Putting Epidemiology into Practice

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Three Legged Stool
Disease and Outbreak Investigation

National Environmental Health Association- Epi Ready Training

“Life Cycle” of Disease Control and Prevention

Surveillance
Prevention Measures
Epidemiologic Investigation
Applied Research
CHANGING EPIDEMIOLOGY

Agent
- Recently recognized pathogens
- New modes of transmission

Environment
- Globalization of food supply
- Centralization of food processing, large producers

Host
- Increasing elderly, immunocompromised
- New eating habits
- Increasing immigration, international travel

National Environmental Health Association- Epi Ready Training

Outbreak Investigation Flow Diagram

Surveillance

Source: International Association for Food Protection
**Sources of Disease Data**

- Outbreak Surveillance System
- Laboratory-based Surveillance
- Complaint Investigations
- Epidemic Investigations

**The Real Cause of Waterborne *E. coli* Outbreaks**

**Enhanced Disease Surveillance for Special Sporting Events, Conferences, Large Community Events and Political Conventions**
History of HCHD/PCHD Enhanced Surveillance System

- Event surveillance for Super Bowl January 2001
- Ongoing countywide surveillance start date November 2001
- All 9 hospitals with ER departments participating since at least April 2002
- LEADERS was used as data gathering tool until March 30, 2003
- March 2003 – August 2007 STARS (CDC-EARS)
- Statewide ESSENCE 2007 to Present
Community Surveillance Partners

- Biowatch – Department of Homeland Security
- EMS Data – reason for emergency response
- Hospital Infection Preventionist
- Urgent Care Providers – working to get on Essence
- Community Clinics – disease burden surveillance
- Florida Poison Information Centers

ESSENCE
Electronic Surveillance System for the Early Notification of Community-based Epidemics
Johns Hopkins University

- Botulism-like illness
- Neurological
- Shock/coma
- Hemorrhagic illness
- Gastrointestinal illness
- Influenza-like illness
- Rash
- Respiratory illness
- Fever
- Other

102 predefined sub-syndrome categories
Free text chief complaint query tool

Daily ESSENCE Analysis, Hillsborough County
Summary of Surveillance Data for Sunday, November 11

Fever, ILI, and Gastrointestinal were elevated. Some chief complaints indicating positive flu tests were noted. Drug sales continue to indicate increased levels of respiratory illness.

Emergency Department Data
Percentages listed with a negative sign indicate values below expected levels

<table>
<thead>
<tr>
<th>Syndrome</th>
<th>ED Visits % above/below expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Botulism-like</td>
<td>-25%</td>
</tr>
<tr>
<td>Fever</td>
<td>42%</td>
</tr>
<tr>
<td>Injury</td>
<td>-14%</td>
</tr>
<tr>
<td>Shock/coma</td>
<td>-10%</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>21%</td>
</tr>
<tr>
<td>ILI</td>
<td>74%</td>
</tr>
<tr>
<td>Neurologic</td>
<td>4%</td>
</tr>
<tr>
<td>Rash</td>
<td>7%</td>
</tr>
<tr>
<td>Respiratory illness</td>
<td>19%</td>
</tr>
</tbody>
</table>

Records of Interest (chief complaints and discharge diagnoses):
One 3-person cluster of vomiting likely among a mother and her two children – will follow up
ESSENCE Evaluation

• ESSENCE evaluation can be event specific: threat level → situational awareness
  – The need for injury data
  – Heat related illness
  – Firework and alcohol related injuries around holidays and special events
  – Automobile injuries
  – Intentional biological or chemical releases
It is Important to Know What You Are Looking For

ETOH (Alcohol) in Chief Complaint at Tampa General

What was happening on Saturday, January 26, 2008?

