Gender Bias Experiences of Female Surgical Trainees

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OBJECTIVE: Medical schools now average approximately 50% female students, yet a disproportionate number of women continue to choose nonsurgical over surgical specialties. Once in training, studies indicate that pervasive gender stereotypes, sexism and harassment negatively affect female surgeons. The aim of this study is to describe female surgeons' experiences with gender bias and microaggressions in the workplace during residency and fellowship training, and understand if differences exist in the experiences of trainees in male-dominant vs female-dominant surgical specialties.

DESIGN: A mixed methods approach was used to explore the experiences of female surgical trainees. Participants were recruited from all surgical disciplines at an academic center. Initially, focus groups were used to explore themes that trainees face related to gender bias. A trained moderator conducted all focus groups, which were audio recorded and transcribed. Qualitative analysis of de-identified transcripts was performed to identify emerging themes. We then created an online survey using the validated 44-question *Sexist Microaggression Experiences and Stress Scale* to assess frequency and psychologic impact of these events with additional questions developed from the focus groups. The survey was sent to all female residents and fellows at one academic institution.

SETTING: University of New Mexico Hospital, a tertiary care academic medical center.

PARTICIPANTS: Fifteen female surgical trainees participated in focus groups. Thirty-three female surgical trainees participated in the online survey.

RESULTS: Two focus groups including 15 female trainees were conducted, revealing 4 themes: Exclusion, Adaptation, Increased effort, and Development of Resilience Strategies. All participants had experienced gender bias or discrimination during medical school or surgical training. The quantitative survey had a 66% response rate (33/50 female trainees). Significant differences were found in the experience of female trainees in male-dominant vs female-dominant specialties, with those in male-dominant fields often reporting more frequent, severe, and stressful microaggression experiences. When describing how gender bias would affect their future in medicine, trainees in male-dominant specialties were more likely to report that due to gender bias, they "may leave medicine/retire early" (33% vs 6%, $p = 0.040$) and that they "would not recommend my profession to trainees or family members" (40% vs 6%, $p = 0.015$)."

CONCLUSIONS: Female surgical trainees continue to experience gender bias. A culture of sexism leads to physical and social adaptations to fit into the role of surgeon. Participants expressed significant effort to sustain this level of adaptation, leading to fatigue and creation of resilience mechanisms. The environment in which a trainee operates (male-dominant vs female-dominant) significantly impacts their experience. Those experiencing more bias were less likely to recommend their specialty and reported plans to leave medicine earlier. Culture change across institutions and system-level interventions are necessary to create meaningful and sustainable change that improves the experience of female surgical trainees. (J Surg Ed 76:e1–e14. Published by

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COMPETENCIES: Professionalism, Interpersonal and Communication Skills, Systems-Based Practice

INTRODUCTION

Surgery is still perceived as a man's world despite a slowly increasing proportion of women entering surgical residencies. As of 2017, 45.8% of all medical students entering residency were female; however, surgical subspecialties (with the exception of Obstetrics and Gynecology [Ob/Gyn]) were notably male-dominant with women making up only 1/3 of surgical trainees,[1] Ahmadiyeh 2009). Within the surgical specialties, female trainee representation ranged from 14.9% of orthopedic surgeons to 38.4% of general surgeons. The opposite is seen in Ob/Gyn with women accounting for 82.7% of trainees (Ahmadiyeh 2009).[2] This lack of representation is even more striking in surgical academia and in leadership roles in academic surgery.[3] As of 2014, women made up only 9% of full professors and 5% of Chairs of Surgery in the United States, with female academic Surgical Chairs increasing to only 5.3% in 2018,[4,5] AAMC Data). Although prior work reports that "the pipeline is busted" and "sticky floors and glass ceilings" prevent women from attaining leadership roles in surgery, the nature and severity of gender bias in training has not been extensively explored as a cause.[6,7]

Gender Discrimination in Surgery

Past studies have offered theories as to why women do not enter surgical specialties or rise to leadership roles. These include a paucity of role models and family responsibilities.[8-10] However, these early studies did not take into account the influence of gender discrimination in discouraging women from pursuing a surgical specialty. The culture of academic surgery has long struggled with problems related to gender discrimination,[11] and unfortunately female surgeons continue to report sexism and stigmatization from patients, OR and clinic staff members and colleagues. A study by Bruce et al. demonstrated that 87% of female medical students, 88% residents, and 91% of practicing surgeons experienced gender-based discrimination in their careers and that this discrimination negatively impacts job satisfaction, perceptions of self-efficacy, relationships between colleagues and career advancement.[12]

Similar trends are observed in surgical education. Female medical students feel that they are treated differently than male counterparts, endure gender discrimination and sexual harassment, and struggle to identify female surgeons as role models.[13-15] This trend continues beyond undergraduate medical education, as female surgical trainees experience continued discrimination from coworkers, superiors, and staff, and suffer from higher rates of burnout.[16-18] These factors contribute to proportionally fewer female medical students aspiring to become surgeons, complicate the training experience, and make practicing as an attending physician less appealing.[1,19] Overall, gender bias plays a role in delaying the advancement of women in surgical academia, exacerbates the wage gap, perpetuates the lack of female mentorship, and limits the number of women who advance in professional and academic institutions (Capodilupo et al., 2010).[20]

