- Now that we are SMART about Influenza Outbreaks --

What's the Next Opportunity?

- What are next steps for flu tracking w/ SMART?
  - Third season reliability/ validity vs. ILI
- Use by public and/or public health practitioners?
  - Marketing to practitioners:
    - Visits to CDC
    - International Soc. Disease Surveillance Abstract
    - Other Meetings? American Public Health Assoc.?
    - Emails to Flu stakeholders – Vaccine Manufactures?
- Feedback/Improvement - Link inviting user to:
  - Send email ? Take Survey ?
  - “User Forum / Chat room with staff feedback?

Rationale for City ILI Focus

-- “all public health is local”

- Other Fly Systems at national & state level
  - Google Flu Trends national, regional city?
  - FluNearYou --- uses crowdsourcing – state reports local maps
- Detecting an outbreak at the city/county level could make impact in reducing disease transmission or treatment
  - Neighboring cities could focus on prevention
  - Could guide resource allocation decisions
    - Anti-viral drugs
    - Hospital staffing , Elective admissions suspended

What other Diseases or Health Issues to Track?

- Problem--
  - Fit problem to tool (twitter)
  - Fit tool to the problem (health condition)
- Finding Problems and Public Health Priorities
  - What are “needs of the market?”
    - Systematic reviews (1)
    - Policy/ Priority Documents (old)
    - White Papers / Plans ?
    - Expert Opinion Surveys ?
    - Governmental / Non-Governmental Organizations ?
    - Not too much Found --- yet

Public Health … big problems
Look at gaps in reportable diseases?

- Foodborne Illness -- “tip of the iceberg”
  - Several Innovative Interactive Systems
    - See tweet on possible Foodborne illness
    - Health Dept Staff sends link to official case report website.
    - Health dept follow-up
- Sustainability issues

Public Health Surveillance

- Definition: ongoing, systematic collection, analysis, and interpretation of data on specific health events
- Collection of Data
  - Pertinent, regular, frequent, prompt, timely
- Consolidation and Interpretation of Data
  - Orderly, descriptive, evaluative, prompt, timely
- Dissemination of Information
  - Prompt, timely, all who need to know
- Action to
  - prevent disease, control epidemics, improve health

Velasco et al. (2014). "Social Media and Internet-Based Data in Global Systems for Public Health Surveillance: A Systematic Review."

TABLE 2
List of Event-Based Systems Identified

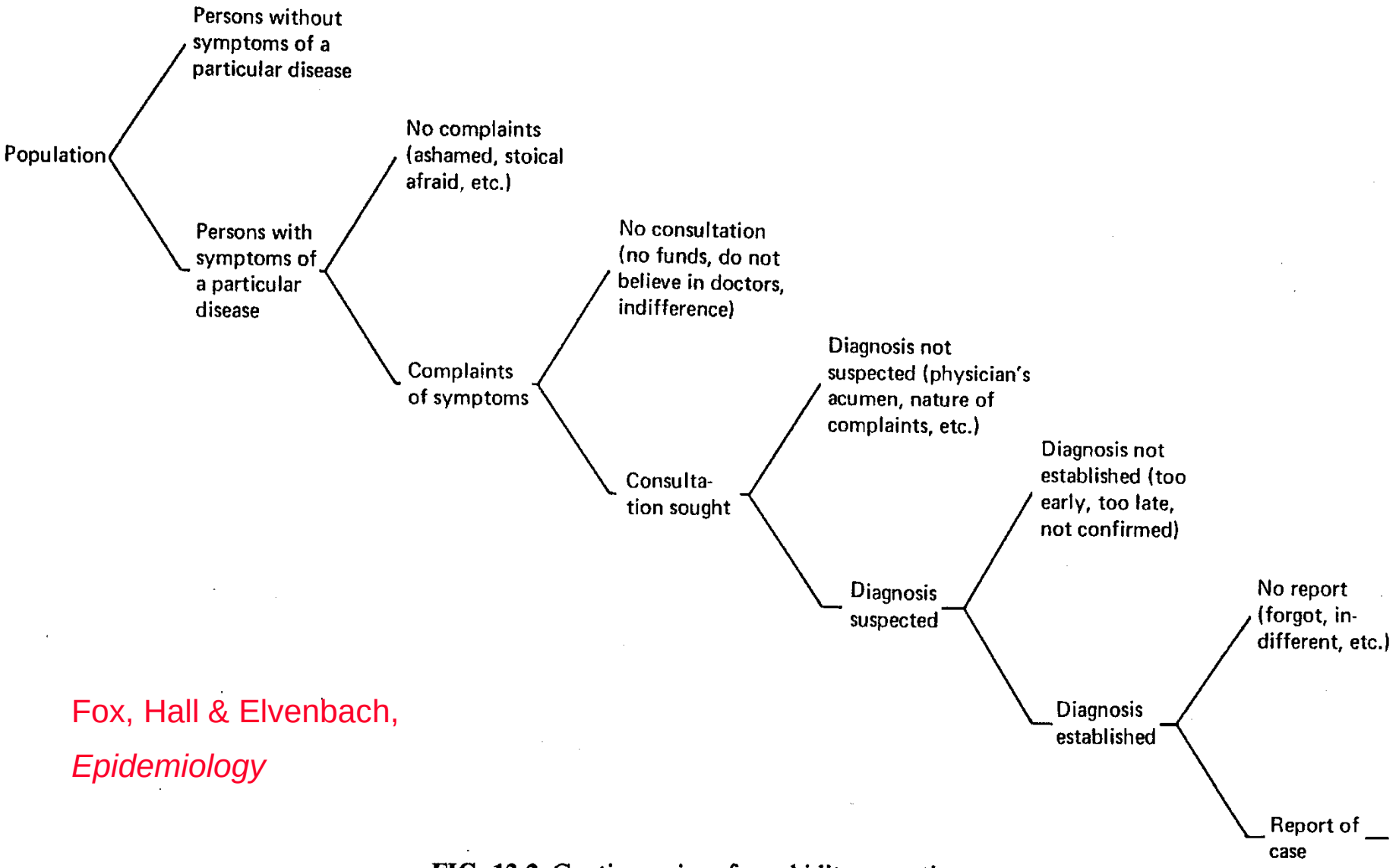
No.	System Name (literature reference)	Category	Country	Year Started
3.1	Argus[43,51]	Moderated	USA	2004
3.2	BioCaster[52]	Automatic	Japan	2006
3.3	EpiSPIDER[34,53]	Automatic	USA	2006
3.4	EWRS[54]	Moderated	EU	1998
3.5	GOARN[55]	Moderated	Multiple[a]	2000
3.6	GODSN[56]	Automatic	USA	2006
3.7	GPHIN[26,57]	Moderated	Canada	1997
3.8	HealthMap[58-62]	Automatic	USA	2006
3.9	InSTEDD[63]	Moderated	USA	2006
3.10	MedISys and PULS[64,65]	Automatic	EU	2004
3.11	MiTAP[66]	Automatic	USA	2001
3.12	ProMED-mail[13,67-69]	Moderated	USA	1994
3.13	Proteus-BIO[11]	Automatic	USA	2000

[a]GOARN is a WHO-coordinated network

Velasco et al. (2014). Finding & Conclusions

- No comprehensive evaluations that show systems have been integrated into actual epidemiological work during real-time health events.
- Acceptability of Internet and social media in public health surveillance programs is limited
- **Circular challenge** willingness to integrate needs effectiveness studies but …. No structured evaluation of newer systems.
- Other non-technical issues are also barriers individual perceptions (epidemiologists)
- Dealing with personal health data and social media and other Internet data

Contingencies of Morbidity Reporting



Fox, Hall & Elvenbach,

Epidemiology

FIG. 13-2 Contingencies of morbidity reporting.

