Yersinia enterocolitica
Listeria monocytogenes
CMed/Epid 526, Epidemiology of Diseases
Communicable from Nature
John Kobayashi MD, MPH
May 28, 2008
Learning Objectives

• Describe some Yersinia enterocolitica outbreak investigations in different cultural or social settings

• Explain why investigating outbreaks of Listeriosis has been difficult in the past

• Describe some epidemiologic tools which are now used to perform more effective investigations of Listeriosis and other diseases
Public Health is like a cake with many layers.

- MOH, political
- Epidemiology
- Clinical
Each public Health Problem is Like a Slice of the Cake

Food borne zoonotic diseases

- Human illness
- Food preparation
- Agriculture, veterinary issues
Yersinia enterocolitica

- Fever, abdominal pain, diarrhea, 4-7 days after exposure
- Older children and adults, may have right sided abdominal pain and fever (mesenteric adenitis). May be confused with appendicitis.
- Frequent animal reservoir: pigs
- Also found in rodents, rabbits, sheep, cattle, horses, dogs, and cats.
Potential Sources of YE Infection

- Contaminated food, especially raw or undercooked pork products
- Contaminated water
- Unpasteurized milk
- Rarely: person to person spread, blood transfusions
### Reported and Estimated Illnesses: Foodborne pathogens--US

<table>
<thead>
<tr>
<th>Disease or Agent</th>
<th>Estimated total cases</th>
<th>Reported Cases by Surveillance Type</th>
<th>% Foodborne transmission</th>
<th>Hospitalization rate</th>
<th>Case-fatality rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bacterial</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Bacillus cereus</em></td>
<td>27,360</td>
<td>720 72</td>
<td>100</td>
<td>0.006</td>
<td>0.0000</td>
</tr>
<tr>
<td>Botulism, foodborne</td>
<td>58</td>
<td>29</td>
<td>100</td>
<td>0.800</td>
<td>0.0769</td>
</tr>
<tr>
<td><em>Brucella</em> spp.</td>
<td>1,554</td>
<td>111</td>
<td>50</td>
<td>0.550</td>
<td>0.0500</td>
</tr>
<tr>
<td><em>Campylobacter</em> spp.</td>
<td>2,453,926</td>
<td>64,577 37,496 146</td>
<td>80</td>
<td>0.102</td>
<td>0.0010</td>
</tr>
<tr>
<td>Clostridium perfringens</td>
<td>248,520</td>
<td>6,540 654</td>
<td>100</td>
<td>0.003</td>
<td>0.0005</td>
</tr>
<tr>
<td><em>Escherichia coli</em> O157:H7</td>
<td>73,480</td>
<td>3,674 2,725 500</td>
<td>85</td>
<td>0.295</td>
<td>0.0083</td>
</tr>
<tr>
<td><em>E. coli</em>, non-O157 STEC</td>
<td>36,740</td>
<td>1,837</td>
<td>85</td>
<td>0.295</td>
<td>0.0083</td>
</tr>
<tr>
<td><em>E. coli</em>, enterotoxigenic</td>
<td>79,420</td>
<td>2,090 209</td>
<td>70</td>
<td>0.005</td>
<td>0.0001</td>
</tr>
<tr>
<td><em>E. coli</em>, other diarrheogenic</td>
<td>79,420</td>
<td>2,090</td>
<td>30</td>
<td>0.005</td>
<td>0.0001</td>
</tr>
<tr>
<td><em>Listeria monocytogenes</em></td>
<td>2,518</td>
<td>1,259 373</td>
<td>99</td>
<td>0.922</td>
<td>0.2000</td>
</tr>
<tr>
<td><em>Salmonella Typhi</em> b</td>
<td>824</td>
<td>412</td>
<td>80</td>
<td>0.750</td>
<td>0.0040</td>
</tr>
<tr>
<td><em>Salmonella</em> nontyphoidal</td>
<td>1,412,498</td>
<td>37,171 37,842 3,640</td>
<td>95</td>
<td>0.221</td>
<td>0.0078</td>
</tr>
<tr>
<td>Shigella spp.</td>
<td>448,240</td>
<td>22,412 17,324 1,476</td>
<td>20</td>
<td>0.139</td>
<td>0.0016</td>
</tr>
<tr>
<td><em>Staphylococcus</em> food poisoning</td>
<td>185,060</td>
<td>4,870 487</td>
<td>100</td>
<td>0.180</td>
<td>0.0002</td>
</tr>
<tr>
<td><em>Streptococcus</em>, foodborne poisoning</td>
<td>50,920</td>
<td>1,340 134</td>
<td>100</td>
<td>0.133</td>
<td>0.0000</td>
</tr>
<tr>
<td><em>Vibrio cholerae</em>, toxigenic</td>
<td>54</td>
<td>27</td>
<td>90</td>
<td>0.340</td>
<td>0.0060</td>
</tr>
<tr>
<td><em>V. vulnificus</em></td>
<td>94</td>
<td>47</td>
<td>50</td>
<td>0.910</td>
<td>0.3900</td>
</tr>
<tr>
<td><em>Vibrio</em>, other</td>
<td>7,880</td>
<td>393 112</td>
<td>65</td>
<td>0.126</td>
<td>0.0250</td>
</tr>
<tr>
<td><em>Yersinia enterocolitica</em></td>
<td>96,368</td>
<td>2,536</td>
<td>90</td>
<td>0.242</td>
<td>0.0005</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td>5,204,934</td>
<td></td>
<td></td>
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Mead et al (1999)
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<tr>
<td>Camylobacter</td>
<td>12.79</td>
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<tr>
<td>Listeria</td>
<td>0.27</td>
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<tr>
<td>Salmonella</td>
<td>14.92</td>
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<td>Shigella</td>
<td>6.26</td>
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<td>E. coli O157</td>
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Population Based Surveillance

