CURRENT ISSUES WITH OPTIMISATION AROUND THE WORLD AND SUPPORT FROM THE IAEA

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International system for radiation protection

UNSCEAR studies the sources and effects of radiation

ICRP provides recommendations for protection

IAEA establishes safety standards and provides for the application of these standards
International system for radiation protection

- All Safety Standards go through a formal process of Member State comments
- Involve relevant professional bodies
- Reflect the international consensus

IAEA establishes safety standards and provides for the application of these standards
Radiation protection in medical uses

International Basic Safety Standards (GSR Part 3)
- Published 2014
- Set basic requirements for protection and safety
- Co-sponsored by 8 international organizations

Safety Guide SSG-46: Medical uses of IR
- Published October 2018
- Jointly sponsored by IAEA, WHO, PAHO, ILO
- Cooperation in developing from international/regional professional organizations: IOMP, ISR, ISRRRT, WFNMB, ESTRO
Optimization of protection (GSR Part 3, SSG-46)

- For medical exposure: The management of the radiation dose to the patient commensurate with the medical purpose.
- In diagnostic and interventional medical exposure: Keeping the exposure of patients to the minimum necessary to achieve the required diagnostic or interventional objective.

Components of optimization:
- Equipment design and software
- Calibration
- Quality assurance and quality control
- Dosimetry of patients and DRLs
- Operational aspects (protocols, technique and parameters)
- Radiological review

Responsibilities:
- Radiological med. professionals
- Medical physicists
- Medical rad. technologists
- Vendors and service engineers
- Licensee
- Regulatory and health authorities
- Professional bodies
Application of safety standards into practice

Guidance

Trainings

Technical assistance

Knowledge exchange

Building awareness
Issues with optimization around the world
IAEA coordinated studies

• Large variations in patient doses for the same imaging exam
IAEA coordinated studies

IAEA study of practice in paediatric radiology:
40 countries, 126 hospitals, 146 CT facilities

- 22-fold variation between average dose indexes for the same age group and the same type of CT exam
- Adult protocols often used for children
IAEA coordinated studies

IAEA study of CT protocols and doses for hematuria and urinary stones 20 countries

- Up to 12-fold variations in urinary stone CT examinations (median DLP values of 219–2664 mGy.cm) with use of reduced dose CT in only 4/20 participating countries.
- 80% use 3–6 phase CT urography protocols associated with 2.4–4.9-fold higher dose compared to 2-phase protocol.
IAEA coordinated studies

IAEA study on COVID-19

• 62 CT facilities from 34 countries
• 10-fold variations in median DLP
• CT use, scan protocols, and radiation doses showed wide variation across health care sites within the same and between different countries.
Challenges with optimization

- Access to dose reduction technology in different parts of the world
- Access to dose data in a digital format
- Knowledge and skills of health professionals, often linked to lack of good professional qualification or lack of training on practical RP aspects
- Access to qualified medical physicists in medical imaging
- Safety culture and team work
- Enforcement through national legislation
- Collaboration between regulatory bodies, health authorities and professional bodies
- National DRLs and patient dose monitoring programs
- Proper QM/QA/QC program, often limited to technical QC
- Operational procedures and optimized protocols
Main issues with the optimization, based on the analyses of the legislation of 24 countries from Europe and Central Asia (TC region Europe) made in 2021:

- Access to medical physicists in diagnostic and interventional radiology is required in only $10/24$ (42%) countries.
- Establishment of a QA program for medical exposure is required in $10/24$ (42%) countries and partly (limited to technical QC) in $10/24$ countries.
- Establishment of DRLs in diagnostic and interventional radiology and local assessment of typical doses for patients in DRL quantities considering image quality is required in $11/24$ (46%) and partly in $10/24$ countries.
- Formal education of medical radiation technologists exists in only 40% of countries.
- Requirements on radiation protection training and competence are in many cases general, not specific for medical exposures.
- Much better enforcement in EU-member states due to the binding EU Directive.
Status and challenges of the use of DRLs

IAEA Technical meeting in 2016
“Patient dose monitoring and the use of DRLs for the optimization of protection in medical imaging”

60 professionals representing 35 countries and 8 international organizations and professional bodies
## Main system components requiring development

