

Tectonic shifts in the health information economy: Case studies in mining existing data for public health

John Brownstein, PhD

Children's Hospital Boston, Harvard Medical School





Children's Hospital Boston
Informatics Program

Harvard-MIT Division of
Health Sciences and Technology



How to measure population health?

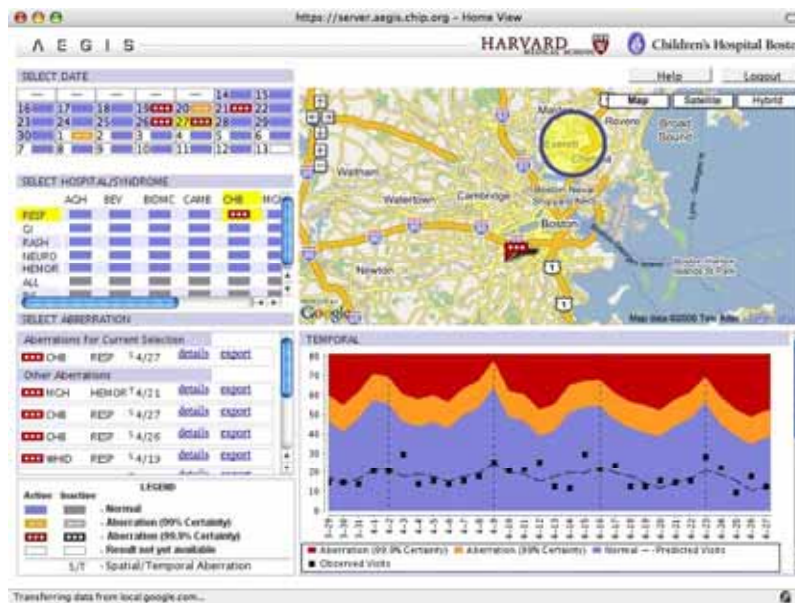


Standard Approaches: RCT and Observational Studies

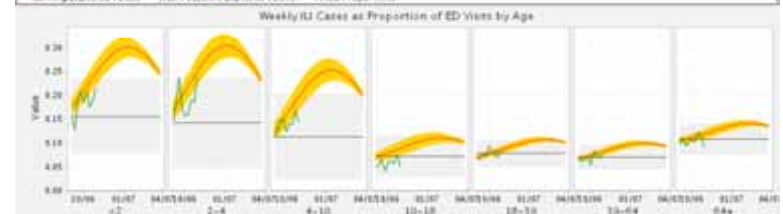
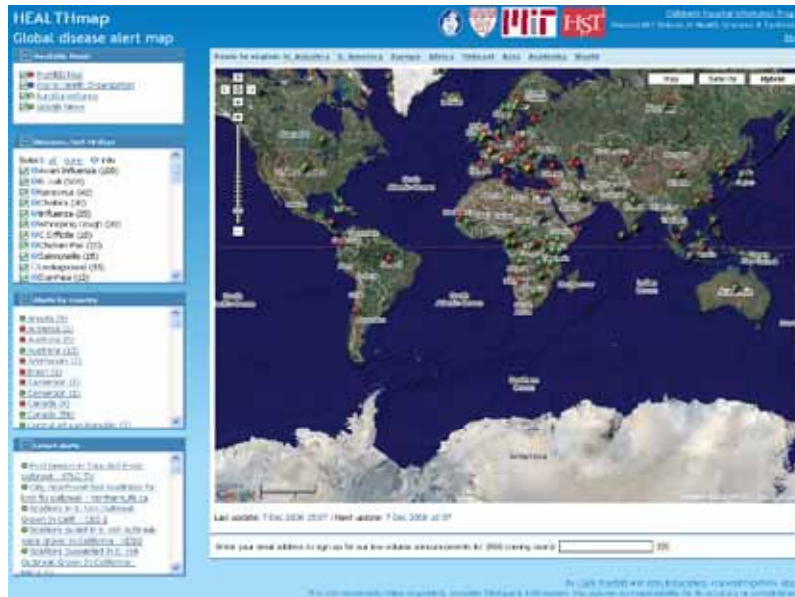
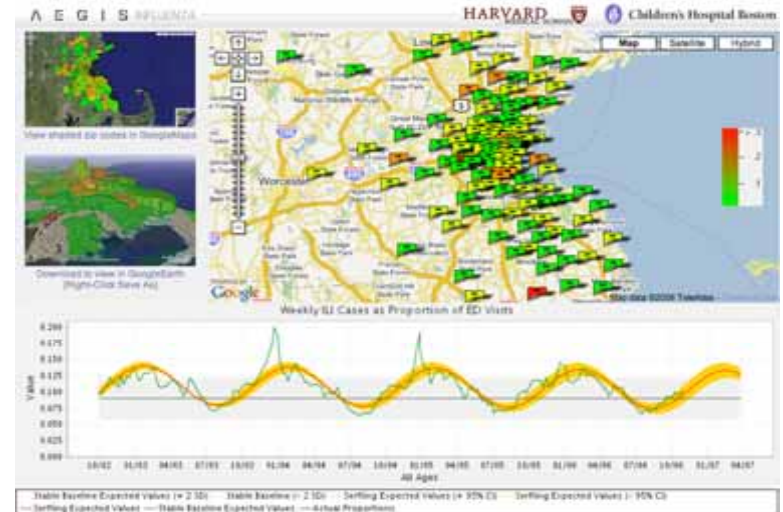
- Small sample sizes
- Detection of rare events is often impossible
- Rare diseases not usually considered
- Often cost prohibitive
- Difficulty in repurposing data
- Not geared to vulnerable populations
- Data not available in real-time or near real-time

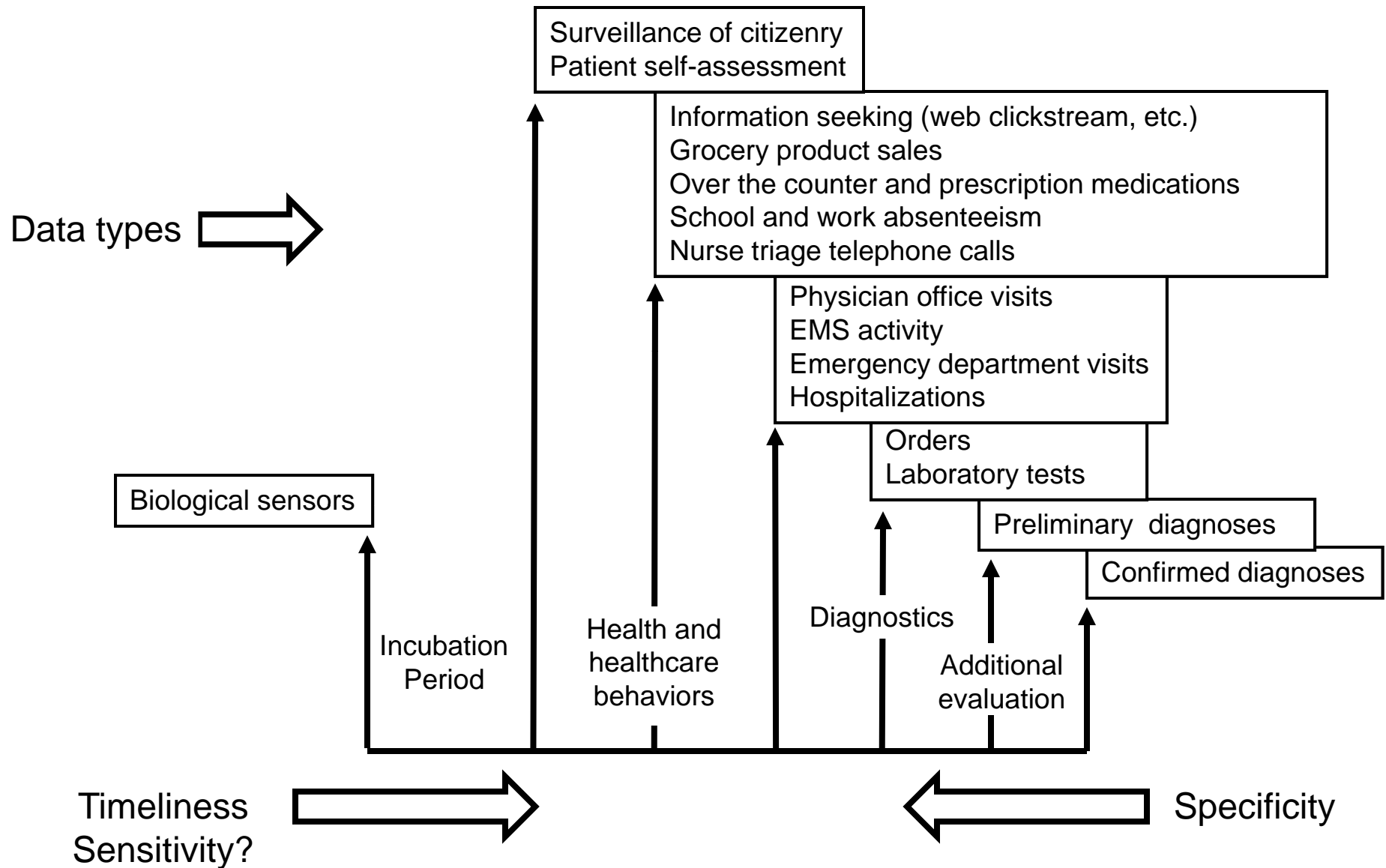


Real-time Population Health Monitoring



Transferring data from local google.com...







Non-traditional Health care data sources

- Emergency department chief complaints
- International Classification of Disease (ICD) codes
- Text-based notes
- Laboratory data
- Radiological reports
- Physician reports



Non traditional non-healthcare data sources

- Retail sales data
- 911 operators
- Call triage centers
- School absenteeism
- Animal surveillance
- Internet-based reports
- Patient self-assessment



Children's Hospital Boston
Informatics Program

Harvard-MIT Division of
Health Sciences and Technology



How to measure population health?

Non-traditional healthcare data



Case study: Challenge of Drug Safety

- Premarketing maximize likelihood that approved drugs are safe and effective
- Issues: many small, short term RCT means missing occurrence of rare but serious adverse drug events, drug interactions, late events, pregnancy, different effects in subgroups
- Challenge of early detection relies on US postmarketing system



Goals of pharmacovigilance

- Early and reliable detection of problem drugs
- Characterization of magnitude of impact



Pharmacovigilance and EMR

- Accumulating evidence suggests critical insights can be realized from monitoring large clinical databases
- Analytical epi studies of large exposed patients clearly outweigh current federal system for collected information
- Need for automated real-time denominator based methods that is capable of capturing rare events
- Existing electronic medical record databases means that exposure and outcome data can be linked without much extra cost or invasion of privacy

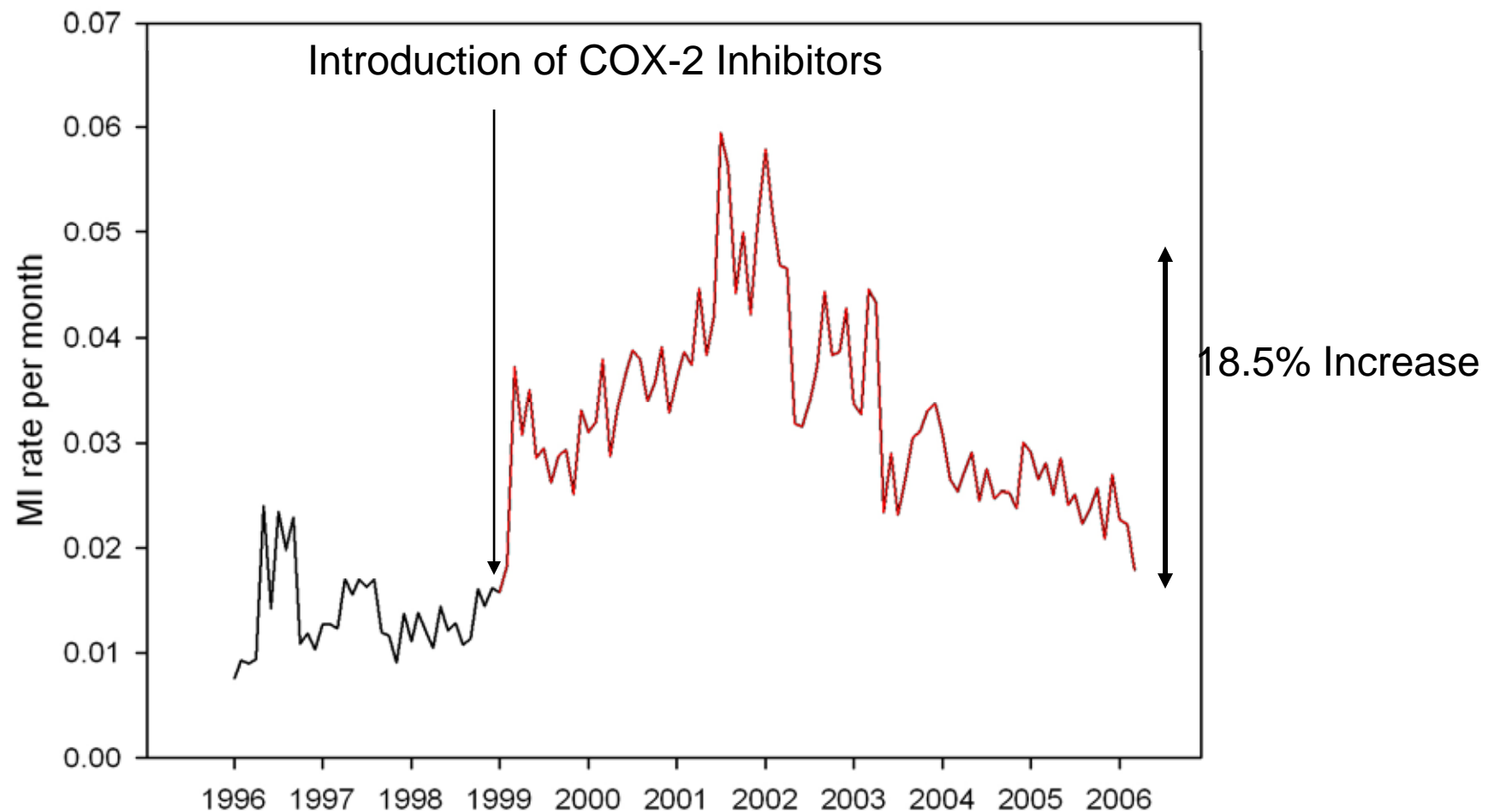


Yearly trends in MI Partners Healthcare (1997-2005)



