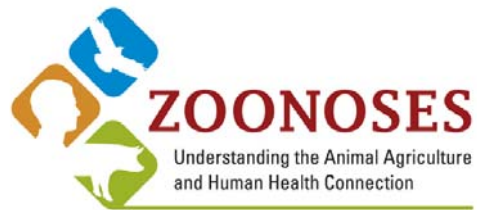




## Addressing Challenges to Effective Information Flow: New Technologies in Web-based Surveillance

Sumiko R. Mearu, DVM, MPVM  
Children's Hospital Boston, Harvard Medical School



Surveillance sans frontières:  
Internet-based emerging  
infectious disease intelligence



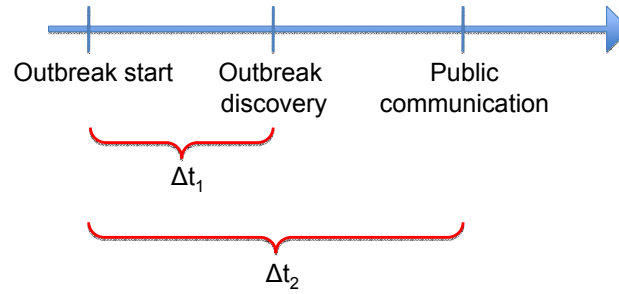
## Barriers to effective information flow

- 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



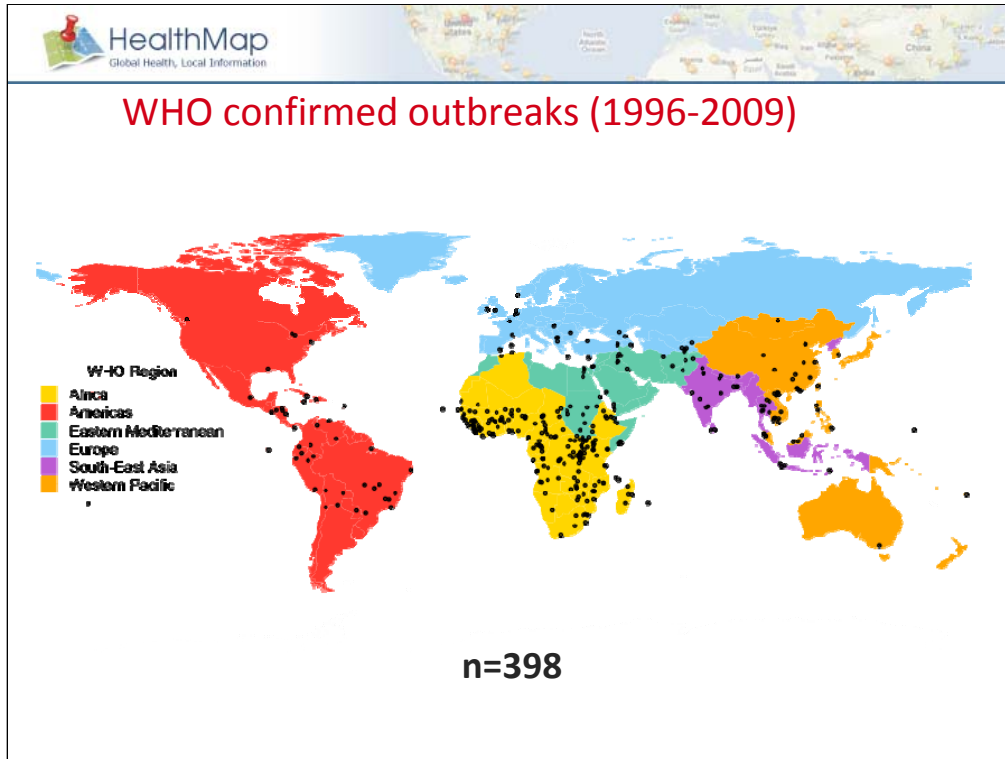
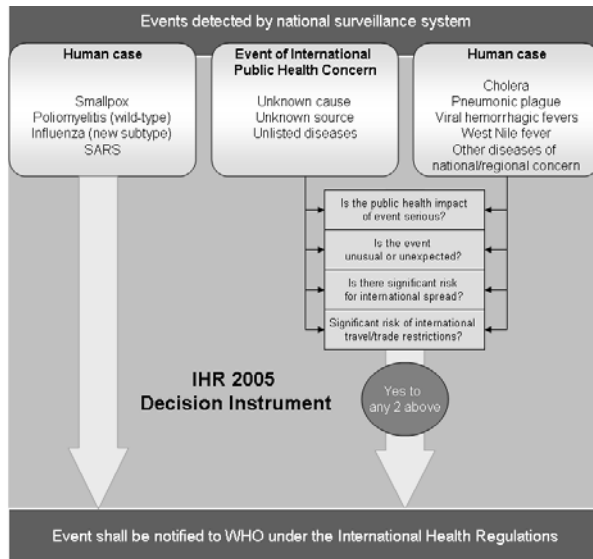


