MEDICAL PHYSICS TRAINING, EDUCATION AND PROFESSIONAL RECOGNITION IN UKRAINE

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Abstract— **Although the history of medical physics in Ukraine is decades old, the profession itself is very young and is just beginning to develop. Successful steps have been taken to establish an association of medical physics and to introduce a Master's degree in medical physics, although the University programmes need to be significantly adjusted in accordance with international and national recommendations. A major challenge for the coming years is the recognition of the medical physicist as a healthcare professional, followed by the establishment of a national registration scheme.**

Keywords— **Medical Physics, Education and Training, Ukraine.**

I. Introduction

The use of X-rays in Ukraine began in 1896, and two years later the first medical rooms with X-ray machines were opened [1]. The widespread use of radiology began during the First World War, when in 1914 the "Commission for the Relief to the Wounded with X-ray Examinations" was established. After the war, after several reforms, the Kyiv X-ray Institute (now the National Cancer Institute) was established on the basis of the commission in 1920, where the X-ray physics department began to operate from the first years. At the same time, the All-Ukrainian X-ray Academy (now the Grigoriev Institute for Medical Radiology and Oncology of the National Academy of Medical Sciences of Ukraine) was founded in Kharkiv. These two centres were the main bases for the development of diagnostic radiology and therapy in the country. Although many physicists worked in these institutes and participated in research, as such there were no clinical medical physicists, or a professional organization of medical physicists. With the restoration of Ukraine's independence in 1991, the first attempts to create this organization began. Thus, in the 1990s, the first Association of Medical Physicists of Ukraine was established (AMPU, President Sitko S.M.). But the main goal of the organization, to unite the community of medical physicists, was not achieved and gradually the organization ceased to exist. During the 2000s, the problem of the lack of a functioning organization of medical physicists was repeatedly expressed. A significant impulse to the development of medical physics in Ukraine were the I and II International seminars "Medical physics - the current state, problems, ways of development. Latest Technologies" (2011 and 2012, Kyiv) conducted at the Taras Shevchenko National University of Kyiv with the support of the Swedish Radiation Safety Regulatory Authority (SSM, within the project "Support to the development of quality assurance and quality control in medical radiology, phase 2") [2, 3]. Thus, in 2012 at the II Seminar a discussion was started on the "Necessity in the existence of the organization of medical physicists of Ukraine" [4] and as a result, in January 2013, the Initiative Group of Medical Physicists was established. The first task of the group was to try to resume the activities of AMPU, which ended in failure, so it was decided to create a new organization. In July 2013, the Constituent Assembly of the All-Ukrainian Association of Medical Physicists and Engineers (UAMPE, the first president Makarovska O.A.) [5] was held, to which 3 members of the Initiative Group (Clinical Medical Physicists) were invited. Despite the participation of clinical medical physicists in the Constituent Assembly, their suggestions and comments were not taken into account, so most medical physicists and members of the Initiative Group did not join the organization, waiting for the results of its work. Seeing no other possibility than the establishment of a new organization, members of the Initiative Group of Medical Physicists and other medical physicists in 2017 at the 2nd Forum of Medical Physicists (October 20, 2017, Kyiv) created the Ukrainian Association of Medical Physicists (UAMP, the first president Zelinskyi R.M.) (6). Since its inception, UAMP has 73 medical physicists as members.

Most medical physicists in Ukraine work in hospitals and provide services in radiation oncology, with a smaller number working in diagnostic radiology and nuclear medicine. The exact number of medical physicists is difficult to calculate because there is no register and often the duties of medical physicist can be performed by engineers, physicians or technicians. The estimated number of medical physicists in Ukraine is shown in Table 1.

Table 1 Estimated number of Medical Physicists (MP) in Ukraine

Specialty	MP
Diagnostic radiology	15
Radiation oncology	170
Nuclear medicine	4
Total	219

At the same time, the quantity of equipment [7], especially in diagnostic radiology, far exceeds the number of available medical physicists (Table 2).

Table 2 Available medical equipment for medical imaging and radiation therapy in the country (2020)

Equipment	Total
LINACr	28
Co-teletherapy	45
Brachytherapy	38
X-ray therapy unit	50
MRI	195
PET	3
SPECT	14
CT	372
Mammography	338
Fluorography	1240
X-ray Radiology	7209

II. Graduate training

There are two universities in Ukraine that have a Master's degree programme in medical physics: Kharkiv National University named after VN Karazin (Faculty of Physics and Technology, programme started in 2013) and Taras Shevchenko National University of Kyiv (two programmes: Faculty of Physics (2021) and Faculty of Radiophysics, Electronics and Computer Systems (2013)). Some other departments and universities have separate courses in their Master's programmes in medical physics. Nevertheless, the content of the programmes and the list of courses do not fully correspond to the knowledge and skills that medical physicists need. An important problem is a lack or a small number of practical classes in the curriculum for medical physicists and a lack of established cooperation between universities and hospitals.

In 2019, UAMP based on international documents, developed recommendations for Master's programmes [8]. The purpose of this document was to assist Universities in adapting their programmes to the knowledge and skills needs of future medical physicists.

There is a worse situation with PhD programmes: today, there is no PhD specialization in medical physics. So the research must be done in biophysics, engineering, radiation physics, nuclear physics, etc. That may sometimes lead to difficulties in submitting the work to the appropriate scientific commission for further consideration.

III. Clinical training and postgraduate education

Today, there is no structured clinical training of medical physicists in Ukraine as well as the legislative requirements for a qualified clinical medical physicist and their certification. The vast majority of medical physicists receive their “clinical training” in the hospital after graduation, starting to work as a medical physicist without any experience or even specialized training in medical physics. Some representatives of manufacturing companies provide additional opportunities to attend short internship trips to hospitals in Europe and various courses in medical physics. Another opportunity to gain the necessary knowledge is various IAEA projects, ICTP with a variety of courses, schools and the opportunity to visit hospitals with well-developed medical physics department (3 medical physicists graduated from ICTP & University of Trieste Master of Advanced Studies in Medical Physics with residency in an Italian hospital).

IV. Future opportunities and challenges

There are still many challenges, most notably the recognition of medical physicists as health professionals. In order to unify with other medical and non-medical specialties in health care, medical professionals must have clinical training (residency), with subsequent licensing and registration and continuous professional development. The UAMP is currently working on the development of clinical training recommendations with examples of residency portfolios. The licensing / certification raises the question of who can conduct it and from whom to set up a commission. Fortunately, today there are several international certification commissions, such as the IMPCB [9] or the EEB [10]. After certification in these commissions, several medical physicists can create their own commission in Ukraine.

By signing the Association Agreement with the EU, Ukraine has committed itself to normalizing its legislation to the current European one, including Euratom Directive 2013/59, in which the critical role of the medical physicist (expert in medical physics) in medical radiological procedures is emphasized. Thus, this harmonization of legislation is also a good opportunity to develop national registration scheme for medical physicists.

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