Wanted: systematic assessment of emerging surveillance systems

			Syndromic	Surveillance	Approaches	Or	systems			Traditional
Surveillance Methods Approaches --→>>> Partial listing	Social Media "Twitter" tracking	Active Crowd Sourcing	Crowd-sourcing with Interaction	Sentinel or "expert" systems	Website and or email text analysis Webcrawler"	Retail sales data bases	Existing "event" based newer approaches	Insurance Claims data	Electronic medical records & regional data exchanges	Mandated disease/ condition reporting
Example(s) --→>>>	SDSU SMART website (San Diego State University 2014)	FluNearYou FluNearYou.org (FluNearYou 2014)	Foodborne Chicago www.foodbornechicago.org	Expert knowledge sourcing (Berrang-Ford and Garton 2013)	New York Health Dept. Yelp.com Restaurant complaint review	This can be considered a form of "event" based data	Multiple established systems see review by (Velasco, Agheneza et al. 2014)	Colorado "all payer mandated system"		
System Characteristics Criteria for evaluation …starter list										
General										
Purpose of system										
Current Status & availability										
Owner(s)										
Customers or stakeholders										
Access – pubic vs private, membership										
Logistical Issues										
Development costs										
Sustainability & Costs										
Innovative / Novel Issues										
Adaptable/ useful with mobile technology										
Operator attention Intensity & type of expertise need										
Privacy, confidentiality HIPPA concerns										
Big Picture --- Strategic & Policy Issues										
Public health significance and or interest in disease or threat or issue										
Health or burden Morbidity/Mortality etc										
Utility --- Fills gap vs. improving existing info?										
Public, Policymaker & Funder interest in disease or issue										

Page Break

- **Surveillance Methods or Approaches -Partial listing**

- State Mandated disease/ condition reporting (Public Health)
- Sentinel or “expert” systems (eg. ILI in selected cities)
- Retail sales data bases
- Insurance Claims data
- Website and or email text analysis Webcrawler”
- Electronic medical records & regional data exchanges
- Crowd-sourcing social media with Interaction
- Social Media “Twitter” tracking
- Active Crowd Sourcing -- Flu Near You

- System Characteristics
  Criteria for evaluation … starter list

- General
  - Purpose of system
  - Current Status & availability
  - Owner(s)
  - Customers or stakeholders
  - Access – pubic vs private, membership

Logistical Issues

- Development costs
- Sustainability & Costs
- Innovation vs incremental improvement
- Adaptable/ useful with mobile technology
- Operator attention
- Intensity & type of expertise need
- Privacy, confidentiality HIPPA concerns

Big Picture -- Strategic & Policy & Political Issues

- Public health significance
  - Interest in disease or threat or issue
  - Health burden
    - Morbidity/Mortality
    - Costs lost school, worker productivity
- Fills gap vs. improving existing info?
- Public, Policymaker & Funder interest in disease or issue

Surveillance (scientific) Characteristics /Issues

- Acceptability & Use by professionals / organizations/ policy makers
- Locus of analysis --
  - Local vs. state vs. national? E.g. granularity of data & information
- Case definition precise vs. vague
- Timeliness –
- Leading or Lagging indicator
- Sensitivity vs Specificity
- Action-ability for disease control or other purposes
  - -- direct or needs more analysis?
- Action-ability for Policy or Planning – and other less immediate uses

Vaccine Information and Sentiment Over Space and Time

Anna C. Nagel, Ming-Hsiang Tsou, Li An, Jean Marc Gawron, Dipak K Gupta, Brian Spitzberg, Jiue-An Yang, Su Han, K. Michael Peddecord, Mark H. Sawyer, Suzanne Lindsay

Committee members;

Dr. Suzanne Lindsay (Chair)

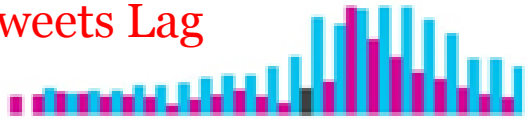
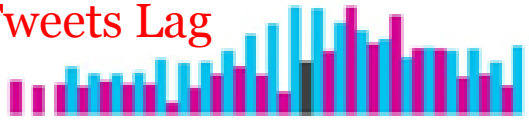
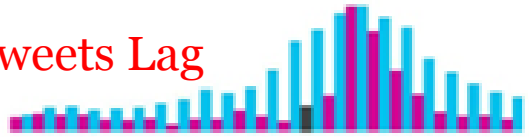
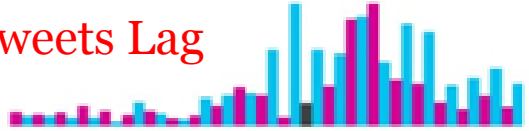
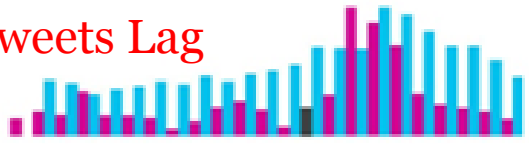
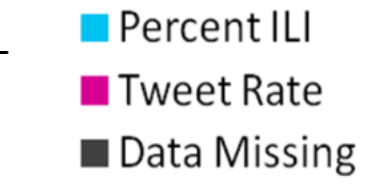
Dr. Michael Peddecord

Dr. Ming-Hsiang Tsou

Nagel et al The Complex Relationship of Realspace Events and Messages in Cyberspace: Case Study of Influenza and Pertussis Using Tweets. J Med Internet Res 2013;15(10):e237. doi:10.2196/jmir.2705. http://www.jmir.org/2013/10/e237

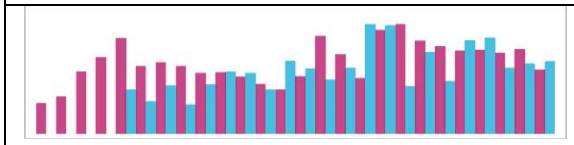
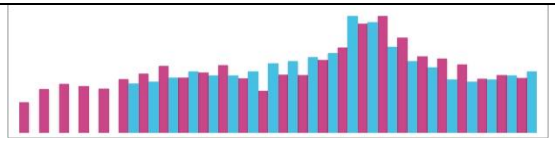
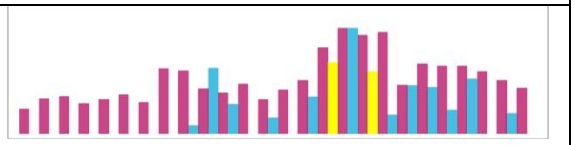
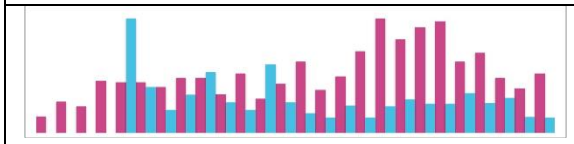
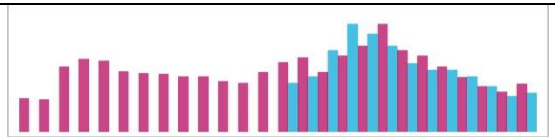
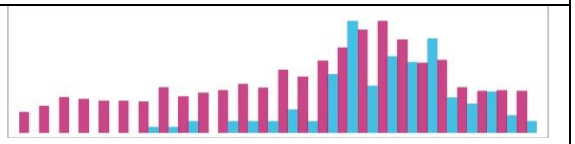
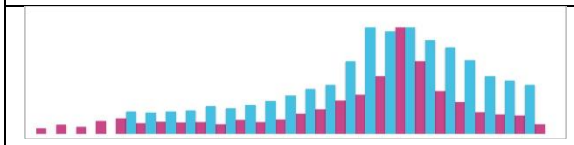
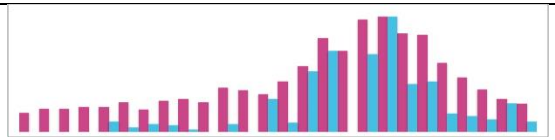
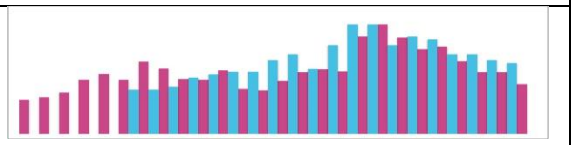
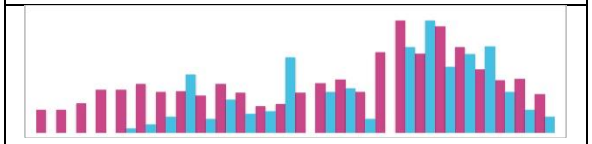
Tweets Leading or Lagging ILI? 2012-13 Flu Season

