

Gender and Cardiothoracic Surgery Training: Specialty Interests, Satisfaction, and Career Pathways

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Background. The cardiothoracic surgical workforce is changing. Although 5% of practicing surgeons are women, 20% of current cardiothoracic surgery residents are women. The purpose of this study was to evaluate the influence of gender on specialty interest, satisfaction, and career pathways of current residents.

Methods. Responses to the mandatory 2015 Thoracic Surgery Residents Association/Thoracic Surgery Directors Association in-training examination survey taken by 354 residents (100% response rate) were evaluated. The influence of gender was assessed with the use of standard univariate analyses.

Results. Women accounted for 20% of residents, and the percentage did not vary with postgraduate year or program type (traditional versus integrated). Although no differences were found between the genders related to specialty interest, academic versus private practice career, or pursuit of additional training, women were more likely to pursue additional training in minimally invasive

thoracic surgery (10% versus 2.5%, $p = 0.001$) and less likely to perform research in their careers (65% versus 88%, $p = 0.043$). Although women were equally satisfied with their career choice, had similar numbers of interviews and job offers, and felt equally prepared for their boards, graduating women felt less prepared technically (77% versus 90%, $p = 0.01$) and for practicing independently (71% versus 87%, $p = 0.01$). Women were less likely to be married (26% versus 62%, $p < 0.001$) and have children (19% versus 49%, $p < 0.001$).

Conclusions. Although career satisfaction and specialty interest were similar between the genders, women were less likely to intend to perform research during their careers despite similar previous research experience. Women also demonstrated lower rates of marriage and childbearing compared with their male counterparts.

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Since 1961 when the first three women were board certified as cardiothoracic (CT) surgeons, the world for women CT surgeons has changed dramatically. In 2011 the 200th woman became board certified in CT surgery, and the world for the female CT surgeon continues to change. Although women comprise approximately 5% of practicing CT surgeons (3% of adult cardiac, 5% of congenital, and 8% of thoracic surgeons) [1],

women comprise a substantially larger proportion of CT surgery residents. How these female CT surgery residents may be unique from their male counterparts in terms of specialty interests, career aspirations, and satisfaction with their training, however, remains unknown. Knowledge of these potential unique features may enable improved training and satisfaction of this group thereby encouraging more women to pursue the specialty.

Women in CT surgery training have not been extensively studied; however, limited studies of women in general surgical training exist. For instance, a study of senior general surgery residents and early career general surgery faculty revealed that women were more likely to be single, not to have children, and to have higher debt [2]. Women were more likely to think they will or have been treated differently because of their gender (54%

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versus 16%, $p < 0.001$), including discrimination (30% versus 5%, $p < 0.001$) [2]. Approximately one-half of women thought having children would be a career barrier (versus 5% of men, $p < 0.001$), but career satisfaction and preparation were not different between the genders [2]. In the limited data available pertaining to women in CT surgery training, one study examined issues related to childbearing [3], finding that women in training delay childbearing and have fewer children because of the perception that their career would be adversely affected. However, broader differences between the genders undergoing CT surgery training, such as specialty interest, pursuit of additional training, career and training satisfaction, and intention to have a research career, have not been examined.

The goal of this study was to use the Thoracic Surgery Residents Association/Thoracic Surgery Directors Association (TSRA/TSDA) in-training examination (ITE) survey taken yearly by CT surgery residents to probe potential differences between the genders in terms of specialty interest, perception of training, career paths, and career satisfaction.

Patients and Methods

After the lead of Lee [4] and the TSRA, mandatory TSRA/TSDA surveys now accompany the yearly ITE taken by CT surgery residents. Questions within the 2015 ITE survey relating to research experience and career goals were analyzed as part of the current study. Residents in nonaccredited fellowships were excluded. Given that the survey is mandatory, the response rate was by definition 100% (354/354) of respondents in Accreditation Council for Graduate Medical Education-accredited fellowships.