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<thead>
<tr>
<th>Main point</th>
<th>Possible solutions</th>
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<tr>
<td>① Human resources and responsibilities</td>
<td>Increase the number and recognition of medical physicists. Raise awareness and responsibilities of the principle professionals.</td>
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<td>② Training</td>
<td>Improve basic and continuous training in radiation protection. Ensure proper mentoring and oversight.</td>
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<td>③ Safety and quality culture</td>
<td>Enhance accountability, awareness, motivation, both at leadership level and among professionals. Emphasize team work.</td>
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<td>④ Regulations</td>
<td>DRLs, QA and medical physicists access should be required by legislation wherever lacking. Advocacy to authorities.</td>
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<td>⑤ Funding</td>
<td>Funding can facilitate quality of data collection. Motivate governments for funding.</td>
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IAEA support for improving optimisation

- Radiation protection of patients (RPOP)
- Dosimetry and medical radiation physics (RDMP)
IAEA guidance
1. INTRODUCTION

2. PATIENT RADIATION EXPOSURE MONITORING GOALS AND STRUCTURE

3. COMPONENTS OF PATIENT RADIATION EXPOSURE DATA

4. PATIENT RADIATION EXPOSURE MONITORING WORKFLOW

5. RECORDING PATIENT RADIATION EXPOSURE DATA

6. COLLECTION OF PATIENT RADIATION EXPOSURE DATA

7. ANALYSING PATIENT RADIATION EXPOSURE DATA

8. IMPLEMENTATION OF PATIENT RADIATION EXPOSURE MONITORING

APPENDIX

REFERENCES

GLOSSARY

LIST OF ABBREVIATIONS AND SYMBOLS

Free training material for trainers

https://www.iaea.org/resources/rpop/resources/training-material
Free webinars

- Online lectures on topics in radiation protection of patients and staff
- In English, Spanish, Portuguese, Russian
- Held in cooperation with Image Gently, ESR (EuroSafe Imaging), LatinSafe, EFRS, IOMP, CIRSE, IADMFR, etc.
- Free registration and attendance
- Recording available for viewing

https://www.iaea.org/resources/rpop/resources/webinars
Technical cooperation

• Regional and national meetings, workshops and trainings
• Participation in medical conferences and congresses
• Group scientific visits for teams of professionals
• Expert support
• Trainings of regulators on inspecting optimization
Public website http://rpop.iaea.org

Annually: 1 million pageviews
• Contains useful information and FAQs for health professionals, patients and public
• Links to resources: training material, posters, webinars, videos, etc.
Dosimetry and Medical Radiation Physics Section (under the Human Health Division of the IAEA)

Medical physics
Development and harmonization of guidance on physical & technical aspects of QA to support safe & effective use of radiation in medicine

Dosimetry
Calibration & audit services
Dosimetry Laboratory and Dosimetry Audit Networks

Education & Training
Dosimetry and Medical Radiation Physics

**Harmonization of radiation dosimetry** through the development of dosimetry codes of practice (e.g. TRS-457);

Publication of **guidelines on quality assurance and quality control** in therapy and imaging physics;

Publication of **guidelines for harmonization of education, training and professional development** of medical physicists in radiotherapy and imaging;

Provision of **dosimetry services** (comparisons and calibration of radiotherapy, X-ray diagnostic radiology and radiation protection standards) and **postal dosimetry audits** for radiotherapy centres.

Supporting the **development of clinical medical physics services** in LMICs (in the framework of the IAEA ‘s Technical Cooperation Programme)

Supporting the establishment and **strengthening of national education programmes** in medical physics, including audit and certification aspects.
Radiation Dosimetry

International harmonization and consistency in radiation dosimetry

Calibration service for national dosimetry standards

IAEA/WHO SSDL Network is an association of national SSDLs Members
- 88 laboratories in 75 countries
- The IAEA laboratory acts as a central laboratory for the network
To achieve international harmonization in quality assurance in radiation medicine by enhancing quality in the practice of diagnosis and treatment in Member States.
Comprehensive clinical audits

Key elements for the development of effective systems for managing quality in health care.
Relevant Coordinated Research Activities

**Evaluation and Optimization of Paediatric Imaging**

**CRP E24020 (2015-2019)**
To enhance the capabilities of Member States to improve the efficiency of existing modalities for paediatric medical imaging, as well as to implement and enhance optimization techniques and methodologies for advanced paediatric medical imaging.

**CRP E24024 (2021-2025)**
Standardization of radiology medical physics dosimetry instrumentation, equipment and procedures in laboratories and hospitals to support the update of the IAEA Technical Reports Series (TRS) No. 457 “Dosimetry in diagnostic radiology: an international code of practice”. 

Medical Physics

E&T

CPD

Guidelines

Access
Harmonization
Resources
Training Courses
Online resources
Dissemination
TC
e-learning
The Human Health Campus
Thank YOU!