Nagel, et al. The Complex Relationship of Realspace Events and Messages in Cyberspace: Case Study of Influenza and Pertussis Using Tweets. *J Med Internet Res 2013;15(10):e237.*

Seattle **r = 0.75** *n = 14229*	**Chicago** r = 0.29 *n = 26924*	**Fort Worth** **r = 0.75** *n = 4820*
Tweets Lag 	Tweets Lag 	Tweets Lag 
Portland **r = 0.33** *n = 1074*	**Cleveland** **r = 0.44** *n = 7434*	**Nashville-Davidson** **r = 0.53** *n = 8755*
Tweets Lead 	Tweets Lag 	Tweets Lag 
San Diego **r = 0.67** *n = 10586*	**Boston** **r = 0.57** *n = 19933*	**Jacksonville** **r = 0.67** *n = 3647*
Tweets Lead 	Tweets Lag 	Tweets Lag 
Denver **r = 0.67** *n = 8964*	**New York** r = 0.23 *n = 55455*	
Tweets Lag 	Tweets Lag 	

Aslam, Anoshe A. et al. "The Reliability of Tweets as a Supplementary Method of Seasonal Influenza Surveillance", under revision *J. Med. Internet Research*, Sept. 2014

Table 4. "Valid" Tweet Rates per 100,000 versus Sentinel Provided ILI Rates by City, 2013-14 Influenza Season

Boston **r =** 0.10 *n = 3813* 	**Chicago** **r = 0.64** *n = 5116* 	**Cleveland** **r = 0.60** *n = 1497* 
Columbus **r =** -0.24 *n = 1034* 	**Denver** **r = 0.69** *n = 1942* 	**Detroit** **r = 0.76** *n = 2195* 
Fort Worth **r = 0.85** *n = 1236* 	**Nashville-Davidson** **r = 0.83** *n = 1630* 	**New York** **r = 0.55** *n = 12632* 
San Diego **r = 0.88** *n = 1808* 		

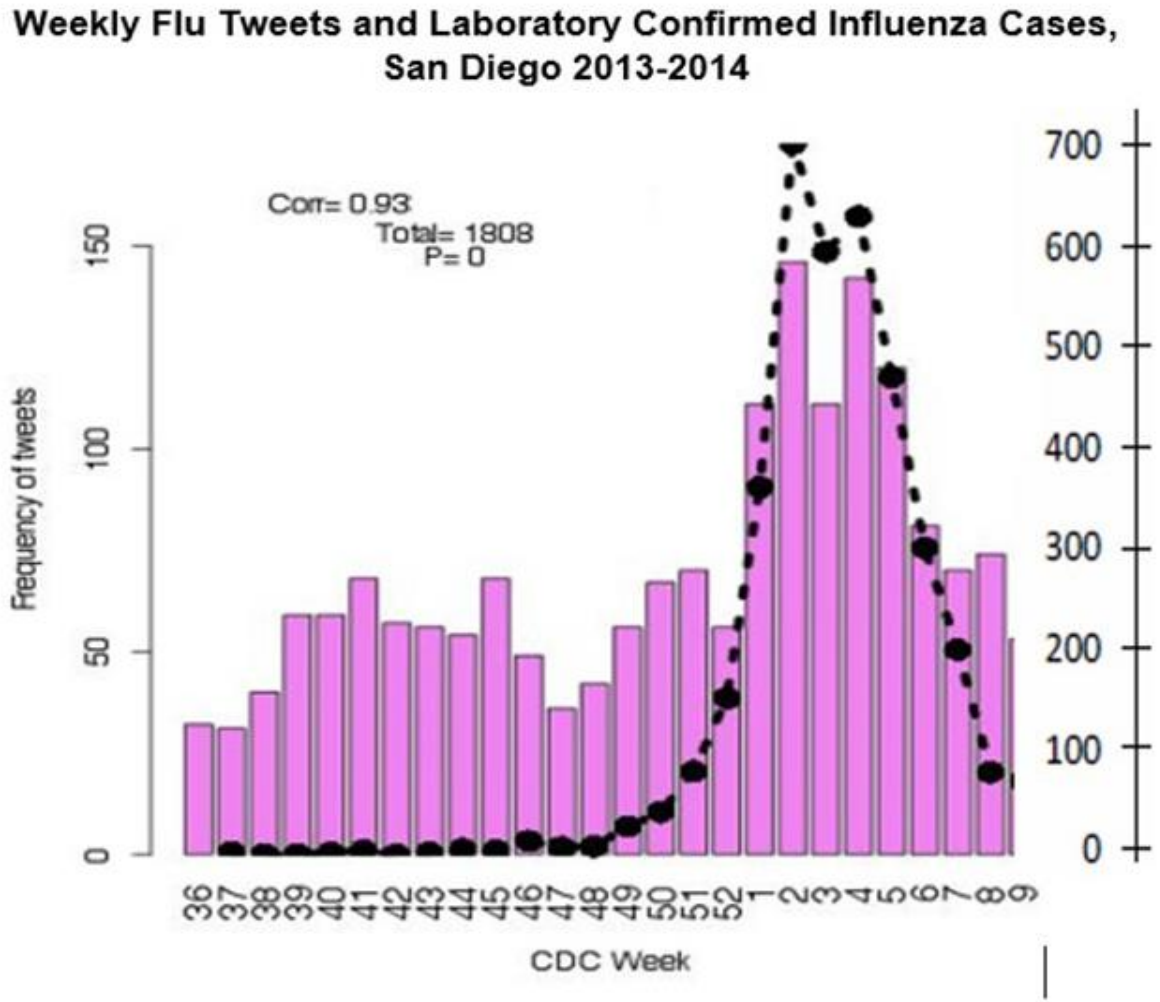
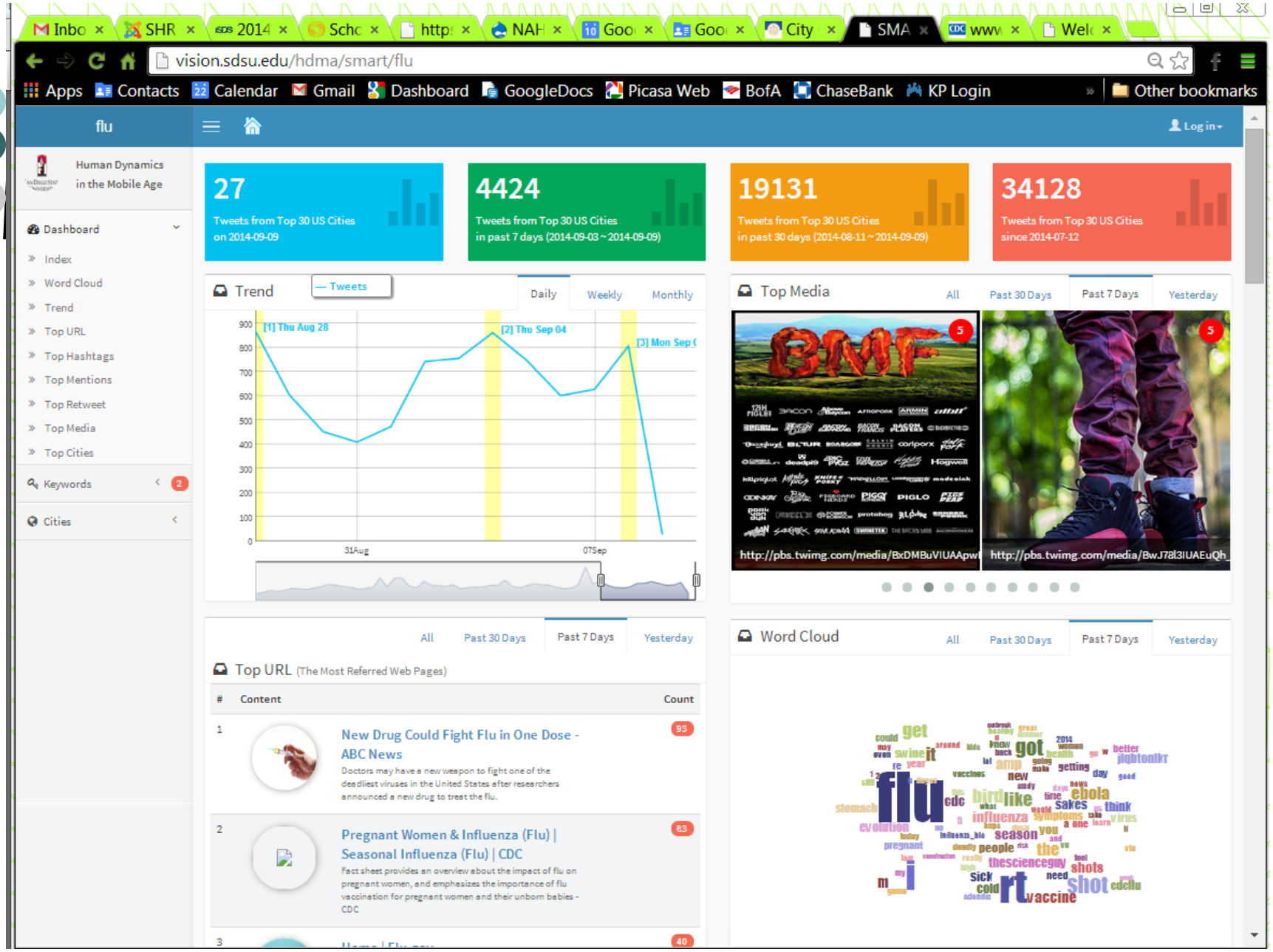