Comparisons were made between male and female surgery residents at all levels of CT training about various aspects of surgical training, career interest, and lifestyle. For analysis, those responding “Strongly Agree” and “Agree” for a given question were pooled, and similarly those responding “Strongly Disagree” and “Disagree” were pooled, whereas those responding “Neutral” were maintained as an independent group. Statistical analysis included χ^2 and Fisher exact testing with significance set at p equal to 0.05. Commercially available software was used for statistical analysis (SPSS, version 22.0; IBM, Chicago, IL).

Results

Women accounted for 20% of residents, and the percentage did not vary with postgraduate year or program type (traditional versus integrated program; Figs 1A, 1B). Although no differences were found between the genders related to specialty interest or pursuit of additional training (Fig 2), the areas of specialty training were different across gender ($p = 0.002$), including women being more likely to pursue additional training in minimally invasive thoracic surgery (10% versus 2.5%, $p = 0.001$; Fig 3).

No differences were found in perception of overall training or preparation for the boards, but women felt less

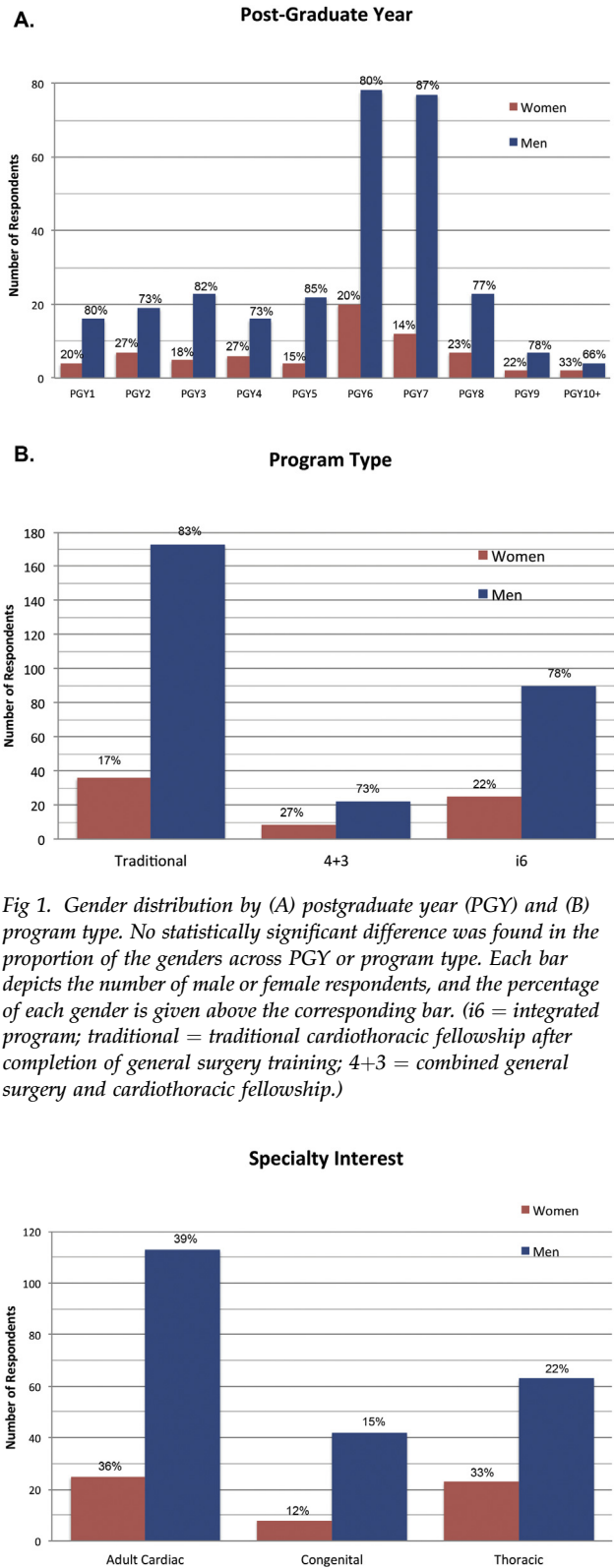


Fig 1. Gender distribution by (A) postgraduate year (PGY) and (B) program type. No statistically significant difference was found in the proportion of the genders across PGY or program type. Each bar depicts the number of male or female respondents, and the percentage of each gender is given above the corresponding bar. (i6 = integrated program; traditional = traditional cardiothoracic fellowship after completion of general surgery training; 4+3 = combined general surgery and cardiothoracic fellowship.)

