

Epidemic intelligence and travel-related diseases: ECDC experience and further developments

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Abstract

The European Centre for Disease Prevention and Control (ECDC) started to work on information gathering for early detection of public health threats in June 2005. Since then, based on a framework including events and data-based surveillance, ECDC has been learning by doing. The internal tools and procedures for epidemic intelligence (EI) were developed while screening signals. Information including relevant epidemiological data, media news detected and actions taken are recorded in a specific event information system (Threat Tracking Tool). We describe the main elements, process and outputs of EI activities at ECDC. We also describe the main results regarding travel-related diseases. Efforts are needed to better identify and gather information about travellers coming to the EU with imported diseases with a potential for further spread inside our territory.

Keywords: Epidemic intelligence, event-based surveillance, risk assessment, travel-related diseases

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Introduction

On 2 January 2009, an Arab-language newspaper reported that pneumonic plague had killed 40 terrorists in Algeria (<http://www.dailymail.co.uk/news/worldnews/article-1121842/Al-Qaeda-hit-Black-Death-fear-medieval-plague-kills-40-terrorists-training-camp.html>). In July 2008, a Dutch tourist returning from Uganda was diagnosed with Marburg haemorrhagic fever and subsequently died (http://ecdc.europa.eu/en/Health_Topics/ebola_marburg_fEVERs/Article_20080805.aspx accessed 24 January 2009). In December 2008, a traveller presenting with haemorrhagic fever was reported to have flown from South Africa to Brazil [ProMED-mail. VIRAL HEMORRHAGIC FEVER – BRAZIL (RIO de JANEIRO) ex SOUTH AFRICA: REQUEST FOR INFORMATION. ProMED-mail 2008; 2 December: 20081202.3792, <http://www.promedmail.org> accessed 23 March 2009]. These are some examples of the potential risks associated with infectious diseases that European citizens expect health authorities to prevent.

Epidemic intelligence (EI) encompasses all activities related to the early identification of potential health hazards, their

verification, assessment and investigation in order to provide appropriate options for public health control measures. EI integrates both an indicator-based and an event-based component in a single surveillance system. Indicator-based or classic surveillance is based on the routine (i.e. weekly, monthly) reporting of cases of disease (i.e. notifiable disease surveillance systems, sentinel surveillance, laboratory-based surveillance), and it is mostly healthcare-facility based. The pitfalls of this system are the rapid detection of outbreaks or the detection of emerging health threats. The event-based component refers to unstructured data gathered from sources of intelligence of any nature that help in detecting events that happen in populations without access to formal healthcare. Another difference is that events are reported immediately after detection. This is a great advantage in detecting new and rare events and enables rapid risk assessment [1–3].

This article focuses on a description of the event-based component of EI activities carried out at the European Centre for Disease Prevention and Control (ECDC), with special emphasis on the detection of threats associated with international travel.

According to the World Tourism Organization, nearly 900 million tourists engaged in international travel in 2007, with a rate of increase of 5% per annum (http://www.unwto.org/media/news/en/press_det.php?id=1665 accessed 12 January 2009). People, human and animal food, as well as wild and domestic animals or their products travel across the globe in just a few hours, providing increasing opportunity for germs to travel as well.

The Elements of Epidemic Intelligence

El activities at the ECDC are organized around a team of four epidemiologists operating in the ECDC emergency operation centre which is equipped with state-of-the-art communications technology. Standard operating procedures ensure optimal efficiency in the detection of threats, which are tracked through information systems supported by a network of dedicated epidemiologists in the EU member states. This network comprises epidemiologists involved in disease surveillance (e.g. European surveillance network for vaccine-preventable diseases, <http://www.euvac.net/>, or European Working Group for Legionella Infections, <http://www.ewgli.org/>) as well as travel medicine specialists (European Travel Medicine Network, <http://www.istm.org/eurotravnet/main.html>) and microbiologists (European Network for Diagnostics of Imported Viral Diseases, http://enivd.de/VHFDI-SEASES/fs_vhfdiseases.htm).

A team of communicable diseases experts assesses detected emerging threats, evaluates their public health impact in the EU and liaises with the European Commission to support public health response by the EU member states.

