SCAI Women In Innovations
Considerations for Female Interventional Cardiologists
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Introduction

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Though recent statistics show that women will outnumber men in many areas of medicine within the next decade, within the field of cardiology there are only a small proportion of female physicians (18%), and even fewer who choose the subspecialty of interventional cardiology. This trend has been shown to be consistent in many countries. In the United States, only 5.9% of board certified interventional cardiologists are women. In Italy, just 12.5% of those physicians performing interventional procedures are women.

The reasons for this discrepancy are unclear, but are likely multifactorial. Becoming a subspecialist extends training time into the childbearing and childrearing years. There are concerns regarding radiation exposure in the catheterization laboratory, especially during pregnancy. Women may be less likely to pursue invasive subspecialties due to the strenuous work schedules without much guidance on how to balance family life. Additionally, women may face professional discouragement or rejection due to a lack of female mentors in the field. Finally, it has been shown that women receive less funding than men for research endeavors and unequal pay for equal work.

Women in Innovations ("WIN") is an international initiative established by the Society for Cardiovascular Angiography and Interventions (SCAI) in part to foster the professional development of female interventional cardiologists in training, in practice, and in the research arena. WIN aims to increase the overall number of female interventional cardiologists worldwide; increase the overall number of female faculty at major medical conferences; increase the overall number of female principal investigators in clinical trials; and provide a global network of female interventional cardiologists who are able to collaborate to these ends. The aim of this WIN booklet is therefore to address the challenges surrounding the practice of interventional cardiology for women around the world in the hope of encouraging an open dialogue on how to improve and welcome more women into the profession.
Training Opportunities in Interventional Cardiology

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If a procedural subspecialty is of interest, the decision to apply to an interventional cardiology training fellowship program requires careful consideration of multiple factors, including the ones discussed in this booklet. Once accepted into any interventional cardiology training program, the training curriculum is the same for both genders. There are no known national regulations or training curricula that specifically address women. The majority of guidelines for training in interventional cardiology provide emphasis on the 3 basic areas of training for an interventional fellowship: 1) Inpatient/outpatient consultations; 2) performing interventional procedures in the catheterization laboratory; and 3) research. Each of these areas must be accomplished in order to progress as an independent interventional cardiologist, and a motivated, competent woman is well suited to each of these components. In fact, women often employ strong empathy, patience and a good bedside manner, perhaps making them better suited to be successful physicians.

If women and men are provided equal training opportunities to become successful physicians, why then is there a lack of women in interventional cardiology? Perhaps the answer is in the details.

In Europe, there are a number of grants available to both sexes which aim to facilitate further training and research. For example, the European Society of Cardiology (ESC)/European Association for Percutaneous Coronary Intervention (EAPCI) offer a training grant for additional clinical training in another ESC member country and another for further research in another ESC member country. Applicants for these grants must be under 36 years of age at the day of application deadline and be a member of the EAPCI. Age limits imposed by such training grants may place women who may have postponed their training in order to start a family at a disadvantage, and they would not have the experience necessary to apply for such opportunities.

The WIN group would therefore recommend that training and professional organizations responsible for providing training and research grants in interventional cardiology take into account the specific challenges faced by women and address these issues in their application process in order to support the successful training and subsequent progression of women as interventional cardiologists.
Maternity and Childbearing Years as an Interventional Cardiologist

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A US study surveying female physicians found that 43% thought childbearing would interfere with their career plans and 21% thought it would lead to the loss of a fellowship position. The same study found that women intentionally postponed their pregnancies due to perceived career threats. A Norwegian study showed that the number of births for a female physician is inversely proportional to her choice of subspecialty, but postponing the first child made it more likely that the woman would complete her subspecialty training. This information is concerning, but still female physicians often choose to have children in their less fertile years when there is higher biological concern for congenital defects.

In the field of medicine there is no such thing as a perfect time to start a family. The decision is up to the individual. A survey of 142 medical school deans found that only 14% of institutions had policies designed to increase gender equity with regard to childbirth and parenting, potentially providing for no time in which women feel safe having a child mid-career. In addition to the financial and career considerations created by the increased training time, female interventional cardiologists also have the added concern of occupational radiation exposure.

