

CORONARY

# Sex Differences in the Pursuit of Interventional Cardiology as a Subspecialty Among Cardiovascular Fellows-in-Training



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## ABSTRACT

**OBJECTIVES** The authors sought to determine the factors that influence fellows-in-training (FITs) to pursue a career in interventional cardiology (IC) and how these differ by sex.

**BACKGROUND** Despite increases in the proportion of women across numerous medical and surgical specialties over the last decade, IC still ranks at the bottom in terms of representation of women. It is unclear why this maldistribution persists.

**METHODS** An online survey of cardiovascular FITs was conducted under the direction of the American College of Cardiology Women in Cardiology Leadership Council to assess FIT perspectives regarding subspecialty choices.

**RESULTS** Of 574 respondents, 33% anticipated specializing in IC. Men were more likely to choose IC than women (39% men, 17% women, odds ratio: 3.98 [95% confidence interval: 2.38 to 6.68];  $p < 0.001$ ). Men were more likely to be married ( $p = 0.005$ ) and have children ( $p = 0.002$ ). Among married FITs, male IC FITs were more likely to have spouses who do not work ( $p = 0.003$ ). Although men were more likely to be influenced by positive attributes to pursue IC, women were significantly more likely to be influenced negatively against pursuing the field by attributes including greater interest in another field ( $p = 0.001$ ), little job flexibility ( $p = 0.02$ ), physically demanding nature of job ( $p = 0.004$ ), radiation during childbearing ( $p < 0.001$ ), "old boys' club" culture ( $p < 0.001$ ), lack of female role models ( $p < 0.001$ ), and sex discrimination ( $p < 0.001$ ).

**CONCLUSIONS** Many factors uniquely dissuade women from pursuing IC compared with men, largely related to the culture of IC as a subspecialty. Targeted resolution of these specific factors may provide the most impact in reducing sex imbalances in the field. (J Am Coll Cardiol Intv 2019;12:219-28) © 2019 Published by Elsevier on behalf of the American College of Cardiology Foundation.

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**ABBREVIATIONS  
AND ACRONYMS****ACC** = American College of  
Cardiology**EAPCI** = European Association  
of Percutaneous Coronary  
Interventions**EP** = electrophysiology**FIT** = fellow-in-training**IC** = interventional cardiology**OBGYN** = obstetrics and  
gynecology**PCI** = percutaneous coronary  
intervention

Over the past 3 decades, increased numbers and the proportion of women have visibly changed the landscape of the physician workforce across most medical and surgical specialties. For the first time, the Association of American Medical Colleges reported that women enrolling in U.S. medical schools exceeded the number of men in 2017, with 51% of medical school matriculates consisting of women (1). Women now account for 44% of internal medicine residents, according to the American Board of Internal Medicine in 2016 to 2017 (2). Even urology, neurosurgery, and cardiothoracic surgery—historically among the most male-dominated fields—have seen more than a doubling of their female trainees in the last decade (3). And yet, despite recent targeted national efforts by the professional cardiovascular community, cardiology and interventional cardiology (IC) still persistently rank at the bottom in terms of female representation, with only 13% of general cardiologists and 7% of interventional cardiologists consisting of women (4). Specifically, only 4.5% of practicing interventional cardiologists are women, and they performed only 3% of total procedures between 2009 and 2013 (5). As of 2017, only 9% of IC fellows in the United States were women (1). Although prior studies have examined sex differences in the cardiovascular profession (6,7), none have examined the specific factors that drive current fellows-in-training to make decisions to pursue IC as a subspecialty at the critical stage when these decisions are made and how these factors may differ by sex.

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**METHODS**

An online multiple-choice survey of current cardiovascular fellows-in-training (FITs) was conducted under the direction of the American College of Cardiology (ACC) Women in Cardiology Leadership Council to assess FIT perspectives regarding professional and personal decision elements that influence cardiology subspecialty choices. A 15-item survey instrument for FITs pursuing IC and a 20-item survey

