AbstractID: 1605 Title: Handling Multiple Clinical Objectives in Intensity Modulated Radiation Therapy Treatment Planning

In designing treatment plans in IMRT, optimal plans may be difficult to describe explicitly in mathematical form because there exist multiple objectives, some of which may be conflicting. The relative importance of objectives (e.g., tumor minimum dose, percentage of tumor volume receiving greater than a specified dose) may depend on the values they simultaneously achieve.
Utilizing four multiple objective approaches (efficient frontier, preemptive programming, goal programming, weighted sum)
treatment plans for a collection of patient cases are generated. The resulting plans are compared using homogeneity, conformity, coverage, isodose curves, DVHs, EUD, mean/max dose to structures and pre-specified dose-volume criteria.
Our findings include: (1)Preemptive programming is most effective for determining dose/dose-volume limit conflicts between different anatomical structures. (2)Conflicts can be resolved using goal programming. (3)There is a trade-off between achieving highly homogeneous plans (homogeneity<1.15) versus highly conformal plans (conformity<1.2). One must compromise between these two factors. In this case goal programming is an efficient method for implementing the compromise. (4)With homogeneity and conformity handled via preemptive and goal programming methods, minimum tumor dose and mean tumor dose can be incorporated using the weighted sum approach. (5)When applying the weighted sum approach with all the stated objectives, it is computationally strenuous to determine the best weight combination that yield high quality plans.
The study provides evidence that good plans can be achieved using combinations of preemptive and goal programming and weighted sum approaches. Clinical studies are needed to validate the importance of our approach in treatment outcome.