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The Effect of Gender on Resident Autonomy in the Operating room

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OBJECTIVE: Discrimination against women training in medicine and surgery has been subjectively described for decades. This study objectively documents gender differences in the degree of autonomy given to thoracic surgery trainees in the operating room.

DESIGN: Thoracic surgery residents and faculty underwent frame of reference training on the use of the 4-point Zwisch scale to measure operative autonomy. Residents and faculty then submitted evaluations of their perception of autonomy granted for individual operations as well as operative difficulty on a real-time basis using the "Zwisch Me!!" mobile application. Differences in autonomy given to male and female residents were elucidated using chi-square analysis and ordered logistic regression.

SETTING: Seven academic medical centers with thoracic surgery training programs.

PARTICIPANTS: Volunteer thoracic surgery residents in both integrated and traditional training pathways and their affiliated cardiothoracic faculty.

RESULTS: Residents ($n = 33$, female 18%) submitted a total of 596 evaluations to faculty ($n = 48$, female 12%). Faculty gave less autonomy to female residents with only 56 of 184 evaluations (30.3%) showing meaningful autonomy (passive help or supervision only) compared to 107 of 292 evaluations (36.7%) at those levels for male residents ($p = 0.02$). Resident perceptions of autonomy showed even more pronounced differences with female residents receiving only 38 of 197 evaluations (19.3%) with meaningful autonomy compared to 133 of 399 evaluations (33.3%) for male residents ($p < 0.001$). Potential influencing factors explored included attending gender and specialty, case type and difficulty, and resident level of training. In multivariate analysis, only case difficultly, resident gender, and level of training were significantly related to autonomy granted to residents.

CONCLUSIONS: Evaluations of operative autonomy reveal a significant bias against female residents. Faculty education is needed to encourage allowing female residents more operative autonomy. (J Surg Ed ▮:▮▮▮-▮▮▮. © 2017 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: gender disparity, surgical education, autonomy, bias

COMPETENCIES: patient care

INTRODUCTION

In 1961, the first women cardiothoracic surgeons were certified by the American Board of Thoracic Surgery. Over the next 20 years, the number of women certified rose to only 10. Since then, advances have been made in recruiting, training, and promoting women in thoracic surgery. In 2010, the 50th anniversary of the first female thoracic surgeon, the 200th woman received board certification.[1] There are now more accessible female role models for trainees, a strong professional society (Women in Thoracic Surgery), and a social media movement to support women surgeons in training and practice (ILookLikeASurgeon).[2]

Women, however, face unique and ongoing challenges. In 1996, Dresler et al.[3] surveyed male and female practicing cardiothoracic surgeons about their experience of harassment and discrimination. Approximately 42% women reported frequent or somewhat frequent harassment from male faculty during cardiothoracic surgery training, 44% reported verbal innuendo, and a full 10% reported physical

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advances. Currently, the profession still is not free of important gender-directed inappropriate behavior. In 2015, evidence of sexual harassment and bullying was brought to light in Australia.[4] Further investigation by the Royal Australasian College of Surgeons showed that more than 50% of surgeons (male and female) responding to a survey reported that they had been subjected to discrimination, bullying, sexual harassment, or harassment in the workplace, and cardiothoracic surgery lead the specialties at 63%.[5] In addition to these explicit instances of discrimination and maltreatment, there are also unconscious biases directed toward women.

Milkman et al.[6] sent potential research mentors standardized e-mails from students seeking to discuss research opportunities. Student names were clearly selected to indicate gender of the student, but the messages were otherwise the same. Male names were significantly more likely to receive a response suggesting a preference for mentoring male students. These biases are so prevalent that many women consider such discrimination normal and expected. Seeman et al.[7] published a study investigating women surgeons' perception of the effect of their gender on their careers. More than 50% of the subjects felt that gender had played a role in their career challenges. One subject stated, "Discrimination is not the term I'd use, but perhaps it is correct. I feel I am looked over for leadership positions because I am a woman."