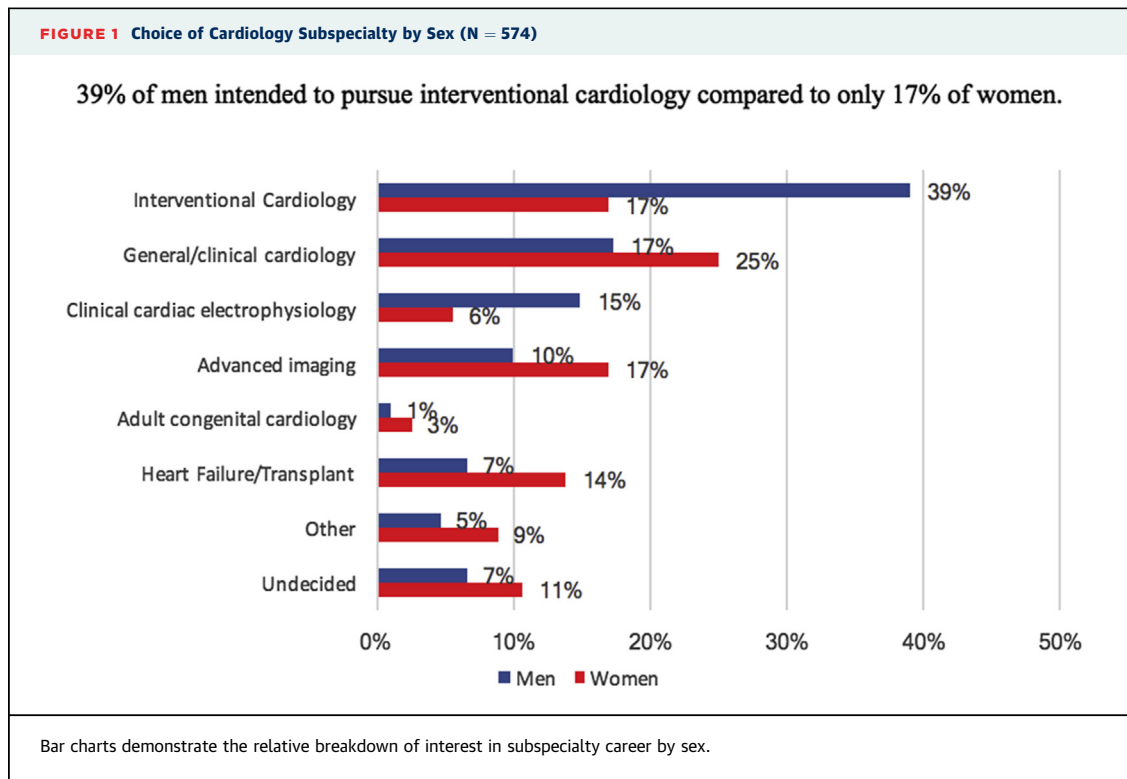
instrument for FITs not intending to pursue IC was used. Demographic information collected included sex, age, marital/child-rearing status, race/ethnicity, training status, and specialization. For each question regarding attributes influencing subspecialty choice, respondents answered using a 5-point Likert scale, with 1 corresponding to “not at all important” and 5 indicating “extremely important” (Online Appendix). Questions spanned categories including mentorship, opportunity, interest, lifestyle, and occupational health. There were also optional areas that allowed for free-text entry as desired by the respondent (342 entries received). These were categorized into thematic groups, with representative comments reported verbatim in the results.

A staged approach was used to reach trainees. First, a survey link was posted at the ACC Legislative Conference in September 2017. Seventeen FITs completed the survey through this platform. Next, an invitation to participate in the online survey was e-mailed to 5,905 ACC FITs through the FIT Listserv. The survey was open from November 7 to 15, 2017, with a small online gift card incentive. A total of 574 FITs completed the survey, representing a response rate of 10%. FITs who selected cardiac electrophysiology (EP) were excluded from the decision factor analysis given possible confounding of the procedural specialties, reducing the base to 504. Of these, 30% of respondents were women, which is higher than the percentage of female FITs in the United States overall (21%) (4).

The p values were calculated using chi-square, Fisher exact, and Mann-Whitney *U* methods. Mean values were used to replace missing values to build exploratory factor models. A principal component analysis with varimax rotation was performed, which mapped the 20 negative attributes against IC choice into a 5-factor solution with 62% explained variance, and the 15 positive attributes contributing to IC choice into a 4-factor solution with 62% explained variance. To assess subspecialty selection preferences, all 20 negative barriers were forced into a 1-factor solution and then a linear regression of the 5-factor solution entered simultaneously on the 1 forced factor. Similarly, to assess the weight of positive attributes contributing to IC career choice, all 15 positive attributes were forced into 1 factor and the

received institutional research funding from AstraZeneca, Bayer, Beth Israel Deaconess, Bristol-Myers Squibb, CSL Behring, Eli Lilly/Daiichi-Sankyo Inc., Medtronic, Novartis Pharmaceuticals, and OrbusNeich; has equity (<1%) in Claret Medical and Elixer Medical; has served on executive committees for Janssen Pharmaceuticals and Osprey Medical; and has received fees paid to the institution for serving on an advisory board for Bristol-Myers Squibb and a data safety monitoring board for Watermark Research Partners. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

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4-factor solutions regressed on the forced factor. Beta values were used to indicate individual factor contribution.

All demographic variables in the instrument were included in a model to predict IC as a career choice (1 = IC; 0 = non-IC). Categorical demographic variables were converted to binary variables for multivariate logistic regression analyses. A logistic regression model with the explanatory variables entered simultaneously was used to predict IC choice. Analysis of responses was performed using IBM SPSS Statistics for Windows Version 24.0, Armonk, New York.