Figure 1. Comparing weekly laboratory confirmed influenza cases (black line) and weekly flu tweeting rates (pink bars). Note: Total lab confirmed cases= 1808

Anoshé A. Aslam, MPH Plan B Project: The Reliability of Tweets as a Supplementary Method of Seasonal Influenza Surveillance

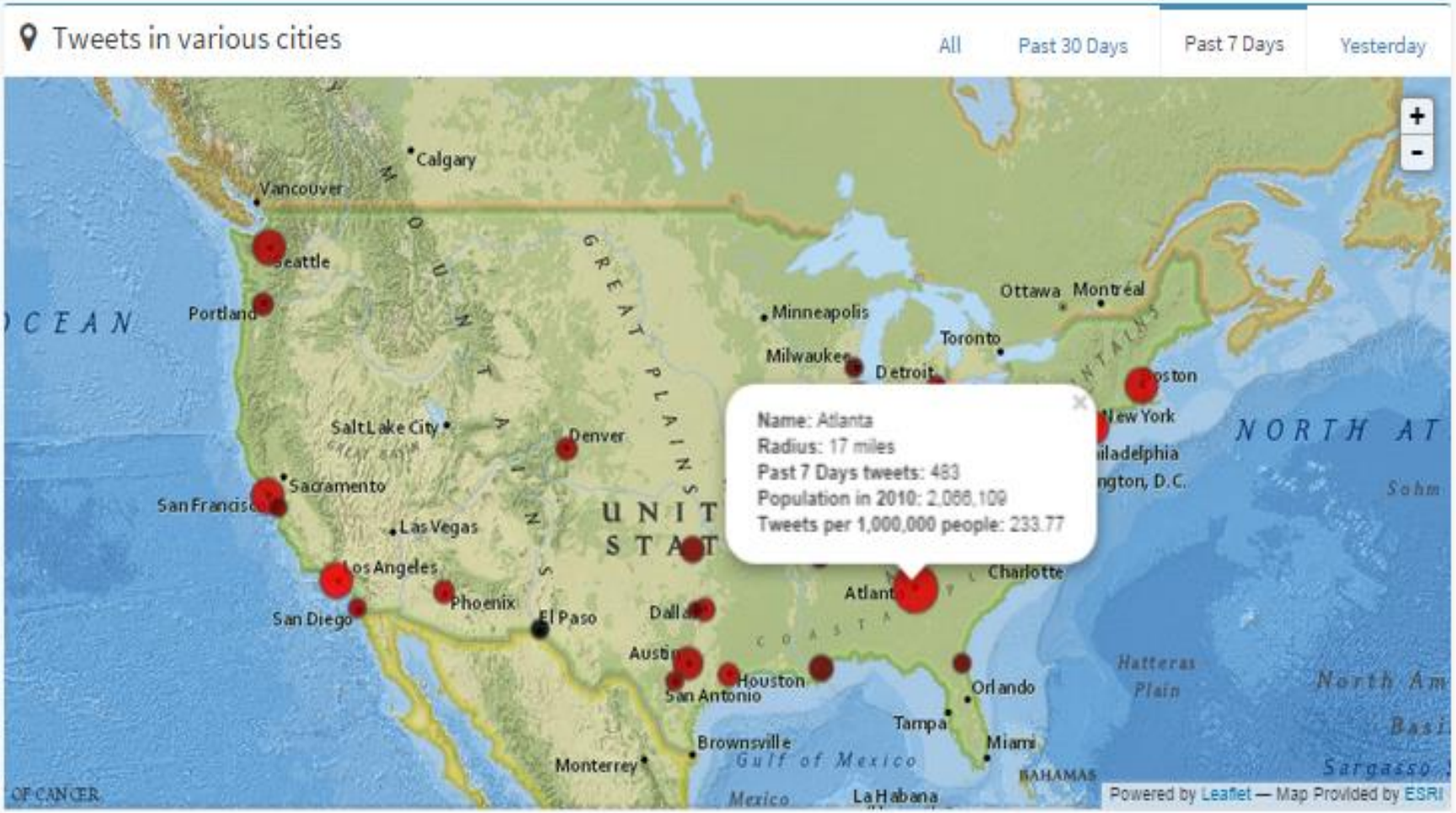
http://vision.sdsu.edu/hdma/smart/

Social Media Analysis & Research Testbed



http://vision.sdsu.edu/hdma/smart/

Map for top 30 cities 9/14/14



City	Radius	Past 7 Days Tweets	Population 2010	Tweets per 1,000,000 people
New York	17 miles	903	10,659,590	84.71
Washington DC	17 miles	773	3,174,706	243.49
Los Angeles	17 miles	649	5,424,122	119.65
Atlanta	17 miles	483	2,066,109	233.77

flu near you
do you have it in you?

