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Drug Resistance and the Kinetics of Metastatic Cancer[1]

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Most metastatic cancers after initial response to current drug therapies develop resistance to the treatment. We present cancer data and a theory that explains the observed kinetics of tumor growth in cancer patients and using a stochastic model based on this theory we relate the kinetics of tumor growth to Kaplan-Meyer survival curves. The theory points to the tumor growth rate as the most important parameter determining the outcome of a drug treatment. The overall tumor growth or decay rate is a reflection of the balance between cell division, senescence and apoptosis and we propose that the deviation of the decay rate from exponential is a measure of the emergence of drug resistance. In clinical trials the progression free survival, the overall survival, and the shape of the Kaplan-Meyer plots are determined by the tumor growth rate probability distribution among the patients in the trial. How drug treatments modify this distribution will also be described. At the end of the talk we will discuss the connection between the theory described here and the age related cancer mortality rates in the United States.

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