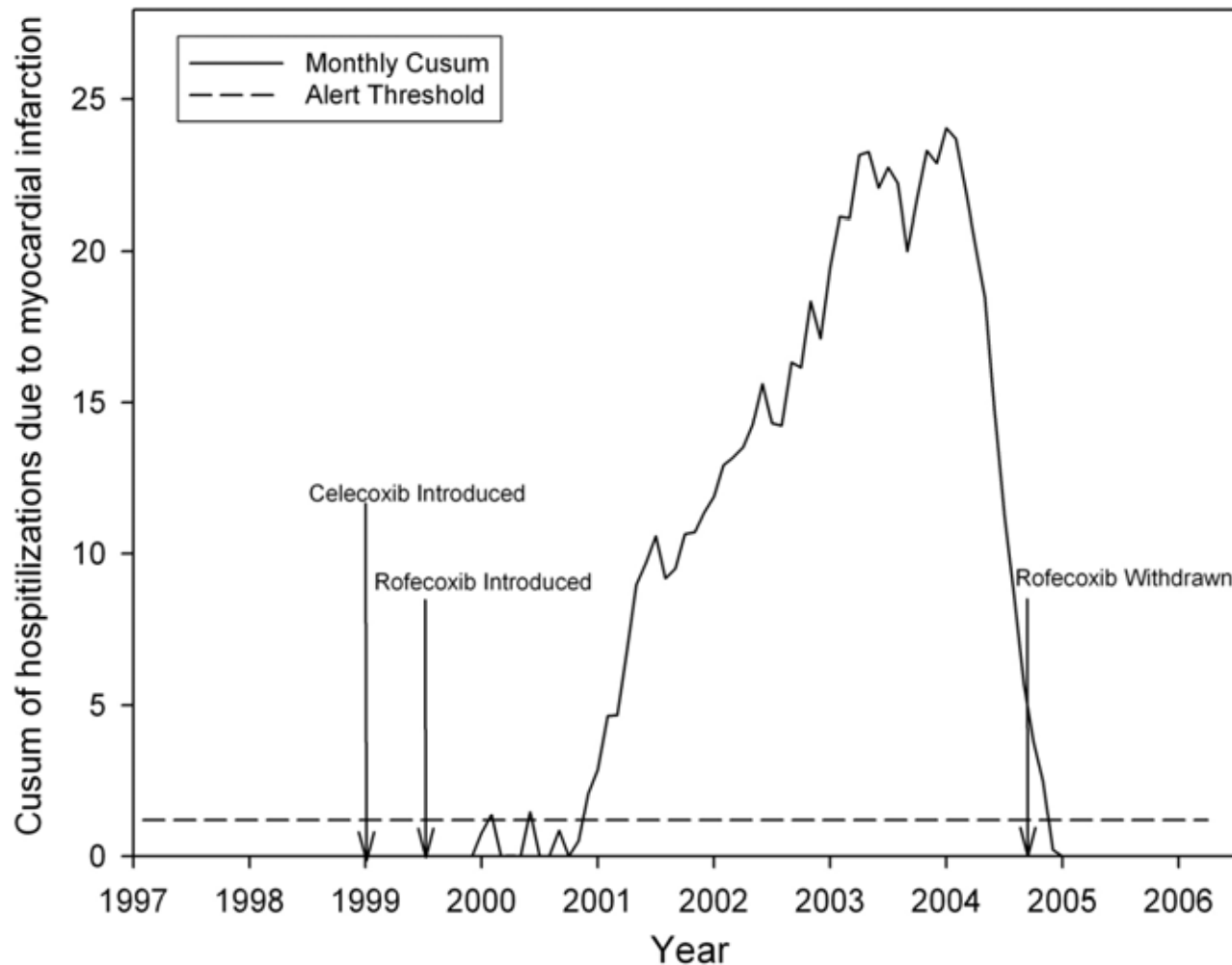


Monthly trends in Myocardial Infarction: Sudden Increase





Signal Detection

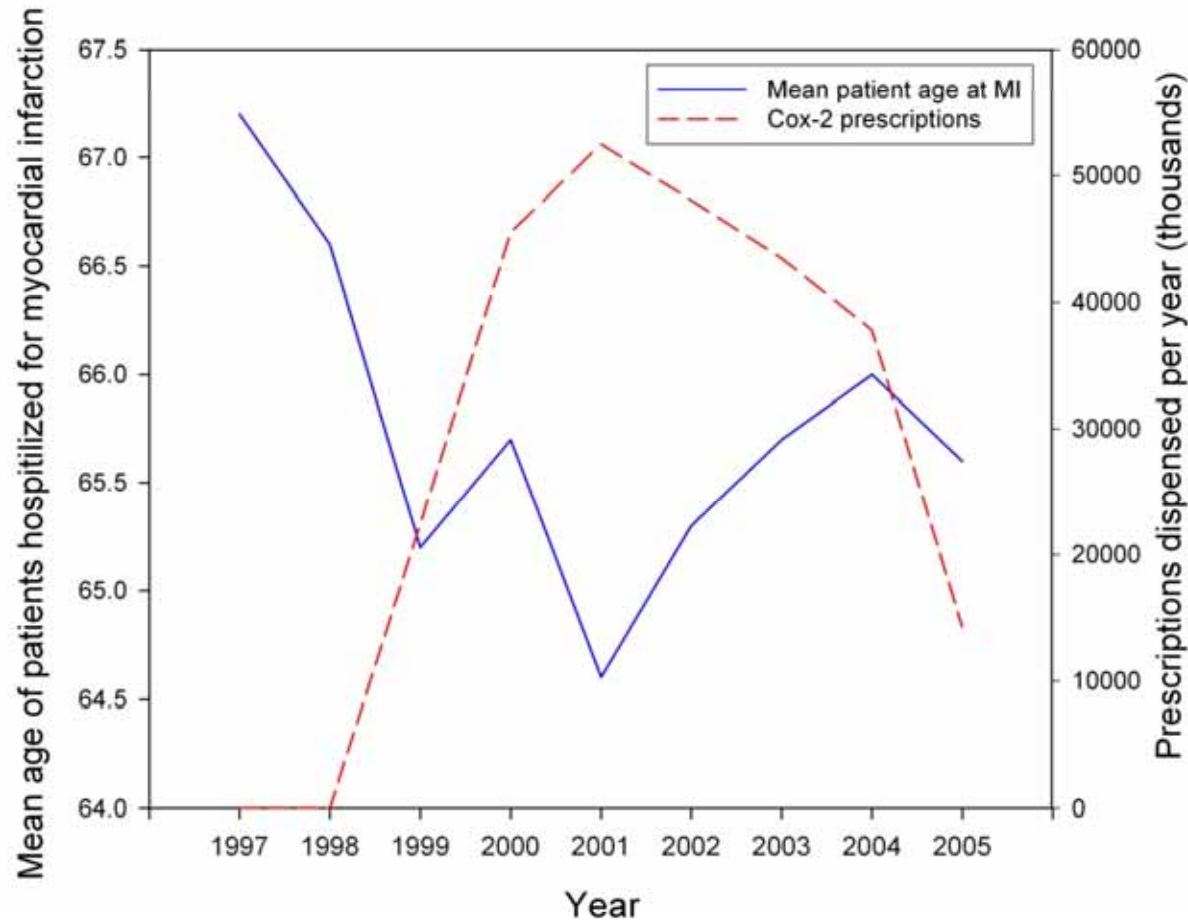


First signal:

- 1 year after Celecoxib
- 8 months after Rofecoxib



Effect on patient age



- Negative association between mean age at MI and prescription volume
- Spearman correlation - 0.67, $P < 0.05$



Partners i2b2 Pharmacovigilance Initiative

Methodology Goals

- To develop model that enables retrospective identification of events in defined patient cohort
- Identify a method for identifying patients receiving their care and prescriptions at Partners (to identify event if occurs)
- Provides framework for identifying patients in prospective manner for real-time analysis



US Population with Diabetes

Table 1—U.S. population (in thousands) and percent of U.S. population with diabetes, 2007

	Total U.S. population	With diagnosed diabetes		With undiagnosed diabetes		Total with diabetes*	
Total population*	301,736	17,486	5.8%	6,640	2.2%	24,126	8.0%
Race/ethnicity							
Non-Hispanic white	199,091	11,403	5.7%	4,520	2.3%	15,923	8.0%
Non-Hispanic black	37,002	2,775	7.5%	699	1.9%	3,474	9.4%
Non-Hispanic other	20,101	1,076	5.4%	317	1.6%	1,393	6.9%
Hispanic	45,541	2,231	4.9%	1,104	2.4%	3,335	7.3%
Sex							
Male	148,744	8,543	5.7%	3,113	2.1%	11,656	7.8%
Female	152,992	8,943	5.8%	3,528	2.3%	12,471	8.2%
Age (years)							
<18	73,878	157	0.2%	35	0.1%	192	0.3%
18–34	70,373	964	1.4%	669	1.0%	1,633	2.3%
35–44	43,356	1,686	3.9%	1,174	2.7%	2,860	6.6%
45–54	43,838	3,443	7.9%	1,327	3.0%	4,770	10.9%
55–59	18,235	2,307	12.7%	756	4.1%	3,063	16.8%
60–64	14,323	2,261	15.8%	775	5.4%	3,036	21.2%
65–69	10,690	1,879	17.6%	850	8.0%	2,729	25.5%
≥70	27,042	4,788	17.7%	1,055	3.9%	5,843	21.6%
Insurance							
Private	169,886	7,057	4.2%	3,018	1.8%	10,075	5.9%
Government	91,794	8,997	9.8%	2,891	3.1%	11,888	13.0%
Uninsured	40,055	1,432	3.6%	731	1.8%	2,163	5.4%

Source: Combined information from the 2004–2006 NHIS, 2004 NNHS, 1999–2004 NHANES, and the U.S. Census Bureau population estimates for 2007.

*Numbers do not necessarily sum to totals because of rounding.

ADA: Economic Costs of Diabetes in the U.S. in 2007. Diabetes Care. 31:596, 2008



FDA Approved Medications for Type 2 Diabetes - 2008

Approved Antidiabetes Medications in the United States.			
Medication*	Route of Administration	Year of Introduction or FDA Approval	Efficacy as Monotherapy, Measured as a Reduction in the Glycated Hemoglobin Concentration <i>percentage points</i>
Insulin	Parenteral	1921	≥2.5
Inhaled insulin	Pulmonary	2006	1.5
Sulfonylureas	Oral	1946	1.5
Biguanides	Oral	1957	
Metformin†	Oral	1995	1.5
Alpha-glycosidase inhibitors	Oral	1995	0.5–0.8
Thiazolidinediones	Oral		0.8–1.0
Troglitazone‡	Oral	1997	
Rosiglitazone	Oral	1999	
Pioglitazone	Oral	1999	
Glinides	Oral	1997	1.0–1.5
GLP analogues	Parenteral	2005	0.6
Amylin analogues	Parenteral	2005	0.6
DPP-IV inhibitors	Oral	2006	0.5–0.9

* GLP denotes glucagon-like peptide, and DPP-IV dipeptidyl peptidase IV.

† Metformin has been available in other countries since 1957 but was approved in the United States in 1995.

‡ Troglitazone was approved in 1997 but was withdrawn from the market in 2000 because of hepatotoxicity.

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812

JUNE 14, 2007

VOL. 356 NO. 24

Effect of Rosiglitazone on the Risk of Myocardial Infarction and Death from Cardiovascular Causes

Steven E. Nissen, M.D., and Kathy Wolski, M.P.H.

ABSTRACT

BACKGROUND

Rosiglitazone is widely used to treat patients with type 2 diabetes mellitus, but its effects on cardiovascular morbidity and mortality has not been determined.

METHODS

We conducted searches of the published literature, the Web site of the Food and Drug Administration, and a clinical-trials registry maintained by the drug manu-

facturer. From the Cleveland Clinic, Cleveland, address reprint requests to Dr. Nissen at the Department of Cardiovascular Medicine, Cleveland Clinic, 9500 Euclid Ave., Cleveland, OH 44186, or at nissen.roscof@ccf.org.

This article is copyrighted as indicated in the article. Reuse of AHA journals is permitted.

In the rosiglitazone group, as compared with the control group, the odds ratio for myocardial infarction was 1.43 (95% confidence interval [CI], 1.03 to 1.98; $P=0.03$), and the odds ratio for death from cardiovascular causes was 1.64 (95% CI, 0.98 to 2.74; $P=0.06$).

CONCLUSIONS

Rosiglitazone was associated with a significant increase in the risk of myocardial infarction and with an increase in the risk of death from cardiovascular causes that had borderline significance. Our study was limited by a lack of access to original source data, which would have enabled time-to-event analysis. Despite these limitations, patients and providers should consider the potential for serious adverse cardiovascular effects of treatment with rosiglitazone for type 2 diabetes.



Effect of Rosiglitazone on the Risk of Myocardial Infarction and Death from Cardiovascular Causes

Table 4. Rates of Myocardial Infarction and Death from Cardiovascular Causes.

Study	Rosiglitazone Group <i>no. of events/total no. (%)</i>	Control Group <i>no. of events/total no. (%)</i>	Odds Ratio (95% CI)	P Value
Myocardial infarction				
Small trials combined	44/10,285 (0.43)	22/6106 (0.36)	1.45 (0.88–2.39)	0.15
DREAM	15/2,635 (0.57)	9/2634 (0.34)	1.65 (0.74–3.68)	0.22
ADOPT	27/1,456 (1.85)	41/2895 (1.42)	1.33 (0.80–2.21)	0.27
Overall			1.43 (1.03–1.98)	0.03
Death from cardiovascular causes				
Small trials combined	25/6,845 (0.36)	7/3980 (0.18)	2.40 (1.17–4.91)	0.02
DREAM	12/2,635 (0.46)	10/2634 (0.38)	1.20 (0.52–2.78)	0.67
ADOPT	2/1,456 (0.14)	5/2895 (0.17)	0.80 (0.17–3.86)	0.78
Overall			1.64 (0.98–2.74)	0.06



EMR Pharmacoepi Study

- Inclusion criteria: Patient is on a diabetes medication
- Analyzing patients Outpatient Encounter or Inpatient Encounter over 6 month intervals
- Characterize patients
 - Age, Gender, Prior cardiovascular disease, use of hypertensive Meds, use of hyperlipidemic Meds, Outpatient insulin, Charlson score, Creatinine, Hba1c, Race, insurance
- For each 6 month period
 - Patient must have inpatient/outpatient visit
 - Determine whether prescribed:
 - ✦ Rosiglitazone, Metformin, Sulfonylurea, Pioglitazone
- Follow patients longitudinally
 - Earliest time period that pt meets cohort definition
 - Analyze patient observation periods until: Death, Myocardial Infarction (IC9-410.x), End of Study or gap in care



Drug Exposure: Preliminary Results

- Total T2D patient- 6 month periods between 1/1/2000 – 12/31/2006:
 - **159,604 periods (from 34,278 patients)**
- Total patient-6 month periods on Rosiglitazone:
 - **8,707 periods (4,274 patients)**
 - **2,888 mono-therapy (1,909 patients)**
 - **1,936 with metformin alone**
 - **1,709 with sulfonylurea alone**
 - **2,174 with all three**
- Total patient-6 month periods on Metformin
 - **48,713 periods (18,162 patients)**
 - **28,630 mono-therapy (12,774 patients)**
- Total patient-6 month periods on Sulfonylurea:
 - **40,694 periods (17,157 patients)**
 - **20,838 mono-therapy (11,435 patients)**

