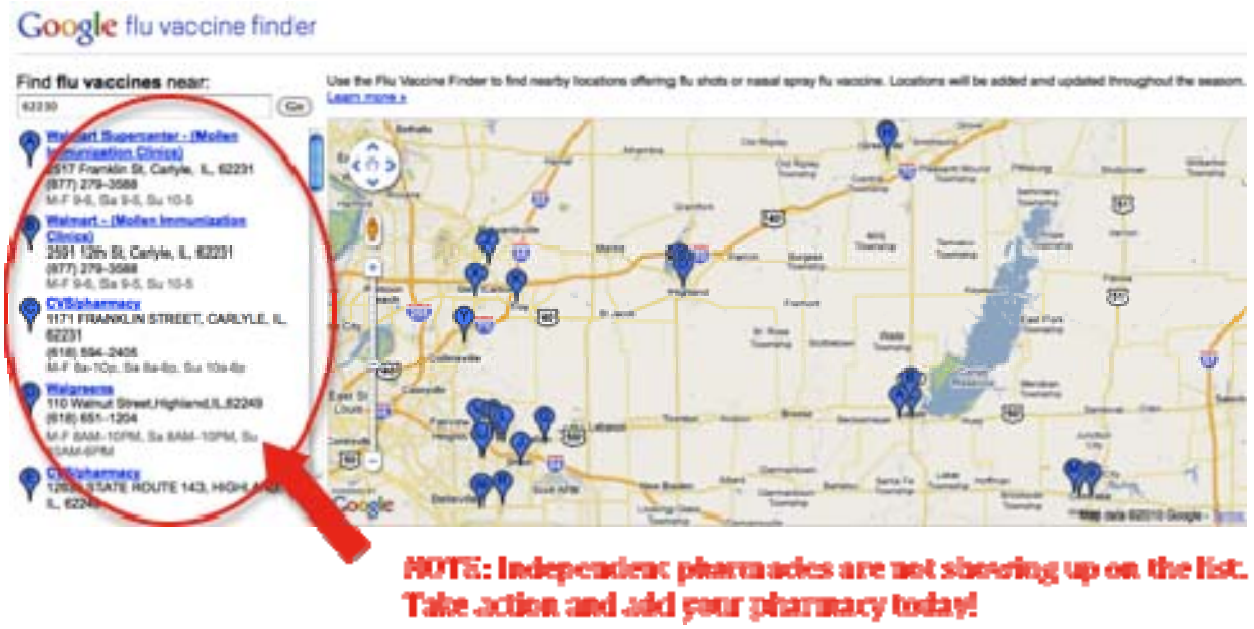
INTERNET-BASED INTELLIGENCE FOR PUBLIC HEALTH EMERGENCIES AND DISEASE OUTBREAK: TECHNICAL, MEDICAL, AND REGULATORY ISSUES



NATO SCIENCE FOR PEACE AND SECURITY PROGRAMME

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ADVANCED RESEARCH WORKSHOP

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NATO Emerging Security Challenges Division, Bd. Leopold III, B-1110 Brussels, Belgium

fax +32 2 707 4232 : e-mail science@hq.nato.int

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DAN PANORAMA HOTEL HAIFA

HAIFA, ISRAEL

ORGANIZING COMMITTEE

Co-Directors

Emilio Mordini

Centre for Science, Society and Citizenship, Rome, Italy

Manfred Green

School of Public Health at Haifa University, Haifa, Israel

Committee Members

François M.H. Géré

Institut Français d'Analyse Stratégique, Paris, France

Toby Merlin

Division of Preparedness and Emerging Infections, National Center for Emerging and Zoonotic Infectious Disease, Centers for Disease Control and Prevention

Secreteriat:

Centre for Science, Society and Citizenship

Piazza Capo di Ferro 23, 00186 Rome, Italy

Phone: +39 0645551042/3 - Fax: +39 0645551044

Email: cssc@cssc.eu

Need

A number of initiatives aimed at identifying health crises earlier than existing official monitoring systems are in progress. Web crawlers – automated software programs that scour the web for information – are increasingly used to find patterns that may signify an emerging threat. "*Over the past 15 years, Internet technology has become integral to public health surveillance. Systems using informal electronic information have been credited with reducing the time to recognition of an outbreak, preventing governments from suppressing outbreak information, and facilitating public health responses to outbreaks and emerging diseases*" [1]. Yet Internet-based systems for outbreak detection still lack a calm and reflective evaluation, which includes not only an assessment of their technical reliability but also a careful analysis of their policy and regulatory implications. The main issues include;