The Process

Daily, El officers review information collected from various official and unofficial sources (Table 1). Confidential sources, such as the Early Warning and Response System (EWRS) [4], allowing secure exchange among EU member states, the International Health Regulations notifications system and the Global Outbreak Alert and Response Network (<http://www.who.int/csr/outbreaknetwork/fr/index.html>) represent an important source of confidential information. The increasing use of the internet by EU citizens and organizations, public and private, is making the management of open sources of information a critical factor in detecting public health events and monitoring their impact [5–7].

Filtering of the information collected through these sources is critical, as the increasing use of informal sources of information has resulted in a huge increase in available information, including irrelevant information. The initial filtering of data concerning an event relies on the judgment of the El officers, guided by internal criteria for EU relevance and public health impact. The initial review of an event should result in either discarding the event as not relevant or including it in the list of events to be validated. Validation is done by obtaining confirmation from official sources or by cross-matching independent reports. Sometimes, these

events are verified at source, before the ECDC starts monitoring them. Then, verified events become signals that require an assessment of their relevance at European level and of their public health impact. The severity of the disease (morbidity, case fatality rate), mode of transmission and capacity to spread, difficulty of diagnosis (awareness among doctors and nurses, lack of diagnostic tests, etc) and control, the anticipated media and political attention, or the possibility of an intentional release (bioterrorism) are among the criteria used to assess signals. These assessments focus on the European implication of the threat, in terms of spread and coordination of the implementation of control measures, in accordance with the principle of subsidiarity that mandates the EU national authorities' response to threats [8]. Assessments are carried out by experts of the Centre's units and programmes during a meeting that takes place daily, the Round Table (RT) meeting.

Once a signal is confirmed as a potential public health threat at the EU level, the threat is registered in the ECDC Threat Tracking Tool, allowing monitoring and the logging of actions implemented for its control. This ensures the accountability and traceability of ECDC activities in the detection and assessment of, and response to, emerging threats.

The assessment of a signal can lead to the creation of an internal response team, involving external experts when required. Upon request from Member States or the WHO, the ECDC will identify a team of appropriate experts to be dispatched in support of outbreak control operations.

Outputs

As a result of its El activities, the ECDC produces a weekly bulletin, the *Communicable Disease Threat Report* (CDTR), every Friday, summarizing the current status of threats monitored by the ECDC. The CDTR is distributed to a restricted list of National Health Authorities, the European Commission and other relevant stakeholders, after authorization by National Health authorities. Daily, a bulletin reflecting discussions during the RT meeting complements the CDTR by providing the latest threats and developments.

Ad hoc facts sheets and threat assessments are prepared and updated when needed. These outputs are usually made public through the ECDC website and distributed to the National Health authorities and relevant stakeholders through the EWRS. Yearly, an annual threat report is compiled and included in the ECDC epidemiological annual report. This report is available on the ECDC website.

Source denomination	Internet address
GOARN	http://sharepoint.who.int/sites/GOARN/default.aspx
Promed: Program for Monitoring Emerging Diseases	http://www.promedmail.org
MediSys: Medical Information System	http://medusa.jrc.it/medisys/homeedition/all/home.html
Healthmap: Global Disease Alert Map	http://www.healthmap.org
Biocaster: Global Health Monitor	http://biocaster.nii.ac.jp/
AlertNet (Reuters)	http://www.alertnet.org
GPHIN: Global Public Health Intelligence Network	https://www.gphin.net
WHO Avian Flu web page	http://www.who.int/csr/disease/avian_influenza/en/
WHO CSR disease outbreak news	http://www.who.int/csr/don/en/
WHO EURO: outbreaks	http://www.euro.who.int/surveillance/outbreaks/20021015_1
OIE alert messages: World Organisation for Animal Health	http://www.oie.int/eng/info/en_urgences.htm
EWRS messages	restricted access website
Hong Kong Avian Flu monitoring	http://www.info.gov.hk/info/flu/eng/global.htm
CIDRAP (Univ. of Minnesota): Centre for Infectious Diseases Research and Policy	http://www.cidrap.umn.edu/index.html
WHO SEARO (South East Asia) website	http://w3.whoosea.org/
WHO cholera website	http://www.who.int/topics/cholera/en/
WHO Polioeradication program website	http://www.polioeradication.org/pressreleases.asp
CDC MMWR	http://www.cdc.gov/mmwr/
WHO WER	http://www.who.int/wer/2007/en/
FAO Avian Flu web page (and periodic reports)	http://www.fao.org/ag/againfo/subjects/en/health/diseases-cards/avian_update.html

GOARN, Global Outbreak Alert & Response Network.

