Module MPE10: High dose X-ray procedures in Interventional Radiology and Cardiology: establishment of a robust quality assurance programme for patient and staff

ABSTRACT

Title: High dose X-ray procedures in Interventional Radiology and Cardiology: establishment of a robust quality assurance programme for patient and staff

Module Code: MPE10

Module Level: EQF level 8

Aims: This module aims to help the future MPE (in the area of Diagnostic and Interventional Radiology, including fluoroscopically guided procedures performed outside the imaging department) acquire the knowledge, skills and competences necessary *to* exercise a leadership role within the profession in his own country and in Europe. The content of the module would address the development of the role of the MPE in D&IR in its entirety and would inform and provide a framework for discussions for other modules. *In the face-to-face phase participants will have the opportunity to discuss the major issues directly with the present European leaders of the profession. The participants would also be updated with the latest EU directives, guidelines and activities impacting the role to ensure they are at the forefront of these developments.*

Learning Outcomes: At the end of the module the participants will be able to:

MPE10.01	Assess, evaluate and optimise image quality, patient dose and occupational dose for clinical protocols for interventional radiology.
MPE10.02	Evaluate room design, shielding and equipment selection for diagnostic and interventional radiology.
MPE10.03	Research, develop, implement and/or test new dosimetric tools providing patient skin dose distribution maps and organ doses.
MPE10.04	Establish a robust quality assurance programme for patient including the set-up and update of diagnostic reference levels and trigger levels for interventional procedure.
MPE10.05	Design a dedicated occupational protection program for staff (including personal dosimetry and relative data analysis), personalized for the different tasks including also criteria for protection of the pregnant staff.
MPE10.06	Evaluate available protective devices and their performances and use and develop new optimised solutions when the available are not satisfactory.

Date and Location of Face-to-Face Component: **Udine 13 – 18 February 2016**

Module Leaders:

Prof. Eliseo Vano (eliseov@med.ucm.es)
Full Professor of Medical Physics at the Complutense University in Madrid and head of the Medical Physics Service at the San Carlos Hospital. Advisor to the Spanish Ministry of Health for radiation protection in medical exposures. Chairman of the Medical Working Party on Medical Exposures of the Article 31 Group of Experts of the EURATOM Treaty. Chairman of the Committee on Protection in Medicine of the ICRP. IAEA consultant for radiation safety in diagnostic and interventional radiology.

Dott. Annalisa Trianni (trianni.annalisa@aoud.sanita.fvg.it)
Medical Physicist at AOUUD. Chair of EURADOS WG12 – SG2 Patient Dosimetry in Medical Imaging. Co-chair of DICOM WG28 "Physics", IAEA consultant for radiation safety in diagnostic and interventional radiology. Actively involved with organizations developing QA protocols (IEC, AAPM and the Italian Association in Medical Physics). Invited lecturer at major European conferences.

Faculty: Eliseo Vano, Annalisa Trianni, Renato Padovani, Faustino Bonutti, José Miguel Fernández and invited lectures.

Delivery of the module: The module will achieve its learning objectives using a combination of online and face-to-face lectures, presentations, demonstrations and discussions. The online phase will mostly cover theory and will be asynchronous so that participants do not need to take time off their clinical duties and there will not be a problem with time zones. All modern tools provided by the e-learning platform will be used (fora, individual feedback, online exercises, etc.). The online phase will require about 40 hours of active participation. The face-to-face component will be over a period of 1 week (4 days learning, 1 day free for revision, 1 day for assessment), totalling about 30 hours active participation.

Total participant effort time: 70 hours

Assessment Mode: To be discussed in AThens

MODULE DATA			
Module Homepage	www.eutempe-rx.eu		
Module Code	MPE10		
Module Leader/s Please limit CV to a max of 250 words and to what is relevant to this module.	Dott. Annalisa Trianni (trianni.annalisa@aoud.sanita.fvg.it) Medical Physics Department. AOUUD. trianni.annalisa@aoud.snaita.fvg.it Chair of EURADOS WG12 – SG2 Patient Dosimetry in Medical Imaging. Co-chair of DICOM WG28 "Physics", IAEA consultant for radiation safety in diagnostic and interventional radiology. Actively involved with organizations developing QA protocols (IEC, AAPM and the Italian Association in Medical Physics). Invited lecturer at major European conferences Prof. Eliseo Vano Radiology Department. Medical School. Complutense University of Madrid and San Carlos University Hospital Madrid eliseov@med.ucm.es Full Professor of Medical Physics at the Complutense University in Madrid and head of the Medical Physics Service at the San Carlos Hospital. Advisor to the Spanish Ministry of Health for radiation protection in medical exposures. Chairman of the Medical Working Party on Medical Exposures of the Article 31 Group of Experts of the EURATOM Treaty. Chairman of the Committee on Protection in Medicine of the ICRP. IAEA consultant for radiation safety in diagnostic and interventional radiology.		
Teaching Staff Teaching staff should be either recognised MPEs or in possession of a PhD. If not please contact the Secretary of the QAC.	Prof Eliseo Vano PhD: Module leader Dott.a Annalisa Trianni: Module leader Dott. Renato Padovani: WP4 leader Dott. Faustino Bonutti, PhD Dr. José M. Fernandez, PhD Invited Lectures		
Candidate Assessment (all assessments open book)	**Written Assessment (open book):**	A 4-hour paper with case-study questions. No choice is allowed.	
	Practical Assessment (open book):	None	
Module Duration The TOTAL number of hours of	**Online phase** Asynchronous methods should be used whenever	The online phase will mostly cover theory and will be asynchronous so that participants do not need to take time off their clinical duties and there will not be a problem with time zones. All modern tools provided by the e-learning platform will be used (fora, individual feedback, online exercises, etc.). The online phase will require about 40 hours of active participation.	