Crowd Sourcing to Track Influenza Outbreaks

https://flunearyou.org

Flu Near You is a free, real-time ILI surveillance system

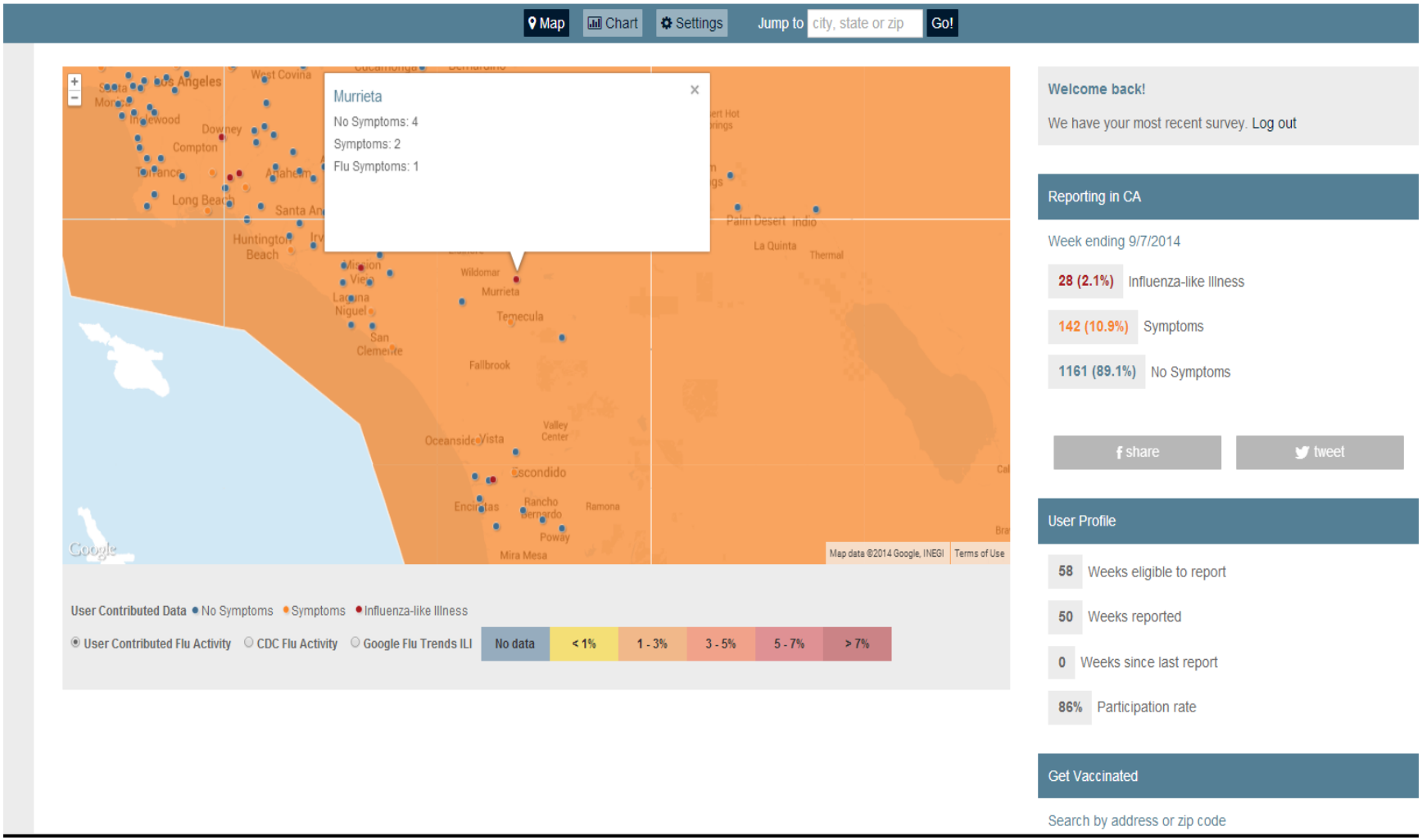
- Uses anonymous crowd-sourced symptom reporting
- Gives public health community & practitioners a new tool
- Early warning system that identifies outbreaks
- May aid targeting of disease prevention and treatment
- Better analysis and visualization disease spread
- Direct public engagement in combating communicable disease
- Possible insight into vaccine effectiveness

a project of HealthMap.org Boston

FluNearYou

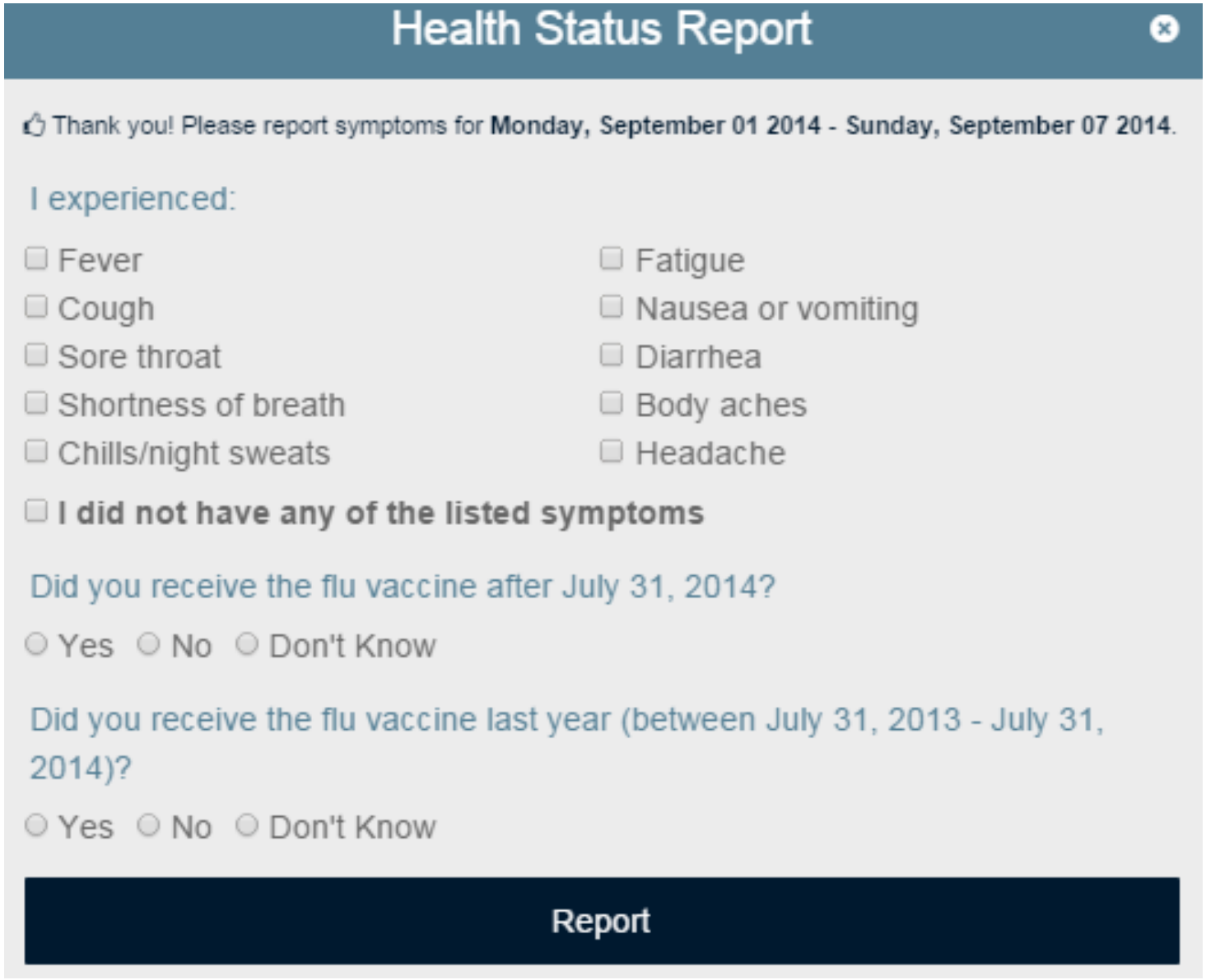
Crowd Sourcing to Track Influenza Outbreaks

