

**REVIEW ARTICLE**

## **Syndromic surveillance in early detection of outbreaks of infectious diseases**

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## Abstract

**Aim:** Motivated by the threat of infectious diseases and bioterrorism, syndromic surveillance systems are being developed and implemented around the world. The aim of the study was to describe the early warning surveillance system in Albania.

**Methods:** Syndromic surveillance is a primary health care-facility- and emergency room (ER)-based syndromic surveillance system aiming at detecting outbreaks and undertaking public health actions. It is based on weekly notifications of nine syndromes by over 1,600 General Practitioners (GPs) in the 36 districts of Albania. Data is aggregated by district epidemiologists (DE) and centralized by the national Institute of Public Health.

**Results:** A syndrome is “a set of symptoms or conditions that occur together and suggest the presence of a certain disease or an increased chance of developing the disease.” In the context of syndromic surveillance, a syndrome is a set of non-specific pre-diagnosis medical and other information that may indicate the release of a bioterrorism agent or natural disease outbreak. Since its inception, syndromic surveillance has mainly focused on early event detection: gathering and analysing data in advance of diagnostic case confirmation to give early warning of a possible outbreak.

**Conclusion:** The system is useful for detecting and responding to natural disease outbreaks such as seasonal and pandemic flu, and thus they have the potential to significantly advance and modernize the practice of public health surveillance.

**Keywords:** *Albania, early event detection, public health, situational awareness.*

## Introduction

The epidemiology of infectious diseases is one of the major crises facing human society. Following the course of epidemic outbreaks of diseases such as SARS (severe acute respiratory syndrome), a health emergency that shocked the world at the end of 2002-2003 or of the influenza pandemic caused by the AH1N1 virus in 2009 to arrive at Covid-19 pandemic, the appropriate management of crises health issues that exceed borders, takes an important role (1-3). Human cases of AH5N1 influenza are still being reported in Asia, and the emergence of new infectious disease epidemics is still a major concern.

Early detection of outbreaks of infectious diseases is essential for taking measures against the disease. In recent years, "syndromic surveillance" has attracted attention as a new technology that meets these needs. The term "surveillance" is used when observing the trends of an infectious disease (4-6).

It refers to the systematic collection, analysis and interpretation of data necessary for the planning, implementation and evaluation of measures against diseases, due to the continuous monitoring of the situation and the trend of disease occurrences, thus making it possible to take effective measures based on timely results and continuous feedback evaluations of decision-making bodies (7,8). Syndromic surveillance focuses on the patient's symptoms such as fever, diarrhoea, etc. Syndromic surveillance takes less time than diagnosis-based surveillance, so it enables an early investigation of infectious disease epidemics and taking measures to prevent their spread. In the situation where "improvement and reinforcement of surveillance" is at the top of the list for measures to be taken for the prevention of infectious diseases, including new subtypes of influenza viruses and Sars-CoV-2 variants, expectations for syndromic surveillance are

high, as was discussed at the international conference maintained by the World Health Organization (WHO) (9,10).

In syndromic surveillance, the technologies of epidemic intelligence, epidemiological analysis of information about the patient's symptoms thanks to statistical methods, as well as the technologies of efficient collection, processing and distribution of information, play a very important role.

This article focuses on the role of syndromic surveillance in taking measures against infectious diseases in humans.

## What is Syndromic Surveillance?

### **Description and Objectives of Surveillance**

The research, development and practical application of syndromic surveillance has been promoted since the anthrax cases that occurred after the September 2001 attacks in the United States of America, as well as after the SARS epidemic in 2002-2003, with the aim of developing measures against bioterrorism, early detection of the emergence and re-emergence of epidemics from infectious diseases, especially unknown or rare ones (11).

The US Centres for Disease Control and Prevention proposed the following definition of syndromic surveillance as the most appropriate and acceptable: Syndromic surveillance is an investigative approach by which health department staff, assisted by data from automated and the construction of comparative statistics, monitors disease indicators in real or near-real time, in order to detect disease epidemics earlier than was possible with traditional public health methods (12-16).

In other words, syndromic surveillance is an action that captures disease outbreaks in real or near-real time, focusing on symptoms that serve as disease indicators, collecting information automatically, and analysing

information from an epidemiological point of view thanks to the use of statistical methods. Syndromic surveillance is an early investigation of the epidemic of an infectious disease, thanks to the rapid and early identification of the growing number of patients with specific symptoms, before the diagnosis is confirmed by the doctor. It is a "surveillance of syndromes", with the aim of quickly engaging in the "early dictation" of new epidemics, especially those of reappearing diseases, of unknown or rare infectious diseases, a description that also explains the objective of syndromic surveillance.