Fig 2. Gender distribution across specialties. Each bar depicts the number of male or female respondents, and the percentage of each gender is given above the corresponding bar. No statistically significant differences were found between the genders in terms of specialty interest.

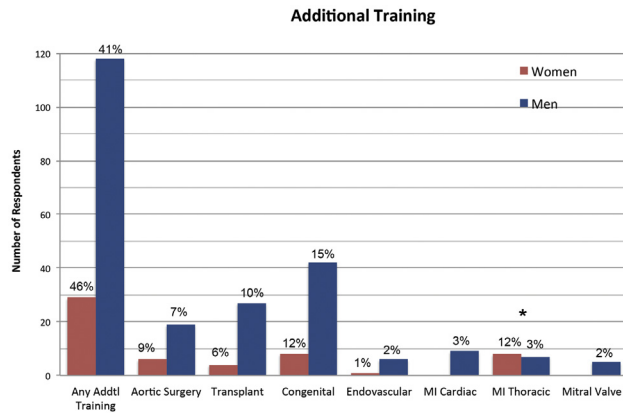


Fig 3. Gender distribution across areas of additional training. Each bar depicts the number of male or female respondents, and the percentage of each gender is given above the corresponding bar. Overall p -value for gender across types of additional training = 0.002; * p = 0.001 women versus men. (Addtl = additional; MI = minimally invasive.)

prepared technically than men (77% versus 90%, p = 0.01; Fig 4) and less prepared to be independent surgeons than men (71% versus 87%, p = 0.01). Similar results were found when analysis was performed with only graduating residents (75% versus 87% for technical preparation and 69% versus 87% for preparation for independence), although differences were at a level of a trend (p = 0.16 and p = 0.10, respectively).

No differences were found in career satisfaction (assessed by whether a resident would choose the same career again), no differences in academic versus private practice career (Fig 5), but women were less likely to intend on performing research during their careers (65% versus 78%, p = 0.043; Fig 6).

Among graduating residents, no gender differences were found related to number of interviews or job offers; however, women were less likely to consider money as "extremely" or "very" important (52% versus 70%, p = 0.007). Female residents were less likely to be married (26% versus 62%, p < 0.001; Fig 7) and have children (19% versus 49%, p < 0.001). However, among married

