

AbstractID: 2735 Title: A COIN-based Comprehensive Specification Index for IMRT Treatment Plans

Purpose: The purpose of this work is to formulate a single index that can be used to specify the relative merit of an IMRT treatment plan for prostate carcinoma. The index includes components for conformity, tolerance, and uniformity and also serves to analytically determine the optimum normalization required for unbiased plan comparison.

Method and Materials: $COIN = C1 * C2 * C3$ has been used to evaluate HDR and EBRT plans. $C1$ and $C2$ are planning target volume and normal tissue conformity metrics. $C3$ accounts for the irradiation of critical structures. An ASTRO prostate patient CT and contour data set were used as a case study. Nominal 76 Gy plans were calculated on a commercial system and DVHs exported to a PC using an in-house program. All IMRT plans were calculated with the same dose-volume constraints and then normalized to give the maximum COIN value. $C3_{critical}$ is calculated for the specific rectal tolerance dose of 65Gy. The COIN integral is a measure of dose inhomogeneity. A term $C4 = [1 - COIN_{integral}(1.02) / COIN_{integral}(1.00)]$ is introduced to account for two percent relative hot spots. The Comprehensive Specification Index $CSI = C1 * C2 * C3_{critical} * C4$ is the proposed figure of merit.

Results: All CSI values were calculated relative to 100 for the 9-field plan. Respective CSI values for a static 4-field, ideal fluence 5 and two 7-field IMRT plans were 44.5, 97.1, 99.6, and 91.8. After conversion to deliverable step-and-shoot segments with 0.5 and 1.0 cm MLCs, CSI value for the 9-field plan was reduced to 75.7 and 53.1.

Conclusion: An index CSI was formulated and used to specify the relative merit of analytically normalized prostate IMRT plans. CSI is a sensitive figure of merit capable of distinguishing plans with various field arrangements and able to quantify the effect of converting ideal IMRT fluence to deliverable segments.