Visualization of Syndromic Surveillance Using GIS

Christopher Goranson, Kevin Konty M.S., Jingsong Lu M.S., Farzad Mostashari, M.D. M.S.

GIS Center of Excellence, Bureau of Epidemiology Services, New York City Department of Health and Mental Hygiene

Objective

This paper describes a series of visualization enhancements and automation processes to efficiently depict syndromic surveillance data in GIS. Modelling the portrayal of events when merging existing syndromic surveillance with geographic information systems (GIS) can standardize and expedite results.

Background

Syndromic Surveillance has been in use in New York City since 2001, with 2.5 million visits reported from 39 participating emergency departments, covering an estimated 75% of annual visits[1]. As syndromic surveillance becomes increasingly spatial and tied to geography, the resulting spatial analysis is also evolving to provide new methodology and tools[2]. In late 2004, the New York City Department of Health and Mental Hygiene (DOHMH) created the GIS Center of Excellence to identify ways in which GIS could enhance programs like syndromic surveillance. The DOHMH uses the SaTScan program for much of its spatial analysis (i.e. cluster analysis).

Methods

In the case of the DOHMH syndromic surveillance program, much of the data processing and analysis is completed outside of GIS. GIS was used to model the mapping product and standardize new spatial analysis.

Automation of user workflows led to the creation of models to run SAS / SaTScan analysis through further spatial analysis in GIS.

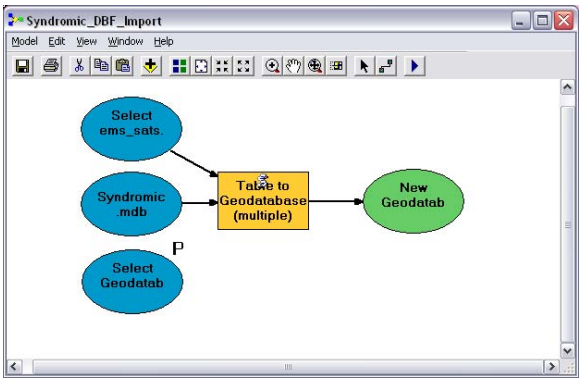

Figure 1 – Process model for transformation of syndromic results into a geodatabase.

Output from syndromic surveillance analysis was placed in a networked directory through an automated step in SAS / SaTScan, the file is then imported into a geodatabase and processed in GIS using an automated step (see Figure 2). A second model (not shown) processes the output table through Cluster and Outlier Analysis and Hot Spot Analysis (Getis-Ord Gi*). Additional models standardize symbols, legend levels and compare data.

Results

Models are an effective way to standardize syndromic data analysis in GIS. ZIP codes can be a misleading indicator of place when shown as polygons, and can complicate temporal comparisons in GIS.

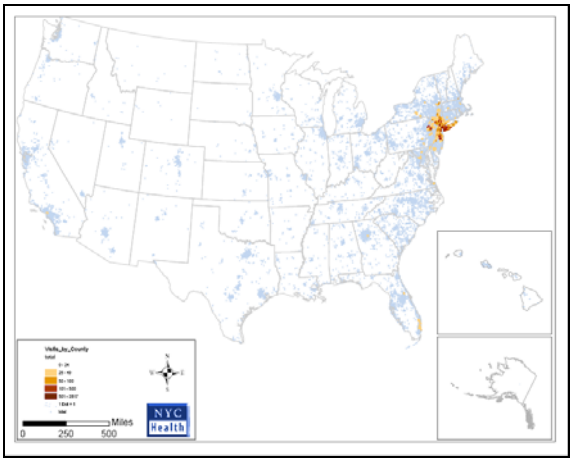

Figure 2 – Dot density map of ILI by county of residents from NYC ED data for one year. ZIP code data was aggregated to a county level for the national map. Color breaks begin at 50 cases.

Conclusions

Modeling of workflows and user processes provides a way to standardize analysis, document procedures and more effectively complete GIS analysis and create map products.

Identifying a consistent method to address ZIP code changes over time is necessary, and it is important to express ZIP codes as polygons with the caveat that they are for reference but are often not implicitly correct when shown in a map product.

References

[1] Heffernan R, Mostashari F, Das D, Karpati A, Kulldorff M, Weiss D, Syndromic surveillance in public health practice, New York City. Emerging Infectious Diseases. 2004 May:10(5):858-64.

[2] Tango T, Takahashi K, A flexibly shaped spatial scan statistic for detecting clusters. International Journal of Health Geographics. 2005 May 18;4(1):11.