• 1996-1999 – 5 FoodNet Sites: MN, OR, CA (Alameda and SF), CT (Hartford, New Haven), GA (8 counties) – 14.8 million people

• Active laboratory and population-based surveillance for YE
What are your hypotheses regarding disease transmission?
Other investigations:
Y. enterocolitica, Norway, 2005-6

• Brawn:
• Layer pork (precooked head meat), veal, lard and spices to a mold
• Heat to a core temp of 74 C, then 70 C for 30 minutes
• Sold ready-to-eat
Yersinia enterocolitica in Norway

- Third most common cause of acute enteritis after campylobacteriosis and salmonellosis.
Y. enterocolitica, Washington State

- 50 YE cases Dec 15, 1981 – Feb 22, 1982,
- Implicated food: tofu (soybean curd).
- YE serotype O:8 from cases, tofu, and water used to make tofu
Listeria monocytogenes

• Gram positive rod, can be confused with “diptheroids.”
• Grows well in refrigerator temperatures (cold enrichment possible)
• Widespread in nature, can be found in soil, decaying vegetation, stool of mammals, raw vegetables, raw milk, fish, poultry, meats.
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Preliminary FoodNet Data: 2007 MMWR, April 11, 2008
FIGURE 2. Relative rates of laboratory-confirmed infections with 
*Campylobacter*, STEC* O157, *Listeria, Salmonella*, and *Vibrio* compared 
with 1996–1998 rates, by year — Foodborne Diseases Active Surveillance 
Network, United States, 1996–2007†

* Shiga toxin-producing *Escherichia coli.*
† The position of each line indicates the relative change in the incidence of that 
pathogen compared with 1996–1998. The actual incidences of these infections can 
differ.
Listeria monocytogenes

- Uncommon cause of illness in the general population.
- High risk groups, neonates, pregnant women, immunosuppressed (AIDS, cancers, transplants)
- Bacteremia, meningitis and other CNS infections
- Pregnancy: influenza-like illness in 3rd trimester
- Incubation period: 11-70 days, mean: 31 days
Streak on Plate

One colony in BHI at 37°C

Mix bacteria and agarose

Pour in the mold, solidify

Plug with bacteria

Bacterial DNA

Add restriction enzyme to digest the DNA

Lysis with detergents & Treatment with proteinase K
Alpine, Wyoming Outbreak

Cases in WA had identical PFGE pattern. Matching was done electronically using PulseNet.
Olsen et al. “Multistate Outbreak of Listeria monocytogenes Infection Linked to Delicatessen Turkey Meat.” CID 2005:40 (1 April)

• What was the main purpose/hypothesis of the study?
• What was the study design? What are its strengths and weaknesses?
• What was the study population? Was it representative?
• What exposures or risk factors were measured? Were there any biases or limitations in their measurement?
• What was the principal outcome of interest (infection or disease) and how was it measured? Identify advantages and disadvantages with this measure.
Olsen et al. “Multistate Outbreak of Listeria monocytogenes Infection Linked to Delicatessen Turkey Meat.” CID 2005:40 (1 April)

- What were the main findings? Do you agree or disagree? Support your position.
- Was there any potential confounding in the data analyses? Was it considered in the data analyses? Explain.
- Were there shortcomings/limitations to the study? If so, were they of sufficient magnitude to invalidate the results?
- Write a one-sentence summary of the article that could potentially be used in the context of community health promotion campaigns
- Based on this work, what would be the next study you would want to do if you had the necessary resources? Why?

- Chap 3: Globalization of the food supply and the influence of economic factors on the contamination of food with pathogens.
- Chap 4: Trends in agricultural management and land use and the risk of foodborne disease.
- Part II: Host Factors, Chap 10: Enhance susceptibility to foodborne Infections and disease due to underlying illness and pregnancy.
- Part III: Agent Factors Chap 17: Dose-response relationships and foodborne disease.