MEDICAL PHYSICS IN THE MEFOMP REGION: CURRENT STATUS 2021

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Abstract— **Middle East Federation of Organizations of Medical Physics (MEFOMP) was established in 2009 with 12 participating countries: Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, United Arab Emirates and Yemen. This wok aims to update the information about medical physics in MEFOMP countries, with limited scope covering education, training, equipment and number of Medical physicists (male/female). The economic diversity and the instability and conflicts in many countries in the MEFOMP region resulted in different tracks of development for medical physics in each country. This implies that enormous efforts must be exerted in order to support the development of the medical physics profession in some of the countries in the region. Medical Physics educational programs offering MSc degrees are currently available in five countries: Iraq, Jordan, Lebanon, Saudi Arabia and Syria. Since, a national or regional certification system does not exist, as interim solution, MEFOMP in collaboration with the International Medical Physics Certification Board (IMPCB) performed certification exams, as some countries in the region started to accept IMCPB certification. The number of Medical Physicists per million ranges between 0.5 in Yemen to over 23 in Bahrain, while the average number for the MEFOMP countries is about 8 medical physicists per million. In MEFOMP countries, the average number of Teletherapy, CT and Nuclear Medicine units are 1, 13.4 and 2.8 units per million population, respectively. MEFOMP has contributed a chapter to a recently published scientific book about medical physics during the COVID-19 pandemic, summarizing the different challenges faced during the outbreak of COVID-19 in MEFOMP countries.**

Keywords— **Medical Physics, Education, Certification, Conference. Middle East and MEFOMP.**

I. Introduction

The Establishment of Middle East Federation of Organizations of Medical Physics (MEFOMP) in 2009 is part of the effort of the International Organization for Medical Physics (IOMP) to organize societies under its umbrella to further enhance and improve the status of medical physics in all regions across the Globe [1]. MEFOMP includes 12 participating countries: Bahrain, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, Syria, United Arab Emirates and Yemen (Figure 1). The mission of MEFOMP is to advance medical physics practice throughout Middle East by disseminating scientific and technical information, fostering the educational and professional development of medical physics, and promoting high quality medical physics services to patients [2]. The mission and the goals of the MEFOMP are planned and executed by the Executive Officers (President, Vice-President, Past President, Secretary-General, and Treasurer) with input from Chairs of Committees (Education & Training, Science, Publications, Professional Relations, Awards & Honors, and Newsletter & Website, while in 2018 elections, the Women's Committee was added).

II. Methods for Updating Medical Physics Information

A comprehensive paper was published in 2017 regarding the status of Medical physics in the Middle East [3]. This work aimed to update information about Middle East countries that are members of MEFOMP. A simple questionnaire was used to collect the information about the status of medical physics in MEFOMP countries, focusing on radiotherapy, nuclear medicine and diagnostic radiology equipment available in each country, the number of available medical physicists, and the education and training programs. Only those countries that have sent their feedback are included in the analysis of this paper.

Figure 1 Countries in the Middle East Region under MEFOM

Table 1 National medical physics societies in MEFOMP including established date, approximate numbers of medical physicists (male and female)