TABLE 1. Selected sources routinely monitored for communicable disease threat detection

TABLE 2. Distribution of monitored threats according to disease groups (June 2005–December 2008)

Disease group	n
Diseases of environmental or zoonotic origin	239
Food- and water-borne diseases	184
Vaccine preventable diseases and diseases due to invasive bacteria	60
Tuberculosis	33
Influenza	19
Anti-microbial resistance and healthcare associated infections	7
Hepatitis, HIV, STI, blood-borne infections	6
Not applicable	91
Total	639

Source: ECDC Threat Tracking Tool.

TABLE 3. Distribution of threats by region of origin (June 2005–December 2008)

Region	Total	%
European Union*	549	68.0
Africa	79	9.8
Americas	53	6.6
Asia	102	12.6
Australia and Oceania	6	0.7
Russia	18	2.2
Total	807	100.0

*Including countries of the European Economic Area (EEA) that are participating in the European Free Trade Association (EFTA): Iceland, Norway and Liechtenstein.
Source: ECDC Threat Tracking Tool.
Note: The numbers total is more than the total number of threats as a single threat can affect more than one geographical region.

Results

Between the establishment of the ECDC in June 2005 and December 2008, 639 threats have been monitored and 6222 items of information regarding these threats have been recorded. The distribution of monitored threats according to disease group is shown in Table 2. It is important to mention that influenza-related threats are grouped in only three threat groups in the database (Threat-Tracking Tool), seasonal flu in the EU, and avian influenza A (H5N1) worldwide and within the WHO EURO region. The geographical distribution of the threats monitored is presented in Table 3. More than two-thirds of the threats monitored by the ECDC involve EU or European Free Trade Association-European Economic Area (EFTA-EEA) Member States. Other geographical regions commonly involved include Asia, especially south-east Asia, and Africa.

On average, the delay between a source reporting an event and the ECDC initiating monitoring is 1 day. Verification is carried out within 2 days of signaling the threat. The initial assessment of the event is completed, on average, within 3 days of threat detection.

Among emerging threats originating in the EU, 83% are primarily detected through confidential sources of information, mainly the EWRS. However, 56% of emerging threats originating outside of the EU are primarily detected through non-confidential sources (Table 4).

Selected Travel-Related Diseases and Events Monitored by the ECDC

In the summer of 2007, in Emilia-Romagna, a single traveller returning from India developed symptoms of Chikungunya

TABLE 4. Distribution of initial source of information according to region and confidentiality levels (June 2005–December 2008)

	Confidential		Non-confidential		Total
	n	%	n	%	n
EU	446	83%	93	17%	539
Non-EU	110	44%	140	56%	250
Total	556	70%	233	30%	789

fever and initiated an epidemic involving approximately 250 cases. Although not currently providing advice on health issues for travellers, the ECDC is monitoring very closely threats that may result in secondary cases occurring in the EU, such as dengue fever, Chikungunya or viral haemorrhagic fevers.

Dengue

In 2007, outbreaks in Brazil, Bolivia, Colombia, Costa Rica, Honduras, Mexico, Paraguay and Venezuela highlighted the explosive nature of dengue epidemics and prompted the Pan-American Health Organization (PAHO) to issue alerts across Latin America. Until 2003, only DEN-1 and DEN-2 virus circulated in the region, leaving a high proportion of the population susceptible to the now circulating DEN-3 serotype virus (see PAHO Highlight on Dengue: <http://www.paho.org/english/ad/dpc/cd/dengue.htm> accessed 24 January 2009).