Microaggressions

As gender bias has become less overt, subtle forms of discrimination now manifest as microaggressions. Pierce et al. first coined the term "Microaggression" in the 1970s when open, easily identifiable expressions of discrimination had become less common and subtle assaults were becoming the "major vehicle" to facilitate prejudice (Pierce). Microaggressions are defined as subtle, often unconscious, discriminatory or insulting actions that communicate demeaning or hostile messages often aimed at marginalized groups based on race, sexual orientation, or gender. These can manifest as:

- Microassaults (insulting/discriminatory behavior shared with others who also share prejudiced views to avoid social judgment)
- Microinsults (subtle rudeness with the intent to demean)
- Microinvalidations (unconscious messages that undermine, minimalize, or negate the reality of marginalized)
- Environmental microaggressions (using systematic rules or the physical environment to exclude, deny protection from discrimination, or allow unequal pay)

Microaggressions are not benign. Studies show that over time, the chronic impact of these subtle biases cause psychological harm that can present as depression, anxiety, binge drinking, sexual dysfunction, and burnout,[21-23] Moore 2009,[24] Owen et al. 2011,[25] Blume 2012,[26] Ong 2013[27]). Career and academic performance suffer in those who experience microaggressions.[28,29] The effect of these insidious and pervasive forces was best described by Derthick, with the development and

validation of the Sexist Microaggressions Experiences and Stress Scale. This tool is used to assess the frequency and severity of gender-based microaggressions against women (Sexist MESS).[30]

In order to determine the effect of gender bias on female surgical trainees, we planned to assess the nature, frequency, and impact of microaggressions against trainees at an academic center. Furthermore, we sought to identify the perpetrators of gender bias in the training environment. Ultimately, we sought to identify methods to prevent and correct this problem as we hypothesize that it may contribute to a lack of women represented in surgical specialties.

METHODS

A sequential mixed methods approach was used to explore the experiences of female trainee surgeons by including qualitative focus groups followed by a survey questionnaire. We recruited trainees (including residents and fellows) from all surgical disciplines at an academic center with the goal of understanding the frequency and severity of bias experiences during training. This work is a subanalysis of a larger study that includes female surgical faculty as well as trainees. The study was approved by the University of New Mexico Human Research Protections Office.

Qualitative Investigation

Focus groups were used to explore themes that female surgical trainees face related to gender bias. All female surgeons from all surgical subspecialties at the University of New Mexico Health Sciences Center were invited to participate. The focus groups were approximately 2 hours in length and included between 4 and 8 participants. Each focus group participant provided informed consent and received a gift card for participating. A trained moderator conducted all of the focus groups, which were audio recorded, deidentified, and transcribed by professional transcriptionists. Focus groups were conducted until thematic saturation was achieved.

The interviews were structured around 7 domains of sexist microaggression expression as described by Derthick.[30] These included (1) leaving gender at the door (downplaying femininity in order to succeed), (2) sexual objectification, (3) environmental invalidations, (4) invalidation of the reality of women (the denial that gender bias exists), (5) assumptions of traditional gender roles, (6) expectations of physical appearance, and (7) inferiority (identifying ways women are assumed to be inferior to men). The interview guides offered nonleading questions regarding participants' experiences.

Qualitative analysis was performed by 2 physicians with formal training in qualitative methods, one subspecialist fellow and a PhD medical anthropologist. Analysis of deidentified transcripts was performed using line-by-line coding to identify themes. Additional questions were added to the focus groups to identify the perpetrators of bias, who intervened against witnessed microaggression, and ideas to combat bias and promote education. Using the themes and experiences of the focus groups, we developed additional surgeon-specific questions which were included in the quantitative portion of the study.

Quantitative Assessment

An anonymous online survey (SurveyMonkey platform) was sent to all 50 female surgical trainees at one academic institution. We did allow former focus group participants to complete the survey as these questions were not duplicative of the focus group content. The survey included a validated 44-question *Sexist Microaggression Experiences and Stress Scale* (Sexist MESS) to assess the frequency and psychologic impact of bias events.[30] Consent was obtained from all participants prior to taking the survey and no identifying data were collected. For the Sexist MESS tool, survey participants were given a scenario and asked to rate its frequency and severity from 0 to 3. Frequency was rated as: 0 = "never occurs," 1 = "few times," 2 = many times, and 3 = most of the time." Severity was rated as: 0 = "not stressful," 1 = "minimally stressful," 2 = "moderately stressful," and 3 = "extremely stressful." Answers were averaged and any scenario with an average of 2 or more was considered to be a "commonly occurring" or "moderately bothersome" experience. We included additional surgeon-specific questions developed from the focus group answers as well an open-ended question at the end to allow participants to share personal experiences with gender bias.

We compared trainees in female-dominant fields (OB/GYN specialties) and male-dominant fields (all other surgical fields) as we hypothesized that a workplace that includes more female mentors, female coworkers, and female patients influences a trainee's experience of gender bias. For continuous variables, a bivariate analysis was performed using a two-tailed t test in Microsoft Excel or the Mann-Whitney U for smaller sample sizes (http://astatsa.com/WilcoxonTest/). A chi-square test was used for analysis of categorical variables (GraphPad Chi Square Contingency Table Calculator).

RESULTS

Qualitative Focus Group Results

Two focus groups were conducted that included a total of 15 trainees from General Surgery, Urology,

Neurosurgery, Ob/Gyn, and Orthopedic Surgery. All focus group participants reported that they had experienced gender bias or discrimination during medical school or surgical training. Based on the results of the focus groups, 4 themes were developed: Exclusion, Adaptation, Increased effort, and Development of Resilience Strategies. Representative statements from each theme are included in Table 1.