<table>
<tr><td rowspan="2">participant effort should be about 80. (including lectures, reading of assigned compulsory texts, participation in online fora etc)</td><td>possible so that participants would not need to take time off their clinical duties and there will not be a problem with time zones. However synchronous methods (evenings or weekends only) should be used when crucial.</td><td></td></tr>
<tr><td>Face-to-face phase

Must include 1 day for revision and 1 day for the assessment proper.</td><td>6 days: 4 days content delivery (30 hours), 1 day for revision, 1 day for assessment.

All modules: All learning materials including presentations will be sent to the participants 2 weeks before the first day of the face-to-face phase.</td></tr>
<tr><td>Date and location of Face-to-Face</td><td colspan="2">Udine 13 – 18 February 2016</td></tr>
<tr><td>Date of Assessment
Normally last day of face-to-face phase.</td><td colspan="2">18 February 2016</td></tr>
<tr><td>Breakdown of participant effort time</td><td colspan="2"><table>
<tr><th>Module Component</th><th>Estimated Time</th></tr>
<tr><td>Online lectures, seminars, tutorials, fora</td><td>25 hours</td></tr>
<tr><td>Online compulsory reading</td><td>15 hours</td></tr>
<tr><td>Face-to-face lectures, seminars, tutorials, fora</td><td>15 hours (over 3 days)</td></tr>
<tr><td>Face-to-face technical demonstrations</td><td>0 hours</td></tr>
<tr><td>Face-to-face laboratory/clinical exercises</td><td>15 hours</td></tr>
<tr><td>Total participant effort time</td><td>70 hours</td></tr>
<tr><td>Free day for exam preparation day (same for all modules)</td><td>1 day</td></tr>
<tr><td>1 day for assessment (same for all modules)</td><td>1 day</td></tr>
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PRE-REQUISITES FOR THE MODULE	
Minimum entry qualifications, training and years of experience for *all* modules Same for all modules	EQF Level 6 in Physics (BSc Physics or equivalent) and EQF Level 7 in Medical Physics (MSc Medical Physics or equivalent) and 2 year equivalent clinical training in D&IR for clinical Medical Physicists or 2 year equivalent Industry/Radiation Authority experience for Industry/Radiation Authority personnel.
Assumed previous KSC for *all* modules from the 'Inventory of Learning Outcomes for the MPE in Europe' (Annex I of the 'European Guidelines on the MPE') Same for all modules	GENERIC SKILLS : Generic Skills Required at EQF level 7 KSC FOR THE MPE AS PHYSICAL SCIENTIST: All Knowledge learning outcomes to EQF level 7 KSC FOR THE MPE AS A HEALTHCARE PROFESSIONAL: All Knowledge learning outcomes to EQF level 7 KSC FOR THE MPE AS EXPERT IN CLINICAL MEDICAL RADIOLOGICAL DEVICES & RADIATION PROTECTION: All Knowledge learning outcomes to EQF level 7 KSC SPECIFIC FOR THE MPE IN DIAGNOSTIC & INTERVENTIONAL RADIOLOGY: All Knowledge learning outcomes to EQF level 7 The Skills and Competences included in the IAEA document 'Clinical Training of Medical Physicists Specializing in Diagnostic Radiology' (IAEA Training Course Series, 47, 2010) to EQF level 7.
Pre-requisite EUTEMPE-RX online summary modules for *all* modules	MPE10 High dose X-ray procedures in Interventional Radiology and Cardiology: establishment of a robust quality assurance programme for patient and staff (online summary version accessible to all participants in all courses)
Additional pre-requisite EUTEMPE-RX online summary modules for *this* module Different for each module.	None required