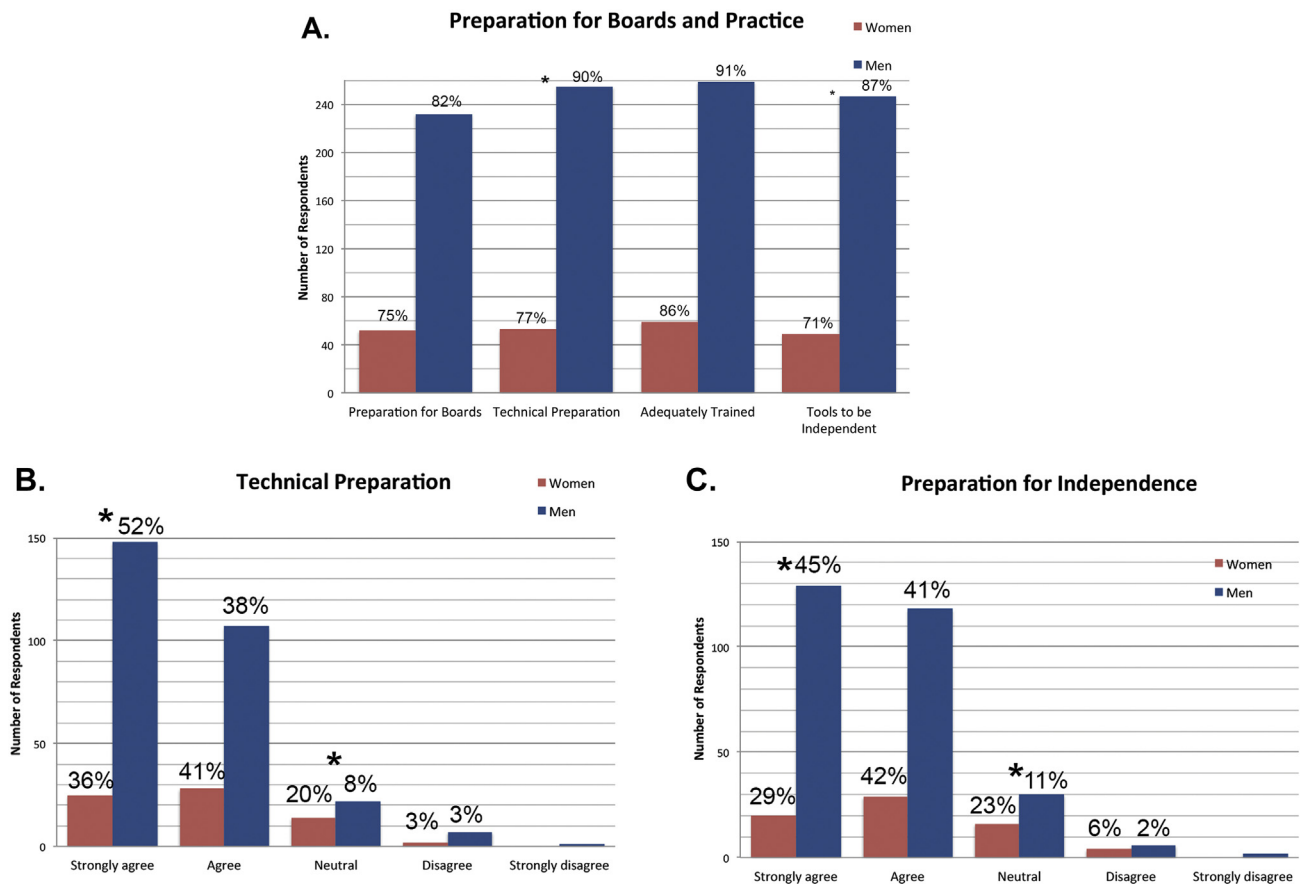


Fig 4. (A) Gender differences in perception of preparation for boards and practice. The columns depict the number of men and women who responded "Agree" or "Strongly Agree" with the percentage of each gender given above each bar. * p = 0.01 women versus men for both perceived technical preparation and preparation for independence. Data for all responses about (B) technical preparation and (C) preparation for independence, respectively. p = 0.018 for women versus men for technical preparation and p = 0.011 for preparation for independence, * p < 0.05 women versus men on post hoc testing.

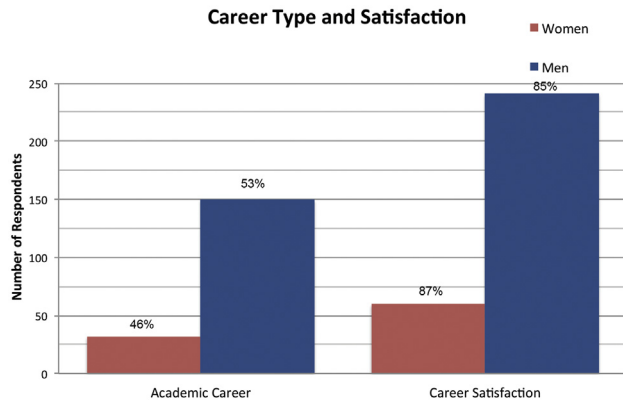


Fig 5. Career type and satisfaction. Each bar depicts the number of male or female respondents, and the percentage of each gender is given above the corresponding bar. No statistically significant differences were found between the genders in terms of career type or satisfaction.

residents, no differences were found between the genders in terms of having children (61% of married women versus 73% married men, $p = 0.167$).