Talented women tend to underestimate their skills, whereas equally talented men are more likely to either overestimate or inflate their skills. This unsupported overconfidence can lead to bias favoring men.[8] In a study of resident confidence with laparoscopy, residents were asked to predict their score on the Fundamentals of Laparoscopic Surgery examination. Female residents predicted scores less than half that of male residents despite the fact that their actual scores were equivalent.[9] The combination of unconscious bias against female trainees and female residents' tendency to underestimate their abilities has the potential to negatively affect their training. Progressive autonomy in the operating room is dependent on resident skill, projection of confidence or readiness, and the relationship between the faculty and the resident, and represents a key developmental step for surgical trainees. In this context, differences in autonomy allowed can be used as a proxy for gender bias. This study investigates the effect of gender on the amount of autonomy received in the operating room by thoracic surgery trainees.

METHODS

After approval by the Institutional Review Board at each site, thoracic surgery residents and faculty underwent frame of reference training on the use of the previously validated, 4-point Zwisch scale to measure operative autonomy (show-and-tell → active help → passive help → supervision only).[10,11] After training, residents were given free access to the Zwisch Me!! mobile application, and demographic data were recorded including resident gender, year of training at the time of study entry, and type of training program (integrated, traditional, or advanced non-Accreditation Council for Graduate Medical Education [ACGME] approved). For data analysis, residents were allocated to 1 of 3 levels of training groups. Integrated residents in their first 3 years were considered junior residents. First-year traditional fellows and fourth-year integrated residents were considered intermediate residents, as this group is in their first year of truly dedicated cardiothoracic training. Second- and third (for 3-year programs)-year traditional fellows, fifth and sixth year integrated residents, and advanced fellows made up the senior residents group, as all of these residents should be approaching independent practice. As the study duration included more than 1 academic year, some residents transitioned from 1 group to another during the study. For each case, their level of training was calculated based on the level at the time of the case.

Faculty data collected included gender and surgical specialty (cardiac or thoracic) that were defined as the case type which composes most of their practice. At the completion of an operative case, residents submitted an evaluation of their perception of autonomy granted for that individual operation as well as operative difficulty compared to other cases of the same type through the app. Faculty members were contacted using an automated text message generated by the app and, without seeing the resident's evaluation, asked for their own perception of autonomy and difficulty as well as brief feedback for the resident. Similar to logging a case in the ACGME system, residents could evaluate only 1 operation per evaluation. For example, if a resident performed an aortic valve replacement and coronary artery bypass grafting on the same patient, the each evaluation can only address 1 component. If they want feedback on each part, they are encouraged to submit 2 evaluations for the same case to get specific comments for both portions. The level of autonomy granted to a resident is expected to vary over the course of a case. It is not uncommon, for example, for a resident to open and close independently (supervision only), but for the faculty surgeon to dissect out and divide the vascular structures of the lung, especially when the resident is on the earlier parts of the learning curve. During frame of reference training, the participants were instructed to describe the level of autonomy granted for the "key portions of the procedure" which is a familiar term used by faculty to document their presence in the operating room for legal and billing purposes. Meaningful autonomy was defined as the resident operating with either passive help or supervision only for the key portions of the case as those are the stages where the resident directs the flow of the operation. Case type was

entered by the resident at the time of evaluation in the app and was defined as cardiac, thoracic, or minor (bronchoscopy, mediastinoscopy, etc.) based on the taxonomy of the ACGME case log reporting system.

Comparison of faculty and resident perceptions of autonomy and difficulty in relation to the gender of both parties was performed. Differences between male and female residents and faculty were compared using Pearson chi-square. Potential variables explored contributing to the level of autonomy granted including resident gender, resident's level of training, types of cases performed, difficulty of cases, faculty specialty, and faculty gender. The effects of each of these were explored with chi-square analysis. Factors showing a significant effect on autonomy in univariate analysis were entered into a multivariate model using ordered logistic regression (SPSS version 23, IBM, NY).