1) Whether web-crawler systems are truly able to extract reliable data on emerging crises from the Internet;
2) How it is possible to deal with information overload, false reports, lack of specificity of signals;
3) How it is possible to exploit new mobile technologies to engage directly with citizens to report illness;
4) How it is possible to minimize the risk that affected groups might deliberately provoke false alarms;
5) Whether it is possible to also apply this technology to the early detection of other kinds of crisis (e.g., conflicts, environmental disasters, financial crisis, etc).
6) How it is possible to improve the coverage of developing countries, where news sources are fewer;
7) Political impact given that Internet based systems bypass state based epidemiological surveillance.
8) How it is possible to implement public verification and follow-up procedures;
9) Privacy concerns for strategies that have the potential to identify individual internet activity.

Importance

The potential threat of infectious diseases to the security of human life and global stability is very real. In a closely interconnected and interdependent world, new infectious diseases may adversely affect economic growth, trade, tourism, business and industry, and social stability as well as public health[2]. Severe high-mortality rate pandemics due to highly-transmissible viruses are a real threat for the world in the 21st century. Over the past three decades, scientists have identified more than 30 "new" infectious diseases, including HIV/AIDS, SARS, Ebola, and the West Nile Virus. In addition, the risk of infectious diseases crossing species boundaries may be more frequent, as in the case of "mad cow disease" and the threat of "swine flu."

Public health measures to control and fight emerging infectious diseases are still limited[3]. Governments have to weigh the benefits and harms of exposing people, communities and whole countries to possible discrimination and economic insult through epidemic controls. A range of negative outcomes are possible including a population's refusal to accept preventive measures or treatment regimens such as isolation and quarantine. Inappropriate public health responses may cause social disruption and civil disobedience. Beyond the immediate human health toll of epidemic crises, there may be damage inflicted by stereotyping, stigmatization and staggering economic losses. Another aspect of epidemics in our age is that it is hard to distinguish a natural disease outbreak from an intentionally caused biological threat. The combined danger arising from the bioterrorist threats to public order and the emergence of naturally-occurring new infections demand novel solutions and particular attention.

[1] Brownstein JS, Freifeld CC, Madoff LC. (2009) Digital disease detection--harnessing the Web for public health surveillance. *N Engl J Med*. 21;360(21):2153-5, 2157

[2] Klaucke D. (2002) *Globalization and Health: A Framework for Analysis and Action*. Presentation at the Institute of Medicine Workshop on the Impact of Globalization on Infectious Disease Emergence and Control: Exploring the consequences and the Opportunities, Washington, D.C. Institute of Medicine Forum on Emerging Infections.

[3] Smolinski, M, Hamburg, MA, Lederberg, J (2001) *Microbial Threats to Health; Emergence, Detection, and Response*. Institute of Medicine of the National Academies: Washington DC.

If fighting new epidemics is not easy, predicting them is still more difficult[4]. The spread of infections depends on several factors, related to the nature of the microbiological agent, peoples' behaviour, socio-economic conditions and the like. Despite established links between microbiological, ecological, geographical, socio-economic variables and epidemics, surveillance systems to forecast epidemics are far from being accurate. False alarms can have huge economic costs and can seriously undermine public confidence. As a consequence, our ability to deal effectively with new and emerging epidemics chiefly relies on early detection. Early detection of disease activity, when followed by a rapid response, can reduce the impact of outbreaks and allow essential medical, social and economic countermeasures to be taken.

Timeliness

Early detection of disease outbreak has traditionally relied on microbiological and clinical data. Yet since 1990s new surveillance systems have been created to monitor indirect signals of disease activity. Among these indirect methods some rely on obvious indicators, such as the volume of over-the-counter drug sales[5] or the number of calls to telephone triage advice lines[6]; other more innovative methods are based on electronic communication monitoring . The aim of these innovative methods is to detect health crises earlier than official monitoring systems. The Program for Monitoring Emerging Diseases (PROMed-mail) was founded in 1994 by the International Society for Infectious Diseases, and it is likely to be the most ancient online, publicly available, reporting system. ProMED uses the Internet to disseminate information on outbreaks by e-mailing and posting case reports, including many gleaned from readers, along with expert commentary. Founded in 1997, GPHIN, Global Public Health Intelligence Network, is an Internet-based 'early warning' system for potential public health threats including chemical, biological, radiological and nuclear (CBRN). GPHIN has been developed by the Canada's Centre for Emergency Preparedness and Response (CEPR). GPHIN retrieves relevant articles from news aggregators every 15 minutes, using extensive search queries. The system monitors on a worldwide, 24/7 basis, with media sources in six languages (Arabic, Chinese, English, French, Russian and Spanish) and provides relevant information on disease outbreaks and other public health events. The automatic system filters and categorizes information, which is further processed by human analysis. More recently a new generation of web application hybrids (*mushups*), which combine information from multiple sources into a single representation, have been used to mine, categorize, filter, and visualize online intelligence about epidemics in real time. Current systems include Healthmap, Google Flu Trends, MediSys, Argus, EpiSPIDER, BioCaster, and the Wildlife Disease Information Node. Text-processing algorithms are used to determine the relevance of the information, which is then sorted by disease and location, with duplicate articles filtered out. The mining power of these systems is constantly increasing, for instance, Healthmap searches 20,000 websites every hour, tracking about 75 infectious diseases, including malaria, cholera, Ebola, and recently also swine flu. An average of 300 reports are collected each day, about 90% of which come from news media sources. Current systems combine similar types of media, yet the introduction of new automated analysis of online video materials and radio broadcasts, and the possibility to aggregate different types of media, will soon provide still more robust and sophisticated systems.

