

# **DESIGN AND IMPLEMENTATION OF SURVEILLANCE SYSTEMS FOR THE EARLY DETECTION OF INFECTIOUS DISEASE OUTBREAKS CAUSED BY ACCIDENTAL/DELIBERATE RELEASE OF PATHOGENS: MODELS OF SENTINEL SYSTEMS**

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## **REZUMAT**

Scopul acestei comunicări este de a trece în revistă diferite tipuri de supraveghere aplicabile detectării precoce a răspândirii accidentale și deliberate de agenți patogeni, precum și a eliberării de substanțe chimice, radiologice sau nucleare. Materialul a fost pregătit printr-o trecere în revistă nesistematică a literaturii, cu accent pe rapoarte de cercetare și editoriale publicate în jurnalele oficiale de supraveghere ale Centrului European pentru Prevenirea și Controlul Bolilor (ECDC) - Eurosurveillance - și ale Centrelor pentru Controlul Bolilor din SUA (CDC) - Morbidity and Mortality Weekly Review. Principalele forme identificate de supraveghere bazată pe indicatori aplicabile detectării precoce a răspândirii de agenți patogeni au fost: notificarea de rutină, supravegherea sindromică și supravegherea prin sondaj.

## **ABSTRACT**

The purpose of this communication is to review the different types of surveillance that can be applied to the early detection of both accidental and deliberate releases of pathogens, and for that matter, chemical, radiological or nuclear releases. It was prepared via an unsystematic review of the literature, concentrating on research reports and editorials published in the official surveillance journals of the European Centre for Disease Prevention and control (ECDC) - Eurosurveillance - and US Centres for Disease Control (CDC) - Morbidity and Mortality Weekly Review. The main forms of indicator-based surveillance applicable to early detection of releases were identified as routine notification, syndromic surveillance and drop-in surveillance.

## **INTRODUCTION**

The purpose of this conference presentation is to review the different types of surveillance that can be applied to the early detection of both accidental and deliberate releases of pathogens, and for that matter, chemical, radiological or nuclear releases. The inherent characteristics of various types of indicator-based (epidemiological) surveillance are considered

from the viewpoints of 1) value added to event-based surveillance (unstructured reporting) from clinicians, laboratory workers and other sources, 2) European Union legislation relating to communicable disease surveillance and early warning and response, and the International Health Regulations, and 3) the resources and strategies needed to strengthen indicator-based surveillance.

## **METHODS**

The presentation was prepared via an unsystematic review of the literature, concentrating on research reports and editorials published in the official surveillance journals of the European Centre for Disease Prevention and control (ECDC) - Eurosurveillance - and US Centres for Disease Control (CDC) - Morbidity and Mortality Weekly Review. Secondary literature references in these articles were followed up in some instances.

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## FINDINGS

A tentative conceptual framework for considering the literature on releases was proposed. It is a 2 x 2 table of accidental vs deliberate against published vs unpublished. It is acknowledged that publication bias is large because accidental releases may be covered up to evade management enquiry or in the interest of avoiding public alarm; and deliberate releases may be subject to official secrecy. In each division of the table, examples of releases are given under three headings: obvious, overt, covert. 'Obvious' refers to health events that are reported in the media or matters of general knowledge. 'Overt' threats include claimed terrorist attacks and well known scientific associations, whereas 'covert' refers to unclaimed terrorist attacks and accidental releases that require scientific methods to detect. The educational purpose of the framework is to suggest to the conference that 1) releases are ubiquitous and lie in a continuum classifiable by the releaser's intention and degree of public information available, and 2) that considerable grey areas exist between these classifications. Further work is needed to define whether the classification is useful.