RESULTS

Thirty-three thoracic surgery residents at 7 institutions submitted a total of 596 evaluations to 48 faculty surgeons between March 2015 and September 2016. Residents included 27 men and 6 women (18%). Male residents submitted an average of 15 ± 18 evaluations and female residents submitted 33 ± 47 evaluations ($p = 0.41$). Female residents were more senior in their training than male residents submitting 77% of their cases as a senior resident compared to only 51% for male residents ($p < 0.001$). Female residents were more likely to receive an evaluation response from the faculty surgeon but received written feedback with equal frequency to men (Table 1). Faculty surgeons included 42 men and 6 women (12%). Male surgeons were evenly split between a cardiac practice and a general thoracic practice, whereas all female surgeons practiced general thoracic surgery only (Table 2). Female faculty were more likely to respond to the text request for evaluation (96% vs 74%, $p > 0.001$) and also more likely to provide formative feedback (87% vs 67%, $p < 0.001$).

When faculty were asked to evaluate how much autonomy they gave their residents, they reported higher levels of autonomy given to male residents than female residents. Male residents were given meaningful autonomy in 107 of 292 cases (36.7%) compared to 56 of 184 cases (30.3%) for female residents ($p = 0.02$). Residents agreed with the attending perception of autonomy in 65% of cases ($r = 0.69$). When they disagreed, residents more often felt that they had received less autonomy than the faculty members thought they had allowed. This difference in perception of autonomy resulted in residents identifying an even larger gap in autonomy between the genders. Male residents reported that they received meaningful autonomy in 133 of 399 evaluations (33.3%), whereas female residents reported meaningful autonomy in only 38 of 197 evaluations (19.3%) demonstrating a much larger gap than seen in the attending perception ($p < 0.001$).

We explored the effect of several factors on difference in autonomy: the resident's level of training, types of cases performed, difficulty of cases, attending specialty, and attending gender. Level of training was significantly associated with autonomy ($p < 0.001$ for both faculty and resident perceptions). The difference between male and female residents was most pronounced at the senior resident level (Fig. 1). The type of case (cardiac, thoracic, or minor) was also associated with the amount of autonomy granted ($p < 0.001$ for both faculty and resident perceptions) with minor cases receiving the most autonomy and cardiac cases receiving the least. Residents identified significant gender differences for all 3 case types while faculty did not (Fig. 2). There were no differences in the difficulty of cases performed by male and female residents (Fig. 3). Case difficulty was predictive of autonomy granted ($p < 0.001$ for both faculty and resident perceptions). There was no difference between male and female residents for the easiest and hardest cases; however, there was a significant difference for cases described as average difficulty (Fig. 4). The primary specialty of the attending surgeon (cardiac vs thoracic) was also predictive of autonomy granted with thoracic surgeons granting higher levels of autonomy than cardiac surgeons

TABLE 1. Demographic Data for Residents Using the Zwisch Me!! App

	Male Residents	Female Residents	p Value
Thoracic residents (*n*)	27	6	
Integrated residents (*n*, %)	14 (74%)	5 (26%)	
Traditional fellows (*n*, %)	13 (93%)	1 (7%)	0.16
Cases submitted (*n*)	399	197	
Junior residents (*n*, %)	39 (10%)	14 (7%)	
Intermediate residents (*n*, %)	158 (40%)	32 (16%)	
Senior residents (*n*, %)	202 (51%)	151 (77%)	<0.001
Faculty response (*n*, %)	292 (73%)	184 (93%)	<0.001
Written feedback (*n*, %)	217 (74%)	133 (72%)	0.67
Resident/faculty gender pairings			
Same gender (*n*, %)	298 (75%)	68 (35%)	
Opposite gender (*n*, %)	101 (24%)	129 (65%)	0.02

