Rapid detection of emerging disease outbreaks using unofficial sources: Lessons from ProMED

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Federation of Infectious Disease Societies of Southern Africa
Epidemiologic Notes and Reports

Pneumocystis Pneumonia --- Los Angeles

In the period October 1980-May 1981, 5 young men, all active homosexuals, were treated for biopsy-confirmed Pneumocystis carinii pneumonia at 3 different hospitals in Los Angeles, California. Two of the patients died. All 5 patients had laboratory-confirmed previous or current cytomegalovirus (CMV) infection and candidal mucosal infection. Case reports of these patients follow.

Patient 1: A previously healthy 33-year-old man developed P. carinii pneumonia and oral mucosal candidiasis in March 1981 after a 2-month history of fever associated with elevated liver enzymes, leukopenia, and CMV viruria. The serum complement-fixation CMV titer in October 1980 was 256; in may 1981 it was 32.* The patient's condition deteriorated despite courses of treatment with trimethoprim-sulfamethoxazole (TMP/SMX), pentamidine, and acyclovir. He died May 3, and postmortem examination showed residual P. carinii and CMV pneumonia, but no evidence of neoplasia.

Patient 2: A previously healthy 30-year-old man developed p. carinii pneumonia in April 1981 after a 5-month history of fever each day and of elevated liver-function tests, CMV viruria, and documented seroconversion to CMV, i.e., an acute-phase titer of 16 and a convalescent-phase titer of 28* in anticomplement immunofluorescence tests. Other features of his illness included leukopenia and mucosal candidiasis. His pneumonia responded to a course of intravenous TMP/SMX, but, as of the latest reports, he continues to have a fever each day.
Emergence of HIV/AIDS

• A plasma sample taken in 1959 from an adult male living in what is now the Democratic Republic of Congo showed HIV

• HIV found in tissue samples from an American teenager who died in St. Louis in 1969

• HIV found in tissue samples from a Norwegian sailor who died around 1976

• Evolutionary model suggests HIV transferred to humans in 1930 +/- 15 years
Why wasn’t HIV detected earlier?
“Because infectious diseases have been largely controlled in the United States, we can now close the book on infectious diseases.” — (attributed to) William Stewart, US Surgeon General, 1969
“Even with my great personal loyalty to [the discipline of] infectious diseases, I cannot conceive of a need for 309 more infectious diseases experts unless they spend their time culturing each other.”

Robert Petersdorf, MD
1978
FIGURE 1. Crude death rate for infectious diseases—United States, 1900-1996
[Adapted by Rear Admiral Dr. Patrick O’Carroll, Regional Health Administrator, U.S. Public Health Service Region X]

*Per 100,000 population per year.
“Microbes are ranked among the most numerous and diverse of organisms on the planet; pathogenic microbes can be resilient, dangerous foes. Although it is impossible to predict their individual emergence in time and place, we can be confident that new microbial disease will emerge.”

-Institute of Medicine, 1992
IHR 2005 (took effect in 2007)

- Obligation to notify WHO of events that may constitute a public health emergency of international concern; not limited to any particular diseases
- Authorizes WHO to consider unofficial reports of public health events
- WHO now encouraging member states to adopt informal “Event-Based Surveillance”
Traditional public health reporting

World bodies: UN, WHO, FAO, OIE

Ministry of Health

Local officials

Practitioners

Public

Labs

Ministry of Health

Local officials

Practitioners

Public

Labs

Local officials

Practitioners

Public

Local officials

Practitioners

Public

Local officials

Practitioners

Public
Traditional Public Health

**Advantages**
- Robust
- Sensitive
- Accurate
- Validated
- Quantitative

**Disadvantages**
- May be slow
- Incentives for non-reporting
- Broken links may lead to non-reporting
- May miss uncharacterized or novel disease
- Expensive
Event-based “informal” surveillance

- Ministries of Health
- WHO
- Media
- Laboratories
- Local health officials
- Lay public
- Healthcare workers
Informal source surveillance
(Event-based surveillance, Biosurveillance)

• Advantages
  – Speed
  – Transparency
  – Multiple sources including
    • Clinicians
    • Labs
    • Media, blogs, Internet
    • Official
  – Identifies any event
  – Inexpensive

• Disadvantages
  – Potential inaccuracy
  – Non-quantitative
  – Biases
    • Information richness
    • Language
    • Sensationalism
Information sources for EBS

• Media reports
  – Systematic search of relevant media

• Astute observers
  – Health care workers
  – Laboratorians

• Official sources

• General public
  – Social media
  – Blogs, chatrooms, YouTube
  – Toll-free phone number
Overload
Global information created and available storage
Exabytes

FORECAST

Information created

Available storage

2005 06 07 08 09 10 11

Source: IDC

The Economist, 2012
The ProMED-mail electronic outbreak reporting system began in August 1994 to monitor emerging infectious diseases globally.

