Challenges of Radiological Protection in Research and Society referring to Medical Field

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The evolving role of the medical physicist in the field of Radiological Protection

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Associazione Italiana di Fisica Medica e Sanitaria (AIFM)

AIFM represents about 1500 medical physics experts (MPEs) working in public (University) and private hospitals

Research and clinical activities in the following fields:

- Radiation protection (patients, staff, public)
- Non ionizing radiation (MR, lasers, hybrid systems)
- Artificial Intelligence
- MPE activities in Radiology, Radiotherapy, Nuclear Medicine

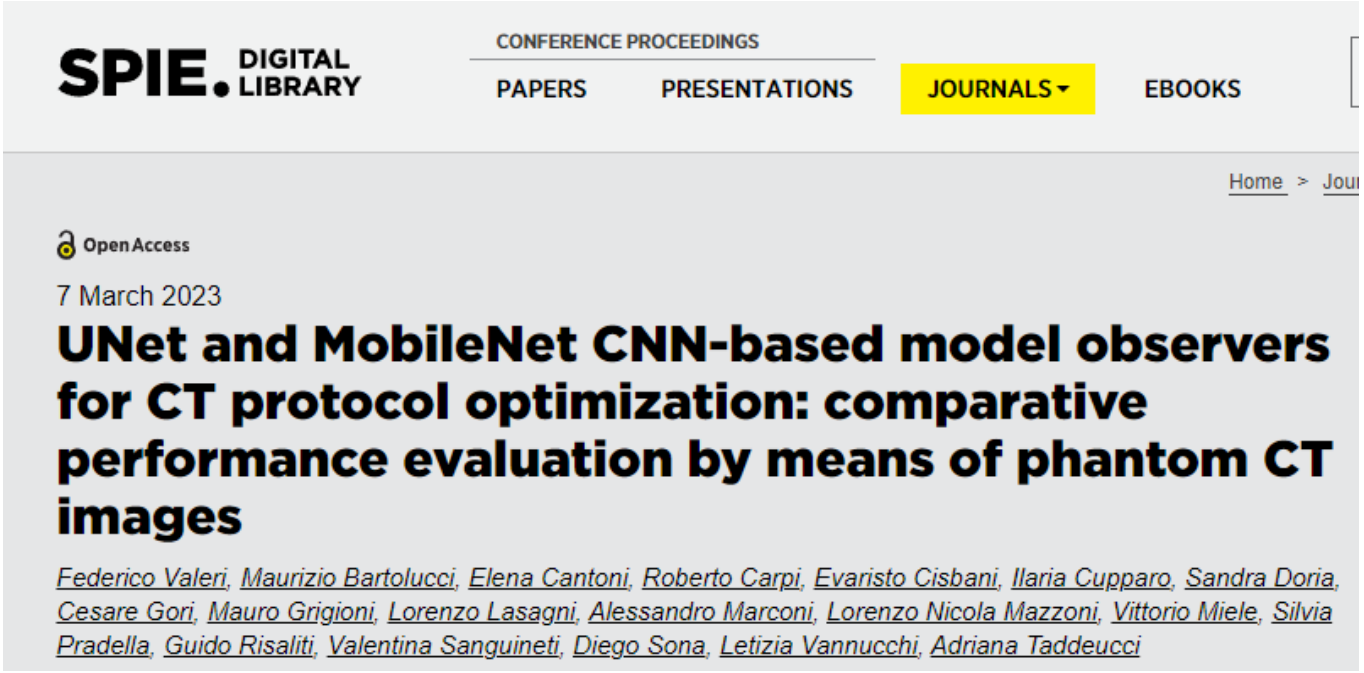
Owner of Physica Medica: European Journal of Medical Physics