Comment

Key Findings

Women accounted for 20% of residents; this percentage did not vary significantly across program type or post-graduate year. Specialty interest and pursuit of additional training were not different across the genders, although specific areas of additional specialty training were. Academic careers were equally likely between the genders, although women were less likely to perform research during their careers. Although women were equally satisfied with their career choice and felt equally prepared for their boards, they felt less prepared technically and for practicing independently. Graduating women

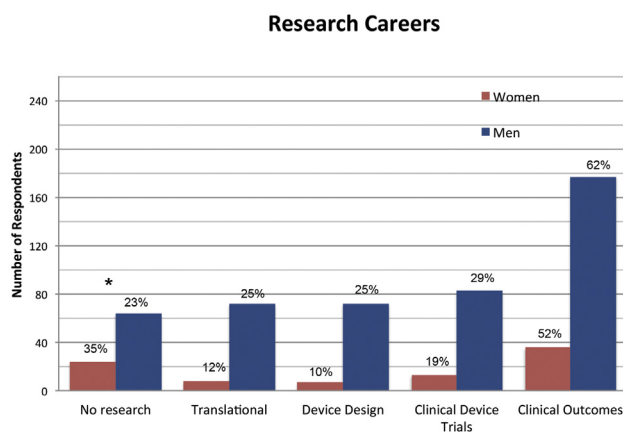


Fig 6. Gender distribution according to research careers. Each bar depicts the number of male or female respondents, and the percentage of each gender is given above the corresponding bar. $*p = 0.043$ women versus men. (Translational = translational basic science research.)

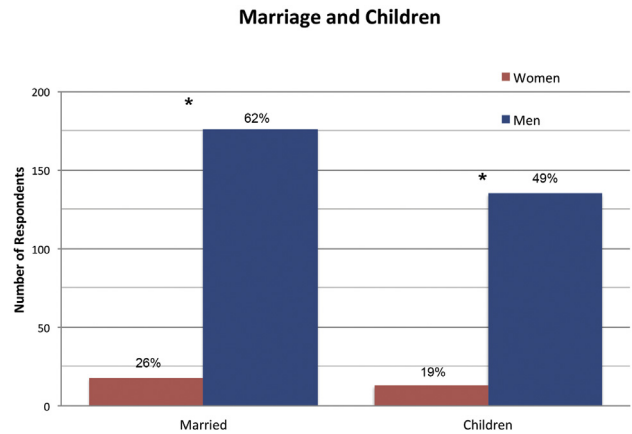


Fig 7. Marriage and children. Each bar depicts the number of male or female respondents, and the percentage of each gender is given above the corresponding bar. $*p < 0.001$ women versus men.

were less likely to be married and have children than their male counterparts.

Women in Thoracic Surgery

Clearly the world of the female CT surgeon has changed dramatically since the pioneers who paved the way. Now 5% of practicing CT surgeons are women in a field previously exclusively occupied by men. Most female CT surgeons are satisfied with their career choice, as demonstrated in this study and the WTS (Women in Thoracic Surgery) survey [5]. However, additional challenges remain. In the WTS survey, 60% of women with academic appointments were instructors or assistant professors, but only 18% were full professors [5]. With women comprising 20% of current surgery residents, the percentage of practicing female CT surgeons will continue to increase. Unfortunately, longitudinal assessment of gender in CT surgery is limited. The only previous surgery residents' survey to include gender was the 2003 survey of graduating residents [6]. In this study, 91% were men and 80% were married; however, no analyses of gender differences were performed within that study [6]. Although over the past decades clearly the proportion of women has increased, based on the proportion of women graduating in 2012 (21%) [5] and in 2015 (16%, based on this survey), the proportion of women in the field does not appear to be increasing in recent years.