a project of HealthMap.org Boston



https://flunearyou.org/ screen capture 9/10/14

FluNearYou Weekly Report

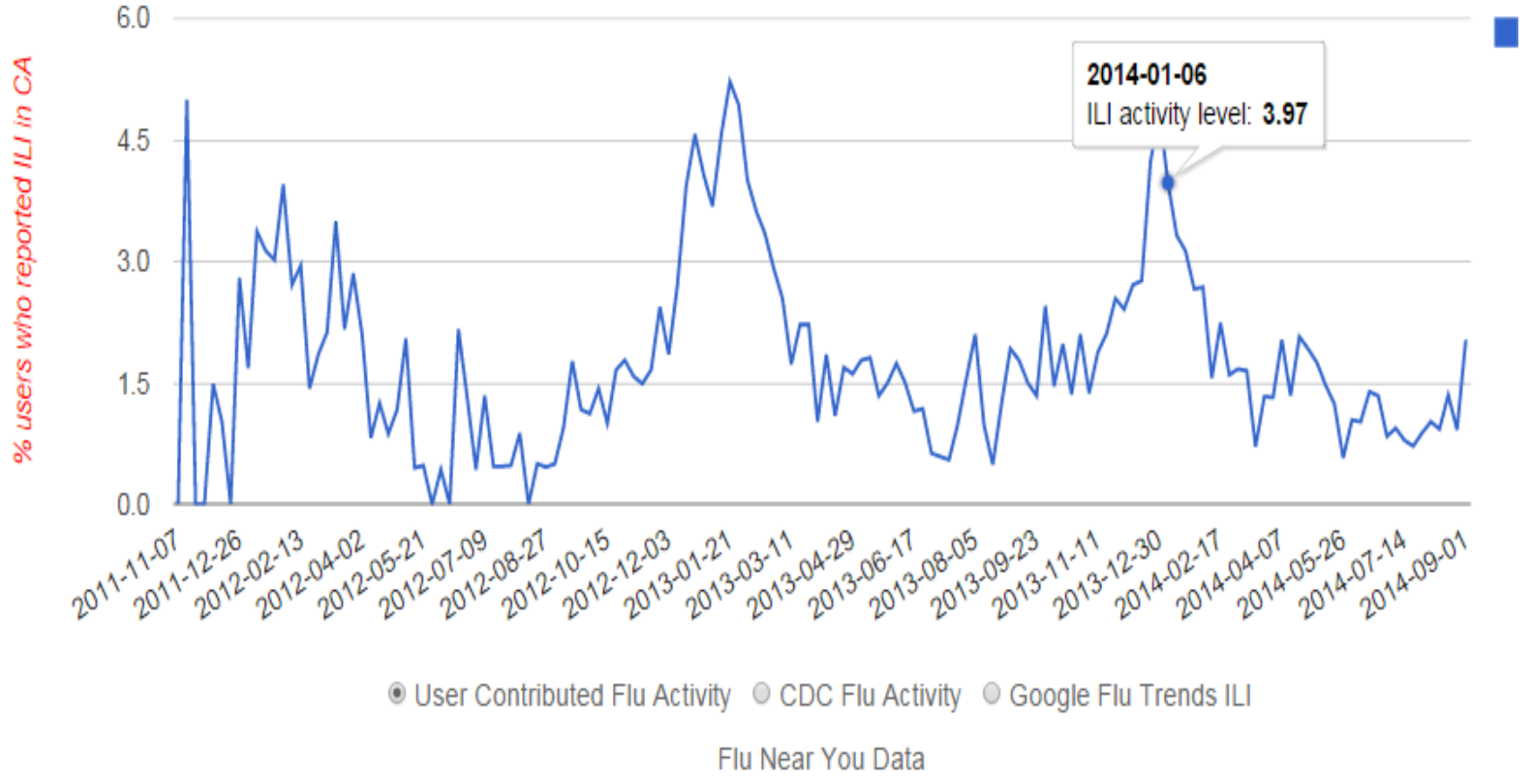


FluNearYou Android or iPhone App

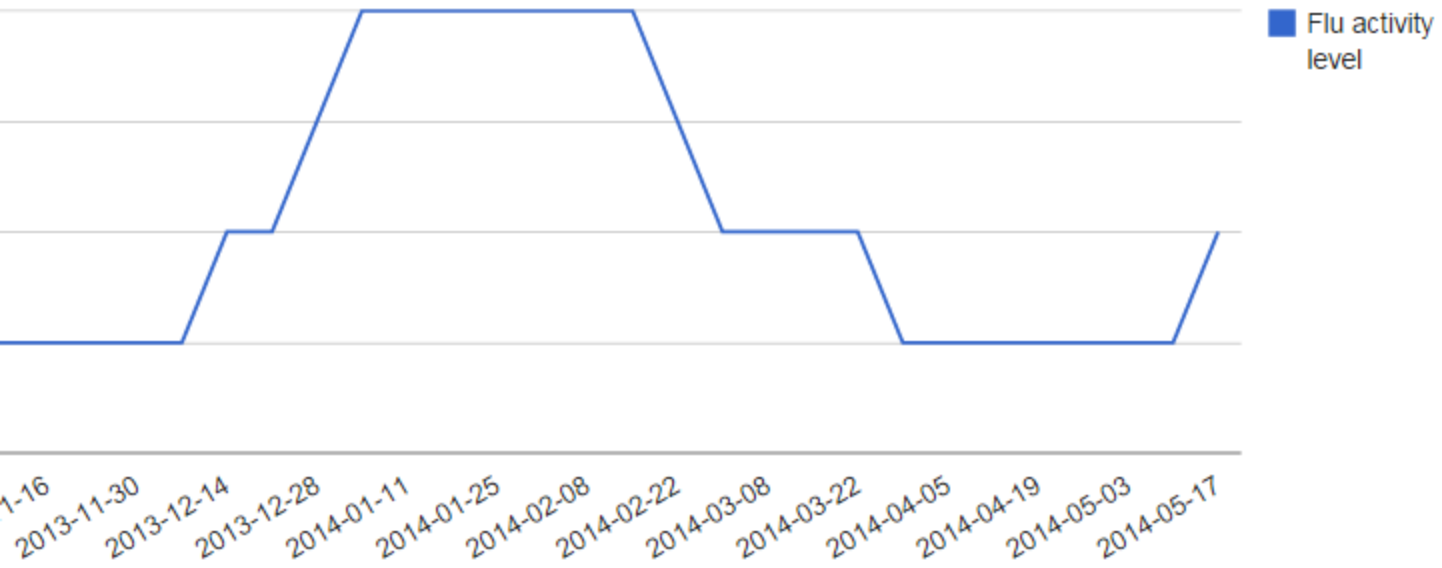
FluNearYou iPhone or Android App

flu near you
do you have it in you?

