

WOMEN IN MEDICAL PHYSICS: ADDRESSING THE CHALLENGES, RECOGNIZING THE PROGRESS WITH IAEA

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Introduction

Medical physics (MP) is a critical field that applies the principles of physics to healthcare, with applications ranging from radiation therapy and diagnostic imaging to nuclear medicine and radiation safety [1]. Medical physicists (MPs) play a crucial role in the healthcare team, providing essential support to physicians and other healthcare professionals to ensure that patients receive safe and effective treatments [2]. Despite the importance of MP in healthcare, women remain underrepresented in the field. According to a 2019 survey conducted by the International Organization for Medical Physics (IOMP), women represent only 28% of medical physicists worldwide [3]. This underrepresentation is a cause for concern, as it limits the diversity of perspectives and experiences that are brought to bear on scientific and clinical problems.

The International Atomic Energy Agency (IAEA) is an international organization established in 1957 with the mission to promote the peaceful use of nuclear energy, nuclear safety, and the non-proliferation of nuclear weapons [4]. The IAEA works with its Member States (MS) and partners to ensure that nuclear technologies and applications are used safely, securely, and for the benefit of humanity. The IAEA's mandate covers a range of areas, including nuclear power and energy, nuclear applications in medicine, agriculture, and industry, nuclear safety and security, and safeguards against the proliferation of nuclear weapons. The IAEA Human Health Division is actively supporting efforts to combat cancer, cardiovascular diseases, malnutrition, and other illnesses by leveraging nuclear and nuclear-related technologies [5]. To achieve this, the Division is providing assistance for projects related to cancer radiotherapy treatment and diagnostic imaging, as well as supporting nutrition centers and human resource development. The division is also involved in creating guidelines and databases, offering quality assurance frameworks and review missions, providing technical and advisory services, and offering dosimetry laboratory services. Finally it is engaged in educational and research initiatives to enhance the capacity for effective disease prevention and treatment [6-8].

The IAEA recognizes the importance of promoting gender equality and diversity in all areas of its work. The IAEA has identified that the underrepresentation of women and other underrepresented groups in all fields including medical physics poses a significant challenge for the field, and that there is a need to take proactive measures to address this issue.

IAEA initiatives on promoting gender equality and diversity in MP

The IAEA has developed a range of initiatives aimed at promoting gender equality and diversity in all fields including MP. These initiatives involve training and professional development opportunities, mentorship programs, and networking events.

1. Education and Training

IAEA provides academic scholarships to students pursuing medical physics degrees or related fields. The organization supports the Master's Programme in MP, run jointly by International Center for Theoretical Physics (ICTP) and the University of Trieste in Italy [9]. It is a two-year programme that includes one year academic training with basic and advanced courses, followed by a year of clinical training in a MP department of a hospital. The programme is based on IAEA MP education and clinical training material and helps address the scarcity of qualified and well trained MPs, a situation common to many countries. The programme is running since 2014

with a total of approximately 140 graduates two thirds of which are men and one third are women. Figure 1 shows the percentage of women graduates from the ICTP MP programme during the years 2014-2021 from different geographical regions and Figure 2 presents the number of women and men graduates during the years 2014-2021.

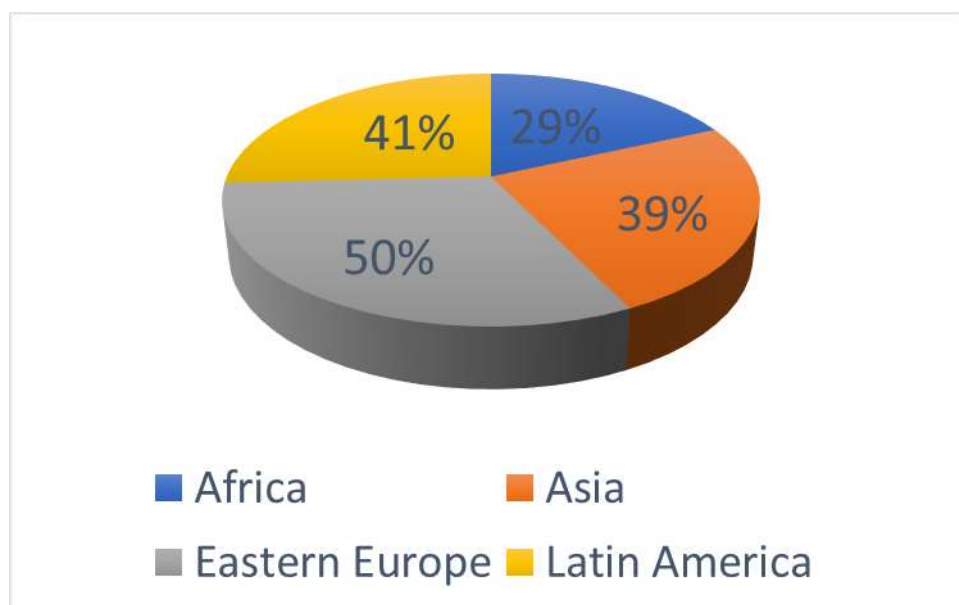


Figure 1. Percentage of women graduating from the ICTP MP programme during the years 2014-2021.