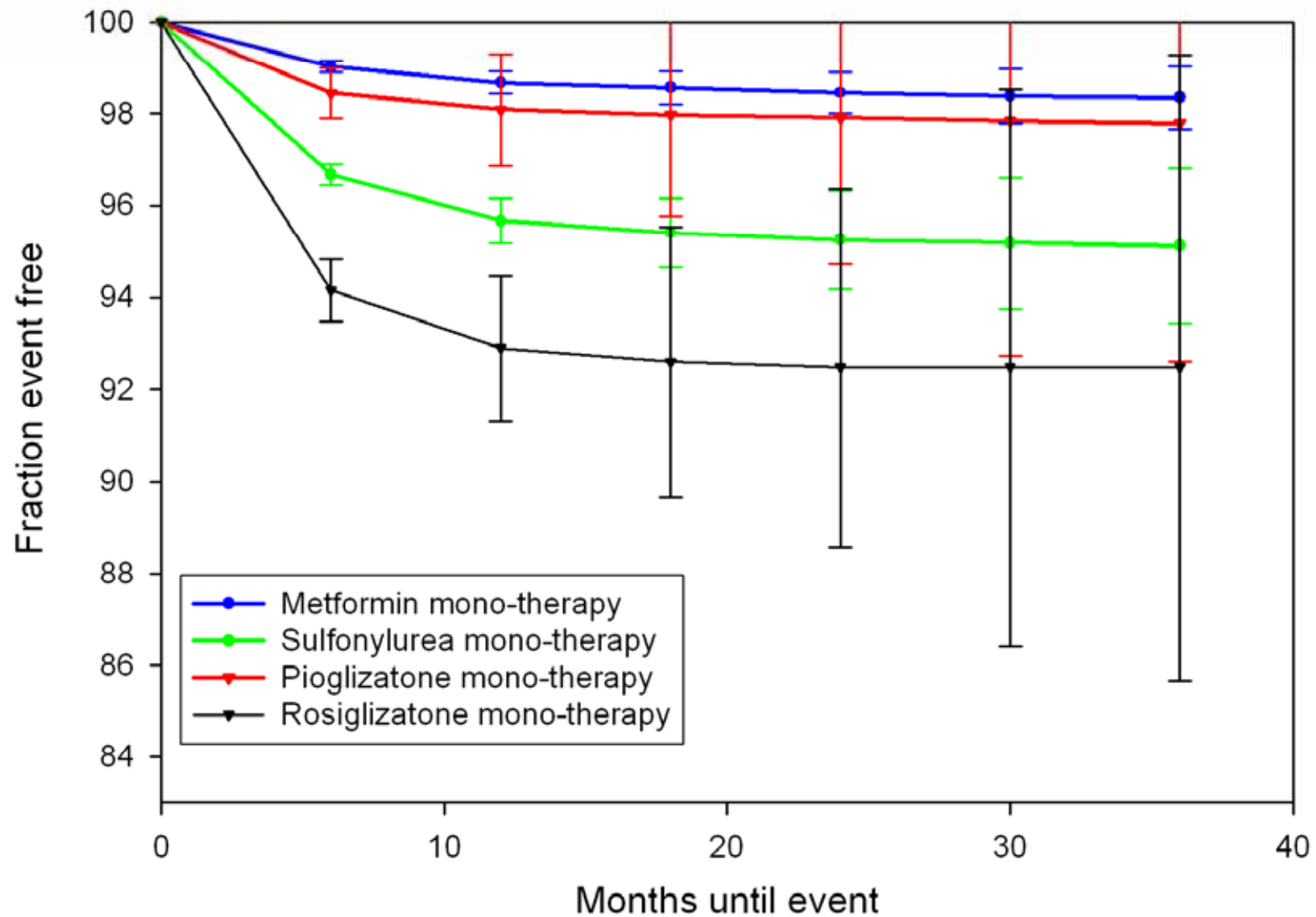


Pharmacovigilance Rosiglitazone Study Event Identification in relation to Drug Exposure

- **Total events**
 - 5,108 MI events (64 per 1000 patient-years)
- **Total events associated with Rosiglitazone:**
 - 477 MI events (110 per 1000 patient-years)
 - 203 MI events on mono-therapy (141 per 1000 patient-years)
- **Total events associated with Metformin**
 - 1,544 MI events (63.4 per 1000 patients-years)
 - 721 MI events on mono-therapy (50 per 1000 patients-years)
- **Total events associated with Sulfonylurea:**
 - 2,405 MI (118 per 1000 patients-years)
 - 1512 MI events on mono-therapy (145 per 1000 patient-years)



Time to event





Diabetes Mellitus Avandia Study Modeling Strategy

- Fit generalized linear models (GLM)
- Poisson distribution
- Exposure time as offset
- Accounts for overdispersion
- Model:
 - Univariate
 - Full Coverage Model (Only variables with data on each individual)
 - Comprehensive Model (All 11 variables)



Model Results

● Rosiglitazone vs Metformin:

- Crude RR: 3.0 (95% CI 2.7-3.3)
- Comprehensive Adjusted RR: 2.5 (95% CI 2.2-3.0)

● Rosiglitazone vs Sulfonylurea:

- Crude RR: 1.0 (95% CI 0.9-1.2)
- Comprehensive Adjusted RR: 1.2 (95% CI 1.0-1.5)

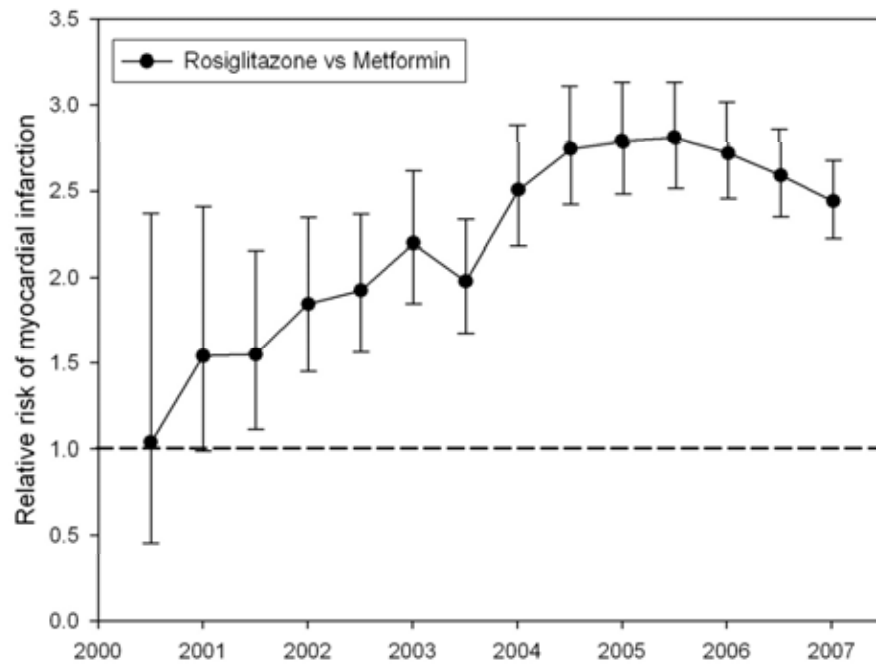
● Rosiglitazone vs Pio:

- Crude RR: 1.5 (95% CI 1.2-1.9)
- Comprehensive Adjusted RR: 1.6 (95% CI 1.2-2.3)

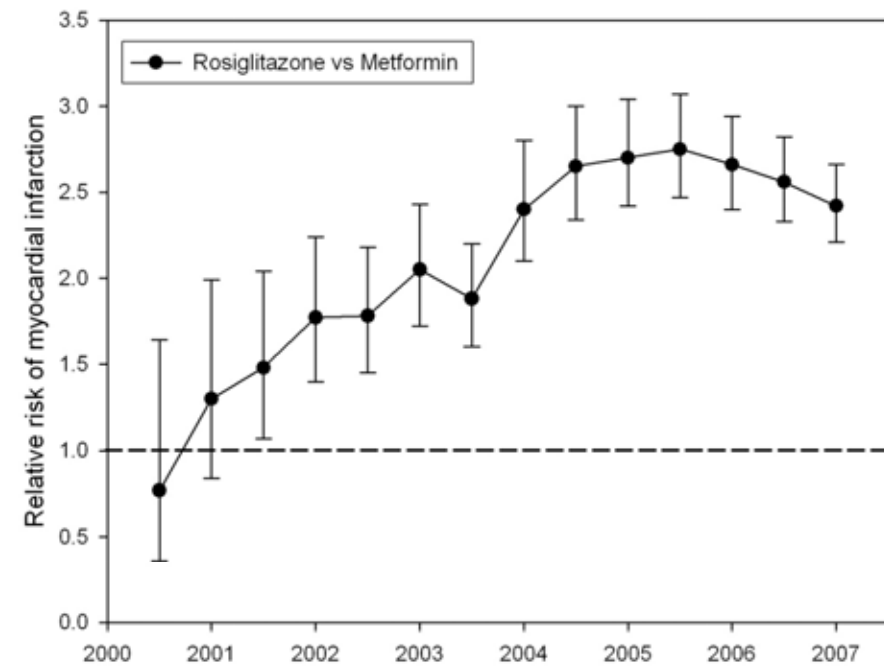


Prospective Surveillance

Initial Model



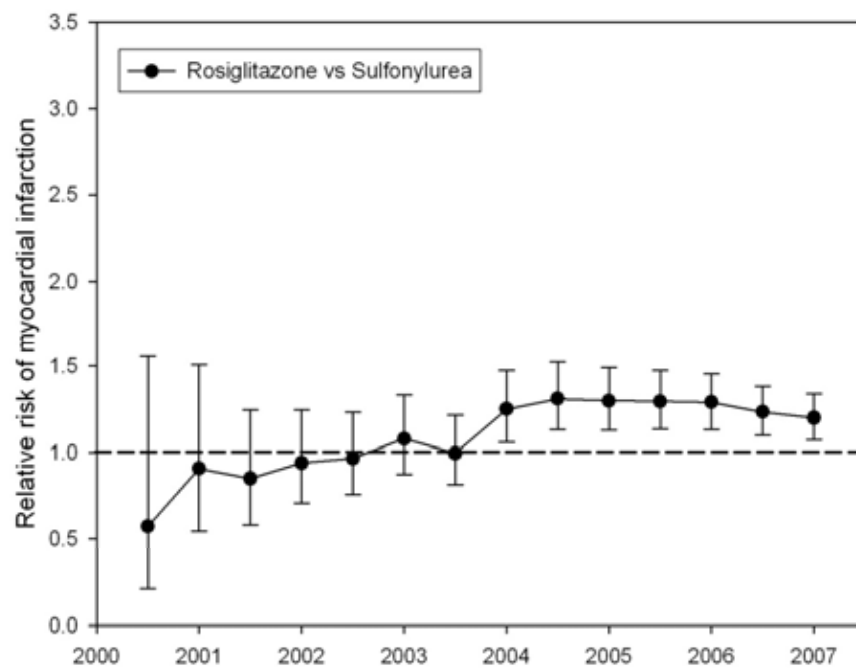
Full Coverage Model



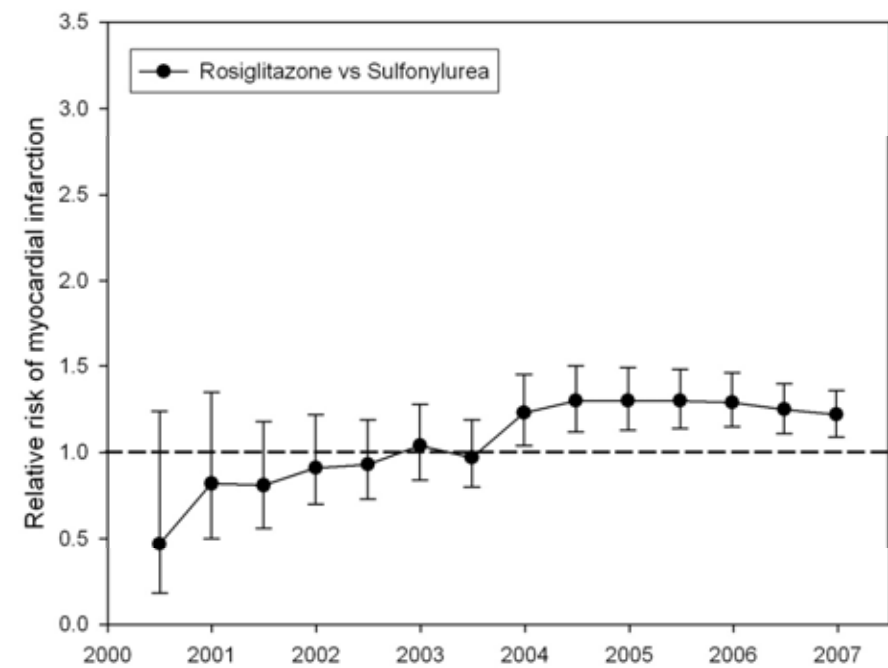


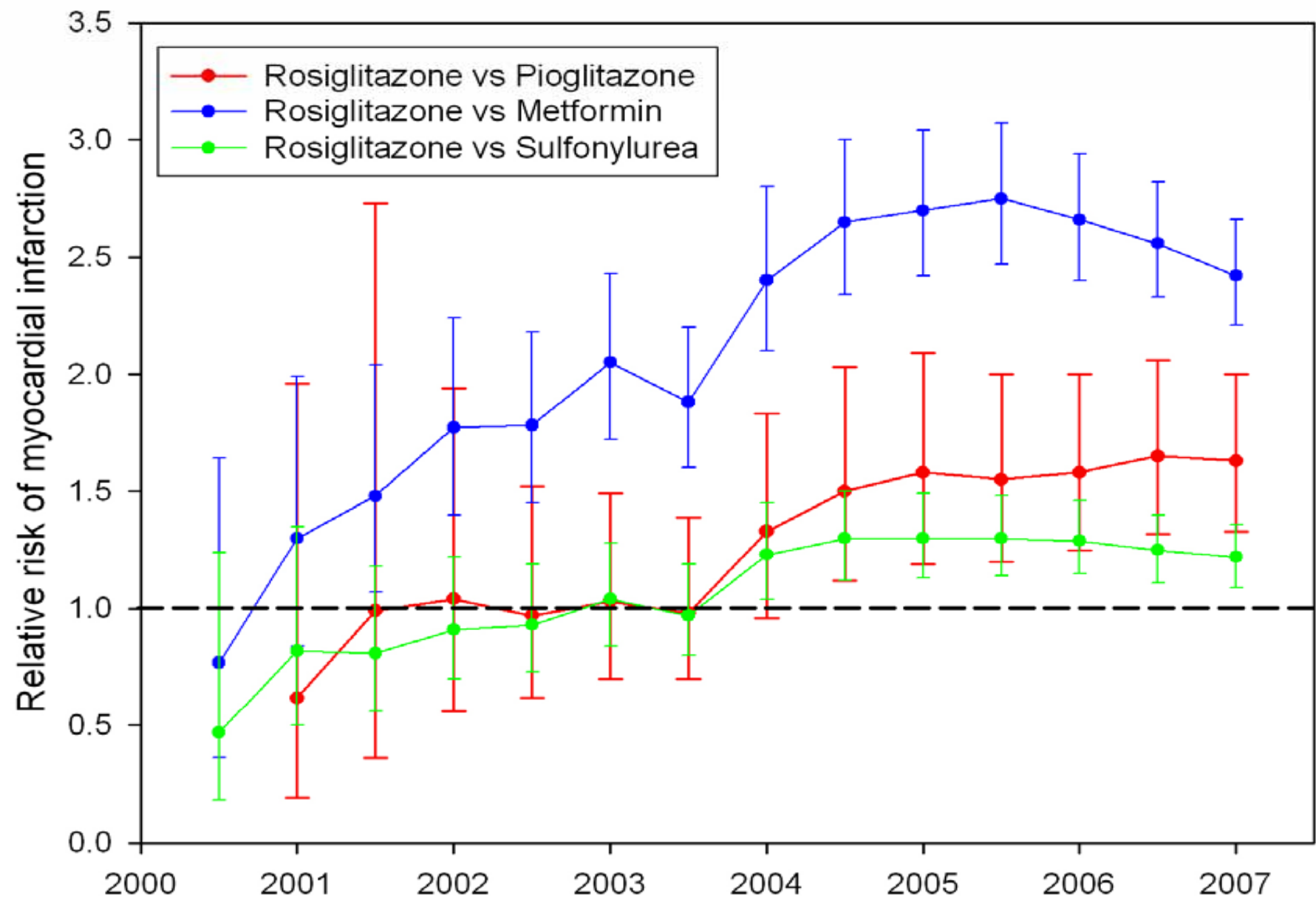
Prospective Surveillance

Initial Model



Full Coverage Model







Study findings

- Despite model assumptions, identified potential CV risk of rosiglitazone based on real-world population
- Confounding by indication → pio results provide confidence
- Risk is consistent with other studies
 - RR against Sulfonylurea of 1.2 → same as NEJM meta-analysis, but higher than others
 - RR against Metformin of 2.5 → higher than other studies
 - Trend is similar to McAfee et al with increased risk when comparing to metformin but results in that study were not significant
 - RR against Pio of 1.6 → consistent with recent Gerritis paper (showed 22% reduction in AMI for PIO)
- EMRs as an innovative approach to rapid safety signal detection



Ongoing Research Challenges

- Much electronic information is in free text
- Medical record data are not complete
- Data quality
- Relationship to RCT data
- Patient Privacy

The screenshot displays the i2b2 website, which is a National Center for Biomedical Computing. The header includes the i2b2 logo and the tagline "Informatics for Integrating Biology & the Bedside". A navigation bar lists links: About Us, Disease Targets, Resources, Events, Training, News, Working with Us, Publications, and Links. The main content area is divided into two sections: "Resources" and "The Hive".