If all the above points are summed up, it can be said that syndromic surveillance "collects information about the patient's symptoms, analyses the information from an epidemiological point of view using statistical methods, notifies family physicians and government organizations about the results, and quickly takes measures for public health" as and "an effective action that prevents the epidemic spread of infectious diseases caused by humans (bio-terrorism) or by nature" (17-20).

### ***System organization and action views***

The operative process of syndromic surveillance consists of three steps:

- Selection of information source and data collection;
- Analysing the information collected and based on the results of judgment about the chances of an epidemic;
- Notifying health professionals and government organizations responsible for taking measures against infectious diseases. These steps are the same for all types of syndromic surveillance.

But since epidemics of infectious diseases vary in form based on the microbiological characteristics of the pathogen and the area of

the outbreak, and since syndromic surveillance uses different sources of information, the collection and analysis algorithms are different.

The main goal of syndromic surveillance is to establish these algorithms and the various research results. The inability of different countries to detect and contain epidemic outbreaks, identify an infectious agent and understand the dynamics of its transmission in time, has contributed to the spread of infectious diseases in the past (21-24).

The International Health Regulations (IHR) were revised to meet the risks and challenges of the emergence or re-emergence of diseases in the 21st century (25). According to this regulation, all states must report as soon as possible all public health events that have a potential international impact, so that control and prevention measures can be implemented as soon as possible (26). This is achieved by strengthening syndromic surveillance of infectious diseases as a function of the early warning and response of the public health surveillance system, which also helps to collect important data on the epidemiology of endemic diseases.

This early warning system was implemented in Albania during the influx of Kosovar refugees in April 1999 (27,28). This was carried out in collaboration with the Institut de Veille Sanitaire (InVS) and the World Health Organization (WHO). After the departure of Kosovar refugees in July 1999, the system was redesigned to meet the needs of the national health system. The system of early warning and response to infectious diseases - ALERT, was established in September 1999, as part of the national surveillance system coordinated by the Institute of Public Health (IPH).

The goal of the ALERT system is the early detection of epidemic outbreaks. It is a syndromic surveillance system based on Health Centers and Emergency Departments

that produces information for action. The participation of general practitioners in surveillance and preventive activities is mandatory and is included in their employment contract with the Institute of Health Insurance. The system also includes the Emergency departments in the hospitals of 36 districts of the country.

At the end of each week, GPs report the syndrome cases they have examined during the week, including reporting zero cases. The system includes nine infectious syndromes. Data are reported to Infectious Disease Information System which is a web-based integrated platform.

After visual verification of the data for any outbreak signal, the data are analysed and a weekly bulletin is prepared on the epidemiological situation all over the country.

The information produced by the PIH is distributed to the Epidemiological Service of

the districts in the form of weekly and quarterly bulletins.

The verification of the alert signal and the epidemiological investigation is also carried out at the district level with the help of the PIH if necessary.

The district epidemiology service is responsible for distributing the weekly newsletter to general practitioners.

In some cases, general practitioners are informed in the form of ALERT data summaries during their monthly meetings with the administration of the Institute of Health Insurance and the directorate of the Primary Health Service (29,30).

The "ALERT" system is integrated and complementary with the mandatory routine reporting system of diagnosed diseases - the Major Disease-Based Surveillance System, along with other case-based surveillance systems.

