The Application of Enhanced Signal Analyses to Medicaid Data

Jian-Hua Chen, MD, MsPH, Kathryn J. Schmit, MPH, Kathleen K. Thoburn
Division of Epidemiology, New York State Department of Health, Albany, NY

OBJECTIVES

To supplement CuSum analyses of syndromic surveillance databases within the New York State Department of Health's (NYSDOH) Electronic Syndromic Surveillance System with other measures that would indicate a daily count is higher than expected in order to minimize the end-user burden of following up generated signals.

BACKGROUND

NYSDOH currently applies EARS's CuSum analyses[1] to Medicaid Over the Counter (OTC) and Prescription Medications data obtained from the Office of Medicaid Management's data warehouse. Daily drug category counts are compared with counts for a 7-day baseline period to generate C1, C2, and C3 signals for 62 counties and 8 Syndromic Surveillance Regions. Summary tables and graphs are posted on the NYSDOH Secure Health Commerce Network for access by state, regional, and county users.

The 7-day baseline CuSum method of analysis of syndromic surveillance databases can result in the generation of a large number of signals. Many signals are generated for counts that, upon manual review of 30-day or long-term trend graphs, are clearly within the range of normal daily variation and would not require follow up by public health authorities.

In order to prevent user desensitization to generated signals and minimize NYSDOH Syndromic Surveillance System end-user burden, supplemental measures that would indicate a daily count is higher than expected are currently being investigated.

METHODS

In addition to the usual output of CuSum analysis of the Medicaid data, NYSDOH's surveillance system produces a report that lists all counts higher than expected on the basis of any one of the following reference values and excludes counts that generate signals based solely on the 7-day CuSum method:

- **(A)** *Extend the baseline period:* Current EARS method with a 28-day baseline
- **(B)** *Compare with same period last year:* Mean plus 3 standard deviations of counts from 2 weeks prior to current date of previous year
- **(C)** *Control for day, month, and holidays:* Value of 99% upper confidence limit of predicted value of regression model for counts for previous years adjusted for day of week, month of year, holiday, and post-holiday day
- **(D)** *Control for season:* 99th percentile of counts for all days in current month plus previous 2 months of current and previous years (in addition, the excess of the current day's count over the 99th percentile value is expressed as a percentage)

RESULTS

The table below displays 4 examples of counts that generated 7-day CuSum signals that would require further manual review to rule out the possibility that the count was within the range of normal variation. Visual inspection of 30-day and long-term graphs revealed that only the 4th example was indeed greater than the historical range of values. Daily comparison of 7-day CuSums with the Enhanced Signal table suggests that, with further testing, methods such as these could be used to decrease the noise of the standard CuSum analysis.

Ex.	Cnty	Med. Group	Current Count	7-day CuSum	(A)	(B)	(C)	(D)	% over (D)
#1	A	Macrolides	15	S	S	S			
#2	B	Tetracyclines	12	S	S		S		
#3	C	Cough/Cold/Allergy	21	S	S	S	S	S	24%
#4	C	Antidiarrheals	7	S	S	S	S	S	75%

Note: S = Signal (current count > threshold value)

In the two days from which these 4 examples were taken, 137 7-day CuSum signals were generated. If elevated levels were defined as counts signalled by all 5 statistical methods, only 6 would be flagged for manual inspection to select those counts exceeding the range of normal variation (and only 4 were in fact unusually high).

CONCLUSIONS

The statistical methods described here will be considered as tools in the next stage of development of NYSDOH's Electronic Syndromic Surveillance System, in the hope that they will help to reduce the number of signals requiring manual review to determine extreme values. Testing has not yet been sufficient to determine if limiting follow-up of "high" counts to those exceeding all the measures noted above is too strict (ruling out counts that *are* high) or too lax (including counts within normal variation), or if other statistical methods should be investigated. Further work is required.

REFERENCES

[1] Hutwagner, L, Thompson W, Seeman GM, and Treadwell T, The Bioterroism Preparedness and Response Early Aberration Reporting System (EARS). Journal of Urban Health, Bulletin of the NY Academy of Medicine, Vol. 80, No. 2, Suppl. 1, 2003.

Further Information: Dr. Jian-Hua Chen, jhc04@health.state.ny.us