Resources

- Overview
- The Hive
- Genomic Resources
- Computational Tools
- Data Sets
- Methodologies Compendium
- How to list
- De-identification Center

The Hive

The most important challenge of i2b2 is to disseminate the computational tools, methodologies, biomedical data sets and educational materials widely within the biomedical and computational research communities. To do so we have committed to make all the resources freely available to all interested parties. In this section you will find access to all of these. We would appreciate referencing i2b2 if you do choose to use these resources. The preferred method of citation or reference is provided in each subsection. Please note that for some resources (e.g. software) the use of the resource requires accepting a specific (e.g. OpenSource) license. Please read the particulars of each license to see how it might impact your current and future use.

i2b2 Hive

Hover over cells below to view resources

The diagram shows a central "File Repository" cell connected to several other cells: "Project Management", "Ontology Management", "Annotating Genomic Data #1", "Data Repository (CNC)", "Natural Language Processing", and "Annotating Genomic Data #2". A red box highlights the "Natural Language Processing Cell" with the text: "This cell manipulates text reports to extract specific terms and knowledge from them. These concepts are then used to achieve various representations of the data." Below this, a link says "Click to view the followings:" followed by icons for PDF, XML, CSV, and XLS.



Next Steps

- NLP approaches to augment drug exposure identification
- Experiment with other drug-event associations
- Relevance networks to look at all comparisons and identify unknown associations
- Implementing methodology and visualization prospective monitoring



Children's Hospital Boston
Informatics Program

Harvard-MIT Division of
Health Sciences and Technology

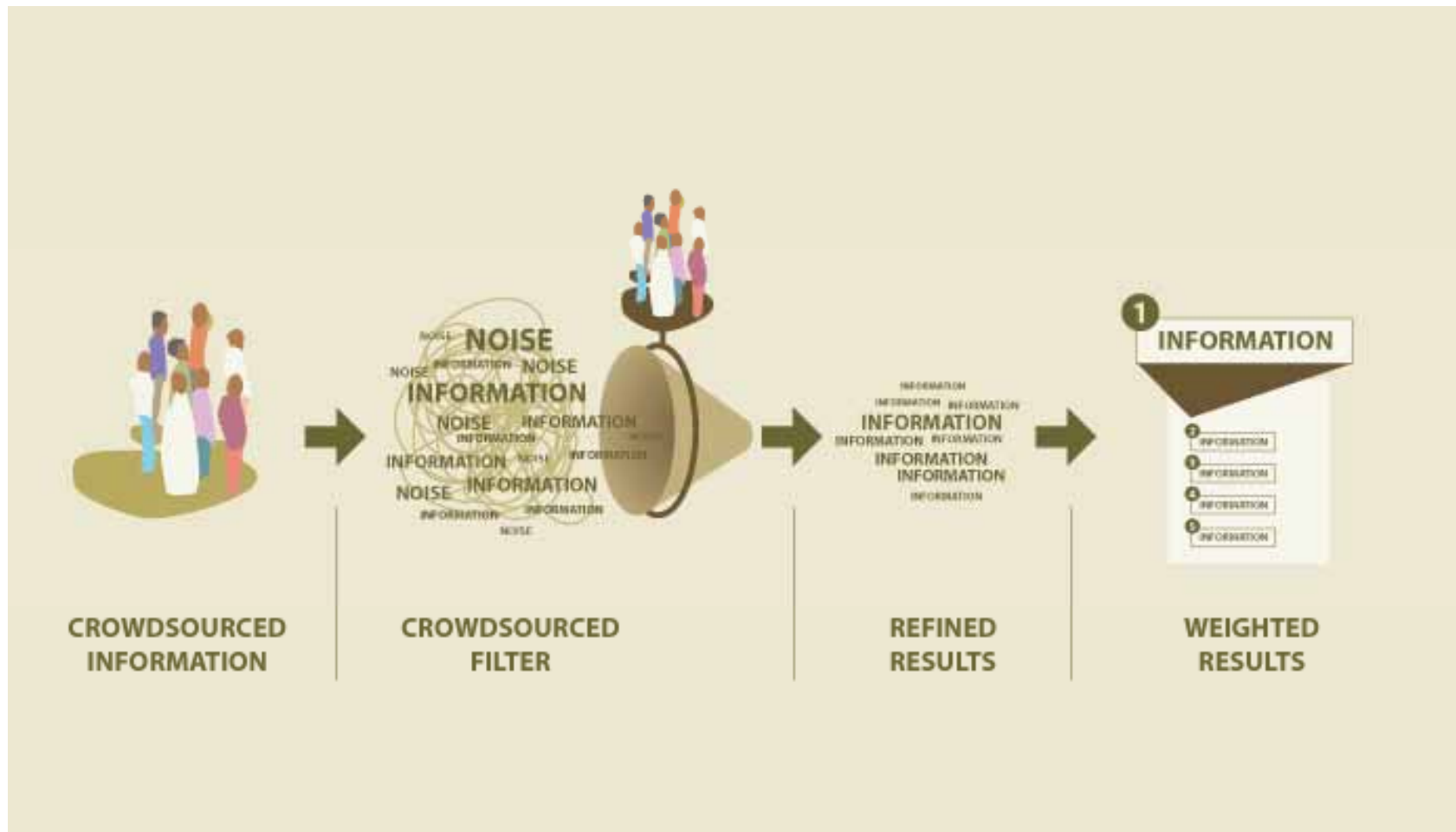


How to measure population health?

Non-traditional non-healthcare data



gathering population data outside healthcare





Case Study: Emerging threat of infectious diseases

- Breakdown of public health measures
- Drug and pesticide resistance
- Unsuccessful vaccine development
- Environmental change
- Human demographics and behavior
- International travel and commerce (ie: wildlife)

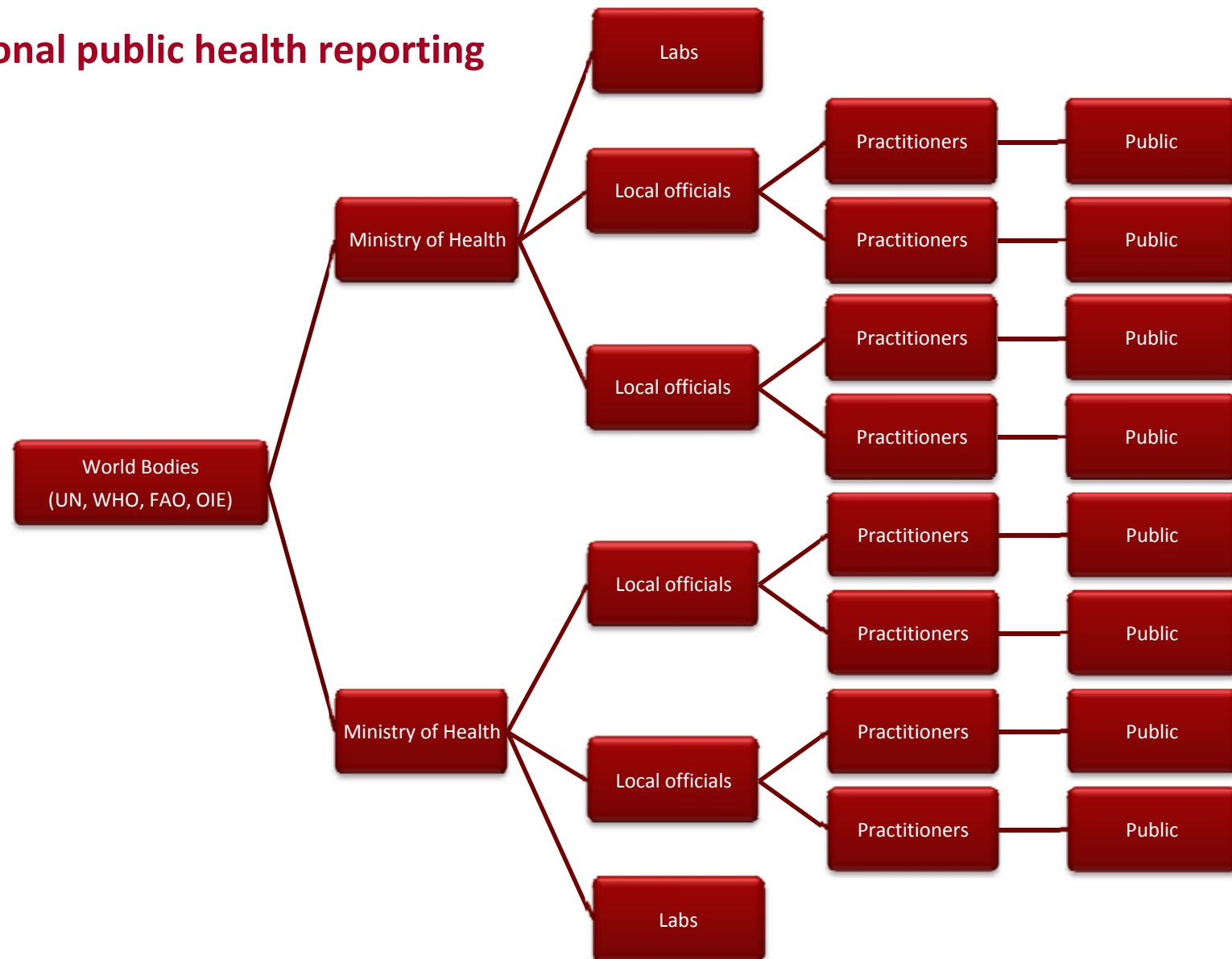


Public Health Surveillance

- Need for evidence-based decisions for implementation and targeting of control activities
- Challenge outside the scope and budget of traditional surveillance systems



Traditional public health reporting





Informal reporting





Influenza A (H1N1) Reports



Influenza A (H1N1) Virus, 2009 — Online Monitoring

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

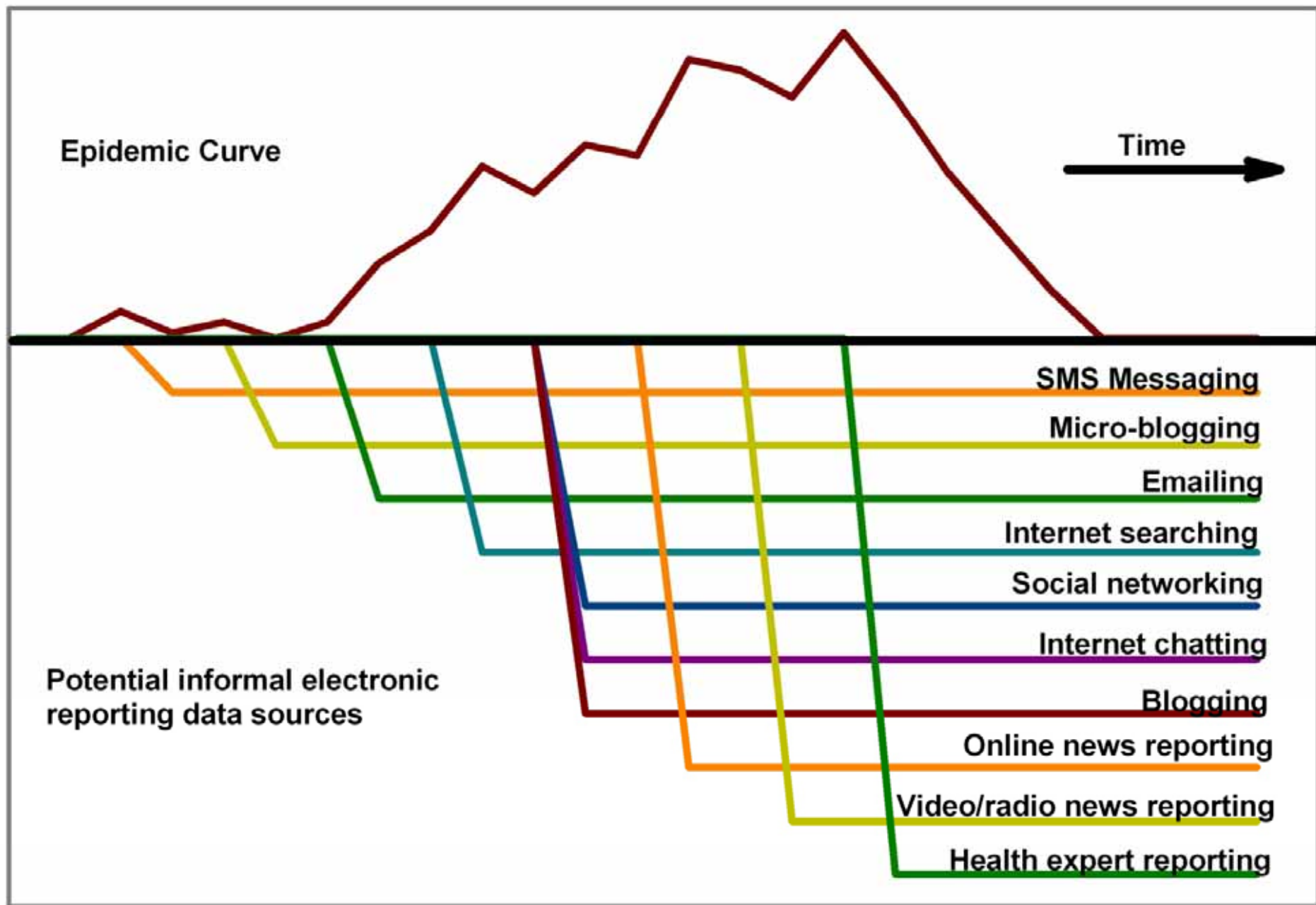
[Portada](#) [Edición impresa](#) [Especiales](#) [Multimedia](#) [Servicios](#) [Escribanos](#)

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.





