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Epidemic intelligence: a new framework for strengthening disease surveillance in Europe

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In a rapidly changing environment, national institutions in charge of health security can no longer rely only on traditional disease reporting mechanisms that are not designed to recognise emergence of new hazards. Epidemic intelligence provides a conceptual framework within which countries may adapt their public health surveillance system to meet new challenges.

Epidemic intelligence (EI) encompasses all activities related to early identification of potential health hazards, their verification, assessment and investigation in order to recommend public health control measures. EI integrates both an indicator-based and an event-based component. 'Indicator-based component' refers to structured data collected through routine surveillance systems. 'Event-based component' refers to unstructured data gathered from sources of intelligence of any nature.

All EU member states have long-established disease surveillance systems that provide proper indicator-based surveillance. For most countries, the challenge lies now in developing and structuring the event-based component of EI within national institution in charge of public health surveillance.

In May 2006, the European Union member states committed to comply with provisions of the revised International Health Regulations (IHR(2005)) considered relevant to the risk posed by avian and potential human pandemic influenza. This provides for the European Centre for Disease Prevention and Control (ECDC) with an opportunity to guide member states in developing and/or strengthening their national EI , in addition to the ECDC's task of developing an EI system for the EU.

Justification

Population movements, behavioural changes, food production and many other factors linked to globalisation and economic development are responsible for the continuous emergence of infectious hazards [1]. Diseases such as SARS or avian influenza, not to mention deliberate release of biological agents, represent new challenges for outbreak alert and response in Europe and elsewhere.

Modern technologies, mainly related to development of the internet, are rapidly changing the way we access health information. Online media, scientific forums and direct electronic communication now allow us to shortcut traditional reporting mechanisms that travel through the various levels of public health administration [2]. Health authorities are no longer in full control of an environment that puts journalists, politicians and the general public in direct contact with raw data.

These phenomena contributed to the revision of the International Health Regulations (IHR(2005)) approved during the 2005 World Health Assembly [3]. Member states of the World Health Organization (WHO) will soon be legally bound to notify both case on a preset list of diseases and all ‘public health events of international concern’.

In such a new and rapidly changing environment, national institutions in charge of health security can no longer rely only on traditional disease reporting mechanisms such as mandatory notification of diseases. While these systems can ensure appropriate public health response to identified risks, they cannot recognise the emergence of new threats such as SARS, human cases of avian influenza or potential bioterrorist-initiated outbreaks. In order to overcome the limitations of traditional surveillance for the detection of previously unknown threats, new approaches have been developed, including the monitoring of syndromes, death rates, health services admissions or drug prescriptions [4]. These new approaches represent an attempt to enhance the performance of traditional surveillance system.

At the same time, the media and other informal sources of information are increasingly recognised as valuable sources of public health alerts. Epidemic intelligence provides a conceptual framework into which countries may complete their public health surveillance system to meet new challenges [5]. This approach represents a new paradigm aiming at complementing traditional surveillance systems.

