important in creating a successful balance of work and life. Navigating how to say no to experiences that may not be valuable long term and helping push career propelling opportunities that are focused and will allow career and personal life to co-exist. Work–life balance is possible, it takes to support and a culture change that allows women to still be successful while prioritizing all the aspects of their life that provides meaning and fulfillment.

DISCUSSION

As female representation increases in orthopedics so should the support for the pregnant trainee and practicing surgeon. There is a lack of policy with respect to breastfeeding and childcare. There are cultural barriers such as a lack of perceived support from faculty or leadership. There is the guilt of burdening co-residents during periods of time away. There is an increased risk of infertility and obstetric complications. Therefore, changes in culture and policy to facilitate pregnancy and parenthood in the training program and workplace will help to recruit the best hand surgery trainees, maintain the surgical workforce, promote the well-being of trainees and practicing surgeons, and facilitate success.

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