EUTEMPE-RX, AN EC SUPPORTED FP7 PROJECT FOR THE TRAINING AND EDUCATION OF MEDICAL PHYSICS EXPERTS IN RADIOLOGY

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The core activity of the medical physics expert (MPE) is to ensure optimal use of ionising radiation in healthcare. It is essential that these healthcare professionals are trained to the highest level, defined as European Qualifications Framework for Lifelong Learning (EQF) level 8 by the European Commission’s Radiation Protection Report 174 ‘Guidelines on the MPE’. The main objective of the EUTEMPE-RX project is to provide a model training scheme that allows the medical physicist in diagnostic and interventional radiology (D&IR) to reach this high level. A European network of partners was brought together in this FP7 EC project to ensure sufficient expertise in all aspects of the subject and to create a harmonised course programme. Targeted participants are medical physicists in D&IR in hospitals, engineers and scientists in medical device industries and officers working in regulatory authorities. Twelve course modules will be developed at EQF level 8, with radiation safety and diagnostic effectiveness being prevalent subjects. The modules will combine online with face-to-face teaching using a blended learning approach.

INTRODUCTION

The new European FP7 project presented in this paper is called ‘European training and education for medical physics experts in radiology’ (EUTEMPE-RX). This project was granted €1 658 000 after successful application to the 2012 FP7 EC call(1) for European fission training schemes (EFTS) in ‘Nuclear fission, safety and radiation protection’. The main objective of the EUTEMPE-RX project is to provide a model training scheme that allows the medical physicist in diagnostic and interventional radiology (D&IR) to reach this high level. A European network of partners was brought together in this FP7 EC project to ensure sufficient expertise in all aspects of the subject and to create a harmonised course programme. Targeted participants are medical physicists in D&IR in hospitals, engineers and scientists in medical device industries and officers working in regulatory authorities. Twelve course modules will be developed at EQF level 8, with radiation safety and diagnostic effectiveness being prevalent subjects. The modules will combine online with face-to-face teaching using a blended learning approach.

Motivation

Medical exposures for radiological examinations represent the highest and fastest growing contribution to man-made radiation exposure in the EU. Justification and optimisation of these exposures are increasingly challenging. This explains the need for highly trained medical physics experts (MPES), as defined by the EU BSS(3), hence, the core activities of the MPE are the optimal use of ionising radiation in healthcare and the transfer of new knowledge and expertise from physics into healthcare. It is therefore essential that these healthcare professionals are trained to the highest level. This level has been defined as EQF level 8 by RP174. These guidelines have developed a harmonised qualification framework for Europe and a curriculum development model linking curriculum content to professional role.

Situation

Most European countries have an educational programme to educate medical physics students to EQF level 7. Medical physics education is usually organised as a master’s study followed by a practical training period. At present, not all the teaching expertise required to allow medical physicists to reach EQF level 8 is available in the majority of states in Europe. This is due to the diverse nature of the profession and the limited availability of experts. Financial considerations also preclude the development of local training schemes.

A successful training and education programme needs a suitable environment. This includes

- Excellent teachers and teaching tools
- High-end teaching platforms
- High-end X-ray systems and applications
- A hospital environment with a large variety of up-to-date systems
- Prototypes and preclinical systems
- Specific software platforms and test objects

In reality, these requirements are not found in a single institution for all the specialist topics relating to the MPE profession. A modular course, developed by European experts possessing sub-sets of the required expertise, seemed an appropriate solution to overcome these problems.

Objectives

The main objective of the EUTEMPE-RX project is to provide a training scheme that allows the medical physicist in diagnostic and interventional radiology (D&IR) to reach EQF level 8 as described in RP174. This includes setting up a network of excellent teaching centres in medical physics and setting up a multi-campus educational and training platform and getting the course either accredited or serving as an example in EU member states.

The project targets three major participant groups: medical physicists in D&IR in hospitals, scientists or engineers working in medical device industries and officers working in regulatory authorities. It is also likely that doctoral students will be interested in specific course modules related to their research topic.

