MATHEMATICAL MODELING IN MEDICAL SCIENCES

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Abstract: Multi-stage models of carcinogenesis were proposed by Armitage and Doll (British Journal of Cancer 8 (1954), 1-12; the Fourth Berkeley Symposium on Mathematical Statistics and Probability, 1961, pp. 19-38). In cancers which are related to antioncogenes (Knudson, Cancer Research 45 (1985), 1437-1443), these models are not appropriate because of lacking biological support. In Part I of this talk biologically based mathematical models for modeling cancer data are discussed. Causal models provide information about the dynamics of the system under study, regardless of how they are discovered, tested, and sometimes more useful then associational models including the landmark model proportional hazards model proposed by Cox (Journal of the Royal Statistical Society Series B 34 (1972), 187-220). In Part II of this talk we discuss causal effect models and G-Estimation Approach proposed by Rubin (Biometika 79 (1992), 321-334). Some applications are given. In Part III of this talk the two-parameter hypertabastic model of Tabatabai et al. (Theoretical Biology and Medical Modeling 4 (2007), 40 doi:10.1186/1742-4682-4-40) is discussed to model time-to-event data, i.e., survival data. The hypertabastic proportional hazards model with parametric baseline hazard function, the hypertabastic accelerated failure model and the hypertabastic proportional odds model based on this model are also discussed. The hypertabastic survival model is suitable to monitor the disease progression and regression and provide the clinicians with the time interval(s) on which the disease progresses or regresses and the time interval(s) on which the disease progression or regression speeds up or slows down. This vital information makes it easier for the physicians to take appropriate action regarding their patients.