

MONITORING DYNAMIC TEMPO-SPATIAL CHANGES OF INFLUENZA-LIKE ILLNESS DURING 2005-2007 THROUGH SENTINEL-PHYSICIAN SURVEILLANCE IN TAIWAN USING RING MAPS

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OBJECTIVE

This study describes a visualizing ring maps to monitor the alert levels of Influenza-like illness, and provide possible insights of temporal and spatial diffusion patterns in epidemic and non-epidemic seasons.

BACKGROUND

The global health threat of highly pathogenic avian influenza H5N1 has been increasing rapidly in the world since the cross-country outbreaks during 2003-04. In South and East Asia, the human influenza A (H3N2) was proved to be seeded there with occurring annual cases¹. Intensive surveillance of influenza is the most urgent strategy to avoid large-scale epidemics and high case fatality rates. Sentinel physicians' surveillance is the most sensitive mechanism to reflect the health status of community people. In France and Japan^{2,3}, comprehensive sentinel-physician surveillance systems were set up and geographic information system (GIS) was applied to display the diffusion patterns of influenza-like illness. Kriging method, which was used to display the diffusion⁴, was hard to monitor the multiple temporal and spatial dimensions in one map. Therefore, Ring maps were proposed to overcome this difficulty⁵.

METHODS

Influenza-like illness (ILI) data were reported by sentinel physician surveillance which involves nation-wide 526-538 physicians with 1 physician per 43,000 populations, were provided by the Centers for Disease Control in Taiwan (Taiwan-CDC). Mean numbers of the reported ILI cases per physician were used in the analysis. Temporal unit used weekly numbers of ILI cases and the spatial unit was displayed as the city/county levels of ILI cases. Each Ring map showed the ILI cases over 8 weeks and 22 cities/counties simultaneously. The analysis was applied to the epidemic and non-epidemic seasons using the national virological surveillance data during 2005-2007. The study also investigated the variations of diffusion patterns for different types/subtypes of human influenza viruses isolated in different years, cities/counties with various sizes of population in Taiwan, and dynamic changes in flu and non-flu seasons. Pearson correlation was used for measuring the strength between mean numbers of reported ILI cases and the size of population. The ring maps were implemented by ArcGIS (ArcMap, version 9.0; ESRI Inc., Redlands, CA, USA).

RESULTS

The inner ring of the ringmap was the earlier week of the study period. The colorful polylines represented the severity of the ILI epidemic. The color of Taiwan was represented the population density in the cities/counties. From the 49th week of 2005, the

number of ILI cases and positive influenza virus isolate rate began to rise. Interesting, the leading wave of this epidemic started in cities with large population (Figure 1). Holiday effect (Chinese New Year) on ILI cases was shown at week #5 of 2006. Correlation between average reported cases per physician and population size was significant ($r=0.37$, $p<0.01$).

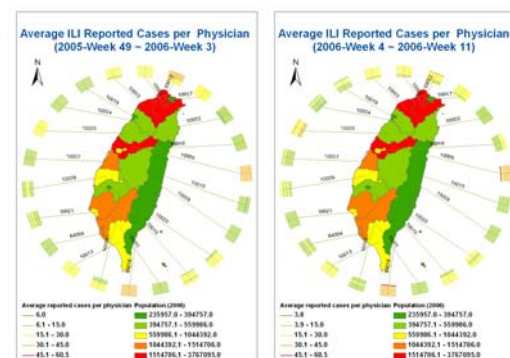


Figure 1 –Mean Numbers of Reported ILI Cases through Sentinel-physician Surveillance in Taiwan shown by Ring Map, from week #49 of 2005 to week #11 of 2006. The dominant circulating human influenza virus during 2005-06 flu seasons in Taiwan was A/H1.

Conclusions

We demonstrated here that ring maps can provide a useful screening tool about the patterns of human influenza of any interesting epidemiologic characteristics (such as age, population size, subtypes/types of human influenza viruses) related to geographic variations. Once the major variations are identified, diffusion patterns regarding to different hypotheses can be further investigated in details.

REFERENCES

1. RUSSELL CA, ET AL. THE GLOBAL CIRCULATION OF SEASONAL INFLUENZA A (H3N2) VIRUSES. *SCIENCE* 2008;320(5874):340-6.
2. SAKAI T, ET AL. GEOGRAPHIC AND TEMPORAL TRENDS IN INFLUENZA-LIKE ILLNESS, JAPAN, 1992-1999. *EMERG INFECT DIS* 2004;10(10):1822-6.
3. FLAHAULT A, ET AL. VIRTUAL SURVEILLANCE OF COMMUNICABLE DISEASES: A 20-YEAR EXPERIENCE IN FRANCE. *STAT METHODS MED RES* 2006;15(5):413-21.
4. CARRAT F, VALLERON AJ. EPIDEMIOLOGIC MAPPING USING THE "KRIGING" METHOD: APPLICATION TO AN INFLUENZA-LIKE ILLNESS EPIDEMIC IN FRANCE. *AM J EPIDEMIOL* 1992;135(11):1293-300.
5. GUILAN HUANG, ET AL. GEOVISUALIZING DATA WITH RING MAPS. *ARCUSER*. VOL. WINTER, 2008;54-55.

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