Challenges in medical X-ray imaging and radiation protection dosimetry and the need for updated standards

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Purpose: Consistent quantification and optimization of radiation exposure using calibrated dosimetry equipment is essential to comply with international and European Basic Safety Standards. A large range of IEC and ISO standards are applied, and their harmonization is needed. In medical X-ray imaging, the IEC 61267 describes the reference radiation qualities used for calibration, but they do not cover the clinical needs. The IEC 61674:2012 and the IAEA TRS-457:2007 define requirements for X-ray imaging dosimetry, but they do not fully consider recent technical developments in X-ray imaging, such as the use of semiconductor-based X-ray multimeters. In radiation protection, new operational quantities are proposed in ICRU Report 95 (2020), and their implementation requires attention and research data as well as bridging gaps in type testing requirements based on IEC standards. Moreover, ISO 4037:2019 needs refinements to be fully implementable.

Methods: Two European projects aiming to provide research data to update dosimetry standards were launched in 2023. They are funded by European Partnership on Metrology and co-financed from the European Union's Horizon Europe Research and Innovation Programme and by the Participating States. 22NRM01 TraMeXI: *Traceability in Medical X-ray imaging dosimetry*, and 22NRM07 GuideRadPROS: *Harmonisation, update and implementation of standards related to radiation protection dosimetry for photon radiation*, aim to improve the situation in dosimetry. Updated measurement and calibration procedures are proposed for inclusion into standards and protocols. First an overview of the current situation in dosimetry was performed based on an international questionnaire. A range of radiation qualities and dosimetry protocols were reviewed, and data on the usage of different dosimeters were gathered.

Results: This presentation summarizes the project objectives and current results. The data of radiation qualities, dosimeters, and dosimetry protocols currently used are analyzed and compared with those considered in the IEC, ISO, and IAEA standards. Discrepancies are discussed, and corrections to overcome the gaps are proposed. A detailed plan for the update of standards is provided.

Conclusions: The collected results provide a good understanding of the range of current measurement and calibration conditions that are relevant for accurate dosimetry and should be considered when IEC and ISO standards and dosimetry procedures are updated.