MEDICAL PHYSICS STATUS IN MOROCCO: EDUCATION, TRAINING AND EVOLUTION

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Abstract— **Medical physicist plays an important role in radiology and oncology departments, including responsibilities in diagnosis, treatment and radiation protection areas.**

Even if Medical Physics education and training were organized for the first time in 2007 at the faculty of science of Rabat, through a master and a bachelor degree, medical physics has been introduced in Morocco since late 1970s, as a preparation for the establishment of the National Oncology Institute in Rabat, the capital of Morocco, which became a reference for the profession and the radiation therapy national wide.

Despite the progression in the technical plateau dedicated for treatment and diagnostic using ionizing radiation, lot of efforts has to be done in the aim to improve the actual state of the education, training and professional situation of medical physicists.

Keywords— **Medical physics, Morocco, education, training.**

I. Introduction

The Kingdom of Morocco is a North African country. It is composed of 12 regions with a population of 35 Millions (2019) with 61% of the urban population. Morocco is a demographically young country with 29% of its population under the age of 15, 62% between 15 and 59 years old and 9% of the population aged 60 and over [1].

An important interest is dedicated by the ministry of health to control and improve the quality of treatment and diagnosis for patient with cancer. These late years has known an increase in the inauguration of hospitals and centers dedicated for oncology, and further projects are prepared for this purpose by the creation of regional centers of oncology, including radiation therapy and nuclear medicine departments, to facilitate the access of treatment for patients. Hence, masters and bachelor degrees in medical physics, radiation protection and dosimetry are created in different universities in Morocco. However, more efforts have to be done to improve the environment of work for medical physicists.

II. Infrastructure

Morocco has developed an important infrastructure of medical imaging, radiation therapy, including the private and public centers, and radiation protection. This development, translated by an increase in the number of medical equipment (table 1 and 2), needs high qualified staff to insure a secure and safe use of radiation. Thus, many efforts are needed to train qualified medical physicists.

Morocco has a set of public and private oncology and diagnostic radiology centers including: 24 radiotherapy department and centers, 19 nuclear medicine departments and centers, and over 424 radiology departments and centers located in the most populated areas. This number is bound to increase in the future with the creation of new regional oncology centers.

Table 1 Medical equipments for nuclear medicine and radiation therapy

Equipment	Total
SPECT/CT	7
SPECT	12
PET/CT	10
Dose calibrators	21
Accelerator	40

Table 2 Medical equipments for diagnostic radiology

Equipment	Total
MRI	> 40
CT	360
Mammography	110
Standard Radiology	>4500
Interventional	60

III. Moroccan regulation

In the Moroccan regulation, the presence of a medical physicist is mandatory in radiation therapy and nuclear medicine departments. But since the new law 142-12,

appeared in 2014, the medical physicist's presence is necessary in radiology departments too:

"*Every health installation, which offers nuclear medicine or radiation therapy services, has to have at least one medical physicist; radiology centers, which respond to the criteria fixed by the regulation, have to have a medical physicist. However, a contract can be passed with a medical physicist for a limited period, depending on the establishment needs; the required qualifications for medical physicist and the modalities of practicing his missions are fixed by the regulation*" [2].

However, until now, there is no medical physicist in radiology departments (table 3). In the other hand, in the actual regulation, there is a lack of recognition of the medical physicist required qualification, specific tasks and work status. Actually, medical physicists are recruited as medical assistants, administrators, or engineers. This situation has created a lack of harmonization in the medical physics practice at national level.

Table 3 Medical physicists' distribution

Medical Physicists	Total
Radiotherapy	57
Nuclear Medicine	4
Radiology	0
Total	61

IV. Education and training

Before 2007, there was no education program, Bachelor or Master, involving the Moroccan universities in the training and graduation of the Moroccan medical physicists. Most medical physicists were trained abroad, especially in France, and they took part, until now, in the International Atomic Energy Agency training programs. In 2007, the first medical physics master degree, of two years, was created in the Mohammed V University, Faculty of Science of Rabat. In the same year, a bachelor degree in dosimetry, of one year (for candidates who have already obtained undergraduate academic degree in physics), was created at the same university for the first time in Morocco.

For the Masters degree, it is composed of 4 semesters. Three of them are dedicated for the fundamentals and theoretical courses, where the final semester is dedicated for an obligatory practical training, taking place in the Moroccan hospitals for about 4 months before graduation.

This step was important to establish an official national program for the education and training of medical physicists. Other universities in Morocco created Master's degrees in radiation protection, for example the Ibn Tofail university, faculty of science of Kenitra in 2014, or medical physics, Faculty of Medicine and Pharmacy of Casablanca (2012-2014), Higher Institute of Health and Science of Settat (ISSS) (since 2016). All these universities are awarded a Ph.D degree in medical physics. Nevertheless, the programs do not adopt the training courses recommended by the IAEA in the TCS N°37 [3], N° 47 [4] and N° 50 [5], which created discordance in the education programs between the universities. Concerning the medical physicists in practice, some of them benefited from The IAEA training programs, under the African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology (AFRA), and the training courses organized by the Abdus Salam International Centre for Theoretical Physics (ICTP).

V. Conclusion

Medical physics in Morocco has known an important progress in the last few years by the creation of master and bachelor degrees at different Moroccan universities, in a step to follow the interest of the official authorities for the control of cancer treatment, the evolution of the number of the medical equipment at national level, and the progress of the creation of new centers and departments dedicated for oncology and diagnostic radiology. Nonetheless, the state of medical physicists needs to be improved by the creation of specific laws in order to organize and harmonize the profession, including the education level and requirements, the qualification and training conditions to practice as medical physicist.

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