- Moderated e-mail lists, website, social media
- Early warning system for emerging disease outbreaks
- Emphasis on rapid reporting
  - Posts are vetted by SMEs but not “peer reviewed”
  - Standard for <24 hour turnaround
  - Requests for Information (RFIs) for unconfirmed reports
• Free subscription
• 85,000 subscribers in > 180 countries
• All reports are screened and commented upon by expert Moderators before posting
• Average of 8 reports per day
• Emphasis on “One Health”
• Regional network system
Could information sharing over the Internet and the use of ‘informal’ or unofficial information sources enhance the detection of emerging diseases?

Most Recent Alert

Published Date: 2017-04-13 10:49:35
Subject: PROPLU Cercospora leaf spot, sugar beet - UK: strobilurin resistance
Archive Number: 21170413-4697511

CERCOSPIRA LEAF SPOT, SUGAR BEET - UK: STROBLURIN RESISTANCE

A Promed-mail post
http://www.promedmail.org
Promed-mail is a program of the International Society for Infectious Diseases
http://www.isid.org

Date: Tue 4 Apr 2017 17:03 BST
Source: Farmers Weekly [edited]
https://www.wfi.co.uk/arsenate/fungicide-resistant-cercospora-found-uk-sugar-beet.htm

Resistance to one of the key fungicide groups used to control cercospora leaf spot in sugar beet has been discovered in the UK for the 1st time. Samples from Cornwall, Suffolk, and Lincolnshire, collected as part of a large-scale European monitoring programme, have confirmed disease resistance to all strobilurin fungicides chemistry.

The British Beet Research Organisation's (BBRO) Mark Stevens says the discovery is concerning, but that it needs to be viewed in context. While cercospora can be a serious disease and is widespread across Europe, it is not the principal disease threat to crop performance in the UK. He says that further work is needed to determine the scale and significance of the resistance.

[Byline: Oliver Hill]

Communicated by: Promed-mail
<promed@promedmail.org>

[Leaf spot caused by Cercospora beticola is the most destructive foliar diseases of beet crops in warm and humid growing areas. It affects most species of Beta (cultivated and wild) and also many weed species in the Amaranthaceae and Chenopodiaceae families which can serve as pathogen reservoirs. Symptoms on sugar beet (Beta vulgaris) include circular leaf spots with characteristic black centres that coalesce and, in severe cases, can lead to complete leaf collapse. During severe outbreaks, new leaf growth can be seen emerging from the centre of collapsed leaves. The disease reduces yield and quality of beet crops. Disease management generally relies on fungicides, but resistant C. beticola strains are emerging. Partial genetic resistance to the pathogen in some Beta varieties is used in breeding programmes to develop new crop cultivars.

Strobilurins are strongly antifungal agents produced by fungi. Being derived from natural products, they are considered environmentally safe. Like several other fungicide classes, they have single-site activity and therefore pathogens must be expected to develop resistance or tolerance over time. Since they are used against most major fungal crop diseases, pathogen resistance is of major concern to many primary industries worldwide. Rotating or mixing chemical classes of fungicides is used to extend the useful life of the compounds.]

Maps
UK
http://www.lib.utexas.edu/maps/europe/united_kingdom.gif and
Regional Programs of ProMED-mail

- ProMED-ESP, ProMED-Port: Latin America in Spanish and Portuguese
  - API
- ProMED-MBDS (Mekong Basin Disease Surveillance Collaboration)
  - MOHs of Cambodia, China, Laos, Myanmar, Thailand, Vietnam, WHO, Rockefeller
- ProMED-EAFR: English-speaking Africa
  - Regional network focused on anglophone Africa
- ProMED-FRA
  - Regional network focused on francophone Africa
- ProMED-RUS
  - Russian language reports from the countries of the independent states of the former Soviet Union
- ProMED-MENA
  - Middle East/North Africa in English with Arabic summaries
- ProMED-SoAs
  - South Asia – Subcontinent in English
Staff Locations

