Purpose: The purpose of this study was to improve dose calculations performed using ImPACT by taking into account tube current modulation and patient size.

Methods: Monte Carlo based methods were used to estimate lung and breast dose to 20 female models of various sizes by performing detailed simulated thoracic CT scans, including the effects of TCM. The z-axis modulation functions extracted from patients' images were used to determine organ-specific tube current values (average tube current of images containing the organ). To account for TCM, these were used as the mA values entered into ImPACT spreadsheet. Calculated organ doses using global mA (average mA over the entire scan) and local mA (organ-specific average mA) were compared to simulated organ doses. For both methods percent differences from simulated organ doses were calculated. For the organ-specific average mA a linear trend with respect to patient size was observed. This suggests a possible size correction using the ratio of MIRD's perimeter at the level of the nipples and each patient's perimeter. Using percent difference versus perimeter plot, a perimeter was calculated at which percent difference was zero and used to adjust for patient size by multiplying it with the TCM-adjusted results.

Results: After adjusting organ doses for tube current modulation the Root Mean Square Error (RMSE) decreased from 4.9 to 2.7 and from 4.0 to 3.4 mGy for breasts and lungs, respectively. Furthermore RMSE decreased to 1.0 and 0.02 mGy, respectively, after adjusting for patient size.

Conclusion: ImPACT has been used to estimate dose from CT, but this software is only capable of estimating dose from fixed tube current scans. However, most clinical protocols make use of TCM. We have shown that results from ImPACT can be adjusted for TCM and for patient size utilizing organ-specific average mA and an adjustment for patient size.