The Journal of Global Radiology
ENSURING MEDICAL IMAGING ACCESS FOR ALL

ORIGINAL RESEARCH

Scarcity of Women in Interventional Radiology in Sub-Saharan Africa: Survey and Insights

Ofonime Ukweh[1], Toma S. Omofoye[2]*, Azza Naif[3], Latifa Rajab[3], Shin Mei Chan[4], Judy Gichoya[5], Fabian Laage Gaupp[4], Janice Newsome[5]

1. Department of Radiology, University of Calabar, Cross River State, Nigeria
2. Department of Breast Imaging, The University of Texas MD Anderson Cancer Center, Houston, Texas, USA
3. Department of Radiology, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania
4. Department of Radiology and Biomedical Imaging, Yale University School of Medicine, New Haven, Connecticut, USA
5. Department of Radiology and Imaging Sciences, Emory University School of Medicine, Atlanta, Georgia, USA

* **Corresponding author.** Contact: TSOmofoye@mdanderson.org

DOI: 10.7191/jgr.752

Published: 11/15/2024

Citation: Ukweh O, Omofoye TS, Naif A, Rajab L, Chan SM, Gichoya J, et al. Scarcity of women in interventional radiology in sub-Saharan Africa: survey and insights. J Glob Radiol. 2024;10(1):752.

Keywords: gender equity, interventional radiology, global health, education, radiologist shortage

Word count: 2,388

ISSN 2372-8418

Abstract

Purpose: Globally, women are underrepresented in Interventional Radiology (IR) and calls have been made to increase gender equity. In sub-Saharan Africa specifically, IR is a rapidly emerging field. However, concerns have been raised about the lack of women in IR in the region. The purpose of this study was to assess the state of women in IR in sub-Saharan Africa, with attention to their training experiences, and perceived barriers, to identiSfy opportunities to increase gender equity.

Methods: We distributed a survey to all identifiable female IR physicians and trainees in sub-Saharan Africa (SSA). The survey included questions on demographics, training experiences, barriers faced professionally, and suggestions for encouraging more women in Africa to pursue IR.

Results: Eight women in IR in SSA were identified, six of whom responded to the survey (75% response rate). Commonly cited perceived barriers include lack of training opportunities, gender underrepresentation and societal expectations. Suggestions for increasing women's participation in IR can be increased by creating more training opportunities in Africa, including gender-specific opportunities, integrating IR into diagnostic radiology training programs, developing mentoring programs, and concerted efforts by professional societies to establish dedicated committees, scholarships and sponsorship of women.

Conclusions: While interventional radiologists are few in SSA, gender disparities already exist. As increasing the number of IR physicians in low resource areas is essential to addressing health disparities, and women in IR frequently treat women's health conditions, including maternal mortality, building physician capacity in a gender-sensitive manner is essential.

Introduction

Women in interventional radiology (IR) are a minority in a historically male-dominated specialty. For example, in the United States, 27% of radiologists are women, and only 8% of interventional radiologists are women (1). The representation of women and minorities in IR in the US has been stagnant for two decades, and radiology leaders have identified achieving gender parity as a critical goal (2). To address the gender disparity in IR, it is important to quantify the issue and understand the underlying factors.

While the gender gap in IR has been studied in many regions around the world, few studies have assessed the state of women in IR in Africa. In Africa, subspecialty training in IR is currently available in only a few countries (3-8). Some data on women in IR in Arab countries includes female interventional radiologists from the North African countries of Egypt, Morocco, and Tunisia (9). In IR, women face many challenges, but targeted studies like this illustrate how the local socio-cultural environment (such as historically conservative religious and cultural beliefs in the Arab countries surveyed discouraging women from working outside the home) can contribute to gender inequality (9). Little is known about women in IR in sub-Saharan Africa, where 46 of Africa's 55 countries are located. Only three countries in sub-Saharan Africa offer IR training: South Africa, Tanzania, and Kenya (established in 2002, 2019 and 2020, respectively), attracting trainees from all over the continent (8). There are now approximately 100 interventional radiologists in The Society of African Interventional Radiology and Endovascular Therapy (SAFIRE), a transcontinental professional association of interventional radiologists in Africa, but only eight identifiable female IR physicians and trainees in sub-Saharan Africa (10). Since sub-Saharan Africa differs greatly from other regions of the world in terms of culture, resources, and training opportunities, and as IR training in the region is in its nascent stages, learning more about the professional experience of women in IR in this region could yield data useful in the quest to achieve gender parity.