Exclusion

Nearly every focus group participant had experienced feeling excluded or isolated from their male counterparts (either overtly or implied through negative comments or actions). All participants described scenarios where they were either dissuaded from pursuing a surgical career as a medical student, encouraged to pursue a "comfortable lifestyle surgical specialty" as a trainee, or made to feel like they did not belong in their chosen field.

Adaptation

Many participants reported intentionally changing their appearance, interests, or habits. Some would attempt to appear or present less feminine and downplay their female characteristics in order to avoid exclusion on the basis of their gender.

Increased Effort

Participants reported feeling as if they had to work harder to prove their ability and intellect while their male colleagues were assumed competent. Common experiences included having to ask someone multiple times for something or performing tasks that a male colleague would delegate to a nurse or surgical technician to avoid a conflict or negative interaction caused by asking that the task to be done.

Development of Resilience

All participants indicated that they had developed a "thick skin" or had become "tough" as a result of the negative verbal and physical interactions experienced on a daily basis. Name calling was reported widely. Participants felt that this behavior undermined their status and instances of overt sexual harassment were also reported in the discussion.

TABLE 1. Qualitative Focus Group Theme Examples

Exclusion	*"I think locker rooms are a big contention . . . . decisions get made in a locker room. Who gets positions. Who gets cases. Who gets a letter. Who gets to go out on the weekend. So when you're the only girl and everybody else is in the locker room whatever they're doing in there, you're excluded from that. There is a social comradery"*
	"He came to advise us as we go forward to med school. . . he told us that the ladies in the room might want to think about something like pediatrics or family medicine, so that we can be at home and see our children grow up"
	"When I said I was going to do surgery it was a lot of 'Oh, really?'. . . They wouldn't have said that if you were a male"
Adaptation	*"I was constantly talked to about how I looked and how I should look and different ways to change my appearance"*
	"I dress in such a way so as to not draw attention"
	"Earlier on in my training, I would be more careful. I'd wear pants more of the time and avoid skirts. I'd avoid girly colors . . . try to fit in more . . . I don't know whether it changes the way people look at me"
	"I was told to change my hair, to change what was showing, to change my piercings, to change everything. All of that focus is all I remember. I don't remember being told anything about my abilities, about where I should be applying, about anything that was actually functional or helpful"
	"I would learn my dirty jokes and know what's going on in football. Not because I care about football, because I at least had something to talk about in the operating room that wasn't where I get my hair done or where I get my manicures done. So I did make adaptations"
Increased Effort	*"When I introduce myself to all my patients, I say, 'I'm Doctor ___' . . . I feel like when I walk in a room, I have to establish the fact that I'm a doctor and not the nurse. I always introduce myself as doctor, always"*
	"I think I do a lot of things myself that should be delegated because I don't want to ask for them . . . I guess the hardest time I have is working with people who are technically subordinate but much older and also female. I feel like they give you the hardest time of anyone"
	"I think that women in general are held to a much higher standard"
	"They don't talk to men as much about what you should look like at your interviews. I feel like, even starting residency, people are more concerned about my appearance than my abilities"
	"I feel like you have to put a lot of thought into it . . . Is my skirt long enough? Is it too tight A lot more thought than any man puts into his wardrobe. It's slacks and a shirt and a tie, done"
Development of Resilience	*"A supervising physician noted, 'Your breasts have gotten really big. You must be pregnant'"*
	"I went to my program director because one of the male faculty had made some comment about how he would help me find my urethra but his wife probably wouldn't like that. . . She told me that it was because I was from the West Coast and just too sensitive. . . when someone in authority over you says, 'Get over it. You're too sensitive.' It makes you feel like, Okay. I guess the issue is mine"
	"It just doesn't bother me, I'm tough"

Quantitative Survey Results

The quantitative survey had a response rate of 66% (33/50 female trainees). The survey included questions on demographics, a validated 44-question Sexist MESS questionnaire and additional surgeon-specific questions created from themes uncovered in the focus groups.

Demographics

Our demographic data are reported in Table 2. The most commonly reported race was white (67%) followed by Hispanic (14%). Just over half of all participants (51%) reported caring for children <18 years of age. Table 3 highlights the overall numbers of female surgeons in all specialties at UNM and the gender of their leadership. Notably, all department chairs and division directors were male outside of Ob/Gyn. The percentage of women in a given specialty was similar between trainees and faculty.

Validated Sexist MESS Results

The quantitative survey included a validated 44-question *Sexist Microaggression Experiences and Stress Scale* (Sexist MESS) to assess frequency and psychologic impact of these events. We examined the most common and the most stressful microaggression experiences and compared these between trainees in male- and female-dominant surgical specialties. We also assessed if the variables of race or providing childcare were significant and did not find a statistical difference.

Overall Frequency and Impact of Microaggression Experiences

The frequency and impact of microaggression experiences was assessed, and the most common items with average scores ≥ 2 were noted (Table 4). Trainees in male-dominant fields reported more frequent and bothersome experiences compared to those in female-dominant fields. "Leaving Gender at the Door" was the most commonly experienced domain of microaggressions; however, "Inferiority" was the most bothersome.