ER Respiratory Visits and Particulate Matter Levels by Date for Hillsborough County
% of I LI Visits to Hillsborough County EDs for I LI (2006-2010)

2009 H1N1 Outbreak Issues

- Case definition issues
- Surveillance case definition
- Changing criteria and confusion
- Testing vs. Treating
- Medical providers disagreeing with CDC and WHO
- Antivirals and pregnant women
- Overwhelming continuing issue
- Medical burden surveillance
Shigella Outbreak Issues

- Antibiotic Stewardship vs. Public Health intervention
- Working with Providers concerning returning to school or daycare
- Ease of person to person transmission- secondary cases
- Lab testing for patients with probable cases

Shigella Outbreak Issues

- Percent of Shigella isolates tested that are sensitive to antibiotic (Hillsborough County, FL - October 2010-February 2011)

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Sensitive (# sensitive/total isolates tested)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin/Clavulanate</td>
<td>36% (5/14)</td>
</tr>
<tr>
<td>Ampicillin</td>
<td>33% (20/61)</td>
</tr>
<tr>
<td>Ceftriaxone</td>
<td>100% (17/17)</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>100% (2/2)</td>
</tr>
<tr>
<td>Trimethoprim/Sulfa</td>
<td>36% (27/74)</td>
</tr>
</tbody>
</table>
| Azithromycin                | Most commercial labs do not perform susceptibility testing for Azithromycin although it is an acceptable treatment option for shigellosis, especially in patients for whom Ciprofloxacin is contraindicated.
### Characteristics of 2005 outbreak, 2010 outbreak, 2006-2010 non-outbreak, and outbreak total (2005 and 2010 outbreak cases combined) cases of shigellosis, Hillsborough County, FL

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>2005 Outbreak</th>
<th>2010 Outbreak</th>
<th>Outbreak Total</th>
<th>Non-Outbreak Total</th>
<th>Outbreak Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male (%)</td>
<td>Female (%)</td>
<td>Sex</td>
<td>Male (%)</td>
<td>Female (%)</td>
</tr>
<tr>
<td>Male</td>
<td>199 (53)</td>
<td>271 (54)</td>
<td>470 (54)</td>
<td>51 (49)</td>
<td>521 (53)</td>
</tr>
<tr>
<td>Female</td>
<td>178 (47)</td>
<td>228 (46)</td>
<td>406 (46)</td>
<td>54 (51)</td>
<td>460 (47)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>Non-Hispanic</td>
<td>Hispanic</td>
<td>Ethnicity</td>
<td>Non-Hispanic</td>
<td>Hispanic</td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>240 (64)</td>
<td>316 (61)</td>
<td>556 (62)</td>
<td>49 (47)</td>
<td>595 (61)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>128 (34)</td>
<td>190 (36)</td>
<td>318 (36)</td>
<td>52 (49)</td>
<td>370 (38)</td>
</tr>
<tr>
<td>Unknown</td>
<td>9 (2)</td>
<td>6 (2)</td>
<td>15 (2)</td>
<td>4 (4)</td>
<td>19 (2)</td>
</tr>
<tr>
<td>Race</td>
<td>White</td>
<td>Black</td>
<td>Race</td>
<td>White</td>
<td>Black</td>
</tr>
<tr>
<td>White</td>
<td>136 (36)</td>
<td>226 (45)</td>
<td>362 (40)</td>
<td>53 (50)</td>
<td>475 (48)</td>
</tr>
<tr>
<td>Black</td>
<td>128 (34)</td>
<td>145 (29)</td>
<td>273 (29)</td>
<td>16 (15)</td>
<td>289 (29)</td>
</tr>
<tr>
<td>American Indian/Alaskan Native</td>
<td>1 (0)</td>
<td>0 (0)</td>
<td>1 (0)</td>
<td>1 (0)</td>
<td></td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
<td>1 (0)</td>
<td>3 (2)</td>
<td>4 (2)</td>
<td>6 (2)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>28 (7)</td>
<td>122 (24)</td>
<td>150 (17)</td>
<td>23 (22)</td>
<td>173 (18)</td>
</tr>
<tr>
<td>Unknown</td>
<td>23 (6)</td>
<td>3 (1)</td>
<td>26 (3)</td>
<td>11 (10)</td>
<td>37 (4)</td>
</tr>
</tbody>
</table>