Figure 1. Geographical distribution of a selected subset of outbreaks confirmed by the World Health Organization (WHO) and reported in the “Disease Outbreak News” reports, 1996-2009. Points mark the reported origin of the outbreak, or if unknown, where there were the highest reported morbidity and mortality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



## New International Health Regulations



Sturtevant, Anema, Brownstein. Disaster Med. 2007

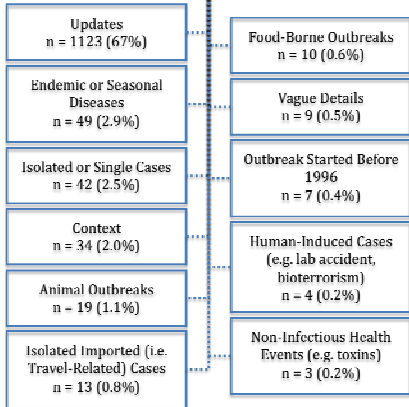


**All WHO Reports (Disease Outbreak News), 1996-2009**  
N = 1664

Included Reports  
n = 378 (23%)

Excluded Reports  
n = 1286 (77%)

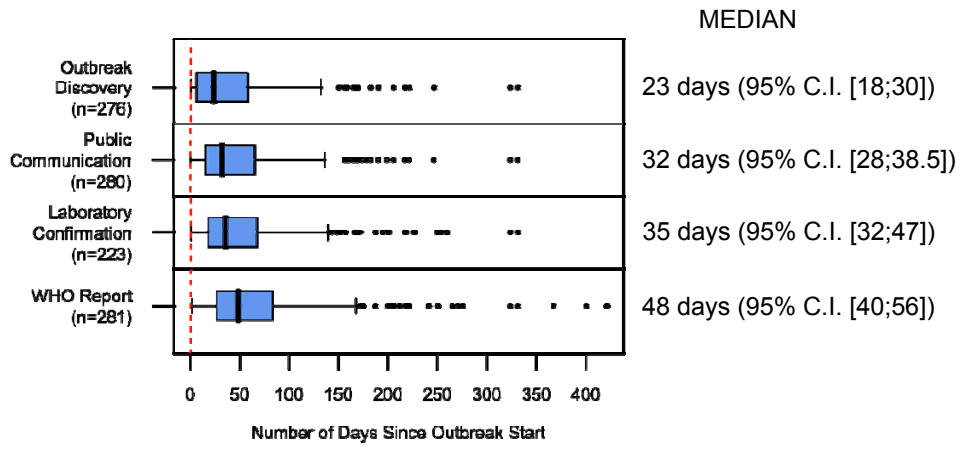
Outbreaks Analyzed  
N = 398



WHO's "Disease Outbreak News" reports: <http://www.who.int/csr/don/en/>

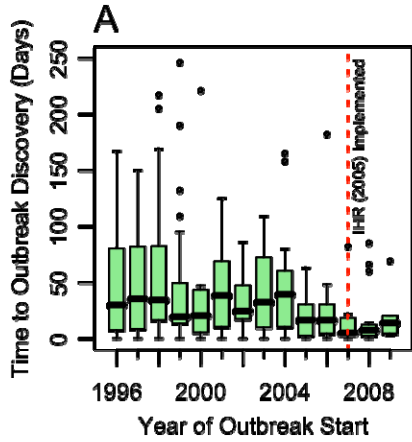


## Outbreak Timepoints

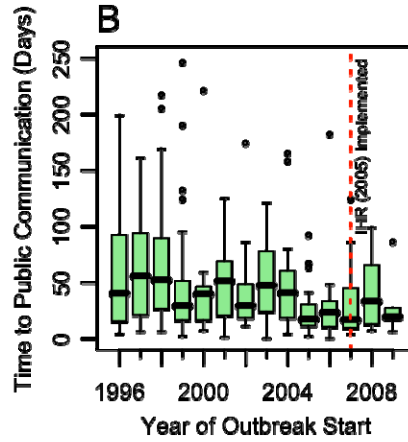




Time from outbreak start to:  
Outbreak Discovery



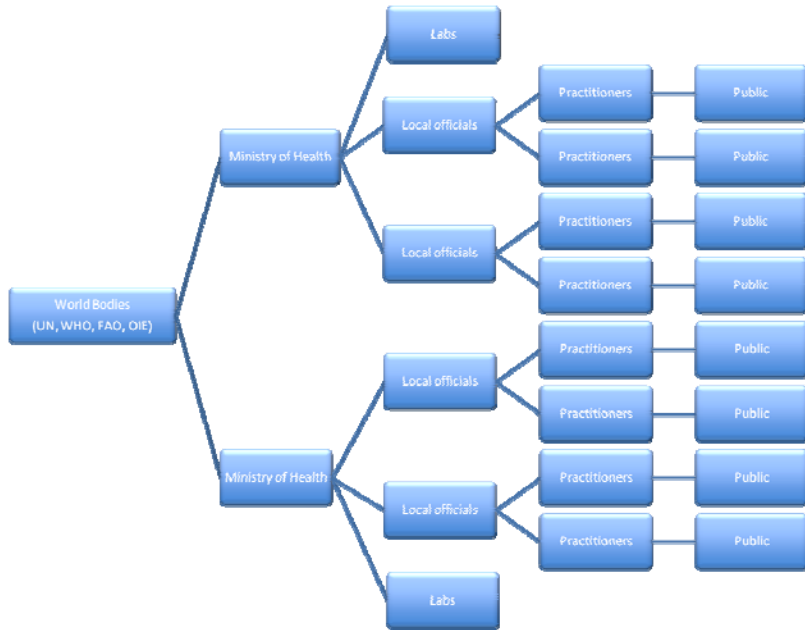
Public Communication







### Traditional public health reporting





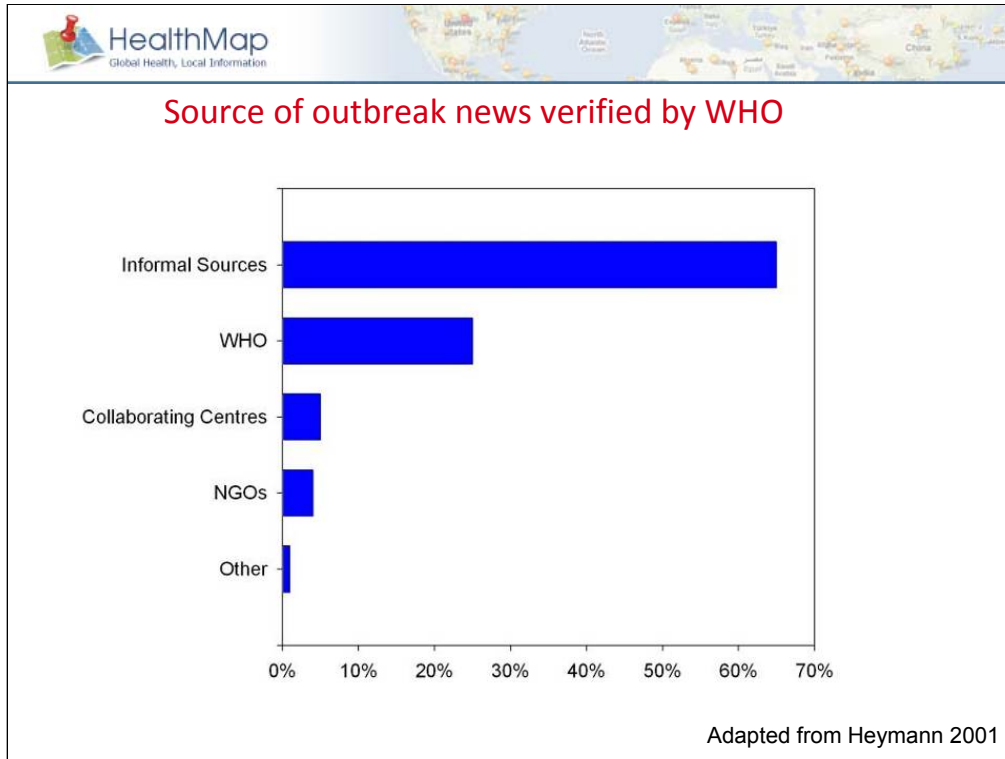
## Informal reporting





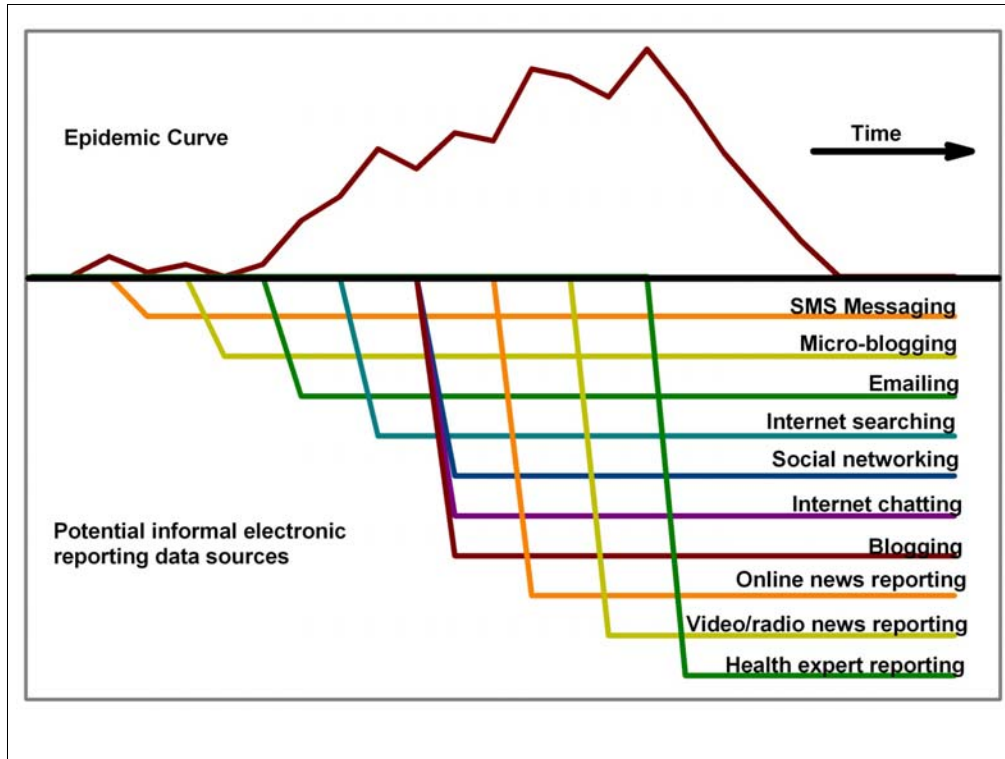
## Barriers to effective information flow



- 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



Initial source of reports of outbreaks 1998–2001.

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



### Traditional Surveillance

**Mortality Surveillance Form 1\***

Site: .....

Date from: Monday ..... To Sunday: .....

Total population at beginning of this week: .....

Births this week: ..... Deaths this week: .....


Arrivals this week (if applicable): ..... Departures this week: .....

Total population at end of week: ..... Total under 5 years population: .....