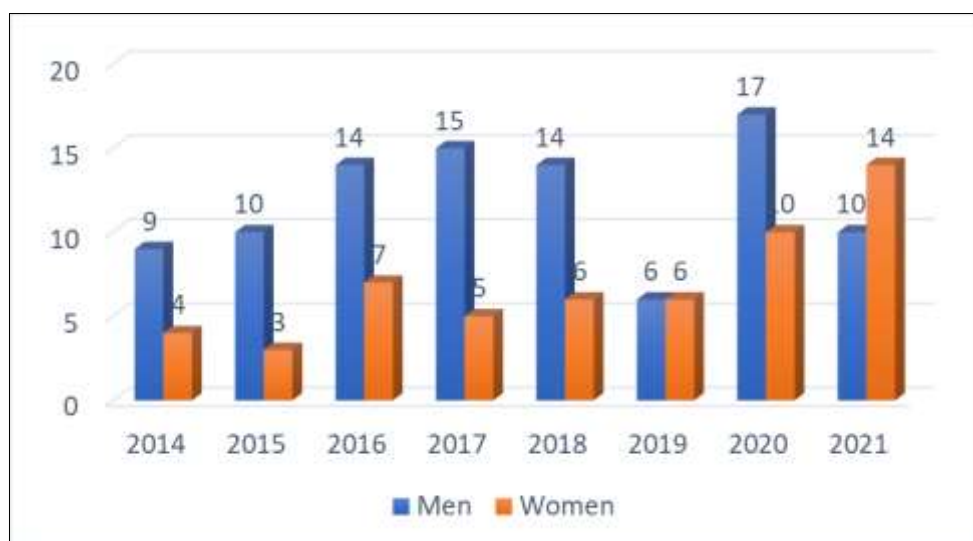


Figure 2. Number of ICTP women and men graduates during the years 2014-2021.

As shown in Figures 1 and 2, women were underrepresented in the programme but this trend is apparently changing over the recent past.

One of the IAEA key programmes launched in March 2020 is the Marie Skłodowska-Curie Fellowship (MSCF) Programme [10]. The academic scholarships provided through the MSCF Programme can help to support the careers of women and promote gender equality and diversity in the field. Selected students receive a scholarship for Master’s programmes in nuclear related studies at accredited universities. They are also provided with an opportunity to pursue an internship facilitated by the IAEA for up to 12 months. The MSCF Programme will contribute to a new generation of women science leaders including MP, who will drive scientific and technological developments in their countries. Scholarships are awarded annually to 100 plus students depending

on the availability of funds. Consideration is given to field of study, and geographic and linguistic diversity. Following the inaugural solicitation for applications in 2020, a total of 360 candidates were chosen to participate in the programme. Among these participants, 44 young female scholars were awarded fellowships specifically for the field of MP; fourteen (14) in 2020, 11 in 2021 and 19 women in 2022.

In addition to providing academic scholarships, the IAEA also offers a range of training and professional development opportunities for women in medical physics including fellowships, online or onsite training courses and workshops on a range of topics. These opportunities are designed to help women in medical physics to develop the skills and expertise they need to succeed in their careers and advance in the field. By providing access to training and professional development opportunities, the IAEA is helping to ensure that MP are well-equipped to address the complex challenges faced by the field.

2. Guidelines, conferences related to MP

The IAEA Dosimetry and Medical Radiation Physics (DMRP) Section lies within the Human Health Division and is responsible for all quality assurance (QA) aspects of the use of radiation in medicine to ensure safety and effectiveness, and deals with the science and technology involved in this area. DMRP is involved in many activities, including education, training, research and service provision. Some of its many activities include developing guidelines and recommendations, organizing and conducting educational programs and training courses for medical physicists, and undertaking research projects to advance the field of medical radiation physics and dosimetry and quality assurance. The section organizes the International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry (IDOS). Figure 3 presents the statistical data on women and men participation during the last years (IDOS 2010 and IDOS 2019). As seen in Figure 3, the representation of women has experienced a modest augmentation, rising from 30% to 32%;

