An Overview of Syndromic Surveillance

Community Health Care Association of New York State
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Disease surveillance:

The ongoing collection, analysis and dissemination of information on health, disease and its determinants, with the ultimate goal of preventing disease and promoting health

Methods:
- Passive vs. active
- Paper vs. electronic

Goals:
- Monitor disease rates & trends
- Risk factors & exposures

What is syndromic surveillance?

- Outbreak detection
- Timeliness
- Electronic & automated
- Pre-diagnostic data sources
- Categorization into “syndromes”
- Rapid & continuous analyses
# Traditional vs. Syndromic Surveillance

<table>
<thead>
<tr>
<th>Traditional</th>
<th>Syndromic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab/clinician diagnosis</td>
<td>Constellation of symptoms</td>
</tr>
<tr>
<td>Passive, established, slow</td>
<td>Active, new, fast</td>
</tr>
<tr>
<td>Main ID system</td>
<td>Adjunct system</td>
</tr>
<tr>
<td>Same in all states &amp; territories</td>
<td>Sporadic, dissimilar</td>
</tr>
<tr>
<td>Government</td>
<td>Government, academia &amp; for profit</td>
</tr>
<tr>
<td>Analyses are simple</td>
<td>Analyses more complex</td>
</tr>
<tr>
<td>No special funding</td>
<td>Federal dollars</td>
</tr>
</tbody>
</table>
Theory

[1] Outbreak behavior
   *Sharp & sustained upslope of epidemic curve*

[2] Health behavior
   *Early access to care*

[3] Clinical patterns
   *Similarity of symptoms*

   *Common exposure*

[5] Data collection
   *Electronic format*
   *Busy clinical staff*
Data sources

Provider encounters

- ED
- Outpatient
- School Nurse

Commercial sales

- OTC medications
- Prescriptions
- Thermometers, diapers

Other health data

- 9-1-1 ambulance dispatch
- Laboratory/radiology
- HMO hotlines
- Worker absenteeism
Which data sources are best?
Privacy/Legal

- NYC Health code: detect and investigate outbreaks
- Data files omit name, address, phone
- Need link to patient
- HIPAA allows reporting to public health
- Define “minimum data necessary” to protect the public’s health
- Evolving issue
NYC Systems

- ED
- OTC Pharmacy
- Rx pharmacy
- RODS Pharmacy
- 9-1-1 Ambulance dispatch
- HHC Outpatient
- School Nurse
Emergency Department Surveillance
New York City, February 2006

77% of 62 EDs in NYC
~90% of ED visits
## ED Data

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Zip</th>
<th>Time</th>
<th>Chief Complaint</th>
<th>ICD9</th>
</tr>
</thead>
<tbody>
<tr>
<td>15</td>
<td>M</td>
<td>11691</td>
<td>01:04</td>
<td>ASSAULTED YEST</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>M</td>
<td>11455</td>
<td>01:17</td>
<td>FEVER 104</td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>F</td>
<td>11220</td>
<td>03:20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>F</td>
<td>10013</td>
<td>22:51</td>
<td>ASTHMA ATTACK</td>
<td>493.9</td>
</tr>
<tr>
<td>48</td>
<td>M</td>
<td>10027</td>
<td>13:04</td>
<td>SOB AT HOME.</td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>M</td>
<td>10031</td>
<td>17:01</td>
<td>PT. CYANOTIC</td>
<td></td>
</tr>
</tbody>
</table>
Syndrome coding
Based on chief complaint

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

Febrile illness
  key words: fever, chills, body aches, flu

Gastrointestinal illness
  key words: diarrhea, vomiting
  excludes: abdominal pain, nausea
Daily statistical analyses

- Citywide temporal aberrations
- Spatial clusters
### Results

#### Citywide

**Citywide Signals by Syndrome and Year**

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diar</td>
<td>30</td>
<td>24</td>
<td>43</td>
<td>59</td>
<td>30</td>
<td>186</td>
</tr>
<tr>
<td>Fevflu</td>
<td>31</td>
<td>38</td>
<td>51</td>
<td>42</td>
<td>16</td>
<td>178</td>
</tr>
<tr>
<td>Resp</td>
<td>36</td>
<td>56</td>
<td>69</td>
<td>69</td>
<td>70</td>
<td>300</td>
</tr>
<tr>
<td>Vomit</td>
<td>26</td>
<td>15</td>
<td>38</td>
<td>45</td>
<td>41</td>
<td>165</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>123</td>
<td>133</td>
<td>201</td>
<td>215</td>
<td>157</td>
<td>829</td>
</tr>
</tbody>
</table>

