

**Geographic Surveillance and Hotspot Detection for Homeland Security:
West Nile Virus: An Illustration of the Early Warning Capability of the Scan Statistic**

Short Description West Nile virus is a serious mosquito-borne disease. The mosquito vector bites both humans and birds. Scan statistical detection of dead bird clusters provides an early crisis warning and allows targeted public education and increased mosquito control.

Since the 1999 West Nile (WN)virus outbreak in New York City, health officials have been searching for an early warning system that could signal increased risk of human WN infection, and provide a basis for targeted public education and increased mosquito control. Birds and mosquitoes with laboratory evidence of WN virus preceded most human infections in 2000, but sample collection and laboratory testing are time-consuming and costly. We have evaluated the cylinder-based space-time scan statistic for detecting small area clustering of dead bird reports and have assessed its utility in providing an early warning of WN virus activity.

Full Description All unique non-pigeon dead bird reports were categorized as 'cases' if occurring in the prior 7 days and 'controls' if occurring during a historic baseline. The most likely cluster area was determined using the scan statistic and its statistical significance was evaluated using Monte Carlo hypothesis testing. Analyses were performed in a prospective simulation for 2000 and in real-time during 2001.

For the 2000 data, dead bird clustering was found in Staten Island over 4 weeks prior to laboratory evidence of WN virus in birds and mosquitoes from this area. Real-time implementation in 2001 led to intensified larval control in eastern Queens, over three weeks prior to laboratory confirmation from this cluster area. Dead bird clusters were identified around the residence of five of seven human infections, from 0-40 days (median 12) prior to the onset of illness, and 12-45 days (median 17) prior to human diagnosis.

We have concluded that scan statistical cluster analysis of dead bird reports may provide early warning of viral activity among birds and of subsequent human infections. Project will repeat the analysis with the ULS space-time scan statistic. Since the latter allows for arbitrarily shaped clusters in both the spatial and temporal dimensions, there is potential for earlier detection with a reduced false alarm rate.

Strategic Cycle Elements Preemption
Crisis Management
Response

Project URL <http://www.stat.psu.edu/~gpp/PDFfiles/Prospectus%2016%20overview.pdf>
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