Differences in Experiences Among Groups

We evaluated each of the 44 items on the Sexist MESS to detect differences in responses between groups, even if the "commonly occurring" or "moderately bothersome" score of >2 was not met. Trainees in male-dominant specialties more frequently felt pressured to overcompensate for being female or appear assertive compared to trainees in female-dominant specialties. Male-dominant surgical trainees experienced more stress when they felt pressure to dress in a less feminine manner (1.33 vs 0.53, $p \leq 0.001$), when their work was ignored or dismissed by a man (2.5 vs 1.53, $p = 0.024$), and when more complex tasks were assigned to male colleagues (2.4 vs 1.43, $p = 0.022$). Female-dominant surgical

TABLE 2. Demographics of Survey Participants

	Overall (*n* = 33)	Male-Dominant (*n* = 15)	Female-Dominant (*n* = 18)
Age			
26-30	13 (39%)	4 (27%)	9 (50%)
31-35	18 (55%)	10 (66%)	8 (44%)
36-40	2 (6%)	1 (7%)	1 (6%)
41-70	0 (0%)	0 (0%)	0 (0%)
Race			
American Indian	1 (3%)	1 (6%)	0 (0%)
Asian	4 (12%)	3 (20%)	1 (6%)
Black	0 (0%)	0 (0%)	0 (0%)
White	20 (61%)	9 (60%)	10 (54%)
Middle Eastern	1 (3%)	0 (0%)	1 (6%)
Indian	1 (3%)	0 (0%)	1 (6%)
Hispanic	5 (15%)	2 (13%)	3 (17%)
Other	1 (3%)	0 (0%)	1 (6%)
Department			
General surgery	8 (24%)	8 (53%)	0 (0%)
Neurosurgery	1 (3%)	1 (6%)	0 (0%)
Ob/Gyn	18 (55%)	0 (0%)	18 (100%)
Orthopedic surgery	3 (9%)	3 (20%)	0 (0%)
ENT	2 (6%)	2 (13%)	0 (0%)
Childcare			
Yes	18 (55%)	6 (40%)	9 (50%)
No	15 (45%)	9 (60%)	9 (50%)

TABLE 3. Surgical Department Demographics

	Female Faculty/ Total Surgeons (%)	Female Trainees/ Total Surgeons (%)	Gender of Division Director or Department Chair
Department			
General surgery	9/27 (33%)	11/34 (32%)	Male/male
Vascular	1/5 (20%)	–	Male
Pediatric	0/2 (0%)	–	Male
Plastic and reconstructive	0/4 (0%)	0/4 (0%)	Male
Surgical oncology	3/7 (43%)	–	Male
Urology	3/15 (20%)	1/10 (10%)	Male
ENT	6/13 (46%)	3/7 (43%)	Male
Ophthalmology	3/10 (30%)	–	Male
Neurosurgery	2/12 (17%)	2/11 (18%)	Male
Orthopedic surgery	5/25 (20%)	7/31 (23%)	Male
OB/GYN	9/13 (69%)	22/24 (92%)	Female
Urogynecology	3/4 (75%)	3/3 (100%)	Male
GYN oncology	3/3 (100%)	–	Female
Family planning	3/3 (100%)	2/2 (100%)	Female

trainees were more bothered by being told they need to change their bodies to be more attractive to men (0.55 vs 1.53, p = 0.026).

Surgeon-Specific Questions

There were 15 surgeon-specific questions developed from focus group responses. Trainees overall reported high rates of microaggressions related to "Increased Effort" and "Development of Resilience Strategies." Needing to ask a circulating nurse or anesthesiologist many times to get surgical supplies or bed height changes, preapologizing before asking for something from another healthcare provider, being told they looked too young to be a doctor and being mistaken for

TABLE 4. Sexist MESS "Most Common" and "Most Bothersome" Experiences

		Overall (*n* = 31)	Male-Dominant (*n* = 14)	Female-Dominant (*n* = 17)	p
Domain	"Most common" experiences (average ≥ 2.0)				
LGD	Attempting to "overcompensate" for being female	1.97	**2.29**	1.71	**0.046**
LGD	Attempting to appear more assertive so you're not dismissed for being female	**2.00**	**2.36**	1.71	**0.027**
LGD	Hiding emotions at work/school to not appear too emotional	**2.03**	**2.21**	1.88	0.239
ENV	Overhearing men being told to "not act like a girl" or to "be a man"	**2.00**	**2.14**	1.88	0.469
TGR	Being asked when (not if) you're going to have children	1.83	**2.08**	1.63	0.272
	"Most bothersome" experiences (average ≥ 2.0)				
IRW	Heard someone in a position of authority say women are to be blamed when they're sexually assaulted	**2.36**	**2.08**	**2.56**	0.334
INF	Being in a setting where a male was automatically allowed to dictate the agenda	1.73	**2.00**	1.56	0.175
INF	Someone has assumed a male was responsible for work you did	**2.08**	**2.30**	1.94	0.351
INF	A male ignoring/dismissing your contribution at work, school, home, or socially	1.92	**2.50**	1.53	**0.029**
INF	Being in a setting where the more complicated tasks we reassigned to males	1.83	**2.40**	1.43	**0.030**
INF	A male being the only one praised for group work you contributed to	1.71	**2.10**	1.43	0.156

LGD, leaving gender at the door; ENV, environmental invalidations; TGR, traditional gender roles; IRW, invalidation of the reality of women; INF, inferiority.
Values >2 are bolded as they represent that an event was experienced on average "many times" or was "moderately stressful".
Bolded p values achieved a significance of <0.05.

a medical professional of lower status were pervasive experiences (Table 5). We again assessed if the variables of race or providing childcare were significant and did not find a statistical difference.