**Table 1. Type of syndromes and target diseases**

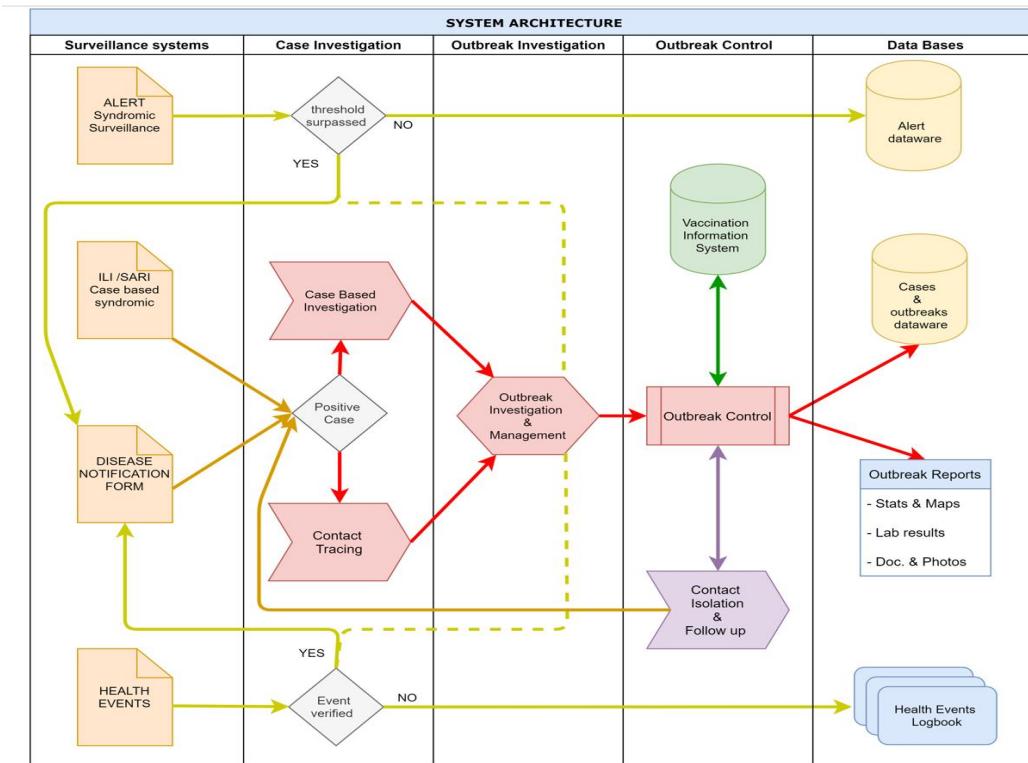
Syndromes	Clinical definition	Disease(s) target
Diarrhoea without blood	More than 3 loose stools in 24h	Salmonellosis...
Diarrhoea with blood	More than 3 loose stools with blood in 24h	Shigellosis...
Upper respiratory infections	Fever, and at least one of the following: rhinitis, cough, sore throat	Influenza ...
Lower respiratory infections	Fever and fast breathing ( $\geq 50$ breathing/min) and at least one of the following: cough, dyspnoea	Bacterial or viral pulmonary infections Sars... Avian influenza
Rash (exanthema) with fever	Rash with fever	Measles, Rubella, Varicella, ...
Jaundice	Yellow eyes and skin	Hepatitis virus infection ...

Congenital anomalies	Structural or functional anomalies that occur during intrauterine life	congenital rubella syndrome (CRS), congenital syphilis, congenital cytomegalovirus (cCMV) infection and congenital Zika syndrome (CZS)
Acute conjunctivitis in neonates	Conjunctival inflammation occurring within the first 30 days of life	Chlamydia, bacteria, viral diseases

Syndromes are broken down by age-group and different automated reports and graphs are produced by epidemiological triad time-place-person.

Integration of different surveillance system aiming at maximizing case detection and fast control actions within Infectious Disease Information System is shown in Figure 1.

**Figure 1. Scheme of integration of different surveillance systems**



## Conclusion

The ALERT component of the surveillance of infectious diseases in Albania is one of the few systems in the world spread over the entire territory of the country. It can be improved by re-examining the case definition and the disorders under surveillance, and its

integration with routine surveillance at the district level. Re-structuring, training, feedback to family doctors can be more frequent, increasing the acceptability of the system. The ALERT system remains very useful, and complements other surveillance systems in a timely and effective manner.

Choices made in building the system—such as frequency of reporting, software used, and syndromes under surveillance—are appropriate.

