

Early Detection of Influenza Activity Using Syndromic Surveillance in Missouri

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Objective

To assess how weekly percent of influenza-like illness (ILI) reported via Early Notification of Community-based Epidemics (ESSENCE) tracked weekly counts of laboratory confirmed influenza cases in five influenza seasons in order to evaluate the early warning potential of ILI in ESSENCE and improve ongoing influenza surveillance efforts in Missouri.

Introduction

Syndromic surveillance is used routinely to detect outbreaks of disease earlier than traditional methods due to its ability to automatically acquire data in near real-time. Missouri has used emergency department (ED) visits to monitor and track seasonal influenza activity since 2006.

Methods

The Missouri ESSENCE system utilizes data from 84 hospitals, which represents up to 90 percent of all ED visits occurring in Missouri statewide each day. The influenza season is defined as starting during Centers for Disease Control and Prevention (CDC) week number 40 (around the first of October) and ending on CDC week 20 of the following year, which is usually at the end of May.

A confirmed influenza case is laboratory confirmed by viral culture, rapid diagnostic tests, or a four-fold rise in antibody titer between acute and convalescent serum samples. Laboratory results are reported on a weekly basis. To assess the severity of influenza activity, all flu seasons were compared with the 2008-09 season, which experienced the lowest influenza activity based on laboratory data. Analysis of variance (ANOVA) was applied for this analysis using Statistical Analysis Software (SAS) (version 9.2).

The standard ESSENCE ILI subsyndrome includes ED chief complaints that contain keywords such as “flu”, “flu-like”, “influenza” or “fever plus cough” or “fever plus sore throat”. The ESSENCE ILI weekly percent is the number of ILI visits divided by total ED visits.

Time series of weekly percent of ILI in ESSENCE were compared to weekly counts of laboratory confirmed influenza cases. Spearman correlation coefficients were calculated using SAS. The baseline refers to the mean of three flu seasons with low influenza activity (2006-07, 2008-09 and 2010-11 seasons). The threshold was calculated as this baseline plus three standard deviations.

The early warning potential of the ESSENCE weekly ILI percent was evaluated for five consecutive influenza seasons, beginning in 2006. This was accomplished by calculating the time lag between the first ESSENCE ILI warning versus the first lab confirmed influenza warning. A warning was identified if either lab confirmed case counts or weekly percent of ILI crossed over their respective baselines.

Results

For each influenza season evaluated, weekly ILI rates reported via ESSENCE were significantly correlated with weekly counts of laboratory-confirmed influenza cases (Table 1). The baseline of ILI ac-

tivity in ESSENCE was 1.8 ILI /100 ED visits/week and the threshold was set at 4.1 ILI visits per 100 ED visits/week. The ESSENCE ILI baseline provided, on average, two weeks of advanced warning for seasonal influenza activity. Figure 1 shows that two influenza seasons (2007-08 and 2009-10) were more severe than others examined based on the ESSENCE percent ILI threshold analysis, this result is consistent with the examination of severity of influenza activity based on lab confirmed influenza data ($p < 0.05$).

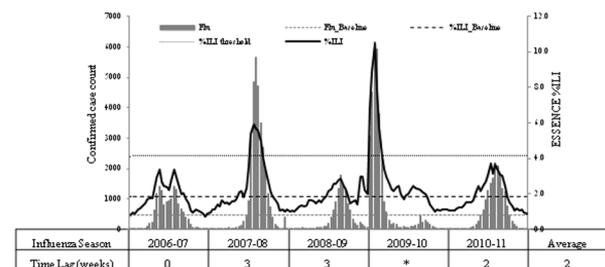
Conclusions

The significant correlation between ILI surveillance in ESSENCE and laboratory confirmed influenza cases justifies the use of weekly ILI percent in ESSENCE to describe seasonal influenza activity. The ESSENCE ILI baseline and threshold provided advanced warning of influenza and allowed for the classification of influenza severity in the community.

Table 1. Correlation between laboratory confirmed influenza cases and ESSENCE ILI weekly percent in five influenza seasons, 2006-2011

2006-2007		2007-2008		2008-2009		2009-2010		2010-2011	
r	p-value								
0.936	<0.0001	0.889	<0.0001	0.773	<0.0001	0.817	<0.0001	0.889	<0.0001

Figure 1. Number and baseline of lab confirmed influenza cases, ESSENCE weekly ILI percent and baseline, and ESSENCE ILI threshold for five consecutive influenza seasons, 2006-2011.



*Time lag was calculated based on the difference between the first ESSENCE weekly ILI percent warning and the first lab confirmed influenza warning.
 **Time lag calculation was not possible during the 2009-2010 influenza season because H1N1 Influenza A emerged prior to the regular influenza season.

Keywords

ESSENCE; syndromic surveillance; influenza-like illness (ILI); baseline; threshold

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