ABSTRACT

Impact of alternate diagnoses on the accuracy of influenza-like illness case definition used for H1N1 screening in the emergency department

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Objective

This study investigates the impact of alternate diagnoses on the accuracy of the Centers for Disease Control and Prevention's (CDC) case definition for influenza-like illness (ILI) when used as a screening tool for influenza A (H1N1) virus during the 2009 pandemic, and the implications for public health surveillance.

Introduction

In June 2009, the CDC defined a confirmed case of H1N1 as a person with an ILI and laboratory confirmed novel influenza A H1N1 virus infection.[1] ILI is defined by the CDC as fever and cough and/or sore throat, in the absence of a known cause other than influenza.[1] ILI cases are usually reported without accounting for alternate diagnoses (that is, pneumonia). Therefore, evaluation is needed to determine the impact of alternate diagnoses on the accuracy of the ILI case definition.

Methods

This is a retrospective cross-sectional study design conducted from September 5, 2009 to May 5, 2010, at an emergency department of a large urban tertiary care academic medical center. During this period, 32,922 patients were seen, of which 1233 were tested for H1N1 using Polymerase Chain Reaction (PCR) testing for respiratory viruses. Geographic Utilization of Artificial Intelligence in Real-Time for Disease Identification and Notification (GUARDIAN), a syndrome surveillance program,[2] was utilized to assign ILI status to each patient.

Positive predictive value (PPV), negative predictive value (NPV), sensitivity, and specificity were calculated with and without consideration of the following alternate diagnoses: pneumonia, respiratory syncytial virus, infectious mononucleosis, and streptococcal pharyngitis. Positive laboratory results, in addition to ICD-9 codes, were used to detect these alternate diagnoses. McNemar's and χ^2-test were then used to compare the results for statistical significance (Table 1).

Table 1 Positive and negative predictive value and sensitivity and specificity of the ILI case definition to detect H1N1 cases

ILI status	H1N1 status		PPV (%)	NPV (%)	Sensitivity (%)	Specificity (%)
	No	Yes				
Including alternate diagnoses	No	439	21	17.2	95.4	86.4	40.7
	Yes	640	133				
Excluding alternate diagnoses	No	638	35	21.3	94.8	77.3	59.1
	Yes	441	119				

Abbreviations: NPV, negative predictive value; PPV, positive predictive value. Based on the McNemar test for evaluation of classifiers, the improvement (especially in specificity) generated by ILI case definition excluding alternate diagnoses was statistically significant ($\chi^2 = 159$, $P < 0.05$).

Results

Of the 1233 tested for H1N1, only 62.7% ($n = 773$) had signs and symptoms consistent with ILI, before considering alternate diagnoses. This significantly decreased to 45.4% ($n = 560$) ($\chi^2 = 74$, $P < 0.001$) after extraction of cases with alternate diagnoses.

Conclusions

By excluding patients with alternate diagnoses, ILI case definition specificity was improved, without significant difference in other indices. Dual diagnoses of H1N1 and pneumonia were present in 15 patients, which complicated ILI status designation. In this study, these cases were considered ILI negative because of their alternate diagnoses. In addition, there was a 17.3% decrease in the overall ILI prevalence rate by excluding cases with an alternate diagnosis. This demonstrates how surveillance methodology may affect ILI rates reported by hospitals, and subsequently

may affect regional public health surveillance data, necessary for appropriate response.

Accurately identifying ILI patients with alternate diagnoses can be difficult because of lack of available data, specifically lab results, which can be delayed up to 48 h. By using GUARDIAN in this study, we were able to automatically and accurately identify ILI patients with other known causes, and increase our accuracy in identifying H1N1 cases. This study exemplifies the importance of an accurate and consistent clinical case definition for the diagnosis of H1N1, along with an automated real-time surveillance system.

References
1 Centers for Disease Control and Prevention. http://www.cdc.gov/.
2 Waddell MJ, Doseck SM, Silva JC, Rumoro DP. GUARDIAN: Geographic Utilization of Artificial intelligence in Real-Time for Disease Identification and Notification. *Adv in Dis Surveill* 2007;**4**:63.