Country	Association / Society	Established (Year)	Population (Million) [5]	Approximate number of Medical Physicists			Number of Medical Physicists per million	Is Medical Physicist recognized as a Health Professional?
				Male	Female	Total		
Bahrain [3]	**Bahrain Society of Medical Physics and Bio-Engineering (BSMPBE)**	2008	1.7	34	6	40	**23.5**	-
Iraq	**Iraqi Medical Physics Society (IMPS)**	2011	40.5	30	47	77	**1.9**	Yes
Jordan	**Jordanian Association of Physicists in Medicine (JAPM)**	2006	10.2	32	56	88	**8.6**	Yes
Kuwait	**Kuwait Association of Medical Physics (KAMP)**	2016	4.3	25	13	38	**8.8**	No
Lebanon	**Lebanese Association of Medical Physics (LAMP)**	2005	6.8	12	8	20	**2.9**	Yes
Oman	**Oman Medical Physics Society (OMPS)**	2018	5.2	7	29	36	**6.9**	Yes
Palestine	**Palestine Medical Physics Society (PMPS)**	2006	5.1	4	5	9	**1.8**	Yes
Qatar	**Qatar Medical Physics Society (QaMPS)**	2009	2.9	28	10	38	**13.1**	Yes
Saudi Arabia	**Saudi Medical Physics Society (SMPS)**	2006	35.0	339	381	720	**20.6**	Yes
Syria	**Syrian Medical Physics Association (SyMPA)**	2009	17.5	26	11	37	**2.1**	-
UAE [3]	**Emirates Medical Physics Society (EMPS)**	2005	9.9	7	51	58	**5.9**	-
Yemen	**Yemen Medical Physics Association (YMPA)**	2013	30.0	15	1	16	**0.5**	Yes
Total (Average)			**169.1**	**559 (47.5%)**	**618 (52.5%)**	**1167**	**(8.0)**	**(75%)**

III. MEFOMP vs NATIONAL SOCIETIES

MEFOMP was established in 2009 with 12 participating countries as shown in Table 1. Although all countries under MEFOM umbrella have similar cultures, speak the same language and have the same religion, due to the economic diversity in the region, the starting point and development of medical physics in each country was quite different. Furthermore, the past and ongoing instability and conflicts in some of these countries imply that enormous efforts must be exerted in order to support the development of the medical physics profession in these countries. It is vital that such efforts be sustained to further accelerate the growth of this field in all MEFOMP countries.

The number of Medical Physicist in the Middle East has been constantly increasing, however, there is a continuous demand for more qualified medical physicists. Table 1 shows the profile of national Medical Physics Societies or Associations in the MEFOMP Countries including established date and approximate numbers of medical physicists (male and female). In Table 1, it is shown that Medical Physics is recognized as a health profession in 75% of these countries. The total number of Medical physicists is about 1180, divided into 560 (47.5%) males and 620 (52.5%) females. As shown, the overall number of female medical physicists in the region is ~16% higher than male. The highest number of medical physicists exists in Saudi Arabia

Table 2 Approximate number of Teletherpay, CT and Nuclear Medicine units in each of the MEFOMP countries (including number of units per million)

Country	Population (Million) [5]	Approximate Number of Teletherapy Equipment		Approximate Number of CT units		Approximate Number of Nuclear Medicine Equipment	
		Number of units	Unit per million	Number of units	Unit per million	Number of units	Unit per million
Iraq	40.5	26	0.6	475	11.7	12	0.3
Jordan	10.2	13	1.3	105	10.3	25	2.5
Kuwait	4.3	4	0.9	45	10.5	49	11.4
Lebanon	6.8	19	2.8	265	39.0	27	4.0
Oman	5.2	5	1.0	28	5.4	10	1.9
Palestine	5.1	3	0.6	10	2.0	3	0.6
Qatar	2.9	3	1.0	60	20.7	10	3.4
Saudi Arabia	35	38	1.1	450	12.9	116	3.3
Syria	17.5	9	0.5	340	19.4	11	0.6
Yemen	30	2	0.1	70	2.3	3	0.1
Total		**122**	**1.0**	**1848**	**13.4**	**266**	**2.8**

(about 720). The number of medical physicists per million population is stretched between 0.5 in Yemen to over 23 in Bahrain. On average, the MEFOMP countries have about 8 medical physicists per million population. This seems a relatively acceptable number, as the average number in the world is about 2.7; 15–20 per million population in the developed countries and 1–5 per million population in developing countries. On the other hand, in many underdeveloped countries this number is close to 0 [4].

