MEDICAL PHYSICISTS IN LITHUANIA IN THE 21st CENTURY

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Abstract— **Regular university level MSc studies in Medical Physics have been established and are successfully carried out over almost 20 years at Kaunas University of Technology providing programme graduates with the opportunity to continue their career in radiation therapy, diagnostic imaging, nuclear medicine or radiation protection. The programme Medical Physics is aligned with international guidelines set by EFOMP and IOMP, is highly focused on clinical training and research and is one of the few programmes in Europe (except UK) delivered in English. Almost 100 programme graduates are daily contributing to the provision of high quality services to oncology patients in Lithuania. The article aims to show the progress in education & training of medical physicists in Lithuania during the last 20 years and discusses the medical physicist career path due to the establishment and implementation of a nationally approved recognition scheme.**

Keywords— **Medical Physics, Medical physicists, Education, Training and Certification, Lithuania.**

HISTORICAL BACKGROUND

The history of medical uses of radiation in Lithuania goes back to 1896 when F. Dembovskis opened his first X-ray cabinet in Vilnius. Application of radionuclides for the treatment tumours was started in the third decade of the past century and the first teletherapy unit with Co-60 source was commissioned in 1954. At this time irradiation services were provided by medical doctors with the support of nurses. There is no well documented information related to contingency and education of medical radiation workers from this time, but some data related to measurements of individual doses of these workers [1] indicate that there was dedicated technical staff, performing medical physicist's tasks.

In 1995, the newly established Lithuanian Society of Radiation therapy recognized that there was an urgent need to start regular education and training of medical physicists in Lithuania [2] and dedicated this task to Medical Physics Committee members represented by medical radiation workers of Oncology institute and Kaunas Medical University Clinics.

Despite the efforts of the MP Committee the situation did not change until a new player – Kaunas University of Technology – came to the scene via participating in the EU TEMPUS PROGRAMME Project S_JEP-12402-97, the main objective of which was: development of a new Joint Baltic Medical Engineering and Physics Master's course (JBMEP) on the basis of developing new educational modules and restructuring of some existing modules on Medical/Biomedical Engineering and Physics (including their teaching materials) delivered as part of various MSc programmes in the universities of Latvia, Lithuania and Estonia. Even though the developed curricula of the joint Baltic MSc programme was never realized (due to the differences in legal requirements for education and training in three Baltic countries), it inspired a new step for the development of medical physicists' education & training and their recognition strategy in Lithuania which was elaborated following EFOMP recommendations in the frame of the National Radiation Protection programme (2001-2005) (Fig.1) [3].

<table>
<tr><th>Level</th><th>Actual scheme</th><th>New scheme</th><th>EFOMP</th></tr>
<tr><td>1</td><td colspan="3">B.Sc. In physics, engineering or equal, 4 years</td></tr>
<tr><td>2</td><td>Professional work in the hospital or hospital environment</td><td>M.Sc. in medical physics, KTU, 2 years</td><td rowspan="3">Post-graduate training:
Theoretical part
(300-400 hrs)
Practical part
(min 2 years professional work)</td></tr>
<tr><td></td><td colspan="2">MEDICAL PHYSICIST</td></tr>
<tr><td rowspan="3">3</td><td>On the job training (min 2 years), theoretical studies and training courses</td><td rowspan="2">Continuous post-graduate studies, KMU, 2 years</td></tr>
<tr><td>Qualification exam as medical physicist</td><td></td></tr>
<tr><td colspan="2">LICENSED MEDICALPHYSICIST</td><td>QUALIFIED MEDICAL PHYSICIST</td></tr>
<tr><td rowspan="2">4</td><td colspan="3">Continuous professional development, 5 year cycle time, credit point system</td></tr>
<tr><td colspan="3">MEDICAL PHYSICS EXPERT</td></tr>
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Fig. 1 Career scheme for medical physicists in Lithuania (2003)

