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Another type of cluster monitoring: detection of groups of anomalous patient residence locations

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Objective

To develop an algorithm to identify disease outbreaks by detecting aberrantly large proportions of patient residential zip codes outside a healthcare facility catchment area.

Introduction

The Veterans Health Administration (VHA) uses the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE) to detect disease outbreaks and other health-related events earlier than other forms of surveillance (1). Although Veterans may use any VHA facility in the world, the strongest predictor of which healthcare facility is accessed is geographic proximity to the patient's residence. A number of outbreaks have occurred in the Veteran population when geographically separate groups convened in a single location for professional or social events. One classic example was the initial Legionnaire's disease outbreak, identified among participants at the Legionnaire's convention in Philadelphia in the late 1970s (2). Numerous events involving travel by large Veteran (and employee) populations are scheduled each year.

Methods

An H1N1 influenza outbreak was identified at a Veteran Benefits Administration (VBA)-sponsored conference in Baltimore, MD, in July 2009 in which affected VBA employees (both local and from out-of-town) sought healthcare at the VA Maryland Health Care System—Baltimore Medical Center. Using ESSENCE, daily counts of ICD-9 codes related to influenza diagnoses (as defined by VA ESSENCE influenza-like illness [ILI] syndrome group) were collected from the VHA Baltimore Medical Center from March 01, 2009, to September 12, 2009. Data included case status (as defined by ICD-9 code and chart review), date and location of visit and patients' zip code of residence. We also accessed data from the VA Planning System and Support Group to determine whether the patients' residential ZIP code fell within the Baltimore VA Medical Center's catchment area. Using SAS, a p-chart (where the denominator was the daily number of patient ILI encounters) was run to determine days during which an aberrant proportion of patients from out-of-catchment zip codes were encountered.

Results

An aberrant proportion of out-of-catchment zip code ILI encounters signaled an out-of-control process (or alert) on July 23, 2009, 2 days later than the beginning of the influenza outbreak at the facility (Fig. 1) on the date when the majority of affected participants were evaluated for flu symptoms. (The alert on July 26, 2009, was a part of this same outbreak.) Using this algorithm, there were two other days in the 7-month period during which the chart signaled that the process was out-of-control: March 21, 2009, and September 6, 2009. Investigations are being conducted to determine the nature of these other signals.

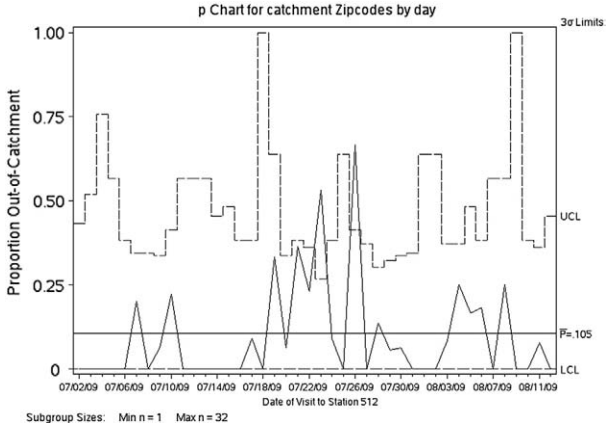

Fig. 1. ILI encounter dates of patients' whose residential zip code is out of the Baltimore VA Medical Center's catchment area. The jagged solid line exceeding the dashed line (the upper confidence limit) indicates an aberrantly large proportion of out-of-catchment events over the surveillance period.

Conclusions

Using p-charts to detect unusual clusters of patients' residential zip codes that fall outside of facilities catchment area is likely a method of detecting disease outbreaks previously not utilized. Future work includes running this algorithm in all VA Medical Centers to prospectively identify disease outbreaks involving increased proportions of patients residing outside of the medical center's catchment area.

Keywords

Surveillance; p-chart; algorithm; signal detection; outbreak

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