When an interventional cardiologist decides to have a child, communication is paramount both at the trainee and attending levels. If a woman is concerned about radiation exposure, despite the paucity of data, the most vulnerable timeframe is immediately following conception and throughout the first trimester and so the decision should be communicated immediately. Once the first trimester has passed the likelihood of miscarriage (from all causes) decreases substantially, and so this also may be a good time to communicate the decision. Some training programs and departments have policies regarding pregnancy which serve as a good starting point. For a pregnant attending, it is important to plan the schedule for the catheterization laboratory and on-call straight away. Rearranging on-call and rotations so the strenuous times occur earlier in pregnancy can be wise, as there may be no warning about a pregnancy complication and the need for time off may be urgent. Deciding whether or not to work in the catheterization laboratory when pregnant can be a personal decision. There are means in place with regard to protection and monitoring discussed in the radiation exposure section of this booklet. In addition, women may choose to work sitting down at the table if the increased load carried becomes a problem in later pregnancy.

Long working hours and sleep deprivation are also factors to consider for both maternal and fetal health. There is little in the way of guidelines or studies available to support these issues. There is, however, data that finds no increase in risk to pregnant physicians compared to the general population of pregnant women. Although the overall outcomes of women physicians were similar, studies have associated women physicians with higher preterm labor, preeclampsia and low birth weight babies. Another study done on this subject assessed female urologists compared to “the average American woman” and found urologists were older by 7-8 years, utilized fertility therapies 10 times as often, and the complication rates were greater than the lowest income bracket in the control group.

Indeed, childbearing decisions may be different depending on geographic location, and there may be more protection and financial support for physicians taking maternity leave outside the US than within. European countries give women 70-100% of their wages for up to 26 weeks, with the bill paid by the government in all countries but Switzerland. US national policies affect businesses with more than 50 employees. Small private practice medical groups often do not fit these criteria and are left to make decisions independently. There are certainly instances in which policies are more lenient and generous than the national policy but the variability is large. This is an important consideration for a woman in interventional cardiology.

There is currently no literature specifically about pregnant female interventional cardiologists, or in closely identified fields such as interventional radiology or vascular surgery. WIN aims to contribute to this area of study to potentially help women interventional cardiologists in planning their families.
Occupational Radiation Exposure

Radiation exposure and its effects continue to be an important issue preventing women from pursuing a career in interventional cardiology. Evaluating the true risk of radiation exposure from performing cardiac catheterization procedures is challenging and clear guidelines are not yet available. Despite the improvement of radiological equipment, the number of procedures has increased exponentially, as well as procedure complexity requiring greater fluoroscopy time and subsequent radiation exposure. Specifically to women, this risk is of even greater concern during childbearing years and radiation exposure has been found to be the reason for altering their career plan in cardiology in 24% of cases.

It is clear how understanding the real magnitude of radiation risk during pregnancy and educating the personnel to limit radiation exposure are critical. The radiation effects on the fetus are strictly dependent on the age of the embryo/fetus and on the dose of radiation to which it is exposed. The biological effects of high dose of radiation are at DNA level and may result in deterministic effects (intrauterine growth retardation, pregnancy loss, mental retardation, congenital malformations) or stochastic effects (childhood risk of cancer, hereditary diseases in the descendants). The overall probability of a child to have a congenital malformation or developing cancer has been estimated to be 0.07% in the general population. (Table 1 from P. West et al), shows that the probability of a child to develop cancer is only very mildly increased (0.079%) if the mother radiation exposure is 0.5-1 mSv; if the exposure is above 10 mSv the risk of a child to develop cancer will exceed 0.16%.

