

# A STUDY WITH EUROPEAN PROFESSIONAL SOCIETIES ON MEDICAL RADIATION PROTECTION EDUCATION AND TRAINING

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**Abstract—** As part of the MEDRAPET European Commission project, a web-based survey was implemented to obtain information from European professional and scientific societies and organizations whose members are working with ionizing radiation on a daily basis regarding the status of radiation protection education and training of their members. The overall response rate was 25.3%. The majority of medical physics, radiology, radiography, nuclear medicine and radiation oncology societies stated that they organize courses focused on radiation protection for their members. A limited number of interventional radiology societies (33%) provide such courses for their members. Continuous professional development courses should be provided for all medical professions working with ionizing radiation, especially for health professionals involved in fluoroscopically-guided procedures.

## I. INTRODUCTION

Medical exposures constitute a considerable source of radiation exposure to human population (1). It is well known that the per capita radiation exposure from medical examinations has increased significantly during the last decades. Medical examinations responsible for this increase are mainly CT and fluoroscopically-guided procedures. Several international organizations recognize the importance of education and training in medical radiation protection (1-8). The European Commission initiated the MEDRAPET project (MEDical RAdiation Protection Education and Training, MEDRAPET) to a) perform a study on the implementation of the Medical Exposure Directive requirements (9) on radiation protection training of medical professionals in the EU Member States and b) update the existing European Guidance (8), containing appropriate recommendations at EU level on harmonization of radiation protection education in the medical field. The professional organizations involved in MEDRAPET include the main European stakeholders and professional groups involved with radiation protection training in the medical field i.e. the European Society of Radiology (ESR), the European Federation of Organizations for Medical Physics (EFOMP), the European Federation of Radiographer Societies (EFRS), the European Society for Therapeutic Radiology and Oncology (ESTRO), the European Association of Nuclear Medicine (EANM) and the

Cardiovascular and Interventional Radiological Society of Europe (CIRSE).

As part of the MEDRAPET project, an EU-wide study has been conducted in order to obtain a view regarding radiation protection education and training of medical professionals in Europe. The current work presents the results of an on-line questionnaire developed to obtain information from European professional and scientific societies and organizations whose members are working with ionizing radiation on a daily basis regarding the status of radiation protection education and training of their members.

## II. MATERIALS AND METHODS

A web-based survey was accomplished through development of an online questionnaire including 9 questions. The questionnaire was decided to have an online format in order to facilitate the collection/analysis of responses, and to ensure a high level of user-friendliness. All relevant categories of health care staff were considered in the study, including referrers, practitioners (diagnostic radiology specialists, radiotherapy specialists, nuclear medicine specialists, interventional specialists, dental doctors etc.), radiographers, medical physicists, nurses. In total, the entire study population comprised of 509 professional societies. Table 1 shows the number of professional societies targeted in the current study for each profession.

Questions were put together following discussions with representatives of the MEDRAPET consortium members and members of the advisory committee of the project. The questionnaire included questions related to training in radiation protection of each professional society members; accreditation of courses; evaluation of legal provisions on radiation protection training of medical professionals in different EU Member States; role of professional societies in the organization and promotion of radiation protection education and training courses; input of organizations on curricula in radiation protection education and training programs. A question on topics essential to medical radiation protection was also included in the questionnaire. The table of topics as defined by ICRP (2) was used in this survey with some additions relevant to the use of new

technologies, radiotherapy and nuclear medicine. In total, 25 topics were included, defined as ICRP and MEDRAPET topics. Table 2 lists all questions included in our questionnaire.

Table 1. The number of professional societies per profession which were targeted in this study.