The main forms of indicator-based surveillance applicable to early detection of releases were identified as routine notification, syndromic surveillance and drop-in surveillance.<sup>1</sup> All the states of WHO's European Region have routine notification systems but the reporting delay inherent in paper-based systems renders them of little use for early detection. They could however provide retrospective evidence of a release (for instance of a food, water or airborne pathogen) but even that is by no means straight forward. Their interpretation is generally complicated *inter alia* by the presence of typographic errors and duplications, year-on-year and seasonal trends, incomplete data, reporting variation and changes in case definition and diagnostic accuracy. Sentinel populations, small enough to permit active, case-based and enhanced surveillance, yet large enough to yield statistically significant signals, are in place in most countries for influenza surveillance. 'Sentinels' have been set up in the US and Western Europe in certain cities and regions to act as test beds for information technology based early detection systems for deliberate releases.<sup>2</sup> They can only be considered experimental however, because many historical releases have been geographically localised and therefore unlikely to be detected by geographically focussed systems. The resources needed to scale-up these sentinel to routine systems are probably not available in Eastern Europe.<sup>3</sup>

Syndromic surveillance, i.e. monitoring the occurrence of symptoms and signs of disease (and often their behavioural correlates such as over the counter anti-diarrhoeal sales), may be justified on the grounds of detecting a release from its health impact before laboratory confirmed diagnoses have been made.<sup>4</sup> There are a number of theoretical limitations to its usefulness, however, including: many releases may result in common prodromic syndromes so that detecting even moderately large increases is like looking for a needle in a haystack, on the other hand, many listed bioweapons have either very short prodromes or very specific clinical signs, implying that clinical event-based reporting is likely to be faster than syndromic surveillance. In practice, evidence from the US, UK and Denmark suggests that syndromic surveillance is a useful adjunct to rapid clinical and laboratory reporting, its main benefit being to reassure the public that there is no evidence of clinically undetected releases.<sup>5</sup> In a well-informed population however, the limits of the system would need to be carefully explained to avoid the charge of false reassurance. A tentative conclusion concerning syndromic surveillance in Eastern Europe is that it should not be introduced as a priority until the costs and benefits have been established in higher resourced settings

Drop-in surveillance is the notion of having a national and regional rapid reaction teams that can provide highly specific surveillance during emergencies within 24 to 48 hours of the emergency occurring. A famous example is the clinic-based surveillance that was put in place by a team of 30 field epidemiologists after the World Trade Centre attack and during the inhalational anthrax threats in New York that followed it.<sup>6</sup> The team was distributed to sentinel hospital clinics and checked all data for completeness and consistency before entering it to the computer. Cases were classified into 12 syndromes, 8 of which were bioterror related. Forty 'false positive' alarms were generated by statistical aberrations and followed up. No untoward findings were revealed and this intervention provided a high degree of reassurance at relatively low cost.

## CONCLUSIONS

The vigilance of clinicians and laboratory workers is far more likely to provide early detection of releases than indicator-based surveillance systems in Eastern Europe. There is therefore an urgent need to raise situational awareness of potential bioterrorist attacks and to ensure the biosecurity of laboratories and patient facilities. This needs to be organised through

programmes of continuing professional education, and included in all under and post-graduate health related curricula.

The best trade off between current needs and resources for strengthening indicator-based surveillance capacity is probably to recruit and train field epidemiologists to strengthen existing surveillance systems (especially sentinel ones) to meet their requirements under EC legislation and the IHR (2005), and to prepare them as rapid reaction teams for drop-in surveillance following a range of emergencies, including natural disasters, chemical spills, radiological and nuclear releases, and conflict related population movements.

The EC has worked closely with the WHO to run surveillance strengthening activities in a number of EC member and accession states. The design of these programmes has followed a fairly common pattern, emphasising: laboratory safety and quality assurance, European Programme of Intervention Epidemiology (EPIET)-like training of epidemiologists, national strategic planning and prioritisation, and integration

of surveillance functions. These activities need to be consolidated through medium-term government investment programmes and national Field Epidemiology Training Programmes need to be established to internationally accredited standards in all countries where significant strengthening of surveillance systems is required.

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