When comparing the types of microaggressions, we identified certain experiences that were specific to trainees in male-dominant surgical fields compared to those in female-dominant surgical fields. Within the realm of "Adaptation," trainees in male-dominant specialties reported more often that they pretended to be interested in a sport or activity in order to be included (67% vs 28%, $p = 0.025$) and had hidden their personal life or changed their personality to adapt to the work environment (80% vs 29%, $p = 0.017$). In the realm of "Exclusion," trainees in male-dominant specialties had more difficulty with scrubs being too revealing (87% vs 28%, $p = 0.0003$), had more trouble finding female mentors (60% vs 11%, $p = 0.002$), and felt more excluded from networking opportunities due to gender (53% vs 11%, $p = 0.007$). Both groups reported high rates of being mistaken for a nurse or receptionist (100% and 94%, respectively). "Increased Effort" and "Development of Resistance" did not demonstrate any statistical differences between groups, although the rates of these experiences were high in both groups (Table 5).

When evaluating the total number of experiences each surgeon reported, we found that trainees in male-dominant specialties experienced more on average compared to those in female-dominant specialties (13.2 vs 7.89, $p < 0.0001$; Table 5).

Perpetrators of Microaggressions

Microaggressions were frequently perpetrated by patients, nurses, and physicians in positions of authority. Trainees in male-dominant surgical specialties reported more bias from all sources except medical assistants and OR cleaning staff (which were higher in female-dominant specialties). This difference was significant with trainees in male-dominant fields reporting bias at higher rates from PACU or floor

TABLE 5. Types and Rates of Microaggressions

	Overall (*n* = 33)	**Male-Dominant (*n* = 15)**	**Female-Dominant (*n* = 18)**	**p**
Adaptation				
Told to wear glasses/pants/change hair color to be taken seriously	5 (15%)	3 (20%)	2 (11%)	0.494
Pretended to be interested in a sport or activity to be included in conversation or event outside work	15 (45%)	10 (67%)	5 (28%)	**0.025**
Hidden personal life or change personality to adapt to work environment (i.e. a pregnancy or relationship)	19 (58%)	12 (80%)	7 (39%)	**0.017**
Increased effort				
Mistaken for a nurse/OT/PT/receptionist or asked when the doctor is coming in	32 (97%)	15 (100%)	17 (94%)	0.370
Someone was surprised you are as good or better than a male physician	18 (55%)	9 (60%)	9 (50%)	0.580
Need to ask circulating nurse/anesthesiologist many times to get surgical supplies or bed height changes	28 (85%)	13 (87%)	15 (83%)	0.798
Pre-apologized before asking for something from a healthcare provider (i.e. scrub tech or nurse)	30 (91%)	14 (93%)	16 (89%)	0.670
Exclusion				
Unable to obtain correctly sized gloves, shoe covers, scrubs or medical device handles	12 (36%)	6 (40%)	6 (33%)	0.703
Difficulty with scrubs being too revealing (i.e., gaping V-neck top)	18 (55%)	13 (87%)	5 (28%)	**0.0003**
Had difficulty finding a female mentor	11 (33%)	9 (60%)	2 (11%)	**0.002**
Felt excluded from networking opportunities due to gender	10 (30%)	8 (53%)	2 (11%)	**0.007**
Development of resilience				
Referred to as a "girl" at work	23 (70%)	13 (87%)	10 (56%)	0.055
Told you look too young to be a doctor	32 (97%)	15 (100%)	17 (94%)	0.370
Noticed that nurses treat you in a different and more negative manner than your male colleagues	26 (79%)	11 (73%)	15 (83%)	0.500
Received unsolicited advice on when to have children or the size of your intended family	24 (73%)	10 (67%)	14 (78%)	0.491
Average reported biases per person (out of 15)	9.18	13.2	7.89	<**0.001**

Bolded p values achieved a significance of <0.05.

nurses (93% vs 56%, p = 0.024), trainees at lower levels (87% vs 50%, p = 0.026), and physician colleagues at the same level (73% vs 33%, p = 0.022; Table 6).

Participants were asked if the gender of the perpetrator of bias was more often female, more often male or equally distributed (both). When comparing trainees in male- vs female-dominant surgical fields, there was no difference in the reported gender of the perpetrator of bias (Table 6).

Overall, gender bias was reported to be most severe at academic hospitals (65% of all respondents) compared to private hospitals (19%) and VA hospitals (16%) (Table 6).

Perception of the Problem and Response to Bias

Survey participants were asked to reflect on their outlook and perception of gender bias. The majority of participants reported that they believed that gender bias would either improve in the future (67% of all respondents) or stay the same (33% of all respondents). There was no significant difference in this perception between any groups. When asked to assess the severity of bias at their current institution, 48% believed it to be a "minimal problem," 42% believed it to be a "moderate" problem, 6% believed it to be a "large" problem, and only 3% believed it to be "not a problem." There was no significant difference in perceived severity of bias at their current institution. Finally, 33% of all respondents believe that men experience gender bias, 27% believe that they do not, and 39% were unsure. There was no significant difference among any groups.

