Using and Improving EARS for Local Public Health Biosurveillance

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Outline of Presentation

• Define biosurveillance
• Discuss evolving need for syndromic surveillance at Health Department
• Describe the EARS program and its use within Monterey County
• Quantitative and qualitative analysis of modifications to EARS’ logic
What is Biosurveillance?

• Homeland Security Presidential Directive HSPD-21 (October 18, 2007):
  – “The term ‘biosurveillance’ means the process of active data-gathering … of biosphere data … in order to achieve early warning of health threats, early detection of health events, and overall situational awareness of disease activity.” [1]

• Syndromic surveillance:
  – “…surveillance using health-related data that precede diagnosis and signal a sufficient probability of a case or an outbreak to warrant further public health response.” [2]

• County Health Officer wanted greater use of real-time surveillance data
• Preparedness grants required enhanced surveillance
• Lag-time in receipt of reports from local hospitals; reports from only two hospitals
Early Aberration Reporting System (EARS)

- Developed by the CDC
- Originally designed to monitor for bioterrorism during large-scale events that often have little or no baseline data
- Now used by various state and local public health departments for routine health surveillance purposes
Benefits of the EARS Program

- Data stays at the local level
- Flexibility to modify syndromes as needed
- Analysis occurs on-site
- Decreased lag-time in reporting
- Program available at no cost
Data Collection and Reporting

Data Collection
- Hospital 1
- Hospital 2
- Hospital 3
- Hospital 4
- County Clinics

Data Management
- Health Department

Analysis
- Syndrome Definitions
- EARS

Reporting
- ILI & DOSE Reports
### ED Census and Clinic Services Census*

<table>
<thead>
<tr>
<th>Color</th>
<th>Alert Flags</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green</td>
<td>No alert flags on the previous day</td>
</tr>
<tr>
<td>Yellow</td>
<td>One alert flag on the previous day</td>
</tr>
<tr>
<td>Orange</td>
<td>Two alert flags on the previous day</td>
</tr>
<tr>
<td>Red</td>
<td>Three alert flags on the previous day or three consecutive days of single or double alert flags</td>
</tr>
</tbody>
</table>

### Syndromic Surveillance* (EARS output for Monterey County aggregate w/o clinics) [Shown as # of patients]

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gastrointestinal</td>
<td>58</td>
</tr>
<tr>
<td>Influenza-Like Illness</td>
<td>6</td>
</tr>
<tr>
<td>Lower Respiratory</td>
<td>9</td>
</tr>
<tr>
<td>Upper Respiratory</td>
<td>29</td>
</tr>
<tr>
<td>Neurological</td>
<td>30</td>
</tr>
</tbody>
</table>

**Note that the hospital ED aggregate and syndemic surveillance only includes data from facilities providing information for the reported days.
ER ILI Visits for Monterey County and California, 2009-2010 Season To Date

Note: Restricted ILI syndrome definition
Early Aberration Reporting System (EARS)

- Designed to be a drop-in surveillance system
- Increasingly being used as standard health surveillance system

<table>
<thead>
<tr>
<th>Test Outcome</th>
<th>Sensitivity</th>
<th>Specificity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Actual Status</strong></td>
<td><strong>Positive</strong></td>
<td><strong>Negative</strong></td>
</tr>
<tr>
<td>Sick</td>
<td>TP</td>
<td>FN (Type II error)</td>
</tr>
<tr>
<td>Healthy</td>
<td>FP (Type I error)</td>
<td>TN</td>
</tr>
</tbody>
</table>
• What happens when we modify the following?
  – Syndrome definitions
  – Symptom aliases
  – Text matching algorithms
ILI Syndrome Definitions

• EARS (CDC)
  – Sore throat or
  – Cold or
  – Cough

• Restricted (MCHD)
  – Fever & cough
  – Fever & sore throat
  – Fever & cough & sore throat
  – Flu and
  – Not shot

• Expanded (MCHD)
  – Cold or
  – Cough or
  – Fever or
  – Chills or
  – Muscle pain or
  – Headache or
  – Flu and
  – Not shot
Emergency Room Influenza-Like Illness Visits for Monterey County and California, 2008-2009 Season

Note: 1. Graph based on ILI chief complaint data as proportion of all patients accessing services for a given week from California sentinel providers and an aggregate from Monterey County Hospitals CHOMP, SVMH, and Mee, and Monterey County Clinical Services. 2. Missing data points for Weeks 19 through 27 will be incorporated at a later date.