HealthMap

Global Disease Alert Map

English | Español | Français | Русский | 中文

[About](#) | [Blog](#) | [Donate](#) | [Store](#) | [Feedback](#)

Feeds

Select: [all](#), [none](#)

- ☒ ProMED Mail
- ☒ ProMED MBDS
- ☒ World Health Organization
- ☒ EuroSurveillance
- ☒ Google News
- ☒ Moreover Technologies
- ☒ Wildlife Disease Node
- ☐ ProMED Español
- ☐ Google News Español
- ☐ ProMED Français
- ☐ Google News Français
- ☐ ProMED Русский
- ☐ Google News Русский
- ☐ Google 资讯

Diseases, last 30 days

- Select: [all](#), [none](#) [info](#)
- ☒ Avian Influenza (471)
 - ☒ Salmonella (312)
 - ☒ Cholera (189)
 - ☐ Not Yet Classified (127)
 - ☒ Influenza (114)
 - ☒ Dengue Fever (112)
 - ☒ Measles (58)
 - ☒ Meningitis (47)
 - ☒ Listeriosis (41)
 - ☒ Other Animal Disease (41)
 - ☒ Ebola (36)
 - ☒ Norovirus (35)
 - ☒ Rabies (35)

Alerts by country

- Zoom to country:
- [United States \(367\)](#)
 - [China \(165\)](#)
 - [Canada \(106\)](#)
 - [United Kingdom \(66\)](#)
 - [Zimbabwe \(61\)](#)
 - [Australia \(44\)](#)
 - [Vietnam \(40\)](#)
 - [India \(40\)](#)
 - [South Africa \(39\)](#)
 - [Philippines \(33\)](#)
 - [Indonesia \(32\)](#)
 - [Nigeria \(24\)](#)
 - [Egypt \(20\)](#)

Zoom to: [N. America](#) [S. America](#) [Europe](#) [Africa](#) [Mideast](#) [Asia](#) [Australia](#) [World](#)

[Full Screen](#)



Date range: 14 Jan - 12 Feb

Latest alerts

- [山西洪洞县-猪蓝耳病疫情 - 生物通](#)
- [U-17: в юношеской сборной России эпидемия гриппа - Хоккей на ...](#)
- [Vets warn of deadly dog disease outbreak in Midwest - KARE](#)
- [СМИ: Майкла Джексона поразила опасная инфекция - bigmir.net](#)
- [Champaign County child affected by recent Salmonella outbreak - ...](#)
- [Cuatro centro de cultivos de salmones confirman brote de virus ISA - ...](#)
- [ЗА МАССОВОЕ ОТРАВЛЕНИЕ СТУДЕНТОВ В ПОДМОСКОВЬЕ ПРИШЛОСЬ ОТВЕТИТЬ ...](#)
- [Un programme d'actions communautaires contre la grippe aviaire ...](#)
- [Вспышка менингита в Индии унесла жизни 165 человек - МедНовости](#)
- [Bird flu outbreaks hit some districts in Central Java, Indonesia](#)
- [Listeria Contamination in Queso Fresco, Fresh Cheese](#)
- [Hundreds of poultry die from bird flu virus in Yogyakarta province](#)

Last update: 12 Feb 2009 12:10 | Next update: 12 Feb 2009 13:10

Legend

- Country level
- Province or local level
- Heat Index:
Low High [info](#)
- [More info...](#)
- [Related Alerts](#)
- Translated by Google Translate
- Alerts of potential international significance



Enter your email to sign up for HealthMap's low-volume announcements list

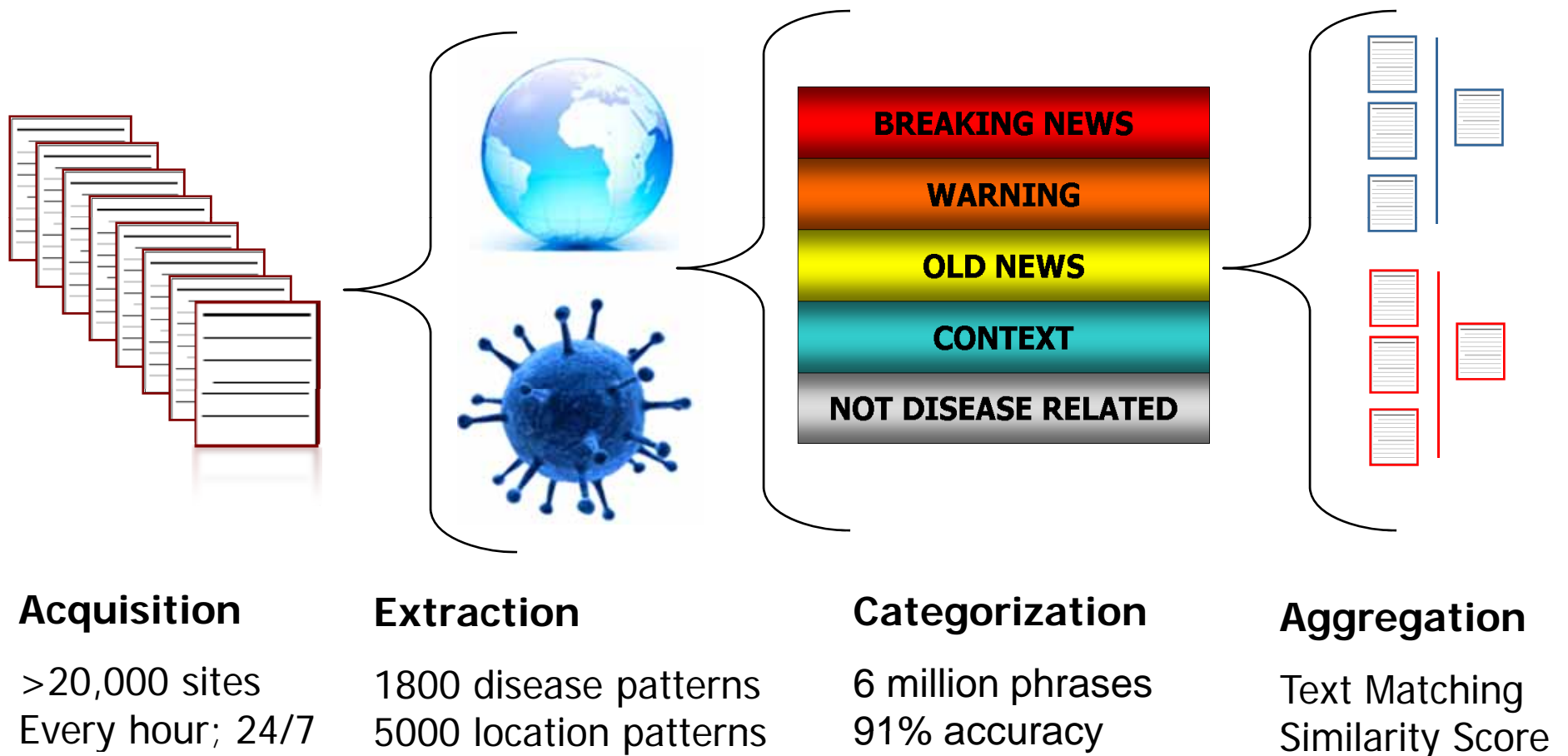
www.healthmap.org

By Clark Freifeld and John Brownstein. Copyright ©2007. [About](#)

This site necessarily relies on publicly available third-party information. We assume no responsibility for its accuracy or completeness.



HealthMap Article Processing





Usage



HHS Command Center



ECDC Command Center

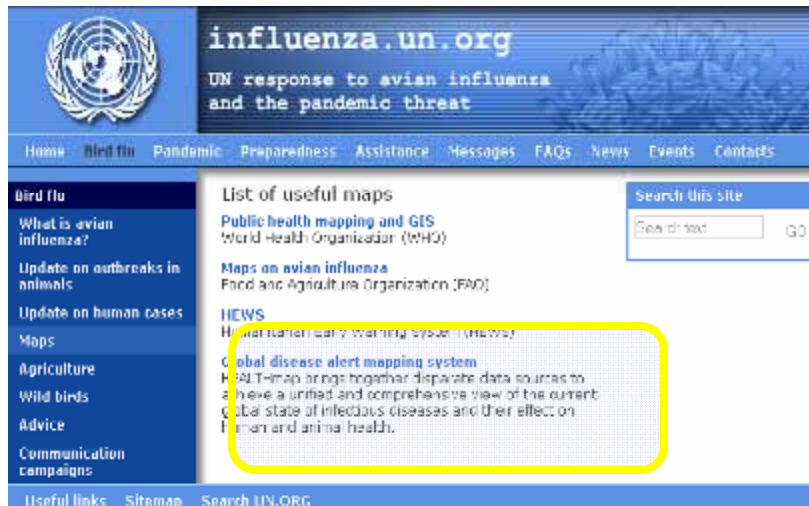


Liberty Science Museum, NYC

- 1,000-150,000 unique visitors/day
- >1,000,000 since launch in 9/06
- Top visitors:
 - CDC.gov
 - WHO.int
 - DHS.gov
 - National, state, local public health depts
 - NGOs
 - National Conventions



Public Health Resource



influenza.un.org
UN response to avian influenza and the pandemic threat

Home | Bird flu | Pandemic | Preparedness | Assistance | Messages | FAQs | News | Events | Contacts

Bird flu
What is avian influenza?
Update on outbreaks in animals
Update on human cases
Maps
Agriculture
Wild birds
Advice
Communication campaigns

List of useful maps
Public health mapping and GIS
World Health Organization (WHO)
Maps on avian influenza
Food and Agriculture Organization (FAO)
NEWS
Humanitarian early warning system (HEWS)
Global disease alert mapping system
HEALTHmap brings together disparate data sources to achieve a unified and comprehensive view of the current global state of infectious diseases and their effect on human and animal health.

Search this site
Search text: GO

Useful links | Sitemap | Search UN.ORG



World Health Organization Regional Office for Europe

Healthy environments for healthy people



This site provides links to activities, reports, news and events, as well as WHO/Europe's contacts and partners that work on health and environment.

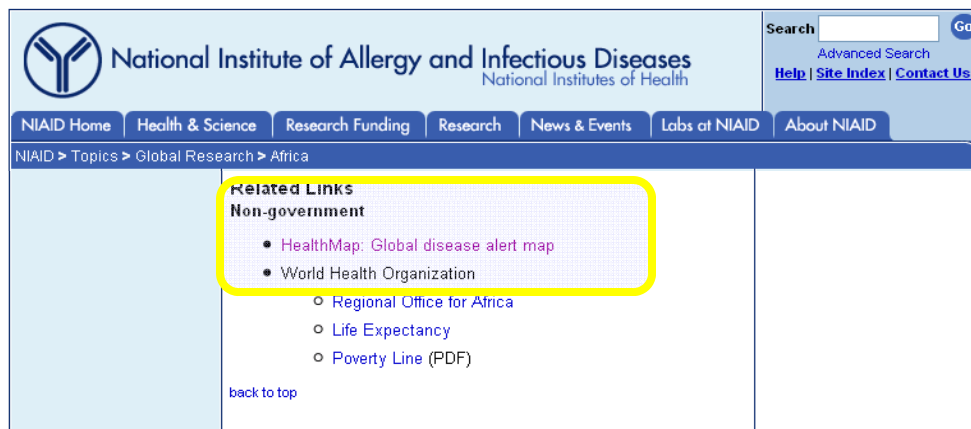
Preventing disease and injury is at the heart of public health and health systems. Human health can only be protected from risks from a hazardous or contaminated environment through collaboration between different sectors. WHO/Europe's environment and health agenda brings many players together to tackle the central issues with Member States.

• [What is environmental health?](#)
The WHO/Europe approach

• [Thematic](#)
Environment and health issues dealt with by WHO/Europe

Headlines

- [New WHO report tackles children's exposure to chemicals](#)
Geneva, 27 July 2007
Evidence for evaluating health risks to children exposed to chemicals is the first ever report highlighting children's special susceptibility to harmful chemical exposures at different periods of their growth. It highlights the fact that in children, the stage in their development when exposure occurs may be just as important as the magnitude of the exposure. In the European Region, the reduction of children's exposure to chemicals is a priority.
- [New online mapping system for global disease alert](#)
Real time information on reported outbreaks, including those related to water, food and climate change can be found in HEALTHmap, a freely available web site that integrates outbreak data of varying reliability. Sources include EuroRIS, the World Health Organization's EuroSurveillance programme of the European Centre for Disease Prevention.



National Institute of Allergy and Infectious Diseases
National Institutes of Health

Search Go
Advanced Search
Help | Site Index | Contact Us

NIAID Home | Health & Science | Research Funding | Research | News & Events | Labs at NIAID | About NIAID

NIAID > Topics > Global Research > Africa

Related Links
Non-government

- [HealthMap: Global disease alert map](#)
- [World Health Organization](#)
- [Regional Office for Africa](#)
- [Life Expectancy](#)
- [Poverty Line \(PDF\)](#)

[back to top](#)



USDA United States Department of Agriculture
National Agriculture Library

FOOD SAFETY INFORMATION CENTER

Home | About FSIC | Contact Us | Help

Search FSIC
Search all USDA
Advanced Search
Search Tips
Go

Browse by Audience
Information for...

Browse by Subject
Pathogens and Contaminants
Sanitation and Quality Standards
HACCP
Food Preparation and Handling
Food Processing and Technology

Yes are here: Home / News and Events / In the News

News and Events

In the News
Provides a continually updated list of news stories from a variety of sources around the world. As such, we have no control over the information available over the Internet and cannot be held responsible for the content or accuracy of material on external sites.

News and Events

- [In the News](#)
- [Web site News](#)
- [Spotlights](#)

See Also

- [Food Recalls](#)
- [Ergonomics call 0157:H7 Resource List](#)
- [Crisis Preparedness and Management Resources](#)
- [Food Safety Guidelines for Leafy Green Supply Chain](#)
- [Commodity Specific Food Safety Guidelines for the Fresh Tomato Supply Chain, 1st Edition](#)
- [Avian Influenza \(Bird Flu\) News Feed](#)
- [HEALTHmap Global Disease Alert Mapping System](#)

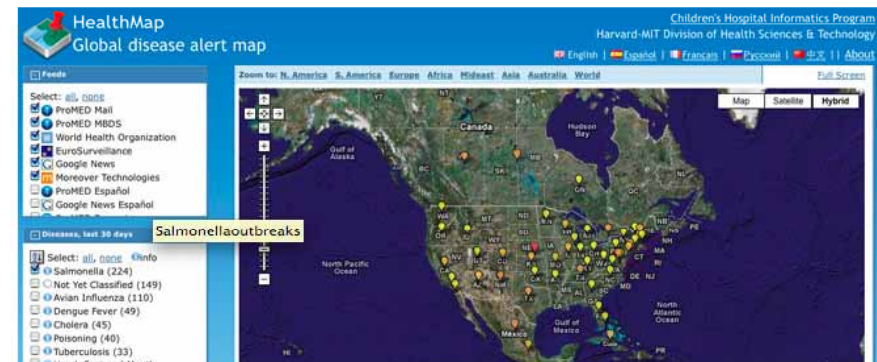
Food Safety News Feed
Major EU agreement achieved on chemicals law (Dec 1, 2006 16:45)
... the EU relies on a negative list to regulate the use of chemicals. This means any chemical not on the European Food Safety Authority (EFSA) blacklist can normally be used ...
Favorite Products of the Year: Delighting taste buds and nostrils (Dec 1, 2006 16:07)
... Special K20 Protein Waters. FoodProcessing.com Even though the food industry faced tremendous challenges from food safety scares, the feds, watchdog groups blaming the ind...
Tasker wins USDA OK to market anti-pathogen chicken plucker product (Dec 1, 2006 15:48)
... of poultry processing, officials report. This is Tasker's second application to receive consent by the Food Safety and Inspection Service of the USDA to begin commercial...



