Dynamic maps aid epidemiological investigations

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A team of researchers has developed a dynamic mapping tool to gain a more nuanced view of the links between diseases and environmental exposures. The application of the method is illustrated by a number of examples of associations between environmental exposures and Salmonella infections among people in the US age 65 and over in 2002. Analysis of the dynamic maps revealed that Salmonella infections were more common during the summer months, were highly clustered in the South, and were potentially more common in areas with high broiler chicken sales. The study, published online in *Environmental Health*, features a set of principles the researchers developed to enhance the use of dynamic mapping technology in epidemiological research.

"Dynamic mapping creates a visual representation of data over time, allowing us to detect relationships between disease and environmental factors that cannot be deciphered from static maps. It enables us to pose new hypotheses about the origins of an outbreak, patterns of disease spread, peak timing of seasonal outbreaks, and clustering of diseases," said senior author Elena Naumova, PhD, professor of public health and community medicine at Tufts University School of Medicine.

The dynamic mapping principles Naumova and colleagues developed advise proper selection of temporal and geographical aggregation schemes, color schemes, legends, and frame speed. They also recommend using a simple design that includes navigation tools. The authors emphasize the importance of gaining an understanding of the technology's limitations and carefully interpreting dynamic maps.

The researchers used hospitalization records from the Centers of Medicare and Medicaid Services for patients age 65 and over with a diagnosis of Salmonella infections. The data were superimposed onto maps of environmental exposures such as average monthly temperature and broiler chicken sales from farms to food distributors. The data were then transformed into an interactive movie, allowing the researchers to view changes in the data over time.

"In providing a comprehensive visual of the massive volume of data over time, dynamic mapping can reveal relationships that might otherwise go unnoticed. As demonstrated by our application to cases of Salmonella, dynamic mapping can be a valuable tool for identifying patterns and generating new hypotheses," said Naumova.

Naumova is the director of the Tufts University Initiative for the Forecasting and Modeling of Infectious Diseases (Tufts InForMID), which works to improve biomedical research by developing computational tools in order to assist life science researchers, public health professionals, and policy makers. The center is focused on developing methodology for analysis of large databases to enhance disease surveillance, exposure assessment, and studies of aging.

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