IAEA
International Atomic Energy Agency
Atoms for Peace and Development

SUMMARY
of the IAEA Technical Meeting on Developing Effective Methods for Radiation Protection Education and Training of Health Professionals, held online 8–10 March 2021

The IAEA Technical meeting was held in a virtual format 8–10 March 2021.

In total, 230 participants and experts represented 67 IAEA Member States, as well as 24 international organizations, professional bodies and safety alliances. Attendees came from a wide spectrum of health disciplines and professions involved in the medical use of ionizing radiation, as well as the medical industry, regulatory bodies, educational and research institutions.

The meeting agenda with links to the recorded sessions is provided in Annex 1, and the list of countries and organizations represented in the meeting is contained in Annex 2.

MEETING OBJECTIVES AND EXPECTED OUTPUT

Objectives:

1. To provide a platform for Member States, cooperating international organizations, professional societies and safety initiatives, to share experiences in developing effective methods for radiation protection education and training, targeted to the needs of specific groups of health professionals, as well as for multidisciplinary training.
2. To identify potential gaps or issues in radiation protection education and training.
3. To propose solutions for addressing those gaps.

Expected output: Conclusions that further strengthen the education, training and professional development of health professionals throughout their career, with a view to ensuring that they meet the requirements for qualification and competence in radiation protection and safety in medical uses of ionizing radiation.

The following report summarizes the findings and conclusions from the meeting.

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

FINDINGS OF THE MEETING

Strengths in the current system for radiation protection education and training

1. There is a consensus and awareness that the education, training, qualification and competence of health professionals underpin radiation protection and safety in medical uses of ionizing radiation. There is further consensus that teamwork, both within the radiation domain and across the clinical and administrative silos, provides better radiation protection for both patients and workers.
2. The International Basic Safety Standards (GSR Part 3) and the IAEA Safety Guide SSG-46 Radiation Protection and Safety in Medical Uses of Ionizing Radiation, the IAEA Safety Reports Series No. 93 and other IAEA guidance documents provide a sufficient foundation for setting an appropriate regulatory framework for education and training of health professionals.
3. Guidelines are available from various international organizations, such as Publication 113 of the International Commission of Radiological Protection (ICRP) and regional organizations such as Publication RP 175 of the European Commission, on the groups of health professionals to be trained according to their duties and responsibilities for radiation protection; learning outcomes in terms of Knowledge, Skills and Competencies (KSC) for these groups; and priority topics and certification of initial and ongoing training. Some curricula have begun to use milestones and entrustable professional activities that include ethics and measurable outcomes, combining Knowledge, Skills, and Attitudes (KSAs).
4. The IAEA provides a variety of free training resources on radiation protection in medicine, including training material for trainers in English, Spanish and Russian, e-learning courses with certificates of completion, and other information and learning resources, all available through the Radiation Protection of Patients website. Regular webinars on radiation protection in medicine organized in partnership with other organizations and promoting a multidisciplinary approach have proved popular and extended outreach. Train the trainers courses and other training opportunities in radiation protection are provided through the IAEA Technical Cooperation Programme.
5. The IAEA provides professional guidelines, handbooks for teachers and students, training material, e-learning courses, digital tools and video tutorials in all applications

of ionizing radiation in human health through the Human Health Campus. The website hosts official Agency publications and information for all health professionals, including radiological medical practitioners, medical radiation technologists and medical physicists. Support to the Member States for professional training of health professionals is available through the IAEA Technical Cooperation Programme and through Coordinated Research Projects (CRPs) which can include the implementation of guidelines.

6. Other international organizations, professional bodies and safety initiatives, as well as manufacturers of radiological equipment and software, provide a growing number of information and learning resources and opportunities.
7. Many local initiatives and good models exist for effective education and appropriate training of health professionals, which make best use of training methodologies, adapted to clinical needs and the busy work schedule of health professionals, provided at the point of care and integrated into the existing clinical scenarios.
8. The COVID-19 pandemic facilitated the development of online learning and communication opportunities that showed great potential for further development and integration with classical methods.