IV. Equipment in Each of the MEFOMP Countries

The approximate numbers of teletherapy, CT scanners and nuclear medicine (gamma cameras, SPECT, PET-CT) units in MEFOMP member countries are given in Table 2, as an indication of the level of Radiotherapy, Diagnostic Radiology and Nuclear Medicine services, respectively.

Table 2 shows that the total number of teletherapy units are 122 in the 10 MEFOMP countries that participated in this survey, with the largest number (38) existing in Saudi Arabia. The number of teletherapy units per million population varies from 0.1 in Yemen to 2.8 in Lebanon, with an average for MEFOMP countries of 1 unit per million population. According to the World Health organization (WHO), this number brings MEFOMP countries in the lower limit of the second band of countries (between 1 and 3.33), well below the first band of countries, where Western Europe and North America are classified, where the number of teletherapy units per million population is between 3.33 and 72.81 [6].

In Table 2, it is evident that the number of CT scanners per million population varies greatly across MEFOMP countries: from 2 in Palestine to about 40 in Lebanon. The average number is about 13.4 CT units per million, which is significantly lower than the mean number of CT scanners per million population in the Organization for Economic Co-operation and Development (OECD) countries, which was 22.94 [7].

Table 3 Universities with BSc or Diploma in subjects related to medical physics in the MEFOMP countries.

Country	University	BSc Duration (years)	Annual number (Male/ Female)
Iraq	Al-Karch university for applied sciences	BSc	45
	Al-Elm private University College of Science	BSc	45
	University of Falloja College of Science	BSc	45
	University of Diyala College of Science	BSc	45
	Univ. of Salah Al-Din Education college - Physics	BSc	35
	Al-Mustaqbal private Univ. College of Science	BSc	40
Jordan	Yarmouk University	4 years BSc.	30 (15/15)
Saudi Arabia	Um AlQura University in Mekkah AlMukarramah	4 years BSc	15 (10/5)
	King Abdulaziz University in Jeddah	4 years BSc	40 (20/20)
Syria	Damascus University - Radiation Protection (PGEC)	1 year Diploma after BSc	25 (13/12)
Yemen	IBB University	4 years BSc	26 (12/14)

The approximate numbers of equipment used in the nuclear medicine procedures (including Gamma Cameras, Positron Emission Tomography (PET), Single Photon Emission Computed Tomography (SPECT), PET-CT, SPECT-CT and Cyclotron) are shown in Table 2. It is clear that there are big variations between MEFOMP countries: from 0.1 unit per million population in Yemen to over 11 in Kuwait, with an average number of about 2.8 in the MEFOMP countries. This showed a significant increase from the average of 2.3 per million population in the Middle East Region reported in 2015 [8].

V. Education and Training

The local authorities in MEFOMP counties started to realize the importance of Medical Physicists in the medical practice at a different pace. Therefore, it is still a challenge to acquire qualified medical physicists due the following [9]:

1. limited number of universities offering this specialty.
2. limited awareness about the importance of this profession.
3. absence of recognition of the profession by the some of the local authorities.

Currently the undergraduate Medical Physics (or related subjects) university programs, offering BSc degree or Diploma are available in 5 countries: Iraq, Jordan, Saudi Arabia, Syria and Yemen. Table 3 shows the list the universities with medical physics BSc programs.

Table 4 Universities offering MSc or PhD program in subjects related to medical physics in the MEFOMP countries.