MATERIALS AND METHODS

The EUTEMPE-RX project will develop a modular course programme to educate medical physicists to the expert level (EQF 8). The courses will be designed using a blended learning scheme, combining online with face-to-face teaching. Each course module will end with an assessment of achieved KSCs. A quality control system will ensure the quality of the course content, course design and course organisation. An important objective is to make the project sustainable and make it a permanent fixture on the radiological calendar. For that reason, a business plan is under development to research the possibilities and opportunities.

Course modules

The EUTEMPE-RX project will develop 12 course modules at EQF level 8, with radiation safety and diagnostic effectiveness being prevalent subjects.

Topics and organisers

It is not possible to cover all the challenges related to the MPE profession in any training course. The 12 module topics have therefore been selected to cover the most important aspects of the MPE profession. After reaching EQF level 8 in the selected topics, it can be expected that the course participants will be sufficiently trained to solve new challenges independently. The 13 partners in the project consortium have been chosen for their individual specialties; they are experts in different and very specific fields. The project partners have also a strong background in leadership, research and teaching activities. This allows the creation of a high-level course programme. The project’s educational board will verify harmonisation of the courses and course content. The background of all partners also emphasises the European aspect of the EUTEMPE-RX project. The project aims to make the European MPE better prepared for (future) challenges.

The course module topics and organisers are shown in Table 1.

Learning outcomes

RP174 defines the KSCs of the MPE, and in particular for the MPE in D&IR. This list covers both generic scientific KSCs and more specific KSCs related to all aspects of D&IR. For the new course, some KSCs (EQF level 7) are considered a prerequisite and will not be covered by the course modules. The other KSCs in the RP174 are used to define the learning outcomes of each course module. The goal is to cover as many of these KSCs as possible within the remit of the project, avoiding overlap between course modules and large gaps of content.

The partners have at present indicated all the KSCs they intend to cover. A division is made at this stage between primary and secondary KSCs to differentiate between the KSCs that will be covered in depth and those at lesser depth. The resulting lists of KSCs are gathered together into one document and compared with the original set of RP174.

Entrance requirements

The EUTEMPE-RX project is aiming to develop educationally high-level courses. This implies that the participants should have reached the level of a qualified medical physicist in a hospital or the equivalent in a medical device company or regulatory authority. The educational entrance level has been set as EQF level 7. This means that the participants should have a masters in medical physics or equivalent. In addition, the participants must have at least 2 y of experience in D&IR to satisfy the entrance requirements. Participants applying for the course modules will be asked for a CV and a letter of recommendation to aid in participant selection when the demand is greater than the supply.

Some additional criteria are taken into account when selecting course participants. The project aims at a diverse European participant group, this means
Participants from all over Europe
Active participation from new member states
A gender balanced participant group
Non-European participants may be allowed to join the course. Entrance requirements may change if quality surveys indicate this is necessary. An educational board, consisting of project partners, will handle participant selection.

As part of the project, the goal is to teach ≈ 20 course participants in each module (funded by the EC).

Quality control of course content
It is very important to perform quality control of the course content starting at an early stage of the course development. A quality manual has been developed to ensure all course modules are harmonised and of the required quality. A quality assessment team, led by the project leader, will keep track of the successful implementation of this quality manual. The quality assessment team will closely monitor the content of each course module and advise the partners, as appropriate, to improve the content. The KSCs selected by each course module are very useful in this process and are used to identify overlap and missing content.

Course delivery
As part of the blended learning scheme, e-learning education and teaching sessions will be developed in combination with the more classical face-to-face teaching sessions. Each module will have an assessment of the KSC achieved and successful participants will receive a certificate of successful completion.

Online teaching
The online teaching phase of each course module is very important since it allows for a shorter face-to-face phase, hence making the whole programme more sustainable in the long term. Each module will aim to maximise the information processed during the e-learning phase prior to attendance to prepare the course participants for the face-to-face session. As a net result, KSCs will be achieved with minimal absence from home, allowing for participants with families, high clinical workloads and other domestic obligations to participate in the course modules. The course participants are expected to invest ≈ 40 h of active learning during the e-learning phase spread over several weeks. Some deadlines will be imposed to ensure a course participant is likely to complete the course although exceptional reasons for delays will be taken into consideration.

