

Preliminary Analysis of SaTScan's Effectiveness to Detect Known Disease Outbreaks Using Emergency Department Syndromic Data in Los Angeles County

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Objective

To determine the usefulness of SaTScan as an outbreak and illness cluster detection tool in syndromic surveillance and to compare to a purely temporal CUSUM algorithm.

Background

Los Angeles County (LAC) Department of Health Services is currently testing SaTScan's space-time permutation model to assist in identifying aberrant illness activity in the community and determine its ability to detect outbreaks through analyzing real-time syndromic data. SaTScan could be useful especially due to its ability to provide geographic locations of outbreaks in the community.

Methods

Data from three hospital emergency rooms from December 29, 2003 through October 25, 2004 in LAC were evaluated. The four syndromic groups studied were: rash, respiratory, neurological, and gastrointestinal. The data was aggregated to zip code level. The spatial parameter defined was less than five kilometers and the temporal parameter was alternated between 1 and 7 days. The Monte Carlo replication size was set to 999.

Both retrospective and prospective space time analyses were tested. Clusters found using retrospective analysis having p-values less than 0.5 were further tested by running the prospective analysis option provided by SaTScan. Prospective analysis was completed using data 29 days prior to and including the day found to have a significant cluster by the retrospective analysis. The spatial parameter defined was less than five kilometers and the temporal parameter was alternated between 1 and 7 days. The Monte Carlo replication size was set to 999. The data was aggregated to zip code level.

Clusters detected using the prospective option were compared with known disease outbreaks and previous syndromic signals generated by a purely temporal aberration detection algorithm (CUSUM). Hospitals containing missing data for the specific time period under investigation were excluded.

Results

The data tested had 7,931 gastro-intestinal, 2,082 rash, 958 neurological, and 26,042 respiratory cases. The retrospective option found 59 clusters. However, only 9 clusters had p-values less than 0.5. Using SaTScan's prospective option the p-values for these nine clusters drastically improved. There were two known outbreaks detected by temporal signals that were also reported by SaTScan: a scabies outbreak at a private residence (p-value= 0.001 for the prospective analysis) and a rotavirus outbreak detected in an emergency room department (p-value=0.2 for the prospective analysis). Most importantly, a reported scombroid food poisoning outbreak (p=0.035 for prospective analysis) not detected by the temporal signal detection system was observed by SaTScan. Six other clusters had very significant p values, but they could not be positively matched with a known outbreak or temporal signals.

Conclusions

SaTScan proved successful in corroborating at least three known outbreaks in the Los Angeles county community. The detection of the food-poisoning outbreak that was not detected by temporal signal generation system demonstrates SaTScan's potential to be a strong complement to the current purely temporal aberration detection system. Clusters that did not correspond to known outbreaks may have been due to random clusters, seasonal increases, or weekend effects.

Shortening the time intervals used for analysis helped SaTScan distinguish between statistically significant clusters and statistically insignificant clusters. Thirty-day time intervals appeared to provide stronger results than other time intervals. Lastly, looking at both one day and seven-day temporal windows helped identify outbreaks of various sizes. The main limitation of our project was poor hospital coverage (3/79) and missing data. Increasing hospital coverage in the future may increase SaTScan's ability to detect disease clusters and outbreaks.