TABLE 2. Demographic Data for Faculty Using the Zwisch Me!! App

	Male Faculty	Female Faculty	p Value
Faculty surgeons (*n*)	42	6	
General thoracic practice (*n*)	20 (48%)	6 (100%)	
Cardiac practice (*n*)	22 (52%)	0	0.02
Utilization			
Evaluation requests received (*n*)	427	169	
Response rate (*n*, %)	314 (74%)	162 (96%)	<0.001
Response rate >0% (*n*, %)	25 (60%)	5 (83%)	0.26
Written feedback (*n*, %)	209 (67%)	141 (87%)	<0.001

($p = 0.008$ for attending perception and $p < 0.001$ for resident perception). Residents identified significant gender differences for both cardiac and thoracic surgeons while faculty did not (Fig. 5). The final factor explored was faculty gender. Female faculty gave male and female residents equal levels of autonomy as perceived by both groups. Male faculty gave male residents more autonomy with 71 of 196 evaluations (36.2) at meaningful autonomy compared to only 27 of 118 evaluations (22.9%) for female residents (Fig. 6). In fact, no male attending rated a female resident at the highest autonomy level, supervision only. From the faculty perspective, faculty gender was not significantly associated with autonomy ($p = 0.14$); however, it was from the resident perspective ($p = 0.01$).

The 6 factors identified as contributing to autonomy were then examined using ordered logistic regression to identify independent effects. From the faculty perspective,

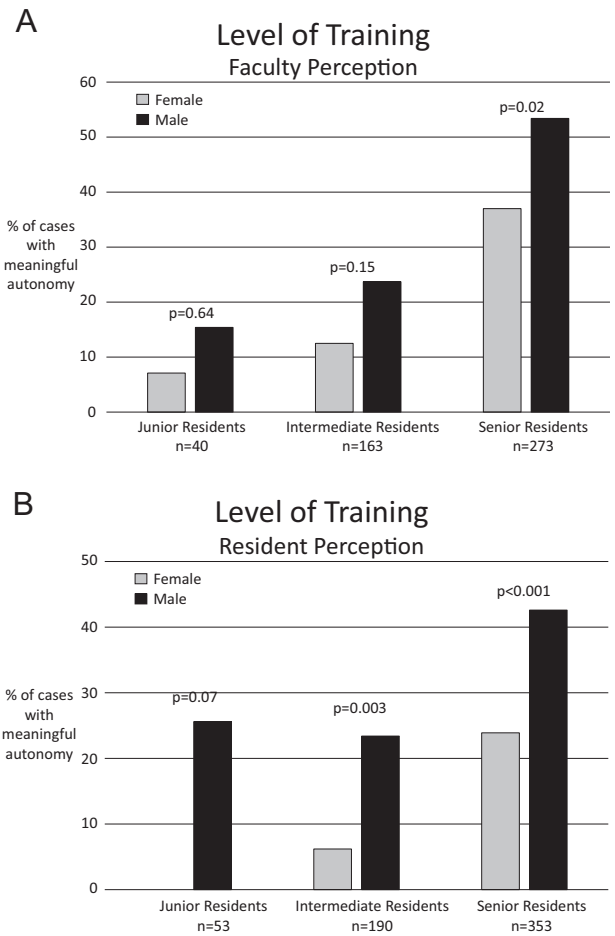

FIGURE 1. Percentage of cases performed with meaningful autonomy (passive help or supervision only) by male and female residents at different levels of training: (A) faculty perception of autonomy and (B) resident perception of autonomy.

