Development of an Integrated Surveillance System for Beijing

[1] **Xiaohui Zhang, Ph.D.,** [2] **Yun Ding, MD.,** [1] **Zhijue Chen, MPH,** [1] **Charles Schable, MS.**

[1] *Scientific Technologies Corp.,* [2] *Beijing Health Information Technologies*

OBJECTIVE

This paper describes the methodology in the development of an Integrated Surveillance System for Beijing, China.

BACKGROUND

After the SARS outbreak in 2003, Beijing established Fever Clinics in major hospitals for the early detection of potential respiratory disease outbreaks. The data collection in Fever Clinics contains the basic patient information, body temperature, cough, and breath condition, as well as a primary diagnosis. Since the symptoms and diagnosis are mainly recorded in free text format, it is very difficult to use for data analysis. Because of the problems in data processing, the data collection has decreased.

Since 2004, China's CDC has developed a Web-based Case Reporting System for China National Notifiable Diseases (currently 37 infectious diseases). This Web-based reporting system directly gets case data into China's CDC central data bank; therefore vastly improving the case report timeliness. With this Reporting System, hospital infectious disease workers have to retype all case data in the format just for this reporting system for China CDC. After the case report, the local public health workers have to re-collect the data for epidemiological investigation.

The objectives of the development of an integrated surveillance system in Beijing are threefold. First it should be an end-to-end surveillance system, which consists of data collection, aberration analysis, and alert functionality. Secondly, the data should be only collected once, and used by both clinics and public health purpose. The standardized terminology and code set should be adopted for information exchange. The similar approach has been applied to Gastrointestinal Disease Clinics (GI Clinics) and Emergency Rooms (ER) in this project.

METHODS

The integrated surveillance system for Beijing is designed with multi-level surveillance, such as patient counts in symptom groups, patient counts in non-reportable infectious diseases, as well as surveillance of reportable infectious diseases. To minimize data input at clinics, the user interface is controlled in only one-page, with exactly the same flow as it works in current clinic system. For data collection in symptoms/signs, reportable diseases, and non-reportable diseases, the dropdown lists are provided with standardized terminology (both in English and in Chinese), as well as mapped with ICD-9 and ICD-10 code set. A similar approach is applied to common lab tests (blood tests, urinalysis, stool tests, and immunological tests) with a LOINC code set. In addition, a mapping rule set is developed to extract the data from clinics other than Fever or GI or ER.

In the data analysis, the minimum one month data is required to derive the referenced 'base-line' for the specified clinic at the selected place in that season. The sample mean and deviation are obtained by 'moving computation'; therefore the seasonal variation is incorporated. For the aberration analysis, the modified Shewhart control chart with WECO rules [1] and one side cumulated sum (CuSUM) [2] method are adopted. Two methods complement each other in the effort of early detection.

RESULTS

One year data from Fever clinics in two major hospitals were used to test the data analysis methods. The results show that the Shewhart control chart [1] has an advantage in detection of a sharp point change, while the CuSUM is more effective in detection of small mean drift, since CuSUM cumulates the variations over an interval. Both methods signaled an alert for a known outbreak in late April of 2004. For the other detected events, the further investigation will be conducted.

CONCLUSIONS AND DISCUSSION

An integrated surveillance system for Beijing is introduced. Its benefits can be identified as the following: the standardized terminology and code set ensure the collected data with consistency and interoperability, and the one-page user interface fits the clinic practice while minimizes the duplicated data entry for public health. The designed end-to-end system has multi-level surveillance functionality, from syndromic /sentinel surveillance until the capability to support case reporting. Two aberration analysis methods are adopted to complement each other in early detection and early warning. As it is planned to be deployed in over 50 major hospitals in Beijing, the system will be further refined and evaluated by the public health practice.

REFERENCES

[1] Harrison M. Wadsworth, Statistical Methods for Engineers and Scientist, McGraw-Hill Professional 1997; ISBN: 007067678X

[2] Hustwanger et al, 2005, *Comparing Aberration Detection Methods with Simulated Data*, Journal of Emerging Infectious Diseases, 11 (2), pp. 314-316.

Further Information: Xiaohui Zhang, Ph.D.,
xiaohui_zhang@stchome.com