### Daycare association and elementary school age for 2005 outbreak, 2010 outbreak, 2006-2010 non-outbreak, and outbreak total (2005 and 2010 outbreak cases combined) cases of shigellosis, Hillsborough County, FL

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<th>Characteristic</th>
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<th>Non-Outbreak Total</th>
<th>Outbreak Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes (%)</td>
<td>No (%)</td>
<td>Yes (%)</td>
<td>No (%)</td>
<td>Yes (%)</td>
</tr>
<tr>
<td>Daycare Association</td>
<td>104 (28)</td>
<td>273 (72)</td>
<td>377 (29)</td>
<td>289 (67)</td>
<td>366 (33)</td>
</tr>
<tr>
<td>Elementary School Age</td>
<td>114 (35)</td>
<td>265 (65)</td>
<td>380 (29)</td>
<td>321 (71)</td>
<td>352 (28)</td>
</tr>
<tr>
<td>Daycare Associated or Elementary School Age</td>
<td>203 (54)</td>
<td>174 (46)</td>
<td>377 (29)</td>
<td>373 (28)</td>
<td>341 (27)</td>
</tr>
</tbody>
</table>

### Annual incidence of shigellosis cases in each age group of 2005 outbreak cases, 2006-2010 non-outbreak cases, 2010 outbreak cases, and total outbreak cases, in Hillsborough County, FL
Case counts of shigellosis for 2005 outbreak cases, 2006-2010 non-outbreak cases, and 2010 outbreak cases, mapped by zip code, in Hillsborough County, FL.

Legionella Outbreak

• Three cases:
  • All three cases had onsets during the one-week period of Oct 8-Oct 14, 2011
  • All three experienced fever, cough and pneumonia
  • All three tested urine antigen positive and were classified as confirmed cases of legionellosis
  • All three are older than 75 years of age

Legionella Outbreak

• Two of the three cases’ homes are 0.1 miles apart with the third house being approximately 0.5 miles away from the other two. All the houses are located along a horizontal axis that runs east-west through the mobile home park
  • Two of the three cases recovered; one died
Legionella Outbreak

- Exposures of interest:
  - The individuals were exposed during the period of September 24-October 8, 2011
  - Two of the three cases had exposures to two different pools
  - One of the three cases used the hot tub during the incubation period
  - All three reported attending activities in the clubhouse and passing by the decorative fountain near the entrance of the building
  - There was no shared exposure to the same shower; all reported showering in his/her respective household

Legionella Outbreak

- Sample sites were chosen where there was maximum exposure of residents, and where little or no chlorine was expected:
  - 1) Decorative fountain at entrance of main clubhouse
  - 2) Showerhead in main clubhouse
  - 3) Condensate sump tank from main clubhouse air conditioning system
  - 4) Showerhead in cabana clubhouse
  - 5) Entry to reclaimed water distribution system
  - 6) Untreated well water

Legionella Outbreak

- Independent Environmental Sampling
  - An independent environmental testing company working with management collected samples from 12 locations on November 4, 2011.
  - The sample collected from the decorative fountain outside the main clubhouse was the only sample that tested positive for the strain of *Legionella* that caused disease in the three individuals.
  - The fountain had been drained prior to collection of this sample, so the sample taken was from rainwater that had since accumulated in the fountain.
Legionella Outbreak

• Conclusion:
  • The likely source of the three cases of Legionnaires’ disease was the decorative fountain outside of the main clubhouse. This conclusion is based on the independent positive environmental test result from the decorative fountain, the fact that all three cases had repeated exposure to the fountain area during the appropriate time period, and the well-documented ability of decorative fountains to cause Legionnaires’ disease outbreaks in other settings.1-4
  • The fact that the decorative fountain had been sitting idle for one month before being restarted around the start of October (exact date unknown), the presence of biofilm and algae in the fountain, and presumably water temperatures of greater than 70°F may all have contributed to the growth of Legionella in this decorative fountain.