MODULE CONTENT: AIM and SUMMARY LEARNING OUTCOMES	
Aim	This module will help the future MPE (Diagnostic and Interventional Radiology, including fluoroscopically guided procedures performed outside the imaging department) to acquire the knowledge, skills and competences necessary to establish a comprehensive Quality Assurance programme for patient and staff safety in Interventional Cardiology and Radiology, exploring and taking into account all the factors impacting on patient and staff dose. In the face-to-face phase participants will have the opportunity to discuss the major issues directly with the present European experts in the field. They will have the possibility to attend practical exercises using the last developed tools to assess equipment performances and to estimate patient and staff doses in the field of interventional radiology. The participants would also be updated with the latest directives, guidelines and activities in the field of interventional cardiology and radiology.
Learning Outcomes (10 – 15 learning outcomes which provide an overview of the KSC addressed in the module)	MPE10.01 Take responsibility for researching, evaluating, leading, and offering vision for the professional development of the role of the MPE (D&IR,) in the ambit of European and national legislation and a holistic vision of healthcare. MPE10.01 Assess, evaluate and optimise image quality, patient dose and occupational dose for clinical protocols for interventional radiology. MPE10.02 Evaluate room design, shielding and equipment selection for diagnostic and interventional radiology. MPE10.03 Research, develop, implement and/or test new dosimetric tools providing patient skin dose distribution maps and organ doses. MPE10.04 Establish a robust quality assurance programme for patient including the set-up and update of diagnostic reference levels for interventional procedure. MPE10.05 Design a dedicated occupational protection program for staff (including personal dosimetry), personalized for the different tasks including also criteria for pregnant staff. MPE10.06 Evaluate available protective devices and their performances and develop new optimised solutions when the available are not satisfactory.

MODULE CONTENT: TARGET KSC TO BE DEVELOPED TO EQF LEVEL 8 From the 'Inventory of Learning Outcomes for the MPE in Europe' (Annex I of the 'European Guidelines on the MPE')	
KSC targeted in *all* modules These learning outcomes are common to and permeate *all* modules, although to a varying degree according to the topic of the module.	GENERIC SKILLS : All 'Generic Skills Required at EQF level 8' KSC FOR THE MPE AS PHYSICAL SCIENTIST: All Skills and Competences to EQF level 8 KSC FOR THE MPE AS A HEALTHCARE PROFESSIONAL: All Skills and Competences to EQF level 8 KSC FOR THE MPE AS EXPERT IN CLINICAL MEDICAL RADIOLOGICAL DEVICES & RADIATION PROTECTION (AND OTHER PHYSICAL AGENTS AS APPROPRIATE): All KSC for Scientific Problem Solving Service to EQF level 8 KSC SPECIFIC FOR THE MPE IN DIAGNOSTIC & INTERVENTIONAL RADIOLOGY: All KSC for Scientific Problem Solving Service to EQF level 8
***PRIMARY KSC* targeted in *this* module** These are the KSC which would be developed to Level 8 during this module. These should be mostly Skills and Competences. However, Knowledge learning outcomes should also be included when the knowledge normally acquired during Level 7 programmes is insufficient for the development of the skills and competences to level 8. The KSC codes from the 'European Guidelines on the MPE' should be inserted for easy reference.	<u>Knowledge:</u> Describe the content of appropriate programmes for healthcare professionals involving the optimised clinical use of medical devices and protection from ionizing radiations in diagnostic and interventional radiology. Describe the process and practical implementation of patient risk assessments in diagnostic and interventional radiology, using techniques for the qualitative and quantitative assessment of risk. Explain the methodology for the setting up of diagnostic reference levels (DRL). Explain how the application of good radiation safety practice and the use of appropriate personal protective equipment minimises worker and public doses in medicine. Describe the requirements for, and the practical implementation of, appropriate systems for the monitoring of radiation dose to the worker, including extremity doses and dose limits for pregnant and lactating workers, and young workers; and for the public; including selection, management and calibration of devices used to measure such doses, dose records and techniques for dose measurement. Describe the process and practical implementation of patient safety / dose audits in the context of Diagnostic and Interventional Radiology. Explain the practical application of ALARA to promote the radiation safety of the worker and public in Diagnostic and Interventional Radiology. Explain the special requirements with respect to occupational radiation protection in fluoroscopy (e.g., particularly in paediatrics and interventional procedures). <u>Skills:</u> Select and use instruments for dosimetric quantities for the various types of ionizing radiations and other physical agents for patients, workers and public in diagnostic and interventional radiology Develop rigorous dosimetry protocols in diagnostic and interventional radiology.