The purpose of this study was to assess the state of women in IR in sub-Saharan Africa (SSA), with special attention to their demographics, training experiences, and perceived barriers.

Methods and materials

An online survey was created to assess the experiences of female IR physicians and trainees in sub-Saharan Africa. Eight female interventional radiologists were identified from The Society of African Interventional Radiology and Endovascular Therapy (SAFIRE) database, and through the existing IR training programs and professional networks. SAFIRE is the largest IR society in Africa, with members representative of interventional radiologists throughout North and sub-Saharan Africa. The 14-question survey (provided in Appendix A) consisted of multiple choice and free-text question types. The questions covered physician demographics, nationality (country of origin), training type, experience, barriers to becoming an interventional radiologist, and suggested areas of improvement. The survey was distributed electronically via an online survey platform (Google Forms, Palo Alto, CA). Participation was voluntary. Respondents granted permission for publication of the anonymized results.

Responses were collected in October 2021 and results were analyzed using SPSS. This study was approved by the Institutional Review Board at Muhimbili National Hospital in Tanzania.

Results

Six women from four countries in sub-Saharan Africa responded to the survey, for a response rate of 75%. The respondents included one attending physician and five trainees.

Age group

The respondents' age range was 30-42 years.

Educational pathway

In most of SSA, the minimum educational requirements prior to a career in IR include completion of a six-year bachelor's degree (Bachelor of Medicine and Bachelor of Surgery). Radiology certification is earned through a postgraduate degree (Master's in Diagnostic Radiology). The length of diagnostic radiology training varies greatly in Africa, from 3-7 years depending on the individual program8. Following this, trainees may undergo further postgraduate training in a 1–2-year dedicated IR training program.

All six respondents received training in diagnostic radiology and subsequently entered a 2-year IR fellowship program.

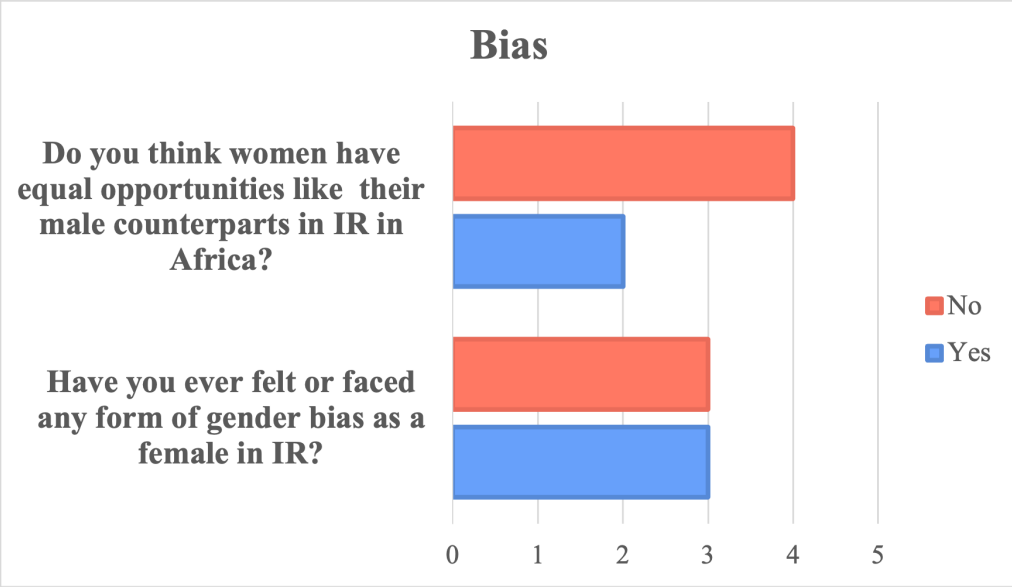
Support

Trainees enrolled in IR training programs in SSA are responsible for tuition fees, as well as cost of living. The main source of financial support in pursuing IR was the respondent's spouse for three respondents and the employer, a scholarship, and personal funds for one respondent each. Of note, Tanzanian nationals enrolled in the IR training program receive financial assistance/ scholarships through government programs.

