Food Borne Illness

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Potluck Panic
Within 24 h of church potluck -> multiple ED visits Diplopia, ptosis, CN deficits, weakness → resp failure >20 ultimately w/ symptoms within a week
One death, multiple intubated, many milder
Botulism confirmed on toxin assay of serum and stool
Health Department and CDC coordination
Potato salad from home canned potatoes implicated

Nehrams2020
Botulism

Recently Attributed Sources
Pruno (in prisoners), fish (or seal) oil/blubber, fermented fish heads, turshi (pickled vegetables)

Management
Toxin removal: Emetics and laxatives/enemas
Timely antitoxin administration
Antibiotics: no role in foodborne botulism
Discard leftovers (No tasting!)

Food Net

• Foodborne Diseases Active Surveillance Network
• 9 pathogens tracked in 10 regions
• 15% of US population
• CDC, 10 state health depts, USDA-FSIS, FDA
• 2020 Goals
Food Net

- Campylobacter
- Cryptosporidium
- Cyclospora
- Listeria
- Salmonella
- STEC 0157 and non-0157
- Shigella
- Vibrio
- Yersinia

2014 Food Net Trends
MMWR 64(18);495-499

19542 infections, 4445 admissions, 71 deaths
Top incidences: Salmonella & Campylobacter

Greatest increases:
- Vibrio (52%)
- Campylobacter (13%)

Cade Martin

CDC/Amanda Mills

Eric Grafman
2014 Food Net Trends

<table>
<thead>
<tr>
<th>Shifts among Salmonella strains</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Salmonella typhimurium</em> decreased</td>
</tr>
<tr>
<td>• USDA standards for poultry industry</td>
</tr>
<tr>
<td>• Decreased contamination of whole chickens</td>
</tr>
<tr>
<td>• Increased salmonella vaccination- breeder poultry flocks</td>
</tr>
<tr>
<td>• Remains the highest incidence strain</td>
</tr>
</tbody>
</table>

Others strains on the rise:
*S. javiana* and *S. infantis*

2014 Food Net Trends

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<th>Shiga-toxin Producing E coli (STEC) 0157 incidence declined 32%</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Portion of decline could be artifact of increased non-culture diagnostic testing</td>
</tr>
<tr>
<td>• 16% of 0157 cases associated with outbreaks</td>
</tr>
</tbody>
</table>

Non-0157 strains – increased incidence now higher than 0157
Culture-Independent Diagnostic Tests for Bacterial Enteric Infections

MMWR 64 (09); 252-257

- Rapid, potentially cost effective tests
- Most are commercial/ some are from local lab
- Were only test used for 19% STEC and 10% Campylobacter 2012-2014
- Lack of culture confirmation limits strain and outbreak tracing and susceptibility testing
- Public health may fill gap left by local labs

Clinical Course

<table>
<thead>
<tr>
<th>Clues</th>
<th>Likely Suspects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Onset N/V in a few hours</td>
<td>Bacillus cereus or Staph aureus preformed toxin</td>
</tr>
<tr>
<td>Onset diarrhea in a few hours</td>
<td>Bacillus cereus or Clostridium perfringens</td>
</tr>
<tr>
<td>Diarrhea within 1-2 days, N/V</td>
<td>Norovirus</td>
</tr>
<tr>
<td>Watery diarrhea that can persist</td>
<td>Giardia, Cryptosporidium</td>
</tr>
<tr>
<td>Bloody diarrhea +/- fever, cramping</td>
<td>Shigella, Salmonella, Campylobacter, Shiga- Ecoli</td>
</tr>
<tr>
<td>Appendicitis-like syndrome, Chitterlings Consumption</td>
<td>Yersinia</td>
</tr>
<tr>
<td>Seafood consumption</td>
<td>Vibrio</td>
</tr>
</tbody>
</table>
Was it something I ate?