Common weaknesses of radiation protection education and training

1. Insufficient knowledge, skills and/or attitude in radiation protection of patients and staff, and poor knowledge of existing regulatory requirements for radiation protection, especially in medical professions using ionizing radiation outside radiology, nuclear medicine and radiation oncology, such as cardiologists, gastroenterologist, urologist, vascular surgeons, orthopedic surgeons, gynecologists, etc.
2. Lack of recognition of clinically qualified medical physicists (CQMPs) as health professionals in many countries, including lack of certification and re-certification through systems of continuing professional development (CPD), and no access to qualified medical physicists in many countries. Absence of recognition negatively affects the availability of adequate education pathways, according to the international guidelines (IAEA Human Health Series No 25, Training Course Series No 71, 56, 37, 47, 50). There is a lack of training programmes for medical physicists especially in areas such as diagnostic imaging.

3. Heterogeneity of education level of medical radiation technologists (also called radiographers) in different regions/countries, from higher education to a few weeks' on-the-job training, and the insufficient basic radiation protection knowledge of those professionals in many countries.
4. Heterogeneity of legislative and regulatory requirements regarding radiation protection training, including requirements for accreditation of educational organizations and credentialing of trainers.
5. Insufficient involvement of professional bodies in establishing regulatory requirements and training syllabi for radiation protection education and training, including insufficient adaptation of mandatory CPD courses to clinical needs and clinical routine.
6. Lack in some countries of a graded approach to radiation protection training based on radiation risks in a particular profession, such as adaptation of training to dentistry.
7. Lack of requirements for certification of the radiation protection competences for some health professionals, resulting in unsafe working conditions.
8. Lack of time and resources for training specific to radiation protection, including hands-on/practical training and support to radiation protection trainers.
9. Insufficient and/or inadequate knowledge and skills, which is limiting the safe use of new equipment/software, computer-aided tools and their features. Adequate training of all team members is not an integral component of the project plan when new equipment is acquired.
10. Lack of sufficient inclusion in the education and training of topics related to justification and optimization of radiation protection in medical exposure.
11. Lack of understanding of dose descriptors, radiation dose effects and diagnostic reference levels in diagnostic and interventional procedures.
12. Lack of implementation of local incident reporting systems and plans for minimizing the likelihood of unintended and accidental exposures, and their use for learning and improving safety culture.
13. Lack of teamwork and a lifelong learning models based on defined roles and responsibilities in radiation protection.

14. Lack of an effective radiation safety culture in institutions that do not provide adequate training and staffing to assure that patients are the focus of activities, which also compromises communication and ethics.
15. Lack of awareness of radiation risks by referring physicians and dentists, linked to the lack of content related to radiation benefits and risks in academic curricula of medical and dental students; lack of access to clinical guidelines and referral guidelines for imaging (especially electronic) or their insufficient use when available.
16. Lack of knowledge, skills, attitudes and behaviors in benefit and risk communication and ethical issues in radiation protection.
17. Lack of involvement of patient advocates in the field of radiation protection.

Possible solutions for improving qualification and competencies of health professionals related to radiation protection

1. Formally recognize the need for accrediting and certifying radiation protection education and training; set requirements for trainers' competencies in radiation protection training. This applies to governments, regulators, educational institutions and professional societies.
2. Strengthen regulatory requirements and their application on a national level for the involvement of clinically qualified medical physicists (as per the IAEA Human Health Series No 25 definition) as health professionals in radiation medicine services, including diagnostic radiology, and their key role in radiation protection training of other health professionals.
3. Ensure sufficient inclusion of radiation protection topics in the basic curricula of medical and dental schools and during residency.
4. Ensure basic education for medical radiation technologists/radiographers, including related competences in radiation protection, and strengthen their hands-on/practical training.
5. Bring together appropriate stakeholders in medical radiation protection, share good practices towards a more harmonized radiation protection environment.
6. Provide clear guidance on mandatory radiation protection CPD linked to existing national and international resources such as those provided by the IAEA, and adapted

to the needs and responsibilities for radiation protection of different professional groups.