Source: MCHD Influenza-like Illness (ILI) Surveillance Report Week 33 Ending 8/22/09
Emergency Room Influenza-Like Illness Visits for Monterey County and California, 2009-2010 Season To Date

Note: Restricted ILI syndrome definition
### ILI Symptom Aliases

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<td>COLD</td>
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<td>EAR PAIN</td>
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### Chief Complaint Examples:

1) NP FOR HIV TEST PER VERONICA/CHART MADE/LM
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1) NP FOR HIV TEST PER VERONICA/CHART MADE/LM
2) RTN RE-COLPO/LM
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### Chief Complaint Examples:

1) NP FOR HIV TEST PER VERONICA/CHART MADE/LM
2) RTN RE-**COLPO**/LM
3) R/S PREV APPT CALL NOT GOING THROUGH
• **EARS (CDC) Logic**
  
  If an ILI symptom alias is found anywhere within the chief complaint text, then it will be flagged as an ILI indicator.

• **Enhanced (NPS) Logic**
  
  – For short words (≤3 characters)
    
    • No variations on alias words allowed
    
    • Example: \text{ST}
      
        – NP FOR HIV TEST PER VERONICA/CHART MADE/LM
    
    • Example: \text{COL}
      
        – RTN RE-\text{COL} PO/LM
  
  – For longer words (≥4 characters)
    
    • Variations on one side of the alias word is allowed
    
    • Example: \text{COUGH}
      
        – PT \text{COUGHING FOR 4 DAYS}
    
    • Example: \text{OUGH}
      
        – R/S PREV APPT CALL NOT GOING THROUGH\text{OUGH}
Base Case
EARS Text Matching Logic
EARS Symptoms Aliases
EARS Syndrome Definitions

9,093 total “flu”
(out of 153,696 total records)
Base Case
EARS Text Matching Logic
EARS Symptoms Aliases
EARS Syndrome Definitions

9,093 total “flu”
(out of 153,696 total records)

Variant 1a
EARS Text Matching Logic
Expanded Symptoms Aliases
Expanded Syndrome Definitions

5,154 added
291 deleted
13,956 total “flu”

Variant 2a
EARS Text Matching Logic
Restricted Symptoms Aliases
Restricted Syndrome Definitions

51 added
8,410 deleted
734 total “flu”
Qualitative Comparisons
Aug 1, 2008 – July 31, 2009

Base Case
EARS Text Matching Logic
EARS Symptoms Aliases
EARS Syndrome Definitions

9,093 total “flu”
(out of 153,696 total records)

Variant 1a
EARS Text Matching Logic
Expanded Symptoms Aliases
Expanded Syndrome Definitions

5,154 added
291 deleted
13,956 total “flu”

Variant 1b
Enhanced Text Matching Logic
Expanded Symptoms Aliases
Expanded Syndrome Definitions

2 added
8,544 deleted
5,414 total “flu”

Variant 2a
EARS Text Matching Logic
Restricted Symptoms Aliases
Restricted Syndrome Definitions

51 added
8,410 deleted
734 total “flu”

Variant 2b
Enhanced Text Matching Logic
Restricted Symptom Aliases
Restricted Syndrome Definitions

0 added
111 deleted
623 total “flu”
In Conclusion

- Recommend **on-going** research that conducts comparisons between methods under various conditions
- Way ahead: results vs. actual diagnosis codes
- Small changes in syndrome definitions, symptom aliases, and text-matching logic can have large effects on the resulting syndrome counts and overall “trend”
- Exercise caution!!
Questions?
Contact Information

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