When describing how gender bias would affect their future in medicine, trainees in male-dominant specialties were more likely to report that they "may leave medicine/retire early due to gender bias" (33% vs 6%, p = 0.040) and that they "would not recommend my profession to trainees or family members" (40% vs 6%, p = 0.015). No difference was found when comparing how a trainee responded to bias events based on their specialty (Table 7).

DISCUSSION

This work further supports prior studies and anecdotal evidence that gender bias continues to plague surgical training environments. Though the nature of this bias has evolved over time, from less overt sexism to more covert microaggressions, we demonstrated the ongoing stress, psychological impact, and effect on career trajectory of women who experience gender-based microaggressions in their daily lives. This study sought to

TABLE 6. Sources of Bias

	Trainee (*n* = 33)	Male-Dominant (*n* = 15)	Female-Dominant (*n* = 18)	p
Perpetrator of bias				
Patients	31 (94%)	15 (100%)	16(89%)	0.194
Medical assistants	16 (48%)	6 (40%)	10 (56%)	0.389
Circulating OR nurses	25 (76%)	12 (80%)	13 (72%)	0.817
PACU or floor nurses	24 (73%)	14 (93%)	10 (56%)	**0.024**
Scrub techs	25 (76%)	12 (80%)	13 (72%)	0.617
OR desk staff	11 (33%)	4 (27%)	2 (11%)	0.305
OR cleaning staff	4 (12%)	1 (7%)	3 (17%)	0.397
Lower level trainee (student, junior resident)	22 (67%)	13 (87%)	9 (50%)	**0.026**
Physician colleagues at same level	17 (52%)	11 (73%)	6 (33%)	**0.022**
Physician in position of authority over you	26 (79%)	14 (93%)	12 (67%)	0.065
Industry representative	11 (33%)	5 (33%)	6 (33%)	1.000
None	1 (3%)	0 (0%)	1 (6%)	0.370
Other	2 (6%)	1 (7%)	1 (6%)	0.898
Gender of perpetrator				
More often female	4 (6%)	2 (13%)	2 (11%)	0.846
More often male	3 (9%)	1 (7%)	2 (11%)	0.658
Equally distributed	25 (76%)	12 (80%)	13 (72%)	0.604
Neither/none	1 (3%)	0 (0%)	1 (6%)	0.931
Setting of most severe bias				
Private hospital	6 (19%)	2 (13%)	4 (32%)	0.510
Academic hospital	20 (65%)	9 (60%)	13 (72%)	0.458
VA hospital	5 (16%)	4 (27%)	1 (6%)	0.092

Bolded p values achieved a significance of <0.05.

TABLE 7. Perception of the Problem and Response to Bias

	Overall (*n* = 33)	Male-Dominant (*n* = 15)	Female-Dominant (*n* = 18)	p
Effect of bias on future plans				
I may leave medicine/retire early	6 (18%)	5 (33%)	1 (6%)	**0.040**
I may change institutions	9 (27%)	5 (33%)	4 (22%)	0.547
I don't think I will achieve the promotion level I am aiming for/I will not go up for promotion	14 (42%)	9 (60%)	5 (28%)	0.065
I will not recommend my profession to trainees or family members	7 (21%)	6 (40%)	1 (6%)	**0.015**
No effect	13 (39%)	4 (27%)	2 (11%)	0.183
Other	6 (18%)	2 (13%)	4 (22%)	0.525
Response to gender bias				
Get angry or frustrated	13 (39%)	5 (33%)	8 (44%)	0.530
Feel offended	22 (67%)	12 (80%)	10 (56%)	0.147
Confront the person	6 (18%)	2 (13%)	2 (22%)	0.525
Talk about the person behind their back	5 (15%)	2 (13%)	3 (17%)	0.798
Blow it off	22 (67%)	11 (73%)	11 (61%)	0.474
Make a joke	16 (48%)	9 (60%)	7 (39%)	0.240
Adapt so it doesn't happen again	15 (45%)	9 (60%)	6 (33%)	0.134
Other	1 (3%)	0 (0%)	1 (6%)	0.370

Bolded p values achieved a significance of <0.05.

understand the overall impact of microaggressions and to evaluate how the work environment (training in a male- or female-dominant surgical field) affects the frequency and severity of gender-based microaggressions and bias. In doing so, we found that surgical trainees experience high rates of gender bias in general, but the environment in which a woman works (whether it is dominated by men or women) can greatly affect her surgical training experience. Interestingly, a person's ethnicity and status as a parent had no effect on their experience with gender bias. To gain more insight on the wider problem of gender bias in surgery, we sought to understand who was perpetrating gender bias in this setting and demonstrated that men and women are equally responsible for perpetrating gender bias against women.

A Vicious Cycle of Exclusion

Though the proportion of graduating women medical students has increased 0.5% per year, and female general surgery trainees have more than doubled from 1994 to 2014, women still make up less than 10% of full professors of surgery at academic training centers.[31] This phenomenon is often referred to as "sticky floors and glass ceilings," a topic recently explored as an ongoing issue for female surgeons by Dr. Caprice Greenberg at the Association of Academic Surgery 2017 Presidential Address.[6] Though prior work has established that these "sticky floors," "glass ceilings," and "leaky pipelines" prevent women from attaining leadership roles in surgery, the cycle of exclusion and failure of advancement begins well before women are in faculty positions.[4,32,33]

Study participants describe early pressure to not become surgeons, some as early as during their premedical education. Descriptions of women students being told to choose a field like "family medicine or pediatrics" so they can "be at home and see your children grown up." This toxic mentality implies that pursuing a surgical career is prohibitive to parenthood, and assumes that every woman, by default, wants to become a parent. Others described being met with comments like "Oh, really?" and "Wow!" when expressing their desire to be a surgeon, receiving signals that what they were pursuing was not the norm or was something out of the ordinary. From the moment a woman begins developing an interest a surgical career, they are met with a barrage of doubt and often well-intentioned concern.

