Surveillance

Syndromic surveillance: is it a useful tool for local outbreak detection?

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New surveillance systems are required to meet the demands of a changing world.

Traditional surveillance systems have served public health well in detecting and responding to infectious disease outbreaks. While generally passive and dependent on laboratory confirmation, they have provided sufficient information to identify disease clusters. The world we live in has changed extensively in the past few decades, with the threat of bioterrorism, an imminent influenza pandemic, massive population movement, and emerging infectious diseases requiring surveillance systems that provide adequate lead time for optimal public health response. Traditional surveillance systems often operate with considerable delay, thus complementary surveillance systems are required to provide the necessary lead time. Syndromic surveillance systems may fulfil this role.^{1,2}

Syndromic surveillance uses clinical features that are discernable before diagnosis is confirmed or activities prompted by the onset of symptoms as an alert of changes in disease activity. Patient information may be acquired from multiple existing sources established for other purposes, including emergency department chief complaints, ambulance dispatch data, and over the counter medication sales.^{3,4} Automated application of analytical algorithms provides signals for scrutiny by public health officials. These systems can function as an early warning system by providing data in close to real time, making them attractive for bioterrorism surveillance. Experts have hypothesised their value for detecting emerging infectious diseases or naturally occurring outbreaks, but their application in this capacity has had limited evaluation.^{5,6}

To determine the value of syndromic surveillance systems in identifying and responding to bioterrorism attacks and naturally occurring outbreaks, we conducted a review of current literature. Using the perspective recommended by the Centers of Disease Prevention and Control,⁷ we conducted a review of peer reviewed journals using Medline, Pubmed, and web sites of relevant

governmental and non-government agencies. Searches were limited to English language articles published from 2000 to 2004 inclusive using keywords: "bioterrorism", "syndromic", "surveillance" and their associated MeSH terms. We contacted topic experts to identify unpublished papers and evaluations in progress. We identified 71 articles describing 36 discreet syndromic surveillance systems. Fifty two articles provided descriptive information for 22 systems. Only 13 contained an evaluation of one or more performance indicators.

This review identified the major strengths of syndromic systems, as their (1) ability to detect community wide seasonal outbreaks of influenza; (2) timeliness of data availability, often within 12 hours of initial activity; (3) completeness of data; (4) role in alleviating community concern when outbreaks are occurring elsewhere; (5) additional case finding when an outbreak has been identified; and (6) flexibility in being able to rapidly conduct surveillance for new and emerging issues (including non-infectious health issues).

However, demonstrated utility in detecting localised disease clusters has remained an elusive goal for syndromic surveillance systems. In this respect, the review identified important limitations, particularly relatively low specificity and positive predictive value, with a considerable burden of false alarms, and an inability to distinguish between signals and background noise. The trade off between sensitivity and specificity, and the use of non-specific symptoms to form syndrome categories potentially limits the scale of outbreak that can be detected. The incubation/latent period of the infectious agent/toxin may also affect the utility of a syndromic surveillance system.

A major constraint to local level syndromic surveillance is the general unavailability of denominator information required to distinguish statistically important departures from expected

rates. An example of how this may be overcome is provided by the New York City emergency department system where a prospective space-time permutation scan statistic based solely on case numbers, with minimal assumptions about the time, geographical location, or size of the outbreak, is used.^{8,9} Experience from New York City suggests that relatively few false signals are currently generated by this system and we have begun to explore a similar syndromic surveillance system through local emergency departments for cluster detection.

If a syndromic surveillance system is to be successful it must be integrated into the public health system to ensure a timely and adequate response once an outbreak is detected.¹⁰ Importantly, we should not under-invest in educating and communicating with frontline healthcare workers about the importance of recognising unusual clinical syndromes. Astute and primed physicians may well be more sensitive and reliable detectors of bioterror events and disease outbreaks than statistical algorithms.¹¹

The dynamic social and biological environment demands novel approaches to surveillance to ensure optimal local response. Syndromic surveillance remains unproved because the events it is primarily seeking to detect, emerging infectious diseases, and bioterrorism, are rare. This should not deter local efforts at refinement, with local outbreaks of gastrointestinal and respiratory disease permitting testing of systems. Rigorous standardised evaluation must be paramount in all phases of development and implementation and should include the opportunity cost to the health system of conducting signal investigation.

J Epidemiol Community Health 2006;**60**:374-375.

doi: 10.1136/jech.2005.035337

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Accepted for publication 18 November 2005

Funding: none.

Competing interests: none.