## RESULTS

### DEMOGRAPHICS AND SUBSPECIALTY INTERESTS.

A total of 574 FITs completed the survey, of whom 33% (N = 190) anticipated specializing in IC, with significantly more men interested than women (39% men vs. 17% women;  $p < 0.001$ ) (Figure 1). Women were more likely to express interest in all other cardiovascular specialties (general/clinical cardiology, advanced imaging, heart failure/transplant, adult congenital, and other) with the exception of EP (13% women vs. 87% men;  $p = 0.001$ ). After exclusion of EP fellow responses to obtain a clear signal about IC fellow responses, 504 surveys were analyzed (69% men, 30% women; 67%

age 30 to 34 years; 41% Caucasian, 36% Asian, 8% Hispanic, 4% Black, >1% Hawaiian/Pacific Islander, 7% Other, 4% refused) (Table 1).

Most respondents were married (66% non-IC vs. 63% IC;  $p = 0.60$ ), with non-IC fellows more likely to have a spouse who works >50 h/week (47% non-IC vs. 36% IC;  $p = 0.04$ ), whereas IC fellows were much more likely to have a spouse who does not work (31% IC vs. 13% non-IC;  $p < 0.001$ ). Of note, when the IC fellows with a non-working spouse were disaggregated by sex, this revealed that all of them were men; there were no female IC fellows with a non-working spouse. Female IC fellows (n = 26) were significantly more likely to not have children (78% women vs. 58% men;  $p = 0.06$ ), though both male and female fellows planned to have children or to have more children in the future (Table 1).

Logistic regression of all demographic characteristics revealed that male sex was the most significant predictor of a career choice in IC (odds ratio: 3.98 [95% confidence interval: 2.38 to 6.68;  $p < 0.001$ ]).

### FACTORS POSITIVELY INFLUENCING IC CHOICE.

Among all respondents who intended to pursue IC, the top 5 reasons among 15 options for pursuing IC as a subspecialty were (in descending order): 1) opportunity to perform hands-on procedures; 2) personal interest in the specialty subject area; 3) opportunity

<b>TABLE 1 Characteristics of Respondents Overall and by Sex and IC Choice</b>								
	<b>Interventional Cardiology</b>				<b>Noninterventional Cardiology</b>			
	<b>Total (N = 190)</b>	<b>Male (n = 160)</b>	<b>Female (n = 26)</b>	<b>p Value</b>	<b>Total (N = 314)</b>	<b>Male (n = 189)</b>	<b>Female (n = 124)</b>	<b>p Value</b>
Sex								
Female	14	0	100		40	0	100	
Male	86	100	0		60	100	0	
Age, yrs				0.41				0.001
25-29	15	16	11		17	11	27	
30-34	70	71	70		66	70	59	
35-39	13	13	15		13	15	9	
40-44	2	1	4		4	4	5	
Race				0.09				0.31
American Indian/Alaska Native	0	0	0		<1	1	0	
Caucasian	38	38	41		43	44	40	
Asian	33	34	30		38	35	43	
Hispanic/Latino	5	6	0		9	11	7	
African American	5	4	11		4	2	6	
Native Hawaiian/Pacific Islander	<1	<1	0		0	0	0	
Other	12	14	4		4	5	3	
Yrs of fellowship training				0.42				0.53
1	27	28	19		30	29	32	
2	32	31	39		27	29	22	
3	28	29	23		27	27	27	
4	7	6	8		10	8	11	
Other	6	6	12		6	5	9	
Refused	0	0	0		1	1	0	
Yrs subspecialty training anticipated				0.46				0.37
1	31	33	27		32	30	35	
2	32	29	50		17	14	21	
3	8	8	7		25	30	17	
4	19	20	12		9	10	6	
5 or more	10	11	4		6	5	7	
Refused	0	0	0		12	11	14	
Marital status				0.004				0.004
Married/domestic partnership	63	68	39		66	72	56	
Single/never married	32	29	50		33	26	43	
Divorced	2	1	8		2	1	2	
Separated	1	0	4		<1	1	0	
Other	2	2	0		0	0	0	
How many children do you have?				0.03				0.06
0	61	58	78		67	63	75	
1	19	19	18		17	20	12	
2	15	17	4		12	13	9	
3	4	4	0		2	3	1	
4	1	1	0		1	1	1	
Refused	0	0	0		<1	1	0	
If you already have children, do you plan to have more?	N = 71	n = 65	n = 6	*	N = 98	n = 68	n = 30	0.90
Yes	61	60	67		60	59	63	
No	21	21	17		24	25	20	
Unsure	18	18	17		15	15	17	
Refused	0	0	0		1	2	0	
If you do not yet have children, do you plan to in the future?	N = 114	n = 93	n = 21	0.20	N = 210	n = 118	n = 92	0.32
Yes	90	91	81		84	87	79	
No	3	2	5		3	2	4	
Unsure	8	6	14		13	10	16	

Values are %, except as noted. \*Cell count too small for significance testing. Some respondents did not indicate sex in their survey response resulting in sex breakdown values that do not equal the total number of respondents.

