Infectious Disease & Biomedical Informatics

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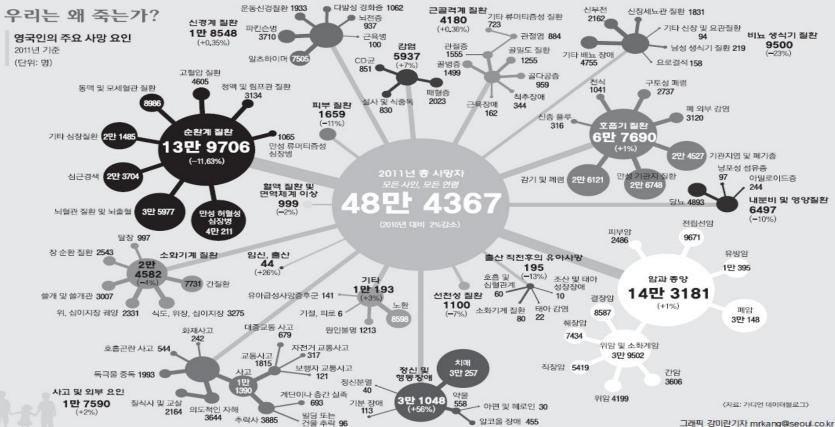


Infection Informatics

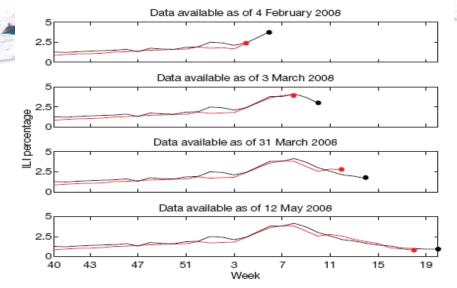
- 대지진후 2년만에 하이티를 공습한 2010년 콜레라 발병으로 동일한 균주가 한 달만에 도미니카, 미국, 베네주엘라, 멕시코, 스페인, 캐나다로 퍼져나갔다. 급격한 유행병의 통제를 위해서는 매우 빠르고도 정확한 도구가 필요한데, 고전적인 감시체계는 수 주 이상의 시간이 걸리는 한계가 있었다. Chunara 등은 지진 발생 후 첫 100일간의 8개 언어로 구성된 뉴스 기사와 블로그 게시물과 트위터의 단문 메시지를 모았다. 45000개의 보고서와 189000개의 트윗을 실시간적으로 HealthMap에 매핑하여 공식 감시 시스템에서 생성되는 보고서와 동일한 수준의 정보를 2주일 앞서 감지하는데 성공했다.
- 스마트폰을 포함한 모바일 컴퓨팅 환경은 또 하나의 강력한 환경을 제공하기 시작했다. 2011년 3월 일본을 강타한 쯔나미는 모든 사회 기반 시설을 파괴했고 전화선 등 통신망도 쓸어버렸다. 그러나 무선 통신망은 건재했고 의사들은 트위터를 이용해서 만성질환자들이 필수적 의료서비스를 어떻게 제공받을 수 있는지 알렸다. 의사들의 트윗은 빠르게 환자들의 네트워크를 통해 전달되었고, 대부분의 환자들이 필수 의료서비스를 얻는데 성공할 수 있었다.

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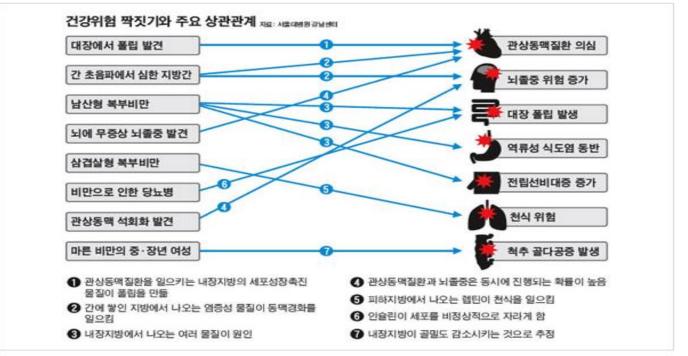