Challenges faced by women in IR in SSA

Of the five respondents who answered the question about the biggest perceived challenges faced by women interested in IR, four identified gender

Figure 1. Women's experiences with gender-related issues in IR. *(n = 6)*



underrepresentation, three identified lack of training opportunities, and one identified lack of support. Other challenges reported were work-life balance conflicting with family responsibilities (cultural gender roles) and acceptance by peers (gender stereotype), reported by one of the five respondents (Table 1).

Regarding gender relations, the majority believed women did not have equal opportunities in IR in Africa compared to male counterparts (Figure 1), and 3 of 6 respondents (50%) reported experiencing gender bias (Figure 1). Survey participants who reported experiencing gender bias were asked to give a brief description of their experience; 2 participants responded (Table 2). Both reported discriminatory behavior and exclusion associated with their age and/or gender; one respondent's experience with discrimination occurred both during training and as an attending. Also, one participant reported being negatively affected by the perception that women should not be subjected to radiation.

Suggestions for addressing concerns of women in IR

Responses to the question "What do you think can be done to encourage more women to pursue a career in IR in Africa?" are detailed in Table 2. These included increased exposure to IR (4 of 6 respondents), promotion of mentorship/visibility of women in IR (3 of 6 respondents), and increased training opportunities in Africa (2 of 6 respondents); one of the latter suggesting dedicated training opportunities for women.

Discussion

We identified eight women in IR (including three physicians and five trainees). Of the six respondents to the survey, the biggest perceived challenges reported were gender bias/underrepresentation (4 of 5) and lack of training opportunities (3 of 5). Three of six respondents reported experiencing gender bias. Other challenges reported were lack of support, difficulties with work-life balance and acceptance by peers.

There is a dire shortage of women in IR in SSA. At the time of writing, the three IR training programs in SSA have produced approximately 100 interventional radiologists distributed throughout the region, only eight of whom are women (six trainees and two consultants (attendings). In Africa, women physicians have steadily increased, with 28 percent of African doctors being female as of this writing (11). In South Africa, the ratio of male to female physicians is 60% to 40%, in Tanzania, 67% to 33%, and in Nigeria, 65% to 35% 12–14. The underrepresentation of women in IR in SSA is consistent with global data on gender inequity in IR. In the United States and United Kingdom, women make up approximately 10% of interventional radiologists (2,15,16). In Egypt, a national survey revealed the proportion of female IR consultants (attendings) to be 5.9% (17). In China, the proportion of women in IR hovers around 10% (4). Women in IR are critical in sub-Saharan Africa. Previous work has demonstrated that in sensitive medical situations, particularly those involving obstetrical-gynecological issues, female patients tend to prefer female providers (18,19). Khafagy et al. demonstrated that many Arab female patients, especially those from conservative cultural

Table 1. Challenges faced by women in IR in SSA.

What do you feel are the biggest challenges as a woman in Africa wanting to pursue IR?
"Low numbers of women."
"Male dominance."
"Not getting enough support and lack of training programs available."
"Lack of opportunities."
"Acceptance among peers, acceptance with especially older senior male colleagues, work-life balance with young family responsibilities, lack of training opportunities."
If you have experienced gender bias, can you please share briefly your experience?
"Less qualified male colleagues are given preferential treatment and more learning opportunities."
"Told by senior colleagues that women should not be getting radiation."
"Difficulties in getting admission rights in some facilities."
"Being bullied by male colleagues."

Table 2. Suggestions for improving women's involvement in IR.

What do you think can be done to encourage more women to pursue a career in IR in Africa?
"Increased IR awareness."
"Encourage more talks from the women who are already in IR society to share their stories."
"To make in known through integration with diagnostic radiology and to encourage them by showing them what IR can do."
"Make the training available in more African countries."
"By having many more women entering the field who can be an example and mentor other women. Also by having dedicated training slots reserves for women."
"Increase training opportunities for women and improved mentorship."

and religious backgrounds, prefer female interventional radiologists over male interventional radiologists to complete their procedures and examinations (9). In addition, IR interventions can effectively reduce morbidity, as in the case of uterine fibroids, a common condition among women of African descent that often leads to elective hysterectomies, which have high complication rates (20). The Sustainable Development Goal of reducing maternal mortality lies partly in treating postpartum hemorrhage effectively, which interventional radiologists can do (21,22).