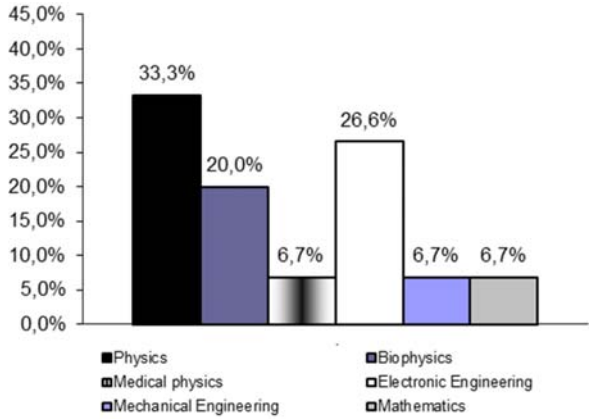

Fig. 2 "Medical physicists" staff in Lithuania's hospitals in 2003

It should be noted that the profession of medical physicist was approved by the Ministry of Health of the Republic of Lithuania in 1992. Implementing the guidelines of EC Directive 1997/43/Euratom [4], hospitals having radiology (especially radiotherapy) departments were forced to employ a number of "medical physicists" without adequate education and training. The distribution of graduates from different study programmes employed as "medical physicist" in 2003 is provided in Fig. 2 [5].

Increasing numbers of modern installations in radiology departments and new patient treatment and diagnostic methods were challenging for the existing "medical physicists" staff as they required deeper specific knowledge in the field of medical physics. The only possibility to overcome this problem was to start education and training of medical physicists at the university MSc level, creating additional possibilities for education and retraining of the staff employed in the hospitals as medical physicists.

GRADUATE TRAINING

Education and training of medical physicists at Master's level was started at Kaunas Technological University (KTU) in collaboration with Kaunas Medical University in 2003, strictly following the recommendations of international authorities, EFOMP and IOMP. A valuable contribution to the successful opening and development of this study programme was the establishment of the Dosimetry laboratory at Kaunas University of Technology, which was financed by the Swedish Government and also supported by colleagues from Lund University, Malmo University Hospital and King's College London.

The main goal of this two-years programme was and is to educate and train medical physicists for the health care institutions where ionizing radiation technologies are applied for the diagnosis and treatment of patients. Besides, medical physicists are additionally trained to work as radiation protection officers.

The MSc programme in Medical Physics has been successfully implemented over the years at KTU and is unique for Lithuania.

There were attempts to run an MSc study programme "Medical physics" at Vilnius University (VU) in 2010-2015, but due to the limited number of highly qualified teachers in the field in Lithuania and some discrepancies of the programme curriculum as compared to international recommendations, this programme was closed.

It should be noted that the number of students in different programmes is regulated by the Ministry of Education, Science and Sports of the Republic of Lithuania, which limits the quota for the number of MP students to 6-8. However, due to the successful implementation of education and training of medical physicists at Kaunas University of Technology, the goal of exceeding 50% of all employed medical physicists having an MSc degree in Medical physics was achieved in 2010 (Fig. 3) [3].

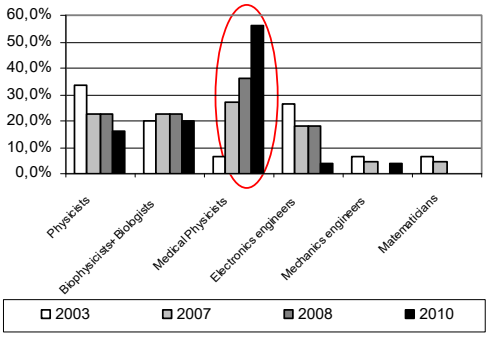

Fig. 3 Qualification of medical physicist staff employed in the Lithuanian health care system

The total number of Lithuanian graduates from the MSc study programme Medical Physics is 115: 92 graduates from KTU and 23 graduates from VU (as of the year 2021).

Since the courses are given in English, the study programme is attractive for foreign students. Programme graduates and students were/are from different countries, including: Japan, Germany, India, Bangladesh, Nepal, Iran, Iraq, Turkey, Bulgaria, Canada, UK, Egypt, Portugal, France, Spain, Lebanon, Georgia, Serbia, Nigeria. Implementation of a so-called "clinical semester" in the frame of the programme, during which the students are taught and are performing their practical and research work mainly in the clinical environment, contributed very much for making the programme relevant to recent needs and supporting integration of Medical physics programme graduates in clinical teams. There is no officially recognized clinical training programme for medical physicists in Lithuania; it runs on individual supervision basis.

