AbstractID: 1171 Title: Dose volume conundrum: the influence of prostate sub-volume doses on TCP in brachytherapy

While brachytherapy dose distributions are highly heterogeneous, their effect on TCP are unknown and it is unlikely that clinical results will provide answers in the near future, given the long follow-up. We employ data from 450 dose distributions combined with radiobiological (RB) parameters consistent with what is known about TCP curves for prostate cancer to study changes in TCP that accompany gross dosimetric measures and particular dosing irregularities. Log-normal distributions of RB parameters (ln (initial clonogen number), $\alpha$, and $\alpha/\beta$) were adjusted so that the predicted population parameters (steepness and location) of dose-response curves for external -beam radiation therapy agreed with published estimates. Radiobiological variability between the selected dose distributions was removed by averaging over 50 randomly chosen sets of RB parameters from the log-normal distributions to estimate the TCP, giving some insight into TCP variations with conventional dosimetric indices and different patterns of underdosing. The individual TCP was greatly dependent on the inhomogeneous dose distribution and dosimetric indices such as $V_{100}$ (volume of prostate receiving100% of the prescribed dose), $D_{90}$ (maximum dose received by 90% of the volume) by themselves are not always accurate predictors of control probabilities. In a multivariate analysis of the dependence of TCP on $V_{100}$, $D_{90}$, minimum dose, moderately and severely underdosed volumes, only $D_{90}$ and the minimum dose were significant. In some instances, extreme underdosing of relatively small volumes may result in a higher TCP than moderate underdosing of relatively large volumes and vice versa.