Technologies for Early Disease Detection and Rapid Disaster Response

InSTEDD Global Platform for Early Detection, Response, and Evaluation

Taha Kass-Hout, MD, MS
Director, Health Informatics
InSTEDD

Mary Jane Marcus, MSW
Program Manager
InSTEDD

Texting4Health Conference
February 29, 2008
Larry Brilliant’s TED Prize Wish:

…that you will help build a global system to detect each new disease or disaster as quickly as it emerges…
From Infection to Detection: Proportion of Infections Detected

50 *Shigella* notifications (5%)

1000 *Shigella* infections (100%)

Get as close to the bottom of the pyramid as possible

Urge frequent reporting
Our Objective

To address these challenges by adopting a social network and cognitive model approach in order to facilitate
- early identification of potential health threats
- their verification, assessment and investigation
- in order to recommend measures (public health and others) to control them.

Prototyped for MDBS
Generalized to other regions and conditions
A Hybrid Surveillance Approach

- Indicator-based surveillance
  - computation of indicators upon which unusual disease patterns to investigate are detected (number of cases, rates, proportion of strains...)

- Event-based surveillance
  - the detection of public health events based on the capture of ad-hoc unstructured reports issued by formal or informal sources.
InSTEDD Platform Overview

Multiple data streams (structured and unstructured)
- Moderated Lists, News Feeds, Articles, Blogs, Emails, wikis (e.g., fluwiki), Videos, Audios
- Human health, animal health, plant health, water quality, Internet traffic, utilities, intelligence, etc.
- SMS, SMS Geo-Chat

Contact Tracing and Network Modeling

Alert and Health Events Board

Time Series Visualization

Spatio-Temporal Analysis

Time Slider

Signal

Remote Sensing

Risk Visualization, Simulation and Modeling

User Alerts

Biosurveillance Tags

InSTEDD Proprietary Level I

2/29/2008
### InSTEDD Platform

*Open source applications, services, and frameworks*

#### Collaboration

<table>
<thead>
<tr>
<th>Directory</th>
<th>Social Networking</th>
<th>Virtual Teaming</th>
<th>Messaging</th>
<th>Social Metadata</th>
</tr>
</thead>
</table>

#### Decision Support

<table>
<thead>
<tr>
<th>Geospatial Visualization</th>
<th>Autonomous Agents</th>
<th>Predictive Modeling</th>
<th>Distributed Workflow</th>
<th>Alerting</th>
<th>Reporting</th>
<th>Search</th>
</tr>
</thead>
</table>

#### Analysis

<table>
<thead>
<tr>
<th>Data Fusion</th>
<th>Anomaly Detection</th>
<th>Complex Systems</th>
<th>Network Analysis</th>
<th>Text Mining</th>
<th>GigaPop Computing</th>
<th>Sensor integration</th>
</tr>
</thead>
</table>

#### Data Collection

<table>
<thead>
<tr>
<th>Forms Design</th>
<th>Shared Ontologies</th>
<th>Schema Evolution</th>
<th>SMS and Mobile Reporting</th>
<th>Geocoding</th>
</tr>
</thead>
</table>

#### Mesh Synchronization

<table>
<thead>
<tr>
<th>Storage Abstraction</th>
<th>Offline Work</th>
<th>Conflict Resolution</th>
<th>SMS Integration</th>
<th>Security</th>
<th>Identity</th>
<th>Adapters &amp; Transformers</th>
</tr>
</thead>
</table>
Field Lab and Platform Synergy

Learning at the edge, building for the future

Field Prototyping  National Rollouts  Global Integration

Selective Pilots  Component Integration  Regional Integration

Emerging Requirements  Design Validation  New Features & Services

Agile Platform Development
Mekong Collaboration Program

Serious infectious disease hotspot.

2/29/2008
InSTEDD Platform – SMS Text Using Twitter Bot

Twitter: rgkirkpatrick
By: Twitter:rgkirkpatrick - www.teddster.org
Last message at 15:15 (02-27-2008)
Twitter:rgkirkpatrick: I have arrived at the farm. Many birds are sick. More than 200 have died. Please send a team.
TED Command Center: Massive reports of cullings needed few km north in Lao. Could we share logistics & resources?
TED Command Center: The Rotanokini team can be there in 6 hours. Can you get samples to the lab in Stoeng Treng?
Reply
- EWARN database SYNCHRONIZES via SMS. Cell phones to laptops.

- The outbreak, the lab confirmation, and the contact tracking, can all be done over SMS.
SMS in a Public Health Emergency: Collaboration Testing in the Field

The Golden Shadow Demonstration
Communication but not collaboration...
Using agile design and early validation for linking people to help
SMS Microblogging (cell phone + Google Earth): GeoChat

- Cell phone SMS messages show up on Google Earth
- Time, date, person, location, text
- Reply directly from Google Earth
- See movements as paths over time
- The status display ages (colors...)

2/29/2008

InSTEDD Proprietary Level I
Emergency Response and Disease Outbreak Tracking using SMS
What we discovered
Creating a collaborative environment where human epidemiologists decision makers and responders interact with automated systems, using their existing tools and services when possible.

Application of Social Network Model approach and Collaborative decision making technology into the process.
Thank you!

Taha Kass-Hout, MD, MS
Director, Health Informatics
InSTEDD
kasshout@instedd.org

Mary Jane Marcus, MSW
Program Manager
InSTEDD
415-269-9079
marcus@instedd.org

400 Hamilton Avenue, Suite 120
Palo Alto, CA 94301
USA
+1.650.353.4440
+1.877.650.4440 (toll-free in the US)
The Need

- The likelihood of disasters and disease outbreaks is growing
  - According to a recent Oxfam report, there has been a four-fold increase in the annual number of natural disasters
    - 30 infectious diseases identified since 1973

- Potential impact is getting greater
  - Impact on health, economies & security
  - Capable of spreading faster than ever before

Current systems design, analysis and evaluation has been geared towards specific data sources and detection algorithms – not humans
- Much less has been towards interaction with responders and domain experts across agencies and at multiple levels
- Often provide contradictory interpretations of ongoing events

We have systems in place for those threats we have been faced with before
- We are more vulnerable to those we know about, but have not faced on a major scale
- Even more vulnerable to those that we don’t know about
Current Partners

- Research Triangle International
- Harvard MIT – Healthmap
- NASA Goddard Space Flight Center
- IBM: Public Health Information Affinity Domain (PHIAD)
- ProMed
Lessons Learned

- Those who had not used text messaging before the demonstration (mainly seniors) reverted to their preferred methods (FRS radio) during the emergency. It is hard to say what would have happened if they only had text messaging as an option.

- Those who were experienced with text messaging loved using it for reporting.
Lessons Learned

- Those who had failures in all other forms of communication (their FRS radios failed) reverted to SMS text messaging and used it for their internal communication.

- The lack of responses to text messaging (and all forms of comm.) was very difficult.

- All of the other things we learned around how info needs to be meaningful...triaging at the field level...