The majority of survey respondents identify female underrepresentation as a challenge, and 50% report overt bias and discrimination. Although training opportunities are a challenge in SSA, respondents to our study also expressed the view that they had fewer opportunities than men, and included descriptions of a lack of access to learning opportunities. This concern of gender bias and discrimination in SSA is different from studies in high-income areas, such as Australia and Europe, where gender bias appears to have less influence on the state of women in IR (5,7).

Compared to other specialties, interventional radiologists may spend more time in the hospital or on call and work irregular hours. Across cultures worldwide, there are different levels of cultural expectations that women prioritize family over career. Consequently, there may be a perception in some cultures that women physicians would have difficulty carrying out IR responsibilities. In our study, the majority of respondents were less than 40 years old, and 50% of the participants referred to IR as "hard to combine with family/pregnancies," thus the concerns of fertility, pregnancy, and domestic responsibilities are likely acute. Globally, there is mixed data on the influence of gender roles on the gender imbalance in IR; but according to Khafagy, in North Africa and other Middle Eastern countries, gender bias and expectations are decreasing, with "minimal contribution" to gender imbalance (17). In contrast, the influence of gender stereotypes and cultural expectations on gender imbalance in IR may be high in sub-Saharan Africa, as respondents to our study identified family responsibilities, peer acceptance, and work-life balance as deterrents to IR careers for women. In our study, more respondents identified gender underrepresentation, rather than gender bias, as one of their biggest challenges. This implies high tolerance for bias but prioritization of representation, female support and belonging. Notably, these concerns may not be driven (primarily) by IR practitioners but by the surrounding culture.

In our study, concerns about radiation risk were uncommon, reported by one respondent. In previous studies of women in IR globally, concerns about radiation risk were a commonly cited deterrent in China and Australia (4-5). While publications have demonstrated that radiation risk is no greater than baseline background radiation

dose with proper technique and shielding (23-25), IR organizations must clearly convey the minimal risks that workers face, especially during pregnancy, and underscore the workplace safety protocols that protect them.

Solutions

In our study, the majority of respondents were younger than 40. Data from Egypt and China indicate a gradual increase in the proportion of female attendings, fellows, and residents in IR (4,17). In Egypt, women comprise 5.9% of IR attendings, but 34% of residents (17). Between 2004 and 2014, the percentage of women in IR in China almost doubled, with the highest rates in the 30-39 age group (4). While the IR gender disparity is stagnant in some regions, there are encouraging signs in others (2,4,17). These provide some examples of successful interventions such as increased exposure to the field, mentorship, and increased sponsorship by professional organizations.

Exposure/awareness of the field

Increased exposure to IR is suggested as crucial to increase women in the field. Female trainees in Canada, US and Australia are less likely to consider IR than male counterparts, and the authors of a Canadian study suggest that less interest in IR by female medical students can be partially attributed to poor awareness of the specialty (3,5,6). Anecdotally, professional societies—including the Society of African Interventional Radiology and Endovascular Therapy (SAFIRE), Road 2 IR, the Radiological Society of North America, The Pan Arab Interventional Radiology Society, and the Cardiovascular and Interventional Radiological Society of Europe—have been instrumental in increasing IR awareness and educational opportunities among providers, patients and trainees in sub-Saharan Africa, but it appears that continued effort is needed, especially outreach to increase awareness among female trainees (10,26-30).

Mentorship/representation

In line with global studies, our results confirm that mentorship is one of the most important issues. The intertwined themes of cultural gender roles and lack of mentorship could be addressed by female representation. The increase in numbers of young women in IR in Egypt has been attributed to increased mentorship (17). While female mentors can serve as role models who demonstrate success on both personal and professional fronts, many of today's successful women in IR have benefited from male mentorship (7).

