GO RED FOR WOMEN SPOTLIGHT

American Heart Association.

A Paucity of Female Interventional Cardiologists: What Are the Issues and How Can We Increase Recruitment and Retention of Women?

Cindy L. Grines, MD ; Michele Voeltz, MD ; Allison Dupont, MD; Deepali Tukaye, MBBS, PhD

Throughout the world, there is a major underrepresentation of women in interventional cardiology (IC).[1, 2, 3] Although 50% of medical school graduates in the United States are women, only 21% of cardiology fellowships are awarded to women, and only 13% of practicing cardiologists are women.[4] Even more discouraging is that among operators who perform coronary interventional procedures in the United States, only 4.5% are women.[2] Despite efforts from US professional societies to better engage and support women in cardiology, these numbers remain unchanged over the past several years and have been referred to as the "leaky pipeline."

In this issue of the *Journal of the American Heart Association* (*JAHA*), to investigate some of these issues among interventional cardiologists in Italy, the Italian Society of Interventional Cardiology performed a survey of its members.[5] Notably, 26% of respondents were women. Women worked hard, and spent similar time in the laboratory and being "on call" compared with men. Women were more likely to be aged <40 years (49% versus 34%), single (22% versus 9%), and childless (56% versus 44%), all $P<0.01$ compared with men. The younger age among women speaks to the success of Italy in attracting young women to IC. But the fact that 56% of female interventional cardiologists in Italy are childless is concerning; hopefully, that is personal choice rather than thinking a family cannot fit with their career … clearly it can. The Italian laws prohibiting women from working in the catheterization laboratory during pregnancy are not based on scientific data and must be modified!

Italian female interventional cardiologists experience more discrimination, and 74% of women thought that being female could preclude or render more difficult training in IC. Pregnancy and breastfeeding were thought to be particularly problematic. Most interventional cardiologists believed that radiation counseling at their institution was inadequate, not specific to sex and age, and not designed to prevent infertility or reduce exposure to gonads and/or highly radiosensitive tissue, such as breast tissue. These observations are similar to our experience in the United States, with radiation safety only discussed during fellowship and the unisex (male) lead aprons that we continue to wear. Clearly, there is room for improvement at a global level.

The Society for Cardiovascular Angiography and Interventions published a Consensus Document on Occupational Radiation Exposure to the Pregnant Cardiologist and Technical Personnel.[6] The authors reviewed current scientific data about risk to the fetus from occupational radiation exposure and recommended measures to reduce radiation exposure. They concluded that "risks to the fetus of pregnant interventional cardiology physicians and staff are extremely low provided that good radiation safety practices are used and dose limits are respected. Therefore, concerns over radiation exposure should not be a barrier to choose a career in interventional cardiology, nor should they arbitrarily limit an existing operator's choices on work environments during pregnancy." Since that time, newer low-dose

imaging systems and radiation safety devices and techniques have further improved, and should result in zero exposure to the fetus.

One of the problems in the United States is lack of access to radiation emission data from individual laboratories within a hospital or between hospitals. One study showed marked variability in operator radiation exposure, and it was predicted mostly by the hospital rather than case complexity.[7] It is not known whether this was because of operator carelessness or because of old, faulty catheterization laboratory imaging systems.

Another issue is conflicting recommendations about radiation limits during pregnancy. Various US agencies recommend maximum exposure to the fetus of 5 mSv, whereas an international commission recommends 1 mSv.[6] The good news is that the underapron badge typically reads zero exposure, and the abdomen, uterus, and amniotic fluid will further reduce fetal exposure. Thus, interventional cardiologists can safely continue cases during pregnancy.

On a positive note, the Italian report suggested an increasing number of young female interventional cardiologists in Italy. Furthermore, a recently published European survey reported that female operators accounted for 18% of interventionalists, and female fellows accounted for 24.5%.[8] Thus, European countries appear to be doing a much better job at attracting and retaining female interventional cardiologists, compared with other regions.

The reasons for underrepresentation among women in the United States are multifactorial. Cardiology is not a required rotation for medical students (despite cardiovascular disease being the number 1 cause of death), whereas other rotations with a seemingly lower prevalence of disease in the population (such as psychiatry, neurology, and surgery) are mandatory. Cardiology is considered an "elective" in medical school, but it is selected by a small minority of students. Thus, at the end of medical school, the choice of a residency training program typically occurs without any exposure to the rewarding career of cardiology.

