Detection of emerging infections and outbreaks

Reflections from ProMED-mail

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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†

40 States Have Health Departments
Influenza Pandemic
First Continuous Municipal Use of Chlorine in Water in United States§
Last Human-to-Human Transmission of Plague
First Use of Penicillin
Salk Vaccine Introduced
Passage of Vaccination Assistance Act

*Per 100,000 population per year.
Why Disease Surveillance Exists
Traditional public health reporting

World bodies: UN, WHO, FAO, OIE

Ministry of Health

Local officials
- Practitioners
  - Public
  - Labs

Local officials
- Practitioners
  - Public

Local officials
- Practitioners
  - Public

Local officials
- Practitioners
  - Public

Local officials
- Practitioners
  - Public

Local officials
- Practitioners
  - Public

Local officials
- Practitioners
  - Public
Traditional Public Health Surveillance

Advantages
- Robust
- Sensitive
- Accurate
- Validated
- Quantitative

Disadvantages
- May be slow
- Broken links may lead to non-reporting
- May miss uncharacterized or novel disease
- Reports only confirmed information, from a limited number of sources
- Expensive
Event-based “informal” surveillance

Ministries of Health

WHO

Informal-source surveillance

Media

Laboratories

Local health officials

Lay public

Healthcare workers
Informal (Non-traditional) 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
  - Astute observers
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”
Innovative Disease Surveillance Initiatives


ProMED
INTERNATIONAL SOCIETY
FOR INFECTIOUS DISEASES

MedSys
Medical Information System

google.org
Flu Trends

Public Health
Agency of Canada
Global Public Health Intelligence
Network (GPHIN)

HealthMap
“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
Could information sharing over the Internet and the use of ‘informal’ or unofficial information sources enhance the detection of emerging diseases?

The global electronic reporting system for outbreaks of emerging infectious diseases and toxins, open to all sources

http://www.promedmail.org
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
• 86,000+ subscribers in > 180 countries
• All reports are screened and commented upon by expert Moderators before posting
• Average of 9 reports per day
• Emphasis on “One Health”
• Regional network system
• Free of political constraints
ProMED-mail

Most Recent Alert

Published Date: 2015-11-14 16:50:27
Subject: HETATMA - Hepatitis A - USA (6) (WALTN)
Archived Number: 20151114-07002

Source: West Virginia Department of Health and Human Resources, Office of Epidemiology and Prevention Services

Since October 2015, the West Virginia Health Department has reported an increase in the number of confirmed cases of acute hepatitis A virus. This increase in cases has primarily been among injecting and non-injecting drug users, homeless or street individuals, and those who have been recently incarcerated. Viral sequencing has traced these cases from Kentucky and California.

West Virginia hepatitis A outbreak cases as of 4 Nov 2015

- Number of cases: 177
- Demographics
  - Age range: 12-66
  - Median age: 37
  - Males: 154 (87.5%)
  - Hospitalizations: 24 (13.7%)
  - Deaths: 6
- Risk factors
  - Co-infection with hepatitis C (information available for 1204 cases) 524 (45.5%)
  - Co-infection with hepatitis D (information available for 1204 cases) 133 (11.1%)
  - Other risk factors (information available for 1517 cases) 1135 (74.8%)
  - Household 134 (10.5%)

More information available via the ProMED-mail forum.
WHAT is ProMED?

- Internet-based reporting system for rapid, global dissemination of information on *infectious disease outbreaks* and *acute exposures to toxins* in humans, animals, and plants

- Free to everyone, open-access, and accessible via email, website, or app
### ProMED Annual Post Counts* 2010-2018**

<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>
</tr>
<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</td>
<td>3327</td>
<td>9.1</td>
</tr>
<tr>
<td>2017</td>
<td>3439</td>
<td>9.4</td>
</tr>
<tr>
<td>2018</td>
<td>2798</td>
<td>8.8</td>
</tr>
</tbody>
</table>

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

** As of 15 Nov 2018
Multiplesectoral connectivity

- 75% of newly emerging diseases in humans are zoonotic
- 70% of newly emerging diseases in animals come from wildlife

The One Health Concept

The One Health Triad

The One Health Concept Recognizes the Important Links Between Human, Animal and Environmental Health
WHO is ProMED?

