

Syndromic Surveillance: An Analysis of the Variation in Patient Populations at Seven Hospital Emergency Departments in Southeastern Virginia

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INTRODUCTION

- Syndromic surveillance combines the disease reporting traits of traditional surveillance with a real time tracking of disease symptoms that is crucial for a rapid response to a bioterrorist incident
- While syndromic surveillance in a hospital emergency department (ED) may contribute to early detection of large-scale bioterrorist attacks, the question remains as to whether the method is useful
- If syndromic surveillance is to play a role in bioterrorism preparedness, consideration of ED data fluctuations, in terms of hospital, time and seasonal-specific differences need to be addressed to develop an optimal method for signaling a "disease event" in an accurate and timely fashion

OBJECTIVES

- To establish syndromic surveillance using the CDC's Cumulative Sum (CUSUM) method of aberration detection for hospitals in Southeastern Virginia
- To examine the intrinsic value of ED-based syndromic surveillance by characterizing the variation of ED data in terms of hospital and time-specific differences as well as climatic changes
- To develop statistical models for the prediction of ED syndrome occurrences

METHODS

Data Collection and Surveillance

- Seven hospital EDs (A-G) in 4 Virginia cities, Norfolk, Chesapeake, Newport News and Virginia Beach served as the data collection sources

- ED census and chief complaint data were collected on a daily basis and categorized into any 1 of 7 syndromes suggestive of a bioterrorist event

- The CUSUM analysis models (Mild, Medium and Ultra) provided by the CDC were implemented to aid in aberration detection of each of the seven syndromes at the seven hospitals

- The CUSUM procedure identified days when occurrences of the seven syndromes escalated beyond an established upper limit

- A high-occurrence day for any syndrome required a patient chart review process at the specific hospital ED

Statistical Analysis

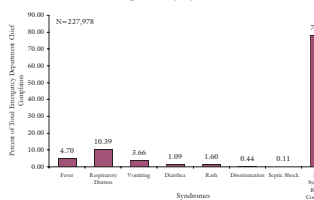
- Univariate:** Summary measures and descriptive statistics of ED data over the ten-month data collection period

- Bivariate:** Chi-square (with accompanying odds ratios and 95% confidence intervals) to test for associations between CUSUM syndrome alerts and variables such as city, hospital, month, day, temperature and precipitation categories

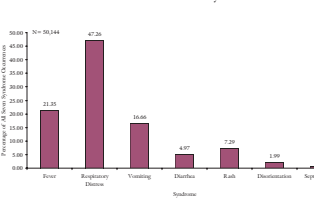
- Multivariate:** Log-linear Poisson statistical model for each of the seven syndrome occurrences
- $$\log(\text{average syndrome occurrence}) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$$
- where: $\beta_0, \beta_k = \text{potential predictor variables}$

- Third Variables:** Examine confounders and effect modifiers in the statistical models

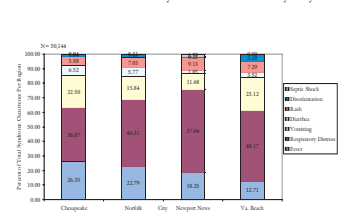
Distribution of Emergency Department Chief Complaints by Syndromes



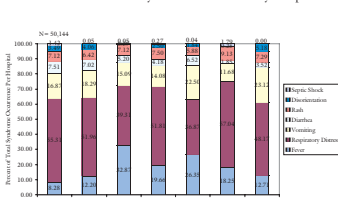
Distribution of the Seven Syndromes



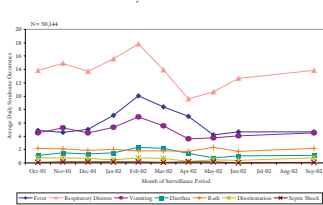
Distribution of Total Syndrome Occurrence by City



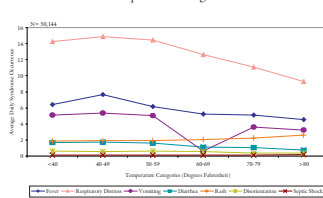
Distribution of Total Syndrome Occurrence by Hospital



Average Daily Occurrence of the Seven Syndromes Across Months



Average Daily Occurrence of the Seven Syndromes Across Temperature Categories



Significant Results of Chi-Square Test of Independence, General Association and Trend for CUSUM Syndrome Alerts

Associated Variables	χ ² -Value	P-Value
CUSUM Syndrome Alerts (χ ² Independence)	8.26	0.0164
CUSUM Syndrome Alerts (χ ² General Association)	12.24	0.0002
CUSUM Syndrome Alerts (χ ² Trend)	12.24	0.0002
CUSUM Syndrome Alerts (χ ² Independence)	12.24	0.0002
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