Moreover, the pathway to IC in the United States is long (4 years undergraduate, 4 years medical school, 3 years internal medicine, 3 years general cardiology, then 1–2 years of IC). Thus, even if one has no gaps in education or training or spent additional time as chief resident, an IC will not finish training until the age of 33 or 34 years. Furthermore, in a 2019 survey of 16 000 graduating medical students, 60% were aged >26 years (43% were aged 27–29 years, 12% were aged 30–32 years, and 6% were aged >32 years).[9] Therefore, a substantial number of physicians may not finish IC training until their late 30s. That is an enormous time commitment for anyone, let alone a woman who may be thinking of starting a family.

The long duration of education in the United States can definitely influence which career is selected. It is unusual for combined undergraduate/medicine programs to exist; the number of spots is limited, the programs are highly competitive, and the combination may only reduce the required educational duration from 8 to 7 years.[10] In fact, in 2019, only 2.7% of medical students graduated from a joint bachelors/MD program.([9], [11]) These accelerated programs are much more common in other countries; perhaps the US university systems can learn from them and expand these important pathways.

Similarly, accelerated training programs that combine internal medicine and cardiology are extremely rare. The American Board of Internal Medicine has developed a pilot program; however, this is limited to few programs and trainees.([12]) Some have speculated that the lack of responsiveness in shortening educational programs has more to do with universities protecting tuition revenue,the American Board of Internal Medicine protecting the board examination revenue, and hospitals protecting manpower needs, than what is appropriate for trainees.

There is a perception among interventional cardiologists that reducing each step along the educational pathway by one or more years would not negatively impact our training. Indeed, cardiothoracic surgical training no longer requires an 8-year commitment because of the previous

mandatory 5-year general surgery residency. In fact, cardiothoracic surgery now has a 6-year integrated program that is designed to allow more time and focus in cardiothoracic surgery ([13]).[12]

Work/life balance was an important influence in 77% of US medical school graduates selecting a specialty.[9] Unfortunately, IC is considered by many to be too demanding. In the Italian survey, both sexes indicated that being an IC has a decisively negative impact on organizing their family life.[5] In a recent survey of 574 US cardiology fellows in training, women were influenced against pursuing IC because of little job flexibility and the physically demanding nature of the job ([14]).[13] With balance considered important to 70% of physicians regardless of sex, perhaps now is the time to work on improving the IC lifestyle. Some hospitals have hired well-trained physician shift workers to cover interventional emergencies that occur on evenings and weekends, some have hired cardiac intensivists and cardiac nocturnists to improve the calls and rounding burden, and some have allowed job sharing.

Although we can give the above recommendations to recruit and retain women in IC, it should be understood that each individual has unique insights and social and professional issues that may influence decisions. Our Northside Cardiovascular Institute is an employed group practice that has 4 female interventional cardiologists! Our perception and pathway to "making it work" may be of value to readers.

Decision to Go Into IC

Cindy Grines (CG): I was readily accepted for IC; however, general cardiology was another story. I completed my medicine training at an institution that never had a female fellow. That institution did not accept me into fellowship, despite being a very strong candidate (I was accepted to all others, 8 different programs with greater stature). This rejection motivated me to prove myself and ultimately that institution awarded me the "Alumni Achievement Award." They also tried to hire me, but I declined.

Michele Voeltz (MV): I would like to say that being a physician was my lifelong dream, but honestly, it was not. I wanted to be a Supreme Court justice, timely, don't you think? So, how did I end up in medicine? I had a counselor in high school who told me I would "never get into medical school as a Black girl from a poor blue-collar town." Challenge accepted. Seven years later, I walked across the stage to receive my MD. Since that time, the doubts have continued. I have been told that I will "never" match into cardiology, "never" get an interventional fellowship, and "never" run a high-volume catheterization laboratory. To date, I have accomplished 2 of the 3, and I am planning to achieve the third as soon as possible.

Allison Dupont (AD): After deciding to apply for interventional training, I had several male attendings who supported my decision and encouraged me to go after my dreams. As we had never had a female interventional fellow in my training program, I needed that encouragement and I am grateful that I had these mentors.

Deepali Tukaye (DT): I recall a lot of my faculty and friends looking at me with raised eyebrows. "The lifestyle is hard and not sustainable for women," "As a woman, it will be physically challenging," and "You are too short for interventional cardiology" were just some of the comments. I distinctly remember the day early in fellowship when a patient was bleeding from a femoral access site and one of the catheterization laboratory staff passed by me, saying "I need a man to hold pressure and stop the bleed."