REFERENCES

- 1 Buehler JW, Berkman RL, Hartley DM, *et al.* Syndromic surveillance and bioterrorism-related epidemics. *Emerg Infect Dis* 2003;9:1197–204.
- 2 Dürheim DN, Speare R. Communicable disease surveillance and management in a globalised world. *Lancet* 2004;363:1339–40.
- 3 Pavlin JA, Mostashari F, Kortepeter MG, *et al.* Innovative surveillance methods for rapid detection of disease outbreaks and bioterrorism: results of an interagency workshop on health indicator surveillance. *Am J Public Health* 2003;93:1230–5.
- 4 Centers for Disease Control and Prevention. Syndromic surveillance: reports from a national conference, 2004. *MMWR* 2005;54(suppl).
- 5 Reingold A. If syndromic surveillance is the answer, what is the question? *Biosecure Bioterror* 2003;1:77–81.
- 6 Bravata DM, McDonald KM, Smith WM, *et al.* Systematic review: surveillance systems for early detection of bioterrorism-related diseases. *Ann Intern Med* 2004;140:910–22.
- 7 Centers for Disease Control and Prevention. Framework for evaluating public health surveillance systems for early detection of outbreaks: recommendations from the CDC working group. *MMWR Recomm Rep* 2004;53:1–11.
- 8 Heffernan R, Mostahari F, Das D, *et al.* Syndromic surveillance in public health practice, New York City. *Emerg Infect Dis* 2004;10:858–64.
- 9 Kulldorff M, Heffernan R, Hartman J, *et al.* A space-time permutation scan statistic for disease outbreak detection. *PLoS Med* 2005;2:e59.
- 10 Stoto M, Schonlau M, Mariano L. Syndromic surveillance: is it worth the effort? *Chance* 2004;17:19–24.
- 11 Kaufmann A, Pesik N, Meltzer M. Syndromic surveillance in bioterrorist attack. *Emerg Infect Dis* 2005;11:1487–8.

Speaker's corner

Autism and diet

Is exposure to antibodies and fatty acids in mother's milk associated with development of autism? Autism is a disease of unknown aetiology, but complex pathogenesis that seems to have become more common in recent decades. We suggest that efforts exploring the aetiology of autism should pay special attention to patterns of breast and artificial feeding in infancy.

Newschaffer grouped the aetiology of risks for autistic disorders into four groups: genetic predisposition of the mother, environmental factors acting on the mother, genetic predisposition of the child, and environmental factors affecting the child.¹ Historical incidence has been difficult to determine as the heterogeneous nature of the syndrome and the recent increase in awareness confound past estimates.² However, it is estimated that autism has increased threefold since the 1970s and that current rates are around 5–10 cases per 10 000 in the general population.¹ If prevalence is increasing it implies that even if there is a genetic component we also need to look for some environmental change that could be triggering any increase in prevalence.

There are well identified links between gastrointestinal disease and symptomatic autism. Wakefield claimed that diarrhoea occurred disproportionately in a control study of autistic children.³ Children with autism have unusual feeding patterns and in one study low appetite, narrow range of preferred dishes, and digestive autonomic nervous system reactions were significantly more common in the autistic group when compared with other children in one study.⁴

The postnatal growth of the human brain requires a range of fatty acids and the content of human milk changes with brain growth. By age 3 the brain of an autistic child undergoes a growth spurt and is larger than that of a normal

child at age 3.⁵ Tanoue and colleagues suggested that breast feeding may protect against autism. Researchers studied the weaning times of 145 autistic infants compared with a control group of 224 normal children. They found that the children in their control group breast fed significantly longer than the autistic infants. The researchers, who had previously found a correlation between incidence of autism and cyclical outbreaks of pneumonia and bronchiolitis, speculated that breast feeding lowered the risk of developing autism by protecting against pneumonia.⁶ Those with autism may be more vulnerable to infection during the newborn period. The evidence of links between diet and autism are suggestive and warrant further investigation.

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Conflicts of interest: none declared.

REFERENCES

- 1 Newschaffer C, Fallin D, Lee N. Heritable and nonheritable risk factors for autism spectrum disorders. *Epidemiol Rev* 2002;24:137–53.
- 2 Stokstad E. Epidemiology. Vaccine-autism link dealt blow. *Science* 2003;301:1454–5.
- 3 Wakefield AJ. Enterocolitis, autism and measles virus. *Mol Psychiatry* 2002;7(suppl 2):S44–6.
- 4 Lesinskiene S, Puras D, Kajokiene A, *et al.* [Features of nursing of the autistic children]. *Medicina (Kaunas)* 2002;38:412–19.
- 5 Courchesne E, Carper R, Akshoomoff N. Evidence of brain overgrowth in the first year of life in autism. *JAMA* 2003;290:337–44.
- 6 Tanoue Y, Oda S. Weaning time of children with infantile autism. *J Autism Dev Disord* 1989;19:425–34.