Monitoring emerging diseases using unofficial sources: A One Health approach

Larry Madoff, MD
ProMED
International Society for Infectious Diseases

Albert Einstein College of Medicine
3 December 2018
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.
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.
“Past performance is not an indication of future results.”

charles SCHWAB
“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
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

ProMED

INTERNATIONAL SOCIETY
FOR INFECTIOUS DISEASES
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
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
Non-Traditional Information Sources Are Also Known as:

- Informal
- Non-governmental
- Unofficial
- Off-the-record
- Unconfirmed
- Unstructured data
- Rumors
Overload
Global information created and available storage
Exabytes

<table>
<thead>
<tr>
<th></th>
<th>Information created</th>
<th>Available storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>0</td>
<td>250</td>
</tr>
<tr>
<td>2006</td>
<td>250</td>
<td>500</td>
</tr>
<tr>
<td>2007</td>
<td>750</td>
<td>1,000</td>
</tr>
<tr>
<td>2008</td>
<td>1,250</td>
<td>1,500</td>
</tr>
<tr>
<td>2009</td>
<td>1,750</td>
<td>2,000</td>
</tr>
<tr>
<td>2010</td>
<td>2,250</td>
<td>2,500</td>
</tr>
<tr>
<td>2011</td>
<td>2,750</td>
<td>3,000</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
• 90,000 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?

Published Date: 2018-11-30 21:22:16
Subject: PRO/AH/EDR > African swine fever - Asia (33): China, domestic swine, spread, control, FAO
Archive Number: 20181130.6178413

AFRICAN SWINE FEVER - ASIA (33): CHINA, DOMESTIC SWINE, SPREAD, CONTROL, FAO

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: Fri 30 Nov 2018

Situation update

Since the China Ministry of Agriculture and Rural Affairs (MoARA) confirmed its 1st African swine fever (ASF) outbreak in Liaoning Province on 3 Aug 2018, ASF was detected in 83 villages/the smallest available admin units in 20 provinces/autonomous region/municipalities. More than 570,000 pigs have been culled in an effort to halt further spread.


Actions taken by China

The government set a 3-km (1.9-mile) epidemic zone and a 10-km (6.2-mile) buffer zone around the epidemic zone. Within a province, movement of live pigs from the county/city/province where ASF occurred is suspended; live pig markets in infected provinces and adjacent provinces are closed; movement of live pigs and pork products from provinces with more than 2 infected cities is prohibited; transport of live pigs from provinces adjacent to ASF-affected are suspended. Breeding pigs can be transported from provinces with epidemic zone with a laboratory ASF test certificate, but it is not allowed to pass through provinces with epidemic zone when transporting live pigs [1]. The government has been strengthening transport of pork meat rather than live pigs [2]. Studies showed that 82% of the first 21 ASF events in China were related to swill feeding. A nationwide ban on swill feeding to pigs and record-keeping of livestock transportation vehicles have been implemented [3]. On 30 Oct 2018, MoARA launched a 3-month investigation campaign against illegal slaughter [4]. On 28 Nov 2018, MoARA released information on cases of illegal live pig movement or lack of timely reporting in Liaoning, Yunnan, Beijing, Shandong and Jilin provinces, which resulted in prosecution or fines (between CNY 1950 and 103 011 [between about USD 280 and 14 830]) [5].
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
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."

PNEUMONIA - CHINA (GUANGDONG): RFI

********************************************
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 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.
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
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.
A map of the spread of MERS by the end of May 2015 © ECDC
Event-based surveillance

- GPHIN
- HealthMap
- Biocaster
- MediSys
- EIN (IDSA)
- Geosentinel
- GOARN
- Epi-X
- GHSAG
ProMED receives outbreak report from a region

ProMED sends RFI to EpiCore members in that region

Epicore member responds to RFI:
• Correct the information
• Verify outbreak information

Verified information is shared globally on ProMED
### EpiCore responses to RFI’s: examples

<table>
<thead>
<tr>
<th>RFI</th>
<th>Location</th>
<th>Time</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholera, # of cases</td>
<td>Lusaka, ZB</td>
<td>10min</td>
<td>confirmed, 11 cases</td>
</tr>
<tr>
<td>CCHF, suspected</td>
<td>PK</td>
<td>&lt;1 hr</td>
<td>not confirmed</td>
</tr>
<tr>
<td>Cutaneous leishmaniasis, #?</td>
<td>Kathmandu, NP</td>
<td>&lt;2hr</td>
<td>confirmed, &gt;10</td>
</tr>
<tr>
<td>HPAI, serotypes H5N8, H5N1?</td>
<td>Tehran, IR</td>
<td>&lt;3 hr</td>
<td>confirmed</td>
</tr>
<tr>
<td>Polio – ?WPV, cVDPV, VAPP</td>
<td>Gilgit, PK</td>
<td>&lt;1 hr</td>
<td>confirmed - WPV</td>
</tr>
</tbody>
</table>

EpiCore Disease Surveillance, Nov 2015 – Sep 2017

2068 members, 142 countries

732 RFI’s posted to 112 countries
1873 responses to RFIs
736 responses with content
320 responses used in ProMED post

Waiting for the comet

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
• One Health is key to understanding emerging infectious diseases
• 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/Ending Pandemics
• Wellcome Trust
• Collaborators
  – HealthMap/Epidemico
  – Imperial College London
  – EcoHealth Alliance
  – Harvard Global Health Institute
• Past supporters
  – Oracle Corporation
  – Google.org
  – Oracle Corporation
  – Rockefeller Foundation
Thank you

lmadoff@promedmail.org
@Imadoff
http://promedmail.org