44 yo male pediatrician on vacation in Germany/Austria
Stayed at conference hotel; Visited zoo/monkeys
After 1 week (Day 1) – Fever/rigors/sweats – 36 hours
Day 2 Watery Diarrhea began, later blood streaked
Day 11 ED Visit in US – Continued Diarrhea, Nausea,
Cramping, Bilateral ankle pain with red rash
WBC 10.5
Stool leukocytes, Protozoal Ags, Shiga toxin All Negative

Diarrhea on European Vacation

Stool culture positive *Salmonella* Stanley
Prompt clinical response to levofloxacin
Common serovar in SE Asia, not in Europe
Domestic outbreaks in Europe

- In 2011-12 >700 cases
- Most European cases - eating turkey
- Product recall for raw cashew-based cheeses
# Foodborne Illness – in Travelers

## Pre-travel: CDC Geography-based Travel Advice

Assess risk for Enterotoxigenic Ecoli

- **Prophylaxis** with Bismuth Subsalicylate or other
- **Presumptive therapy** to shorten course
  - Usually Flouroquinolone
  - Azithromycin in children, pregnancy, SE Asia

## (Very) Vulnerable Patients

<table>
<thead>
<tr>
<th>Condition</th>
<th>Pathogen</th>
<th>Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Immunodeficiencies</td>
<td>Giardia, Campylobacter, Salmonella</td>
<td></td>
</tr>
<tr>
<td>Transplant/Autoimmune Ds</td>
<td>Norovirus</td>
<td>Chronic gastroenteritis</td>
</tr>
<tr>
<td></td>
<td>Salmonella enteritis</td>
<td>Rare, but more bacteremia</td>
</tr>
<tr>
<td></td>
<td>Listeria</td>
<td>Serious, but less when on tmp/smz</td>
</tr>
<tr>
<td></td>
<td>Toxoplasma</td>
<td>As with Listeria</td>
</tr>
<tr>
<td>HIV/AIDS</td>
<td>SSC, Giardia, Listeria, Cryptosporidia, Cyclospora</td>
<td>Low CD4+ Lymphocyte count</td>
</tr>
<tr>
<td>Fe Overload, Liver disease</td>
<td>SSYC, Vibrio</td>
<td></td>
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</tbody>
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### (Almost as) Vulnerable Patients

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<tr>
<th>Condition</th>
<th>Pathogen</th>
<th>Consideration</th>
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<tbody>
<tr>
<td>Neonates</td>
<td>Most enteric pathogens, infant botulism &lt; 1 year old</td>
<td>Avoid honey and contaminated formula</td>
</tr>
<tr>
<td>Pregnant Women</td>
<td>Listeria</td>
<td>Despite mild disease, fetal impact can be devastating</td>
</tr>
<tr>
<td>Elderly</td>
<td>Salmonella</td>
<td>More aortic seedings</td>
</tr>
<tr>
<td></td>
<td>Shiga toxin E. coli, Norovirus</td>
<td>Higher mortality</td>
</tr>
<tr>
<td></td>
<td>Listeria</td>
<td>Empiric coverage for meningitis if &gt; age 50</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>Salmonella, Campylobacter, Listeria</td>
<td>Decreased gastric acid, autonomic dysmotility may contribute</td>
</tr>
<tr>
<td>Reduced Stomach Acidity</td>
<td>SSC, E. coli 0157, Listeria, Vibrio</td>
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### Safeguarding Vulnerable Patients

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<tr>
<th>Possible Intervention</th>
<th>Patient Populations</th>
<th>Consideration</th>
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<tbody>
<tr>
<td>Low microbial diets</td>
<td>Stem cell transplants, Solid Organ Transplants</td>
<td>Data is lacking, so variably applied</td>
</tr>
<tr>
<td>Safer Food Choices</td>
<td>All vulnerable populations</td>
<td></td>
</tr>
<tr>
<td>Boiling/cooling water</td>
<td>Those vulnerable to cryptosporidia and other water contaminants</td>
<td>Can’t trust all bottled or filtered water</td>
</tr>
<tr>
<td>Antimicrobial Prophylaxis</td>
<td>When otherwise indicated</td>
<td>Primarily this is tmpsmz</td>
</tr>
</tbody>
</table>

