USE OF SYNDROMIC SURVEILLANCE IN MONITORING HEALTH EFFECTS OF SOUTHERN CALIFORNIA WILDFIRES IN OCTOBER 2007

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INTRODUCTION

October 20, 2007 marked the beginning of a series of wildfires in Southern California that destroyed thousands of homes within a few days [1]. Stretching from Santa Barbara County to the U.S. Mexico border, the extent of the fires almost paralleled that of the October 2003 fires, which were considered to be the biggest in California's history. While causing the sky to become visibly murky even hundreds of miles away, the increased concentration of smoke, ash, and dust particles caused the air quality across Southern California to deteriorate as well [2]. Most areas of Los Angeles experienced unhealthy-sensitive air (Air Quality Index (AQI) of 101 to 150), whereas areas close to the wildfire experienced unhealthy air (AQI of 150 to 200) [3]. Air pollution is a major cause of respiratory stress and is especially harmful to the elderly, people with lung or heart problems, and children, whose lungs are still developing. On October 22, 2007, Los Angeles County (LAC) Department of Public Health Acute Communicable Disease Control Program's (ACDC) syndromic surveillance team was requested to rapidly assess the health impacts caused by the wildfires. Within a few hours, after making minor modifications to pre-existing syndromes, an automatic system to monitor respiratory syndromes related to poor air quality was implemented as an addition to the syndromic surveillance system. Daily analysis results were sent to ACDC and other stakeholders for one week, until a declaration of improved air quality was made for LAC. Air quality was reported to have returned to normal levels in the first week of November [4].

OBJECTIVE

Determine if the poor air quality resulting from the wildfires could be monitored in the general population by respiratory symptoms in the participating Emergency Departments (EDs).

METHOD

Using ED admission data from 33 LAC EDs, overall respiratory illness visits (respiratory syndrome) and subcategories of the respiratory syndrome category were analyzed using ACDC's syndromic surveillance system. Since previous studies indicate patients with asthma and chronic obstructive lung disease (COPD) are most sensitive to respiratory stress [5,6,7], a new asthma syndrome category was created and utilized as the primary focus of analysis. This category included patients with chief complaints, diagnosis and ICD-9 codes such as "asthma", "COPD", "wheezing", and "breathing difficulties." The Centers for Disease Control and Prevention (CDC) Early Aberration Reporting System (EARS) [8] was utilized for calculating and analyzing daily counts and rates (per 1000) of ED visits. A threshold based on the cumulative sum (CUSUM) algorithm with three standard deviations was used for detecting significant aberrations from normal levels.

Analysis was extended until the first week of November to further quantify the change in ED visit frequency resulting from the poor air quality. This included using SatScan [9] to analyze spatial-temporal clusters as well as purely temporal aberrations. In addition, counts and rates of asthma-related ED visits were compared one week before (October 14-20) and after (October 21-27) the fires using *t* tests.

RESULTS

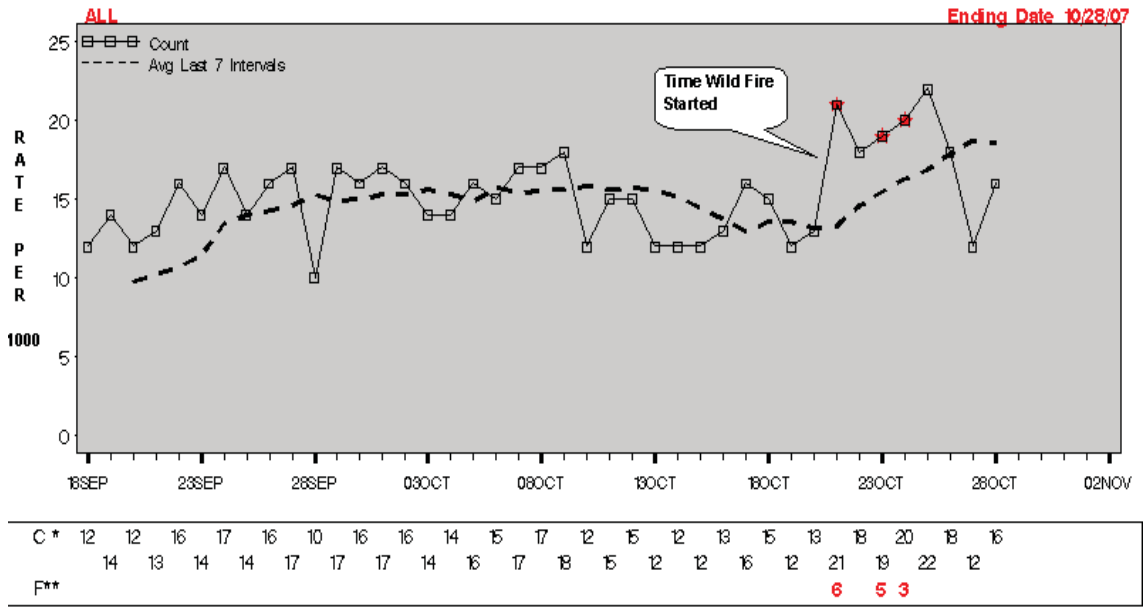
Upon reviewing 152,028 ED visits, the overall number of daily ED visits did not change significantly during the wildfire period (p=.0.95). However, both respiratory (overall) and asthma syndrome visits significantly increased during the fire. Overall respiratory syndrome visits significantly increased and generated three consecutive CUSUM signals from October 22 to October 25. Both daily counts and rates of asthma syndrome visits significantly increased, and three CUSUM signals were generated during October 21 to 24 as well (Figure 1). Asthma syndrome trends returned to the baseline levels one week

after the fire started, which was the same time that the air quality was reported to have improved. Retrospective space-time scan statistics did not detect significant hot spots during the fire (p=0.86). However, retrospective purely temporal scan statistics showed a very significant increase (p=0.001) in asthma syndrome visits between October 21 to 25. The average asthma syndrome related daily ED visits for the week changed from 69 in the week before the fires began, to 87 during the week after the fires began (p=0.0115). Similarly, average rates of asthma syndrome related visits changed from 1.4% (14 per 1000) to 1.8 % (18 per 1000) (p=0.01).

CONCLUSIONS

The syndromic surveillance system results support that wildfire induced air pollution caused a temporary increase in respiratory and asthma related ED visits. While the number of overall ED visits remained relatively stable, the system quickly detected aberrations in respiratory illness related visits. This information provided certain evidence of wildfire induced health impacts on the general population, and it offered guidance towards LAC DPH's decision to declare a county-wide smoke advisory. These results demonstrate the utility of syndromic surveillance in assessing the health-related impacts of natural disasters in near real-time. Despite the limitations in this study, which include potential syndrome misclassification due to the lack of definitive diagnosis data for most of the EDs, the possibilities for using syndromic surveillance system for objectives, beyond the early warning of infectious diseases or bioterrorism outbreaks, is promising.

Figure 1. Asthma Syndrome Rate Trend from September 18 to October 28, 2007



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