Unfortunately, there are no data available on the actual radiation exposure to the fetus of a mother working in the catheterization laboratory. This lack is mainly due to different approaches to the pregnancy healthcare in the various countries. In some European countries, there is a strict policy on pregnant workers and women are obliged to leave the cardiac catheterization laboratory by law as soon as their pregnancy is known. Other countries allow women to continue performing procedures if the radiation dose not exceeds 1-2 mSv throughout pregnancy. These policies are not in any way evidence-based but rather are the result of the employers/organization’s fear of litigation. A discussion and uniformity of evidence-driven policies that respect women’s choices would certainly help this issue. Nevertheless, the fact that a career could be interrupted during pregnancy can contribute to persuade a trainee not to undertake this kind of profession.

Data collections from countries in which women continue to work during pregnancy in the catheterization laboratory are essential in order to standardize the legislation on the basis of scientific background. However, being aware that there is a small increase in the risk for the fetus when the mother exposure is above 1 mSv, every pregnant worker should evaluate her own individual risk and if needed should reduce the amount of procedures during pregnancy, monthly monitoring the radiation exposure under the lead at the waist level. The mean effective dose that an expert operator takes during one working year is around 4 mSv. This means that during the pregnancy the amount of procedures performed should be halved.
Considerations for Female Interventional Cardiologists

There are several different ways to limit radiation exposure: a formal education, continued training in radiation protection and close occupational surveillance. Lead shields and proper types of lead or non-lead aprons should be utilized carefully. The thickness of these garments is also important (it has been demonstrated that a 0.25 mm lead apron absorbs ~ 96% of scatter radiation, while a 0.5 mm lead apron absorbs ~ 98%) \(^{15}\). Larger size aprons specifically for pregnant workers are also available. Another technique includes wearing an additional lead apron for double lead protection of the abdomen. Overall radiation exposure could also be limited utilizing specific working views (postero-anterior or right anterior oblique preferably) \(^{16}\). Furthermore, increasing the distance of the operator from the x-ray source is important \(^{17,18}\).

The National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP) recommend limiting occupational radiation exposure of the fetus to a value as low as reasonably achievable, but not to exceed 5 mSv (NCRP) or 1 mSv (ICRP) during the entire pregnancy respectively \(^{19,20,21}\) (Table 2). In order to reduce operator radiation exposure, implementation of X-ray protection equipment, maybe with automatic sensors to lower the flat screen detector as close as possible to the patient body, should be requested to the hospital. Furthermore, a training course for interventional fellows in radiation protection should be arranged in every training center in order to learn how to reduce operator radiation exposure (attention to fluoroscopy time, avoiding extreme angulated views, reducing the number of frames per second and frames recording).

### Table 1: Probability of a child born with a congenital malformation or developing childhood cancer.

<table>
<thead>
<tr>
<th>Conceptus dose above background (mSv)</th>
<th>Probability of a child with a congenital malformation (%)</th>
<th>Probability that a child will develop cancer (%)</th>
<th>Probability child will have a congenital malformation or that will develop cancer (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>4</td>
<td>0.07</td>
<td>4.07</td>
</tr>
<tr>
<td>0.5</td>
<td>4.001</td>
<td>0.074</td>
<td>4.072</td>
</tr>
<tr>
<td>1</td>
<td>4.002</td>
<td>0.079</td>
<td>4.078</td>
</tr>
<tr>
<td>2.5</td>
<td>4.005</td>
<td>0.092</td>
<td>4.09</td>
</tr>
<tr>
<td>5</td>
<td>4.01</td>
<td>0.11</td>
<td>4.12</td>
</tr>
<tr>
<td>10</td>
<td>4.02</td>
<td>0.16</td>
<td>4.17</td>
</tr>
</tbody>
</table>

### Table 2: Recommended occupational dose limits by National Council on Radiation Protection and Measurements (NCRP) and International Commission on Radiological Protection (ICRP).