Immediate cause	0-4 yrs		5-99		Total
	male	female	male	female	
Acute lower resp. infection					
Cholera (suspected)					
Dysentery - bloody					
Dysentery - watery					
Injury - non-accidental					
Malaria					
Maternal death - direct					
Measles					
Meningitis (suspected)					
Necrotic (2-28 days)					
Other					
Unknown					
<i>Total by age and sex</i>					
<b>Underlying cause</b>					
AIDS (suspected)					
Malaria					
Maternal death - indirect					
Other					

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

### Informal Surveillance



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

Zip through this: (1) don't need to sell them on the approach; (2) all the things on the left apply on the right

HealthMap  
Global health, local information

Username: [ ] Password: [ ] Login Register | Forget Password? | HealthMap for your Smartphone [ ]

Search [ ] Advanced Search Full Screen [ ]

Map Satellite Earth Terrain

Outbreak Missing? Add it to the map

Google 2000 mi 2000 km

Quick Views

Activity Index: Low High Country Level Local/Province Level

Latest Alerts Worldwide Alerts Dengue Risk View HMCommunity

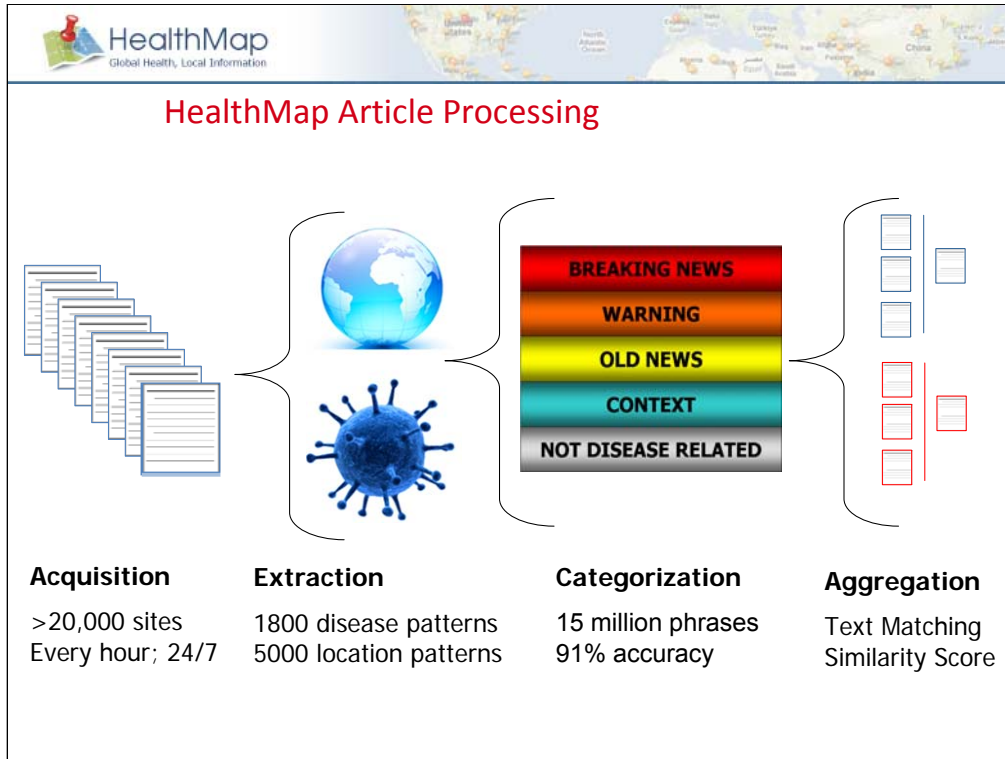
Alerts Now Showing

Source	Date	Summary	Disease	Location	Cases	Deaths	Related
[ ]	29 Apr	PRV/AH/EOR - Rabies, wildlife - USA (07) - fox, raccoon	Rabies	United States			[ ]
[ ]	29 Apr	Joe Arpaio under strict medical care for respiratory disease - A Day	Chronic/Non-Infectious Disease	United States			[ ]
[ ]	29 Apr	Association between glyemic index, glyemic load, and fructose with ...	Chronic/Non-Infectious Disease	United States			[ ]
[ ]	29 Apr	World Health Organization Dubious About 3-In-1 Flu Shots	Swine Flu H1N1	United States			[ ]