Influenza

 Accurately estimate the current level weekly influenza activity in each region of the United States



Mating Disease



조선일보 2011.04.07



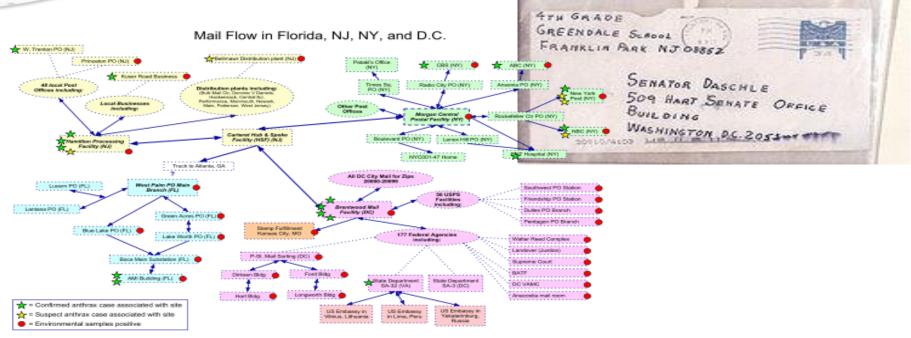
- CDC: from the beginning
- Amerithrax and Bio-terrorism to National Defense
- HealthMap: Infectious Disease Intelligence using Web resources (Mashup and GIS)
- Twitter: accessing vaccination sentiments
- Conclusion: the future



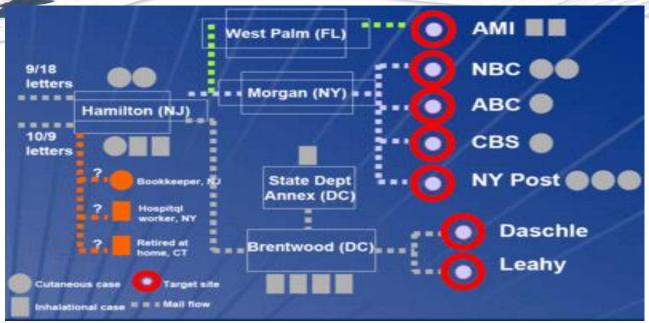
Center for Disease Control

- On July 1, 1946 the Communicable Disease Center (CDC) came into being on one floor of a small building in Atlanta, Georgia.
- Malaria Control in War Areas (MCWA) and DDT
- Infectious and chronic diseases, injuries, workplace hazards, disabilities, and environmental health threats.
- health surveillance to disease outbreaks (including bioterrorism), disease prevention strategies, national health statistics, controlling international disease transmission.
- supporting state and local health departments, improving global health, implementing measures to decrease leading causes of death, strengthening surveillance and epidemiology, and reforming health policies.

Globalization: internet & bioterrorism



Globalization: internet & bioterrorism

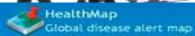


Seven letters are believed to have been mailed in the U.S., resulting in 22 infections; five people died.

HealthMap

- a freely accessible, automated electronic information system since 2006
- for monitoring, organizing, and visualizing reports of global disease outbreaks
- according to geography, time, and infectious disease agent.
- ProMED-mail, Eurosurveillance, Wildlife Disease Information Node
- in English, Chinese, Spanish, Russian, French, Portuguese, and Arabic.
- Users: WHO, CDC, and the European CDPC





