The Economic Cost of Communicable Disease Surveillance in Colorado

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Meeting and Conference Presentation
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ASHEcon
Sponsor Organization: National Coordinating Center for PHSSR and PH PBRN
June 25, 2014
Los Angeles, California
Acknowledgements:

Funded by the Robert Wood Johnson Foundation

Disclaimer:

Any results, conclusions, findings or errors in this study are the sole responsibility of the authors and do not reflect the views of the funding agency.
Project Introduction

• Little data on the cost of developing and maintaining infrastructure, and providing essential population-based public health services.

• Difficult to make a clear financial case for public health services.

• Limits the amount of informed decision-making that can be done by public health leaders.

• National programs laid the groundwork for our current understanding of the essential components and capabilities of a local public health agency.
Core Services

• Lists of “Recommended” Core Services
  • IOM / NACCHO / Colorado

• Colorado List:
  1. Communicable Disease Surveillance / Investigation
  2. Disease Prevention / Population Health Promotion
  3. Environmental Health
  4. Assessment and Planning
  5. Emergency Preparedness
  6. Administration and Governance
  7. Vital Records
<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communicable Disease</td>
<td>2.64</td>
</tr>
<tr>
<td>Prevention and Population Health Promotion</td>
<td>2.70</td>
</tr>
<tr>
<td>Environmental Health</td>
<td>3.70</td>
</tr>
<tr>
<td>Assessment and Planning</td>
<td>3.76</td>
</tr>
<tr>
<td>Administration and Governance</td>
<td>4.00</td>
</tr>
<tr>
<td>Emergency Preparedness and Response</td>
<td>4.82</td>
</tr>
<tr>
<td>Vital Records</td>
<td>6.39</td>
</tr>
</tbody>
</table>
Listeria Outbreak Traced to Cantaloupe Packing Shed

The Food and Drug Administration recalled 300,000 cases of melons from Jensen Farms in Colorado following a listeria outbreak.

By WILLIAM NEUMAN
Published: October 19, 2011

A nationwide listeria outbreak that has killed 25 people who ate tainted cantaloupe was probably caused by unsanitary conditions in the packing shed of the Colorado farm where the melons were grown, federal officials said Wednesday.
How Does Communicable Disease Monitoring Work?

Series of tasks by Local Public Health Agency (LPHA)
- Monitoring CEDRS
- Tabulating data
- Assessing community risks and trends
- Receiving reportable disease/condition reports
- Phone or email communication from Regional Epi or Infection Control Practitioner
- Phone or email communication to providers
- Data entry and analysis
- Travel
Research Questions

1. What is the cost of routine communicable disease surveillance by LPHA?
2. Are there economies of scale?
Colorado Idiosyncrasies

• Some “regional” programs
  • “Outposted EPIs”

• The state role
  • STI’s
    • Maintaining databases
Methods

Need measures of both *Inputs* and *Output*

- **Inputs**
  - Time in minutes

- **Output**
  - Number of cases investigated

- Unit of analysis is the LPHA

- Current study looks at relationship between the number of cases investigated and time spent on communicable disease surveillance

Other control variables

- Case-Mix – types of conditions
- County Characteristics – poverty rate, population, population density
Description of Time Log Data Collection

• 54 LPHAs in Colorado
• 46 agencies agreed to participate
  • Response Rate: 85.2%
• 8 agencies were not included in study
  • Time Constraints
    • Not within agency’s best interest at the time
    • No time dedicated to CD weekly
• Instrument in field from April 7th, 2014 to June 20th, 2014
Enter 'X' for every 15 minutes an activity is done

<table>
<thead>
<tr>
<th>Activity</th>
<th>1/1/2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check CEDRS</td>
<td></td>
</tr>
<tr>
<td>Routine Investigations</td>
<td></td>
</tr>
<tr>
<td>Phone/email communication to/from Regional</td>
<td></td>
</tr>
<tr>
<td>Epic Infection Control Practitioner: Provider</td>
<td></td>
</tr>
<tr>
<td>or someone else related to Communicable Disease</td>
<td></td>
</tr>
<tr>
<td>Surveillance outside of Routine Investigation</td>
<td></td>
</tr>
<tr>
<td>Tabulate Data</td>
<td></td>
</tr>
<tr>
<td>Assess community risks and trends</td>
<td></td>
</tr>
<tr>
<td>Learning and research (NOT training)</td>
<td></td>
</tr>
<tr>
<td>Travel</td>
<td></td>
</tr>
<tr>
<td>Please insert 'other' here</td>
<td></td>
</tr>
<tr>
<td>Please insert 'other' here</td>
<td></td>
</tr>
<tr>
<td>Please insert 'other' here</td>
<td></td>
</tr>
<tr>
<td>Please insert 'other' here</td>
<td></td>
</tr>
</tbody>
</table>