Tool for general population

Researchers Track Disease With Google News, Google.org Money

By Alexis Madrigal | July 07, 2008 | 7:00:03 PM | Categories: Disease, Pandemic, Web/Tech



washingtonpost.com

Hot Spots

Before Traveling, You May Want a Checkup

Tuesday, March 20, 2007; Page HE02

What's New Now you can satisfy your morbid curiosity and discover what diseases are plaguing your favorite vacation spot *before* hopping the next flight. Instead of stumbling through a host of blogs and news sites, visit <http://www.healthmap.org>, created by Boston epidemiologist Clark Freifeld and research software developer John Brownstein to track disease outbreaks around the world.

Wired NEWS Search: All of Wired

Top Technology Culture Politics Columns Blogs Wired Magazine

RSS Cars Computers Gadgets Internet Med-Tech Security Space

AOL® Search with FullView™ results

Get Your Daily Plague Forecast

PRINT MAIL RANTS + RAVES

By Seán Captain | Also by this reporter
02:00 AM Oct, 19, 2006

July 8, 2008 in Health | 0 comments | Post a comment

World Wide Wellness: Online Database Keeps Tabs on Emerging Health Threats

A new tool tracks diseases, contaminants and other threats as they occur worldwide
By Adam Hadzazy

SHARE Digg submit NT f submit EMAIL PRINT TEXT SIZE: -



TRACKING WORLD HEALTH: The online database, HealthMap, is designed to help scientists track health threats worldwide.

News travels fast—especially online—and a group of scientists intends to put this to good use by monitoring and trying to stop *infectious diseases* in their tracks.

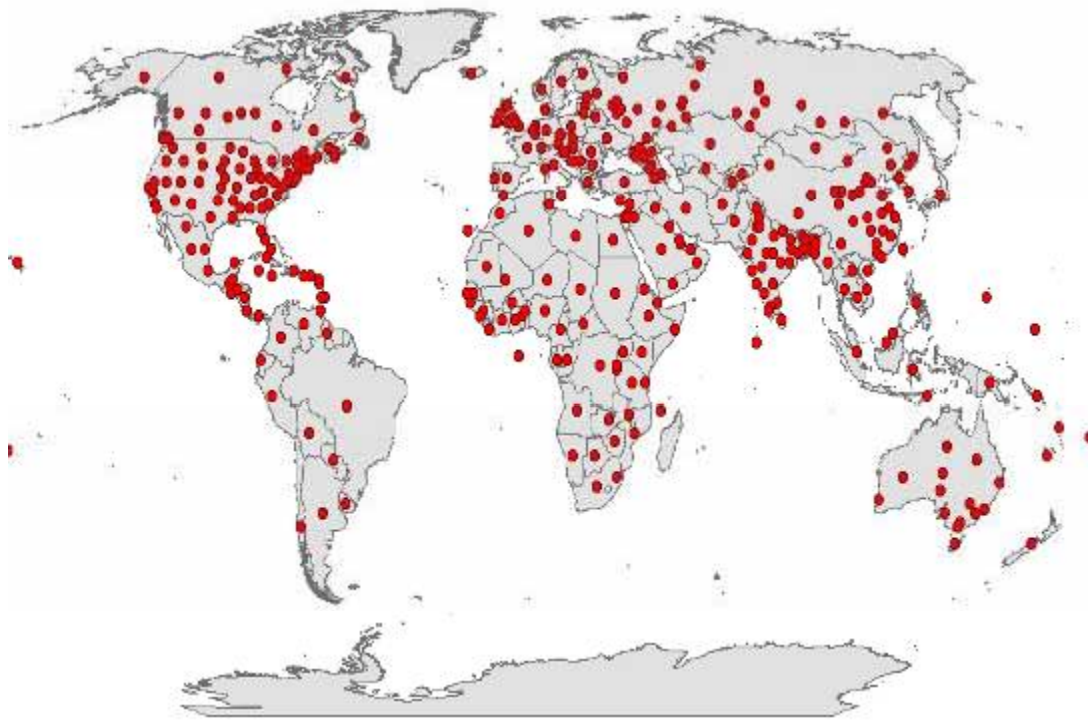
Researchers at Children's Hospital Boston and Harvard Medical School have launched a data-mining project called *HealthMap*. This automated system scours news services and online discussion forums, pooling information about emerging health threats worldwide.

By doing so, HealthMap provides a glimpse of potential disease outbreaks in local pockets, often before government and other health agencies such as the World Health Organization and the U.S. Centers for Disease Control and Prevention (CDC) realize they are threats.

"We hope that HealthMap will be able to identify outbreaks before traditional organizations become aware of them," says John Brownstein, co-founder of HealthMap and an assistant professor at the Information Science (PHS) at Philadelphia University.



HealthMap Stats



- > 200 alerts per day
- >200,000 alerts so far
- Alerts in 201 countries & territories
- 175 disease categories
- Five languages – English, French, Spanish, Russian, Chinese, Portuguese, Arabic



Influenza A (H1N1) Reports

Source

- ☒ Informal Sources (Media)
☐ Official Sources (ie: CDC, WHO)

[All HealthMap Sources »](#)
[View H1N1 on HealthMap »](#)

Category

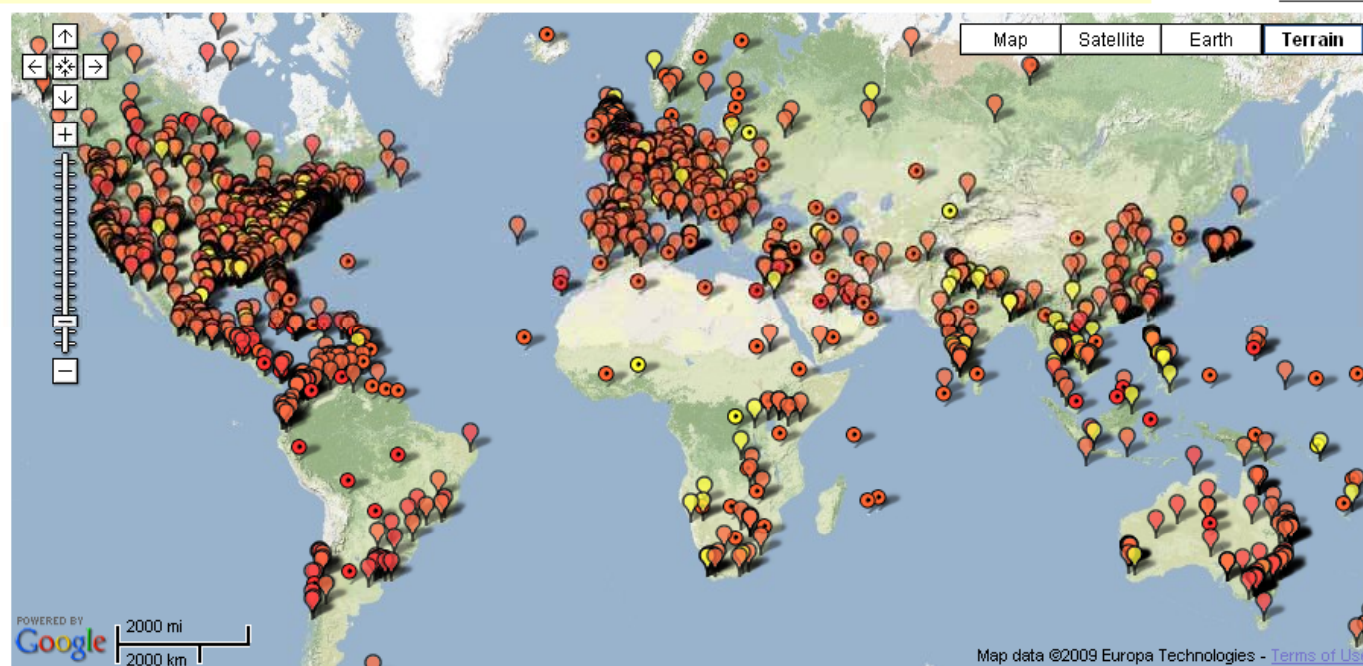
- ☐ Ruled Out
☒ Suspected Cases
☒ Suspected Deaths
☒ Confirmed Cases
☒ Confirmed Deaths

Zoom to country

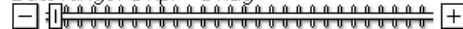
[Afghanistan](#)
[Albania](#)
[Algeria](#)
[American Samoa \[USA\]](#)
[Antigua & Barbuda](#)
[Argentina](#)
[Australia](#)
[Austria](#)
[Azerbaijan](#)
[Bahrain](#)
[Bangladesh](#)
[Barbados](#)
[Belarus](#)
[Belgium](#)

Zoom to: [N. America](#) [S. America](#) [Europe](#) [Africa](#) [Mideast](#) [Asia](#) [Australia](#) [World](#)

[Full Screen](#)



Date range: 1 Apr - 1 Aug *



Province/ Local Level	Country Level
	Ruled Out
	Suspected Cases
	Suspected Deaths
	Confirmed Cases
	Confirmed Deaths

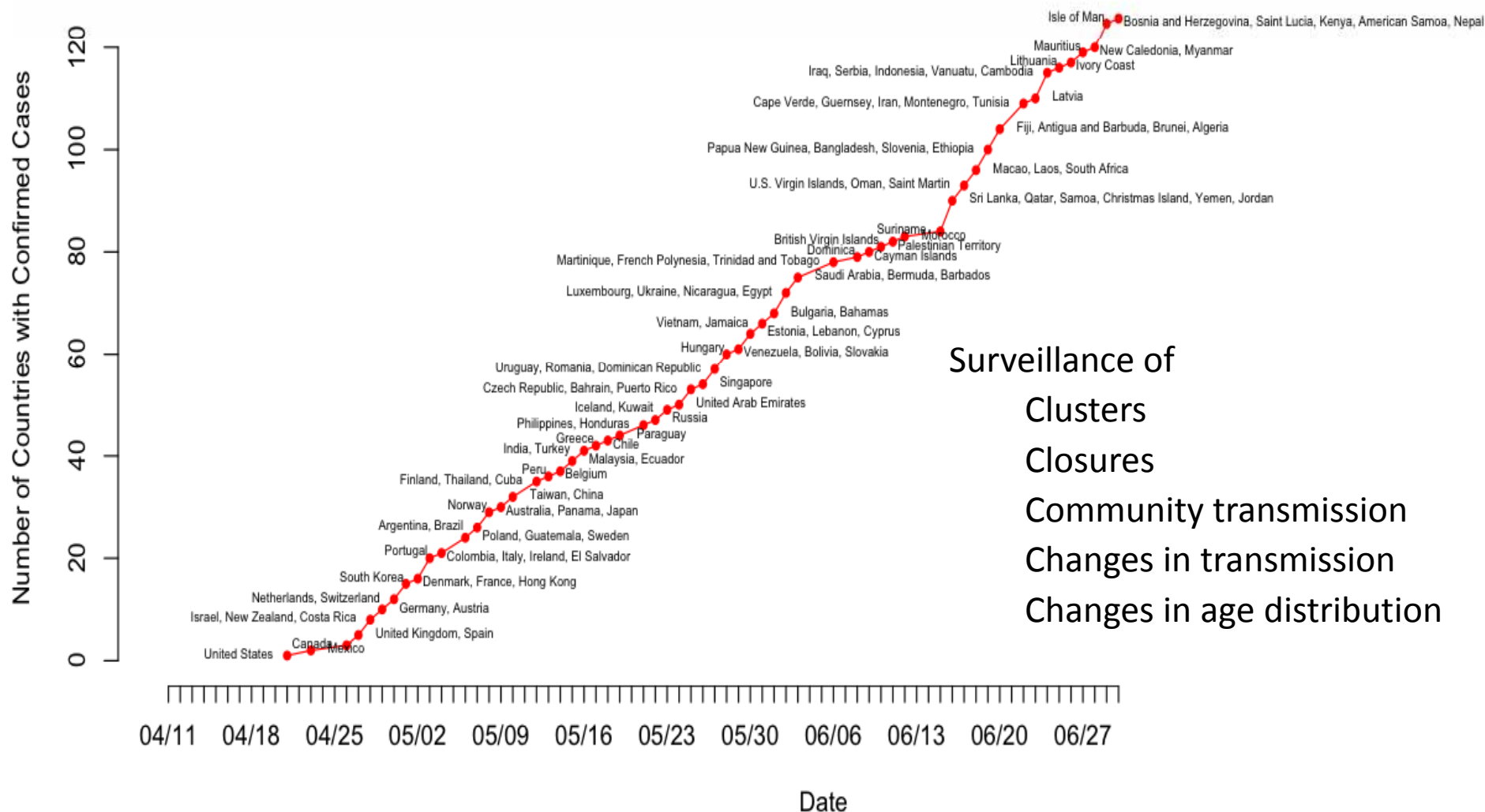
[View Progression](#)

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

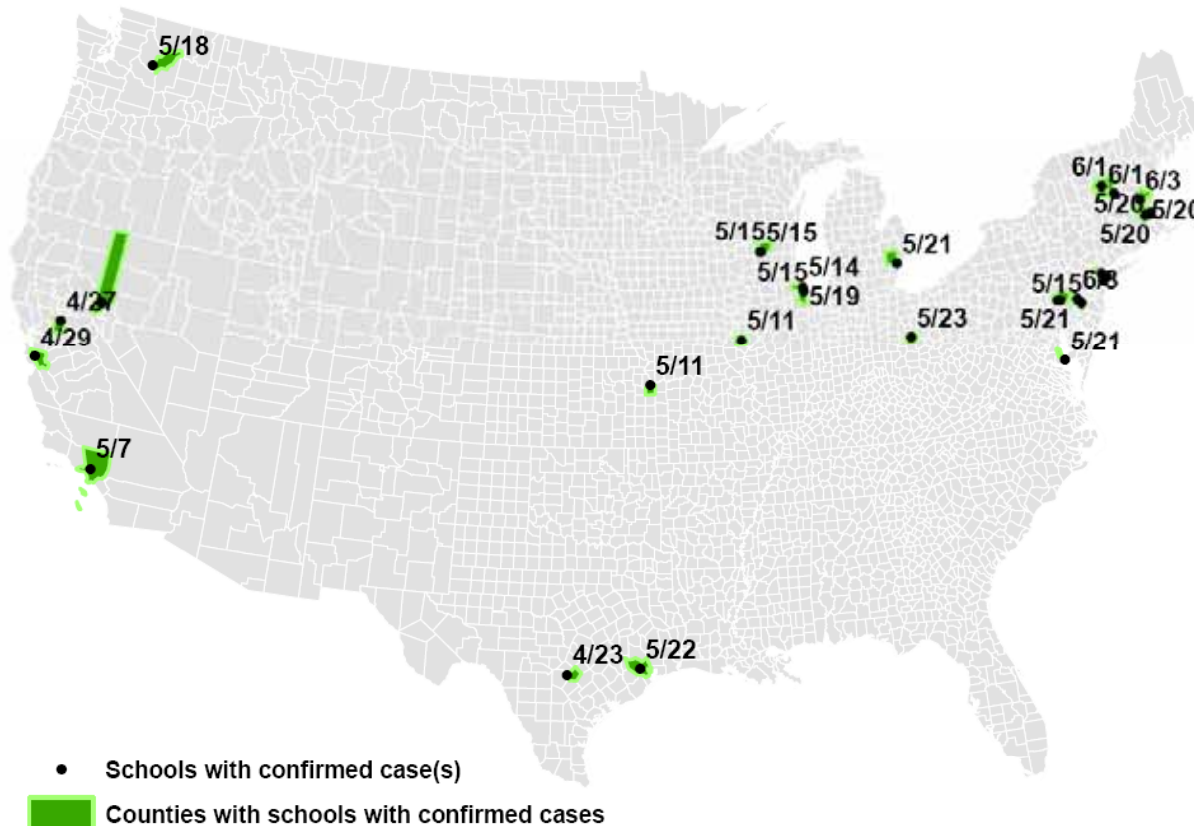


Global Spread of H1N1





School closures



- 37 schools with at least one confirmed case in 25 counties in 14 states
- 32 public schools, 5 private;
- 13 schools in urban districts; 16 schools in suburban districts; 6 schools in smaller towns; 2 schools in rural areas

37 schools with cases compared with the other 10,035 schools in the 25 counties containing the outbreak schools

→ Increased risk in urban more affluent areas (increased travel history, healthcare access, reporting bias...)