Program Type

Interestingly, no difference was found in the gender distribution between program types. In the face of the declining interest in CT surgery and the untapped female population (with women comprising at least 50% of medical school classes) some felt the new integrated training paradigm with its focused, shortened training may help recruit women into CT surgery [7]; however, there appears to be no increase in women in that program type nor a change in recruitment of women in recent years. However, as stated earlier, the only previous

survey to include gender was the 2003 survey; therefore, longitudinal study of recruitment of women into the field and potential increased recruitment as a result of the integrated approach is warranted.

Marriage and Children

As recently documented by a survey of CT trainees and faculty that found 98% of women in training delay childbearing and have fewer children because of the perception that their career would be adversely affected (82%) [3], in this survey graduating women were much less likely to have children (19% versus 49%, $p < 0.001$) and less likely to be married (26% versus 62%, $p < 0.001$) than their male counterparts. Our field is not unique in this regard. In a study of general surgery residents and faculty, women were more likely to be single (39% versus 12%, $p < 0.001$) and not have children (67% versus 31%, $p < 0.001$) compared with their male counterparts, and approximately one-half of women thought having children would be a career barrier (versus 5% of men, $p < 0.001$) [2]. Interestingly, when those who perceived childbearing as a career barrier were asked whether they could overcome this barrier, fewer than one-half were confident they could [2]. Another study of academic general surgeons similarly found that a quarter of women never married (versus 4% of men), and the majority (63%) deferred starting a family until after fellowship (compared with 41% of men, $p < 0.001$), despite the known decreased fertility faced with advanced age [8].

Surgery Resident Preparation

Although this survey indicated that women felt less prepared technically and less prepared for independence, it is unclear whether those differences are actual differences in preparation or differences in the residents' perceptions of either their own abilities or what constitutes being "adequately" prepared technically and for independence. Further investigation is required to tease out these elements. Of note, similar results were obtained when analysis of graduating residents was performed, suggesting this perception of preparation was not dependent on postgraduate year. A survey of academic general surgeons did not find differences in confidence, decision-making abilities, or preparation between academic female and male surgeons [2], and previous studies in other areas of surgery have not consistently shown differences in surgical abilities between the genders [9]. A study of practicing surgeons did demonstrate that the genders rely on different strategies for developing successful careers: men relied more on training (29% versus 0% women, $p < 0.05$), whereas women more frequently cited social supports/networks (88% versus 12% men, $p < 0.05$) [10]. Men and women may tend to benefit from different learning or training strategies during residency, or there may be differences in how faculty train women as opposed to men; however, these issues have not been explored.

Research in business and science has demonstrated a "confidence gap" between the genders, that is, women perceiving a lack of ability in tasks where they display equal competence to men [11]. In one such study,

although women and men performed equally on a science quiz, women perceived their performance as significantly worse (56% versus 73%, $p < 0.0005$) [12]. In another study the genders performed equally on a math examination, but 1 year later men consistently recalled their performance 30% higher than reality versus 15% for women [13]. Equivalent observations have been made among psychology students [11]. Studies have also documented this confidence gap among managers. In one such study 70% of male managers had "high" or "quite high" self-confidence versus 50% of women and one-half of female managers reported self-doubt versus less than one-third of male managers [14]. Similar observations have been made in job applications; although men who are 60% qualified will apply for a given job, women will only apply if they are 100% qualified [11]. Studies have also shown that performance can be directly affected by manipulating a person's confidence in their ability to perform a task [15]. Although equivalent studies have not been performed in our field, it is conceivable that the women's perception of their abilities may account for the differences observed in the current study.