	Interpret the results of dosimetry measurements For each imaging modality, identify and carry out appropriate patient / occupational / public safety related dosimetric measurements and calculations. For each imaging modality measure / calculate patient safety /dose related indicators/quantities and wherever possible verify independently values supplied by manufacturers. Use specialized dosimetry software / conversion coefficients to calculate effective doses and organ absorbed doses from dosimetry measurements. Use radiobiological dose-effect relationships relevant to Diagnostic and Interventional Radiology to estimate patient risk (including adverse incidents involving high exposures). Optimize patient radiation protection in high dose or high risk practices: interventional radiology, CT, health screening programmes, irradiation of children, neonates or the foetus, genetic predisposition for detrimental radiation effects. Verify that radiation protection and risk management is in compliance with guidelines, directives, and legislation (including dose limits). <u>Competences:</u> Take responsibility for the selection, acceptance testing, commissioning and quality control of instruments for the measurement of dosimetric quantities for ionizing radiations and other physical agents in own area of medical physics practice. In the case of acceptance testing this should be done in cooperation with the vendor. Take responsibility for dosimetric investigations and the supervision of dosimetry measurements. Take responsibility for the ongoing optimization of existing and newly introduced protocols in own area of medical physics practice with respect to patient protection and in accordance with the latest published evidence or own research when the available evidence is not sufficient. Implement a detailed organisational policy to support the safety of patients in Diagnostic and Interventional Radiology Take responsibility for statutory and institutional requirements for Medical Physics Services in own area of medical physics practice with respect to Occupational and Public Safety / Risk Management when there is an impact on medical exposure or own safety. Oversee daily patient safety / risk management involving medical devices and associated ionizing radiations and other physical agents in own area of medical physics. For each imaging modality, take responsibility for the measurement of appropriate patient / occupational / public safety related dosimetric monitoring quantities. Take responsibility for the protection of patients by optimization of practices, procedures and acquisition protocols. Take responsibility for establishment of diagnostic reference levels. Take responsibility for statutory and institutional requirements for Medical Physics Services in Diagnostic and Interventional Radiology with respect to Occupational / Public Safety /Dose Optimization when there is an impact on medical exposure or own safety.

***SECONDARY KSC* targeted in *this* module** (EQF Level 8) These are the KSC that are included in the module but would be given less attention owing to time constraints. Please insert the KSC code from the 'European Guidelines on the MPE' project KSC Inventory.	
***NEW KSC* which are NOT** INCLUDED in the 'Inventory of Learning Outcomes for the MPE in Europe'.	

OUTLINE TEACHING PLAN	
Online phase	The online component will consist of a series online lectures, seminars, tutorials as well as compulsory readings on the topics below. Each set will be accompanied by an asynchronous online forum for difficulties and prompting question/s to provoke reflection and discussion. An initial range of topics are: 1. Interventional Cardiology and Radiology procedures. Medical Physics and Radiation Protection topics of interest. 2. Radiobiology. Relevant aspects for fluoroscopy guided procedures. 3. Room design and shielding, interventional system design, regulations, standards. 4. Image Quality assessment for interventional equipment. 5. Dose quantities. 6. Dosimetric indicators, calibration factors, accuracy. 7. Patient dose quantities. 8. Trigger Levels and Diagnostic Reference levels. 9. Patient dose estimation. 10. Risk for staff during interventional procedures. 11. Dose quantities used in personnel dosimetry. 12. Ambient dosimetry. 13. Models for organ and effective dose assessment 14. Protective tools 15. Radiation protection optimisation 16. European and international regulations and recommendations on radiation protection for IR 17. Education and training for health professionals involved in IR
Face-to- Face Phase	The face-to-face component will consist of a series lectures, laboratories and clinical exercises on the topics below: 1. New Horizons in Interventional Cardiology (Invited Lecture – Cardiologist) 2. New Horizons in Interventional Radiology (Invited Lecture – Radiologist) 3. Radiobiology of skin and eye lens (TBA – A. Ottolenghi?) 4. New trends in system design (Invited Lecture – Manufacturer). 5. Image Fusion in Interventional radiology Invited Lecture – C. Cavedon)

	6. Test objects and procedures to evaluate image quality in interventional equipment (A. Trianni). 7. Patient dosimetry: comparison of different methods in terms of availability, implementation difficulties and accuracy (A. Trianni) 8. Patient dose calculation based on mathematical models using DICOM objects information (invited lecture): a. Algorithms (MC codes) b. Mathematical Phantoms c. Accuracy 9. Trigger levels and Diagnostic Reference Levels (E. Vano) 10. Experience with the management of patient dosimetry on line (Jose M. Fernandez) 11. Personal monitoring, including eye lens dosimetry: protocols and new limits (R Padovani) 12. Role of Active Occupational Dosimetry (R Padovani, E Vano) 13. Education and Training: European Guidelines (R Padovani, E Vano)