(2) Modern phantoms and their applications

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Abstract–Medical imaging of the infant, child, and adolescent plays an extremely important role in the overall medical management of this critical component of the medical patient population. The vast majority of medical images are acquired via use of ionizing radiations (photons) and thus careful optimization of patient radiation dose and image quality must be undertaken. Organ doses from medical imaging of the pediatric patient population are difficult to ascertain via experimental measurement, and thus one typically employs computational anatomic models coupled to Monte Carlo radiation transport simulations. In this present, we will review the development of reference phantoms for the ICRP pediatric series – newborn, 1-year-old, 5-year-old, 10-year-old, and 15-year-old male and female, as well as series of pregnant female models. We will also review the use of phantom libraries that cover a broad range patient body morphometries such as those of the UF/NCI phantom series, which permit more detailed and patient-specific estimates of organ dose. The presentation will review techniques for organ dose assessment in three key areas of medical imaging – computed tomography, fluoroscopy (both diagnostic and interventional), and nuclear medical. We will discuss various studies which seek to quantity the accuracy by which reference phantoms and phantom libraries can provide patient-specific values of internal organ dose.