Although previous analyses of length of training within traditional programs (2-year versus 3-year programs) have demonstrated differences in perceived preparation, such differences were not noted among the traditional residents in this study. Nguyen and colleagues [16] found that residents graduating from 3-year traditional programs tended to more likely to feel adequately trained overall compared with those graduating from 2-year programs (93% versus 84%, $p = 0.08$), better technically prepared (94% versus 83%, $p = 0.03$), and better prepared for independent practice (93% versus 79%, $p = 0.01$).

Challenges for Women in CT Surgery

In a survey of CT surgeons from 1996, 41% of women reported "frequent" or "somewhat frequent" gender discrimination that hindered their career [18]. Harassment, particularly from male peers and attending staff, was reported by 55% of women to be frequent or somewhat frequent during general surgery and CT surgery residency [18]. Regardless of faculty rank, the women in that study were more likely than the men to feel that the promotion was unfair [18]. We hope that the environment for women in our specialty has improved since the time of that survey. Our specialty, however, is not unique for gender discrimination. Studies in general surgery have found that women are more likely to think they will or have been treated differently because of their gender (54% versus 16%, $p < 0.001$), including discrimination (30% versus 5%, $p < 0.001$) [2]. Another study found that women in academic surgery were 10 times more likely to perceive gender discrimination than men, whereas female academic medical physicians were 2.5 more likely to perceive gender discrimination [17]. Understandably, those who experienced gender discrimination had lower career satisfaction [17]. Another study of academic general surgeons reported 61% of women had experienced harassment (versus 10% of men), with 59% of the harassment sexual in nature and 85% gender-based

nonsexual [8]. Despite these challenges, and the issues related to childbearing discussed earlier, women in this study were equally satisfied with their career choice compared with their male counterparts. Indeed, a survey of attending physicians in CT surgery also found that women were equally satisfied with their career choice compared with their male counterparts [18].

Career Paths

Although in this study women were less likely to pursue research during their career, they were equally likely to pursue an academic career. This is in contrast to the survey of CT surgeons from 1996 in which women were significantly less likely to work in an university environment (64% versus 52%) [18]. Another survey of academic general surgeons found 29% of women surgeons who were assistant professors were seriously considering leaving academia compared with 5% of male assistant professors ($p = 0.03$) [8]. Many of the reasons leaving were similar between the genders except for inadequate mentorship and sense of isolation ranked higher by the women [8]. Interestingly, a recent study of academic physicians found that women in academia were almost twice as likely to only have clinical activities with no research component compared with their male counterparts [19]. Given that women in this study were equally interested in academia, but less likely to include research as part of the career, conceivably a considerable portion of women pursuing academia may be planning on an education track. It will be interesting to see if the female residents who desire an academic career identified in this study stay in academia and experience the obstacles reported previously.

Mentorship and Women Role Models in the Field

Mentorship has been shown to be critical to recruitment into CT surgery and likely is important specifically for the recruitment of women. A study of general surgery residents found residents interested in CT surgery considered exposure to a positive CT surgery role model much more important than residents not interested in CT surgery (71% versus 52%, $p < 0.01$) with the majority (71%) of those pursuing CT surgery having such a mentor [20]. However, focus group discussions from that study comment on women finding few female mentors available, and the few available female mentors were overburdened with mentoring responsibilities [20]. In the study of Donnington and colleagues [5] increased female recruitment was found for thoracic surgery as opposed to cardiac surgery. It was hypothesized that increased female faculty in that specialty led to the increased recruitment [5]. Although there was no increased recruitment into thoracic surgery noted in this study, future studies should assess the role of female faculty in recruitment. Similarly, studies in general surgery examining recruitment of women into the field have shown the importance of women role models and mentorship. One study found that 85% of women who chose surgery were from schools with a greater proportion of women surgeon faculty (40%) [21]. Certainly, some institutions have paid special attention to the recruitment, retention, and advancement of women [22], recognizing