Epidemiology of Pertussis
Hillsborough County, FL

• Cases in the US
• Incidence by age-group
• Cases in Florida
• Cases in Hillsborough County
  – Age Groups
  – Hospitalizations
  – Immunization Rates
• Additional Information

Outbreak Overview

• Cases in the US
• Incidence by age-group
• Cases in Florida
• Cases in Hillsborough County
  – Age Groups
  – Hospitalizations
  – Immunization Rates
• Additional Information
**Reported Cases of Pertussis, Hillsborough County, FL 1998-2012**

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>10</td>
</tr>
<tr>
<td>1999</td>
<td>15</td>
</tr>
<tr>
<td>2000</td>
<td>20</td>
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<td>2008</td>
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<td>2009</td>
<td>65</td>
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<tr>
<td>2010</td>
<td>70</td>
</tr>
<tr>
<td>2011</td>
<td>75</td>
</tr>
<tr>
<td>2012</td>
<td>80</td>
</tr>
</tbody>
</table>

**Reported Cases of Pertussis, Hillsborough County, FL 1998-2012, by Age Group**

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-4 years</td>
<td>10</td>
</tr>
<tr>
<td>5-9 years</td>
<td>15</td>
</tr>
<tr>
<td>10-14 years</td>
<td>20</td>
</tr>
<tr>
<td>15-19 years</td>
<td>25</td>
</tr>
<tr>
<td>20-24 years</td>
<td>30</td>
</tr>
<tr>
<td>25-29 years</td>
<td>35</td>
</tr>
<tr>
<td>30-34 years</td>
<td>40</td>
</tr>
<tr>
<td>35-39 years</td>
<td>45</td>
</tr>
<tr>
<td>40-44 years</td>
<td>50</td>
</tr>
<tr>
<td>45-49 years</td>
<td>55</td>
</tr>
<tr>
<td>50-54 years</td>
<td>60</td>
</tr>
<tr>
<td>55-59 years</td>
<td>65</td>
</tr>
<tr>
<td>60-64 years</td>
<td>70</td>
</tr>
<tr>
<td>65-69 years</td>
<td>75</td>
</tr>
<tr>
<td>70-74 years</td>
<td>80</td>
</tr>
</tbody>
</table>
2012 Reported Cases of Pertussis, Hillsborough County, Hospitalization Status by Age Group

- 60+: 4 cases, 36%
- 7+: 7 cases, 64%
- 0-5: 8 cases, 62%

- 5-19: 3 cases, 7%
- 20-29: 2 cases, 14%
- 30-39: 4 cases, 9%
- 40-49: 1 case, 20%
- 50-59: 2 cases, 40%
- 60+: 1 case, 20%

Hospitalized: Not Hospitalized

2012 Reported Cases of Pertussis, Hillsborough County, Number of Doses of Pertussis Containing Vaccine

- Unknown: 27 (29%)
- No Doses: 13 (14%)
- 1-2 Doses: 35 (37%)
- 3-4 Doses: 11 (12%)
- 5+ Doses: 8 (9%)

- 5 of the 35 (54%) 5+ dose cases received their last dose of pertussis containing vaccine within the last five years and 7 of those 5 received their last dose within 2 years.

2012 Reported Cases of Pertussis, Hillsborough County, Reason for Two or Less Doses of Pertussis Containing Vaccine

- Medical Contraindication: 3 cases, 14%
- Religious Exemption: 3 cases, 13%
- Age < 7 Months: 5 cases, 24%
- Unknown: 2 cases, 9%

- Does not include those with an unknown number of doses.
- 3 of the 5 reported medical contraindications were in the same family.
**Additional Information**

Two likely reasons causing increased cases

1. Children too young to be vaccinated or not getting vaccinated
   - Sometimes because of parent option (religious exemption)
   - Major cause of severe cases
2. Waning immunity in those who have been vaccinated
   - Shorter protection from DTaP and Tdap than expected
   - Variation in circulating strains vs. vaccine strains

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**Be Prepared, Have a Plan and Follow the Plan**

- When you are up to your hinny in alligators it is hard to remember that the prime objective was to:
  - "DRAIN THE SWAMP"

  "MUDDY GATORS"