AbstractID: 10084 Title: Cell Survival Curve Fitting Techniques in High Dose Region for Use in Stereotactic Body Radiation Therapy (SBRT)

Purpose: To select a cell survival curve model that is capable of fitting cell survival at high dose region used in stereotactic body radiation therapy.

Materials and Methods: Data from fourteen cell lines were examined. These include a Chinese hamster cell line, a human glioblastoma cell line, two prostate cell lines and ten lung cancer cell lines. Each of these cell lines were fitted to eight different models (4 with 2 parameters and 4 with three parameters) for cell survival. These models included among others the well known linear quadratic model and the single hit multi target model; and the more recent McKenna-Ahmad repair model, Kavanagh-Newman model and universal survival curve model. The χ^2/df of each fit was compared to determine the model most appropriate for that survival curve.

Results: No single model provided the best fit for all the cell lines. For all cell lines there were models that were superior to the linear quadratic. Two recent models (McKenna-Ahmad repair model, Kavanagh-Newman model) provided the best fits for many cell lines. These models have low dose quadratic behavior which changes to linear behavior at high doses. The McKenna- Ahmad and Kavanagh-Newman formulas for cell survival are respectively as follows:

$$\ln S = -\beta D^2 \frac{1}{1+\frac{\beta}{\gamma}D} \quad ; \quad \ln S = -K_0\left(1-e^{-K_g D}\right)D.$$

Conclusion: We recommend that one of the two recent two parameter models be used for fitting cell survival curves if one is primarily interested in cell survival into or past the shoulder region of the cell survival curve.