IC = interventional cardiology.

**TABLE 2 Importance of Factors in Choosing a Subspecialty in IC**

	Factor Loading	Total (N = 190)	Men (n = 160)	Women (n = 27)	p Value
<b>Positive mentorship</b>					
Encouragement/guidance from mentors	0.78	5.0	5.0	5.0	0.66
Having role models who demonstrate work-life balance in this field	0.77	5.0	5.0	5.0	0.42
Having mentors or role models you identify with	0.76	5.0	5.0	5.0	0.11
Opening available in desired training program	0.59	4.0	4.0	4.0	0.79
Likelihood of employment after completion of training	0.59	5.0	5.0	4.0	0.002
Having a female mentor or role model	0.53	3.0	3.0	4.0	0.001
<b>Specialty features</b>					
Personal interest in the specialty subject area	0.79	5.0	5.0	5.0	0.78
Opportunity to perform hands-on procedures	0.76	5.0	5.0	5.0	0.75
Thrill of treating ill patients in critical situations	0.72	5.0	5.0	5.0	0.38
Opportunity for immediate gratification or sense of accomplishment	0.70	5.0	5.0	5.0	0.98
<b>Prestige</b>					
Prestige hierarchy or status	0.88	3.0	4.0	3.0	0.027
Financial advantages	0.85	4.0	4.0	3.0	0.025
Opinions of other important people in your life	0.64	4.0	4.0	3.0	0.64
<b>Expertise</b>					
Importance of being an expert in the field	0.83	5.0	5.0	4.0	0.019
Innovation in the field	0.73	5.0	5.0	4.0	0.005

Values are median. Factor loadings are the correlation between the original variables and the factors; they are key to understanding the nature of a particular factor. Squared factor loadings indicate what percentage of the variance in an original variable is explained by the factor.  
 IC = interventional cardiology.

for immediate gratification or sense of accomplishment; 4) thrill of treating ill patients in critical situations; and 5) having mentors or role models you identify with.

When disaggregated by sex, there were 6 attributes that were significantly different between men and women in terms of reasons for pursuing IC. Men were more likely to be driven by innovation in the field, importance of being an expert, likelihood of employment after completion of training, financial advantages, and prestige. Women were more likely to be driven by having a female mentor or role model (Table 2).

Principal component analysis revealed 4 major factor categories (in descending order of influence): positive mentorship (beta = 0.69), specialty features (beta = 0.52), prestige (beta = 0.35), and expertise (beta = 0.36) (Table 2, Figure 2).

Free-text responses further elucidated the selection of IC as a career, with responses emphasizing mentorship such as: “I have great female mentors in the field, which helped encourage me; without them, I honestly don’t know if I’d be pursuing further training.” Culture also played an important role with responses: “Found myself gravitating towards those in the interventional field and mesh with their personalities and mindset.” The nature of the work and immediate gratification also contributed to interests in IC: “I think treating a STEMI patient is one of the