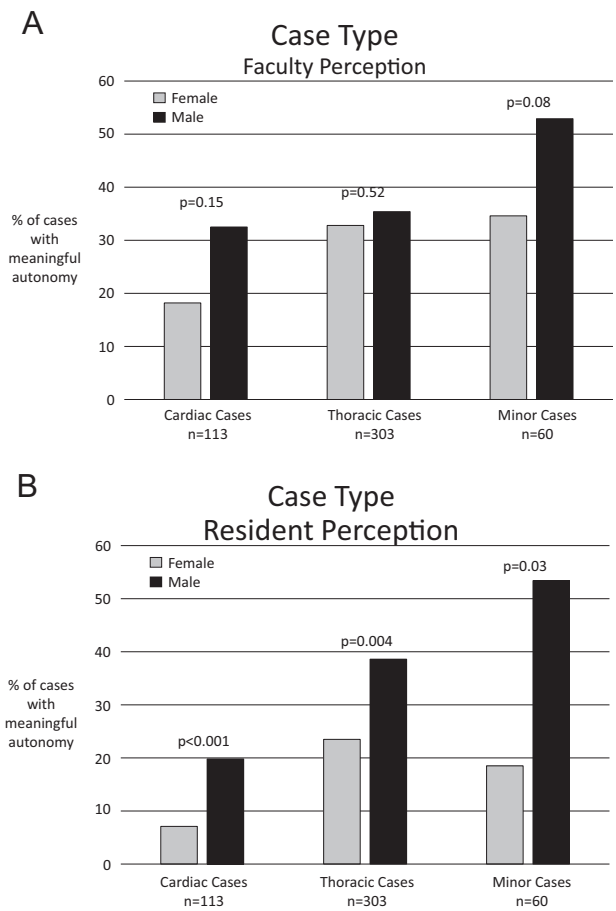

FIGURE 2. Percentage of cases performed with meaningful autonomy (passive help or supervision only) by male and female residents divided by the type of case performed: (A) faculty perception of autonomy and (B) resident perception of autonomy.

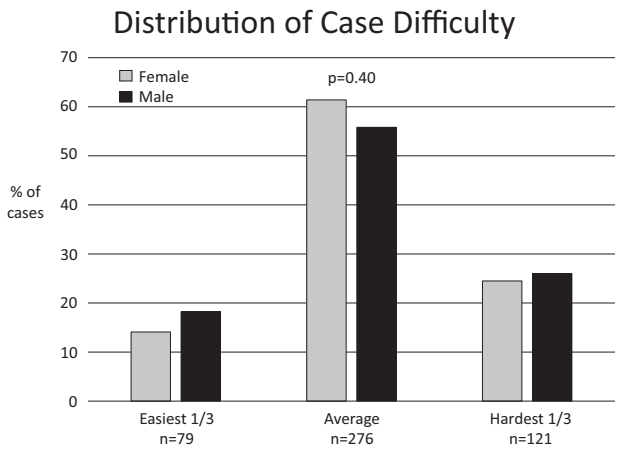

FIGURE 3. Percentage of cases described by the faculty surgeon as each level of difficulty (compared to other cases of that type) performed by male and female residents.

attending gender and specialty were not predictive in the multivariate model; however, case type ($p = 0.03$), case difficulty ($p < 0.001$), resident level of training ($p < 0.001$), and resident gender ($p = 0.02$) were independent predictors. From the resident perspective, attending gender and specialty as well as case type were not independently predictive, while case difficulty ($p < 0.001$), resident level of training ($p < 0.001$), and resident gender ($p < 0.001$) were predictive (Table 3).

DISCUSSION

The data presented here clearly demonstrate that despite controlling for multiple factors that could affect the amount of autonomy allowed, resident gender remains an independent predictor of autonomy. When residents complete their thoracic training program, they are expected to be able to perform all of the basic operations of the specialty safely and

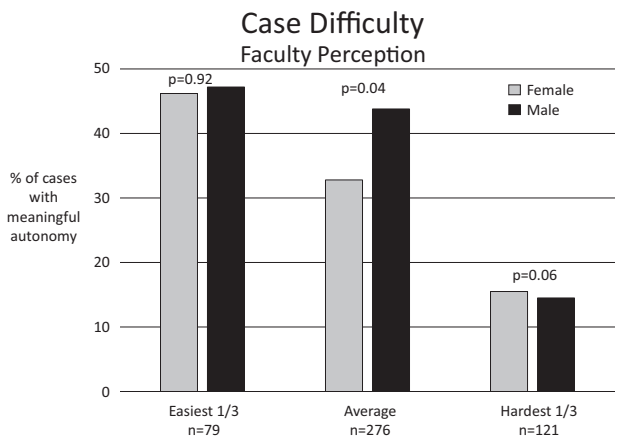

FIGURE 4. Percentage of cases performed with meaningful autonomy (passive help or supervision only) by male and female residents at each level of difficulty (compared to other cases of that type) based on the faculty perception of autonomy.

