Lessons Learned from Recalls and Outbreaks

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FOODBORNE ILLNESSES & OUTBREAKS

CDC Estimates of Foodborne Illness, USA per year

- Illnesses 47.8 million
- Hospitalizations 127,839
- Deaths 3,037

Total United States population 313.6 million

CDC – US foodborne illness outbreaks:

- 2006 summary of 6,647 outbreaks for 1998-2002 (~1,330 outbreaks/year). These outbreaks caused a reported 128,370 persons to become ill (a small fraction of presumed cases).
- 2011 summary of 1,034 outbreaks in 2008 found 23,152 cases, 1,276 hospitalizations and 22 deaths. Norovirus accounted for 49% of outbreaks and 46% of illnesses. *Salmonella* accounted for 23% of outbreaks and 31% of illnesses.
COMMON PRODUCTS

PRODUCTS COMMONLY ASSOCIATED WITH OUTBREAKS

• CDC 2008 - top commodities to which outbreaks were attributed were poultry, beef and finfish.

• The top commodities to which outbreak-related illnesses were attributed were fruits and nuts, vine-stalk vegetables, and beef.

More generally, consistent problems with meat products, seafood, eggs and egg products, fruits, vegetables and nuts, and complex foods.

Recent outbreaks have implicated previously unexpected sources including low-moisture foods such as dry cereal and peanut butter.
<table>
<thead>
<tr>
<th>Pathogen-Food Combinations</th>
<th>Combined Rank</th>
<th>QALY loss</th>
<th>Cost of Illness ($ mil.)</th>
<th>Illnesses</th>
<th>Hospitalizations</th>
<th>Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Campylobacter – Poultry</td>
<td>1</td>
<td>9,541</td>
<td>1,257</td>
<td>608,231</td>
<td>6,091</td>
<td>55</td>
</tr>
<tr>
<td>Toxoplasma – Pork</td>
<td>2</td>
<td>4,495</td>
<td>1,219</td>
<td>35,537</td>
<td>1,815</td>
<td>134</td>
</tr>
<tr>
<td>Listeria – Deli Meats</td>
<td>3</td>
<td>3,948</td>
<td>1,086</td>
<td>651</td>
<td>595</td>
<td>104</td>
</tr>
<tr>
<td>Salmonella – Poultry</td>
<td>4</td>
<td>3,610</td>
<td>712</td>
<td>221,045</td>
<td>4,159</td>
<td>81</td>
</tr>
<tr>
<td>Listeria – Dairy products</td>
<td>5</td>
<td>2,632</td>
<td>724</td>
<td>434</td>
<td>397</td>
<td>70</td>
</tr>
<tr>
<td>Salmonella – Complex foods</td>
<td>6</td>
<td>3,195</td>
<td>630</td>
<td>195,655</td>
<td>3,682</td>
<td>72</td>
</tr>
<tr>
<td>Norovirus – Complex foods</td>
<td>6</td>
<td>2,294</td>
<td>914</td>
<td>2,494,222</td>
<td>6,696</td>
<td>68</td>
</tr>
<tr>
<td>Salmonella – Produce</td>
<td>8</td>
<td>2,781</td>
<td>548</td>
<td>170,264</td>
<td>3,204</td>
<td>63</td>
</tr>
<tr>
<td>Toxoplasma – Beef</td>
<td>8</td>
<td>2,541</td>
<td>689</td>
<td>20,086</td>
<td>1,026</td>
<td>76</td>
</tr>
<tr>
<td>Salmonella – Eggs</td>
<td>10</td>
<td>1,878</td>
<td>370</td>
<td>115,003</td>
<td>2,164</td>
<td>42</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36,915</strong></td>
<td><strong>8,151</strong></td>
<td><strong>3,861,128</strong></td>
<td><strong>29,830</strong></td>
<td><strong>765</strong></td>
<td><strong>4</strong></td>
</tr>
</tbody>
</table>

BOTTOM LINE

• Large numbers of outbreaks identified annually
• Foodborne illnesses associated with outbreaks account for relatively small percentage of total cases
• Outbreak identification likely to improve steadily in the future
• Significant implications for the food industry
DEFINITION

Foodborne Disease Outbreak

An incident in which two or more persons experience a similar illness resulting from the ingestion of a common food *(CDC)*

Definition changed in 1992
HOW ARE OUTBREAKS IDENTIFIED?
OUTBREAK IDENTIFICATION

United States
Foodnet
Pulsenet
CDC, FDA, USDA
State and Local Health Departments
Coordination among agencies

Europe
Rapid Alert System for Food and Feed (RASFF) notifications and follow-ups
FoodNet sites (10) capture foodborne illness information for 15.3% of the US population.