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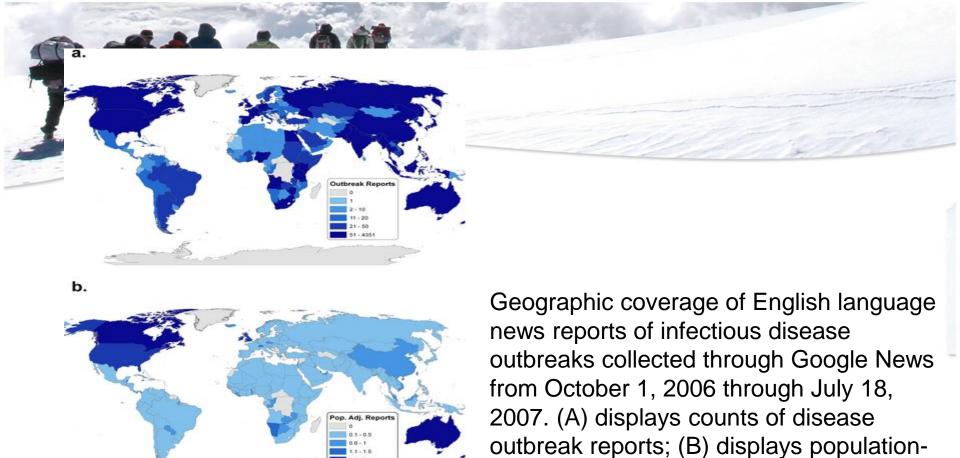
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des violences W

C [Pellow Fever] his has pelleg a an in some part of

Left update: 7 No. 2000 13:07 1 Next update: 7 No. 2008 12:07 Enter your small address to sign-up for our low-volume amountaments fat-





adjusted outbreak reporting as number of

reports per million inhabitants.



M Around 50 die of cholera in central Nigeria: press

Related Alerts: Nigeria

- 📦 31 Mar PRO/EDR> Cholera, diarrhea & dysentery update 2008 (19) » (Cholera, Diarrhea, Dysentery)
- 🗿 30 Mar <u>PRO/RUS>Зарубежное эпидобозрение корь (Нигерия)</u> » (Measles)
- 29 Mar PRO/ESP> Cólera, brote, muertes NIgeria » (Cholera)
- 🕝 29 Mar Nigeria padece el peor brote de cólera de los últimos años Europa Press » (Cholera)
- 🔟 28 Mar Measles Kills 165 Children in Katsina State » (Measles)

Related Alerts: Cholera

- C 2 Apr Vietnam faces expanding cholera outbreak Earthtimes » (Vietnam)
- 2 Apr PRO/MBDS> Cholera Viet Nam (07): RFI > (Vietnam)
- 🧿 1 Apr PRO/RUS>Зэрубежное эпидобозрение Кения (холера), грипп H5N1 (Индонезия) 🥦 (Kenya, Indonesia)
- G 30 Mar <u>Au moins 116 cas de choléra enregistrés dans le sud de l'Angola XINHUA</u> » (Angola)
- m 30 Mar Cholera kills 39 in western Kenya amid fresh fears; officials » (Kenya)

Disease Info: Cholera

<u>Wikipedia</u>

WHO CDC

PubMed

Google Trends

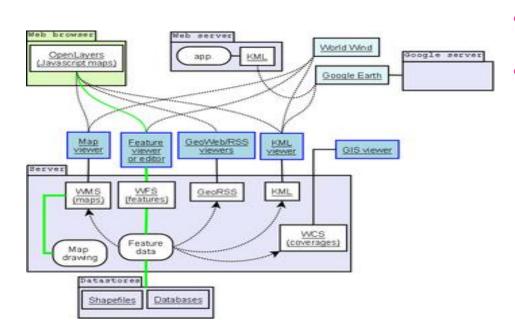
Related Background

- m 23 Mar Bird flu: FG pays N623m compensation to farmers » (Avian Influenza Nigeria)
- G 2 Apr Now, predict the next cholera outbreak from space Thaindian.com » (Cholera London)
- 30 Mar Bird flu: FG gets N6bn World Bank grant » (Avian Influenza Nigeria)
- 30 Mar <u>Cuban govt to help Delta on malaria</u> (Malaria <u>Cuba, Nigeria</u>)
- 26 Mar Programme Officer Speaks On Seriousness of TB » (Tuberculosis Nigeria)
- 17 Mar <u>Nigeria: Why New Malaria Strain Resists Drugs</u> » (Malaria Nigeria)
- m 17 Mar <u>Nigeria: Bird Flu Re-Emerges in Borno</u> (Avian Influenza Nigeria)

All articles related to a given outbreak are aggregated by text similarity matching in order to provide a situational awareness report. Furthermore, other outbreaks occurring in the same geographic area or involving the same pathogen are provided.