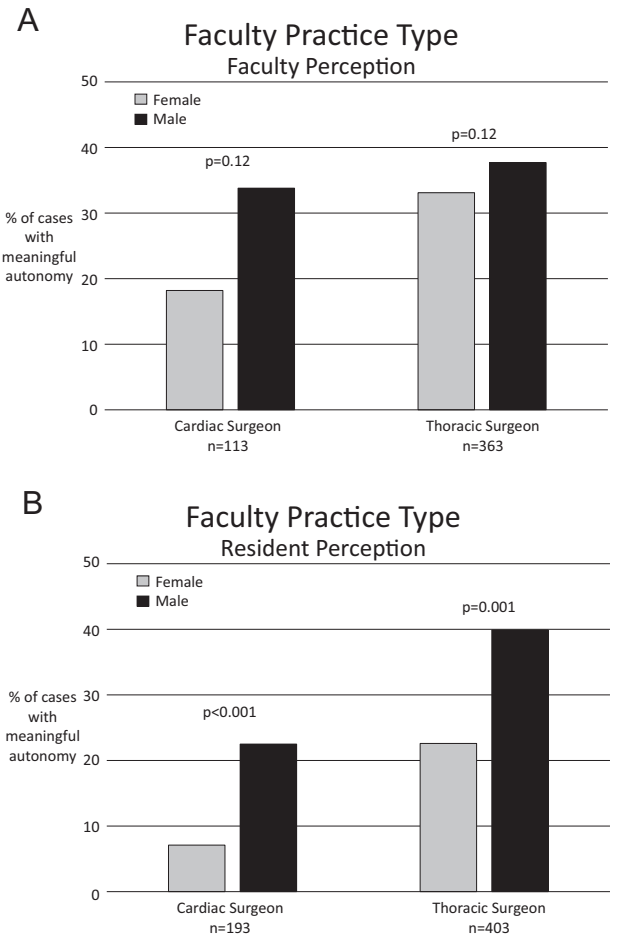

FIGURE 5. Percentage of cases performed with meaningful autonomy (passive help or supervision only) by male and female residents divided by the primary practice type of the faculty surgeon: (A) faculty perception of autonomy and (B) resident perception of autonomy.

independently. Their competence and confidence after graduation are related to their experience in training, and it has been suggested that increasing graduated autonomy in training can ease the transition to practice.[12] A resident who has mostly assisted in the required number of lobectomies will find independent practice more difficult than the resident who has performed the cases autonomously under direct attending supervision. Odell et al.[13] reported residents' perceptions of the percentage of cases where they were the operating surgeon. For common cases such as coronary artery bypass grafting, 60% to 70% of residents spent at least half of their cases as operating surgeons. That percentage decreases for more complex cases such as minimally invasive mitral valve operations and transcatheter aortic interventions where in about less than 30% of cases senior residents reported acting as the operating surgeon.[14] These numbers are less than ideal, but for the most part, residents feel capable of going into practice. Residents reported a need for more training and lacked confidence with many advanced procedures including endovascular operations, minimally invasive esophageal operations, and