<table>
<thead>
<tr>
<th>Body area</th>
<th>Occupational dose limit/year</th>
</tr>
</thead>
<tbody>
<tr>
<td>NCRP effective dose limits for occupational exposure</td>
<td>50 mSv 150 mSv 500 mSv &lt;5 mSv</td>
</tr>
<tr>
<td>ICRP planned occupational dose limits</td>
<td>20 mSv 150mSv 500 mSv &lt;1 mSv</td>
</tr>
</tbody>
</table>

As a female operator it is important to customize X-ray protection, taking into consideration anatomical differences such as breast size, bone density, weight and stature. These adjustments may include X-ray protective apron with more complete chest coverage to protect the left breast, left arm coverage, and double coverage at the ovary and uterus level. Decision on radial vs. femoral access should be made by the individual operator, as there is conflicting data regarding possible increased radiation exposure via the radial approach \(^{22}\). Whole body shields, though cumbersome, is another mode of protection. Robotic-assisted interventions are also being explored \(^{23}\).
Wages: Equal Pay for Equal Responsibility

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A large concern for women intending on a career in interventional cardiology is remuneration. In 1964, the British Journal of Medicine published a letter titled “Equal pay for Women Doctors”, denouncing that female physicians were paid 75% of the male rate for performing the same job. This inequality in wages persists more than 40 years later. The 2008 Employment Outlook report found that women were paid 17% less than their male counterparts. Moreover, a study based on survey data from roughly 8,000 newly trained physicians in New York showed that starting salaries in 1999 were $173,400 for male physicians vs. $151,600 for female physicians. This gap was even larger in 2008, when starting salaries were $209,300 vs. $174,000, respectively. Consistent with these observations, a Latin-American report stated that even if women represented 61% of professionals in public hospitals, only the 48% of the total wage was divided among them.

Wage disparities are often explained away as a result of women working part time or limited hours, or choosing lower paying specialties to allow for more time off raising a family. However, even after accounting for specialty, hours worked and other measures of productivity and achievement, women still earn less than their male colleagues.

Female physician researchers earn lower salaries than their male colleagues, even when statistics are adjusted for specialty, academic rank, leadership positions, publications and research time. The reasons for these discrepancies need further investigation.

WIN recommends that pay disparities in interventional cardiology be addressed to help women achieve equal pay for equal work. Women should be taught to negotiate employment contracts so that they not only include fair wages but flexible working arrangements, adequate maternity leave and good quality, affordable child-care. Salaries should also be transparent, based on a merit system, and clearly communicated (similar to the model employed by the legal world). Moreover, major efforts are needed to ensure that all individuals have access to the same job opportunities. Even though women now account for over half of the applicants to medical schools, women physicians are much less likely to reach senior positions than their male counterparts. Promoting equal opportunities requires a long-term investment in education and training, as well as policy interventions to promote access to productive and rewarding jobs. WIN supports the analysis and discussion about wage disparities as one of its aims is to facilitate the professional advancement of female interventional cardiologists worldwide.
Conclusion

There continue to be unresolved issues for women in interventional cardiology. The issues addressed in this booklet, such as pay discrepancies, radiation safety concerns and family planning, continue to be barriers to success. There are also other professional areas such as mentorship, research, and entrepreneurialism, that while not specifically touched on here, pose additional challenges. Women in Innovations (“WIN”) hopes to push all of these issues to the forefront, creating a more open dialogue in order to usher in a wave of change for female interventionalists around the world. Change is underway. Physicians are slowly taking charge over their schedules. Improvements are being made in radiation safety and cath lab equipment options. There are more women in leadership roles in interventional cardiology, creating a louder and more unified voice in support of the female physician.

Cardiovascular disease continues to be a global health burden, and women should be encouraged to join the exciting field of interventional cardiology. Through publications, research, forums, and mentoring, WIN plans to contribute to this effort by urging more thoughtful consideration of women and their value in all planning, training, educational and employment practices.

To learn more about the Society for Cardiovascular Angiography and Interventions’ (SCAI) Women in Innovations (“WIN”) initiative, and to read profiles of WIN members from around the world visit www.scai-win.org.
Citations


2. American Board of Internal Medicine’s Workforce Data. www.abim.org

3. As reported by Patrizia Presbitero, MD for the publication “Why So Few Women in Interventional Cardiology?” Carlo Di Mario, EAPCI President Royal Brompton Hospital & Imperial College, London, United Kingdom. EAPCI Column - EuroIntervention Journal - April 2010.


