“Public health surveillance is the ongoing systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice, closely integrated with the timely dissemination of these data to those who need to know.”

CDC
Traditional Disease Surveillance

- List of notifiable diseases or conditions
- Relies on doctor/ laboratory reporting
- By paper, telephone, fax, electronic

- Significant diagnostic and reporting delays
- Does not include most common causes of widespread illness outbreaks (viral agents)
What is Syndromic Surveillance?

- “Real-time” public health surveillance using data that is routinely collected for other purposes

- Non-specific health indicators
- Uses existing data
- “Real time” transmission, analysis, and alerts
- New analytical techniques needed
Goals

• Early detection of large outbreaks
• Characterization of size, spread, and tempo of outbreaks once detected
• Monitoring of disease trends
Assumptions (Bioterrorism Detection)

- **Symptom Onset**
- **Severe Illness**

Number of Cases vs Days

- Release
- Symptom Onset
- Severe Illness
Data sources for early detection of acute illness

Day 0 - exposure occurs
Day 1 - feels fine
Day 2 - headaches, fever
Day 3 - develops cough
Day 4 - sees primary care provider
Day 5 - worsens - calls ambulance
Day 6 - admitted - “pneumonia”
Day 7 - critically ill - ICU, lab tests
Day 8 - expires - “respiratory failure”

Pharmaceutical Sales
Nurse’s Hotline
Outpatient Visit Data
Ambulance Dispatch (EMS)
ED Logs
Absenteeism
Diagnosed
Reported
Data Transfer

EMS          Emergency Department          Absenteeism          Pharmacy

FTP Server Inside Firewall

Data available

Email server at DOHMH

Data available for analysis

FTP server outside firewall

Decryption

Email server at DOHMH

Data available

Data available

FTP Server Outside Firewall
Key Hardware and Software

• Secure ftp server
• Desktop personal computers for analysis

• **SAS statistical software (COTS)
• **SatScan cluster detection tool (freeware)

• Other applications
  – PHIN Messaging (freeware)
  – Microsoft SQL Server database
# EMS-911 surveillance

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
<th>Call-type</th>
<th>Zip</th>
</tr>
</thead>
<tbody>
<tr>
<td>09/06/99</td>
<td>13:09:19</td>
<td>SICK</td>
<td>10013</td>
</tr>
<tr>
<td>09/06/99</td>
<td>11:09:57</td>
<td>UNC</td>
<td>11220</td>
</tr>
<tr>
<td>09/05/99</td>
<td>09:09:12</td>
<td>SEIZR</td>
<td>10458</td>
</tr>
<tr>
<td>09/05/99</td>
<td>08:09:22</td>
<td>RESPIR</td>
<td>10025</td>
</tr>
<tr>
<td>09/04/99</td>
<td>11:09:52</td>
<td>ABDPN</td>
<td>11434</td>
</tr>
</tbody>
</table>

Influenza-like illness
- RESPIR, DIFFBR, SICK, SICPED
41 (60%) of 67 NYC EDs
75% of ED visits
## Electronic ED logs

**Admission List For 01/28/2002**

<table>
<thead>
<tr>
<th>AGE</th>
<th>SEX</th>
<th>TIME</th>
<th>CHIEF COMPLAINT</th>
<th>ZIP</th>
</tr>
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<tbody>
<tr>
<td>15</td>
<td>M</td>
<td>01:04</td>
<td>ASSAULTED YESTERDAY, RT EYE REDDENED.</td>
<td>11691</td>
</tr>
<tr>
<td>1</td>
<td>M</td>
<td>01:17</td>
<td>FEVER 104 AS PER MOTHER.</td>
<td>11455</td>
</tr>
<tr>
<td>42</td>
<td>F</td>
<td>03:20</td>
<td></td>
<td>11220</td>
</tr>
<tr>
<td>4</td>
<td>F</td>
<td>01:45</td>
<td>FEVER, COUGH, LABORED BREATHING.</td>
<td>11507</td>
</tr>
<tr>
<td>62</td>
<td>F</td>
<td>22:51</td>
<td>ASTHMA ATTACK.</td>
<td>10013</td>
</tr>
<tr>
<td>48</td>
<td>M</td>
<td>13:04</td>
<td>SOB AT HOME.</td>
<td>10027</td>
</tr>
<tr>
<td>26</td>
<td>M</td>
<td>06:02</td>
<td>C/O DIFFICULTY BREATHING.</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>M</td>
<td>17:01</td>
<td>PT. MOTTLED AND CYANOTIC.</td>
<td>10031</td>
</tr>
</tbody>
</table>

- 4% of records have missing or uninformative chief complaint (Eg. ‘See Triage’, ‘Walkout’, ‘N/A’ etc.)
Coding chief complaints into syndromes

Respiratory illness
  key words: cough, shortness of breath, URI, pneumonia
  excludes: cold symptoms

