COACTION PUBLISHING

Multistream influenza surveillance for situational awareness

Eric Lau*, Benjamin Cowling, Lai-ming Ho and Calvin Cheng

School of Public Health, The University of Hong Kong, Hong Kong

Objective

This paper describes the use of multiple influenza surveillance data for situational awareness of influenza activity.

Introduction

Much progress has been made on the development of novel systems for influenza surveillance (1, 2) or explored the choices of algorithms for detecting the start of a peak season. The use of multiple streams of surveillance data has been shown to improve performance (3) but few studies have explored its use in situational awareness to quantify level or trend of disease activity. In this study, we propose a multivariate statistical approach, which describes overall influenza activity and handles interrupted or drop-in surveillance systems.

Methods

A multivariate dynamic linear time series model was fitted to data on influenza-like illness (ILI) rates among networks of public and private general practitioners and school absenteeism rates, plus drop-in fever count data from designated flu clinics (DFC) that were created during the pandemic. The data streams were assumed to follow an underlying latent process with local linear trend. The estimated level and trend of the latent process reflect the magnitude and direction of influenza activity, which are then combined to infer an overall influenza activity index. Correlations between the estimated influenza level from the model and laboratory isolation rate were calculated to assess its performance before and during the 2009 pandemic.

Results

ILI rates from public outpatient clinics and the estimated influenza level from the multivariate model had the highest correlations with laboratory isolation data before the 2009 pandemic ($\rho = 0.57$ and 0.58, respectively) but the former was interrupted during the pandemic period due to activation of the DFC. The estimated influenza level from the multivariate model captured the influenza level well during the pandemic period ($\rho = 0.76$), significantly better than the best surveillance data in the same period (p-value $= 0.03$). The inferred influenza activity index is able to reflect the influenza activity (Fig. 1).

Conclusions

The use of a multivariate method to integrate information from multiple sources of influenza surveillance data can improve situational awareness of influenza activity, with the advantage of maintaining performance when data streams are interrupted or supplemented by additional systems during certain critical periods such as the 2009 influenza pandemic.

Keywords

Sentinel surveillance; influenza; multivariate analysis; pandemic

Acknowledgements

This research was in part funded by the Research Fund for the Control of Infectious Diseases of the Food and Health Bureau of the Hong Kong SAR Government, the Area of Excellence Scheme of the University Grants Committee (grant number AoE/M–12/06) and the Harvard Center for Communicable Disease Dynamics from the National Institute of General Medical Sciences (grant number U54 GM088558).

References

1. Ginsberg J, Mohebbi MH, Patel RS, Brammer L, Smolinski MS, Brilliant L. Detecting influenza epidemics using search engine query data. Nature. 2009;457:1012–4.
2. Schmidt WP, Pebody R, Mangtani P. School absence data for influenza surveillance: a pilot study in the United Kingdom. EurSurveill. 2010;15:4–9.
3. Lau EH, Cowling BJ, Ho LM, Leung GM. Optimizing use of multistream influenza sentinel surveillance data. Emerg Infect Dis. 2008;14:1154–7.

***Eric Lau**
E-mail: ehylau@hku.hk

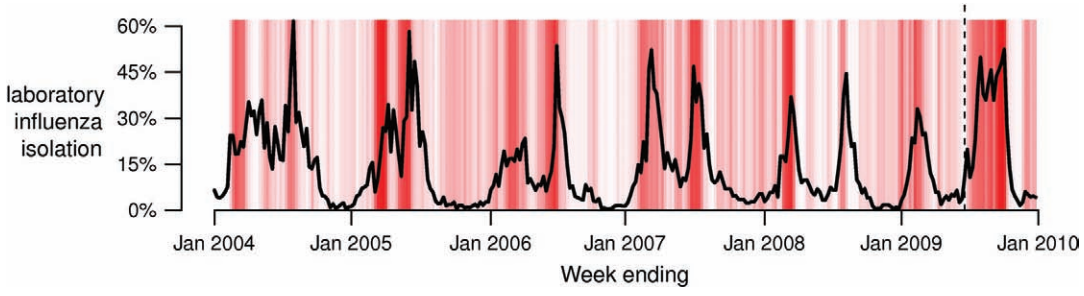

Fig. 1. Laboratory influenza detection rates from January 2004 through December 2009. The inferred influenza activity index was superimposed and color-coded from white (low) to red (high) in each panel. The vertical dashed line indicates the start of the pandemic period.

Citation: Emerging Health Threats Journal 2011, **4**: 11029 - DOI: 10.3402/ehtj.v4i0.11029