Professional Society	Number of contacts
Cardiologists	23
Dentists	34
Emergency Doctors	25
Gastroenterologists	29
General practitioners	27
Interventional Cardiologists	1
Interventional Radiologists	23
Medical Associations	32
Medical Physicists	47
Neurosurgeons	1
Nuclear Medicine physicians	33
Nurses	26
Orthopaedic Surgeons	26
Pediatricians	31
Radiation Oncologists	29
Radiographers	47
Radiologists	34
Urologists	30
Vascular Surgeons	11

The questionnaire was piloted in order to identify possible mistakes or questions being misunderstood. The pilot survey was carried out from mid-June 2011 to mid-August 2011. Table 3 shows the national professional societies involved in the pilot study. A pre-survey announcement was sent to all survey participants as a measure to maximize response rate. For the same reason, a regular reminder scheme during the running time of the survey was established. Thus, a reminder was sent twice per week to the non-respondents in order to maximise response rate. In addition, personal follow-up by telephone calls were made to the target groups in order to increase turnout. All recipients were informed of the study purpose. The web-

based survey was conducted from September 13 to the October 31, 2011.

Table 2. Questions to obtain information from European professional and scientific societies whose members are working with ionizing radiation on a daily basis regarding the status of radiation protection education and training of their members and possible answers.

Question	Possible answers
1. How do you classify the practical training in radiation protection of your members?	Good Adequate Inadequate None
2. If you answered good, adequate or inadequate in the last question, is the practical training in radiation protection certified by:	Your national radiation protection authority Your society Other organization Not certified
3. Is the practical training in radiation protection a national legal requirement?	Yes No
4. Is the practical training in radiation protection given during:	Undergraduate courses During residency/clinical placements CPD courses
5. Does your society promote courses in radiation protection for its members?	Yes No
6. Does your society organize courses in radiation protection for your members?	Yes No
7. Has your society been asked to give input on curricula in radiation protection education and training developed for your members by health or other authorities or organizations?	Yes No
8. Does your current national legislation adequately address the needs of education and training in radiation protection for your members?	Yes No
9. Please identify the topics in your curriculum regarding radiation protection education T1- Atomic Structure, X-ray production and interaction of radiation T2- Nuclear structure and radioactivity T3- Radiological quantities and units T4- Physical characteristics of the X-ray machines T5- Fundamentals of radiation detection T6- Fundamentals of radiobiology ,biological effects of radiation T7- Risks of cancer and hereditary disease and effective dose T8 - Risks of deterministic effects T9 - General principles of RP T10- Operational RP T11- Particular patient RP aspects T12 - Particular staff RP aspects T13- Typical doses from diagnostic procedures T14- Risks from foetal exposure T15- Quality control and quality assurance T16- National regulations and international standards T17- Dose management of pregnant patients T18- Dose management of pregnant staff T19- Justification of imaging examinations	Not included Partially included Fully included

T20- Dose optimization in digital radiographic and fluoroscopic techniques.	
T21-Dose optimization in computed tomography	
T22-Dose optimization in diagnostic and therapeutic procedures with unsealed radionuclides.	
T23- Biokinetics of incorporated radionuclides	
T24-Treatment plan optimization and strategies for maximizing the therapeutic ratio	
T25-Target volume-confined (conformal) irradiation in a radiation protection perspective	

Table 2. The national professional societies and countries involved in the MEDRAPET pilot study.

Professional Society	Country
Medical Physicists professional society	Italy
Radiographers professional society	Slovenia
Radiation Oncologists professional society	Norway
Radiologists professional society	United Kingdom
Nuclear Medicine Physicians professional society	Netherlands
General Practitioners professional society	Italy

### III. RESULTS

There were 129 responses with an average response rate of 25.3%. The response rate was high for societies representing professions directly involved with the use of ionizing radiation. Specifically, the response rate was 67.7% for radiologists, 51.1% for radiographers, 46.8% for medical physicists, 42.4% for nuclear medicine physicians and 41.4% for radiation oncologists. However, the response of interventional societies was relatively low. Thus, the response rate for interventional radiologists and vascular surgeons was 26.1% and 18.2% respectively. There were 11 responses from dental societies with a response rate of 32.4%. Results from professions with less than 5 responses are not presented in this work.