7. Develop a guidance document on 'model' teamwork that defines roles and responsibilities in radiation protection for medical and dental practices, linked to existing international guidelines; ensure their translation into multiple languages.
8. Support practical training by using online, on-demand case studies; integrate radiation protection education and training into clinical training; employ the use of multimedia, virtual reality and simulators.
9. Develop 'made easy' short guides (leaflets, flyers, posters) about dose descriptors and other topics of interest, adapted for each stakeholder group's needs, and ensure their translation into multiple languages.
10. Improve industry involvement to provide tailored and improved application training to all involved health professionals, and maximize the knowledge and proper use of complex equipment/software and their relevant features for radiation protection of patient and staff.
11. Encourage sharing across regions of methodologies for design and optimization of imaging protocols, in support to the best use of equipment or software.
12. Increase operators' awareness of their responsibilities for radiation protection and their knowledge om implementing routine dose assessments (CT, FGI, PET-CT), standards of good practice and clinical audits on a regional and/or national level.
13. Promote awareness and benefits and simplify higher quality clinical care by implementing innovative technologies such as clinical decision support systems (CDS) and radiation exposure monitoring (REM) systems to help in justification and optimization of medical imaging; measure outcomes from use of these systems.
14. Increase the use of tools that promote safety culture and identify areas of improvement as part of a patient-centered comprehensive quality management programme and increase number of clinical audits (such as IAEA QUATRO, QUANUM and QUAADRIL).
15. Hold regular lunchtime meetings in the workplace towards continuing medical education (CME), for example, conferences like tumour boards and credit-conferring; provide education at multidisciplinary staff meetings, underlining responsibility of clinicians.

16. Include refresher courses on radiation protection at annual professional conferences of relevant disciplines.
17. Provide learning opportunities from incidents and near misses and through peer reporting and learning systems (such as the IAEA's SAFRAD and SAFRON), and promote a no-blame approach to incident reporting and learning for minimizing the likelihood of unintended and accidental exposures.
18. Encourage greater application of science concepts to clinical practice into the field of radiation protection as a strategy to develop competences and enhance evidence-based practice.
19. Consider learning from the experience of patient advocates in the radiation protection environment.
20. Encourage research projects with an emphasis on education and training in radiation protection.

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

MEETING CONCLUSIONS

Based on the discussions and analysis of the strengths, weaknesses and available solutions, the meeting participants agreed upon the following actions to strengthen radiation protection education, training and competence of health professionals at the international level:

1. Request the IAEA to develop, in cooperation with partnering international organizations and professional bodies from all regions, a guidance document on education and training in radiation protection for health professionals. Such a publication has to:

    a. Focus on how to implement the requirements for qualification and competence in radiation protection and safety in medical uses of ionizing radiation of various groups of health professionals tailored to their field of application, role and responsibility for radiation protection.

    b. Define standards of competence and qualification in radiation protection for relevant professional groups.

    c. Combine the existing catalogue of learning outcomes with the expected competencies suggested for all professional groups.

    d. Advise on the learning methodology and practical implementation of training adjusted to adult learning approaches and best practices.

    e. Define the requirements for the identification of trainers, training resources and training institutions.

    f. Provide a catalogue of existing free training resources from international or national organizations.

2. Improve the implementation of training programmes of radiation protection at national and facility level, to address the above identified weaknesses and newly emerging challenges:

    a. Include sufficient training on aspects of radiation protection with respect to new equipment, software, computer-aided tools, and applications of technology in medical/dental imaging and radiation therapy, with close collaboration of the healthcare industry.

   b. Foster the close involvement of qualified medical physicist to facilitate on-the-job training for all health professionals and improve recognition of such activities in the CPD system.

   c. Include a basic training for the management of Clinical Decision Support (CDS) systems and the Radiation Exposure Monitoring (REM) systems to improve justification and optimization of medical imaging.

   d. Include ethical aspects and benefits/risks in communication with patients and other stakeholders.

   e. Promote and maintain online training in radiation protection (based on experience during the pandemic period) and assess outcomes.

3. Advocate for more training resources and make them available for trainers and for self-study at international level, including:

   a. Material for basic training in radiation protection for health professionals to be used by education institutions.

   b. Electronic training resources for practical aspects of radiation protection, including visuals, videos and simulations, to be used during basic training and CPD courses.

   c. Online information material on radiation benefits and risks for referring practitioners and patients.

