

AbstractID: 5087 Title: Evaluation of clinical margins via simulation of patient setup errors in 27 prostate IMRT plans

**Purpose:** To evaluate: (i) the size of random and systematic setup errors that can be absorbed by 5mm CTV-to-PTV margins in prostate IMRT treatment plans; (ii) whether findings are consistent with published margin recipes; (iii) if shifting contours with respect to a static dose distribution accurately predicts dose coverage due to setup errors.

**Method and Materials:** 27 IMRT treatment plans with 5mm CTV-to-PTV margins were utilized. Random setup errors with standard deviations (SDs) of 1.5, 3 and 5mm were simulated by fluence convolution. Systematic errors with the same SDs were simulated using two methods: (a) shifting the isocenter and recomputing dose (isocenter shift), and (b) shifting patient contours with respect to the static dose distribution (contour shift). Maximum tolerated errors were evaluated such that 90% of plans had target coverage greater than a specified minimum.

**Results:** For coverage criteria consistent with margin formulas, plans generated with a 5mm margin were able to absorb SDs >3mm. Most structures, including the prostate CTV, showed close agreement between isocenter and contour shift methods. Exceptions were the nodal CTV and small bowel. For 3mm SDs, contour vs isocenter shift estimates for the percent of plans with acceptable dose differed by >2% for the nodal CTV, and >7% for the small bowel. Contour shift small bowel  $D_{30}$  values differed from isocenter shift values by >120% for some simulated shifts.

**Conclusion:** Published recipes require margins of 8-10mm for 3mm SDs. For the IMRT cases presented here, a 5mm margin would suffice. Approximating structure doses by shifting contours with respect to a static dose distribution was acceptable for most structures, but resulted in significant errors for the nodal CTV and small bowel doses for some shifts due to proximity to high dose gradients. (Work supported by NIH R01CA98524)

**Conflict of Interest (only if applicable):**