Since 1 January 2008, Brazil has experienced an epidemic of dengue fever, with >730 000 clinical cases and 212 deaths reported up to week 35, compared with almost 560 000 cases of dengue in 2007 and 158 deaths. The majority of cases originated from Mato Grosso do Sul, a state that borders Paraguay and Bolivia (see: http://ecdc.europa.eu/en/Health_Topics/Dengue_fever/080308_update.aspx).

The number of cases reported in Thailand is also increasing, with a total of 37 128 in 2008, compared with <15 000 cases in 2007 (Department of Disease Control, Ministry of Public Health, Thailand, <http://203.157.15.4/surdata/disease.php?ds=66> accessed 24 January 2009).

Dengue fever does not naturally occur in the continental EU nowadays, even though large outbreaks have occurred in the past, such as in 1927 in Greece [9]. However, travellers are frequently affected while returning from south-east Asia and the Indian subcontinent, but also, increasingly, from South and Central America and the Caribbean. Between 2002 and 2007, 876 cases of imported dengue fever were reported

to EuroTropNet (http://www.tropnet.net/reports_friends/pdf_reports_friends/may08_dengue07_friends.pdf accessed 24 January 2009). The recent autochthonous transmission of Chikungunya virus in Italy and the presence of *Aedes albopictus* in Europe highlight the need for continuous awareness of dengue virus infection.

The ECDC updates weekly the situation of dengue fever worldwide. Pro-MED (39%), public reports on the web (22%) and the Global Public Health Intelligence Network (12%) are the main sources of information for this update.

Chikungunya

At the end of 2005 and in early 2006, Chikungunya fever resulted in a large outbreak affecting the French Island of La Réunion, a European Overseas Territory. Subsequently, it spread to different states of India (Tamil Nadu, Karnataka, Kerala and Gujarat), Sri Lanka and Malaysia. This spread in the northern hemisphere resulted in an exposure of EU travellers during summer months, being the active period for vectors in the EU such as *A. albopictus*. As a result, the ECDC conducted, in March 2006, an assessment of the risk of establishment of Chikungunya transmission and initiated preparedness activities (ECDC Consultation on Chikungunya risk assessment for Europe, http://ecdc.europa.eu/documents/pdf/Final_chik_meeting_report.pdf accessed 30 March 2006).

In the summer of 2007, the first local transmission of Chikungunya virus on the European continent was reported in Italy. Between July and September, 247 cases were reported from four provinces in the Emilia-Romagna region, 217 of which were laboratory confirmed. This outbreak led to a joint ECDC/WHO visit to the affected area to assess the risk on a European level (ECDC, Mission report: Chikungunya in Italy. Joint ECDC/WHO visit for a European Risk Assessment, 17–21 September 2007, http://ecdc.europa.eu/documents/pdf/071020_CHK_report.pdf accessed 24 January 2009).

In 2008, Chikungunya virus transmission was reported from Indonesia, where recurrent epidemics have occurred since the 1970s. Recently – affected areas include Central, West Java and Sumatra. In Singapore, local transmission was reported for the first time with a cluster of 13 cases.

The ECDC continues to closely monitor the situation of Chikungunya worldwide. More than 200 updates have been prepared since the establishment of the ECDC in March 2005. Pro-MED (47%) and public reports on the web (22%) are the main sources of information.

Viral Haemorrhagic Fevers

In contrast with dengue fever and Chikungunya fever, which can start autochthonous transmission through mosquito vectors present in the EU, viral haemorrhagic fever caused by Lassa, Ebola or Marburg viruses cannot result in extended transmission once imported into the EU, but may generate a few secondary cases, especially in hospital care settings if not promptly diagnosed, and in relation to breach of universal precautions. Since June 2005, two separate events involved the travel of a patient affected by Lassa fever to the EU [10] (Case of Lassa Fever in Specialist Unit in London. 23 January 2009. United Kingdom Health Protection Agency National Press Releases: <http://www.hpa.org.uk/webw/HPAweb&Page&HPAwebNewsroom/Page/1153846674338?p=1153846674338> accessed 2 February 2009), which justified the tracing of contacts. No further transmission was identified. Recently, one EU visitor to Uganda developed Marburg haemorrhagic fever and died. Contacts were traced and no further transmission was identified.