Financial support

In our study, four of six respondents used personal or family funds to cover tuition expenses. Anecdotally, government assistance was available to the Tanzanian citizens to defray costs, as part of healthcare reform prioritizing workforce capacity building and improving health outcomes and equity among women nationally (31). Other ministries of health and educational institutions have considered implementing similar tuition assistance programs to support training of women in IR, as they could become instrumental in improving health outcomes in their home countries (9,32).

Increased sponsorship by professional organizations

Survey respondents suggest specific efforts of professional IR societies to highlight female membership. Indeed, it has been demonstrated that increased numbers of female conveners of scientific assemblies correlate with increased numbers of female speakers and representation (7,17,32). Women remain infrequently represented across major IR societies, with no women in leadership positions in the Interventional Radiology Society of Australasia or the Cardiovascular and Interventional Radiological Society of Europe in 2019 (5). Professional societies could consider creating specific committees dedicated to serving women in IR and developing scholarships to financially support women interested in IR training.

Limitations

There are several limitations to this study. Given the limited number of women in IR in sub-Saharan Africa, the sample size was small, and thus may not capture all gender-based needs of women that may be interested in careers in interventional radiology.

Conclusions

Sub-Saharan Africa not only suffers from a scarcity of formal IR training programs, but also suffers from a scarcity of female interventional radiologists. To our knowledge, this is the only study examining the state of women in IR in SSA. Gender inequality in the IR workforce in Sub-Saharan Africa may be due to lack of exposure and training opportunities, but female underrepresentation and gender stereotypes may play a larger role in SSA compared to other regions. Potential solutions include increased exposure, mentorship and support from professional societies. In SSA, IR training opportunities are in their infancy, so improving female representation now could have a significant impact on gender parity and women's health outcomes.

Acknowledgments

The authors would like to thank Drs. Sarah Khoncarly and Mwivano Shemweta for their assistance with the project.

Conflicts of interest

The authors report no conflicts of interest.

References

1. Parikh RS, Shamimi-Noori S, Reddy S, Gade T, Nadolski GJ, Hunt SJ. Demographic trends in female interventional radiology trainees with the advent of the integrated interventional radiology residency. J Am Coll Radiol. 2021;18(10):1451-1455. Available from: https://doi.org/10.1016/j.jacr.2021.06.016

2. Higgins MCSS, Hwang WT, Richard C, Chapman CH, Laporte A, Both S, et al. Underrepresentation of women and minorities in the United States IR academic physician workforce. J Vasc Interv Radiol. 2016;27(12):1837-1844.e2. Available from: https://doi.org/10.1016/j.jvir.2016.06.011

3. Li O, Ross M, Wiseman D. Women in interventional radiology: exploring the gender disparity in Canada. Curr Probl Diagn Radiol. 2021;50(2):115-118. Available from: https://doi.org/10.1067/j.cpradiol.2020.02.007

4. Zeng CH, Lu J, Zhu HD, Teng GJ. Benchmark status of women interventional radiologists in China. J Vasc Interv Radiol. 2021;32(7):974-982. Available from: https://doi.org/10.1016/j.jvir.2021.02.026

5. Foo M, Maingard J, Wang M, Kok HK, Chandra RV, Jhamb A, et al. Women in interventional radiology: insights into Australia's gender gap. Clin Radiol. 2020;75(7):560.e1-560.e7. Available from: https://doi.org/10.1016/j.crad.2020.03.030

6. Huasen B, Suwathep P, Khan A, Connor B, Holden A. Female medical student impression of interventional radiology: what can we do to improve this? Diagn Interv Radiol. 2021;27(4):542-545. Available from: https://doi.org/10.5152/dir.2021.20378

7. Wah TM, Belli AM. The interventional radiology (IR) gender gap: a prospective online survey by the Cardiovascular and Interventional Radiological Society of Europe (CIRSE). Cardiovasc Intervent Radiol. 2018;41(8):1241-1253. Available from: https://doi.org/10.1007/s00270-018-1967-3

8. Iyawe EP, Idowu BM, Omoleye OJ. Radiology subspecialisation in Africa: A review of the current status. SA J Radiol. 2021;25(1):2168. Available from: https://doi.org/10.4102/sajr.v25i1.2168