Country	University	MSc Duration (start year)	Annual number (Male/ Female)
Iraq	University of Nahrain Medical college	2 years (2016)	15
	University of Baghdad, Science College (Females)	2 years	50
	University of Baghdad/ Baghdad Medical College	2 years	10
	Univ. of Mustansiriyah Medical College	2 years	10
	University of Hwler Medical college (MSc& PhD)	2 years	30-40
	Univ. of Salah Al-Din/ College of Science Physics	2 years	10
Jordan	Jordanian University	2 years (2007)	16 (10/6)
	Yarmouk University	2 Years (2020)	13 (5/8)
Lebanon	Lebanese University (MSc.& PhD)	2 years (2015)	12
	Beirut Arab University (MSc& PhD)	2 years (2017)	5 (3/2)
Saudi Arabia	King Fahd University	2 years (2002)	3
	Um AlQura University in Mekkah AlMukarramah	2 years (2019)	35 (20/15)
Syria	Damascus University (Rad Prot) (MSc & PhD)	2 years (2006)	16 (8 /8)
	Damascus University (Medical Physics) (MSc & PhD)	2 years (2013)	14 (7 /7)

Post Graduate Medical Physics (or related subjects) educational programs offering MSc and PhD degrees are currently available in 5 countries: Iraq, Jordan, Lebanon, Saudi Arabia, and Syria. Table 4 shows the Universities offering MSc or PhD in subjects related to Medical Physics in the MEFOMP countries.

There is a strong need to establish regulations, guidelines and standards specific to the medical physics profession. This will facilitate the improvement of professional recognition, which would promote interest within the new generation of medical physicists. A formal recognized education system and preferably certification system on a national or at least on the regional level such as a MEFOMP Certification Board, would further promote the Medical Physics field as a well-established profession.

During the last 3 years, as an interim solution, MEFOMP and some National Societies in the region, in collaboration with the International Medical Physics Certification Board

Table 5 International Medical Physics Certification Board Exams in MEFOM region.

Country	IMPCB Exam	Dates
Saudi Arabia	Examination Part I and II	9-10/2/2019
Jordan	Examination Part I and II	24- 25/4/201
Qatar	Examination Part I, II and III	22-24/10/201
Saudi Arabia	Examination Part I, II and III	8-9/2/2020
-	Online exams Part I, II and III	2020 &2021

(IMPCB, website: www.IMPCB.org) started to carry out certification exams in the region as shown in Table 5. Some countries in the region started to accept IMCPB certification for Medical Physics and included it in the job description requirements.

VI. Awards and Honors

Most medical physics societies in MEFOMP countries established their national award system. At the federation level, MEFOMP nominates three candidates every year to the International Organization of Medical Physics (IOMP) – International Day of Medical Physics (IDMP) Award since its start in 2015. The individuals who won this award from MEFOMP till now are: Mr. Ibrahim Duhaini (2015), Dr. Abdalla AlHaj (2016), Dr. Huda AlNaemi (2017), Dr. Jamila Al Suwaidi (2018), Dr. Hanan AlDousari (2019) and Dr. Mohammad Hassan Kharita (2020).

As appreciation for hard work of the medical physicists in the region during the COVID-19 outbreak, MEFOMP decided to give a special MEFOMP award under the title of "MEFOMP Award for Best Medical Physicist during COVID-19". The award was given as a recognition of the total contribution of the winners during this crisis, to highlight those Medical Physics community members who played an important role during this pandemic. This honor was awarded to 14 medical physicists from different MEFOMP countries [10].

VII. MEFOMP Contribution during COVID-19

COVID-19 has been spreading worldwide starting at early 2020. MEFOMP has contributed a chapter in a recently published scientific book with title of “Medical Physics during the COVID- 19 pandemic” published by CRC press on 18 March 2021 [11]. The book explores how the COVID-19 pandemic has affected clinical practice, education, and research in medical physics, and how colleagues on the frontline dealt with this unpredictable and unprecedented pandemic. The chapter from MEFOMP summarizes the contribution of the Medical Physics National Societies’ of MEFOMP country members, for better diagnosis and treatment of COVID-19 patients, as well as the challenges faced in order to continue offering the routine medical physics services during the special circumstances which a pandemic. This book addresses the activities related to all aspects of medical physics, health physics and radiation safety in radiology, radiotherapy, and nuclear medicine during the COVID-19 pandemic, with some examples from the different MEFOMP member countries.