### Number of Laboratory-Confirmed Bacterial and Parasitic Infections, by Site and Pathogen — FoodNet, 2009

<table>
<thead>
<tr>
<th>Bacteria</th>
<th>Parasites</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Campylobacter</em></td>
<td><em>Cryptosporidium</em></td>
</tr>
<tr>
<td><em>Listeria</em></td>
<td><em>Cyclospora</em></td>
</tr>
<tr>
<td><em>Salmonella</em></td>
<td></td>
</tr>
<tr>
<td><em>Shigella</em></td>
<td></td>
</tr>
<tr>
<td>STEC O157</td>
<td>TOTAL</td>
</tr>
<tr>
<td>STEC non-O157</td>
<td></td>
</tr>
<tr>
<td><em>Vibrio</em></td>
<td></td>
</tr>
<tr>
<td><em>Yersinia</em></td>
<td></td>
</tr>
</tbody>
</table>
PulseNet – USA

Isolates Reported to PulseNet USA, 1996-2011

“Of the 10 largest outbreaks in the U.S. in the last decade, 8 would not have been detected had it not been for information stored in PulseNet”

John Besser (Deputy Chief of CDC's Enteric Diseases Laboratory Branch) comment at APHL meetings on May 20, 2012.
LESSONS FROM OUTBREAKS

• Outbreaks are important teachable moments for the food industry
• Learning more about food outbreaks possible
  • Systematically publishing findings from foodborne illness outbreak investigations
  • Archiving reports in centralized repositories
  • Make repositories accessible by food professionals
DATA SOURCES

• CDC Foodborne Outbreak Online Database (FOOD)
  – http://wwwn.cdc.gov/foodborneoutbreaks/

• CDC foodborne disease outbreak surveillance
  – http://www.cdc.gov/outbreaknet/outbreaks.html

• CDC outbreak reports and online journals
  – http://www.cdc.gov/mmwr/

• CSPI Outbreak Alert Database

• EU Rapid Alert System for Food and Feed

• EU Eurosurveillance
  – http://www.eurosurveillance.org/
MANGO SALMONELLA NEWPORT OUTBREAK

- Attributed to use of contaminated water for hot water treatment of mangoes (fruit fly control).
- November and December 1999
- Multistate outbreak
- Patients from 13 US states infected

Patients infected with outbreak strain

Infected 78
Hospitalized 15
Died 2

AVAILABLE DATA SUMMARY
MANGO SALMONELLA NEWPORT OUTBREAK

• Data for 72 patients available
• Median age of 37
• Range: 3 months to 91 years
  • 44 female
  • 30 Asian, Latino or Arab
CAUSES
MANGO SALMONELLA NEWPORT OUTBREAK

- Single Brazilian farm
- Hot water treatment source of contamination
- Farm produced about 11 tons of mangoes from October-December 1999
- Small farm
CAUSES & EFFECTS
MANGO SALMONELLA NEWPORT OUTBREAK

• Mangoes subjected to hot water treatment for fruit fly disinfestation. Hot water was not chlorinated.
• Mangoes were immediately submerged in cool water (21.1°C for 6–10 min) following hot water treatment. Cool water was chlorinated, but chlorine concentration not monitored.
CAUSES & EFFECTS
MANGO SALMONELLA NEWPORT OUTBREAK

- Water was sourced via an open canal from a river 26 km away
- All dip tanks were unenclosed, droppings of bird feces were noted in the tanks
- Improper water treatment and monitoring procedures
- Mangoes shipped to Europe not implicated
- Research demonstrated that over 80% of mangoes internalize Salmonella from cool water dips under conditions similar to those used in this facility (Penteado et al. 2004. J. Food Prot. 67:181-184.)
DOLE PRE-PACKAGED SPINACH

*ESCHERICHIA COLI* 0157:H7 OUTBREAK

- August-September 2006
- Bagged selections from California supplier – Natural Selection Foods
- **205** Confirmed Illnesses
- **26** US States
- **103** Hospitalizations
- **31** cases of Hemolytic Uremic Syndrome (HUS)
- **3** Deaths
DOLE PRE-PACKAGED SPINACH

ESCHERICHIA COLI 0157:H7 OUTBREAK

States affected by pre-packaged spinach outbreak

Confirmed cases, as of Sept. 2006

- 1-4
- 5-9
- 10-14
- 15 or more
INVESTIGATION HIGHLIGHTS

ESCHERICHIA COLI 0157:H7 OUTBREAK

- 13 unopened packages of product tested positive for the outbreak strain – 11 packages with identifiable lot codes were from a single lot representing one shift on one day of production.
- Product for implicated lot sourced from four ranches.
- All four ranches used mechanical harvesters.
- Spinach harvested into plastic totes or bins.
- “Spotters” walked in front of machines to watch for hazards. Manual harvesting with sickles around hazards.
- Harvesters washed daily.
- Abundant livestock and wildlife in area.
- *E. coli* O157:H7 positive samples in environment.
MICROBIAL SAMPLES

*ESCHERICHIA COLI 0157:H7 OUTBREAK*

- 28 samples had identical PFGE patterns compared to the outbreak strain
PEANUT CORPORATION OF AMERICA

SALMONELLA TYPHIMURIUM OUTBREAK

As of April 2009, 714 persons infected in 46 states, 24% hospitalized, contributed to 9 deaths.

States affected by PCA Salmonella outbreak

Confirmed cases, as of April 2009

- 1-4
- 5-19
- 20-102
PEANUT CORPORATION OF AMERICA

SALMONELLA TYPHIMURIUM OUTBREAK

• Peanut butter and peanut paste from PCA was recalled as ingredients in 3,913 products produced by 361 companies.
• PCA cost others in the food industry at least $1 billion.
• Test and release procedures relating to *Salmonella* were extremely flawed at PCA (“Lab Shopping”).
Lessons Learned from Recalls and Outbreaks

Susan Linn, MS
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Sysco Corporation