Map | Chart | Settings | Jump to city, state or zip



Map | Chart | Settings | Jump to city, state or zip | Go!



User Contributed Flu Activity | CDC Flu Activity | Google Flu Trends ILI

1 = No Report 2 = No Activity 3 = Sporadic 4 = Local
5 = Regional 6 = Widespread

Data supplied by CDC weekly flu reports

Welcome back!

We have your most recer

Reporting in CA

Week ending 9/7/2014

29 (2.1%) Influenza-li

147 (10.8%) Symptor

1219 (89.2%) No Syn

share

User Profile

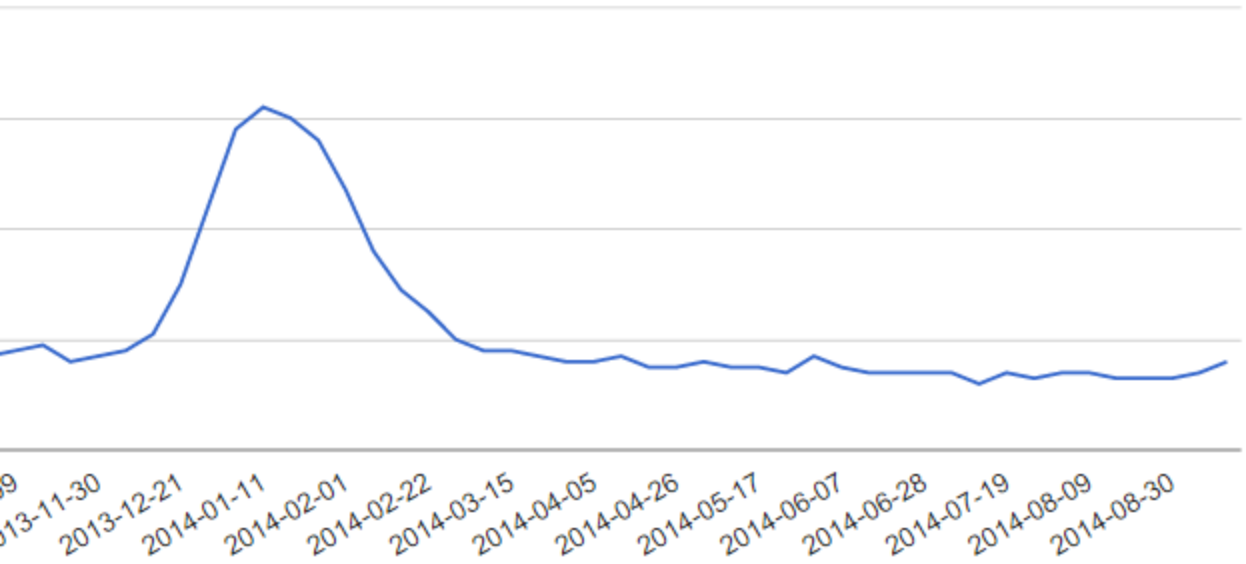
58 Weeks eligible to r

50 Weeks reported

0 Weeks since last re

86% Participation rate

Map | Chart | Settings | Jump to city, state or zip | Go!



User Contributed Flu Activity | CDC Flu Activity | Google Flu Trends ILI

Google Flu Trends

Welcome back!

We have your most recer

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User Profile

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50 Weeks reported

0 Weeks since last re

86% Participation rate

Thank you!

Questions?

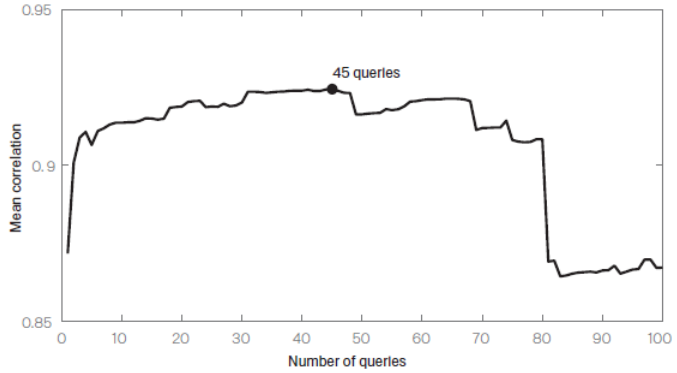
Evolution of Health Surveillance

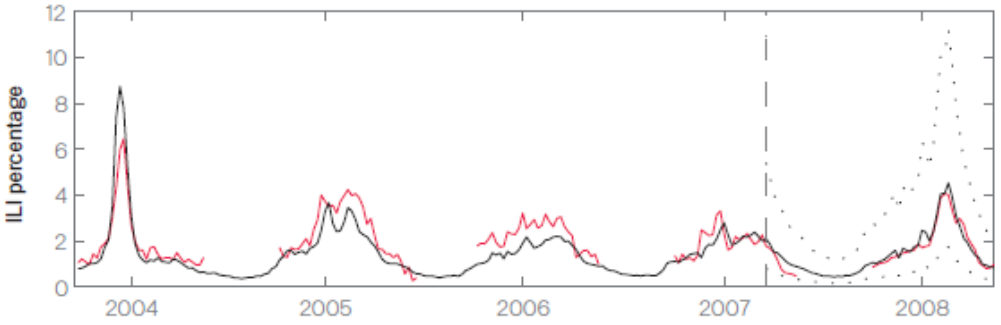
- Classical: Communicable Disease Reporting Cycle:
  - Providers >> Local >> State >> Federal >> Users
- Sentinel Surveillance
  - Selected organizations and providers
- Syndromic Surveillance
  - Mining of electronic data
    - Examples: Electronic Medical Records, Pharmacy sales
- Emerging concepts
  - **Infodemiology** - study of the distribution and causal factors using information in cyberspace
  - **infoveillance** – monitoring online texts for surveillance

Previous works – Google Flu Trends

www.google.org/flutrends/us/#cities

- Compared search queries with ILI
  - Mean correlation = .9
- Used 45 different search queries