Total Minutes

Number of Cases (Report if cases/day in EAST): **Enter**

Number of Calls/Emails (Phone/email communication): **Enter**
Output Data

• Based on the Colorado Electronic Disease Reporting System “CEDRS”
• Reported conditions by location
  • Can be entered either by the state or LPHA
• Reportable conditions defined by statute
• Can be reported by:
  • Physicians
  • Other healthcare providers
  • Laboratories
# Colorado Board of Health

**Conditions Reportable by All Physicians and Health Care Providers in Colorado**

*Infection in Colorado residents ascertained out of state should also be reported.*

The list below applies to physicians and health care providers. Laboratories have separate reporting requirements. A case must be reported to the state or local health department following diagnosis within the timeframe indicated. The State Health Department requires reporting all suspected cases whether or not laboratory data are available.

## 24-Hour Reportables

<table>
<thead>
<tr>
<th>Animal Bites by dogs, cats, bats, skunks or other wild carnivores</th>
<th>Haemophilus influenzae (invasive disease)</th>
<th>SARS (Coronavirus)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthrax ( Bacillus anthracis)</td>
<td>Hepatitis A (HAV-IGM)</td>
<td>Smallpox</td>
</tr>
<tr>
<td>Botulism (Clostridium botulinum)</td>
<td>measles (Rubella)</td>
<td>Syphilis, early (1st, 2nd, early latent)</td>
</tr>
<tr>
<td>Cholera (Vibrio cholerae)</td>
<td>Neisseria meningitidis (invasive disease)</td>
<td>Tuberculosis (active disease)</td>
</tr>
<tr>
<td>Diphtheria (Corynebacterium diphtheriae)</td>
<td>Pertussis (Bordetella pertussis)</td>
<td>Typhoid Fever (Salmonella typhi)</td>
</tr>
<tr>
<td>Group Outbreaks – known or suspected of all types including foodborne, waterborne or other illness</td>
<td>Poliomyelitis</td>
<td></td>
</tr>
<tr>
<td>or other wild carnivores</td>
<td>Rubella</td>
<td></td>
</tr>
</tbody>
</table>

## 7-Day Reportables

<table>
<thead>
<tr>
<th>AIDS and HIV infection</th>
<th>Hepatitis B</th>
<th>Q Fever (Conorillia burnettii)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aseptic / viral meningitis</td>
<td>Hepatitis other viral</td>
<td>Relapsing Fever (Borrelia sp.)</td>
</tr>
<tr>
<td>布鲁菌病</td>
<td>Hemolytic uremic syndrome if &lt; 18 yrs</td>
<td>Rocky Mountain Spotted Fever</td>
</tr>
<tr>
<td>Campylobacteriosis</td>
<td>Hemolytic uremic syndrome if &gt; 18 yrs</td>
<td>Rubella, congenital</td>
</tr>
<tr>
<td>Chlamydia trachomatis</td>
<td>Influenza – associated hospitalization</td>
<td>Salmonellosis</td>
</tr>
<tr>
<td>Cryptosporidiosis</td>
<td>Influenza – associated death if &gt; 18 yrs</td>
<td>Shigellosis</td>
</tr>
<tr>
<td>Cyclospora</td>
<td>Kawasaki Syndrome</td>
<td></td>
</tr>
<tr>
<td>Escherichia coli 0157:H7 &amp; s.a. enteropathogenic E.coli</td>
<td>Listeriosis</td>
<td></td>
</tr>
<tr>
<td>E. coli</td>
<td>Listeria monocytogenes</td>
<td></td>
</tr>
<tr>
<td>Giardiasis</td>
<td>Lyme Disease (Borrelia burgdorferi) &amp; s.a. toxigenic E.coli</td>
<td></td>
</tr>
<tr>
<td>Gonococcal</td>
<td>Mumps</td>
<td></td>
</tr>
<tr>
<td>Gonorrhoea, any site</td>
<td>Poliomyelitis (Chlamydia psittaci)</td>
<td></td>
</tr>
<tr>
<td>Hepatitis B</td>
<td>Rubella</td>
<td></td>
</tr>
</tbody>
</table>

## Disease Report Form

Disease Report Forms can be downloaded from [www.co.health/ени/ - search for Reporting a Disease](http://www.co.health/ени/ - search for Reporting a Disease) Please fax completed Disease Report Form to 303-782-0338
CEDRS Data