The majority of programme graduates are employed in the health care system of Lithuania. The dynamics of the employment of MP programme graduates, which is one of the highest in Lithuania, is presented in Fig. 4.

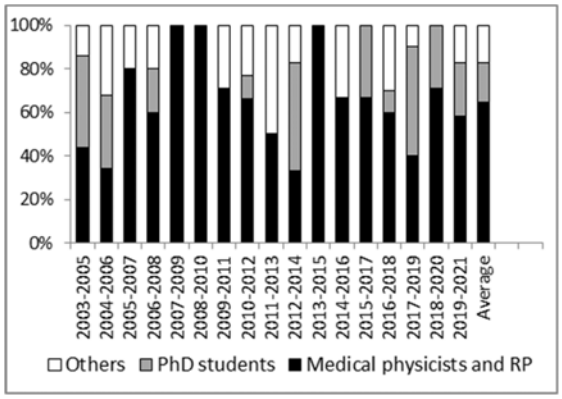

Fig.4. Employment of graduates from the MSc programme Medical Physics at KTU

There are 5 Oncology departments in Lithuania: National Cancer Institute, Vilnius University hospital "Santaros" Clinics, Hospital of Lithuanian University of Health Sciences Kaunas Clinics, Klaipėda University Hospital, Šiauliai Republican Hospital. The total number of Medical Physicists employed at radiotherapy departments in 2016 and perspective number of MPs employed at RT departments in 2021, together with a total number of MPs calculated following RP 174 guidelines in 2013 are provided in Table 1 [6].

Table 1. Numbers of MP in Lithuania 2013-2021*

Hospitals	Requested total number of MP (calculated following RP174 guidelines, 2013)	Number of full time positions for MP in RT, 2016 (fact)	Number of full time positions for MP in RT, 2021 (perspective)
University Hospital of Lithuanian University of Health Sciences Kauno Klinikos	15MPE+22MF	10.25	12
National Cancer Centre	11MPE+22MF	10	12
Republican Šiauliai Hospital	3MPE+7MF	3.5	4.5
Klaipeda University Hospital	6MPE+12MF	6.5	8.5
	98 (35MPE+63MP)	**30.25**	**41.5 (37)???**

* table with calculation mistake is taken from original document (6).

The real total number of MPs employed in the clinical environment in 2021 was 41: 29 MPs in radiotherapy, 8 MPs in Radiology and 4 MPs in nuclear medicine. They were involved in the operation and preparation of dose treatment plans for patients at 12 Linacs, 5 HDR/LDR brachytherapy units, 3 X-ray therapy units, 1 Gamma knife, and also were carrying out QA and calibration work in different radiology departments or performing their duties working with two 2 PET/CT units. It is worth pointing out that installation of a medium energy cyclotron is underway.

Due to a very strong involvement of the KTU Research group "Radiation and Medical Physics" led by Prof. Diana Adliene and researchers from Clinics during preparation of MSc thesis by the programme students, a relatively large number of medical physics graduates are continuing their PhD studies. There is no PhD programme in Medical Physics due to the lack of professors in this field, however there are possibilities for programme graduates to enter PhD studies in Physics or Materials engineering and work on topics related to the medical physics field: dosimetry (materials and devices), phantoms (materials), modelling of radiation induced processes in materials, etc.

The remainder of the graduates are working in the radiation protection field or are choosing different pathways for their career.

National recognition scheme of medical physicists clinical training

With the successful implementation of MSc studies, the knowledge and skills gained by programme graduates raised a question regarding non adequate professional recognition of medical physicists among health care workers and their role in clinical work. Following ILO (2008) recommendations it was suggested that MP professional recognition should be assigned to the group of physicists working in the medical environment. However, the profession of MP in Lithuania was often misinterpreted, assigning medical physicists to supporting staff or engineers in the clinic.

