Outbreak Data for Foodborne Illness Source Attribution: From Good to Great

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Pew Foundation
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This work is about getting data for policy from investigated outbreaks (not about detecting or investigating outbreaks)
Investigated Outbreak Data: From Good to Great

- Surveillance of investigated outbreaks is unique
- A peek behind the scenes
- Estimation of foodborne illness source attribution
- Extracting the data -- making estimates needed for policy

Investigated outbreak data source: Foodborne Disease Outbreak Surveillance System (FDOSS)
Foodborne Disease Outbreak Surveillance System (FDOSS) is one of the major “apps”
- It collects data on investigated outbreaks
Foodborne Disease Outbreak Surveillance System

FDOSS

Captures data from investigated outbreaks on agents, foods, and settings responsible for illness

Developed: 1973

Because: Outbreaks are the major way we learn what foods are causing illness and how to prevent it.

Now: States report hundreds of outbreaks each year through the National Outbreak Reporting System (NORS). The data is used to determine pathogen-food combinations to target for prevention.
Goals of Investigated Outbreak Surveillance

- Describe characteristics of outbreaks
  - Determine major foods causing illness
  - Determine major agents causing foodborne illness
  - Determine settings for foodborne illness
  - Determine factors that repeatedly contribute to foodborne illness outbreaks

- Obtain data that can be used to estimate foodborne illness source attribution

Investigated outbreak data source: Foodborne Disease Outbreak Surveillance System (FDOSS)
What is Unique about Investigated Outbreak Surveillance?

- **Collects reports on groups of people**
  - with the same illness
  - (rather than individuals with that illness)

- **The food that caused the illness can often be determined with certainty**
  - (rarely possible with individual illnesses)

- **Outbreak reports contain a wealth of data**
  - broad range of illnesses, foods, settings
  - even “unsolved” outbreaks provide information on symptoms, agents, settings
The decade's 10 biggest food-borne illness outbreaks

By Jacque Wilson, CNN
updated 11:04 AM EST, Fri September 30, 2011
Harvesting and Extracting Data from Outbreaks – an Olive Oil Analogy
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Investigated outbreak data source: Foodborne Disease Outbreak Surveillance System (FDOSS)
Steps along the way to disseminating data on investigated outbreaks

Health dept.

Possible outbreak!

Investigates outbreak

Enters data into CDC form

CDC

Data downloaded into CDC database

Data accuracy and quality checked

Data ready for analysis and dissemination

Investigated outbreak database is the Foodborne Disease Outbreak Surveillance System
Steps along the way to disseminating data on investigated outbreaks

- Possible outbreak!
- Investigates outbreak
- Enters data into standard form

- CDC is improving data flow from state and local health departments
  - providing standards and forms for reporting
Steps along the way to disseminating data on investigated outbreaks

- Possible outbreak!
- Investigates outbreak
- Enters data into standard form

- CDC is improving data flow from state and local health departments
  - providing standards and forms for reporting
  - providing personal consultation
Epidemiologists at CDC ready to help states with investigated outbreak reporting!

American Samoa
Commonwealth of the Northern Mariana Islands
Republic of the Marshall Islands
US Virgin Islands

Puerto Rico
Guam
Republic of Palau
Steps along the way to disseminating data on investigated outbreaks

- **Possible outbreak!**
- **Investigates outbreak**
- **Enters data into standard form**

- CDC is improving data flow from state and local health departments
  - providing standards and forms for reporting
  - providing personal consultation
  - conducting webinar trainings
### Webinar Trainings to Improve the Quantity and Quality of Outbreak Reports

<table>
<thead>
<tr>
<th>Topic</th>
<th>Date</th>
<th>Attendees</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009 Outbreak Surveillance Data</td>
<td>Aug 2011</td>
<td>~50 attendees from 25 states, CDC</td>
<td>~60 more outbreaks reported for 2009</td>
</tr>
<tr>
<td>Bacterial toxin-mediated outbreaks</td>
<td>Nov 2011</td>
<td>~85 attendees from 24 states, FSIS, CDC</td>
<td>CDC notified of several outbreaks</td>
</tr>
<tr>
<td>Improving food attribution using outbreak data</td>
<td>Feb 2012</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foodborne outbreaks and the law</td>
<td>May 2012</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Other CDC programs contribute to quantity and quality of investigated outbreak data, for example...

