

Updating ICRP 70 Skeleton Weight vs. Body Height Equation

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A total skeletal activity is one of the fundamental quantities for modeling biokinetics of bone-seeking radionuclides. The uncertainty in the activity estimates depends on the precision of radionuclide bone concentration measurements and the accuracy of the calculated skeleton weights. This is a challenging task, especially if only limited number of bones are collected and analyzed and no prior information on skeleton weight is available. In 1995, the International Commission on Radiological Protection (ICRP) published the skeleton weight vs. body height equation, $W(\text{kg}) = -10.7 + 0.119 \times H(\text{cm})$, based upon data from 31 male individuals including two US Transuranium and Uranium Registries' (USTUR) whole-body donors. Currently, data are available from additional USTUR whole-body donations that provide a unique opportunity to update the ICRP 70 equation. In this study, the total skeleton weights were estimated for 39 male whole-body donors, including 2 previously used by ICRP. All skeleton weights were calculated using a standardized approach and corrected for bilateral asymmetry, and possible bone mass losses during dissection. Body heights were based upon autopsy reports (when available) or medical examination records. To update the skeleton weight vs. body height correlation, original ICRP 70 and new USTUR data were combined in a set of 68 data points representing a group of 25 to 90+ year old individuals. For this group, body heights and skeleton weights ranged from 155 to 188 cm and 6.5 to 13.4 kg, respectively. Data were fitted with a linear least-square regression. A significant correlation between two parameters was observed ($r = 0.55$), and a new skeleton weight vs. body height equation was derived: $W(\text{kg}) = -6.65 + 0.094 \times H(\text{cm})$. This equation will be used to estimate the skeleton weights and, ultimately, total skeletal actinide activities for biokinetic modeling of the USTUR partial-body donation cases.

USTUR-0390A-16