9. Khafagy RTM, Abd El Tawab KA, Hammami N, Bouklata S, Findeiss L, Arabi M. Experience of women in IR in the Arab world: survey by the Pan Arab Interventional Radiology Society. J Vasc Interv Radiol. 2020;31(7):1158-1163.e2. Available from: https://doi.org/10.1016/j.jvir.2020.03.019

10. Society of African Interventional Radiology & Endovascular Therapy. SAFIRE – Promoting interventional radiology in African countries. Accessed 2023 Jun 29. Available from: https://africasafire.com/

11. Boniol M, Mc Isaac M, Xu L, Wuliji T, Diallo K, Campbell J. Gender equity in the health workforce: analysis of 104 countries. Working paper 1. Geneva: World Health Organization; 2019 (accessed 2023 Jun 29). Available from: https://apps.who.int/iris/bitstream/handle/10665/311314/WHO-HIS-HWF-Gender-WP1-2019.1-eng.pdf

12. Tiwari R, Wildschut-February A, Nkonki L, English R, Karangwa I, Chikte U. Reflecting on the current scenario and forecasting the future demand for medical doctors in South Africa up to 2030: towards equal representation of women. Hum Resour Health. 2021;19(1):27. Available from: https://doi.org/10.1186/s12960-021-00567-2

13. Duke Global Health Institute. Tanzania's first female physician begins medical school, builds alliances with US Institutions. Durham (NC): Duke Global Health Institute; 2009 Nov 2 (updated 2013 Oct 25, accessed 2023 Jun 29). Available from: https://globalhealth.duke.edu/news/tanzanias-first-female-physician-begins-medical-school-builds-alliances-us-institutions

14. Statista. Distribution of doctors in Nigeria from 2017 to2019, by gender. New York: Statista Research Department; 2021 Aug (accessed 2023 Jun 29). Available from: https://www.statista.com/statistics/1260797/distribution-of-doctors-in-nigeria-by-gender/

15. Association of American Medical Colleges. Physician specialty data report. Washington (DC): AAMC; 2022 (accessed 2023 Jun 29). Available from: https://www.aamc.org/data-reports/data/2022-physician-specialty-data-report-executive-summary

16. Bailey C, Sok M, Komorowski D. Entrance of women into interventional radiology lags behind other surgically oriented specialties. J Vasc Interv Radiol. 2017;2(S)(28):S187-S188. Available from: https://doi.org/10.1016/j.jvir.2016.12.1061

17. Khafagy RM. Egyptian females' experience in interventional radiology field. Arab J Interv Radiol. 2019;3(1):1. Available from: https://doi.org/10.4103/AJIR.AJIR_28_18

18. Nolen HA, Moore JX, Rodgers JB, Wang HE, Walter LA. Patient preference for physician gender in the emergency department. Yale J Biol Med. 2016;89(2):131-142. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4918861/

19. Riaz B, Sherwani NZF, Inam SHA, Rafiq MY, Tanveer S, Arif A, et al. Physician gender preference amongst females attending obstetrics/gynecology clinics.

Cureus. 2021;13(5):e15028. Available from: https://doi.org/10.7759/cureus.15028

20. Michael D, Mremi A, Swai P, Shayo BC, Mchome B. Gynecological hysterectomy in Northern Tanzania: a cross- sectional study on the outcomes and correlation between clinical and histological diagnoses. BMC Womens Health. 2020;20(1):122. Available from: https://doi.org/10.1186/s12905-020-00985-9

21. Yang Y, Moore A, Gaupp FL, Ahuja R, Sanyika C, Makris GC. A call to action; an open letter to WHO from the international interventional radiology community. CVIR Endovasc. 2021;4(1):3. Available from: https://doi.org/10.1186/s42155-020-00195-2

22. Droti B, O'Neill KP, Mathai M, Yao Tsidi Dovlo D, Robertson J. Poor availability of essential medicines for women and children threatens progress towards Sustainable Development Goal 3 in Africa. BMJ Glob Health. 2019;4(Suppl 9):e001306. Available from: https://doi.org/10.1136/bmjgh-2018-001306

23. Marx VM, Niklason L, Mauger EA. Occupational radiation exposure to interventional radiologists: a prospective study. J Vasc Interv Radiol. 1992;3(4):597-606. Available from: https://doi.org/10.1016/S1051-0443(92)72903-0

