PROFESSIONAL ISSUES

COST OPTIMIZED MEDICAL PHYSICS EDUCATION AND TRAINING: AN INNOVATIVE E&T SCHEME IN MALTA

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Abstract—**Until recently the number of Medical Physicists in Malta was much lower than that recommended by EU institutions. This was impacting the extent, effectiveness, safety and efficiency of clinical services. The University of Malta and the Ministry of Health in Malta embarked on a project to address the issue. The objective was to produce an E&T programme which followed the then developing EU, EFOMP and IAEA recommendations whilst optimizing costs and ensuring future-proofing. We present the innovative scheme, which was part financed by the EU European Social Fund, as a model of academic and public administration cooperation in the service of patients.**

Keywords—**Medical Physics, Education and Training, Curriculum Development, Innovation.**

I. Introduction

Until recently the number of Medical Physicists in Malta was much lower than that advised by European recommendations [1]. This was having a negative impact on the extent, effectiveness, safety and efficiency of clinical services; modern techniques in radiation oncology could not be implemented whilst image quality and radiation doses in diagnostic services were not sufficiently optimized. Academics from the Department of Medical Physics of the University of Malta and public officials from the Ministry for Health in Malta together embarked on a project to address the issue. The objective was to produce a scheme which followed the then developing EU, EFOMP and IAEA recommendations in Medical Physics E&T whilst optimizing costs and ensuring future-proofing [1-3]. Given the impossibility of providing clinical training locally (owing to the very small number of Medical Physicists then available in Malta) it was decided that whilst the Masters in Medical Physics was to be undertaken at the University of Malta, it would be structured in a way as to make overseas training possible. Part EU funding was sought and obtained through the European Union European Social Fund (ESF) for the overseas training by the Ministry for Health.

The scheme was to provide for E&T in the three principal Specialty areas of Medical Physics namely Diagnostic and Interventional Radiology (D&IR), Radiation Oncology (RO) and Nuclear Medicine (NM) [1]. In addition, since in today's rapidly changing and highly competitive world, being a good scientist is not sufficient to achieve professional and clinical goals, it was decided that the Masters programme would include not only the necessary scientific and mathematical content but also the soft skills required for modern professional practice (e.g., leadership, teambuilding, communication, managerial and strategic planning skills) [4, 5].

II. Materials and methods

A review and documentary analysis of European legislation and documentation regarding the role, E&T and human resource requirements of Medical Physicists was carried out [particularly 1-3, 6]. The curricula of established international Medical Physics Masters programmes were scrutinized and elements of good practice identified. European recommendations regarding the structuring of qualifications frameworks [7] and IAEA recommendations regarded clinical training were adopted [8-10]. The scheme was also designed in to serve as a basis for trainees to move seamlessly into developing EU training schemes to Expert level ('Medical Physics Expert')[1, 11].

III. results

The resulting 2.5 year E&T programme is summarized in Table 1 and consists of a 120 ECTS masters course linked to 24 months equivalent of clinical training at an accredited clinical training centre. The study units during the first

academic year are delivered in standard face-to-face small group teaching mode. First semester units are designed to develop the participants as Clinical Physical Scientists and are compulsory for all irrespective of their eventual Major Specialty area. During this semester the participants also experience a month of induction training in *all* Specialty areas. This helps bridge the gap between the physics/engineering backgrounds of the participants and the healthcare milieu whilst exposing them to all possible Major Specialties. At the end of the semester the participants are required to choose their future Major Specialty area.

In the second semester of the first year, participants read towards 20 credits in one Specialty area as Major and 5 credits in each of two Specialty areas as Minors. For example, one can study D&IR as Major whilst taking RO and NM as Minors. This structure ensures that whilst trainees specialize early (in line with EU recommendations given the rapid expansion and increased sophistication of medical device technology [1]), they would also have the necessary background to be able to collaborate with colleagues working in the other specialty areas later on in their careers e.g., by being aware of the critical importance of D&IR in cancer detection, treatment planning and post-therapy patient follow-up. During this semester the participants undergo a month of training in their respective Major Specialty area. This helps them gain direct experience of the clinical applications of Medical Physics in their respective Major Specialty and also in identifying a dissertation project in the same specialty.