- PulseNet provides subtype data
- NARMS provides resistance data
- FoodNet conducts model surveillance
- FoodCORE improves outbreak investigation techniques
Steps along the way to disseminating data on investigated outbreaks

1. **Possible outbreak!**
2. **Investigates outbreak**
3. **Enters data into standard form**

Health dept.

- Data downloaded into CDC database

CDC

- Data accuracy and quality checked

Data ready for analysis and dissemination

Investigated outbreak database is the Foodborne Disease Outbreak Surveillance System
Steps along the way to disseminating data on investigated outbreaks

CDC is making enhancements to improve data quantity and quality

- Data downloaded into CDC database
- Data accuracy and quality checked

Investigated outbreak database is the Foodborne Disease Outbreak Surveillance System
Enhancements to Improve Data Quantity and Quality

- To deploy in 2012: changes that make reporting easier for state and locals
  - NORSDirect
    (so states can move info directly from their database into NORS)
  - NORS download
    (so states can download their info from the CDC database)
  - Updated guidance on how to improve their reports

- Envisioned: a program that will continue to improve quantity and quality of outbreak reports, modeled on PulseNet
Steps along the way to disseminating data on investigated outbreaks

- CDC is making enhancements to improve data quantity and quality
- CDC is getting investigated outbreak data verified and out faster

Investigated outbreak database is the Foodborne Disease Outbreak Surveillance System
CDC is Getting Investigated Outbreak Data Verified and Out Faster

- CDC hired and trained new people to do the work
  - NORS Data Unit expanded to meet demands for data
    - September 2010: 3 people (1 doctoral, 2 MPH)
    - now: 6 people (1 doctoral, 5 MPH)

- CDC is enhancing database to make data corrections go faster
  (to deploy in 2012)
Investigated Outbreak Surveillance and PulseNet Have Many Similarities

<table>
<thead>
<tr>
<th></th>
<th>PulseNet Surveillance</th>
<th>Investigated Outbreak Surveillance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scope</strong></td>
<td>National</td>
<td>National</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>Detect outbreaks</td>
<td>Extract actionable info from reports of investigated outbreaks</td>
</tr>
<tr>
<td><strong>Unit of measure</strong></td>
<td>Isolates and cluster</td>
<td>Outbreaks</td>
</tr>
<tr>
<td><strong>Data flow</strong></td>
<td>State and locals to CDC</td>
<td>State and locals to CDC</td>
</tr>
<tr>
<td><strong>CDC role</strong></td>
<td>Set standards, assure quality data, analyze data</td>
<td>Set standards, assure quality data, analyze data</td>
</tr>
<tr>
<td><strong>Data flow method</strong></td>
<td>Electronic</td>
<td>Electronic</td>
</tr>
<tr>
<td><strong>CDC Support for data flow from states</strong></td>
<td>PulseNet microbiologist in every state</td>
<td>1 part-time epidemiologist in most states</td>
</tr>
</tbody>
</table>

Data quantity and quality are essential for both systems to have impact.
Electronic Data Transmission to PulseNet

Public health laboratories

PFGE patterns

National database at CDC
Electronic Data Transmission to Foodborne Disease Outbreak Surveillance System

Public health epidemiologists

Reports

National database at CDC
Quantity and Quality of Outbreak Data is Key to Getting Good Estimates of Foodborne Illness Source Attribution

- Outbreak detection and investigation is just one part of the process. Outbreak reporting is essential to document:
  - food source
  - agent
  - contributing factors
  - setting
  - severity
Quantity and Quality of Outbreak Data is Key to Getting Good Estimates of Foodborne Illness Source Attribution

- Analyses of many outbreak investigations are needed to show that particular food-pathogen pairs are important causes of illness.
- Therefore, to estimate foodborne illness source attribution from outbreaks, we need:
  - capacity in state and local health depts to report investigated outbreaks,
  - a CDC quality assurance team
  - a CDC IT team
  - a CDC analytics team
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Investigated outbreak data source: Foodborne Disease Outbreak Surveillance System (FDOSS)
Foodborne illness source attribution is estimation, and estimation has challenges.
The US Economy

“The risk that the economy has entered a substantial downturn appears to have diminished over the past month or so.”