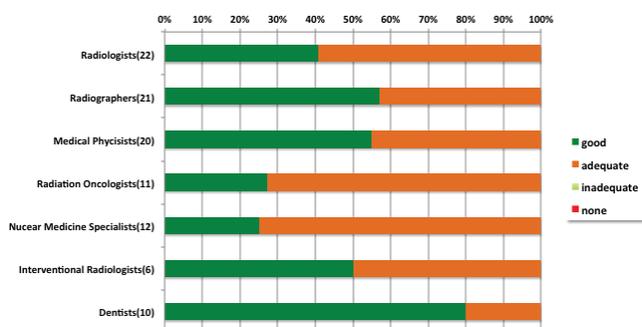


Figure 1. Graph showing answers to question ‘How do you classify the practical training in radiation protection of your members?’.

All professional societies stated that the practical training

in radiation protection of their members is good or adequate (Fig. 1). Eighty percent of dental societies classify the practical training in radiation protection of their members to be good.

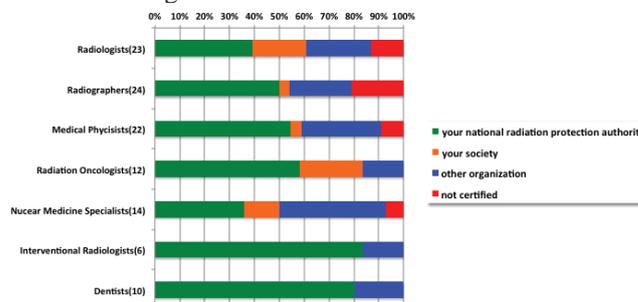


Figure 2. Graph showing answers to question ‘If you answered good, adequate or inadequate in the last question, is the practical training in radiation protection certified by a) your national radiation protection authority, b) your society, c) other organization, d) not certified’.

Corresponding percentages for nuclear medicine physicians and radiation oncologists were less than 24% and 26%. Most societies confirmed that practical training is certified by an organisation, the majority being certified by radiation protection authorities. Only a small percentage (8%-21%) of radiologists, radiographers, medical physicists and nuclear medicine physicians’ professional societies stated that there is no certification whatsoever in radiation protection practical training (Figure 2).



Figure 3. Graph showing answers to question ‘Is the practical training in radiation protection a national legal requirement?’

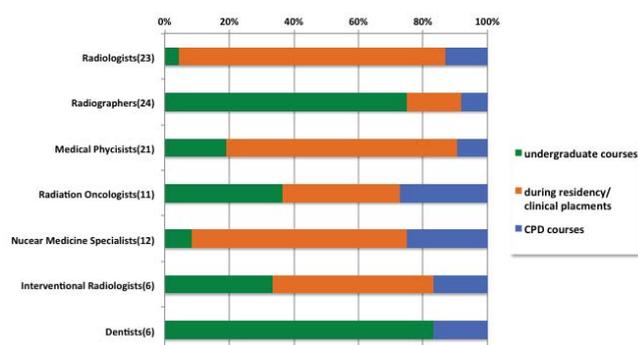


Figure 4. Graph showing answers to question ‘Is the practical training in radiation protection given during a) undergraduate courses, b) during residency/clinical placements, c) CPD courses’

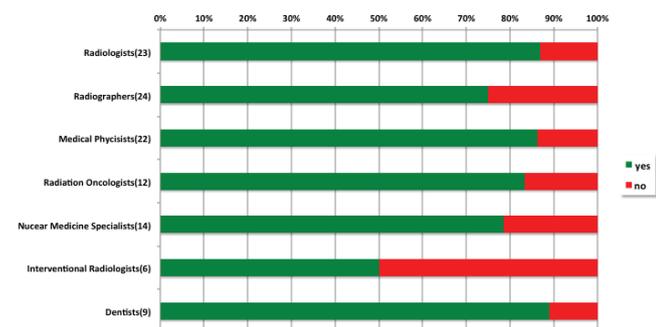


Figure 5. Graph showing answers to question ‘Does your society promote courses in radiation protection for its members?’

On average 72.4% of societies confirmed that practical training in radiation protection is a national legal requirement in their country (Fig. 3). Medical professionals and medical physicists obtain their practical training in radiation protection mostly during residency/clinical placements, while radiographers receive training during their undergraduate courses (Fig. 4). The majority of societies stated that they promote courses in radiation protection. Surprisingly, only 50% of interventional radiology societies said that promote such courses, despite the fact that the members of these societies receive relatively high doses of radiation (Fig. 5).