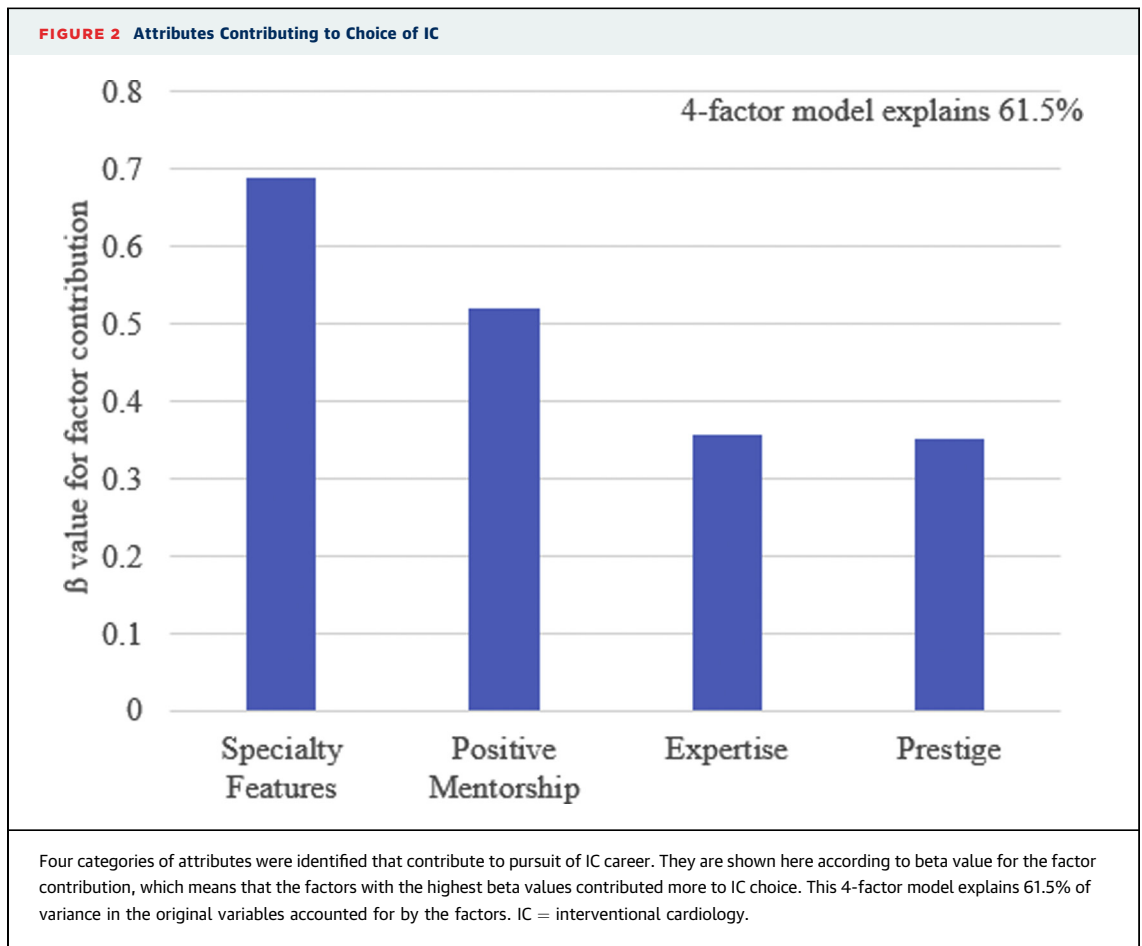
most gratifying things to do, since you can really help someone quickly.”

**FACTORS NEGATIVELY INFLUENCING IC CHOICE.**

Among all respondents of both sexes who expressed that they did not intend to pursue IC as a subspecialty, the top 5 reasons among 20 options for not pursuing IC were (in descending order): 1) uncontrollable or unpredictable lifestyle; 2) concern over long work hours and poor work/life balance; 3) greater interest in another field; 4) desire for different type of patient contact; and 5) wanting to have children in the next 5 years.

When disaggregated by sex, there were 7 attributes identified that negatively influenced IC choice differently by sex. Women were more likely to be negatively influenced by all 7 of these factors compared with men (in descending order): 1) greater interest in another field; 2) little flexibility in job prospects/opportunities over a lifetime; 3) physically demanding nature of job (e.g., wearing heavy lead); 4) radiation exposure concerns during childbearing; 5) “old boys club” culture; 6) lack of female role models; and 7) sex discrimination or harassment (Table 3).

Principal component analysis revealed 5 major factor categories (in descending order of influence): culture (beta = 0.51), work conditions (beta = 0.50), job opportunities (beta = 0.45), schedule (beta = 0.42), and other interests (beta = 0.08) (Table 3, Figure 3).



Examples of free-text responses regarding why IC was not chosen as a subspecialty highlight these findings, with emphasis on work/life balance: “Two children and a physician wife. Want better work/life balance,” and “Lifestyle demands with balancing family life at home.” There were also concerns about radiation: “Considering I already have back issues, wearing lead would further aggravate it. In addition, I was concerned about lifetime risk of radiation exposure,” and “Concerns over radiation for child bearing.” Fellows also cited the demanding, unpredictable schedule as a deterrent: “I decided on a field that would allow me to be a specialist...while not having to be on call overnight and coming in.” Lack of mentorship was also cited: “I didn’t want to be an interventional cardiologist because I didn’t identify with this subspecialty and did not have a strong mentor.”

**SUBSPECIALTY DECISION RESOURCES.** In order to assist fellows in making decisions about whether to pursue IC, the majority of fellows felt that more special sessions at ACC Scientific Sessions dedicated to

addressing issues of choosing a subspecialty, career success, work/life balance, and transitioning from fellow to faculty would be helpful (63% of female vs. 57% of male IC [ $p = 0.55$ ], and 64% of female vs. 60% of male non-IC responded yes [ $p = 0.45$ ]). Of note, there was a significantly higher number of female FITs who expressed interest in having more opportunities for direct mentorship with male and female leaders in the field (67% female IC fellows vs. 61% male IC fellows [ $p = 0.55$ ], and 78% non-IC female fellows vs. 51% male non-IC fellows [ $p < 0.001$ ]).