#### Spatial

**Spatial signals by Syndrome and Year**

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diar</td>
<td>16</td>
<td>16</td>
<td>11</td>
<td>14</td>
<td>23</td>
<td>80</td>
</tr>
<tr>
<td>Fevflu</td>
<td>13</td>
<td>21</td>
<td>7</td>
<td>16</td>
<td>10</td>
<td>67</td>
</tr>
<tr>
<td>Resp</td>
<td>11</td>
<td>8</td>
<td>7</td>
<td>4</td>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>Vomit</td>
<td>16</td>
<td>10</td>
<td>4</td>
<td>18</td>
<td>10</td>
<td>58</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>56</td>
<td>55</td>
<td>29</td>
<td>52</td>
<td>49</td>
<td>241</td>
</tr>
</tbody>
</table>
GI Syndromes-Citywide trend, 2006-07

NYC Emergency Department Surveillance
Citywide trends in the ratio of syndrome visits to other visits through Feb 25, 2007

**Diarrhea Syndrome, All ages, last 18 months**

**Vomiting Syndrome, All ages, last 18 months**

**Last 30 days**

NYC DOHMH Bureau of Communicable Disease, 26FEB07
Resp & Fever Syndromes-Citywide trend, 2006-07

NYC Emergency Department Surveillance
Citywide trends in the ratio of syndrome visits to other visits through Feb 25, 2007

Respiratory / other, Age 13+, last 18 months

Fever / other, Age 13+, last 18 months

Last 30 days
ED Flu by age & season

Distinct age patterns by circulating strain
ED Flu by age (2003-04 season)
ED Respiratory
July 2003 - June 2004
ED Respiratory & OTC Allergy
July 2003 - June 2004
Investigation of signals

• Review line list
• Check complementary systems
• Calls to ED(s)
• Chart reviews
• Patient follow-up
• Augment lab testing
HHC Outpatient

- 8 facilities (n=17)
- > 4000 records/day (deduped)
- weekends
- ICD-9 codes
- ILI, GI & asthma syndromes
- Data Lag
- Data elements:
  - Medical record number
  - Date of visit
  - HHC site
  - Gender
  - Race
  - Age at visit
  - ZIP
  - ICD-9 diagnosis codes
  - CPT procedure codes
  - Type of clinic
DAILY CUSUM C1 & C3 SIGNALS FOR INCREASES IN GI

PLOT

- % GI
- GI 7-DAY ROLLING PERCENTAGES
- * * * C1 FLAG
- o o o C3 FLAG

PERCENTAGE OF VISITS

ENCOUNTER DATE

08/06 09/06 10/06 11/06 12/06 01/07 02/07 03/07
The National Bioterrorism Syndromic Surveillance Demonstration Program

- CDC funded
- EHR data, covers ~ 1.5 million population
- Auto extracts encounters, codes & forwards to data center

HMO data providers:
Denver, CO
Boston area, MA
Minneapolis-St. Paul, MN
Austin, TX
San Francisco Bay area, CA

12/19/2002

Respiratory Complaints

- Normal
- Heavy
- Very Heavy
The National Bioterrorism Syndromic Surveillance Demonstration Program

• Retrospective, 2001-2003
• Detected 59 syndromic signals:
  □ 3 unusual signals  Concordant yet unrelated
  □ 55 “chance” signals
  □ Median 4-9 cases; 1 zip code
  □ Chance signals not fully investigated
• 110 GI outbreaks (MN):  None detected
• Health seeking behavior

Yih et al., Ambulatory-Care diagnoses as potential indicators of outbreaks of gastrointestinal illness-Minnesota. MMWR: 45, supp 157-162.
Public Health Utility
NYC 3-yr ED evaluation study¹

• 138 spatial GI signals, no outbreaks¹
• 47 known GI outbreaks, none detected¹

Outbreaks detected

- Blackout (2003)²
- Mosque pot luck (2005)*
- Irish students (2007)*

Citywide trends

- Influenza/RSV
- Norovirus
- Rotavirus

Reassurance

Absence of visits

¹Balter MMWR 2005; ²Marx AJPH 2005 *Previously reported
Spatial outbreaks

Outbreak at a pot luck dinner

Citywide Diarrhea
Obs-270 exp-198.3 RR-1.4

Zipcode (11XXX)
Obs- 8/Exp- 0.9 p=0.0031
Multi-use systems

- Heat/Cold-related illness
- Asthma trends
- Cigarette sales
- Cipro sales after anthrax
- Fireworks
- Dog bites/rat bites
- West Nile virus spraying
- Suicide attempts
- Overdoses

Case finding:

- Bloody diarrhea
- Jaundice
Cost

- NYC DOHMH
  ~ $500k per year ½ operations ½ R&D
- UK national nurse call system
  ~ $300k per year
- CDC BioSense system
  ~ $50 million per year
Summary/Future

Adjunct systems
Two-way provider communication
Specificity vs. timeliness
Signal to noise
Critical evaluation
Large outbreaks
EHR & lab data
Acknowledgements

NYC DOHMH Syndromic Surveillance Team:

Bureau of Communicable Disease
Bureau of Epidemiology Services
Primary Care Information Project

For more information contact ... DWeiss @health.nyc.gov

And special thanks to ...

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NYC Hospitals: Emergency Departments, MIS and Infection Control staff
Martin Kulldorff (Harvard University)
Centers for Disease Control and Prevention (CDC)