- ProMED moderators are infectious disease specialists (human, animal, plant) trained to recognize possible outbreaks of public health significance.

- Continuously monitor nontraditional information sources and publish reports on emerging and re-emerging diseases.

WHO is ProMED?
ProMED-mail email subscribers 2010-2017

2010: 53,944
2011: 61,949
2012: 60,734
2013: 64,258
2014: 60,779
2015: 77,559
2016: 82,412
2017: 86,427
WHERE is ProMED?

60 staff or volunteers in 38 countries
ProMED-mail Regional Networks

- ProMED-PORT (1997) Latin America + Portuguese speaking countries
- ProMED-ESP (2001): Latin America + Spanish speaking countries
- ProMED-RUS (2005) Russia and former Russian speaking countries
- ProMED-FRA (2008): Francophone Africa
- ProMED-EAFR (2009): Anglaphone Africa
- ProMED-MENA (2014) Middle East/North Africa - English with Arabic summaries
- ProMED-SoAs (2014) South Asia – English
What has ProMED been talking about in the 1st 3 Quarters of 2018?

January – October 2018 Reports to ProMED*

*words represent # of reports, but word location does not always correspond to the exact location

Word cloud courtesy of ProMED’S Taryn Lorthe
HOW is ProMED?

- ProMED information flow

- Infectious Disease Outbreaks
- Acute Exposures to Toxins + Plants & Animals
ProMED information flow

- Media Reports
- Readers
- HealthMap
- Official Reports
- Proactive search

Carrion and Madoff, International Health 2017; 9:177–183
ProMED information flow

Receipt

Media Reports → ProMED Top Mod → Dissemination
Readers → ProMED Top Mod

Proactive search

HealthMap

Official Reports → ProMED Top Mod

Expert Subject Area Moderator

Outside Experts

Copy Editing & Technical Review

Review – Verification - Commentary

Carrion and Madoff, Int Health 2017; 9:177–183
First Reports

- 1996 - Cholera Manila, Philippines
- 1997 - Meningococcal meningitis in Vietnamese immigrants, Russia
- 1998 - Fatal hand, foot, and mouth disease in Malaysia
- 1999 - Yellow fever Bolivia
- 2000 - Anthrax-contaminated heroin, Norway
- 2001 Post 9/11 anthrax mail attacks, USA
- 2002 Measles Papua New Guinea
- 2003 Avian influenza Indonesia
- 2003 - Severe Acute Respiratory Syndrome (SARS), China → global
- 2004 - Avian Influenza, Thailand
- 2005 - Chikungunya - Mauritius and Reunion Island
- 2012 - Middle East Respiratory Syndrome (MERS), Saudi Arabia
- 2014 - Undiagnosed hemorrhagic fever, Guinea (Ebola)
- 2015 - Early Zika spread - the Americas
- 2016 - Highly Pathogenic Avian Influenza (HPAI), poultry in Europe
- 2017 - Severe H1N1 in Ghana
- 2017 - Human brucellosis Paraguay, veterinary students
FIRST REPORT - SARS

PNEUMONIA - CHINA (GUANGDONG): RFI
*****************************************************************************

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."

Source: ProMED-mail archives 10 February 2003
A new human coronavirus was isolated from a patient with pneumonia at the Virology Laboratory of Dr Soliman Fakeeh Hospital Jeddah Saudi Arabia.

