Purpose:

To develop a set of conversion factors from dose length product (DLP) to effective dose (E) for pediatric and adult reference individuals undergoing computed tomography (CT) examinations.

Methods:

This study used 12 hybrid computational phantoms representing reference pediatric and adult individuals in compliance with the International Commission on Radiological Protection (ICRP) reference data. The phantoms were combined with a model of the Siemens Sensation 16 scanner, to compute organ doses from CT examinations using a radiation transport code, MCNPX2.7. Effective doses based on ICRP 60 and 103 tissue weighting factors were calculated. The DLP was derived from the scan length and Computed Tomography Dose Index (CTDI)vol. The resulting DLP-to-E conversion factors were analyzed.

Results:

The results consist in a set of DLP-to-E conversion factors for head, chest, abdomen, abdomen-pelvis, and chest-abdomen-pelvis CT examinations for newborn, 1-, 5-, 10-, 15-year-old and adult reference phantoms, for 80, 100 and 120 kVp and for ICRP 60 and 103 tissue weighting factors. The DLP-to-E factors decrease with smaller tube potential, with the greatest decrease for the head examinations for which values at 80 kVp are 20% smaller than at 120 kVp on average. The ICRP 103 weighting factors, compared to ICRP 60, result in variations of DLP-to-E from 0.8 to 1.2-fold with a systematic increase for the chest, 1.14-fold on average, due to the increased breast weighting factor. The DLP-to-E factors for the body examinations are relatively similar to each other but 5 to 12-fold higher than for the head exam. The factors decrease with age until 15 years and then slightly increase for adult except for head.

Conclusions:

An updated set of DLP-to-E conversion factors were established based on more realistic human phantoms and provide an improved accuracy to obtain effective dose from DLP for patients undergoing CT examinations.