Purpose: To assist in the rapid reporting of patient organ doses, researchers at the University of Florida and the National Cancer Institute have developed a family of computational hybrid phantoms, constructed from NURBS and polygon mesh surfaces, that fully represent the ICRP 89 50th percentile reference newborn, 1-year-old, 5-year-old, 10-year-old, 15-year-old male and female, and adult male and female. Coupled with Monte Carlo simulations, these phantoms can be used to estimate patient organ doses. Substantial increases seen in childhood obesity in the United States have prompted us to undergo a major revision to the UF/NCI phantom library.

Methods: A decision was made to construct the new library in a gridded fashion by height/weight without further reference to age-dependent weight/height percentiles. At each height/weight combination, secondary circumferential parameters are also defined and used for phantom construction. All morphometric data for the new library are taken from the CDC NHANES survey data over the time period 1999 to 2006, the most recent reported survey period. A subset of the phantom library was then used in a CT organ dose sensitivity study to examine the degree to which full Monte Carlo simulations would be required to track organ doses for patients that are severely underweight to obese in body size.

Results: Using primary and secondary parameters, a grid containing 85 pediatric male height/weight bins and a grid containing 73 pediatric female height-weight bins were constructed. These grids will provide the blueprints for later constructing a comprehensive library of patient-dependent phantoms containing 158 pediatric phantoms.

Conclusions: In the future, the UF/NCI phantom library will be used to construct pre-computed dose libraries for individuals undergoing CT examinations. Ultimately, these libraries can be deployed in the clinic for electronic recording of patient organ dosimetry following diagnostic imaging procedures.