## DISCUSSION

Despite an increasing proportion of women in most areas of medicine, the majority of interventional cardiologists are men. Although few studies have investigated the causes for this maldistribution, this study reveals 3 major novel findings which explain this and also point to solutions: 1) there are significant demographic differences among current fellows who plan to pursue IC and those who do not, with male sex

**TABLE 3 Barriers to Choosing IC as a Subspecialty**

	Factor Loading	Total (N = 314)	Men (n = 189)	Women (n = 124)	p Value
<b>Work conditions</b>					
Radiation exposure concerns during childbearing	0.82	3.0	1.0	4.0	0.001
Radiation exposure concerns for personal well-being	0.68	4.0	4.0	4.0	0.56
Sex discrimination or harassment	0.61	1.0	1.0	3.0	0.001
Wanting to have children in the next 5 yrs	0.60	4.0	3.0	4.0	0.14
Physically demanding nature of job	0.52	3.0	3.0	4.0	0.005
<b>Culture</b>					
You do not identify with other physicians in the specialty	0.73	3.0	3.0	3.0	0.97
"Old boys club" culture	0.73	2.0	1.0	3.0	0.001
Lack of encouragement from mentors	0.68	2.0	3.0	2.0	0.19
Lack of female role models	0.64	1.0	1.0	3.0	0.001
<b>Job opportunities</b>					
Poor likelihood of employment after completion of training	0.84	3.0	3.0	3.0	0.27
Little flexibility in job prospects/opportunities over lifetime	0.75	3.0	3.0	4.0	0.021
Overly competitive application process	0.71	2.0	2.0	2.0	1.00
Need to shorten training length in order to repay student loans	0.47	2.0	2.0	2.0	0.72
<b>Schedule</b>					
Uncontrollable or unpredictable lifestyle (on-call schedule)	0.80	5.0	5.0	4.0	0.88
Concern over long work hours/poor work/life balance	0.73	5.0	5.0	4.0	0.72
Did not want to extend years of training	0.67	3.0	3.0	3.0	0.24
Anticipated pressure on the job	0.47	3.0	3.0	3.0	0.62
<b>Other interests</b>					
Desire for different type of patient contact	0.83	4.0	4.0	4.0	0.49
Greater interest in another field	0.78	4.0	4.0	5.0	0.007
Technical difficulty	0.45	2.0	2.0	2.0	0.60

Values are median. Factor loadings are the correlation between the original variables and the factors; they are key to understanding the nature of a particular factor. Squared factor loadings indicate what percentage of the variance in an original variable is explained by the factor. Some respondents did not indicate sex in their survey response resulting in sex breakdown values that do not equal the total number of respondents.  
 IC = interventional cardiology.

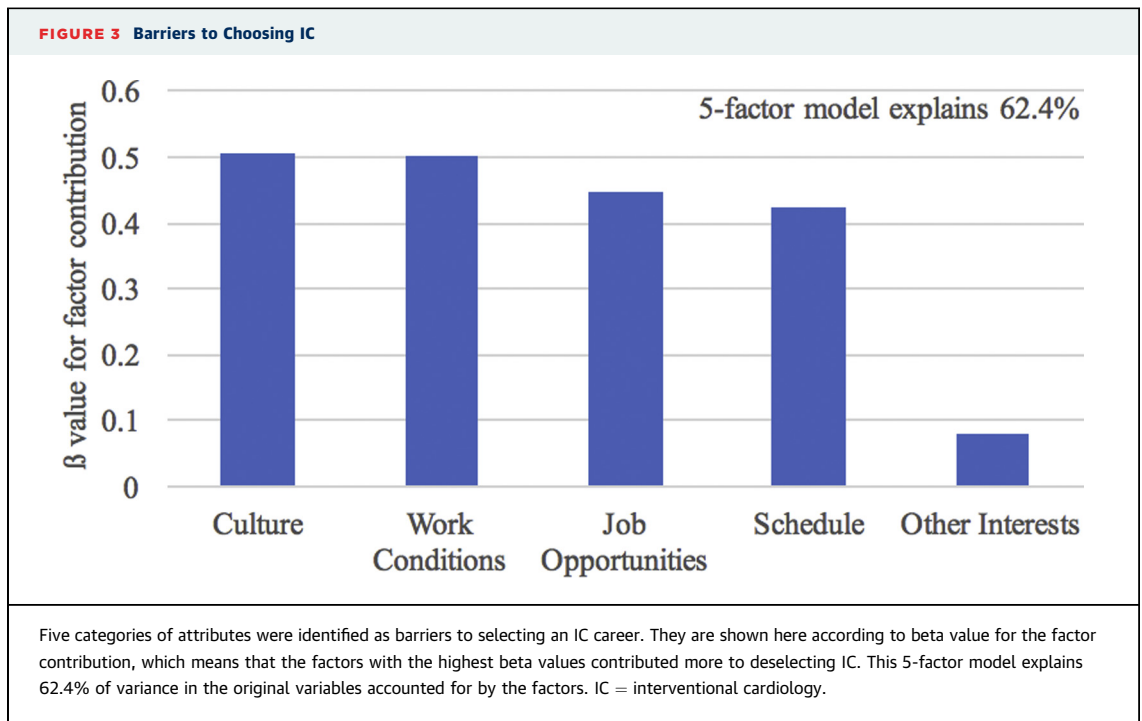
being the strongest predictor of IC choice; 2) although IC specialty decision making among men is positively influenced by a number of factors, women are significantly more likely than men to be influenced negatively by multiple unique factors; and 3) women are more interested than men in having facilitated opportunities for direct mentorship with leaders in the field, regardless of whether they pursue IC or not. Although other prior studies have examined the issue of sex differences in IC, they have either focused on an earlier stage in training (residency) (6) or a much later stage (practicing cardiologists) (8). This study is the first to examine reasons for selection of IC as a subspecialty at the exact stage of training during which the decision is made—during general cardiology fellowship.

