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

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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]

Crude death rate* for infectious diseases — United States, 1900–1996†

*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
The Conquest of Infectious Diseases: Who Are We Kidding?

The 20th century has seen unprecedented scientific progress and so it is ironic that as the century draws to a close, scientists and clinicians must learn to deal with emerging new infectious agents whose existence in human beings was proved only in the past few years (1). National surveillance of drug-resistant *Mycobacterium tuberculosis* was discontinued in 1984 and has only recently been reinstated. Surveillance of food-borne disease is inadequate in most areas of the United States, and many outbreaks go undetected (11).

Almost a quarter century ago, the Surgeon General of the United States testified to Congress that it was time to “close the book on infectious diseases” (2). The wide use of effective antibiotics, the potential for universal vaccination for many major childhood illnesses.

1 September 1993
Ruth L. Berkelman and James M. Hughes
Annals of Internal Medicine
Could information sharing over the Internet and the use of ‘informal’ or unofficial information sources enhance the detection of emerging diseases?

Origins

“The year was 1993 and to some attendees at a [bioweapons] conference in Geneva co-sponsored by the Federation of American Scientists (FAS) and the World Health Organization (WHO), the convergence of two important trends was becoming apparent. The first was the role of emerging infectious diseases... The second was the dramatic coming of age of the Internet.”

“At a follow-up conference in the U.S. in 1994, attendees joined an e-mail list that allowed them to stay in touch with one another and share news in their field. It began with some 40 subscribers, but as news of outbreaks spread among these inaugural subscribers was forwarded to colleagues, others sought to subscribe to the list and within months hundreds joined. The list was named ProMED-mail.”
Overload
Global information created and available storage
Exabytes

<table>
<thead>
<tr>
<th>Year</th>
<th>Information created (Exabytes)</th>
<th>Available storage (Exabytes)</th>
</tr>
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<tbody>
<tr>
<td>2005</td>
<td>250</td>
<td>750</td>
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<tr>
<td>2010</td>
<td>500</td>
<td>1,000</td>
</tr>
<tr>
<td>2011</td>
<td>550</td>
<td>1,100</td>
</tr>
</tbody>
</table>

*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
• **82,000** 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
The Kenyan government has refuted reports of an outbreak of rinderpest disease in the country as well as a threat from neighboring Tanzania. Ministry of Agriculture, Livestock and Fisheries cabinet secretary Willy Bett said Kenya has an active and passive surveillance program that ensures that there is no re-emergence of rinderpest in the country, while keeping a high level of alertness. "This surveillance program also ensures that other important trans-boundary animal diseases are controlled to safeguard our livestock herds and trade," Bett said in a statement issued in Nairobi.

The local media had reported that there was a possible outbreak of rinderpest disease, which affects livestock, in Kenya. The reports said that the disease had already killed thousands of livestock in neighboring Tanzania, with the government on high alert over a possible occurrence in Kenya.

However, Bett said that rinderpest — a devastating contagious animal disease, also known as cattle plague, that affects cloven hoofed animals, mainly cattle and bufaloes — was successfully eradicated the world over in 2011. Kenya had earlier eradicated the disease in 2009, and a certificate was issued to that effect by the World Organisation for Animal Health (OIE).

Bett said that an outbreak of anthrax in wild animals in Tanzania had elicited rumors to the effect that it was an outbreak of rinderpest. The rumor has attracted a lot of media attention in Kenya. "We, however, have official confirmation from the veterinary authorities in Tanzania that the outbreak was indeed anthrax and not rinderpest," Bett said.

Rinderpest is one of the world's deadliest livestock diseases, capable of clearing 90 per cent of livestock in just 10-15 days. The disease's symptoms in cattle, goats and sheep [see comment] include fever, erosive lesions in the mouth, discharge from the nose and eyes, profuse diarrhea, and dehydration, often leading to death.
I have heard from four different sources that at least one of the isolates from Malaysia, from a pig that died of suspect Japanese encephalitis (JE), has been identified as a paramyxovirus closely related to or identical with Hendra virus. Hendra virus has so far been reported (on three occasions) only from Queensland, Australia. It is known to be a human and equid pathogen but not much more than that; there is no data with regard to porcine pathogenicity, as far as I know. Whether these rumors are true remains to be seen (and reported officially).
Nipah virus in Malaysia, 1998-1999
Human encephalitic cases

Source: Jonathan Epstein, EcoHealth Alliance
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."
Date: 10 Feb 2003
Moderator comment:

[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

Traditional public health reporting
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
- Healthcare workers
- Laboratories
- Lay public
- Local health officials
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
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
1060 posts refer to *Eurosurveillance* reports

*Global English network only, similar volume on regional services in addition*
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.

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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

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]
erespiratoryillnessidentified/ 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.
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.
“I would be interested to know whether the outbreak of severe respiratory disease of unknown origin in Jordan in April [2012] is now being reviewed for evidence of this new coronavirus.”
A map of the spread of MERS by the end of May 2015 © ECDC
MERS – South Korea

MERS CoV confirmed cases in Republic of Korea, China, Saudi Arabia and other Countries
Estimated week of onset as of 19 Jun 2015

Please note that the underlying data is subject to change as the investigation is ongoing. Source: WHO
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 é 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

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...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_."
Editorial

Why is the yellow fever outbreak in Angola a ‘threat to the entire world’?

J.P. Woodall, T.M. Yuill
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”
Event-based biosurveillance

- GPHIN
- HealthMap
- Biocaster
- MediSys
- Argus
- 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.

Chan et al., PNAS 2010
Synergy from multiple surveillance systems

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

- 1708 members representing 137 countries
- 378 RFIs posted in 77 countries
- 905 responses to RFIs
- 406 responses with content
- 164 responses used in ProMED post
Mapping the Risk of International Infectious Disease Spread

- User-friendly tool to estimate and visualize the risks of outbreak events spreading
- Aimed at helping decision makers with health resource allocation and infectious disease threat preparedness
- Uses multiple data streams including ProMED, international flight data, and health center data
- Potential end-users include government, public health experts, health care workers, NGOs, and others

Project partners:
- The International Society for Infectious Diseases (ISID) and its Program for Monitoring Emerging Diseases (ProMED)
- Imperial College London
- heathsites.io
- HealthMap
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, reporting based on 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
Acknowledgments

• ProMED/ISID staff and supporters
• USAID
  – Emerging Pandemic Threats PREDICT project
  – Zika and other threats
• CRDF
• Skoll Global Threats Fund
• Wellcome Trust
• Collaborators
  – HealthMap/Epidemico
  – Imperial College London
  – EcoHealth Alliance
• Past supporters
  – Oracle Corporation
  – Google.org
  – Oracle Corporation
  – Rockefeller Foundation
Thank you

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18th International Congress on Infectious Diseases

XVIII Congreso de la Sociedad Argentina de Infectología (SADI)

BUENOS AIRES • ARGENTINA • MARCH 1~4, 2018

Organized by the
International Society for Infectious Diseases

In collaboration with the
Sociedad Argentina de Infectología (SADI)
The China Problem

- 20% of world’s population
- Multiple hotspots for emerging diseases
  - SARS
  - Avian flu
  - AMR
  - Yellow fever threat
- No ProMED staff in China
- Few EpiCore members in China
- Official efforts to quell unofficial information
- Great Firewall