ProMED and GPHIN played critical roles in informing public health officials of the outbreak of SARS, or severe acute respiratory syndrome, in Guangdong, China, as early as November 2002, by identifying informal reports on the Web through news media and chat-room discussions. Yet the use of using electronic tools to monitor for infection outbreaks went to the limelight only with the recent outbreak of swine flu in Mexico when *Google Flu Trends*, which aggregates and analyzes search queries to detect online early sign of flu epidemics, found a peak in telltale flu-related search terms about two weeks in advance of the actual outbreak. In other words,

[4] Tait, J., Meagher, L., Lyall, C., Suk, J. (2006) Foresight. Infectious Diseases: preparing for the future. Risk Analysis. *Office of Science and Innovation*, London

[5] Magruder, S., (2003) Evaluation of over-the-counter pharmaceutical sales as a possible early warning indicator of public health. *Johns Hopkins University APL Technical Digest* **24**, 349–353

[6] Espino, J., Hogan, W. & Wagner, M. (2003) Telephone triage: A timely data source for surveillance of influenza-like diseases. *Proc AMIA Symp* 215–219

Google data may have been able to provide an early warning of the swine flu outbreak, if the system were adopted as a reference system. When on April 25, 2009 the World Health Organisation (WHO) declared a "public health emergency of international concern", it was too late to contain the disease and stop its spread. Could the spread of the virus have been stopped if public health groups had paid better attention online earlier? The answer is likely to be "yes". John Brownstein, an assistant professor of pediatrics at Harvard University and co-creator of the Health Map service (one of the new digital detection devices for infectious diseases), believes the swine flu outbreak represents a "*different era*" in the world of information flow and communication. "*The speed at which we are receiving data of this outbreak and new reports in different countries, different provinces is just astonishing*" he said[7].

Early detection of an infectious disease outbreak is an important element of security policies. Infectious disease outbreak are not only medical events, but complex socio-economic incidents which affect the whole of society in several ways, not to mention the possibility of the occurrence of bioterrorist attacks. Rapid disease identification allows to implement public health intervention and to establish the necessary social, economical and political countermeasures, which improve public resilience and reduce the risk of disruptive societal reactions. Yet many countries, often in the same world regions in which new infectious diseases are emerging, lack capacity for early detection and sometimes tend to not fully disclose the nature and extent of an outbreak in order to avoid a negative economic impact. The Internet offers solutions to some of these challenges. Freely available Web-based sources of information may allow us to detect disease outbreaks earlier with reduced cost and increased reporting transparency. A vast amount of real-time information about infectious disease outbreaks is found in various forms of Web-based data streams. These range from official public health reporting to informal news coverage to individual accounts in chat rooms and blogs. However infectious disease intelligence, like any other kind of intelligence, should never be considered a trivial issue. On the contrary it always requires a careful, technical and political, critical assessment. This ARW aims to initiate such a critical assessment by gathering a multidisciplinary pool of experts and launching a high level conversation on the main technical, regulatory and political issues raised by this new technology.

General Approach

The workshop will provide a flexible framework within which to assess emerging systems of global epidemiological surveillance based on monitoring online communications and the World Wide Web. We aim to gather information from different perspectives and provide a pluralistic picture of the issue. The workshop will allow a full exchange of opinions to take place and promote open debate among participants. These participants will be both men and women from academia, international organisations, civil society organizations, national and international regulatory bodies and security agencies. During the three-day workshop, the main speakers will present a full picture of the situation from their own perspectives to a selected audience, including other speakers, chairs, and participants, up to max 40 persons in total. This should allow ample opportunity for each participant to ask questions, debate points or refute one or more of the statements made by the speakers. Papers will be collected, edited, and published in a book.