The window also provides links to further research on the subject. In this example, we show all alerts relating to a recent cholera outbreak in Nigeria.





- The Internet
- GIS: Geographic information system
- Mashup



OPEN ACCESS Freely available online

PLOS COMPUTATIONAL BIOLOGY

Assessing Vaccination Sentiments with Online Social Media: Implications for Infectious Disease Dynamics and Control

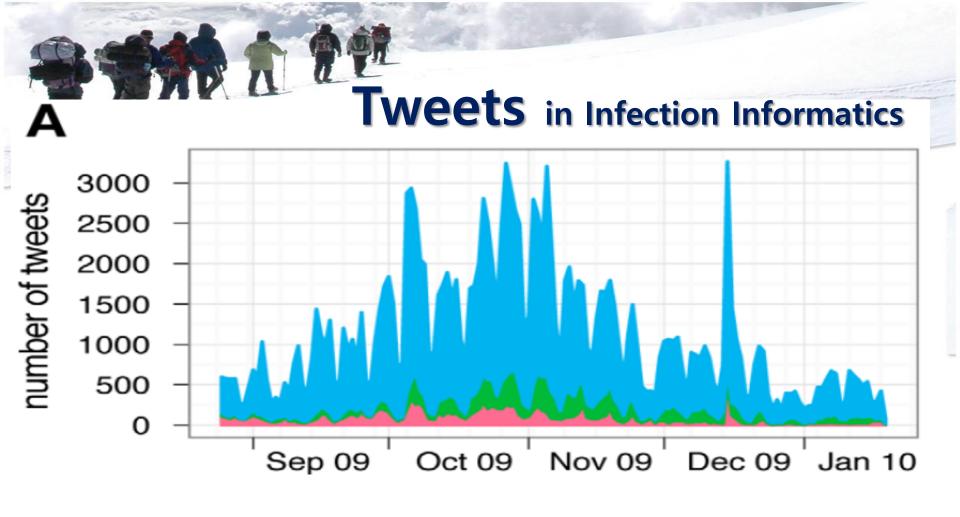
Marcel Salathé*, Shashank Khandelwal

Center for Infectious Disease Dynamics, Department of Biology, Penn State University, University Park, Pennsylvania, United States of America

Outbreaks of vaccine preventable diseases are a major public health issue. Outbreaks are more likely to occur if either overall vaccination rates decline, or if communities with very low vaccination rates increase in frequency or size

Fundamental shift in measurement methodology: the study population is not responding to a survey, but rather shares data in a survey-free context, often in real time

- 477,768 Tweets in U.S. August 25th 2009, Until January 19th 2010
- Either negative, positive or neutral on A(H1N1)
- collected all tweets in English containing at least one of the following search strings: vaccination OR vaccine OR vaccinated OR vaccinate OR vaccinating OR immunized OR immunize OR immunization OR immunizing → 318,379 tweets
- Trained a machine learning classifier using (64 students') manually rated tweets as the training set for prediction → 255,828 (neutral), 26,667(negative), 35,884(positive)
- Temporal, localized influenza A(H1N1) vaccination sentiment score
- Constructing a network of sentiment information flow



- Sentiment analysis
- positive: A positive sentiment means the author is likely to get the influenza A(H1N1) vaccine.
- Example tweet that was rated as positive: off to get swine flu vaccinated before work.
- negative: A negative sentiment means the author is unlikely to get the influenza A(H1N1) vaccine.
- Example tweet that was rated as negative:

 <u>What Can You Do To Resist The U.S. H1N1 "Vaccination" Program? Help Get Word Out. The H1N1 "Vaccine" Is DIRTY. DontGetIt.</u>
- neutral: No clear sentiment can be detected.
- Example tweet that was rated as neutral:

The Health Department will be offering the seasonal flu vaccine for children 6 months — 19 yrs. of age starting on Monday, Nov. 16

- irrelevant: The tweet is not clearly about the influenza A(H1N1) vaccine.
- Example tweet that was rated as irrelevant:

Filipino discovers new vaccine against malaria that 'treats' the mosquitoes, too!

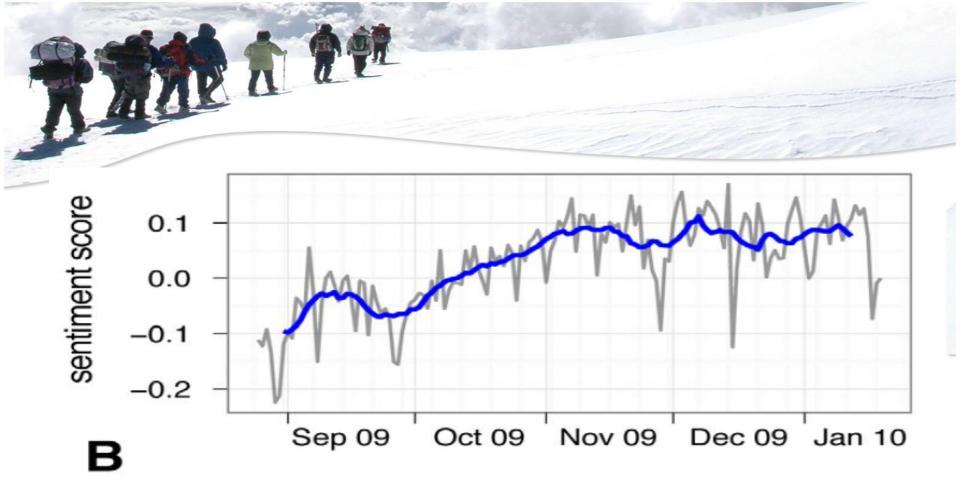
- Using NLTK, MegaM, LingPipe
- Naive Bayes classifier: + / tweets
 Maximum Entropy classifier: neutral / irrelevant tweets
- > Geocoding
- Twitter allows a tweeter's location to be manually entered into his or her profile
- Using GPS, Yahoo Place-Finder API
- Of the 155,676 locations, there were 9,231 location strings that could not be accurately resolved using the PlaceFinder
- asked students to resolve the location manually if possible



- Network Creation
- 1. Each user who has at least one relevant (i.e. +, or neutral) tweet → a node in the network.
- 2. There is a **directed edge** from user A to user B if at any time point, user B is found among the **followers** of user A, or user A is found among the **friends** of user B. (friends < 5,000)
- The overall influenza A(H1N1) vaccine sentiment score, measured as the relative difference of positive and negative
 tweets ((n₊-n₋)/(n₊+ n₋ +n₀))
- Assortativity Coefficient r

$$r = \frac{\sum_{i} e_{ii} - \sum_{i} a_{i} b_{i}}{1 - \sum_{i} a_{i} b_{i}}$$

- r > 0: nodes are predominantly connected to nodes of the same type
- r = 0 : randomly mixed network
- r < 0, <= -1 would indicate a disassortative network where nodes of one type are predominantly connected to nodes of the other type
- Ex) r=0.144 In the network of 39,284 users who had a non-zero sentiment score



