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Researchers envision better disease surveillance to improve public health

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With current public health threats ranging from swine flu to bioterrorism to environmental contamination, innovations that better predict disease outbreaks have vast potential to protect the public. In a paper published online in advance of print on July 6 in *Emerging Health Threats Journal*, public health researchers describe their vision for the future of disease surveillance, detailing innovations on the horizon that may facilitate earlier detection and improved public health preparedness.

"Advances in identifying and gathering data, techniques for combining and processing that data, and technologies that enable deeper data analysis will facilitate a new paradigm in outbreak definition and detection. Our goal is to develop data analysis tools that can accurately determine both the probability that an outbreak will occur and its predicted severity," said co-author Elena Naumova, PhD, professor of public health and community medicine at Tufts University School of Medicine (TUSM).

"There are many obstacles to improving tools for disease surveillance. Varying definitions of what constitutes an outbreak, differences in the quality and source of data, and differences in how quickly diseases progress and spread - all of these are realities that make it challenging to accurately and efficiently predict an outbreak," said Naumova.

In the current study, Naumova and co-author Nina Fefferman, PhD, describe cutting-edge methods that address these obstacles and have the potential to revolutionize the way disease data is processed and analyzed.

Fefferman is an assistant professor in the department of ecology, evolution, and natural resources at Rutgers University as well as a research assistant professor in the department of public health and community medicine at TUSM.

"There is vast, untapped potential in the multitude of new data streams made available by technological progress. Data can be submitted instantly from the site of an outbreak investigation, it can be gleaned from websites and news items, it can be obtained from satellite images; our current methods, however, are not up to the challenge of tapping and appropriately analyzing these sources. New techniques are being developed that will dramatically shorten the time it will take us to detect an outbreak," said Fefferman.

"Dynamic mapping, multivariate visualization, flow mapping, outbreak signature forecasting, and large-scale simulations of infection spread are just a few of the tools being developed that might help us better detect the complexities of disease spread. These data analysis tools present huge data sets in such a way that researchers can better detect and interpret trends and anomalies," said Naumova.

"Additionally, we can gain further insight into an outbreak if auxiliary information related to the population is readily available. By including information about demographics, population migration and travel patterns, vaccination patterns, and large social gatherings, we can factor in the many contributors to an outbreak," said Fefferman.

According to the researchers, taking this auxiliary information into account will allow public health researchers to adjust their analyses by population, perhaps examining areas with limited vaccination coverage, or higher proportions of older adults, or heavy traffic from airports and tourism.

"Our hope is that improved disease surveillance tools will help us detect the unique signature of each outbreak, and as a result improve our ability to recognize the warning signs early and with greater accuracy," said Naumova.

More information: Fefferman NH, Naumova EN. Emerging Health Threats Journal. 2010. "Innovation in Observation: A Vision for Early Outbreak Detection." Published online July 6, 2010, doi: 10.3134/ehtj.10.006

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