Hot Topics for MPEs

- CT dose optimization (AI and model observers techniques), Virtual/in silico?
- Novel nuclear medicine tracers, including theranostics – personalized dosimetry
- More accurate organ dose estimation – Update of DRLs and QA to keep them 'Fit for clinical purpose'
- Radiotherapy – dose escalation, dose painting by numbers (intergration between imaging and therapy), heavy ions, FLASH, dose rate effect
- Hybrid systems – safety and optimization (PET-CT, PET-MR, MR-LINAC) – how to transpose quantitative imaging experience (imaging biomarkers) on those systems?
- A holistic approach to the management of physical agents in hospitals (xray, lasers, US, EMF, etc.) is needed to ensure an optimized and fit-for-purpose use of medical devices – large MP dept. with different expertise
- Large emergencies response, improve training and preparedness in hospitals
- Screenings – risk to benefit assessment
- Connections between categories of exposure in the hospital setting

Increase individualization/personalisation of exposure optimization while maintaining reasonableness of choices for the benefit of patients and system sustainability

Inter-professional and inter-istitutional collaboration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UNet and MobileNet CNN-based model observers for CT protocol optimization: comparative performance evaluation by means of phantom CT images

Federico Valeri, Maurizio Bartolucci, Elena Cantoni, Roberto Carpi, Evaristo Cisbani, Ilaria Cupparo, Sandra Doria, Cesare Gori, Mauro Grigioni, Lorenzo Lasagni, Alessandro Marconi, Lorenzo Nicola Mazzoni, Vittorio Miele, Silvia Pradella, Guido Risaliti, Valentina Sanguineti, Diego Sona, Letizia Vannucchi, Adriana Taddeucci

Radiologists, medical physics experts, researchers from hospitals, university hospitals, research centres, Istituto Superiore di Sanità working together with the aim of optimizing exposure in CT examinations.

Do all these efforts make sense? I think yes, for two reasons.

1. The artificial exposure of the population is largely dependent on medical exposure (UNSCEAR)

2. It is an exciting challenge for a physicist

Maintain and reinforce what has worked well

The application of the system in hospital is based on two pillars, transposed into Italian legislation (Dlgs 101/2020) from the 2013/59/Euratom Directive

Clinical responsibility– Medical Doctor with appropriate Specialisation

Dose Estimation – Medical Physics Expert

Modern and more effective optimization - team action – ICRP TG 108

Individual Justification– Medical Doctor

Dose Estimation – Medical Physics Expert

Current and Near Future fields of activity for MPEs involving radiological protection