In October 2008, a new *Arena* virus was identified in South Africa in a patient evacuated from Zambia. Three subsequent cases resulted from nosocomial transmission. Three of the four cases were fatal (ECDC Threat Assessment: Unknown Disease Identified in South Africa, 3 deaths, ex-Zambia. 10 October 2008. http://ecdc.europa.eu/en/files/pdf/Health_topics/20081010_unknown_disease_Zambia-Final.pdf). Recently, an outbreak of Ebola Reston virus affected pigs in the Philippines, triggering an investigation coordinated by the WHO to assess the risk for humans (Ebola-Reston in pigs in the Philippines 2008: WHO Situation Summary,

Updated 19 December 2008. http://www.wpro.who.int/health_topics/ebola_reston accessed on 17 March 2009).

The ECDC closely monitors outbreaks of viral haemorrhagic fever worldwide, to anticipate the public health impact of such an introduction into the EU.

Tuberculosis

Tuberculosis (TB) is of great public health concern when exposure to infectious cases occurs in a confined environment such as in planes and ships. The ECDC has monitored 23 of those threats since May 2005 (16 in planes, four in ships, one involving a bus, two involving international schools). Assessment of the events in accordance with WHO guidelines (Tuberculosis and air travel: guidelines for prevention and control – 3rd ed. “WHO/HTM/TB/2008.399”, WHO 2008, http://www.who.int/tb/publications/2008/WHO_HTM_TB_2008.399_eng.pdf) and coordination of contact tracing when appropriate were the main actions taken by the ECDC. Fig. 1 represents the trend of media reports scanned in 2007 by MedISis related to TB and significant events that were monitored by the ECDC. Peaks tend to occur immediately after events that can imply a public health threat. The most significant example was the event involving an extensively drug resistant (XDR)-TB case in a US citizen travelling from the USA to Europe, who visited different countries and travelled back to the USA (US CDC Investigation of U.S. Traveler with Extensively Drug Resistant Tuberculosis (XDR TB). May 29, 2007. Available at: <http://www2a.cdc.gov/HAN/ArchiveSys/ViewMsgV.asp?AlertNum=00262> accessed 24 January 2009).

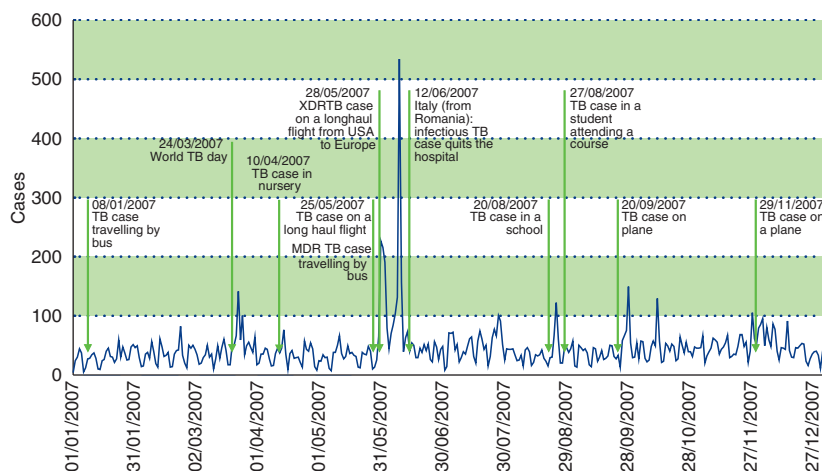


FIG. 1. Distribution of media reports related to tuberculosis as monitored by MedISys*.

Conclusions

In a globalized world, travel-related public health risks are increasingly important. The ECDC, as a new institution in the EU, is mandated to monitor, detect, assess and ensure appropriate responses to emerging threats. This can be achieved only through a partnership of experts involved in ensuring health security. In this context, the ECDC, since its establishment, has been aiming at developing collaboration with epidemiologists, microbiologists, and clinicians from the various EU member states.

Efforts need to be made to better identify and gather information about travellers coming to the EU with imported diseases with a potential for further spread inside our territory. Open sources of information, those publically available though the internet, are important sources to detect and monitor events with possible impact on public health in the EU, especially for events originating outside the EU borders.

Transparency Declaration

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