[7] CBC News, *May 1, 2009 , http://www.cbc.ca/technology/story/2009/05/01/tech-090501-online-tools-pandemic.html*

SUNDAY, MARCH 13

15:00 - 17:00 *Registration and Coffee*

SESSION 1 OPENING

*Chair: **Manfred Green**, Israeli Co-Director*

17:00 – 17:20 Welcome by **Manfred Green**, Israeli Co-Director

17:20 – 17:40 Welcome and scope of the workshop by **Emilio Mordini**, NATO country Co-Director

Key notes delivered by

17:40– 18:10 **Rumi Chunara**, Research Fellow, Harvard Medical School and HealthMap
HealthMap: Harnessing the web for public health surveillance

18:10 - 18:40 **Marjorie P. Pollack**, Deputy Editor Epidemiology & Surveillance, Moderator ProMED-mail
Digital Detection of Diseases: where we are, where we go

18:40 – 19:00 Chair's conclusive remarks and adjourn

19.00 *Get together Reception*

MONDAY, MARCH 14

SESSION 2 EARLY DETECTION OF DISEASE OUTBREAKS BY USING THE INTERNET, THE CONTEXT

*Chair: **Toby L. Merlin** Director, Division of Preparedness and Emerging Infections, National Center for Emerging and Zoonotic Infectious Disease, Centers for Disease Control and Prevention (CDC)*

09:00 -09:10 Chair's general introduction

09:10 – 09:30 **Tamar Shohat**, Director, Israel Center for Disease Control
The use of multi sources digital data bases for influenza surveillance

09:30 – 09:50 Discussion

09:50 - 10:10 **Predrag Kon**, Head of the Department for immunization at Institute of Public Health
Internet based intelligence service during pandemic influenza season 2009/2010 in Serbia

10:10 – 10:30 Discussion

10:30 – 11:00 *Break*

11:00 – 11:20 **Marc Gastellu Etchegorry,** Director of the International Department, French Institute for Public Health Surveillance, EpiSouth project
Epidemic Intelligence around the Mediterranean Basin: the Episouth Network

11:20 – 11:40 Discussion

11:40 – 12:00 **Massimo Ciotti**, Preparedness and Response Unit, European Centre for Disease Prevention and Control
Epidemic intelligence in the European Union: the role of Internet

12:00 – 12:20 Discussion

12:20-12:40 **Laetitia Vaillant** Global Health Security Action Group, Institute for Public Health Surveillance
Epidemic intelligence in France and within the GHSAG community

12:40 - 13:00 Discussion

13:00 – 13:10 Chair's conclusive remarks and adjourn

13:10 – 14:30 Lunch

SESSION 3 INTERNET, PUBLIC HEALTH AND COMMUNICATION

*Chair: **Emilio Mordini**, Centre for Science, Society and Citizenship*

14.30 – 14:40 Chair's general introduction

14:40 – 15:00 **Donato Greco,** Italian National Institute of Health
New Communication Strategies in Epidemics

15:30 – 15:20 Discussion

15:20 – 15:40 **Ben Reis**, Assistant Professor, Harvard Medical School, Affiliated Faculty, Harvard-MIT Division of Health Sciences and Technology
Social networks and health

15:40 – 16:00 Discussion

16:00 – 16:20 Break

16:20 – 16:40 **Anat Gesser-Edelsburg** Health Promotion-School of Public Health, University of Haifa
Strategies of persuasion for effectively communicating with the public using websites and social media during emergencies and disease outbreak

16:40 – 17:00 Discussion

17:00 – 17:20 **Yair Amikam**, Dep. Dir. General Information & Int. relations, Israeli Ministry of Health
Transparency in Public Health Communication

17:20 – 17:40 Discussion

17:40 – 18:00 **Goran Belojevic**, Institute of Hygiene and Medical Ecology, School of Medicine, University of Belgrade
Internet Based Health Communication – Analysis of Messages on the Websites of Serbian Public Health Institutes

18:00 - 18:20 Discussion

18:20 – 18:30 Chair's conclusive remarks and adjourn

20:30 Conference dinner

TUESDAY, MARCH 15

SESSION 3 THE COMPLEX RELATION BETWEEN SECURITY AND PUBLIC HEALTH

Chair: ***François M.H. Géré****, Institut Français d'Analyse Stratégique*

09:00-09:10 Chair's general introduction

09:10 – 09:40 **Deborah Cohen**, British Medical Journal
WHO and the "pandemic flu conspiracies"

