AbstractID: 11570 Title: Enhanced modeling of radiation therapy for head and neck cancers with probabilistic outcomes using mixed predictors

Purpose: To develop a probabilistic model of outcomes of radiation therapy which includes both dosimetric and non-dosimetric predictors, and includes a decision-making component to quantify the balance between disease cure and radiation-induced side-effects. This model was implemented to assess IMRT treatment plans for individual patients for head and neck cancer.

Materials and Methods: Physicians have available many resources that may not be easily reconcilable to predict patient outcomes. Dosimetric indicators, such as the EUD and NTCP are probabilistic in nature, without explicit representation of the underlying biology. Clinical trials focus on patient and disease characteristics, such as disease location, T-stage, nodal involvement, Karnofsky performance status, and often include one treatment variable, such as DVH-cutpoints or chemotherapy regimes. Newly recognized factors, such as HPV positivity, may affect outcome, however, without definitive clinical data, integrating such factors into clinical decision-making is not straightforward. Finally, experience-driven beliefs affect treatment choices and may vary between physicians. We combine all of the aforementioned resources using a Bayesian network in order to make an outcome prediction for each IMRT plan. Outcome predictions highlight the stark trade-off between preventing recurrent disease that generally has a fatal prognosis and preventing radiation-induced side effects that range from xerostemia to blindness to paralysis. We use a Markov Model to compute a quality-adjusted life expectancy using patient preferences for health states.

Results: Probabilities of local and distant control matched published values well, as did life expectancies. The trade-offs between quality of life and quantity of life are explored. Sensitivity analysis highlighted physician beliefs that affected treatment choices.

Conclusions: Modeling of radiation therapy has grown progressively more sophisticated. We present a method by which probabilities and expected values of clinically relevant outcomes, based on a range of variables, are calculated.