English | About | Mobile | Partners | Blog | [ ] [ ]

Last update: 29 Apr 2010 12:24 | Next update: 29 Apr 2010 13:24

Just previous interest



Information extraction, syntactic representation of sentences





## Case Study: 2009 H1N1



### Influenza A (H1N1) Reports

**Source**

Informal Sources (Media)  
 Official Sources (e.g. CDC, WHO)

[All HealthMap Sources »](#)

**Category**

Ruled Out  
 Suspected Cases  
 Suspected Deaths  
 Confirmed Cases  
 Confirmed Deaths

**Zoom to country**

Mexico



### Influenza A (H1N1) Virus, 2009 — Online Monitoring

*John S. Brownstein, Ph.D., Clark C. Freifeld, B.S., and Lawrence C. Madoff, M.D.*

[Portada](#) [Edición impresa](#) [Especiales](#) [Multimedia](#) [Servicios](#) [Escribanos](#)

Usted está aquí: [Portada](#) → [2009](#) → [04](#) → [01](#) → [Veracruz: reporta agente municipal extraño brote epidémico que ha cobrado dos vidas](#)

## Veracruz: reporta agente municipal extraño brote epidémico que ha cobrado dos vidas

[Enviar esta página a alguien](#)  
[Imprimir esta página](#)

**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 (H1N1) Reports

**Source**

Informal Sources (Media)  
 Official Sources (ie: CDC, WHO)

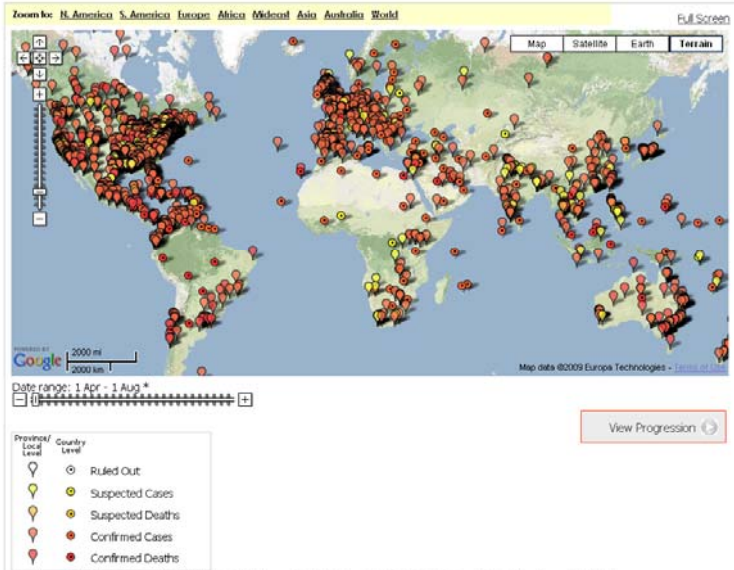
[All HealthMap Sources =>](#)  
[View H1N1 on HealthMap =>](#)

**Category**

Ruled Out  
 Suspected Cases  
 Suspected Deaths  
 Confirmed Cases  
 Confirmed Deaths