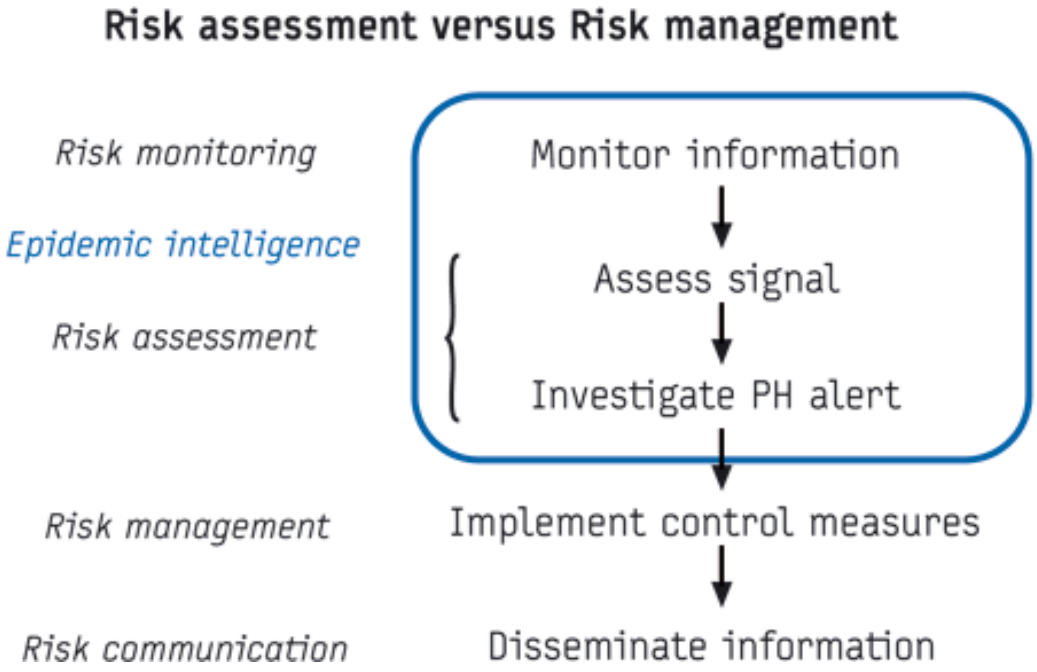
In January 2006, the European Centre for Disease Prevention and Control (ECDC) convened a meeting in Stockholm with representatives from the 25 EU member states to agree on the role of EI in Europe [6]. Basic terminology and methods framework were agreed upon and further developed within a smaller working group. We present here the state of this project as of October 2006.

Definition and principles

Epidemic intelligence (EI) encompasses all activities related to the early identification of potential health hazards that may represent a risk to health, and their verification, assessment and investigation so that appropriate public health control measures can be recommended. The scope of EI includes risk monitoring and risk assessment and does not include risk management [FIGURE 1]

FIGURE 1

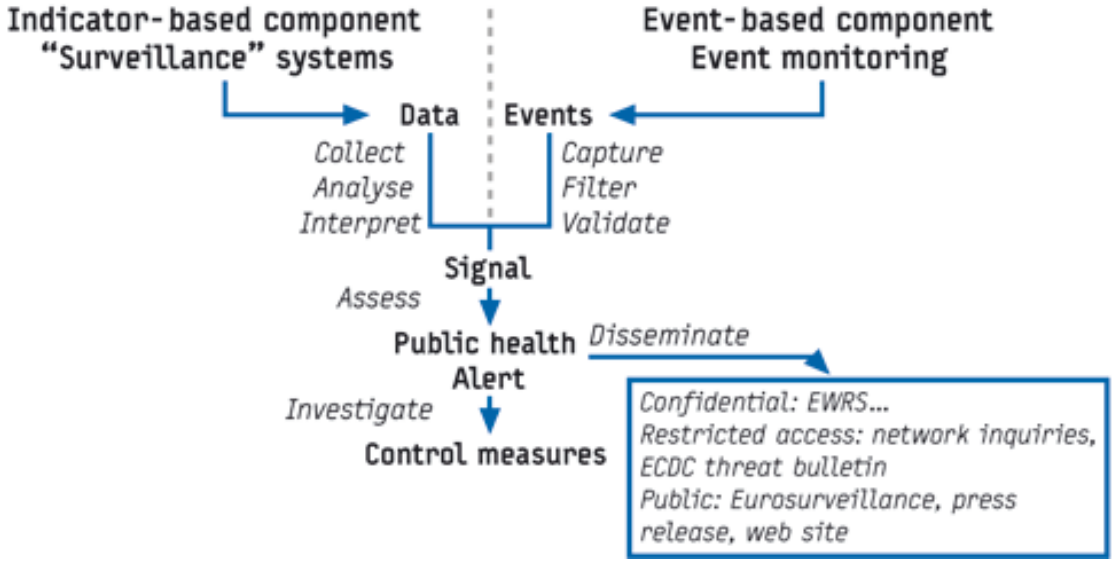
Functions of early warning and response related to epidemic intelligence



EI integrates indicator-based and event-based components. 'Indicator-based component' refers to structured data collected through routine surveillance systems. 'Event-based component' refers to unstructured data gathered from sources of intelligence of any nature. As a basic principle of EI, both components are given equal attention and processed in the same way, since a signal leading to a public health alert can originate from either one [FIGURE 2].

