AbstractID: 5477 Title: Can dose-volume parameters be replaced with gEUD in the treatment planning process?

Purpose: Dose-volume metrics have often been correlated with outcomes and are often used to evaluate treatment plans. Unfortunately, when used for IMRT treatment planning, dose-volume metrics are computationally complex (non-convex) and can warp DVHs near the constraint dose. We investigate whether the generalized equivalent uniform dose (gEUD) can be made to highly correlate with different parts of the DVH curve by tuning the exponential parameter. If so, gEUD may be a smooth and computationally attractive replacement for dose-volume metrics in treatment planning and evaluation.

Method and Materials: We correlated gEUD with various values of its parameter *a* and clinically applicable dose-volume constraints. Three datasets were used: lung, esophagus, and prostate, with 219, 263, and 291 patient plans, respectively. We tested values of *a* between -10 and 10 by intervals of 0.2 and in some cases tested values as low as -40. The dose-volume constraints tested include: V10, V20, and V30 for lung, V55 for esophagus, and D95 for prostate PTV and lung PTV.

Results: For all cases tested, we found a Spearman correlation between 0.917 and 0.989 (mean correlation 0.956) with negligible ($<1x10^{-6}$) p-values. Values of *a* ranged from 0.4 to 3.2 for volume metrics and -7.8 to -27.2 for lung PTV and prostate PTV dose metrics (respectively).

Conclusion: There is a significant and strong correlation between dose-volume metrics and gEUD for the datasets tested. The practical application of this is that for a particular dose-volume metric, we can find the value of *a* (the gEUD parameter) with the highest correlation and use the convex gEUD function in place of the non-convex dose-volume constraint in the IMRT optimization, thereby allowing optimization to be faster and more able to efficiently achieve a global optimum.

Conflict of Interest: Partially supported by NIH grant R01 CA85181 and a grant from TomoTherapy, Inc.