The cycle continues as trainees find themselves with a paucity of female mentors in surgery. Our research found that in medical school, female students are consistently pressured to find mentorship where there often is none. The lack of women mentors (a direct effect of the underrepresentation of women in surgery and leadership positions) has been shown to be a key factor in determining whether women medical students pursue careers in surgical fields.[14] Medical students, regardless of gender, are twice as likely to pursue a surgical career if they have identified a positive surgical role model, and female students are often unable to identify women role models in surgery. This can lead to medical students self-selecting out of surgical careers.[13] In residency, this

problem continues during a time when guidance and mentorship becomes crucial. Of our study participants, 33% of all trainees and 60% of trainees in male-dominated specialties reported having difficulty finding a female mentor. Despite many female trainees preferring female mentorship, many in the focus groups described having access to only male faculty mentors. Although male mentorship may be able to supplement this lack of female mentors, one of our focus group participants reported that some male faculty are uncomfortable meeting with them in a one-on-one setting, due to concerns of being accused of sexual harassment.

Gender bias in resident selection and faculty promotion has been well documented in prior research and was frequently mentioned as problematic by our focus group participants (Cochran et al.). A recent study has demonstrated that gender bias negatively affects female applicants during candidate selection for surgical residency (Turrentine et al.).[34] Writers of applicants' recommendation letters systematically use different language to describe attributes of male and female applicants. In letters for male applicants, average word count is higher, their name is used more often and there is more reference to standout adjectives, awards, achievement, ability, and leadership. Meanwhile, letters for female applicants more often reference work ethic, physical description, and caring words. Once they obtain a surgical residency position, female trainees endure comments from their peers that throw into question their right to exist in their position as a resident. "Why would we ever hire a female resident. . .? She just taking a spot from a man who's going to work his whole life. . .it's not useful to let women do this work." Throughout training and beyond, women will regularly endure doubt of their worth from their peers, superiors, and patients. Beyond biased comments and behavior, the majority of our participants who are trainees in male-dominant fields reported feeling excluded from networking opportunities due to gender, which can lead to significant opportunity loss as trainees enter the workforce.

Personally addressing microaggressions can be daunting. Fear of retaliation, further discrimination, and exclusion can pressure trainees to avoid reporting these events. Nadal[35] created "A Guide to Responding to Microaggressions" in 2014, which discourages passive-aggressive responses and agitated active responses (such as yelling or responding in anger) and recommends an assertive response. Assertive responses include calmly addressing the perpetrator about how it made her feel, educating about microaggressions, and addressing the behavior itself instead of the person to avoid further microaggressions or defensive retorts. After the encounter, seeking workplace support from Human Resources or employee services (filing a complaint if appropriate), social support from family, friends, or coworkers, and emotional support from loved ones or mental health professionals can all be effective options for those affected. Implicit bias and diversity training have been implemented to reduce biases based on gender, race, sex orientation, and religion, but training methods are varied and evidence of successful changes in work environment are limited.[36,37]

The problematic reality faced by women in surgical fields is a difficult one to fix. Because it is a cultural problem that has reach beyond the world of surgery and extends into many aspects of the modern woman's life, there is not one simple solution to make long lasting, sustainable change. Interventions must be made on an individual level through education, intervention, and behavior change with individuals who have been identified as perpetrators of gender bias and microaggressions against women. These changes will have very little lasting impact if they are made on a one-off basis with individuals. They must be made in the context of wider institutional or organizational change at a given training program or hospital. This begins with organization leaders making a concerted effort to define a culture of inclusion and accessibility for women with concrete actions and changes to back up their intentions. This may include zero tolerance for sexist remarks or actions from authority figures and peers at every level as gender bias in the workplace is likely a learned behavior. This would require both a culture of advocacy and accountability on the part of colleagues of women (both male and female) as well as a mechanism for reporting behavior that goes against a define culture that allows reporters to be safe from retribution. Investment in mentorship programs from an early stage of education and training can help female medical students identify role models and increase the number of female applicants into surgical fields. Universal education for medical professionals and hospital staff on the impact of gender-based microaggressions and implicit bias on women students, trainees, and faculty can improve awareness and understanding of the problem. Creative solutions to address the lack of women mentors include matching interested trainees to mentors in community practice or other parts of the country through national networks. To address issues with pay equity and fairness in promotion, standardized policies regarding transparency in salary and promotion expectations should be made and should be accessible to all trainees and physicians. Finally, initiatives to improve fair and timely promotion rates including the active recruitment of qualified female faculty, use of transparent criteria for promotion, and offering development programs specifically for women are all opportunities to support female surgeons.