09:40 – 10:00 Discussion

10:00 - 10:20 **Michael Hopmeier,** Director, Unconventional Concepts
Public Health, Intelligence and National Security: an approach for the 21st Century

10:20 – 10:40 Discussion

10:40 – 11:00 Break

11:00 – 11:20 **Iris Hunger,** Head, Hamburg Research Group for Biological Arms Control at the Centre for Science and Peace Research, University of Hamburg
Internet based intelligence for bioweapons control

11:20 – 11:40 Discussion

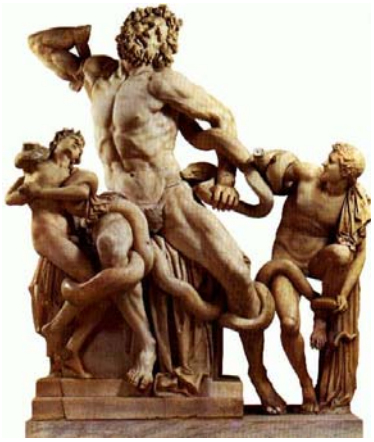
11:40 – 12:00 **Richard B. Schwartz**, Chairman, Emergency Medicine Georgia Health Sciences University, Vice Chairman National Disaster Life Support Foundation (NDLSF)
A Health Security Card (HSC) for Disasters and Public Health Emergencies

12:00 – 12:20 Discussion

12:20 – 12:30 Chair's conclusive remarks

12:30 - 13:00 **FINAL ROUND TABLE: LESSON LEARNED AND FUTURE DIRECTIONS**
Manfred **Green**, Emilio **Mordini**, Toby l. **Merlin**, François M.H. **Géré**

13: 00 Adjourn & Lunch



Participants

Yair Amikam	*Information & Int. relations, Israeli Ministry of Health*	ISRAEL
Valeria Balestrieri	*Centre for Science, Society and Citizenship*	ITALY
Artak Barseghyan	*Academy of Armenia Engineering*	ARMENIA
Goran Belojevic	*Institute of Hygiene and Medical Ecology, School of Medicine, University of Belgrade*	SERBIA
Rumi Chunara	*Harvard Medical School and HealthMap*	UNITED STATES
Massimo Ciotti	*Preparedness and Response Unit, European Centre for Disease Prevention and Control*	EUROPEAN UNION
Daniel Cohen	*Dept of Epidemiology, Tel Aviv University*	ISRAEL
Deborah Cohen	*British Medical Journal*	UNITED KINGDOM
Michal Cohen-Bar	*Ministry of Health, The Northern Region, Medical Health Officer*	
Danny Eger	*Israel Trauma Center for Victims of Terror and War (NATAL)*	ISRAEL
Marc Gastellu Etchegorry	*French Institute for Public Health Surveillance, EpiSouth project*	FRANCE
François M.H. Géré	*Institut Français d'Analyse Stratégique*	FRANCE
Anat Gesser-Edelsburg	*Health Promotion-School of Public Health, University of Haifa*	ISRAEL
Donato Greco	*Italian National Institute of Health*	ITALY
Manfred Green	*School of Public Health at Haifa University*	ISRAEL
Mike Hiley	*Emergency Response Department, Health Protection Agency*	UNITED KINGDOM
Michael Hopmeier	*Unconventional Concepts*	UNITED STATES
Iris Hunger	*Research Group for Biological Arms Control, University of Hamburg*	GERMANY
Predrag Kon	*Department for immunization at Institute of Public Health*	SERBIA
Toby Merlin	*Division of Preparedness and Emerging Infections, National Center for Emerging and Zoonotic Infectious Disease, CDC*	UNITED STATES
Ehud Miron	*District of Nazareth, Ministry of Health*	ISRAEL
Emilio Mordini	*Centre for Science, Society and Citizenship*	ITALY
Adkham Paiziev	*Uzbek Academy of Science and Ministry of Public Health*	UZBEKISTAN
Marjorie P. Pollack	*Epidemiology & Surveillance, and ProMED-mail*	UNITED STATES
Ben Reis	*Harvard Medical School, Children's Hospital Informatics Program, Harvard-MIT Division of Health Sciences and Technology*	UNITED STATES
Tamar Shohat	*Israel Center for Disease Control*	ISRAEL
Richard B. Schwartz	*Emergency Medicine Georgia Health Sciences University, National Disaster Life Support Foundation (NDLSF)*	UNITED STATES
Laetitia Vaillant	*Global Health Security Action Group, French Institute for Public Health Surveillance*	FRANCE
Noa Weinstein	*School of Public Health at Haifa University*	ISRAEL
Salman Zarka	*Medical Corps Northern Command*	ISRAEL