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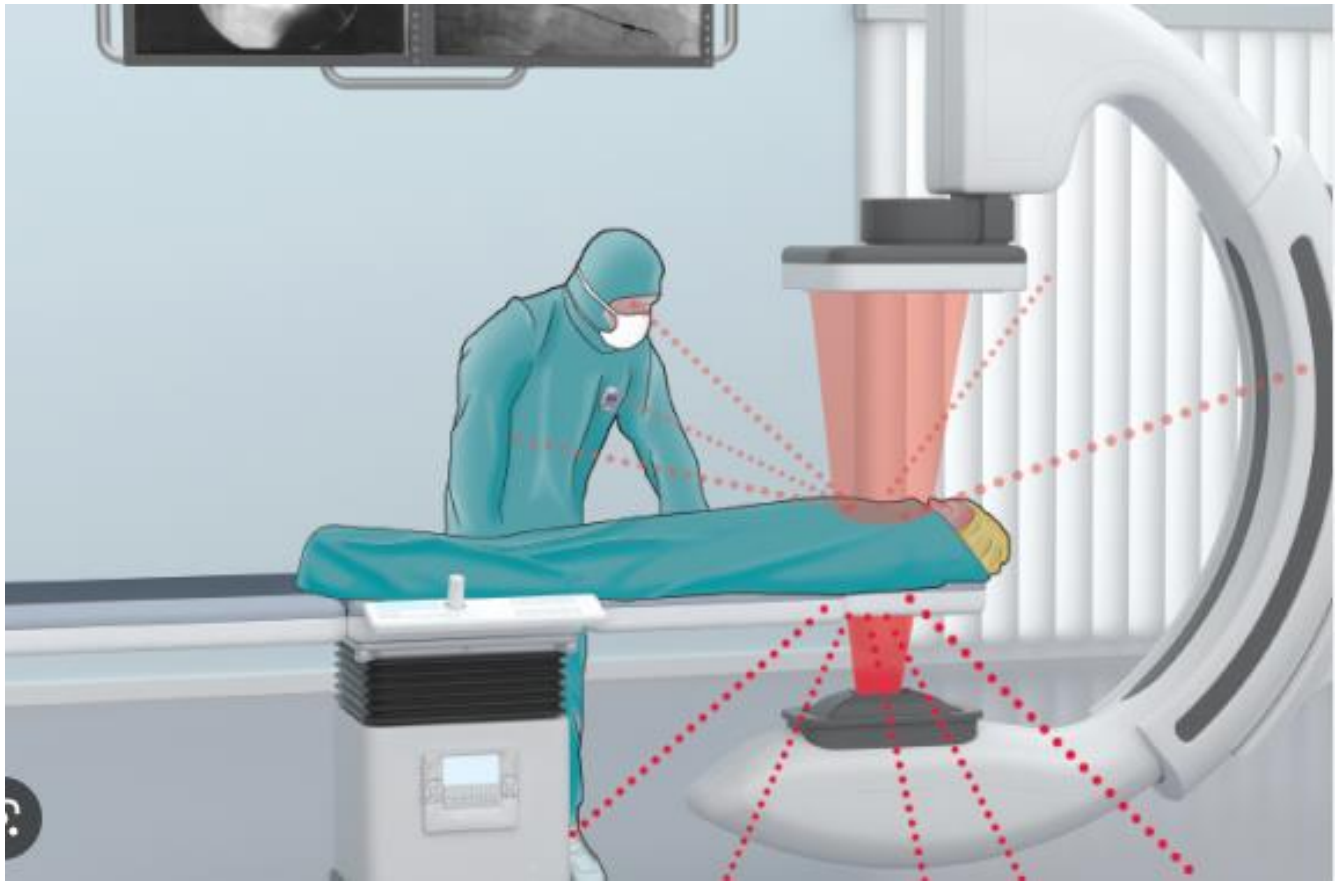
- **Connections between categories of exposure in the hospital setting**

- The existence of different categories of exposure is reflected in regulatory systems where the management of the protection of patients and workers/public can be quite separated (different professionals involved, separated application of the optimisation principle, etc.)

- But in practice staff and public exposures are related with patients exposures and actions that ensure the radiation protection of workers are often strongly interconnected with those dedicated to the radiation protection of patients.



staff exposure depends on imaging protocols, collimation, frame rate, dose rate, resolution, etc. etc.

Similar scenario in nuclear medicine

patient is injected with a radioactive tracer and has to be assisted

Graphics&Comics from Francesco Rossi, Florence Italy

- However in Europe we have two professionals taking responsibilities… MPE and RPE

- So … The application of system is redundant and its effectiveness depends on the effectiveness of the liaison between RPE and MPE. Where the MPE also acts as the RPE the problem does not exist

- In 2013 the 59/EURATOM directive highlighted the need for a liaison between MPE and RPE in the hospital setting, implicitly recognizing that lack of cooperation can limit the effectiveness of radiation protection, but without adding anything else. Something more is needed at the regulatory level

- In 2023 EFOMP updated the **Malaga Declaration to fill this gap**

- Today MPEs in many European countries act also as the RPE (in Italy more than 94% in public healthcare system*).

- Where the RPE is a MPE, radiation protection management **is simplified, more effective and less expensive**.

*data from 2019 AIFM survey, thanks to Carlo Cavedon and Michele Stasi

Summarizing…

- Medical exposures grow in number and complexity … a lot of work to do: research, traslational research, teaching, … improving the effectiveness of the system
- Mantaining and strenghtening the basic principles and responsibilities
- Collaboration with all the healthcare professionals involved in optimization – team action
- MPE acting also as the RPE in the hospital setting

Thank you very much for your attention

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