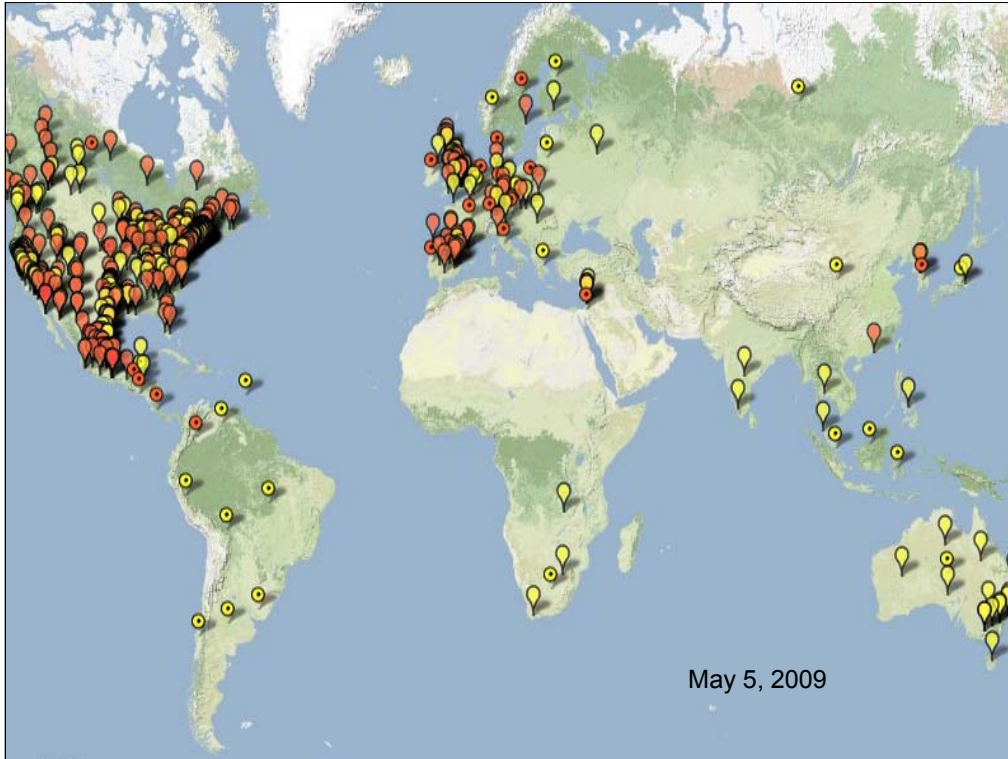
**Zoom to country**

[Afghanistan](#)  
[Albania](#)  
[Algeria](#)  
[American Samoa \(USA\)](#)  
[Antigua & Barbuda](#)  
[Argentina](#)  
[Australia](#)  
[Austria](#)  
[Azerbaijan](#)  
[Bahrain](#)  
[Bangladesh](#)  
[Barbados](#)  
[Belarus](#)  
[Belgium](#)

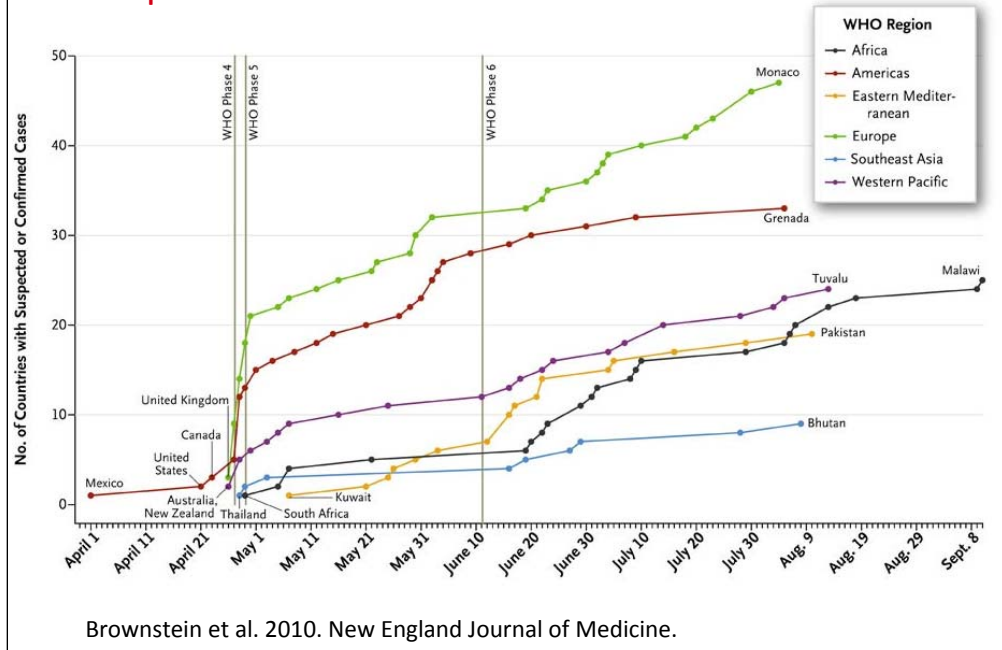


J.S. Brownstein, C.C. Freifeld, and L.C. Madoff (2009) Influenza A (H1N1) Virus, 2009 - Online Monitoring. New England Journal of Medicine