## References

1. Heymann DL, Rodier GR. Hot spots in a wired world: WHO surveillance of emerging and re-emerging infectious diseases. *Lancet Infect Dis* 2001;1:345-53.
2. World Health Organization. Background paper for Health Metrics Network: Disease Surveillance (draft); 2003.
3. Factors in Emergence. In: Mark S.Smolinski, Margaret A.Hamburg, Joshua Lederberg (eds), Committee on Emerging Microbial Threats to Health in the 21st Century, editors. *Microbial Threats to Health: Emergence, Detection and Response*. Washington, DC: The National Academies Press; 2003. p. 53-148.
4. Jernigan DB, Raghunathan PL, Bell BP, Brechner R, Bresnitz EA, Butler JC, et al. Investigation of bioterrorism-related anthrax, United States, 2001: epidemiologic findings. *Emerg Infect Dis* 2002;8:1019-28.
5. Martens P, Hall L. Malaria on the move: human population movement and malaria transmission. *Emerg Infect Dis* 2000;6:103-9.
6. The BSE Inquiry. The BSE Inquiry report. Volume 1: Findings and conclusions. <http://www.bseinquiry.gov.uk/report/index.htm>.
7. Enserink M. Infectious diseases. WHO wants 21st-century reporting regs. *Science* 2003;300:717-8.
8. Cash R, Narasimhan V. Impediments to global surveillance of infectious diseases: consequences of open reporting in a global economy. *Bull World Health Organ* 2000;78:1358-67.
9. Bean NH, Martin SM. Implementing a network for electronic surveillance reporting from public health reference laboratories: an international perspective. *Emerg Infect Dis* 2001;7:773-9.
10. Heffernan R, Mostashari F, Das D, Karpati A, Kuldorff M, Weiss D. Syndromic surveillance in public health practice, New York City. *Emerg Infect Dis* 2004;10:858-64.
11. Moran GJ, Kyriacou DN, Newdow MA, Talan DA. Emergency department sentinel surveillance for emerging infectious diseases. *Ann Emerg Med* 1995;26:351-4.
12. Vogt RL. Laboratory reporting and disease surveillance. *J Public Health Manag Pract* 1996;2:28-30.
13. Goldenberg A, Shmueli G, Caruana RA, Fienberg SE. Early statistical detection of anthrax outbreaks by tracking over-the-counter medication sales. *Proc Natl Acad Sci USA* 2002;99:5237-40.
14. Lewis MD, Pavlin JA, Mansfield JL, O'Brien S, Boomsma LG, Elbert Y, et al. Disease outbreak detection system using syndromic data in the greater Washington DC area. *Am J Prev Med* 2002;23:180-6.
15. Valenciano M, Pinto A, Coulombier D, Hashorva E, Murthi M. Surveillance of communicable diseases among the Kosovar refugees in Albania, April-June 1999. *Euro Surveill* 1999;4:92-5.
16. Valenciano M, Coulombier D, Lopes CB, Colombo A, Alla MJ, Samson S, et al. Challenges for communicable disease surveillance

- and control in southern Iraq, April-June 2003. JAMA 2003;290:654-8.
17. Gesteland PH, Wagner MM, Chapman WW, Espino JU, Tsui FC, Gardner RM, et al. Rapid deployment of an electronic disease surveillance system in the state of Utah for the 2002 Olympic Winter Games. Proc AMIA Symp 2002;285-9.
18. Weber SG, Pittrak D. Accuracy of a local surveillance system for early detection of emerging infectious disease. JAMA 2003;290:596-8.
19. Malison MD. Surveillance in developing countries. In: Halperin W, Baker ELJr, Monson RR, editors. Public Health Surveillance. New York: Van Nostrand Reinhold; 1992. p. 56-61.
20. World Health Organization, Dept. of Communicable Disease Surveillance and Response. Global Outbreak Alert and Response. Report of a WHO meeting Geneva, Switzerland 26-28 April, 2000 (WHO/CDS/CSR/2000.3).
21. Centers for Disease Control. Framework for Evaluating Public Health Surveillance Systems For Early Detection of Outbreaks. MMWR Morb Mortal Wkly Rep 2004;53:1-14.
22. Centers for Disease Control. Framework for Evaluating Syndromic Surveillance Systems for Bioterrorism Preparedness. MMWR Morb Mortal Wkly Rep 2004;53(RR-5):1-14.
23. Grein TW, Kamara KB, Rodier G, Plant AJ, Bovier P, Ryan MJ, et al.
- Rumors of disease in the global village: outbreak verification. Emerg Infect Dis 2000;6:97-102.
24. World Health Organization. Regional Office for Europe. The Dubrovnik pledge on surveillance and prioritization of infectious diseases: report on a WHO meeting, Bucharest, Romania 21-23 November, 2002.
25. The Albanian Center for Economic Research (ACER). UN common country assessment: Albania; 2002.
26. Nuri B. Health Care Systems in Transition – Albania; 2002.
27. Valenciano M, Bergeri I, Jankovic D, Milic N, Parlic M, Coulombier D. Strengthening early warning function of surveillance in the Republic of Serbia: lessons learned after a year of implementation. Euro Surveill 2004;9:24-6.
28. Valenciano M, Pinto A, Coulombier D, Hashorva E, Murthi M. Surveillance of communicable diseases among the Kosovar refugees in Albania, April-June 1999. Euro Surveill 1999;4:92-5.
29. Kakarriqi E. Survejanca e Shendetit Publik. Leksion per Specializantet Pasuniversitare te Fakultetit te Mjekesise (Universiteti i Tiranes); 2003 (in Albanian).
30. Kakarriqi E. Epidemiologjia e semundjeve infektive ne Shqiperi (1960-2001) dhe kontrolli e parandalimi i tyre ne kontekstin: fatkeqesite natyrore dhe semundjet infektive. Tiranë; 2003 (in Albanian).