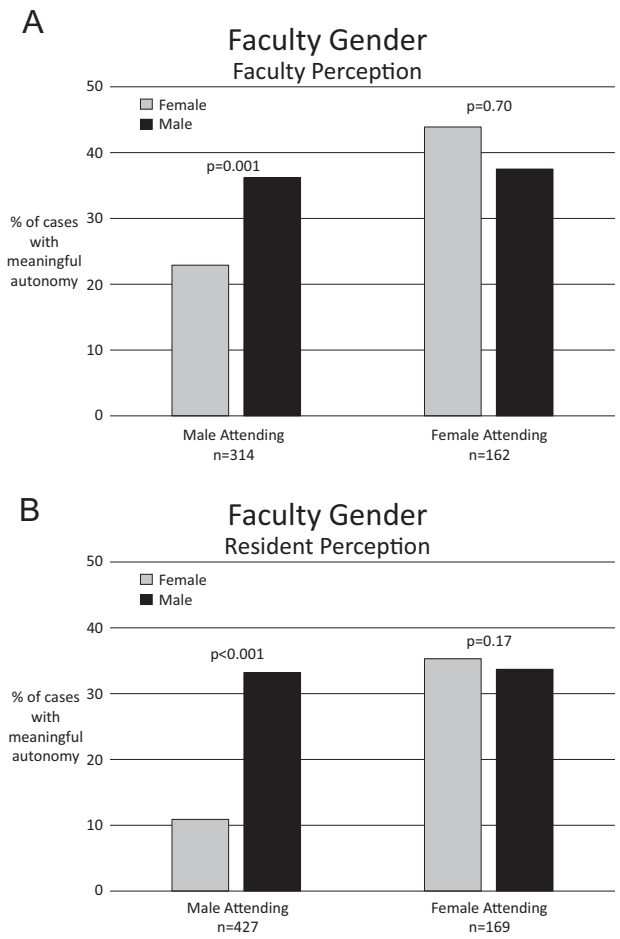

FIGURE 6. Percentage of cases performed with meaningful autonomy (passive help or supervision only) by male and female residents divided by the gender of the faculty surgeon: (A) faculty perception of autonomy and (B) resident perception of autonomy.

all types of robotic surgery.[15] As residents overall may not get adequate autonomy in training, we have now identified an important subset of residents who receive even less autonomy.

There are clear factors that do and perhaps should contribute to the amount of autonomy allowed. When surveyed, faculty surgeons' top 5 factors which related to how much autonomy they gave residents in the operating room were observed clinical skill, attending confidence with the specific case, difficulty of the operation, prior time spent with the resident, and level of training.[16] Our data confirm 2 of these factors directly showing an increased autonomy for senior trainees and decreased autonomy for more difficult cases. Our study, however, demonstrates that there is a clear decrease in the amount of operative autonomy given to female trainees independent of those factors.

There are a wide variety of potential negative effects of decreased autonomy given to women in thoracic surgery. First, cardiothoracic surgery has traditionally been male dominated. Starting in 1961, over the next nearly 40 years, only 50 women were trained in cardiothoracic surgery. Those numbers have increased since the beginning of the 21st century with number 300 likely to become board certified this year. However, the increase in female trainees has been slow. Medical school classes are now at least 50% women, and general surgery programs as of a study in 2008 included 32% women.[17] Thoracic trainees, on the contrary, are currently only 23% women. If women are actually getting a less robust training experience than men, this could further hamper efforts to recruit women to cardiothoracic surgery. If women interpret decreased autonomy as a sign they are not as capable as men, this could lead to lack of confidence and create a spiral of decreasing performance.

TABLE 3. Results of Multivariate Analysis of Potential Factors Contributing to Autonomy Allowed to Residents in the Operating Room

	Attending Perception		Resident Perception	
	Parameter Estimate	**Significance (p Value)**	**Parameter Estimate**	**Significance (p Value)**
Attending gender				
Male vs female	−0.17 (−0.58 to 0.24)	0.41	−0.10 (−0.51 to 0.322)	0.66
Attending specialty				
Cardiac vs thoracic	−0.18 (−1.56 to 1.20)	0.80	0.21 (−1.18 to 1.60)	0.77
Case type				
Cardiac vs minor	−1.60 (−3.02 to −0.18)	0.03	−1.75 (−3.18 to −0.32)	0.02
Thoracic vs minor	−0.81 (−1.36 to −0.27)	0.003	−0.40 (−0.95 to 0.15)	0.16
Case difficulty				
Easiest 1/3 vs hardest 1/3	1.49 (0.91–2.08)	<0.001	1.67 (1.07–2.27)	<0.001
Average vs hardest 1/3	1.23 (0.79–1.68)	<0.001	1.36(0.90–1.81)	<0.001
Level of training				
Junior vs senior resident	−2.10 (−2.81 to −1.40)	<0.001	−1.76 (−2.47 to −1.06)	<0.001
Intermediate vs senior resident	−1.64 (−2.08 to −1.20)	<0.001	−1.48 (−1.93 to −1.03)	<0.001
Resident gender				
Male vs female	0.75 (0.36–1.14)	<0.001	0.75 (0.35–1.14)	<0.001