Demographic analysis of spouse employment revealed that IC fellows were more likely to have a spouse who does not work, and conversely, non-IC fellows more likely to have a spouse who works >50 h/week. Although the lower spousal work hour demands of IC fellows may influence willingness or ability to pursue a specialty with a demanding,

unpredictable work schedule, it is unclear if it is causal. It is important to note that whereas IC fellows were more likely to have a non-working spouse, a closer look at only the female IC fellows revealed that none had a non-working spouse. Given the demands of the field of IC, it is possible that the lack of a spouse with a flexible schedule may be a major hurdle for women pursuing a career in IC.

Demographic analysis also showed that female IC fellows were significantly more likely to not have children than their male counterparts. Given that the age at which women often pursue IC training extends into the age range during which reproductive risks significantly increase (medically termed “advanced maternal age”) (9), this may make the selection of an IC career more difficult for women. Our study shows that women still plan to have children in the future in similar proportions regardless of IC career choice, which suggests that women who pursue IC are generally postponing childbearing. Despite data showing that interventional cardiologists can become pregnant safely while working in the cardiac catheterization laboratory (10), women who prefer to





postpone childbearing while completing a grueling training program in the catheterization laboratory may be more dissuaded from an IC career.

It is important to note that the motivating elements that influenced fellows to pursue IC were more pronounced among men. For example, financial factors influenced men to pursue IC more than women. This may reflect the concomitant finding that male IC fellows were more likely to have spouses who did not work compared with women. However, as the traditional family structure and attitudes towards this change over time, the family wage concept may also morph, with women seeking to garner salaries comparable to their male counterparts. Studies have shown that women cardiologists receive a significantly lower salary than men even after adjusting for measures of personal, job, and practice characteristics (11,12), which likely reflects a complex interplay of demands, perceptions, and even sex discrimination. Lower salaries for female interventionalists may compound the already high hurdles to career entry.

The most interesting findings of this study are arguably the significant differences in negative influencers to pursue IC by sex, because they suggest the areas in which women may face more barriers than men to pursuing the field. Women uniquely cited factors, such as interest in other fields, limited job flexibility, physical demands of the job, radiation during childbearing, “old boys club” culture, lack of female role models, and sex discrimination, as being

central to their decision to not pursue IC; these were not considered as important by men. These findings support those from a recent survey of trainees at an earlier stage in their training (residency), which showed that women valued work/life balance more and had more negative perceptions of cardiology than men (7). In our study, factor analysis by sex showed that for women, “likelihood of employment after completion of training” was more strongly correlated with “having mentors or role models you identify with” than men ( $r = 0.74$  for women compared with  $r = 0.33$  for men), suggesting that women may feel that mentorship is more directly related to future employment opportunities.

In the category of work conditions, there are tremendous advancements in technology that may offer improved conditions for both men and women pursuing IC. For example, concerns over the physical demands of wearing heavy lead and radiation exposure may be resolved with increased adoption of weightless lead and robotic percutaneous cardiovascular interventions (PCI). Regarding radiation exposure, consensus statements have helped educate trainees that current data do not suggest an increased risk to the fetus of pregnant women in the catheterization laboratory with the use of standard protective measures (13). Yet findings from a worldwide survey by the European Association of Percutaneous Cardiovascular Interventions (EAPCI) Women Committee cited radiation concerns as the second highest reason



that women do not pursue IC, among both trainees and practicing cardiologists who may have made their subspecialty decisions decades ago (8). By focusing on current FITs, our study specifically addresses the fact that regardless of recent consensus statements on radiation safety in pregnancy, this concern still remains a major deterrent to pursuing the field of IC. Balancing these concerns with the desire to maximize learning during interventional fellowship can further complicate training for female fellows, who may also feel the need to hide their pregnancy so they are not viewed as less dedicated to their job by their predominantly male peers (“the motherhood penalty”) (8,14).