MEFOMP has emphasized the role of medical physicists during this pandemic in the diagnosis, and the containment of the virus to prevent its spread by implementing the safety measures to protect themselves, patients and other staff. MEFOMP has also encouraged medical physicists to play a leading role in fighting this pandemic. Through its website [2], newsletter and direct communication with its national counterparts, MEFOMP emphasized the importance of protection of staff and patients in addition to the cooperation with physicians for better diagnosis and treatment for the COVID-19 patients.

MEFOMP Award and Honors Committee’s contribution was to express MEFOMP’s appreciation towards their members in all countries, by giving a special award [10] the "MEFOMP Award for Best Medical Physicist during COVID-19", as a recognition of exceptional performance during this crisis (as mentioned in the previous section). Furthermore, at the peak of the pandemic, several online courses, webinar and conferences on various aspects of medical physics and radiation safety were offered by MEFOMP and different national societies in the Middle East for all medical physicists and health professionals.

MEFOMP in cooperation with International Atomic Energy Agency (IAEA) has recently organized the 2021 Virtual Medical Physics Conference [2, 12]. This event aimed to enhance the knowledge of healthcare professionals in various aspects of medical physics by providing state-of-the-art and up-to-date developments in the profession. The conference attracted over 2,900 individuals from 81 countries. This indicated that this virtual conference has succeeded to spread knowledge and updates, making them accessible to a larger and more diverse audience. The conference has put MEFOMP firmly on the Medical Physics world map. The number of participants competes with the big and established international meetings. The world-class speakers and the excellent IT infrastructure were essentials to the phenomenal success of the conference.

During the COVID-19 pandemic, various international organizations such as IOMP and the IAEA, prepared several online courses on various aspects of medical physics and radiation safety, which were attended also by many medical physicists of MEFOMP countries.

The contribution of MEFOMP Women in Medical Physics Committee in fighting the pandemic focused on medical teams as frontiers in their tireless battle against the infection. The women committee issued a special booklet [13] about the effort and experiences from women medical physicists during COVID-19, which was very challenging for all medical community including medical physicists. Women medical physicists bravely faced the epidemic accepting the risks by taking all precautions to protect themselves and their beloved ones. Women medical physicists exerted extra efforts in the field of awareness and education especially for female patients. The committee participated in the webinar organized by the International Organization for Medical Physics Women Group (IOMP-W) on 24 July 2020 which focused on the role and contributions of women scientists during COVID-19 pandemic.

The medical physics teams played critical role in all MEFOMP countries since the beginning of the pandemic in ensuring that staff are working in a safe environment while following safety protocols to prevent the spread of the virus to patients and other staff across the medical facilities. During the COVID-19 medical physics practices covering different specialties, modalities and services related to all aspects of medical physics, health physics and radiation safety activities in all radiology, radiotherapy and nuclear medicine, were continued despite all the adversities.

In summary, medical physicists in the MEFOMP region played a significant role during this unprecedented time, both in sustaining its essential role to the healthcare system and in optimizing the preventive effort of humankind in the control of this pandemic. Medical physicists is in support of other front-liners and scientists in their effort to enhance diagnostics and therapeutics so that the world will come up with a robust control of the virus and eventually end the COVID-19 pandemic.

VIII. Conclusions

MEFOMP, during those 12 years that have passed since it was established in 2009, has exerted remarkable efforts in order to support the development of the medical physics profession in the region. The average number of Medical Physicists per million in MEFOMP countries is about 8 medical physicists per million. In MEFOMP countries, the average number of Teletherapy, CT and Nuclear Medicine units are 1, 13.4 and 2.8 units per million population, respectively. Medical Physics educational programs offering MSc degrees are available only in five countries in the region. Since currently there are no national or regional certification system, as interim solution, MEFOMP in collaboration with the IMPCB has performed certification exams. Some MEFOMP countries started to request and accept IMCPB certification for medical physics jobs.

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