The virus was isolated from sputum of a 60 year old male patient 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 isolate was initially tested for influenza virus A, influenza virus B, parainfluenza virus, enterovirus and adenovirus, with negative results. Testing with a panchorronavirus RT-PCR yielded a band at a molecular weight appropriate for a coronavirus. The virus RNA was tested also in Dr. 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.
Reporting outbreaks in an on-line world

- Informal surveillance: ProMED’s place in the ecosystem of disease surveillance
- Strive for accuracy AND timeliness
- Building quality means building collaborations
- Share processes and data
- Enhance access and lower barriers to submitting information
- *Trust, but verify!*
Improving Disease Surveillance

Gaps That Need to Be Addressed

- Delays in official reporting
- Capturing unusual disease events
- Limited reach of traditional systems
What is Innovative Surveillance?

In today’s world of rapid, electronic communication, you may get a report of a health event through an email, a blog post, an online media source, or an online innovative surveillance platform long before the event is detected, confirmed and reported by the formal surveillance system.
Innovation makes a difference

- Studies have shown a more than 50% reduction in time to detect an outbreak and for public communication of an outbreak, with the use of innovative disease surveillance methods in conjunction with traditional disease surveillance methods.

Enter.... EpiCore...
EpiCore Partners

- skollglobal threats fund
- ProMED INTERNATIONAL SOCIETY FOR INFECTIOUS DISEASES
- TEPHINET Training Programs in Epidemiology and Public Health Interventions Network
- HealthMap
What is EpiCore?

EpiCore links a worldwide member network of health professionals in order to provide verification of suspected or rumored disease outbreaks.

Crowd Sourcing
Secure Online Networking and Reporting System

Global community of human, animal and environmental health professionals verify disease outbreak information in geographic regions.
How Does EpiCore Work?
ProMED-Mail experts look for leads regarding possible outbreaks around the world.
When evidence of outbreak is found, ProMED experts send Requests For Information (RFI) to EpiCore members in geographic region
Members easily and quickly provide local expertise through secure online platform speeding outbreak verification.
Information then globally shared on ProMED-mail
1. EpiCore moderator needs more info

2. Creates RFI

3. Sends RFI to EpiCore Volunteers

4. EpiCore volunteer responds to RFI

5. Validation information shared
Important Confidentiality features
Permission Levels for Sharing One’s Response on Public Forum

Directly quote you and attribute it to you with name and title appearing in post (you must provide name and title in RFI)

Click: “Quote this response and attribute to me.”
Permission Levels for Sharing One’s Response on Public Forum

Quote your response but mask identifying information (identify information you would like masked)

Click: “Quote this response but mask any identifying information referenced in the response text and do not provide any details on my identity”
Permission Levels for Sharing One’s Response on Public Forum

Paraphrase response, avoiding words or phrases that might reveal your identity

Click: “Paraphrase/do not use direct quotes from this response, mask any identifying information referenced in the response text and do not provide any details on my identity.”
Then WHAT?

The ProMED-mail Moderator compiles all responses and posts to ProMED-mail for distribution to 86,000+ subscribers around the world.

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Rawalpindi's large hospitals are seeing hundreds of patients daily with acute respiratory tract infections (RTIs) with the onset of winter; 70-80 percent of the illnesses are upper RTIs, but nearly 20 to 30 percent are lower RTIs, including mild to severe pneumonia. 50 to 60 children with severe pneumonia per day are requiring hospitalization. The majority of patients with pneumonia we are told are infants around the age of 6 months. However, no etiologic agents had apparently been identified at the time of the report.

For a discussion of pneumonia in children, please see my moderator comments in prior ProMED-mail posts below. ProMED-mail thanks the responder for the above response to a request for information concerning identification of the etiologic agents responsible for this outbreak and if pediatric admissions were being placed more than 1 to a bed or isolate, a practice that would facilitate nosocomial transmission of infectious agents.
# EpiCore responses to RFI’s: examples

