

University of Pennsylvania researchers develop formula to gauge risk of disease clusters

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Researchers at the University of Pennsylvania have developed a mathematical formula to assess whether concentrated disease outbreaks can be ascribed to random-chance events or, instead, suggest a contagious or environmental effect that requires epidemiological investigation.

A feature of the formula is that, given the relevant data, the required probability calculations can be done in less than five seconds on a personal computer.

In statistical terms, the formula gives an exact expression for the probability distribution of the maximum of a number of multinomially distributed random variables. Mathematically, the formula depends on generating function technology developed by Herbert Wilf, professor of mathematics in the School of Arts and Science at Penn. Warren Ewens of Penn's Department of Biology joined Wilf in developing the formula. Until now, only potentially unreliable, approximate formulae have been available.

The formula was used to investigate two disease cluster cases.

The first was the classic case of a clustering of eight cases of leukemia in Niles, Ill., in 1956-1960, which was reasonably assessed as a chance, random event. On the other hand, 12 cases of acute lymphocytic

leukemia in Churchill County, Nev., in 1999-2001 was assessed not to be a chance event but due to a common, possibly environmental cause.

Multiple cases of non-communicable disease, like leukemia, have clustered in small geographic areas quickly, resulting in costly epidemiological study. The authors note that a purely mathematical calculation cannot answer serious public-health questions, but that they can nevertheless point to cases that appear to require further public health study.

Source: University of Pennsylvania

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