• Provided by State Department of Health
  • Required permission of each individual LPHA
• Received 3 Months of Data
• Matched CEDRS data to time-log data by 2-week time period
• Excluded data on animal bites
  • Recorded inconsistently by LPHA
Results
CEDRS Data

• Significant Range
  • 16 counties had no cases reported during two week timeframe
  • High was 30 cases
  • Mean: 2.6
  • SD: 1.7
  • Skewness: 1.65
  • Kurtosis: 6.45
Foodborne Illnesses: 55%

- Vaccine Preventable: 29%
- Hepatitis B, C, E: 5%
- Lead Poisoning: 1%
- Waterborne: 1%
Results: Descriptive Statistics on Time-logs

<table>
<thead>
<tr>
<th></th>
<th>Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>435.0</td>
</tr>
<tr>
<td>Mean</td>
<td>802</td>
</tr>
<tr>
<td>Minimum</td>
<td>50</td>
</tr>
<tr>
<td>Maximum</td>
<td>4,800</td>
</tr>
</tbody>
</table>
Zero Counties

• **16 counties** did not have any cases assigned to them over their 2-week period
  - Mean Population Size of these Counties: 13,339
  - Largest Population of these Counties: 51,944

• Still, these agencies spent an average of **766 minutes** on CD surveillance over two weeks
  - Minimum: 120 minutes over two weeks
  - Maximum: 2,580 minutes over two weeks
  - Range: 2,460 minutes over two weeks

• Time Spent:
  - Checking CEDRS (28%)
  - Communicating with Regional Epis, Infection Control Practitioners, etc. (17%)
  - Learning and Research (13%)
Understanding the minute averages

• 16 counties with no cases average:
  • 766 minutes per two weeks
  • 77 minutes per day

• 19 counties with cases spend an average of:
  • 3,247 minutes per two weeks
  • 325 minutes per day \(\rightarrow\) 5 hours 25 minutes per day
  • 1,131 minutes \textit{per case} \(\rightarrow\) 19 hours per case

• Large range of minutes per case
  • High of 1,793 (1 case)
  • Low of 230 (30 cases)

• Subtract off apparent “fixed costs”
  • High of 1,409
  • Low of -526
Relationship between the Number of Cases Reported and the Minutes Dedicated to CD Surveillance

- Total Number of Minutes Spent on CD Surveillance
- Total Number of Reported Cases
- n=35
Relationship between the Number of Cases Reported and the Time Dedicated to CD Surveillance (for counties with <5 cases)

Number of Reported Cases

Number of Minutes Spent on CD Surveillance

n=31
## Results: Regression Analysis

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t statistic</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td>1604.2</td>
<td>202.4</td>
<td>7.93</td>
<td>0.000</td>
</tr>
<tr>
<td>Cases Squared</td>
<td>-44.4</td>
<td>6.8</td>
<td>-6.54</td>
<td>0.000</td>
</tr>
<tr>
<td>Population Density</td>
<td>-0.4</td>
<td>1.6</td>
<td>-0.28</td>
<td>0.780</td>
</tr>
<tr>
<td>County Percent Poverty</td>
<td>6.2</td>
<td>49.4</td>
<td>0.13</td>
<td>0.901</td>
</tr>
<tr>
<td>Percent of Case Foodborne</td>
<td>-945.8</td>
<td>890.7</td>
<td>-1.06</td>
<td>0.298</td>
</tr>
<tr>
<td>Percent of Cases Zoonotic</td>
<td>-1356.8</td>
<td>1117.7</td>
<td>-1.21</td>
<td>0.235</td>
</tr>
<tr>
<td>Percent of Cases Vaccine Preventable</td>
<td>-2653.8</td>
<td>1076.2</td>
<td>-2.47</td>
<td>0.020</td>
</tr>
<tr>
<td>_cons</td>
<td>627.2</td>
<td>908.3</td>
<td>0.69</td>
<td>0.496</td>
</tr>
</tbody>
</table>
Limitations

• Measures of Quality
• Issues of Seasonality
• State Costs
• Indirect Costs
• CEDRS Data
  • Only includes cases where local agency is tasked with the follow-up
  • Some counties do not report animals bites to CEDRS
  • Lead Poisoning cases can also be incomplete
    • There is a different database at CEDRS to track these cases
Conclusions

• Results suggest some economies of scale
  • Increases at a decreasing rate

• Huge variation in time
  • Appears unrelated to type of case investigated

• Possible cost savings if smaller agencies coordinate