

Multiple Interacting Risk Factors: On Methods for Allocating Risk Factor Interactions

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A persistent problem in health risk analysis where it is known that a disease may occur as a consequence of multiple risk factors with interactions is allocating the total risk of the disease among the individual risk factors. This problem, referred to here as risk apportionment, arises in various venues, including: (i) public health management, (ii) government programs for compensating injured individuals, and (iii) litigation. Two methods have been described in the risk analysis and epidemiology literature for allocating total risk among individual risk factors. One method uses weights to allocate interactions among the individual risk factors. The other method is based on risk accounting axioms and finding an optimal and unique allocation that satisfies the axioms using a procedure borrowed from game theory. Where relative risk or attributable risk is the risk measure, we find that the game-theory-determined allocation is the same as the allocation where risk factor interactions are apportioned to individual risk factors using equal weights. Therefore, the apportionment problem becomes one of selecting a meaningful set of weights for allocating interactions among the individual risk factors. Equal weights and weights proportional to the risks of the individual risk factors are discussed.