Using Age as Space: Looking for Citywide Age Clusters of Influenza

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Objective

This paper presents an implementation of a citywide SatScan analysis that uses age as a one-dimensional spatial variable. The resulting clusters identify age-specific clusters of respiratory and fever/flu syndromes in the New York City Emergency Department Data.

Background

There has been much recent interest in using disease signatures to better recognize disease outbreaks[1]. Conversely, the metrics used to describe these signatures can also be used to better characterize the outbreaks. Recent work at the New York City Department of Health (NYCDOH) has shown the ability to identify characteristic age-specific patterns during influenza outbreaks [2]. One issue that remains is how to implement a search for such patterns using prospective outbreak detection tools such as SatScan.

A potential approach to this problem arises from another currently active research area: the simultaneous use of multiple datastreams[3]. One form of this is to disaggregate a data stream with respect to a third variable such as age. Two drawbacks to this approach are that the categories used to make the streams have to be defined *a priori* and that relationships between the streams cannot be exploited. Furthermore, the resulting description is less rich as it describes outbreaks in a few non-overlapping age-specific streams. It would be desirable to look for age specific patterns with the age groupings implicitly defined.

Methods

We employ the same programs that perform the citywide and spatial ED analyses of fever/flu and respiratory syndromes. However, age is encoded as a one-dimensional geographic variable and the resulting cluster search looks for age clusters. We analyze fever/flu and respiratory syndromes separately, as if it were done prospectively for the year 2002 and compare the resulting signals to the Citywide satscan analyses and the TERS plots of age-specific patterns identified by Olson et al. [2]

Results

Age cluster signals provide additional contextual information about disease outbreaks and can potentially help quantify the beginning, end, and magnitude of outbreaks. True citywide respiratory outbreaks tended to signal first among younger age groups. This is evident during the Influenza B outbreak in early 2002 in both the retrospective and prospective analyses.

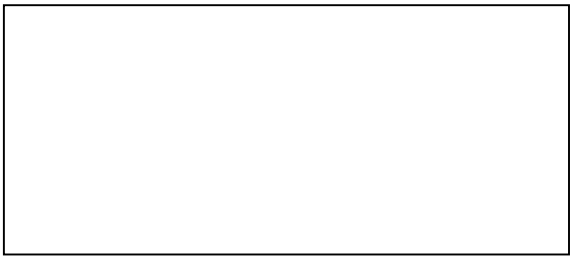

Figure 1 – Fever/Flu sigma;s by age for the year 2002

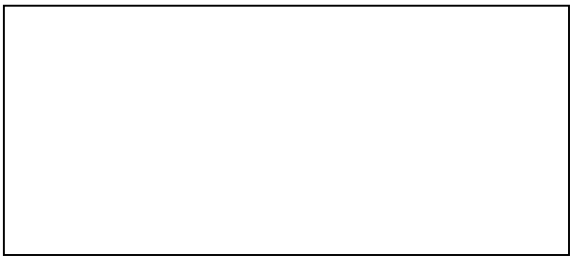

Figure 1 – Respiratory sigmals by age for the year 2002

Figures 1 and 2 present the city wide age clusters for 2002. Although they appear much more chaotic than do smoothed plots of relative increase, some patterns are noticeable, particularly as periods of repeated signals in the young. The total number of signals is similar to the number produced by citywide analysis but provide more detail. The tremendous overlap between ages across signals highlights the difficulty in creating groupings *a priori.*

Conclusions

Non-spatial citywide analysis can be directly disaggregated to search for citywide age-clusters of respiratory and fever/flu that can be used to better identify influenza outbreaks and to improve characterization of other signals found within the system.

References

[1] Naumova, E and I MacNeill. A Signature-forecasting and early outbreak detection system. Envirometrics 2005.

[2] Olson, D, Mostashari F, Kendall M. Age Matters: Emergency Department Syndromic Surveillance for Epidemic Influenza. To be presented at the 2005 Syndromic Surveillance Conference

[3] Kulldorff, M The Space-Time Scan Statistic for Multiple Data Streams. MMWR Supplement 2005 in press

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