Children's Hospital Boston
Informatics Program

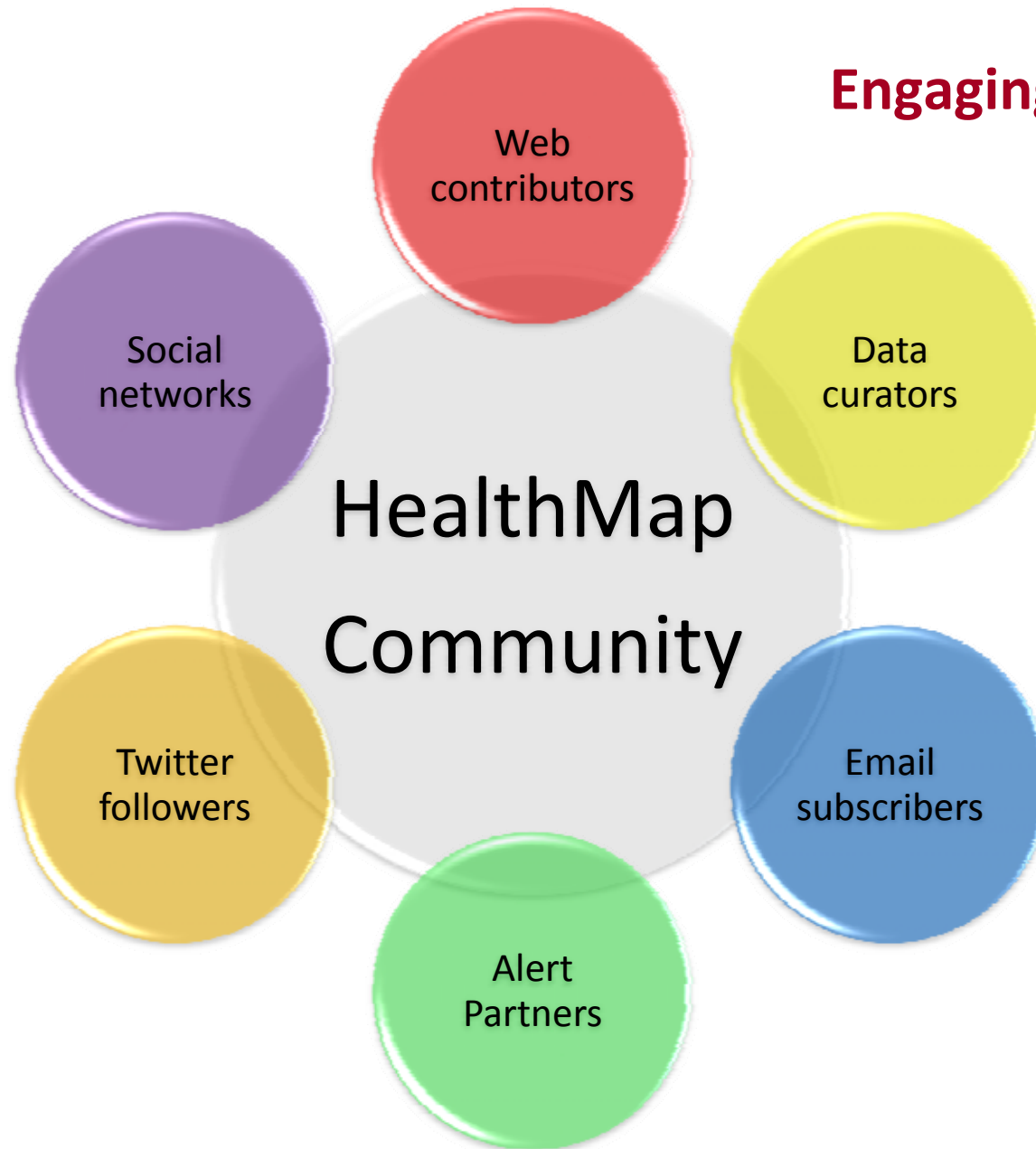
Harvard-MIT Division of
Health Sciences and Technology



Moving from passive to active surveillance: Participatory Epidemiology



Engaging Users





HealthMap and Participatory Epidemiology



Edit Page

Send an Update to Fans

Promote Page with an Ad

More

HealthMap is a real-time disease outbreak tracking system.
February 2009 Newsletter
http://www.healthmap.org/documents/newsletter_2_2009.pdf

Fans

6 of 84 fans

See All



Clark Freifeld



Tara Mohr



Jean Willard



Bob Stein



David Radley



Nabarun Dasgupta

Social RSS

blog | tweet |

HealthMap Blog | Report

Influenza A (H1N1) - "Swine Flu":
An Overview
7 May 2009, 10:45 pm
Hand, Foot, and Mouth: Outbreak
Spreading in China
17 Apr 2009, 1:33 pm

HealthMap

Wall

Info

RSS/Blog

Photos

What's on your mind?

HealthMap + Fans

Just HealthMap

Just Fans



HealthMap <http://h1n1.nejm.org/>

H1N1 Influenza: England Journal
Source: h1n1.nejm.org
From the Publisher

May 7 at 4:04pm · Comment · Like · Share

Amy L. Sonnick likes this.

Write a comment...



Andy Mcmurry Children's Hospital in MIT division of Health Sciences and Technology
April 29 at 9:09pm · Comment · Like · Report



HealthMap Visit <http://twitter.com/healthmap>
April 26 at 11:55am · Comment · Like · Share

Michal Galdzicki, Clark Freifeld and 3 others

Write a comment...



Taha Kass-Hout Hello HealthMapper interest: "NASA Study Predicted Outbreak product, a Rift Valley fever "risk map, Africa up to six weeks of warning for <http://www.sflong.com/earthnews/en>
February 15 at 3:22pm · Comment · Like · Report



HealthMap HealthMap Tech Talk is now on YouTube:



Search America's #1 News Site

MSN Home | Mail

featuring Today Show · Nightly News · Dateline · Meet the Press

WATCH LIVE: New York officials discuss swine flu outbreak

Technology & science / science

Categories

U.S. news

World news

Politics

Business

Sports

Entertainment

Health

Tech & science

Space

Science

Tech and gadgets

Games

Wireless

Swine flu outbreak tracked with Twitter



Home Profile Find People Settings Help Sign out



healthmap

Woman Being Tested in Thailand:
<http://tinyurl.com/d36t26> #swineflu

about 1 hour ago from web

1st Case Confirmed in Israel: <http://tinyurl.com/cpz8k8> #swineflu
about 1 hour ago from web

3 confirmed swine flu cases in New Zealand:
<http://www.reuters.com/arti...> #swineflu
about 2 hours ago from web

Israel confirms first swine flu case: <http://tinyurl.com/c7mqk4> #swineflu
about 2 hours ago from web

Obama urges calm and caution, not panic for swine flu:
<http://tinyurl.com/dcux4x> #swineflu
about 11 hours ago from web

Name HealthMap.org
Web <http://www.healthmap.org>
Bio Public website bringing together disparate data sources to achieve a unified view of the current global state of infectious diseases

38 following 2,131 followers

Updates 150

Favorites

Following





Community Input: Digital Disease Detectives

Hosted by Google™

Search News

[Back to Google News](#)

Iceland reports its first death from swine flu, cases have spiked on island in recent weeks

By THE ASSOCIATED PRESS (CP) – 1 day ago

REYKJAVIK, Iceland — Icelandic health officials reported their country's first swine flu death Monday amid a spike in cases on the North Atlantic island.

The victim, an 18-year-old disabled woman, died after falling ill about 11 days ago, Iceland's Directorate of Health said in a statement. The woman had a pre-existing lung condition which contributed to her death, according to Dr. Olafur Baldursson, the director of medicine at Reykjavik's Landspítali University Hospital, where she died.

"The girl had been multiply disabled for a long period of time and suffered from a chronic pulmonary disease," Baldursson told journalists Monday.

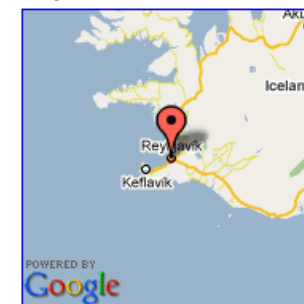
Iceland, a country of about 300,000 people, has so far seen a total of 479 laboratory-confirmed cases of the virus - many of them occurring in the past two weeks. Until recently the virus was largely confined to the capital, but swine flu has now spread across the country, resulting in "a huge drop" in school attendance in some rural areas, according to the health directorate.

The directorate added that the virus was adding considerably to the work of the small nation's health care service.

Swine flu, first identified in April, is a global epidemic. The World Health Organization says there have been nearly 400,000 laboratory confirmed cases and over 4,700 deaths linked to the illness. But many countries have stopped counting individual cases and the organization says the true totals are likely to be much higher.

THE CANADIAN PRESS

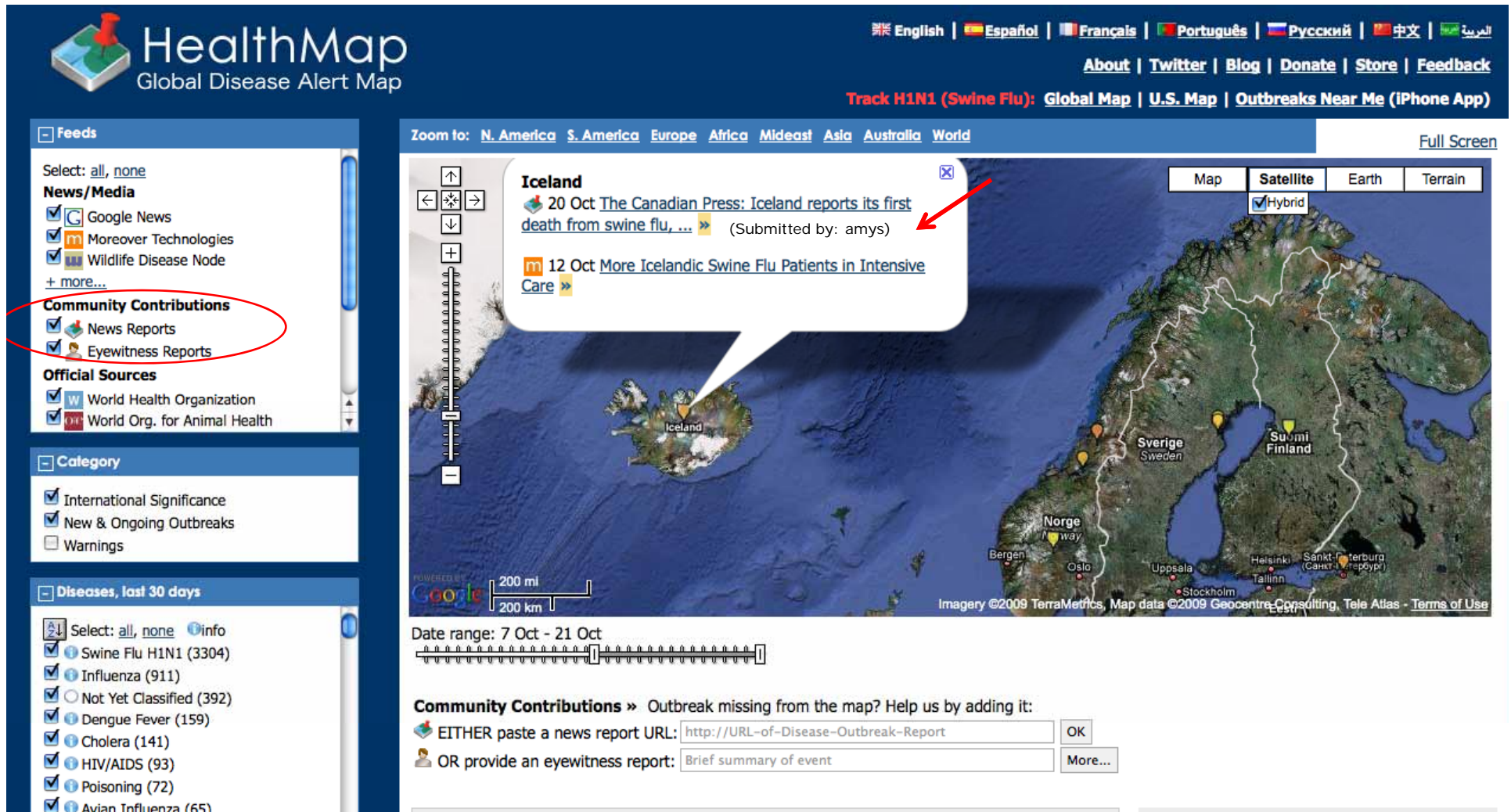
Map



Outbreak missing from the map? Help us by adding it:

OK

HealthMap Community Feed





Community input: Digital Disease Detectives

http://news.yahoo.com/s/ap/20090207/ap_on_he_me/marburg_fever;_ylt=AiQHfaswehX14.7AsAUBLSLVJRIF

Latest Headlines Aims and Scope: Epid...

Yahoo! My Yahoo! Mail More Make Y! My Homepage

YAHOO! NEWS Search

HOME U.S. BUSINESS WORLD ENTERTAINMENT SPORTS TECH POLITICS SCIENCE

Health Video Weight Loss Sexual Health Medications/Drugs Parenting/Kids Seniors/Aging

VIDEO: Yoga is helping older men turn back the hands of time

1st US case of Marburg fever confirmed in Colo. AP Associated Press

Sat Feb 7, 6:13 pm ET Buzz Up Send Share Print

WHEAT RIDGE, Colo. — The first U.S. case of Marburg hemorrhagic fever has been confirmed in Colorado, and authorities say the patient — who contracted the rare illness while traveling in Uganda — has since recovered.

Outbreak missing from the map? Help us by adding it:


The patient had traveled to Uganda, visited a python cave in Maramagamba Forest in Queen Elizabeth Park and encountered fruit bats, which can carry the Marburg virus. The Ugandan government closed the cave after a tourist from the Netherlands died from Marburg in July.

The patient was treated at Lutheran Medical Center in January 2008 and sought follow-up care in July, after learning of the tourist's death. The patient recovered and his or her identity wasn't disclosed.

Pierre Rollin, acting chief of the [Special Pathogens Branch](#) of the CDC, said specialized tests of the initial sample taken in January 2008 confirmed the illness in the Colorado patient in December.