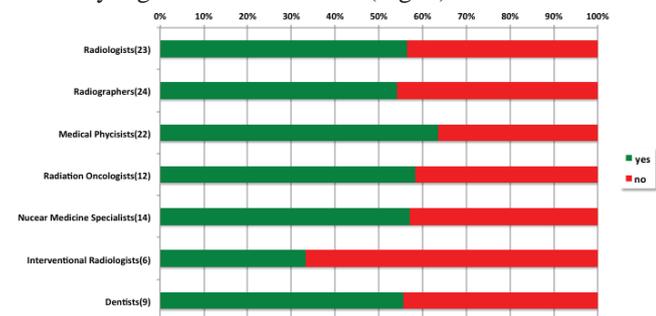


Figure 6. Graph showing answers to question ‘Does your society organize courses in radiation protection for your members?’

Figure 6 shows the percentage of societies that organise courses in radiation protection. Interventional radiology societies were those with the lowest percentage for this question (33%). More than 50% of professional societies have been asked to contribute to curricula in radiation protection by health or other authorities or organizations (Fig. 7). Seventy five percent of medical physics societies gave a positive answer to this question. This result indicates a higher involvement of medical physics professional societies compared to other professional societies in giving input on radiation protection curricula. The majority of professional societies (over 60%) consider their national legislation to adequately address the needs of their members in radiation protection education and training (Fig. 8).

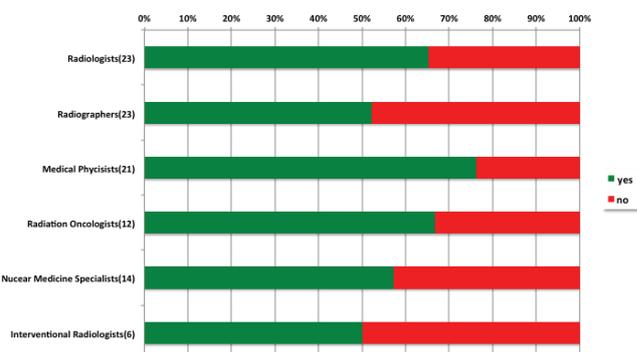


Figure 7. Graph showing answers to question ‘Has your society been asked to give input on curricula in radiation protection education and training developed for your members by health or other authorities or organizations?’

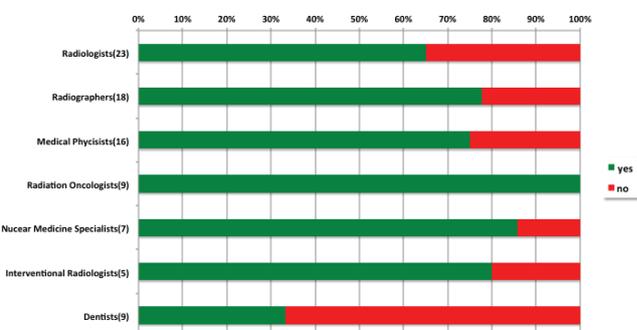


Figure 8. Graph showing answers to question ‘Does your current national legislation adequately address the needs of education and training in radiation protection for your members?’

Figure 9 shows the mean percentage of ICRP and MEDRPAPET topics included in the curriculum of 7 professions. Results indicate that interventional radiologists have included the minimum number of radiation protection topics in their curricula.