4. Provide a set of training activities to be adapted for continuous training in radiation protection at the national level. Tailor CPD activities to the learning outcomes for each group of health professionals with a priority towards practice-oriented online activities and adaptable to the clinical routine of health professionals.

5. Promote the evaluation of the impact of radiation protection training in the improvement of radiation protection and safety in the health sector at national and facility level (e.g. measuring the decrease of exam protocol variation, patient and occupational doses, reported incidental and accidental exposures and related near-misses).

6. Promote coordination and collaboration at all levels for best results in education and training in radiation protection of health professionals:

a. At international level: between international organizations and professional organizations.

b. At national level: between regulatory bodies, educational and health authorities, and professional bodies.

c. At facility level (depending on the field of application): multidisciplinary team approaches for radiation protection training involving qualified radiological medical practitioners (radiologists, nuclear medicine physicians, radiation oncologists, dentists or physicians of other specialties performing interventional procedures), medical radiation technologists and medical physicists, as well as other health professionals, hospital leadership, radiation protection officers.

d. At all levels: involve regulatory, clinically qualified medical physicists and industry representatives for application training tailored to radiation protection with the new equipment/software. Involve patient advocates.

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Annex 1. Meeting agenda

Monday, 8 March 2021
Session recording

13:30 – 14:00	*Testing the online connection*	
14:00 – 14:10	Opening and welcome	Chair: Jenia Vassileva, IAEA Peter Johnston, Director NSRW
Session 1. Setting the scene: current status of international guidance ***Objective:*** *Identify the available international guidelines and standard syllabi for building knowledge, skills and competence of health professionals in radiation protection*		Chair: Eliseo Vano & Jenia Vassileva
14:10 – 14:30	*Motivation, scope and objectives of the TM. Summary of the pre-meeting survey*	Jenia Vassileva, Scientific Secretary
14:30 – 14:40	International BSS requirements and guidance for education and training in radiation protection	Andrea Luciani, IAEA
14:40 – 14:50	IAEA program for radiation protection of patients and IAEA training resources	Ola Holmberg, IAEA
14:50 – 15:00	IAEA guidance on education and training of health professionals and related NAHU resources	Miriam Mikhail, Giorgia Loreti, Ben Prajogi, IAEA
15:00 – 15:10	WHO perspective to radiation protection education and training of health professionals	Maria Perez, WHO
15:10 – 15:20	ICRP Publication 113 and other ICRP recommendations for education and training in radiation protection of health professionals	Kimberly Applegate, ICRP
15:20 – 15:30	European guidelines on radiation protection education and training of medical professionals (RP 175)	Graciano Paulo, EURAMED, EFRS
15:30 – 15:45	*Break*	

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Session 2: Radiation protection training of health professionals: good practices, problems and solutions ***Objective**: Share good practices in effective radiation protection training, identify existing gaps and problems, and suggest solutions*		Chairs: Kimberly Applegate, Jenia Vassileva
15:45 – 15:55	Introduction and tasks for the panel discussions and contribution of participants	Session chairs
15:55 – 16:25	<u>Panel discussion 1:</u> Radiation protection training in diagnostic radiology, including dental *Questions for the panel:* *1) From the perspective of your professional group, what are the three main weaknesses in E&T in relation to having robust radiation protection and safely of patient and staff in diagnostic radiology?* *2) Suggest three solutions/ approaches related to E&T for improving radiation protection of patients (list them in priority order)*	Brenda Byrne, EFOMP Carlo Catalano, ESR Arun Chougule, IOMP Jessica Clements, AAPM Dina Husseiny Salama, AFROSAFE Reinhilde Jacobs, IADMFR Jonathan McNulty, EFRS Miriam Mikhail, IAEA Paulo Melo, Council of European Dentists Stewart Whitley, ISRRT
16:25 – 16:55	<u>Panel discussion 2:</u> Radiation protection training in fluoroscopy guided interventional procedures *Questions for the panel:* *1) From the perspective of your professional group, what are the three main weaknesses in E&T in relation to having robust radiation protection and safely of patient and staff in fluoroscopy guided interventional procedures?* *2) Suggest three solutions/ approaches related to E&T for improving radiation protection of patients (list them in priority order)*	Arun Chougule, IOMP Olivera Ciraj-Bjelac, IAEA Jessica Clements, AAPM Werner Jaschke, CIRSE Graciano Paulo, EFRS Napapong Pongnapang, ISRRT Kemal Sarika, International Alliance of Urolithiasis Suphot Srimahachota, Thailand Asadur Tchekmedyian, Uruguay

