Addressing Challenges to Effective Information Flow: New Technologies in Web-based Surveillance

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Surveillance sans frontières:
Internet-based emerging infectious disease intelligence
Barriers to effective information flow

• Reluctance by individuals to report disease
• Delays in relaying diagnoses up the hierarchy
• Delay between tentative diagnosis and laboratory confirmation
• Delay in official statements
• Delay in recognizing a new, emerging, or unusual disease
Global Surveillance Capacity Assessment

Characterize global spatial-temporal trends in the timeliness of outbreak detection and reporting

\[
\Delta t_1 \\
\Delta t_2
\]
WHO confirmed outbreaks (1996-2009)

Figure 1. Geographical distribution of a selected subset of outbreaks confirmed by the World Health Organization (WHO) and reported in the “Disease Outbreak News” reports, 1996-2009. Points mark the reported origin of the outbreak, or if unknown, where there were the highest reported morbidity and mortality rates.
New International Health Regulations

Event shall be notified to WHO under the International Health Regulations

Sturtevant, Anema, Brownstein. Disaster Med. 2007
WHO's "Disease Outbreak News" reports:  http://www.who.int/csr/don/en/
Outbreak Timepoints

MEDIAN

- **Outbreak Discovery (n=276)**: 23 days (95% C.I. [18;30])
- **Public Communication (n=280)**: 32 days (95% C.I. [28;38.5])
- **Laboratory Confirmation (n=225)**: 35 days (95% C.I. [32;47])
- **WHO Report (n=281)**: 48 days (95% C.I. [40;56])
Time from outbreak start to:

Outbreak Discovery

Public Communication

![Graph A: Time to Outbreak Discovery](image1)

![Graph B: Time to Public Communication](image2)
Traditional public health reporting
Informal reporting
Barriers to effective information flow

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Source of outbreak news verified by WHO

GPHIN picked up 56% of 578 outbreaks subsequently verified by WHO
Informal Surveillance

- Abundant cheap/free resource
- Detailed local information
- Near real-time reporting
- Less susceptible to political pressure

Traditional Surveillance

- Lack of infrastructure
- Low level training
- Gaps in coverage
- Poor information flow

Zip through this: (1) don’t need to sell them on the approach; (2) all the things on the left apply on the right
Just previous interest
HealthMap Article Processing

Acquisition
>20,000 sites
Every hour; 24/7

Extraction
1800 disease patterns
5000 location patterns

Categorization
15 million phrases
91% accuracy

Aggregation
Text Matching
Similarity Score

Information extraction, syntactic representation of sentences
Case Study: 2009 H1N1
Vernaza: reporta agente municipal extraño brote epidémico que ha cobrado dos vidas

La funcionaria de La Gloria informó que el raro padecimiento ha afectado a 60 por ciento de sus tres mil habitantes con infecciones respiratorias.
Influenza A (H3N1) Reports

Source:
- Official Sources (WHO)

Category:
- Influenza A
- Influenza B
- Influenza C
- SARS
- Avian Influenza
- MERS
- Other

The New England Journal of Medicine

HealthMap

Official data obtained from WHO daily (Influenza A) updates. Historical data sources are a subset of reports from the HealthMap database. The case numbers shown are cumulative counts. HealthMap is a public website bringing together disparate data sources to achieve a unified view of the current global state of influenza.
Global spread of H1N1 with informal sources

USAID: PREDICT Project
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From Sue. Stats run in August 2010
Participatory Epidemiology
Reporting through the website

**Outbreak Missing?** Help us by adding it to the map.

Provide an eyewitness report
(something you personally know or heard about)
- **Headline:** Dead cows in park
- **Disease:** Undigested
- **Location:** in Pat. Town 1, State A
- **Email:**
- **Description:** Scores of dead cows.

Or
Share a news report
(a news article you read online)
Outbreaks Near Me – iPhone App

- Set location where you want to receive reports
- See all current outbreaks in your selected location
- Search and browse outbreak reports on the interactive map
- Set up the app to alert you with a notice automatically whenever an outbreak is occurring in your area.
- If you know of an outbreak not yet on the map, be the first to report it using the app’s unique outbreak reporting feature. You will be credited and your report will be featured on the website.
Outbreaks Near Me – iPhone App
Conclusion

- Informal surveillance systems like mass media surveillance complements traditional public health surveillance systems.
- HealthMap.org provides unified view of current global state of infectious diseases and effect on human and animal health.
- Participatory epidemiology may allow faster detection of an outbreak.

HealthMap works to overcome many limitations of Internet-based surveillance:

Data can also be leverage for epidemiological studies.
Internationalization → Localization

   Useful because of a new context for public health issues

Further supports English report bias

   greater population, numbers of media outlets, public health resources, and availability of electronic communication infrastructure.
Thank you!