The study units in the second year of the Masters complete the transformation of the physicist/engineer into a Healthcare Professional and Clinical Researcher and are heavily training oriented (including the Medical Physics Dissertation and extended case study in the Practices and Procedures study unit *which are both required to be service development oriented*). Theoretical subjects range from the legal and professional to ethical and management issues and health technology assessment; participants are required to permeate their assignments with clinical examples and illustrate the added value which their profession and respective Specialty bring to the broader healthcare system. *The theoretical units are delivered asynchronously via elearning so that the trainees who would then be on full-time clinical training can take the study units at any day/time of the week outside their training schedules.*

Clinical training is carried out at accredited clinical training centres where the training schedules are structured to follow very closely the IAEA training schemes [8-10]. *An eportfolio in the IAEA format is also required*. A 30 ECTS dissertation in the Major Specialty area is required to complete the masters. The subject of the dissertation *must be service development oriented, be carried out at the clinical training center and be of major contribution to the training*. In the case of the first two cohorts the training was carried out at a leading training centre in the UK; however, it is envisaged that future cohorts would be trained locally.

IV. CONCLUSIONS

We have developed an E&T scheme which is attuned to modern Medical Physics curricular developments and curricular delivery and which is sufficiently flexible and innovative to be implemented in other countries. The scheme is cost effective with a total E&T time of only 2.5 years and inherently designed to permit expansion to other specialty areas. Given the tight time-frames, training schedules need to be carefully planned and monitored. A disadvantage for the trainees is that they cannot avail themselves of any extended vacation leave (e.g., no long summer holidays); however, on the other hand they do qualify faster and hence can take up full-time employment earlier (however, duration can be extended to reduce the need for tight scheduling). The process of development of the scheme is presented as a model of cooperation between academia and public administration in the development of a practical curriculum in the service of patients.

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Table 1 E&T Scheme for entry level Medical Physicists in Malta

Academic Year		**Education Medical Physics Department, University of Malta**				**Clinical Training Ministry for Health**
		MSc Study Units		**Notes**	**ECTS***	**Months**
1	Oct - Jan	The Medical Physicist as *Clinical Physical Scientist*	Biophysics and Basic Biomedical Sciences for Medical Physicists Clinical Medical Devices & Protection from Physical Agents** Principles of Biomedical Signal Processing for Medical Physics Principles of Biomedical Image Processing for Medical Physics Research Methods and Statistics for the Physical and Health Sciences	These study units are core units to be taken by all candidates	10 5 5 5 5	1 month All Specialty Areas. Training delivered locally.
	Feb - May	The Medical Physicist as *Specialist*	Specialty Areas available at present:*** Medical Physics in Radiation Oncology (RO) Medical Physics in Diagnostic and Interventional Radiology (D&IR) Medical Physics in Nuclear Medicine (NM)	Candidates to choose one Specialty Area as Major and two Specialty Areas as Minors****	20, 5, 5	1 month Major Specialty Area. Training delivered locally.
	Jun-Sep		Training only			22 months in Major Specialty Area. In the case of Malta training delivered non-locally for initial cohorts (in the UK) but to be delivered locally in future. However even when locally based training is available individual candidates would still have the option to train non-locally in more advanced training centers (overseas in the case of Malta, however if the scheme is implemented in major states this could mean distant approved training centers within the same country).
2	Oct - May	The Medical Physicist as *Healthcare Professional*	Professional, Ethical, Legislative & European Issues in Medical Physics Clinical Medical Physics Practices and Procedures Service Quality Development, Health Technology Assessment & Innovation in Medical Physics	All three modules delivered online via Moodle. All modules applied to respective Major Specialty Area.	10 10 10	
		The Medical Physicist as *Clinical Researcher*	Medical Physics Dissertation	In Major Specialty Area *and service development oriented*. Carried out at training center and must be of major contribution to the training.	30	
	Jun-Sep		Training only			
3	Oct-Mar		Training only			
Total 2.5 years					**Total 120 ECTS**	**Total 24 months**

* 1 European Credit Transfer and Accumulation System (ECTS) credit is nominally equivalent to 25 hours of student learning of which 5 – 7 are direct teaching when a study-unit is imparted in the standard lecturing mode.
** All physical agents: ionising radiation (includ. radiobiology), magnetic fields, EMF, intense optical etc Greatest emphasis is on ionising radiation.
*** In future more specialty areas will be added e.g., physiological measurement for neurology, cardiology. The scheme is designed for such eventualities.
**** Each Specialty Area of Medical Physics is offered as Major (20 ECTS) and Minor (5 ECTS).