16:55 – 17:30	Panel discussion 3: Radiation protection training of referring physicians and dentists *Questions for the panel:* *1) From your experience, what are the best training approaches (list three) for raising awareness of referring physicians on their responsibility for appropriate use of radiation?* *2) What is the best timing for courses related to radiation risks and benefits during the professional development of all physicians and dentists?*	Boris Brkljacic, ESR/ ISR Shane Foley, EFRS Donald Frush, Image Gently Reinhilde Jacobs, IADMFR Marco Landi, Council of European Dentists Miriam Mikhail, IAEA Ernesto Mola (WONCA) Maria Perez, WHO Kemal Sarika, International Alliance of Urolithiasis

Tuesday, 9 March 2021

Session recording

Session 2: Radiation protection training of health professionals: good practices, problems and solutions (cont.)		Chair: Graciano Paulo, Ola Holmberg
14:00 – 14:05	Opening and introduction	Scientific secretary and Session chairs
14:05 – 14:35	Panel discussion 4: Radiation protection training in nuclear medicine *Questions for the panel:* *1) From the perspective of your professional group, what are the three main weaknesses in E&T in relation to having robust radiation protection and safely of patient and staff in nuclear medicine?* *2) Suggest three solutions/ approaches related to E&T for improving radiation protection of patients (list them in priority order)*	Klaus Bacher, EURAMED Jessica Clements, AAPM Lídia Cunha, EANM Eduardo Herrrera Reyes, EANM Peter Knoll, IAEA Donna Newman, ISRRT Diana Paez, IAEA
14:35 – 15:05	Panel discussion 5: Radiation protection training in radiation oncology *Questions for the panel:* *1) From the perspective of your professional group, what are the three main weaknesses in E&T in relation to having robust radiation protection and safely of patient and staff in radiation oncology?*	Bette W. Blankenship, AAPM Mary Coffey, ESTRO Giorgia Loreti, IAEA Loredana Marcu, EFOMP Pedro Ortiz Lopez, IOMP Gregorius Ben Prajogi, IAEA Anastasia Sarchosoglou, EFRS

	2) Suggest three solutions/ approaches related to E&T for improving radiation protection of patients (list 3 in priority order)	
15:05 – 15:35	<u>Panel discussion 6:</u> Training at introduction of new technologies or new equipment and during the equipment life cycle *Questions for the panel:* *1) From the perspective of your organization, what are the three main weaknesses in E&T related to the optimal and safe use of a technology or equipment that is new for a clinic* *2) Suggest what equipment vendors/ service providers and users should improve to ensure that radiological equipment is used safely for patients and staff*	Lacy Hubbard, DITTA Christoph Bert, EFOMP Ivana Blazic, ESR Bette W. Blankenship, AAPM Olivera Ciraj-Bjelac, IAEA Mary Coffey, ESTRO Riccardo Corridori, DITTA Alexia De Lussy, DITTA Christian Drexler, DITTA Shane Foley, EFRS Philip Malca, DITTA Donna Newman, ISRRT Pedro Ortiz Lopez, IOMP Gregorius Ben Prajogi, IAEA Katrien Van Slambrouk, HERCA
15:35 – 16:05	<u>Panel discussion 7:</u> Training on communication, professional codes of ethics, teamwork and safety culture *Questions for the panel:* *1) When and how training on communication, code of ethics, teamwork and safety culture should be embedded into the E&T of health professionals?* *2) Suggest three training solutions/ approaches that might work for strengthening teamwork and safety culture*	Kimberly Applegate, ICRP Bette W. Blankenship, AAPM Mary Coffey, ESTRO Donald Frush, Image Gently Debbie Gilley, IAEA Giorgia Loreti, IAEA Jonathan McNulty, EFRS Emad Naguib, ISR Diana Paez, IAEA Maria Perez, WHO Stewart Whitley, ISRRT
16:05 – 16:20	*Break*	
Session 3: Training approaches: good practices ***Objective:*** *Share information on successful and innovative approaches for radiation protection training of healthcare staff*		Chair: Maria Perez
16:20 – 16:30	Image Gently: Shared Dialogues and Shared Decisions through Shared Voices	Donald Frush, Image Gently
16:30 – 16:40	EuroSafe Imaging Campaign: from the cradle	Graciano Paulo, EuroSafe Imaging