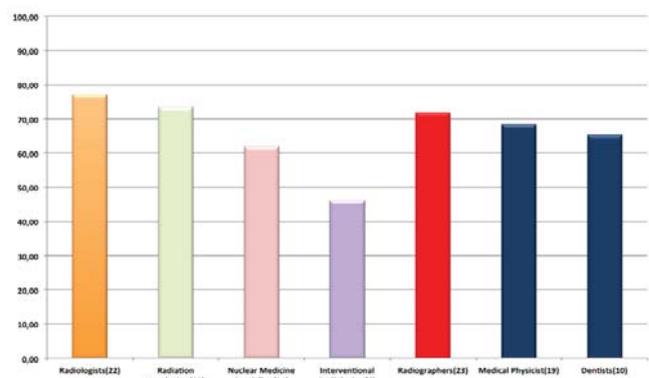


Figure 9. Percentage of ICRP and MEDRPAPET topics included in the curriculum of 7 professions

#### IV. DISCUSSION

Education and training in medical radiation protection is of great importance for all medical professions and especially for those working directly with ionizing radiation. Fluoroscopically-guided procedures are associated with high radiation doses not only to patients but also to personnel. This study shows that interventional radiologists lack curricula and dedicated training in radiation protection. Continuous professional development (CPD) courses should be provided for all medical professions working with ionizing radiation, especially for health professionals involved in fluoroscopically-guided procedures. There were societies of certain professions with no or minimum interest in responding to our questionnaire. Among the societies of this category were societies with members that perform fluoroscopically-guided procedures such as the societies of cardiologists (23 contacts, 0 responses), gastroenterologists (29 contacts, 0 responses), orthopedic surgeons (26 contacts, 2 responses) and vascular surgeons (11 contacts, 2 responses). Interventional cardiologists, vascular surgeons, gastrointestinal endoscopists and orthopaedic surgeons that perform fluoroscopically guided procedures require basic and dedicated training in radiation protection.

The MEDRAPET project has developed the European Guidance on radiation protection education and training containing recommendations on harmonization in this field (10). This Guidance document provides a structured Knowledge-Skill-Competence (KSC) table model according to the European Qualifications Framework (11) and provides adequate coverage of requirements and guidance for new specialists using ionising radiation, in particular those outside imaging departments. Detailed KSC inventories have been produced for all health care professions. They are structured within a novel curriculum development framework and key activities thus directly linking curriculum content to professional role. The structure of this document will facilitate future amendments and the inclusion of new professions. Additionally, a permanent multidisciplinary working party will draft and maintain European standard sets of competences at various levels for minimum Radiation Protection training and continuous professional development required for all different groups of medical staff working with ionising radiation.

Figure 6 shows that many societies representing medical specialities directly associated with the use of ionizing radiation do not organize courses on radiation protection. We believe that, on a national level, the main reasons for the absence of specific training schemes are financial, and there is lack of academic staff specialized in all aspects of medical radiation protection. Professions working with ionizing radiation require educational and training platforms suitable for radiation protection teaching. These platforms are not generally available in the EC member States. Networks of excellent of teaching centres should be created

that will develop high level radiation protection courses to bring health care professionals to the required scientific level. An effort should be made to increase CPD courses in radiation protection education and training for all professions and specialities. A European body for accreditation in medical radiation protection is needed to promote radiation protection by evaluating and accrediting graduate, residency and CPD courses focused on medical radiation protection. The MEDRAPET European Guidance provides the standards for external assessment of radiation protection courses. Projects should be initiated to provide the best possible training opportunities to the European professionals involved in medical radiation procedures. These projects should transform the learning outcomes identified in the MEDRAPET European Guidance into specific programmes of advanced education and training and CPD.

The majority of professional societies consider national legislation to adequately address the needs of their members in radiation protection education and training (Fig. 8). A high percentage of dental societies (70%), however, consider national legislation to be inadequate regarding education and training in radiation protection (Fig. 8). The introduction of a radiation protection course in the basic curriculum of medical and dental schools has been made mandatory recently in the revised Euratom BSS (draft version) and this is very encouraging (12). However, support in the implementation of the legislative requirements related to radiation protection education and training of health care professionals is needed. Universities, training institutions, radiation protection authorities, health authorities, scientific and professional societies, hospitals, educational authorities, international organizations and equipment manufacturers may all have an important role in the promotion, organization, certification, accreditation, support of the training activities in radiation protection for medical exposures. There is a need to build a bridge between these institutions, authorities and organizations in order to achieve the goals of EC directives concerning medical exposure.

#### ACKNOWLEDGMENTS

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