FIGURE 2

Epidemic intelligence framework



Epidemic intelligence framework

The EI framework is made up of five standard steps. It applies to any situation considered from any level of the public health system. Within a single situation (for example, an outbreak), these different steps may be covered several times as an iterative process allowing new developments to be integrated, and progressively improving the decision making process. There are two ways of entering the framework, corresponding to indicator-based and event-based components of EI,

respectively.

The first step is data collection (indicator-based component) and the detection/capture of events (event-based component). Data collection refers to quantitative indicators (number of cases, rates, etc.) routinely obtained from established surveillance systems [TABLE 1]. Capture of events potentially encompasses a much broader scope, as shown in Table 2.

TABLE 1

Indicator-based component – Example of EI sources

EI Sources	Rationale	Method
Mandatory notification	Some rare but serious diseases need prompt and targeted action	Legal framework
Surveillance on a sample of sources (sentinel)	Trends of some common diseases can be obtained from a representative network of health care professionals	Sentinel network
Syndromic surveillance	Emerging diseases may not fit into disease-specific definitions. Early detection of cluster of syndromes may trigger an alert before cases appear in traditional surveillance systems	Lists of syndromes
Mortality	Serious emerging threats may initially be recognised by an increase of deaths	Real time death reporting
Health services activities	Serious emerging situation may initially present with increased admissions to health services such as emergency rooms	Real time activity reporting
Drug consumption	Increase in specific drug consumption may indicate emerging disease	Pharmacy networks

TABLE 2

Event-based component – Example of EI sources

EI Sources	Rationale	Method
Scientific watch	Scientific findings related to new organisms, drug resistance, etc. may trigger public health action	Literature review
Direct notifications	Clinicians or public health personnel may come across abnormal health events	On-call numbers
Media watch	Outbreaks and other unusual health events are often picked up early by local media	Media review Web scanning
International watch	A country may be affected secondarily by an health event emerging abroad	WHO reports ProMED, GPHIN
Inter-sectoral events	Agriculture, environment, industry and other sectors collect information on health related risks and exposure	Communication channels

As a consequence of gathering large amount of information from a variety of different sources, EI

requires strong filter and validation capacities to avoid an overflow of information. Indicator-based data must be checked for relevance in order to rule out surveillance biases, artefacts or reporting errors (step 2). The significance of the data should then be established (step 3), usually through statistical comparison with baseline rates or thresholds. As far as events are concerned, these steps correspond to evaluating their relevance (step 2: 'is the event within the scope of public health?'), which is usually straightforward; and their reality (step 3: did the event really happen?), which may require a few phone calls to verify.

Indicators and events that have gone through steps 2 and 3 of the framework without being discarded are considered to be signals. A signal is a verified health-related issue. Whatever its origin (indicator or event), a signal has the same value for EI purposes and is processed in the same way.

Many signals have few or no public health consequences and only a few represent genuine public health alerts. Initial signal assessment is thus a key component of EI framework (step 4). Depending on the nature of the signal, the scope of the problem, the type(s) of disease(s) potentially involved and the population of concern, initial assessment may require different methods, of varying degrees of sophistication. It is very often necessary to go back to the source of the signal at this stage, and field investigation is sometimes required (step 5).

Once ascertained, the alert is classified according to its scope; that is, the level of the health system which will have to deal with it. As a simplified scheme, local, national and international levels can be considered. The IHR(2005) contain a decision instrument to help assess whether or not an alert is of international concern [3].