16:40 – 16:50	Practical online tools for patient and occupational radiation safety	Alan Mason, Australia
16:50 – 17:00	CPD for healthcare professionals: balancing clinical relevance with practical use	Tom Clarijs, Belgium
17:00 – 17:10	Decreasing radiation dose to the operator and patient in fluoroscopy guided interventions by using simulators	Gabriel Bartal, Israel
17:10 – 17:20	Entire Hospital Personnel Training: mission Impossible?	Prodromos Kaplanis, Cyprus
17:20 – 17:30	"Involve me and I learn". The paradigm of a competition	Anastasia Sarchosoglou, Greece

Wednesday, 10 March 2021

Session recording

Session 4: Recommendations of the meeting ***Objective:*** *Summarize and prioritize meeting recommendations (to the Members States, IAEA and partnering organizations)*		Chairs: Eliseo Vano, Jenia Vassileva
14:00 – 15:00	Summary of session 2 (day 1 and day 2) Summary of session 3	Session chairs
15:00 – 15:30	Discussion on the need of a framework document and a standard syllabus for education and training in radiation protection for different health professional groups.	Introduction by Jenia Vassileva and open discussion
15:30 – 15:45	*Break*	
15:45 – 16:45	Recommendations of the meeting	Advisory group and open discussion
16:45 – 17:00	Summary and closing	IAEA

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Annex 2. List of IAEA Member States and international organizations represented in the meeting

Representing Country	
Afghanistan	Malta
Algeria	Mali
Argentina	Morocco
Armenia	Netherlands
Australia	North Macedonia
Belgium	Norway
Benin	Oman
Brazil	Pakistan
Brunei	Peru
Bulgaria	Poland
Chile	Portugal
China	Romania
Croatia	Russia
Cyprus	Saudi Arabia
Denmark	Senegal Republic
Ecuador	Serbia
Egypt	Slovenia
Estonia	Spain
Finland	Sri Lanka
Germany	Sudan
Greece	Sweden
Iceland	Switzerland
India	Tanzania
Indonesia	Thailand
Ireland	Togo
Israel	Tunisia
Italy	Turkey
Jordan	Ukraine
Kenya	United Arab Emirates
Kuwait	United Kingdom
Laos	Uruguay
Latvia	Sri Lanka
Lithuania	Uruguay
Luxembourg	

IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Organization	
1.	American Association of Physicists in Medicine (AAPM)
2.	AFROSAFE
3.	Cardiovascular and Interventional Radiological Society of Europe (CIRSE)
4.	Council of European Dentists
5.	Global Diagnostic Imaging, Healthcare IT and Radiation Therapy Trade Association (DITTA)
6.	European Association of Nuclear Medicine (EANM)
7.	European Commission (EC)
8.	European Federation of Organisations for Medical Physics (EFOMP)
9.	European Federation of Radiographer Societies (EFRS)
10.	European Society of Radiology (ESR)
11.	European Society for Radiotherapy and Oncology (ESTRO)
12.	European Alliance for Medical Radiation Protection Research (EURAMED)
13.	Heads of the European Radiological Protection Competent Authorities (HERCA)
14.	EuroSafe Imaging
15.	International Association of DentoMaxilloFacial Radiology (IADMFR)
16.	International Atomic Energy Agency (IAEA)
17.	International Alliance of Urolithiasis (IAU)
18.	International Commission on Radiological Protection (ICRP)
19.	Image Gently Alliance
20.	International Organization for Medical Physics (IOMP)
21.	International Society of Radiology (ISR)
22.	International Society of Radiographers and Radiological Technologists (ISRRT)
23.	World Health Organization (WHO)
24.	World Organization of Family Doctors (WONCA)