With the establishment of the national Medical Physicists Society in 2007 it was decided to initiate development of a national strategy for recognition of medical physicists, as medical professionals working in the clinical environment. The idea was supported by the Radiation Protection Centre, Kaunas University of Technology and Vilnius University and a working group was created at the Ministry of Health of the Republic of Lithuania. The newly established representative Lithuanian Association of Medical Physics and Biomedical Engineering joined the working group by the end of 2008. It took 10 years until 2017 to get an officially approved National Registration Scheme which defines the requirements and procedures for the recognition of medical physicists in Lithuania (Table 2) [7].

Table 2. National recognition scheme of Medical Physicists in Lithuania

Junior Medical Physicist
4 years of BSc studies in physical, biomedical, technological sciences + 2 years of MSc studies in Medical physics. Working in clinical environment is allowed under supervision of medical physicist specialist (MPS) or Medical physicist expert (MPE)
Medical Physicist Specialist
2 years working experience in clinical environment under supervision of MPS and MPE and clinical training and research. After obtaining MPS in one of fields of medical physics (radiotherapy, imaging and diagnostic, nuclear medicine, lasers and non-ionizing radiation), MPS in another field can be awarded after one year of clinical training in relevant field. When the requirements are fulfilled, MPS is recognized as a person who is legible for license of work in the ionizing radiation environment.
Medical Physicist Expert
At least after 3 years of clinical work as MPS in a selected field + at least 100 hours of professional training, + minimum of 200 hours of participation in research and teaching experience. The expertise of MPE shall be approved by State Commission for Recognition of medical physicist expert. Re-certification of MPE is mandatory every 5th year following the procedures set by Radiation Protection Centre of Lithuania.

All requested achievements for the obtaining any Medical Physicist's category must be approved by corresponding documents. The qualification of Junior Medical Physicist and Medical Physicist Specialist in one or more areas is assigned to a person for a life-long period, however the Medical Physics Expert category may be withdrawn if the person fails during the re-certification procedure, which is mandatory every 5th year.

The responsibility for registration of Medical Physicists as persons working in an ionizing radiation environment is delegated to the Radiation Protection Centre, which maintains a National Register of the sources of ionizing radiation and occupationally exposed persons.

A small confusion remains, speaking about the profession of Medical Physicists. In general, medical physics studies are assigned to the study direction "Medical technologies", which are covering both medical and physics fields; however, according to the diploma, programme graduates are assigned directly to the health care workers.

Since 2020, MSc diploma in Medical physics holders, as health professionals, are obliged to apply for the stamp with individual number at the State Accreditation Service for Health Care Activities under the Ministry of Health, before they are able to start to provide health care services [8]. It should be noted that 29 medical physicists have already applied for and got their individual stamps in 2020/2021, thus being included into the data base of health care workers in Lithuania.

The national recognition scheme is already being applied for the evaluation of Medical Physicists. They must show their knowledge, skills and abilities during discussion with the members of the accreditation board, which is created by a special order of the Minister of health of the Republic of Lithuania. The first 8 MPEs are already recognized and the recognition process is going on with support from the very active Medical Physicists Society which is organizing different seminars and training for young medical physicists, supports their training abroad, encourages colleagues to perform research in the medical physics field and present their results at the International Conference "Medical Physics in the Baltic States" which is organized every second year by Kaunas University of Technology, Lund University and the Medical Physicists Society.

Conclusions

The education & training, recognition and career pathways of medical physicists in Lithuania have been discussed. It was indicated that the training and certification of medical physicists must be key activities for the professional organizations while education should be left as a priority for the University.

It was also shown that, even having two professional organizations in the country: Lithuanian Association of Medical physics and Biomedical Engineering which has only a representative role at the international organizations and Medical Physicists Society which is the main driver of ideas and activities related to the medical physicist's profession, it is possible to move forwards. A network established by both societies allows reaching of every Medical Physicist in Lithuania, to provide them with advice and to consult him/her by solving specific problems or support (if requested) regarding the career pathway.

The national recognition scheme of medical physics professionals is already implemented and seems to work properly, however there some problems left. The most important question for Lithuania is the establishment of officially regulated and recognized clinical training of MSc graduates from the university. Contribution to the recognition of Medical Physicist's profession at the European level is another priority for Lithuanian Medical Physicists, since it would allow movement of medical physicists around Europe.

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