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The relative tail of longevity and the mean remaining lifetime

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Abstract
Vaupel (1998) posed the provocative question, “When it comes to death, how do people and flies differ from Toyotas?” He suggested that as the force of natural selection diminishes with age, structural reliability concepts can be profitably used in mortality analysis. Vaupel (2003) went a step further, using simulations to investigate the impact of redundancy, repair capacity, and heterogeneity on the relative length of post-reproductive life spans, called relative tails of longevity. His 2003 paper showed that structural redundancy and the possibility of repair decrease the relative tail of longevity, whereas greater heterogeneity increases it. Here, we consider the problem in much greater generality and prove these results analytically. Structures with repairable and non-repairable components are considered. Heterogeneity is described by a frailty-type model and different definitions of the tail of longevity are discussed.

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