59 staff in 37 countries
<table>
<thead>
<tr>
<th>Year</th>
<th>Posts</th>
<th>Posts/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>2613</td>
<td>7.2</td>
</tr>
<tr>
<td>2011</td>
<td>2588</td>
<td>7.1</td>
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<tr>
<td>2012</td>
<td>2930</td>
<td>8.0</td>
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<tr>
<td>2013</td>
<td>2924</td>
<td>8.0</td>
</tr>
<tr>
<td>2014</td>
<td>3035</td>
<td>8.2</td>
</tr>
<tr>
<td>2015</td>
<td>3154</td>
<td>8.6</td>
</tr>
<tr>
<td>2016 (to date)</td>
<td>2792</td>
<td>9.3</td>
</tr>
</tbody>
</table>

*Global English network only, similar volume on regional services in addition*
Event-based surveillance is the organized and rapid capture of information about events that are a potential risk to public health. This information can be rumours and other ad-hoc reports transmitted through formal channels (i.e. established routine reporting systems) and informal channels (i.e. media, health workers and nongovernmental organizations reports), including:
Date: 10 Feb 2003
From: Stephen O. Cunnion, MD, PhD, MPH
    International Consultants in Health, Inc
    Member ASTM&H, ISTM

This morning I received this e-mail and then searched your archives and found nothing that pertained to it. Does anyone know anything about this problem?

"Have you heard of an epidemic in Guangzhou? An acquaintance of mine from a teacher's chat room lives there and reports that the hospitals there have been closed and people are dying."
[ProMED-mail appreciates the preliminary information above and would be grateful for any additional information. The etiology and extent of this apparent outbreak of pneumonia are unclear, as is whether the outbreak is secondary to influenza. - Mod. LM]
Acute Respiratory Syndrome in Hong Kong SAR, Viet Nam

• WHO Press Release 12 Mar 2003
  – WHO issues a global alert about cases of atypical pneumonia. Cases of severe respiratory illness may spread to hospital staff. Since mid February 2003, WHO has been actively working to confirm reports of outbreaks of a severe form of pneumonia in Viet Nam, Hong Kong Special Administrative Region (SAR), China, & Guangdong province in China.
March 5: First Canadian death
Probable cases of SARS by week of onset
Worldwide* (n=5,910), 1 November 2002 - 10 July 2003

* This graph does not include 2,527 probable cases of SARS (2,521 from Beijing, China), for whom no dates of onset are currently available.
One Health

Considers disease without regard to species and recognizes the commonality of human and veterinary health
Zoonoses in disease emergence

- 1407 human pathogens
- 58% are zoonotic
- 130 of the 177 recently emerged pathogens zoonotic (RR=2.0)

Breadth of host range vs. fraction regarded as emerging or reemerging

Published Date: 2012-09-20 15:51:26
Subject: PRO/EDR> Novel coronavirus - Saudi Arabia: human isolate
Archive Number: 20120920.1302733

NOVEL CORONAVIRUS - SAUDI ARABIA: HUMAN ISOLATE
***************************************************************************
A ProMED-mail post
http://www.promedmail.org
ProMED-mail is a program of the International Society for Infectious Diseases
http://www.isid.org

Date: Sat 15 Sep 2012

From: Ali Mohamed Zaki [edited]
A new human coronavirus was isolated from a patient with pneumonia by Dr Ali Mohamed Zaki at the Virology Laboratory of Dr Soliman Fakeeh Hospital Jeddah Saudi Arabia.

The virus was isolated from sputum of a male patient aged 60 years old presenting with pneumonia associated with acute renal failure. The virus grows readily on Vero cells and LLC-MK2 cells producing CPE in the form of rounding and syncetia formation.

[The clinical isolate] was initially tested for influenza virus A, influenza virus B, parainfluenza virus, enterovirus and adenovirus, with negative results. Testing with a pancoronavirus RT-PCR yielded a band at a molecular weight appropriate for a coronavirus. The virus RNA was tested also in Dr. Ron Fouchier's laboratory in the Netherlands and was confirmed to be a new member of the beta group of coronaviruses, closely related to bat coronaviruses. Further analysis is being carried out in the Netherlands.