<table>
<thead>
<tr>
<th>RFI</th>
<th>Location</th>
<th>Time to response</th>
<th>Response information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cholera, # of cases</td>
<td>Lusaka, Zambia</td>
<td>10 minutes</td>
<td>Confirmed, 11 cases</td>
</tr>
<tr>
<td>CCHF suspected</td>
<td>Pakistan</td>
<td>&lt; 1 hour</td>
<td>Not confirmed</td>
</tr>
<tr>
<td>Cutaneous leishmaniasis #?</td>
<td>Kathmandu, Nepal</td>
<td>&lt; 2 hours</td>
<td>Confirmed, &gt;10 cases</td>
</tr>
<tr>
<td>HPAI, serotypes H5N8, H5N1?</td>
<td>Tehran, Iran</td>
<td>&lt; 3 hours</td>
<td>confirmed</td>
</tr>
<tr>
<td>Polio - ?WPV, cVDPV, VAPP</td>
<td>Gilgit, Pakistan</td>
<td>&lt;1 hour</td>
<td>Confirmed, WPV1</td>
</tr>
</tbody>
</table>

An EpiCore Snapshot
EpiCore members and posts

- 2326 Members in 145 Countries

- Total posts with EpiCore information provided: 445
  - 225 on the Global English language ProMED network Plus
  - 220 posts on ProMED Regional networks

As of 15 November 2018
EpiCore member Distribution

(as of 15 November 2018)

2326 Members in 145 Countries
Of 194 posts reviewed:

- 99 (51%) supported verification
- 56 (29%) provided additional information
- 23 (12%) refuted verification
- 16 (8%) provided no new information.

WHO are members?

Members Professional Background

- Human/Anim/Envir 7%
- Human/Environ 17%
- Human/Animal 7%
- Animal/Environ 2%
- Environmental 2%
- Animal 11%
- Human 54%
EpiCore 2

- Additional requesters
  - MSF
  - GeoSentinel
  - HealthMap
  - Plus more to come....
Detecting intentional events

- Good surveillance on the ground
  - Routine disease surveillance
  - Event based surveillance

- Good epidemiology to detect something different about the outbreak
Reports of intentional events

- 2001 Post 9/11 anthrax mail attacks, USA
- 2002 - Food poisoning, fatal - China (Nanjing) (02)
- 2003 - Food poisoning, intentional - China (Jiangsu)
- 2006 - Undiagnosed poisoning, human fatalities - Iraq
- 2007 - Thallium poisoning, intentional - USA ex Russia
- 2007 - Pet food fatalities, pets - USA, Canada, Mexico (03): melamine
- 2008 - Food poisoning, dumplings - Japan ex China
- 2008 - Melamine contaminated food products - Worldwide ex China
- 2008 - Shigellosis - Sweden: intentional exposure susp.
- 2011 - Poisoning, fatal - Mexico: (Guadalajara), cyanide
- 2011 - Poisoning, fatal, Coca-Cola product - China: (JL) pesticide susp.
Reports of intentional events (2)

- 2009 - Tritium contamination, water - India: (KA)
- 2009 - Sodium azide, coffee - USA: (MA)
- 2011 - Undiagnosed deaths - Taiwan (03): (NT), intentional poisoning,
- 2012 - HIV - USA: (MI) malicious intent
- 2012 - Anthrax parcel - Pakistan (IS)

- 2013 - Cyanide poisoning, elephants - Zimbabwe (02): (Hwange National Park)
- 2014 - Ricin - USA (08): (Washington DC,WI)
- 2014 Rodenticide poisoning, children - China (02): (YN) fatal
- 2015 - Ricin - UK
- 2016 - Anthrax - Kenya: foiled anthrax attack, susp ISIS
- 2018 Condor die-off - Argentina: poisoning susp.
Take away messages....
Think outside of the box!

but it's so peaceful here...
Food for thought

Beware of formalizing informal information sources...
Acknowledgments

- ProMED/ISID staff and supporters
- Our subscribers
- 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
- Past supporters
  - Oracle Corporation
  - Google.org
  - Gates Foundation
  - NTI
  - Rockefeller Foundation
Questions?

Comments?

Thank you!
Thank you

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