It may also lead to frustration where women identify that they are not being treated equally to men despite having the same experience or skills. The ultimate extreme could even be increased attrition of women from training programs. In a qualitative study of residents who left their training programs, the importance of perceptions and self-image was clearly noted. Former residents described being called weak, but faculty members were unable to tell them how to improve. There is also still a culture in surgery where strength, personified as the ability to handle anything under any circumstances, is key. One resident described this as "You cannot be seen as weak in a surgery residency, especially as a woman because they will chew you up and spit you out."[18] This perception that women must be better than men to be considered equal may extend into the operating room as well.

In the current era, we doubt that faculty intentionally and consciously withhold autonomy from women. Public discussion of gender bias supported by objective data such as this study is the first step toward equity, which can only benefit the profession as a whole. However, we must work on concrete ways to improve autonomy for female trainees. Women in surgery, they are a minority and may respond differently to criticism than men. A traditional approach to feedback in residency is described as the "shame and blame approach." This uses guilt ("I did something wrong") and shame ("I am wrong") to spur improvement. Although it has been shown that this approach is a poor way to improve performance, it persists. The negative effects of "shame and blame" are more prominent in women. After shaming events, 65% of men used the experience for internal reflection and self-improvement, trying to make a negative situation into a positive. Women were less successful in using the event to improve with only 32% reporting self-reflection and improvement, but women had twice the rate of feelings of professional isolation as in men.[19] Framing feedback as event specific (you made this error, here is how to avoid it next time) rather than person-directed (you always make mistakes) will help avoid the spiral of shame and decreased self-confidence.

Women are also very aware of gender norms, and these can limit aggressiveness and self-promotion that may limit opportunities for operative autonomy. When men ask for what they want, for example, autonomy in the operating room, they are perceived as being confident and assertive. Women, on the other hand contrary, are often perceived as arrogant, self-promoting, or conceited.[20] When women fear being labeled as bossy or controlling, they can become passive and not advocate for themselves. They tend to underestimate their own abilities and limit their goals.[21] As faculty, we need to be aware of these tendencies and positively support and encourage our female trainees. This may take the form of pushing our female residents to be more autonomous using questions such as "what are you going to do next?" or "how should I help you?" rather than waiting for them to ask for autonomy. When women appear reluctant due to lack of prior experience or overall limited self-confidence, we can use positive reinforcement to push them forward. Instead of taking over the operative role immediately when they appear to lack confidence, we can push them to go as far as they can. If they require help to get over a tough part of a case, it does not mean their operative role is over. Returning the case to their control for easier parts will help build confidence for the next time. Another approach to empowering female trainees is explicit discussion of these issues with both residents and faculty. Awareness of the effect of gender norms can help diffuse their impact and allow female residents to advocate for their own interests in the operating room and in training overall. There is often the perception in surgery and medicine as a whole that "women's issues" center on family responsibilities and child care.[22] In fact women's issues are just as important in the workplace in areas such as equal salaries, equal access to leadership roles, and now equal autonomy during training.

CONCLUSIONS

Evaluations of operative autonomy reveal a significant bias against female residents even when controlled for other factors such as case difficulty and level of training. This may have significant negative effect on our trainees and the profession as a whole. Faculty education, introspection, and conscious effort are needed to facilitate more operative autonomy for our female residents.

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