For most modules, the online phase will precede the face-to-face phase and mainly focus on theory and reading. It will be enabled using a modern e-learning platform called SEKOIA (Leuven, Belgium). Modern teaching techniques will be used through this platform including web lectures, movies, audio files.

Table 1. Course module topics and organisers.

<table>
<thead>
<tr>
<th>No.</th>
<th>Topic</th>
<th>Organiser</th>
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<tbody>
<tr>
<td>1</td>
<td>Developments of the profession and the challenges of the MPE: legal aspects, professional matters, communication and risk assessment, incidents and accidents, today and tomorrow. Raising the public profile of the profession. Basics of teaching RX users, interaction with the RPE</td>
<td>C.J. Caruana and E. Vano</td>
</tr>
<tr>
<td>2</td>
<td>Radiation biophysics and radiobiology: integration of radiobiology and medical physics in radiation risk evaluation, research and management in D&amp;IR</td>
<td>A. Ottolenghi, V. Smyth and K. Trott</td>
</tr>
<tr>
<td>3</td>
<td>Introduction to Monte Carlo simulation of photon and electron transport: application to X-ray imaging</td>
<td>J. Sempau</td>
</tr>
<tr>
<td>4</td>
<td>Fundamental physics of X-rays: energy, absorption and their phase for innovation purposes</td>
<td>M. Gambaccini and A. Taibi</td>
</tr>
<tr>
<td>5</td>
<td>Anthropomorphic phantoms</td>
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<td>6</td>
<td>The development of advanced QA protocols for optimised use of radiological devices</td>
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<tr>
<td>7</td>
<td>Optimisation of X-ray imaging using standard and innovative techniques</td>
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<td>8</td>
<td>Role of the medical physicist in CT imaging and patient dose optimisation</td>
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<td>9</td>
<td>Achieving quality in diagnostic and screening mammography</td>
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<td>10</td>
<td>High dose X-ray procedures in interventional radiology and cardiology: establishment of a robust quality assurance programme for patient and staff</td>
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<td>11</td>
<td>Radiation dose management of pregnant patients, pregnant staff and paediatric patients in diagnostic and interventional radiology</td>
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<tr>
<td>12</td>
<td>Personnel dosimetry—clinical involvement: from device management to higher diagnostic effectiveness and dose optimisation in diagnostic and interventional radiology</td>
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and formative assessments. The e-learning platform allows the progress of the course participants to be tracked and interaction using discussion fora, online exercises, online feedback, etc.

**Face-to-face teaching**

The face-to-face teaching phase will usually take place in universities or hospitals connected to the partners. The course participants will be required to invest \(\sim 40\) h of active participation spread over 4–8 d depending on the course module. Weekends might also be included because of the easier access to hospital and university test facilities.

The face-to-face phase will mainly consist of practical sessions and workshops, including discussions in small groups, demonstrations of specific software packages, skills lab, etc. The last day of the face-to-face teaching will be used to perform the assessment and review the course modules with the participants.

**Assessment**

The EUTEMPE-RX project aims to create scientists at EQF level 8. The profession of the MPE will have huge societal responsibilities. Assessment by the regulatory authorities of achieved KSCs for a person to be appointed to the status of an MPE is a must. Each module will therefore have a module-specific assessment that can be a classical exam, a multiple choice exam or a task in order to test the level of achievement gained by the course participants.

**Quality control of course delivery**

The quality assessment team controls the quality of the course delivery. This includes checking that the level of the modules is at the required EQF 8 level, whether the material on the e-learning platform is distributed appropriately, checking whether the possibilities of the e-learning platform are used appropriately (self-assessment tests, discussion fora, etc.), checking whether the deadlines are respected, etc.

The e-learning platform can also be used to check the participants’ satisfaction. This information is very useful data that will be used to assess and improve the overall quality of the project.

**Course organisation**

The course modules will take place from January 2015 to April 2016. The exact dates are to be fixed, but module 1 will take place in Prague on 9–13 February 2015. This first module aims to help the future MPE acquire the KSCs necessary to exercise a leadership role within the profession.

All the course modules will be designed so they can be followed independently of each other. It is unlikely that many people can participate in all 12 course modules in 1.5 y although it is possible to follow all 12 course modules since they will not overlap and they will be organised in a logical order concerning content.