The Vulnerability of the Trainee

An important finding of this study is the pervasive nature of bias against female surgical trainees, regardless of surgical specialty. Due to the hierarchical structure of medical training, women at lower levels likely endure more bias. Female trainees experienced the most frequent microaggressions as pressure to downplay femininity (the domain "Leaving Gender at the Door") and being assumed less capable due to gender (the domain "inferiority") caused the most stress. This finding suggests that being assumed inferior, despite achieving a supposedly equal status of physician, is the most psychologically harmful. Trainees in male dominant specialties have higher rates of bias experiences. The combination of being in a position of low power and stature, being considered an "outsider" in male-dominated environments, and not having developed the "toughness" from years of developing resilience strategies make surgical trainees vulnerable to gender bias and its psychological impact. Our focus groups and survey suggest that this bias acts as a barrier, causing active female surgical trainees to recommend against other women entering their field. Over a quarter of our respondents reported that they plan to change institutions to avoid gender bias and over 40% do not think they will be promoted fairly. Belief that promotion may not occur in a fair manner may be a result of what female mentors disclose to trainees, or what trainees observe themselves.

Traditionally, sexual harassment has been considered the most common form mistreatment and bias toward young female surgical trainees; however, our study did not demonstrate overt sexual harassment as a common experience. Subtle, systematic bias was reported much more frequently.

The Role of the Environment

Given the significant difference of female representation between trainees in Ob/Gyn and other surgical specialties, our findings are likely indicative of the influence of more women in a field. We found that the presence or lack of other women peers and mentors influenced the experience of gender bias and microaggressions, as data reflect that women trainees in male-dominated fields have a much different experience than those in female-dominated fields in respect to gender bias. Although the focus group participants reported similar experiences and coping strategies, the quantitative survey revealed that women who were gender minorities in their environment reported a higher number of microaggression experiences compared to those in female-dominated fields. They also experienced more psychological stress around these experiences and were more likely to attempt to adapt or overcompensate to avoid bias. Although these microaggressions were perpetrated by both men and women in many different roles in the healthcare environment, trainees in male-dominant specialties reported more bias originating from trainees at lower levels and the same level as them. Additionally, nurses outside the operating room were more likely to display discriminatory behaviors toward these surgeons. This finding was not clearly elucidated during qualitative interviews, so it is unclear why such a difference occurs. The higher proportion of female nurses on Ob/Gyn floors in the hospital and the expectation that the Ob/Gyn resident will be a woman may contribute to this finding.

The phenomenon of being "the only woman in the room" was also evaluated in a large study of women in corporate America. Being the only woman in a workplace or on a team correlates to higher numbers of perceived microaggressions.[38] Based on this, as the number of surgical trainees in historically male-dominated specialties increases, there should be improvement in the gender bias experienced by women trainees. However, given the high rates of microaggressions experienced by all trainees, simply increasing the number of women in isolation will not solve this problem in a culture that ignores the contributions of women, turns a blind eye to abusive behavior, tolerates misogyny, and allows exclusion based on gender.

Impending Burnout

The significance and importance of wellness, avoiding burnout, and improving retention in the physician workforce have been hot topics of research in recent years. Our focus groups repeatedly commented on the impact of bias on their overall mental health and feelings of burnout. Several recent studies and a meta-analysis on physician burnout have reported that female gender is a risk factor for burnout. Compared to their male counterparts, female physicians (including those who do have children) report more responsibilities at home, which contribute to fatigue.[16-18] Our study did not demonstrate an association between caring for a child <18 and a woman's bias experience, but we did not assess what percentage of household work the participant performs, the gender of the surgeon's partner, or if the participant has a partner currently.

Although we could find no studies directly linking workplace bias and microaggressions to burnout and physician retention, our study does demonstrate that physicians in female-dominant specialties (who generally noted fewer microaggressions) reported that they were less likely to retire early due to bias than their colleagues in male-dominant fields. Both our focus group and survey findings suggest that gender bias may be a major contributor to women leaving medicine. Not all trainees had

a healthy way to respond to bias events, with many "feeling offended," "getting angry or frustrated," or "adapting" to avoid stigma. These maladaptive responses to bias and future plans suggest that avoidance of a malignant work environment may contribute to lower retention of female surgeons.

Limitations and Strengths

The limitations of this study include a small sample size and evaluation of a single institution. As focus group participants could also complete the anonymous survey, it is possible that their prior experience could have influenced their answers. We also acknowledge our binary use of gender and sex as our survey instrument was validated for those who self-identify as female. Of note, all participants in the survey portion of the study did self-identify as female.

The strengths of this study include the inclusion of a variety of surgical specialties in both the qualitative and quantitative portions of the study. Use of a mixed methods approach was helpful in informing quantitative assessment of an area that has not been extensively studied. The use of validated questionnaire allowed us to ensure that we can accurately compare results between groups. Additionally, we demonstrated consistency between results of focus groups and quantitative data.

CONCLUSIONS

Female surgical trainees continue to experience gender bias. A culture of exclusion beginning in medical school leads to physical and social adaptations to fit into the role of surgeon. Participants expressed significant effort to sustain this level of adaptation, leading to fatigue and creation of resilience mechanisms. Although overt sexism and explicit discrimination have become less tolerated due to changes in societal norms, standards of conduct, and improved systems of reporting and addressing sexist behavior, underlying systemic gender bias in surgical academia continues to negatively affect trainees. In the future, further studies aimed at assessing the impact of gender bias on female surgeons with a focus on the link between severity of experiencing gender bias and burnout is an important next step. Implementing and evaluating interventions for the issues highlighted in this work could lead to improvements in training and wellness with the goal of increasing recruitment and retention of female surgeons.

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SUPPLEMENTARY INFORMATION

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