Implementing epidemic intelligence at country level

All EU member states have long-established disease surveillance systems that provide proper indicator-based surveillance to meet early warning objectives. The detection of non-specific events or health events of unknown origin could, in some cases, be improved by building up the sources of indicators with some of the one listed in table 1,

However, for most countries, the challenge lies in developing and structuring the event-based component of EI. Paying the same degree of attention to a local newspaper article as to a statistical analysis may represent a paradigm shift for most national institutions in charge of surveillance. Examples presented in Table 2 provide suggestions based on which each country can progressively develop systems based on its own objectives: a country with overseas territories and large numbers of people travelling in and out of the country on a regular basis may decide to concentrate on watching international factors, and develop sophisticated methods, using tools such as the Global Public Health Intelligence Network (GPHIN) [7], while another country with fewer overseas interactions may decide to rely on WHO postings in this regard [8].

EI must be seen as a consistent system and there is mutual benefit from implementing each of its two components: clinicians engaged in notifying disease under traditional surveillance will be keen to notify abnormal events while clinicians approached for notification of abnormal events will better understand the need for traditional surveillance. Good scientific principles of surveillance represent a perfect incentive for facilitating notification of events that may not be covered by a surveillance scheme.

Signal processing must be organised in an integrated way, allowing intelligence from different sources to be cross-checked and assessed together: a journal article reporting sewage problems along with an increase in admissions to the local hospital emergency department may lead to the recognition of an outbreak .

For the reasons given above, EI must be developed within the national institution in charge of public health surveillance as an extension of their current scope.,. Furthermore, all processes related to signal management should be carried out from a transversal structure within the

institution, allowing experts from the various surveillance systems, as well as media officers, international health specialists and “epidemic intelligence managers” to jointly perform the risk assessment related to threats being detected.

EU perspectives

The founding regulation of ECDC specifies its mandate regarding risk identification and risk assessment. The Centre’s tasks under this regulation include identifying and assessing emerging threats to human health from communicable diseases, and establishing, in cooperation with the Member States’ (MS) procedures for systematically searching for, collecting, collating and analysing information and data with a view to the identification of emerging health threats which may have mental as well as physical health consequences and which could affect the European Community.

In order to fulfil its mandate, ECDC has begun to monitor potential public health threats from a European perspective [9], under the principle of subsidiarity and building on the experience acquired by the health threat unit of the European Commission. ECDC has developed a threat tracking tool to facilitate the capture, verification and assessment of public health events of relevance. The main output of the tool is a weekly bulletin, for restricted distribution to MS health authorities and to the European Commission. Another EI source is the weekly release of the journal Eurosurveillance, with which ECDC has collaborated since September 2005 [10]. The Eurosurveillance weekly release includes an ‘e-alert’ capacity used by MS epidemiologists to widely and rapidly share information about ongoing threats.

While ECDC has a mandate to further develop EI at European level, it remains the prerogative of health authorities to implement these activities in their countries. ECDC added value may include facilitating exchange of information among MS and supporting assessments and standardisation of EI systems in MS. ECDC’s activities in filtering, processing and summarising information from international sources may also allow MS to reduce their activities in this area and focus on regional threats, or on countries with which they have heavy travel and trade relations.

ECDC will evaluate its EI activities in 2007, after 18 months of operation. This evaluation will focus on finding evidence of the added value of a structured approach to event-based surveillance in complement to indicator-based surveillance. A similar process is encouraged at MS level.

Further operational research on EI is needed in order to optimise the detection of events using keywords and algorithms, filtering of events and other processes involved. It should be carried out in consistence with WHO’s activities in this area in order to promote global EI tools.

In May 2006, Members States of the European Community voluntarily committed to complying with provisions of the IHR(2005) considered relevant to the risk posed by avian and potential human pandemic influenza. This provides an opportunity for ECDC to guide MS in developing and/ or strengthening their national EI, in addition to the ECDC’s task to develop an EI system for the EU. A guideline on EI implementation is currently being prepared.

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