that successful women in academia are crucial for providing the mentorship and role models for female trainees. Indeed, most respondents to the recent survey on childbearing in CT surgery felt the most important issue related to recruitment of women into the field was mentorship [3]. Interestingly, a survey from 1996 found that men were less likely than women to encourage women to pursue a surgical career (3.1 versus 2.3 on 4-point scale, $p < 0.01$), with almost one-half responding that they would “never” or “almost never” encourage a woman toward a surgical career [18]. A 2010 study confirmed this finding with male academic surgeons less likely than female academic surgeons to agree that surgery was a “good career” for women (4.6 versus 6.4 on 7-point scale, $p < 0.01$) [10]. This bias could influence male faculty’s interest in teaching women to operate and allowing them to progress, which ultimately could affect the preparedness of female surgeons. Interestingly, the same 1996 CT surgeon survey found in the cohort 45 years old or younger, men were less likely than women to indicate that women needed female role models [18]. Although issues related to retention and advancement of academic female CT surgeons is outside the scope of this study, it is important to note that such issues have significant impact on providing role models and mentors for female trainees.

Limitations

Although this study provides important information about the role of gender in CT surgery training, the study brings up a number of issues worthy of further study. For instance, the role of mentorship for women in CT surgery requires additional study. Further investigation is required to determine whether the gender differences in perceived preparation are true differences in preparation or differences in perceptions. It would be interesting to assess whether women in CT training may tend to learn or process information in a manner different from their male counterparts. As these female residents enter the workforce, it will be important to monitor their retention, professional advancement, and any hindrances to that progression. Furthermore, this survey is limited in that it is a single snapshot in time. Future studies should examine changes in gender longitudinally and assess for differences in actual career paths (as opposed to residents’ intended career paths during training). Finally, although this is a mandatory survey and one would hope that the residents’ responses express their actual opinions and intentions, this is not guaranteed.

Conclusion

Women are increasingly represented among CT surgery residents. Although many aspects of their interests and career paths were equivalent to their male counterparts, certain important distinctions were apparent, including women feeling less prepared technically or for independent practice, less likely to pursue research during their careers, and less likely to be married and have children. As this population enters the workforce, attention to their advancement and continued success is vital to encourage more women to enter the field.

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DISCUSSION

DR JENNIFER D. WALKER (Worcester, MA): Obviously, women have made up a small percentage of cardiothoracic surgery for a long time. I think we are close to somewhere between 200 and 250 women certified now by the Board, which has increased tremendously in the 20 years that I have been doing this. I think one of the important steps in the right direction has been the Women in Thoracic Surgery Program, which, as you know, had their 30-year celebration, and there is a huge mentoring program that reaches across the nation and internationally. How would you counsel a woman who is interested in cardiothoracic surgery to proceed with a career?

DR STEPHENS: That is a great question. Mentorship, mentorship, mentorship. I could not agree with that more. I was very lucky in that regard. Dr Chuck Fraser was the first person who got me interested in CT surgery, and at that time Shanda Blackmon was just finishing fellowship. I naively sent Dr Fraser an email, not knowing at all the statistics of how few female CT surgeons there were, commenting that I had not seen any female CT surgeons. He put me in contact with Dr Blackmon, who has been incredible. There are data I quoted from an older study

demonstrating that male CT surgeons, at least at that time, did not seem to think that female CT surgeons needed female mentors, and I disagree with that. I think that if you can find a female mentor, and I have been incredibly blessed in that regard, it makes a huge difference. In talking to the generation of female CT surgeons before me, they did not have any female role models or mentors. We are very fortunate in this generation to have those pioneers who went ahead of us.

DR WALKER: The only other comment I would make, which is not necessarily a question, I think that even at different levels of your training, as a resident, a cardiothoracic resident, or a fellow, it is important to take this one step forward and start to mentor the students that you see below you and the younger residents. That is something that has made a very big difference. It is something that I have enjoyed doing for a long time, and I would advise you to continue to do that, because people need different levels of mentorship at different stages in their career.

Very nice presentation. Thank you.

DR STEPHENS: Thank you.