AbstractID: 10815 Title: Hybrid Patient-Dependent Phantoms Covering Statistical Distributions of Body Morphometry in the U.S. Adult Population: Development and Validation

Purpose: To investigate the usefulness of patient-dependent phantoms for medical patient dosimetry. **Method and Materials:** In order to create patient-dependent phantoms built around the anthropometric distributions of a US adult population, a methodology was developed for modifying hybrid reference phantoms based on target anthropometric parameters as determined from the NHANES III database. This database compiled by the U.S. Center for Health Statistics includes roughly 15,000 adult patients and a variety of primary and secondary anthropometric measurements. Primary parameters including standing height and total body mass were parameterized according to 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentile values. The database was then culled according to these targets, and secondary parameters including waist, arm, thigh, and buttock circumference were selected based upon the average value within each sub-grouping. The UF hybrid adult male (UFHADM) and adult female (UFHADF) were used as anchor phantoms for this study and remodeled non-uniformly according to the target parameters. Fifty patient-dependent phantoms were created and evaluated based on appearance and internal organ mass. **Results:** Aesthetically, the phantoms appeared correct and displayed characteristics of a diverse population including variability in shape and size. Organ masses displayed several general trends including a gradual increase with both standing height and weight. Organ mass was also validated by comparing with a series of segmented CAP scans and with a French-based autopsy study. **Conclusions:** This work highlights the unique advantages of hybrid phantoms for the construction of diverse anthropomorphic models. These phantoms are of particular importance for medical patient dosimetry where there is a need for computational models that balance the practicality of reference models with the specificity and anatomical accuracy of patient-specific models. As such, the UFHADM and UFHADF patient-dependent series may be used for a wide variety of medical applications where body size may have a large influence on dose.