The Virology Laboratory at the Dr Fakeeh Hospital will be happy to collaborate with others in studies of this virus.

--
Ali Mohamed Zaki
Professor of Microbiology
Dr Fakeeh hospital Jeddah Saudi Arabia
Novel Coronavirus - UK

Published Date: 2012-09-23 17:29:14
Subject: PRO/AH/EDR> Novel coronavirus - Saudi Arabia (03): UK HPA, WHO, Qatar
Archive Number: 20120923.1305982

NOVEL CORONAVIRUS - SAUDI ARABIA (03): UNITED KINGDOM HEALTH PROTECTION AGENCY, WHO, QATAR

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A ProMED-mail post
http://www.promedmail.org
ProMED-mail is a program of the International Society for Infectious Diseases

[1] HPA press release

Date: 23 Sep 2012 Source: Health Protection Agency UK press release [edited]
http://www.hpa.org.uk/NewsCentre/NationalPressReleases/2012PressReleases/120923acuterespiratoryillnessidentified/ The Health Protection Agency (HPA) can confirm the diagnosis of one laboratory confirmed case of severe respiratory illness associated with a new type of coronavirus. The patient, who is from the Middle East and recently arrived in the UK, is receiving intensive care treatment in a London hospital.
Novel coronavirus – Saudi Arabia

Published Date: 2012-11-04 13:11:42
Subject: PRO/AH/EDR> Novel coronavirus - Saudi Arabia (15): new case
Archive Number: 20121104.1391285
NOVEL CORONAVIRUS - SAUDI ARABIA (15): NEW CASE
*****************************************************************************
Date: Nov 4, 2012 12:11 PM
From: Ziad Memish (Saudi Ministry of Health)

Subject: Re: A new Saudi novel coronavirus case diagnosed in KSA (Kingdom of Saudi Arabia) Attached is a report we would like for you to consider releasing in ProMED-mail: In accordance with Ministry of Health's (MoH) responsibilities for disease prevention and control, and in keeping with our practice to inform the public and the media about significant findings that result from MoH disease surveillance activities, we are announcing today [4 Nov 2012] that one of our hospitalized citizens has been confirmed to have pneumonia caused by novel Coronavirus (nCoV). This case had no epidemiological links to the 2 documented novel coronavirus cases to date.
A map of the spread of MERS by the end of May 2015 © ECDC
ProMED and Zika
Unknown illness: Brazil (Maranhão) outbreak

Published Date: 2015-02-08 20:02:43
Subject: PRO/PORT> Doença desconhecida - Brasil (MA), surto
Archive Number: 20150208.3150347

DOENÇA DESCONHECIDA - BRASIL (MARANHÃO), SURTO
***********************************************

Uma mensagem / Una mensaje / de ProMED-PORT
http://www.promedmail.org
ProMED-mail e um programa da / es un programa de la
International Society for Infectious Diseases
http://www.isid.org

Data: Domingo, 08 de fevereiro de 2015
Fonte: Prefeitura Municipal de Caxias, Maranhão [04/02/2015] [editado]
http://caxias.ma.gov.br/noticia/secretario-de-saude-adota-providencias-sobre-surto-de-virose-em-caxias

Secretário de Saúde adota providências sobre surto de virose em Caxias
The outbreak of a virus that causes fever, red spots in the body and joint pain, remains on alert health authorities of Caxias. The Municipal Health clarifies already aware of the outbreak, which is affecting hundreds of people in the city.

According to the health secretary, Vinicius Araujo, without the test result is not possible to say whether the virus has no connection or with Chikungunya fever. The agency issued a clarification note. Check the note:

"Regarding the virus outbreak that is happening in the city, were not notified to the Chikungunya fever, for all serology requested to date for the LACEN (reference laboratory tests for diagnosis of tropical diseases by the Ministry of Health in São Luís) were negative.

We ask the Secretary of State for Health to send technicians to our city to perform virus isolation research to clarify what type of virus could be circulating. Until next week this team should get.

Meanwhile, it is important that everyone keep the care of prevention of Dengue, for Chikungunya fever is also transmitted by mosquitoes _Aedes aegypti_ infected and, less commonly, by the mosquito _Aedes albopictus_ ".