-Ben Bernanke, Fed chairman, June 9, 2008, during the middle of what would later be recognized as the longest and deepest recession since World War II
The US Economy:
Sometimes measuring what has already occurred is a Sisyphean task

The quarterly GDP (gross domestic product) growth rate is published and revised 7 times

“When you’re building forecasts on a baseline that’s shifting, it can be very, very difficult.”
Steve Landefeld, Director, Bureau of Economic Analysis
A Way to Think about Foodborne Illness Source Attribution Estimates

- Like other estimates, foodborne illness source attribution estimates will be the best we have based on data available now.
- Could different methods for extracting data give different results? 
  *Yes, and this can help to identify the best method*
- Should we expect estimates to be revised?
  *Yes, as data and methods improve, estimates should be revised*
- Why revise estimates?
  *Because we want to use the best data and the best methods to inform decision-making*
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Investigated outbreak data source: Foodborne Disease Outbreak Surveillance System (FDOSS)
Investigated Outbreak Data are Extracted and Shared in Many Ways

- Foodborne Outbreak Online Database (FOOD)
- Responses to data requests
- Scientific articles
- MMWR reports
Investigated Outbreak Data are Extracted and Shared in Many Ways

- Foodborne Outbreak Online Database (FOOD)
- Responses to data requests
- Scientific articles
- MMWR reports
Foodborne Outbreak Online Database (FOOD)

Choose search criteria:

<table>
<thead>
<tr>
<th>Year</th>
<th>State</th>
<th>Location of Consumption</th>
<th>Etiology (Genus Only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>All</td>
<td>All</td>
<td>All</td>
</tr>
<tr>
<td>1998</td>
<td>Alabama</td>
<td>(Not Reported)</td>
<td>Adenovirus</td>
</tr>
<tr>
<td>1999</td>
<td>Alaska</td>
<td>Banquet facility</td>
<td>Anisakiasis</td>
</tr>
<tr>
<td>2000</td>
<td>Arizona</td>
<td>Camp</td>
<td>Astrovirus</td>
</tr>
<tr>
<td>2001</td>
<td>Arkansas</td>
<td>Cater</td>
<td>Bacillus</td>
</tr>
<tr>
<td>2002</td>
<td>California</td>
<td>Church, temple, religious location</td>
<td>Bifidobacterium</td>
</tr>
<tr>
<td>2003</td>
<td>Colorado</td>
<td>Day care center</td>
<td>Brucella</td>
</tr>
<tr>
<td>2004</td>
<td>Connecticut</td>
<td>Fair, festival, other temp or mobile services</td>
<td>Campylobacter</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Search | Download Results

Disclaimer: This site was developed by the Centers for Disease Control and Prevention (CDC) to make Foodborne Disease Outbreak Surveillance System data more available to the public and stakeholders. The FOOD tool is intended to be used for limited and simple descriptive summary of outbreak data. Data obtained from this tool are an extract of reported data and therefore should not be considered completely representative of the findings in investigations of all outbreaks reported. CDC uses more detailed information for its analyses of the causes and risk factors of foodborne disease outbreaks. Please see the FOOD FAQ for more information and limitations of the data.