Non-specific febrile illness
  key words: fever, chills, body aches, flu/influenza, viral syndrome

Gastrointestinal illness
  key words: diarrhea, vomiting
  excludes: abdominal pain alone, nausea alone
RODS/NRDM OTC Pharmacy Sales
Citywide trends in adjusted total units sold through Jun 14, 2004

Analgesics sold since May 1, 2003

Cough/cold units sold since May 1, 2003

Date of sale

NYC DOHMH Communicable Disease Program, 15JUN04
EMS calls

Influenza Activity and EMS Calls, NYC past 3 months through 22MAR02

Pharmacy Antiviral Rx

Prescription Data

ED respiratory visits

NYC Emergency Department Syndromic Surveillance
Citywide, Respiratory Syndromes, Age >65, 01NOV01 to 22MAR02

Employee Absenteeism—“flu”
Summary of citywide temporal signals

• Some clear seasonal patterns evident
• Sharp spikes associated with known events
• Difficult to investigate
• Used to reinforce public health messages (influenza, viral GI, heat wave, blackout)
Spatial cluster detection using SatScan

Details: Zip Obs/Exp RR UHF Neighborhood
10455 3/0.7 4.6 Hunts Point - Mott Haven
10459 5/0.5 10.9 Hunts Point - Mott Haven
10473 4/1.2 3.3 Pelham - Throgs Neck
10474 0/0.3 0.0 Hunts Point - Mott Haven
Legal Mandate

Local health officers shall exercise due diligence in ascertaining the existence of outbreaks of illness or the unusual prevalence of diseases, and shall immediately investigate the causes of same.

New York State Sanitary Code, 10 NYCRR Chapter 1, Section 2.16(a)
Guidelines for evaluating alarms

More concerning
- Sustained increase
- Multiple hospitals involved
- Multiple syndromes
- High number of cases
- Other systems alarming
- Strong geographic clustering
- Coincident clinician call
  - Coincident with high profile public event

Less concerning
- One-day increase
- Single hospitals involved
- Low number of cases
- No other evidence
- Diffuse increase across city
Is It Worth the Effort?

• Costs
  – Implementation costs are modest
  – Operational costs = time of public health staff, investigations

• Benefits
  – Possibility of huge benefit if early detection
  – Characterization
  – Strengthening traditional surveillance
  – Dual Use
Early warning of viral GI activity

Weekly Emergency Department Visits for Vomiting and Diarrhea Syndrome, New York City, All ages, Oct 2001 - Dec 14, 2002

Broadcast fax sent 11/13 to hospitals/schools

Ratio: Syndrome visits / Other visits

Week ending

2001

2002
Increase in NRT sales concurrent with taxes/regulations?
Allergy Meds & Asthma Visits

ED Adjusted Ratio vs. OTC Adjusted Ratio over time.

- Red line: ED Asthma/Other
- Black line: OTC Allergy/Analgesics
Other Uses

- Case finding for measles outbreak
- Heat-related illness
- Cipro sales after anthrax
- Fireworks
- Dog bites/rat bites
- West Nile virus spraying
- Suicide attempts
- Overdoses
- Carbon monoxide poisoning
Privacy and Confidentiality

• Health departments have strong tradition of maintaining security of confidentiality information
  – Public health provisions in HIPAA
• Data collected under auspices of bioterrorism surveillance de-linked from any identifiers for non-BT surveillance
So What?

- Strengthened surveillance systems in place
- Potential to better monitor all public health situations
- Even if there are no more bioterror attacks, preparation can strengthen our public health infrastructure and ability to respond
Which Data Source is Best?

- Readily Available
- Representative
- Timely
- Flexible
- Specific
- Investigable
- Good Signal-Noise

In NYC
- ED visit logs
- Ambulance Dispatch
- Local Pharmacy Chain
- National Pharm Data
- Absenteeism
National Program?

• Potential Issues:
  – Legal mandate
  – Regional outbreaks
  – Data sources available
  – Support investigation and response
  – Support multi-use/ flexibility
  – Single point of failure?
Build the Highway

- Standards that enable data flow
- Facilitate National ➔ Local data flow
- Support evaluation
- Develop and deploy rapid diagnostics

- Strengthen local capacity
  - Reliable, sustained funding
Future Steps

• Data Sources
  – Outpatient visit & EMR data
  – Lab orders
  – School sick visits

• Data Transport
  – Transition to PHIN-MS

• Data Analysis
  – Text normalization and coding
  – Multiple data sources
  – Integration with environmental surveillance
  – Outbreak “signatures”
Future Steps, cont.

• Investigation
  – Rapid specimen collection & diagnostic testing

• Evaluation & Validation
  – Simulated (synthetic) outbreaks
  – Systematic documentation of prospective surveillance
  – Sharing of experiences
2004 National Syndromic Surveillance Conference

Boston, Nov 3-4

www.syndromic.org
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