During the project years, no (or low) registration fees will be asked of the course participants, although some contribution might be charged for meals and educational visits related to the content of the module. Travel costs will not be reimbursed.

**Trial runs**

Partners of module 6 and module 12 will perform a trial run of their module prior to the actual course programme. The trial participants will be selected to represent the target groups. Both the online phase and face-to-face phase will be performed. This trial run will help identify any problems early on which can be remedied before the course module is open to course participants.

**Quality control of course organisation**

The quality assessment team controls the quality of the course organisation. A quality manual is under development to provide guidelines to be followed by each course module concerning the course organisation (registration procedure, lecture halls, organisation of practical sessions, organisation of the assessment etc.). As in the case of the course content, the quality control procedures for the course organisation are designed to create a harmonised and high-level course organisation.

**Sustainability**

The EUTEMPE-RX project is funded for 3 y of activity by the EC. After this time the course will find itself in a new phase. The project consortium has resolutely chosen to aim for a continuation of the course programme. The accreditation of medical physicists as MPEs after following the course programme is very important in the development of the proposed business plan.

**Business plan**

To make the courses sustainable first an estimate has to be made regarding the costs of the face-to-face components of each course. Once this cost is known a decision can be made regarding the number of course participants that is required to keep the registration fee to a reasonable level and what sponsorship may be needed. The business plan will map these costs and investigate the possibilities for future income. This task has been subcontracted to HDW Consult (Herent, Belgium).
To estimate the target market in Europe a survey was sent out through EFOMP to all the national membership organisations in an attempt to estimate the number of medical physicists in D&IR in hospitals, industry and regulatory authorities. The results of this survey will also indicate the need for more MPEs on the job market and therefor their value. To estimate the cost of the course organisation, all partners are asked to keep track of all the costs related to their face-to-face components. The main cost categories are expected to be personnel costs (teachers, invited lecturers), travel expenses (invited lecturers) and delivery costs (lecture halls, software, computers, multimedia equipment etc.). These data can then be used to estimate the cost of organising the future repeat programmes.

Future course modules could be opened to non-EU participants, industry might want to integrate some of the modules into their internal training programmes, new modules could be added, the organisation could become a summer school etc. Each of these scenarios results in different financial consequences.

Accreditation

The accreditation of the successful course participants as MPEs is invaluable for the future of the course and the profession over all. The accreditation system developed in the project can be proposed to Member States as a model to recognise the MPE in the transposition of the new EU Directive. EFOMP and HERCA could play a role in the accreditation.

RESULTS

The EUTEMPE-RX project started successfully in August 2013. The course content has been broadly specified and is being developed in more detail with continuous overview. The intended learning outcomes cover the majority of KSCs to be found in RP174 project and overlap between different course modules is minimal. The e-learning platform is operational and a demonstration has been given to the partners during the half-yearly project meeting. More features will be added to the platform before the actual start of the course programme. The first versions of some online courses are under development. The modules performing a trial run will start using the platform intensively.

A first version of the business plan was presented during the half-yearly project meeting. Surveys to support the business plan development have been sent to the national MP membership organisations.

The public relations team has started disseminating the EUTEMPE-RX project at conferences through oral presentations, posters and leaflets. Future events are on the agenda to promote the project further.

CONCLUSIONS

The EC funded FP7 EUTEMPE-RX project will create courses at EQF level 8 to raise the medical physicist in D&IR to the MPE level. The course programme will consist of 12 modules that can be followed individually or in combination. The module topics have been chosen to cover the most important KSC as listed in RP174. The courses will combine online with face-to-face teaching to allow for a diverse European participant group. Efforts are being taken to make this course programme a permanent fixture on the diagnostic and interventional radiology calendar. Further information about the progress of this project can be obtained by emailing info@eutempe-rx.eu or info@eutempe-rx.org.

FUNDING

This project was funded by the European Commission. It was granted € 1 658 000 after successful application to the 2012 FP7 EC call for European fission training schemes (EFTS) in ‘Nuclear fission, safety and radiation protection’. The grant agreement number is 605298.

REFERENCES