Radiation

AD: When I was pregnant during my third year of fellowship, I was asked "you're not going to do any cath cases are you?" by several attendings. I now regret the decision to avoid radiation. In retrospect, I should have fought to stay in the laboratory.

CG: I stayed in the laboratory during both of my pregnancies. I spoke to 2 different radiation physicists, and both told me there would be no exposure to the fetus. Despite that, I wore 2 aprons over my abdomen (societal pressure).

MV: I have *6 children*, including a catheterization laboratory pregnancy. I would do every moment of it again.

Child Care

CG: I initially had a live-in nanny, but found it gave me an excuse to spend more time at work, so I switched to a daytime sitter. On rare occasions, I had no backup and had to bring the children to the hospital. The staff were fine … it showed my human side.

AD: My spouse is not in medicine and has been a stay-at-home father for our sons since the end of my residency when we had our first child.

Harassment/Discrimination

AD: I have been fortunate not to experience sexual harassment from coworkers or other physicians. However, I will never get out of my mind a particular fellowship program I visited where the fellows' lounge had a large poster of a half-naked woman on the wall. Scratched that program off the list right away. It was a shame because it was a great program.

MV: I have been confused with nursing staff, as most female physicians have, but also mistaken for environmental services, food services, and transport, even after introducing myself as "doctor." I have had well-known male interventional cardiologists disparage my skills even when my outcomes were superior to their own. I have been told I am not "lady-like" and had my "body language" questioned during meetings, all the while acting as the go-to worker bee.

DT: The standards by which you are judged compared to male fellows are different. The male fellows are easily accepted, and the bonding process involves largely sports and jokes. I found teaching and team building in a nonthreatening manner were effective ways to bond with the catheterization laboratory staff. I definitely had to work harder than the male fellows to prove my competency. Female trainees have to earn what male trainees are handed, no questions asked.

Work-Life Balance

AD: I will say that I do not feel like juggling (I like that word better than balancing, because there is never a perfect balance) home and work life is easy, but it is absolutely doable with the right support from family. I honestly do not believe that it is any more difficult to juggle than any other full-time career in medicine.

DT: I enjoy what I do, and at end of the day that makes all the difference. As a female IC in group practice, I have not felt that my choices have led to a harder lifestyle. However, being foreign medical graduates in a competitive field, both my husband and I have had to make sacrifices to achieve our dreams. Maintaining a long-distance relationship for some years has been the biggest sacrifice. Trust, technology, and strong friendship is how we have cherished and grown our relationship.

CG: I made the decision early on that if I wanted lifestyle I would have gone into dermatology. However, how can one study and excel for years and accept a boring career? I am passionate about cardiology since there are always new and exciting discoveries, and I am saving lives! Of course, there are times when I feel overwhelmed, but then I do something just for me and I am rejuvenated.

Conclusions

There are a few ways that the global IC community can adapt to improve our professional experience for both men and women. Being female brings unique issues, and we understand the perceived and real difficulties with being interventional cardiologists, but we love it! If we can make it work, so can you, so please consider a career in IC.

Appendix

Society for Cardiovascular Angiography and Interventions Women in Innovations 2020 Committee Members and Contributing Authors

Alexandra Lansky, MD; Patricia Best, MD; S. Ellisa Altin, MD; Suzanne Baron, MD; Megan Coylewright, MD; Allison G. Dupont, MD; Howaida El-Saeid, MD, PhD; Lauren Glassmoyer; Mayra Guerrero, MD; Micaela Iantorno, MD, MHSc; Sohah Iqbal, MD; Sasanka Jayasuriya, MD; Kathleen Kearney, MD; Katherine Kunkel, MD; Regina Lee, MD; Kalgi Modi, MD; Rita Mukerji, MD; Vivian Gar-Yan Ng, MD; Lindsay M. Prescher, DO; Sheila Sahni, MD.

Notes

The opinions expressed in this article are not necessarily those of the editors or of the American Heart Association.
For Disclosures, see page 4.
See Article by Bernelli et al.

Disclosures

None.