HealthMap Community Feed



HealthMap

Global Disease Alert Map

[English](#) | [Español](#) | [Français](#) | [Português](#) | [Русский](#) | [中文](#)
[NEJM H1N1 Case Reports](#) | [About](#) | [Twitter](#) | [Blog](#) | [Donate](#) | [Store](#) | [Feedback](#)

Feeds

Select: [all](#), [none](#)

☐ ProMED Mail

☐ ProMED MBDS

☐ ProMED East Africa

☐ World Health Organization

☐ EuroSurveillance

☐ Google News

☐ Moreover Technologies

☐ Wildlife Disease Node

☒ HealthMap Community

☐ ProMED Español

☐ Google News Español

Category

☒ International Significance

☒ New & Ongoing Outbreaks

☐ Warnings

Diseases, last 30 days

Select: [all](#), [none](#) [info](#)

☒ Swine Flu H1N1 (2796)

☒ Influenza (2412)

☒ Not Yet Classified (251)

☒ Dengue Fever (90)

☒ HIV/AIDS (58)

☒ Hand, Foot and Mouth Disease (53)

Zoom to: [N. America](#) | [S. America](#) | [Europe](#) | [Africa](#) | [Mideast](#) | [Asia](#) | [Australia](#) | [World](#)

Map

Satellite

Earth

Terrain

☒ Hybrid

Florida

30 Jun [Two horses in eastern Leon County euthanized after testing positive ...](#)

30 Jun [Clay County Reports EEE in Three Horses | Firstcoastnews.com | Local ...](#) (submitted by: a.kitepowell)

United States

Mexico

Canada

South America

Europe

Africa

Asia

Australia

2000 mi

2000 km

POWERED BY Google

Imagery ©2009 TerraMetrics, NASA, Map data ©2009 Europa Technologies - [Terms of Use](#)

Date range: 24 Jun - 23 Jul



Children's Hospital Boston
Informatics Program

Harvard-MIT Division of
Health Sciences and Technology



Wednesday, Sep. 09, 2009

Is a Swine Flu Outbreak Coming? Ask Your iPhone

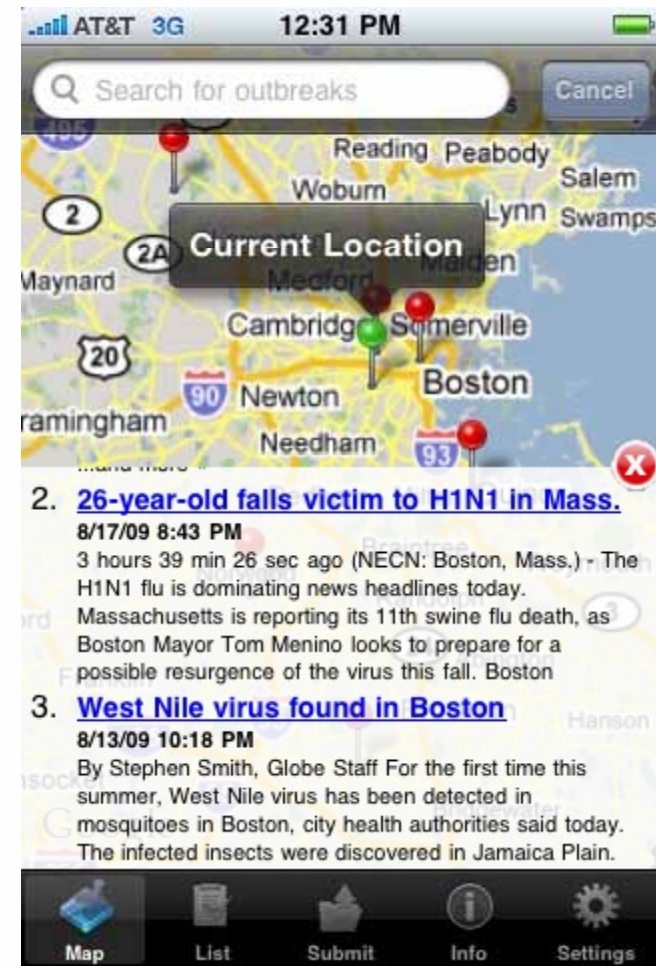
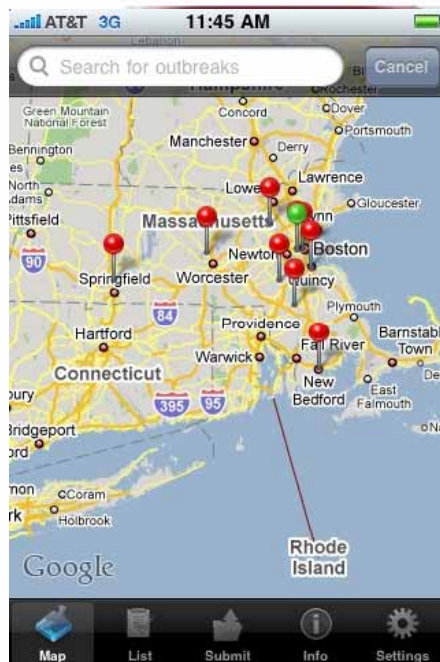
By Bryan Walsh



Location,
preferences



Relevant real-
time alerts



TIME

WIRED

IT News Online

SCIENTIFIC
AMERICAN

NECN.com sci-tech

boston.com

Discovery
CHANNEL

THE WALL STREET JOURNAL

USA
TODAY

wbur.org
BOSTON'S NEWS SOURCE

abc NEWS

NYDailyNews.com
DAILY NEWS



Geo-alerting

The 'Alert Settings' screen features a 'Save' button in the top right. Below the title, there's a section for 'Diseases to receive alerts' with a 'Select All' button. A list of diseases includes 'Soybean Rust', 'Swine Flu H1N1' (checked with a blue checkmark), 'Tick-borne disease', and 'Vaccine Complication'. At the bottom, there are fields for 'Location' (with a 'Current Location' placeholder) and 'Email'. A bottom navigation bar contains icons for 'Map', 'List', 'Submit', 'Info', and 'Settings'.

Geo-reporting

The 'Submit Outbreak Report' screen has a 'Submit' button in the top right. It includes a text field for the disease name (filled with 'Anthrax'), a 'Location' section with a 'Current Location' field, and an 'Upload Related Photo' section with a 'Photo' button and a camera icon. Below these is an 'Email' field. A full QWERTY keyboard is displayed at the bottom for text entry.



80k downloads in first week





crowd-sourced surveillance

- **Closures** “Outbreak of laboratory-confirmed H1N1 in schools in the provinces of Lucca and Pisa, Tuscany, Central Italy” “Canterbury elementary school closed until 10/23 due to 30% percent of students out with flu.”
- **Clinical** “10 year old boy confirmed test positive. Initial onset came on fast with extreme headache, fatigue, and low/med grade fever. He began tamiflu same day. Is asthmatic. So far is recovering well.”
- **Clusters** “First my 5 year old son got it then my 18 month old daughter got it. Now my wife and I both have it.”



Part II: Conclusions

- Value in the fusion and visualization of distributed electronic resources
- Complements traditional healthcare data sources by providing customized real-time intelligence for the broad scope of international public health activities
- Importance of multi-lingual, collaborative approach that minimizes information overload and engages users



Key questions

- What are the regulatory obstacles impacting your work?
- What are the resource needs required to replicate your work at other institutions?
- What are the priority short term "translational" questions in your fields that would represent the most rapid payoff on investment?



Regulatory Obstacles

Non-traditional healthcare data

- IRB
- Data security
- Anonymization of data (especially when considering rare events)
- Data standards
- Adoption of EMRs is low (only 33% of physician offices use)
- Lack of universal patient identifier
- Data often silo'd by clinical specialty, lab service, etc

Non-traditional non-healthcare data

- Much of the non-traditional data falls outside regulatory structures



Resources Needed

Non-traditional healthcare data

- NLP approaches (eg: augment drug exposure identification)
- Database storage capacity
- IT infrastructure
- Signal processing technology
- Implementing methodology and visualization
- Prospective monitoring (human analysts)
- Validation efforts
- Common data “clearinghouses” – allow parties to publish data while retaining control
 - Patient locator/identifier/anonymization services
 - Patient consent
 - Billing code resolution
 - Drug metadata



Resources Needed

Non-traditional non-healthcare data

- Validation efforts
- Population representativeness
- Extrapolation of results
- Appropriate denominators
- Historical baseline
- Self-report biases
- Sampling frame
- Signal to noise
- Validity of empirical surveillance data for epidemiologic studies
- Value to make regulatory decisions



Priority short term question

- Mining EMRs for discovery (safety, benefit, drug interactions)
- Mining search usage data for discovery (safety and benefit and drug interactions)
- Use of social networking for clinical trials recruiting, safety and discovery
- Mobile devices and EMR, to reach underserved populations US & worldwide
- Beyond drug safety: could we have discovered virus - CFS association from EMR data?



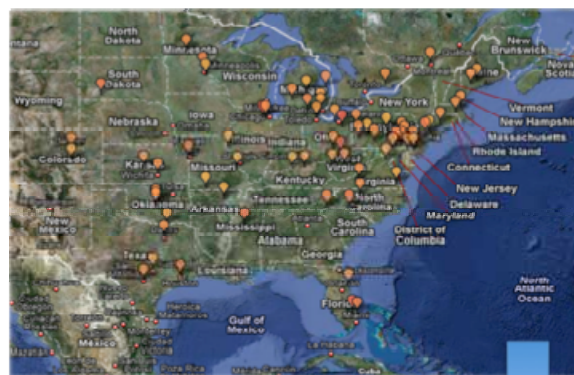
Public Health 2.0 and EMRs



1498		gerold56789@yahoo.com		2009-10-17 20:03:29	a mom and 2 kids have h1n1 in kyle SD	4 kids in their teens and a mom worse. The kids are in good si recovering. It was later for he be hospitalized for the disease
1497	✓	m23@gmx.us	33,790, -89,613	2009-10-17 18:22:40	its here	
1496	✓	jarodbrown1@gmail.com	41,275, 111,953	2009-10-17 18:17:08	Swine flu Gibbs residence	
1495	✓	jarodbrown1@gmail.com		2009-10-17 18:14:59	Swine flu Gibbs residence	
1494	✓	wicajosh@tbtinternet.com	53,500, -1,060	2009-10-17 16:36:58	ill omg	Mum and son feel very bad
1493	✓	stineakypete@yahoo.com	40,539, -74,169	2009-10-17 15:33:36	women has swine flu in Staten ISHD	Two women at least in Staten dose out to her fearing an out
1492	✓	kucsubh@rojabakajp@dn	39,909, -86,783	2009-10-17 14:06:20		3dyjygdtkdskhgydygkghvrdnrdtjkrkkrkjkhndnrdmghr
1491	✓	wikawak64@gmail.com	33,645, -112,075	2009-10-17 11:05:57		

Page 10

post to public



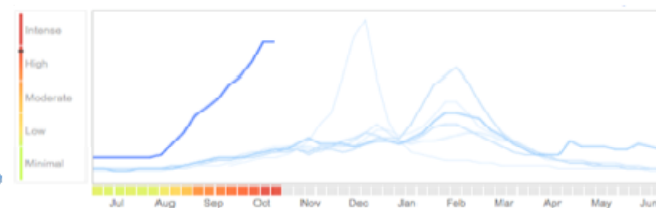
review



notify contributor



aggregate





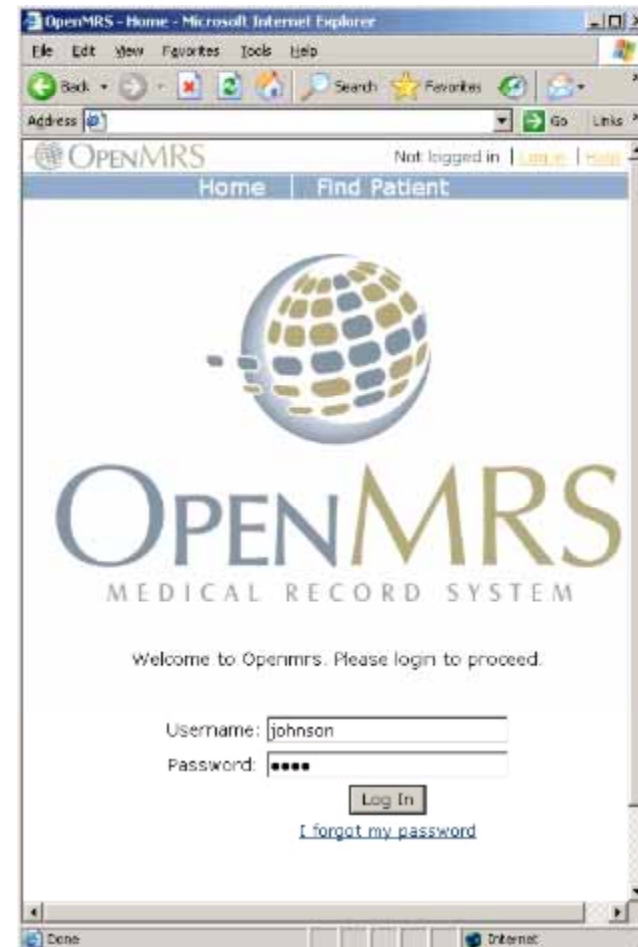
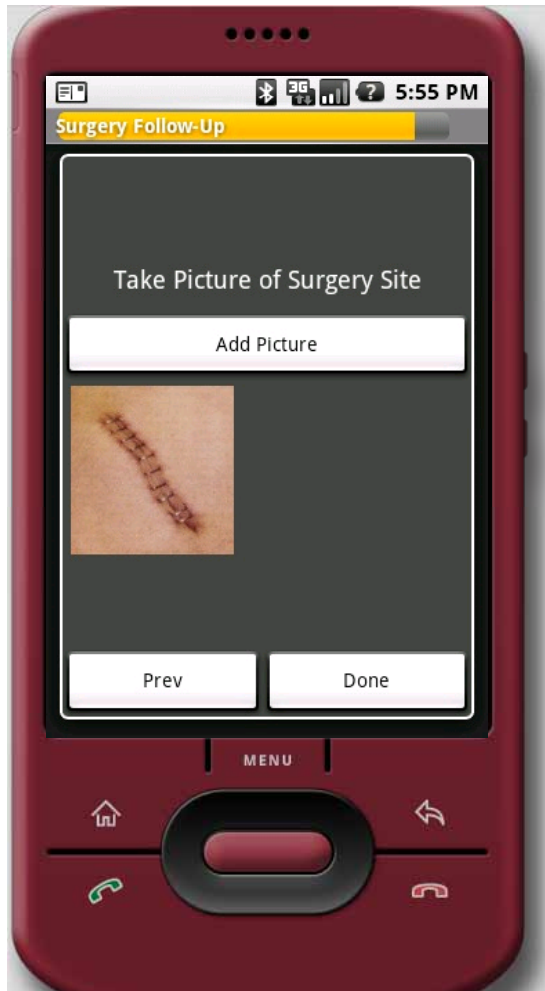
Social Networking and EMRs



Real time group and individual measurement of outcomes, treatment side effects, adverse events



Mobile Devices and EMRs





HealthMap Team

- John Brownstein, PhD
- Clark Freifeld
- Mikaela Keller, PhD
- Susan Aman
- Amy Sonricker, MPH
- Emily Chan, MSc

Children's Hospital Informatics Program

- Ken Mandl, MD MPH
- Ben Reis, PhD
- Isaac Kohane, MD PhD

Partners

- Susanne Churchill, PhD
- Shawn Murphy, MD PhD

Collaborators

- Larry Madoff (MA-DPH/ProMED)
- Marjorie Pollack (ProMED)
- Tim Brewer (ProMED)

Acknowledgments

Funding



CIHR IRSC