Official data is obtained from CDC and WHO daily Influenza A (H1N1) updates. Informal 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



# Global spread of H1N1 with informal sources



Brownstein et al. 2010. New England Journal of Medicine.

# USAID: PREDICT Project

The screenshot displays the USAID PREDICT HealthMap interface. At the top, there are logos for USAID PREDICT and HealthMap. Below the logos is a search bar and navigation options like 'Map', 'Satellite', 'Earth', and 'Terrain'. The main part of the interface is a world map with colored markers indicating health activity. Below the map, there are controls for 'Activity Index' (Low to High) and 'Country level' (Province or local level). A 'Quick Views' section shows 'All Regions', 'Congo Basin', and 'Latin America'. At the bottom, there is a table titled 'Alerts Now Showing' with columns for Source, Date, Summary, Disease, Location, Cases, Deaths, and Related.

Source	Date	Summary	Disease	Location	Cases	Deaths	Related
	29 Jun	福建发生麻疹暴发疫情... 2死	Not Yet Classified	Fujian Province		2	
	29 Jun	福建发生麻疹暴发疫情... 78 people were killed, 78...	Not Yet Classified	Fujian Province			
	29 Jun	麻疹病毒暴发通过死亡 78 人造成... 福建, 麻疹病毒...	Not Yet Classified	Fujian Province			
	29 Jun	福建, 麻疹病毒暴发造成持续不稳定... 2死...	Not Yet Classified	Fujian Province			



## Barriers to effective information flow

- Reluctance by individuals to report disease
- Delays in relaying diagnoses up the hierarchy
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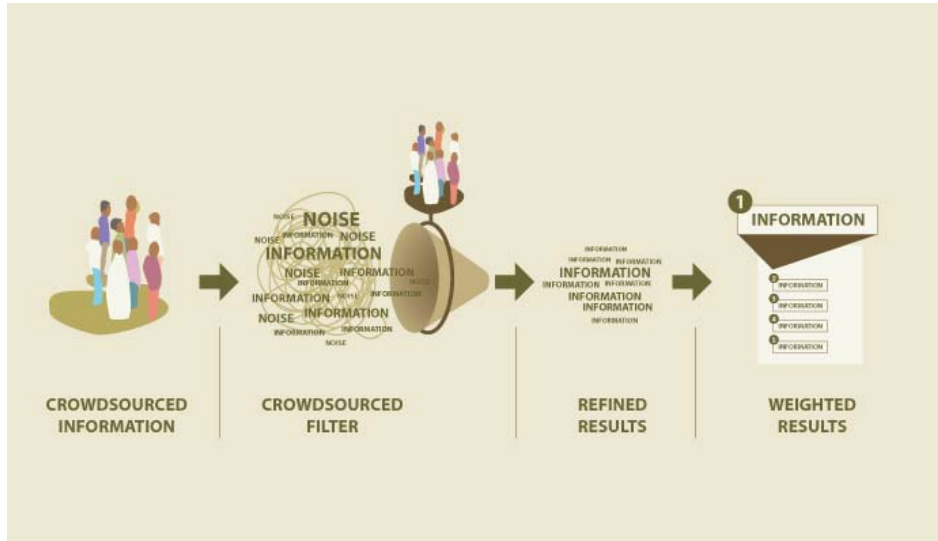


From Sue. Stats run in August 2010





## Participatory Epidemiology





## Reporting through the website

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

 **Online Form**  **Email**  **Voice or Text**  **SmartPhone App**

**Provide an eyewitness report**

(something you personally know or heard about)

Headline:

Disease:

Location:

Email:

Description:

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!**