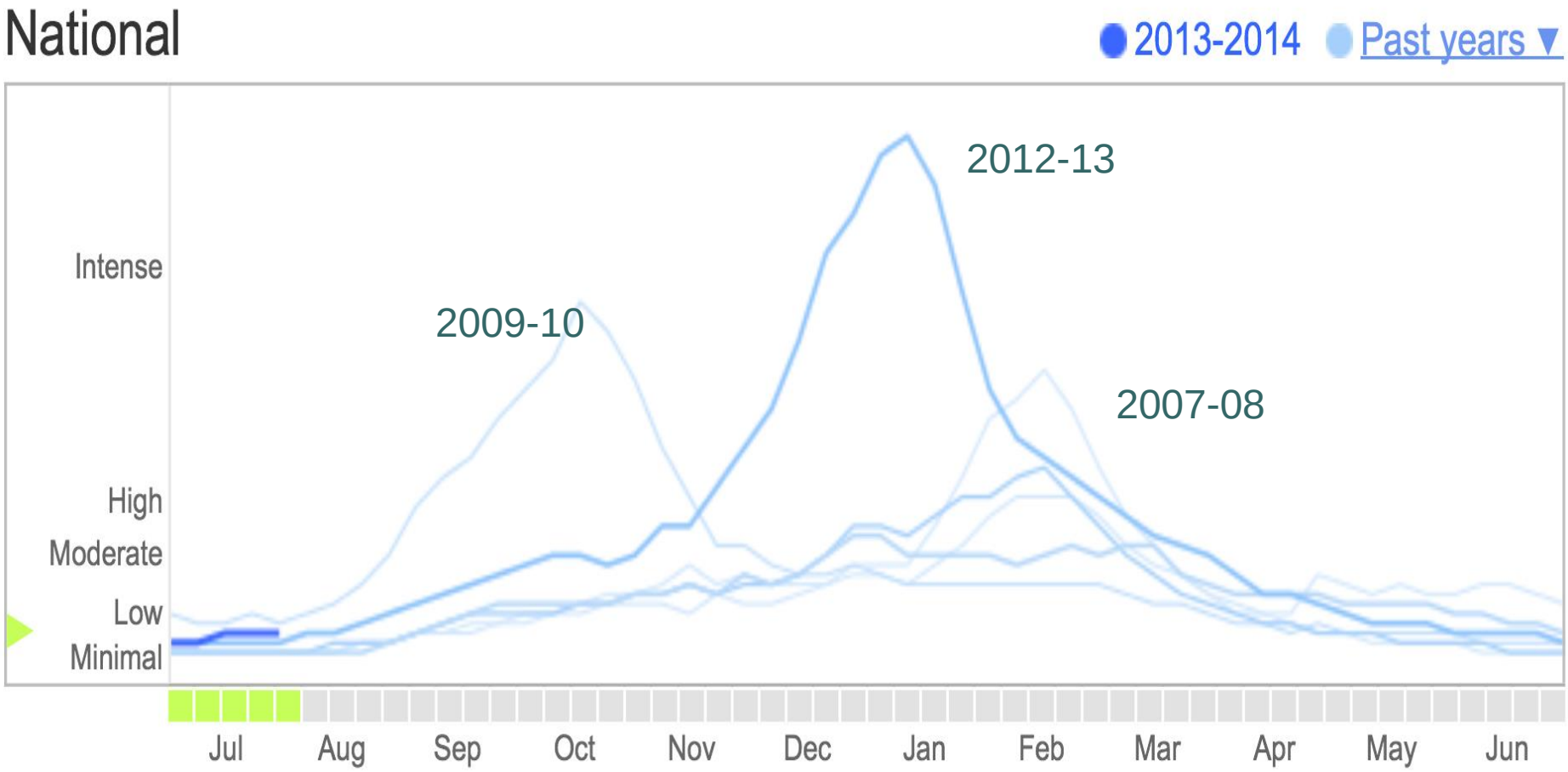


Search Query Topic	Top 45 Queries N	Weighted
Influenza Complication	11	18.15
Cold/Flu Remedy	8	5.05
General Influenza Symptoms	5	2.60
Term for Influenza	4	3.74
Specific Influenza Symptom	4	2.54
Symptoms of an Influenza Complication	4	2.21
Antibiotic Medication	3	6.23
General Influenza Remedies	2	0.18
Symptoms of a Related Disease	2	1.66
Antiviral Medication	1	0.39
Related Disease	1	6.66
Unrelated to Influenza	0	0.00
	45	**49.40**

Ginsberg et al. *Nature Vol 457, Feb 2009*

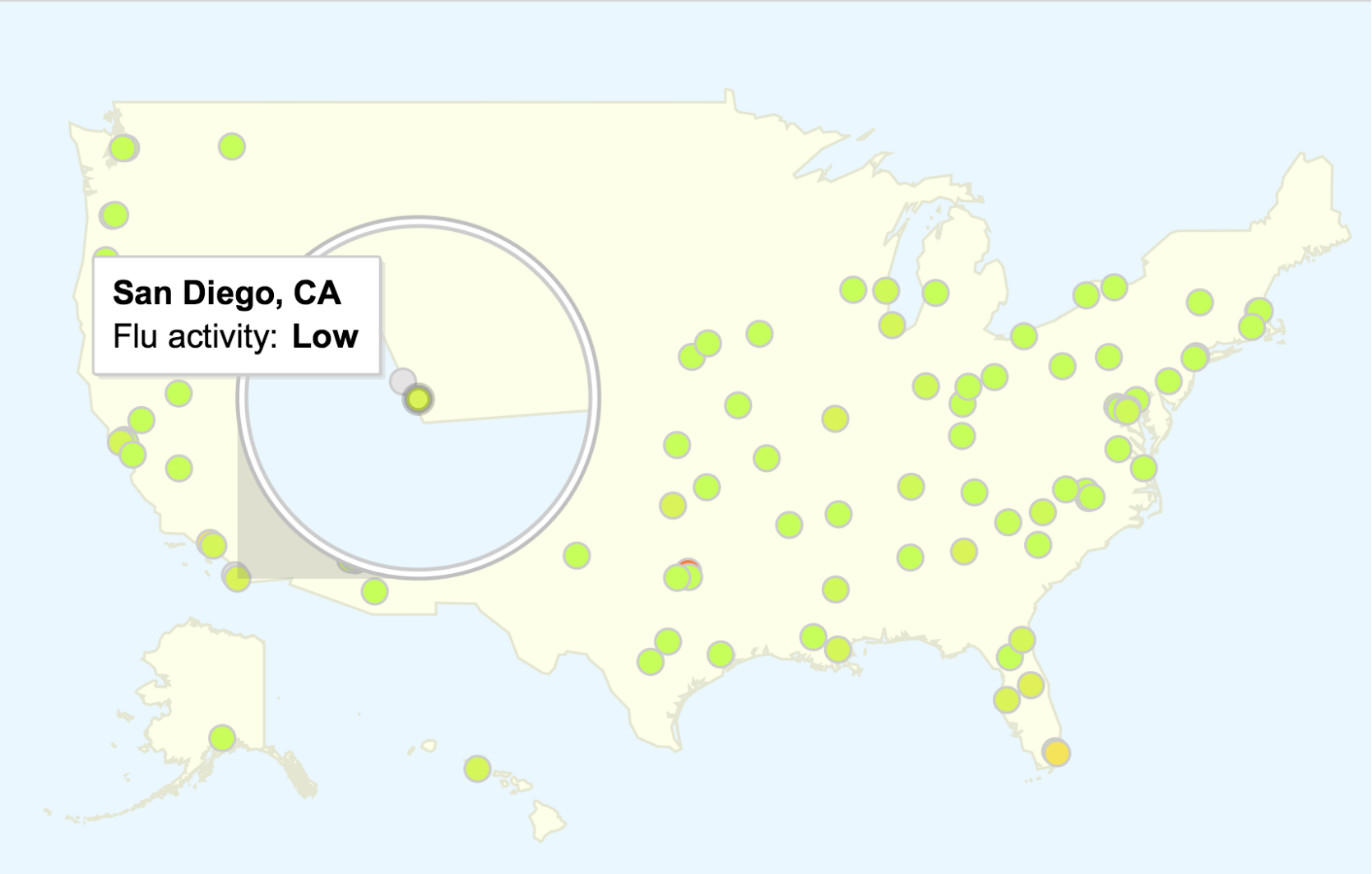
Google Flu Trends last 6 seasons

We've found that certain search terms are good indicators of flu activity. Google Flu Trends uses aggregated Google search data to estimate flu activity. Learn more »



Google Flu Trends

States | **Cities** (Experimental) - Click on a city below to chart the flu trend above.



Google Flu Trends Cities