Purpose: Reduced kVp scanning is being recommended for pediatric patients as well as when contrast studies are being performed. The purpose of this work is to quantitatively compare the organ doses resulting from scans at different kVP and determine the ratio of mAs at each kVp that results in equivalent organ dose.

Methods: Using Monte Carlo simulations, two fixed tube current chest exams with 120kVp and 80kVp were simulated for 18 voxelized adult female patient models. Each patient had lung and glandular breast tissues contoured, so that doses to these tissues could be estimated. The resulting organ doses for two kVps were compared for a given mAs, which allowed a comparison to identify the ratio of mAs values needed to achieve the same organ dose for 120kVp and 80kVp. For a further comparison, these values were compared to CTDIw values obtained at both kVps in both 16cm and 32cm CTDI phantoms.

Results: For lung dose, the ratio of dose from 120kVp to 80kVp was 3.96 (standard deviation of 0.17) for a given mAs across all 18 patient models; similarly, the glandular breast dose ratio was 4.15 (standard deviation of 0.12). For the CTDIw phantom values, the ratio of dose values from 120kVp to 80kVp were 3.37 and 3.78 for 16 cm and 32 cm phantoms, respectively.

Conclusions: Monte Carlo simulation results indicate that lowering tube voltage from 120 to 80 results in almost 4 fold radiation dose reduction for a given mAs. Stated another way, the mAs at 80kVp could be increased by up to a factor of four compared to mAs used at 120kVp and still receive a similar organ dose in chest scans. This is an even higher ratio than predicted by CTDI phantom results. Future studies include pediatric models with contoured lungs and breast.