Population carrying capacity as patient-specific biomarker for cancer radiotherapy response

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In current clinical practice, radiation dose and dose fractionation are based on average clinical outcome data from large dose-escalation clinical trials, resulting in a "one size fits all" approach. In current radiation oncology, there exists no explanation for why two patients with similar clinical stage and molecular profile would have different responses and outcomes. Reliable biomarkers and frameworks are direly needed to predict RT responses to personalize dose and fractionation based on individual tumor features. We propose the tumor volume carrying capacity in a classic logistic growth model to be patient-specific. We train the growth and treatment response parameters from data in training sets, and use the model to simulate untreated and treated tumor growth to predict response to radiotherapy in independent patient cohorts. This model can help stratify patients into different radiation protocols in an accruing clinical trial to improve response and ultimately treatment outcomes for cancer patients.

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