Table is populated based on the following criteria:

<table>
<thead>
<tr>
<th>Year</th>
<th>Month</th>
<th>State</th>
<th>Genus Species</th>
<th>Serotype or Genotype</th>
<th>Etiology Status</th>
<th>Location of Consumption</th>
<th>Total Ill</th>
<th>Total Hospitalization</th>
<th>Total Death</th>
<th>Food Vehicle</th>
<th>Contaminated Ingredient</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>June</td>
<td>Washington</td>
<td>Vibrio para-haemolyticus</td>
<td>Confirmed</td>
<td>Private home</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>chicken, unspecified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>August</td>
<td>Washington</td>
<td>Vibrio para-haemolyticus</td>
<td>Confirmed</td>
<td>Restaurant - other or unknown type</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>oysters, unspecified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>October</td>
<td>Texas</td>
<td>Hepatitis A</td>
<td>Confirmed</td>
<td>Private home</td>
<td>29</td>
<td>0</td>
<td>0</td>
<td>strawberries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>September</td>
<td>Texas</td>
<td>Vibrio para-haemolyticus</td>
<td>Suspected</td>
<td>Private home</td>
<td>8</td>
<td>0</td>
<td>0</td>
<td>oysters, raw</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>August</td>
<td>Texas</td>
<td>Vibrio para-haemolyticus</td>
<td>Confirmed</td>
<td>Private home</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>seafood, unspecified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1998</td>
<td>August</td>
<td>Texas</td>
<td>Vibrio para-haemolyticus</td>
<td>Confirmed</td>
<td>Private home</td>
<td>60</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

http://www.cdc.gov/foodborneoutbreaks/
FOOD is Getting Better

- 2009 data was available August 2011
- 2010 data will be available mid-2012
- Enhancements based on user feedback
  - more information on each outbreak (e.g., contaminated ingredient)—added in 2011
  - data can be sorted by each attribute—added in 2011
  - new search fields—planned for 2012
- Updated FAQ and website in 2011
Investigated Outbreak Data are Extracted and Shared in Many Ways

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  - annual
  - cumulative

Foodborne agents cause an estimated 48 million illnesses annually in the United States, including 9.4 million illnesses from enteric pathogens. CDC collects data on foodborne disease outbreaks submitted from all states and territories through the Foodborne Disease Outbreak Surveillance System. During 2008, the most recent year for which data are obtained, 1,416 foodborne disease outbreaks were reported, which resulted in 23,553 cases of illness, 2,721 hospitalizations, and 22 deaths. Among the 1,416 outbreaks with a laboratory-confirmed single etiology agent reported, microbiology was the most common, accounting for 42% of outbreaks and 40% of illness. Foodborne illness is a second most common, accounting for 32% of outbreaks and 38% of illness. Among the 218 outbreaks associated with food vehicles with populations from only one of 7 different food commodities (i), the report confirmed to which outbreaks were attributed were poultry (15%), beef (6%), and fish (5%), whereas the top commodities to which outbreak-related illnesses were attributed were fruits and nuts (28%), starchy vegetables (25%), and buns (13%).

Outbreak surveillance provides insights into the agents that cause foodborne illness, type of implicated foods, and settings where transmission occurs. Public health, regulatory, and food industry professionals can use this information to target prevention efforts against pathogens and foods that cause the most foodborne disease outbreaks.

Since 1992, CDC has defined a foodborne disease outbreak as the occurrence of two or more similar illnesses resulting from ingestion of a common food. Since local and territorial health departments use a standardized method to report outbreaks to CDC, an online module of clinical and laboratory information is available to researchers investigating and reporting outbreaks.

This report includes outbreaks in which the first illness occurred in 2008 and were reported to CDC by June 30, 2009. Data collected for each outbreak include the number of illnesses, hospitalizations, and deaths; the etiology agent (confirmed or suspected); the implicated foods or foods; and the source of food preparation and consumption. CDC defense foods as one of the investigators if a single contaminated ingredient is identified or if all investigations belong to that outbreak. Outbreaks that could not be assigned to one of the 17 categories are not included. For outbreak data requests, please contact the CDC Foodborne Outbreak Surveillance System (FOSS) at (770) 488-7100.
investigated outbreaks
State and local reporting groups (>50)

investigated outbreaks
CDC QA group

investigated outbreaks
CDC IT group

investigated outbreaks
CDC analysis group
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The findings and conclusions in this presentation are those of the author and do not necessarily represent the views of the Centers for Disease Control and Prevention.

Thank you.