With regard to the demanding, unpredictable schedule of interventionalists, there may be changes that can be made to the field to make it more manageable for both sexes, as well as for older interventionalists who may find IC schedules untenable. For example, many other fields have transitioned to shift-based schedules (e.g., anesthesia, emergency room, obstetrics and gynecology [OBGYN]). Although the predominantly female OBGYN profession is similarly procedural with unpredictable scheduling, OBGYN physicians have largely shifted their culture so that patients expect the on-call physician to deliver their care. In IC, some interventionalists remain territorial about performing PCIs, taking great pride in the skills required to perform difficult PCIs and feeling longitudinal ownership over their patients. These historical practice paradigms may have to shift in order to ensure that the best talent—both men and women—are attracted to the field of IC.

With regard to training schedules, the development of alternative training tracks may provide more options for fellows who either do not wish to postpone childbearing, or who may prioritize completing substantial research or paying off student loans before embarking on further subspecialty training. For example, developing an accepted track that allows for 1 to 2 years of alternative research work or clinical practice after general cardiology fellowship but before starting interventional fellowship may offer one solution. Another possibility is creating a “competency-based” short-track program from internal medicine training to cardiology fellowship that eliminates 1 year of training; such a model is currently being piloted at 4 institutions across the United States with sponsorship from the American Board of Internal Medicine (15).

FIT feedback on how to focus future interventions highlighted the desire for more special sessions at ACC Scientific Sessions dedicated to career issues. Of

note, significantly more women expressed interest in more facilitated opportunities for direct mentorship, highlighting that women potentially face higher barriers to connecting with established mentors in the field (who currently are predominantly men). Given that two-thirds of female cardiologists report experiencing sex discrimination (nearly 3 times the rate in men) according to the most recent ACC Professional Life Survey (6), a directed campaign to change the entire culture of our field may be necessary to ensure that the messaging from existing cardiologists reaching young trainees is appropriate. For example, there needs to be a clear distinction between sex equity and benevolent sexism (i.e., ‘this might not be the best choice for you if you want to have time for your family’). As more men and women desire to take an active role in both their career and home lives, mentors must not allow their assumptions of mentees’ goals to guide them.

**STUDY LIMITATIONS.** First, the survey was voluntary with a small incentive for participation. As such, respondents may be skewed toward either those with a particular interest in IC, sex disparities, or small financial incentives. Our survey had a 10% response rate, which is consistent with the average 11% response rate for survey research in general, but still does not capture the perspectives of all FITs (16). This may reflect either indifference related to the topic or issues with survey methodology and ability to engage large numbers of participants (for example, the e-mailed survey was open for a short period for completion, and some FITs may not have been identified if not on the Listserv). Additionally, although the multiple-choice survey format allowed for ease and speed of completion, and blank spaces were offered for free-text responses by respondents, the options for response may have inadvertently biased the responses. Also, different numbers and types of questions were presented to respondents depending on their answer to prior questions, making direct comparison between respondents more difficult. EP fellow responses were excluded from the primary analyses in this study in order to obtain a clear signal about IC (given their overlapping career concerns, such as radiation exposure). However, the importance of sex inequities in EP is also significant and warrants further study. Sex analysis between IC and non-IC resulted in small cell sizes for some of the analyses, which may have affected significance values. The 62% variance explained in the exploratory principal component analysis suggests that the elements that affect career decision making are complex, nuanced, and not fully captured here.

## CONCLUSIONS

Even in the modern era of improved representation of women across most other medical specialties, this study provides evidence that IC lags behind. Positive drivers that motivate fellows to choose IC more predominantly influence men, whereas barriers to entering the field impact women more significantly. If we hope to have a workforce that reflects the diversity of our patients and optimizes delivery of care, directly addressing the unique barriers that are cited by women will maximize the impact of our efforts.

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## PERSPECTIVES

**WHAT IS KNOWN?** Despite increases in the proportion of women across numerous medical and surgical specialties over the last decade, IC still ranks at the bottom in terms of representation of women. It is unclear why this maldistribution persists.

**WHAT IS NEW?** This study identified many factors that uniquely dissuade female cardiology fellows from pursuing IC compared with male cardiology fellows, largely related to the culture of IC as a subspecialty.

**WHAT IS NEXT?** Targeted resolution of the specific factors identified may provide the most impact in reducing sex imbalances in the field.

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**KEY WORDS** interventional cardiology, sex differences, women

**APPENDIX** For the survey questionnaire, please see the online version of this paper.