References

1. Capranzano P, Kunadian V, Mauri J, Petronio AS, Salvatella N, Appelman Y, Gilard M, Mikhail GW, Schüpke S, Radu MD, et al. Motivations for and barriers to choosing an interventional cardiology career path: results from the EAPCI Women Committee worldwide survey. *EuroIntervention*. 2016;12:53–59. Crossref. PubMed.
2. Wang TY, Grines CL, Ortega R, Dai D, Jacobs AK, Skelding KA, Mauri L, Mehran R. Women in interventional cardiology: update in percutaneous coronary intervention practice patterns and outcomes of female operators from the National Cardiovascular Data Registry. *Catheter Cardiovasc Interv*. 2016;87:663–668. Crossref. PubMed.
3. Burgess S, Shaw E, Ellenberger K, Thomas L, Grines C, Zaman S. Women in medicine: addressing the gender gap in interventional cardiology. *J Am Coll Cardiol*. 2018;72:2663–2667. Crossref. PubMed.
4. Association of American Medical Colleges. Table 1.3 number and percentage of active physicians by sex and specialty. https://www.aamc.org/data/workforce/reports/458712/1-3-chart.html. Accessed October 14, 2020.
5. Bernelli C, Cerrato E, Ortega R, Piccaluga E, Ricottini E, Chieffo A, Masiero G, Mattesini A, La Manna A,

Musumeci G, et al. Gender issues in Italian catheterization laboratories: the GENDER-CATH study. *J Am Heart Assoc*. 2020;9:e017537. Crossref.

6. Best P, Skelding K, Mehran R, Chieffo A, Kunadian V, Madan M, Mikhail G, Mauri F, Takahashi S, Honye J, et al. SCAI consensus document on occupational radiation exposure to the pregnant cardiologist and technical personnel. *EuroIntervention*. 2011;6:866–874. Crossref. PubMed.
7. Madder RD, Dixon SR, Seth M, Lee D, Earl T, Hill T, Shah I, Gurm HS. Institutional variability in patient radiation doses ≥5 Gy during percutaneous coronary intervention. *JACC Cardiovasc Interv*. 2020;13:846–856. Crossref. PubMed.
8. Manzo-Silberman S, Piccaluga E, Radu MD, James SK, Schüpke S, Vaquerizo B, Kunadian V, Capranzano P, Mehilli J, Buchanan GL, et al. Radiation protection measures and gender distribution in European interventional catheterization laboratories: results from the EAPCI women's survey. *EuroIntervention*. 2019;16:80–82. Crossref.
9. Medical School Graduation Questionnaire 2019 All Schools Summary Report. https://www.aamc.org/system/files/2019-08/2019-gq-all-schools-summary-report.pdf. Accessed October 14, 2020.
10. https://www.aamc.org/system/files/2019-08/2019-gq-all-schools-summary-report.pdf. Accessed October 14, 2020.
11. https://blog.prepscholar.com/ba-md-bs-md-programs-list. Accessed October 14, 2020.
12. ABIM Internal Medicine Cardiology Pilot Program. https://www.abim.org/program-directors-administrators/competency-based-medical-education-pilot-programs/internal-medicine-cardiology.aspx. Accessed October 14, 2020.
13. Thoracic Surgery Directors Association—CT Surgery Training Pathways. https://tsda.org/the-tsda/ct-residency-programs/ct-surgery-training-pathways/. Accessed October 14, 2020.
14. Yong CM, Abnousi F, Rzeszut AK, Douglas PS, Harrington RA, Mehran M, Grines G, Altin SE, Duvernoy CS; American College of Cardiology Women in Cardiology Leadership Council (ACC WIC). Gender differences in the pursuit of interventional cardiology as a subspecialty among cardiovascular fellows-in-training. American College of Cardiology Women in Cardiology Leadership Council (ACC WIC); Society for Cardiovascular Angiography and Interventions Women in Innovations (SCAI WIN). *JACC Cardiovasc Interv*. 2019;12:219–228. Crossref. PubMed.

Key Words: Editorials • discrimination • female sex • interventional cardiologist • radiation • sex • training

From the Northside Cardiovascular Institute Northside Hospital System Atlanta GA.

Correspondence to: Cindy L. Grines, MD, 721 Wellness Way, Suite 210, Lawrenceville, GA 30046. E-mail: cindy.grines@northside.com

*A complete list of the Society for Cardiovascular Angiography and Interventions Women in Innovations members can be found in the Appendix at the end of the article.

J Am Heart Assoc. 2021;10:e019431. https://doi.org/10.1161/JAHA.120.019431