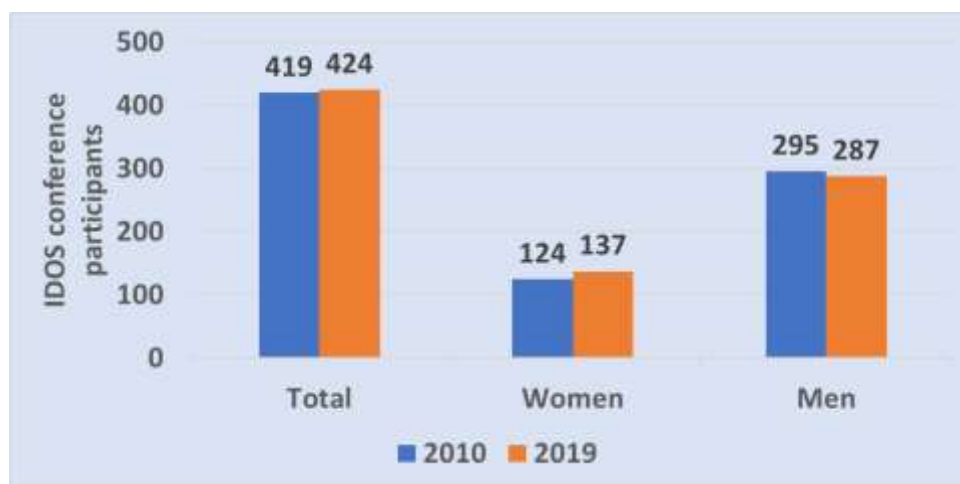


Figure 3. IDOS statistical data for the years 2010 and 2019.

A salient exemplar that mirrors the DMRP's endeavors concerning gender diversity is the heightened involvement of women specialists having a core role in the formulation of guidelines. As delineated in Figure 4, the proportion of women amongst the expert panel involved in drafting guidelines has experienced a marked ascension during the last 3 years. This aspiration necessitates continued dedication to enhancing the representation of women, thereby fostering an equitable distribution of expertise within but also outside the organization.



Figure 4. Percentage of women experts with a core role in drafting the publication by DMRP, IAEA.

3. Mentoring programme

Mentorship plays a critical role in promoting gender equality and diversity in MP. Research has shown that mentorship can help to increase the representation of women in science and engineering fields by providing support, guidance, and career advice. The IAEA's mentorship program was launched earlier this year (2023), called the IAEA Lise Meitner (LM) Programme, that provides early- and mid-career women professionals with opportunities to participate in a multiweek visiting professional programme and advance their technical and soft skills [11]. The LM Programme envisages enhancing participants' soft skills through management and leadership training, mentoring, networking and coaching, and competency management. The visiting professional programme typically lasts between two to four weeks and possibly longer in some host countries, gathering 10 to 15 visiting professionals per cohort.

4. Networking events

In addition to providing training and professional development opportunities, the IAEA has also established a range of networking events [12] and social media groups [13] aimed at promoting gender equality and diversity in all fields including MP. These events provide opportunities for women in the field to connect with one another, share their experiences, and build professional relationships. By creating a supportive and inclusive community, the IAEA is helping to promote gender equality and diversity in medical physics and providing a platform for women in the field to succeed.

Challenges and barriers to promoting gender equality and diversity in medical physics

Despite the IAEA's efforts to promote gender equality and diversity in MP, there are still significant challenges and barriers that must be addressed. Societal and cultural factors, biases and stereotypes, and structural barriers can all contribute to the underrepresentation of women in MP.

One challenge is the lack of women role models and mentors in the field specially in leading positions. Research has shown that women are more likely to enter and succeed in male-dominated fields when they have access to female role models and mentors [14]. It is anticipated that the IAEA's mentorship program will help address this challenge by providing aspiring women MPs with access to experienced mentors who can provide guidance and support.

Another challenge is the prevalence of biases and stereotypes that can limit women's opportunities and hinder their advancement in the field. Research has shown that unconscious biases can influence hiring decisions, performance evaluations, and promotions, which can have a significant impact on women's careers [15]. The

IAEA's initiatives to promote gender equality and diversity, including its training and professional development opportunities and networking events, are helping to raise awareness of these biases and promote a more inclusive culture, also in the field of MP.

Conclusions

The IAEA has undertaken various initiatives to promote gender equality and diversity, including training and professional development fellowships and opportunities, mentorship programmes, and networking events. These initiatives are critical for ensuring that women have the support and resources they need to succeed in the field and for promoting a more inclusive and diverse culture. While progress has been made in promoting gender equality and diversity including the field of MP, there are still significant challenges and barriers that must be addressed. By continuing to develop and implement initiatives aimed at promoting gender equality and diversity, the IAEA can help to ensure that also the MP domain benefits from the diverse perspectives and experiences of women and other underrepresented groups. Future actions and initiatives should aim to build on these successes and further promote gender equality and diversity.

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