24. Vu CT, Elder DH. Pregnancy and the working interventional radiologist. Semin Intervent Radiol. 2013; 30(04):403-407. Available from: https://doi.org/10.1055/s-0033-1359735

25. International Commission on Radiological Protection. Pregnancy and medical radiation. Ann ICRP. 2000;30(1):iii-viii, 1-43. doi: 10.1016/s0146-6453(00)00037-3. Available from: https://doi.org/10.1016/S0146-6453(00)00024-5

26. Kaur M, Gaupp FL, Rukundo I, Naif AA, Lwakatare F, Mbuguje EM, Asch M. Interventional radiology awareness among clinicians at Muhimbili National Hospital, Tanzania. Cardiovascular and Interventional Radiology. 2021;44:658-61. Available from: https://doi.org/10.1007/s00270-020-02685-1

27. Silva CF, Elizondo-Rojas G, Atalabi O, Karçaaltincaba M, Morana G, Mahmood U, et al. RSNA Committee on International Radiology Education: 25 years of global education outreach. Radiographics. 2020;40: 1938–1952. Available from: https://doi.org/10.1148/rg.2020200100

28. El Tawab KA, Arabi M. Locoregional challenges for interventional radiology practice in the Middle East/North Africa. Cardiovasc Intervent Radiol. 2022;45(10):1557-8. Available from: https://doi.org/10.1007/s00270-022-03167-2

29. Cazzato RL, Garnon J, Gangi A. Old IR challenges: It's time for common views and actions!. Cardiovasc Intervent Radiol. 2022;45(10):1551-2. Available from: https://doi.org/10.1007/s00270-022-03196-x

30. Nice C. EBIR--helping to foster global IR. Cardiovasc Intervent Radiol. 2022;45(10):1553-4. Available from: https://doi.org/10.1007/s00270-022-03138-7

31. United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children. Health Sector Strategic Plan July 2021–June 2026 (HSSP V). Dodoma, Tanzania: Ministry of Health, Community Development, Gender, Elderly and Children; 2021 (accessed 2023 Jul 17). Available from: https://mitu.or.tz/wp-content/uploads/2021/07/Tanzania-Health-Sector-Strategic-Plan-V-17-06-2021-Final-signed.pdf

32. Casadevall A, Handelsman J. The presence of female conveners correlates with a higher proportion of female speakers at scientific symposia. mBio. 2014;5(1):e00846-13. Available from: https://doi.org/10.1128/mBio.00846-13

Appendix A: A survey on African females in interventional radiology

1. How old are you?
   - 30 – 40
   - 40

2. Please state your Nationality.

3. What medical program were you in or had finished prior to specializing in Interventional Radiology?*
   - Diagnostic Radiology
   - Other:

4. What is the structure of your IR training program?
   - Post Diagnostic Radiology training program
   - Integrated Diagnostic and Interventional Radiology training program

5. Who has supported you financially, academically and or emotionally through your education and decision to pursue IR?
   - Spouse
   - Extended Family
   - Friends
   - Scholarship
   - Personal Funds
   - Other:

6. What do you feel the biggest challenge is as a woman in Africa wanting to pursue IR?
   [Open text]

7. Are you a Fellow/Trainee or an attending?
   - Attending
   - Fellow

8. How many years of training did you have if you are an attending?
   - 1 year
   - 2 years
   - > 2years
   - Not Applicable

9. How many years is your training if you are a Fellow/Trainee?
   - 1 year
   - 2 years
   - > 2years
   - Not Applicable

10. State the country Location of your training in Africa
    [Open text]

11. Do you think women have equal opportunities like their male counterparts in IR in Africa?
    - Yes
    - No
    - Maybe

12. Have you ever felt or faced any form of gender bias as a female in IR?
    - Yes
    - No
    - Maybe

13. If Yes, can you share briefly your experience
    [Open text]

14. What do you think can be done to encourage more women to pursue a career in IR in Africa?
    [Open text]

Extras

Suggestions offered by respondents in our study for encouraging more women to pursue a career in IR in Africa were **increased exposure to IR**, and **increased visibility/mentorship of women in IR**.