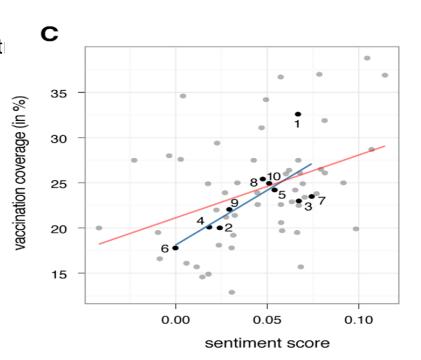


Result

estimates are based on results from the Behavioral Risk Factor Surveillance System (BRFSS) and the National 2009 H1N1 Flu Survey (NHFS)

• a strong correlation at the level of State, very st





Result

We performed simulations as described previously with a constant vaccination rate but varying levels of assortativity

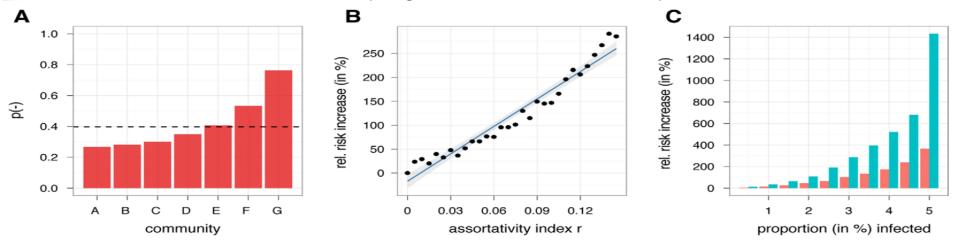


Figure 2. (A) Proportion of negative sentiments $p(\cdot)$ in the network communities. Dashed line shows overall proportion in the opinionated network. The proportions of negative and positive sentiments are significantly different from the overall proportions in the entire opinionated network (with the exception of community E). (B) Effect of positive assortativity index (r) on relative risk increase (compared to risk at $r\sim0$) of disease outbreaks that infect at least 3% of the population. Blue line shows best fit of linear regression (confidence interval based on standard error). (C) Relative risk increase (compared to risk at $r\sim0$) of disease outbreaks of a given fraction of the population (on horizontal axis) for two values of assortativity index (r), 0.075 (red) and 0.145 (green). Note that the latter corresponds to r found in the opinionated network (see main text). doi:10.1371/journal.pcbi.1002199.g002

A positive correlation between the influenza A(H1N1) vaccination sentiment score and
estimated vaccination coverage would be relevant to public health efforts because it would
allow for the identification of target areas for communication interventions

the significantly positive assortativity of negative and positive sentiments provide evidence
that online social media can act as an "echo chamber" where personal opinions that affect
individual medical decisions are predominately reaffirmed by others

A proposal

- Time, location, body temperature per hour via your smartphone
- Digital stethoscope with cloud computing for pneumonia detection at underserved area
- Microbial infection is a genome infermacology & Therapeutics 92, 393-396 (September 2012) | dc
- Pharmacogenomics of antibiotics
- Informatice for determining evnergie

Am J Epidemiol. 2012 Oct 16. [Epub ahead of print]

Neighborhood Determinants of 2009 Pand Montreal, Quebec, Canada.

Systematic idea targeting HIV

Construction of an Open-Access QT Database for Detecting the Proarrhythmia Potential of Marketed Drugs: ECG-ViEW

M Y Park, D Yoon, N K Choi, J Lee, K Lee, H S Lim, B J Park, J H Kim and R W Park

Information about the QT interval from surface electrocardiograms (ECGs) is essential for surveillance of the proarrhythmia potential of marketed drugs. However, ECG records Brien S, Kwong JC, Charland KM, Verma AD, Brownstein JS obtained in daily practice cannot be easily used for this purpose without labor-intensive manual effort. This study was aimed at constructing an open-access QT database, the Electrocardiogram Vigilance with Electronic Data Warehouse (ECG-ViEW). This longitudinal observational database contains 710,369 measurements of QT and associated clinical data from 371,401 patients. The de-identified database is freely available at http://www.ecaview.org.

Xu Tan, Long Hu, Lovelace J

John Lu, Peter J Park & Stephen J Elledge

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