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*The impact of tumour heterogeneity on the radiation treatment*

Radiation oncologists try to deliver the maximum amount of radiation to cancerous cells (while simultaneously minimizing energy delivered to adjacent normal tissues) in order to maximize cancer cell kill while preventing damage to the normal cells around the affected tissue. To achieve this goal, various treatment schedules have been developed, but there still remain significant obstacles to improving the effectiveness of these schedules. Recent studies have explained the existence of cellular diversity within tumors or during the different steps of tumor evolution such as, tumour heterogeneity. These genetic and non-genetic variations can lead to different radiosensitivity among cancer cells that can make treatment processes complicated. Thus, a model is proposed to study the effect of treatment on tumour heterogeneity and to investigate the repair impact on the treatment. The stochastic and deterministic simulations have been used to extrapolate the model's parameters using the experimental results. The sensitivity analysis is also applied to explore how changing a model's parameters alter the model's outcome in conventional radiotherapy protocols. The results suggest that shrinking the tumor is not sufficient to control the disease and fraction of resistant cells to the treatments is also need to be reduced. In addition, the optimal treatment schedules are not unique and changing model's parameter may change the best treatment schedules.