Event-based surveillance

- GPHIN
- HealthMap
- Biocaster
- MediSys
- EIN (IDSA)
- Geosentinel
- GOARN
- Epi-X
- GHSAG
Time to outbreak discovery and public communication is decreasing

Fig. 3. Box plots of the temporal trends in the yearly median time between estimated outbreak start and (A) outbreak discovery and (B) public communication about the outbreak for selected WHO-verified outbreaks, 1996–2009. The revised International Health Regulations (IHR 2005) went into effect in 2007.
Synergy from multiple surveillance systems

ECDC Round Table Report and ProMed-mail most useful international information sources for the Netherlands Early Warning Committee

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2. VU University, Amsterdam, The Netherlands
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ECDC Round Table Report and ProMed-mail most useful international information sources for the Netherlands Early Warning Committee

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Citation style for this article:

- ECDC Round Table (RT) Report and ProMED-mail were the most complete and timely sources, reporting 140 of 178 (79%) and 121 of 178 (68%) threats
- The combination of both sources reported 169 (95%) of all threats in a timely manner
- Adding any of the other sources resulted in minor increases in the total threats found, but considerable additional time investment per additional threat
- Only three potential relevant threats (2%) would have been missed by only using the ECDC RT Report and ProMed-mail
What is EpiCore?

EpiCore is a new system that finds, validates and reports outbreaks faster than traditional disease surveillance methods alone.
When evidence of outbreak is found, ProMED experts send RFI to EpiCore members in geographic region.
EpiCore Program Update
Membership and RFIs

- >2000 members representing 142 countries

- 732 RFIs posted in 112 countries

- 1873 responses to RFIs
- 736 responses with content
- 320 responses used in ProMED post
Pioneer an Innovative Approach to Disease Surveillance

Use your skills and knowledge to speed up early detection of outbreaks and help save lives

www.epicore.org
Published Date: 2017-11-08 13:28:24
Subject: PRO/EDR> Cholera, diarrhea & dysentery update (129): Asia (Yemen)
Archive Number: 20171108.5431389

CHOLERA, DIARRHEA AND DYSENTERY UPDATE (129): ASIA (YEMEN)

**************************************************************************
Published Date: 2017-11-08 13:28:24
Subject: PRO/EDR> Cholera, diarrhea & dysentery update (129): Asia (Yemen)
Archive Number: 20171108.5431389

CHOLERA, DIARRHEA AND DYSENTERY UPDATE (129): ASIA (YEMEN)

11 Oct / 815 000 / 2156
16 Oct / 841 906 / 2167
25 Oct / 862 858 / 2177
29 Oct / 884 368 / 2184
31 Oct / 890 017 / 2185
7 Nov / 910 996 / 2195
Madagascar plague outbreak 2017 (most affected regions)

- 23 Oct 2017 / 1192 / 124 / 10
- 27 Oct 2017 / 1554 / 113 / 122
- 30 Oct 2017 / 1801 / 127 / 82
- 1 Nov 2017 / 1836 / 133 / 17
- 3 Nov 2017 / 1947 / 143 / 55

Source: WHO

© DW

ProMED-mail
Published Date: 2017-09-10 15:41:50
Subject: PRO/EDR> Antibiotic-resistant Klebsiella - China: (ZJ) fatal, hypervirulent strain, ICU
Archive Number: 20170910.5307210

ANTIBIOTIC-RESISTANT KLEBSIELLA - CHINA: (ZHEJIANG) FATAL, HYPERVIRULENT STRAIN (HVKP)

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April – June 2017 Reports to ProMED-mail

[World map with various diseases listed and highlighted]
Monsieur Barbinel prévenu par sa portière de la visite de la comète.

-Daumier
Summary

• Control of outbreaks depends upon rapid detection and reporting

• Over the past 20 years, event-based reporting using non-traditional data has become established as an important complement to traditional public health in the detection of new pathogens

• Transparency is a guiding principle. You can’t predict who needs to know what and when

• Timeliness of outbreak detection has improved as a result of these systems
18th International Congress on Infectious Diseases

XVIII Congreso de la Sociedad Argentina de Infectología (SADI)

BUENOS AIRES • ARGENTINA • MARCH 1~4, 2018

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  – Emerging Pandemic Threats PREDICT project
  – Zika and other threats
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  – Imperial College London
  – EcoHealth Alliance
• Past supporters
  – Oracle Corporation
  – Google.org
  – Oracle Corporation
  – Rockefeller Foundation
Thank you

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