Safer Food Choices

- Pasteurized eggs for raw egg recipes
- Pasteurized milk and cheeses (watch brie, feta, blue-veined)
- Smoked or precooked seafood reheated to 165F
- Washed salad and fresh vegetables
- Cooked sprouts
- Reheated hotdogs and lunch meats

Antibiotic Resistance Serious Threats
CDC 2013

<table>
<thead>
<tr>
<th>Pathogen</th>
<th>Antimicrobial</th>
<th>Estimated Annual Cases</th>
<th>Estimated Annual Deaths</th>
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<tr>
<td>Campylobacter</td>
<td>Azithromycin 2% or Ciprofloxacin 23%</td>
<td>310,000</td>
<td>28</td>
</tr>
<tr>
<td>Non-typhoidal Salmonella</td>
<td>Multiple agents, Ceftriaxone 3%, Ciprofloxacin 3%</td>
<td>100,000</td>
<td>40</td>
</tr>
<tr>
<td>Salmonella typhi</td>
<td>Ciprofloxacin 70%</td>
<td>3,800</td>
<td>&lt;5</td>
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<td>Azithromycin 3% or Ciprofloxacin 2%</td>
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Surveillance of enteric pathogens by National Antimicrobial Resistance Monitoring System (NARMS)
### First Line Antimicrobial Therapy

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<th></th>
<th>Recommended</th>
<th>AVOID</th>
</tr>
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<tbody>
<tr>
<td>Campylobacter</td>
<td>Erythromycin or Azithromycin</td>
<td>Fluoroquinolone</td>
</tr>
<tr>
<td>Salmonella (non-Typhoidal)</td>
<td>None for mild/moderate disease in healthy adult hosts. Severe disease or other populations: Fluoroquinolone, ceftriaxone</td>
<td></td>
</tr>
<tr>
<td>Shigella</td>
<td>Check Susceptibilities Fluoroquinolone Azithromycin</td>
<td>Amoxicillin</td>
</tr>
<tr>
<td>Yersinia</td>
<td>None or Fluoroquinolone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tmp/smz in children</td>
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### 2015 Multistate Foodborne Outbreaks

#### Example CDC Investigations

<p>| | |</p>
<table>
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<tbody>
<tr>
<td>Listeria</td>
<td>Soft Cheeses</td>
</tr>
<tr>
<td></td>
<td>Blue Bell Ice Cream</td>
</tr>
<tr>
<td>Salmonella Poona</td>
<td>Cucumbers</td>
</tr>
<tr>
<td>Other Salmonella strains</td>
<td>Pork</td>
</tr>
<tr>
<td></td>
<td>Raw, Frozen, Stuffed Chicken Entrees</td>
</tr>
<tr>
<td></td>
<td>Frozen Raw Tuna</td>
</tr>
<tr>
<td>Cyclospora</td>
<td>Unknown source (Cilantro in 2014)</td>
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Food-Borne Diseases

Jeffrey T. LeJeune, DVM, PhD
Professor and Head
Food Animal Health Research Program
Ohio Agricultural Research and Development Center
The Ohio State University

Food Safety Radar
Food Safety Radar

Fruits and Vegetables: A safe choice?

COLLEGE OF FOOD, AGRICULTURAL, AND ENVIRONMENTAL SCIENCES
COLLEGE OF VETERINARY MEDICINE

Food Safety Radar

Fruits and Vegetables: A safe choice?

STEC
Where’s the beef?

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COLLEGE OF VETERINARY MEDICINE
Food Safety Radar

Fruits and Vegetables: A safe choice?

STEC

Where’s the beef?

Antibiotic Resistance

Foodborne (poultry) UTI’s?

Fruits and Vegetables: A safe choice?

STEC

Where’s the beef?

Antibiotic Resistance
Fruits and Vegetables

Sources of Disease Outbreaks

EID 19, (2013)


Changes to protect food

- Food Safety Modernization Act (FSMA)
  - Produce Safety
  - Preventive Controls
  - Foreign Supplier Verification
  - Preventive Control for Animal Food
Shiga toxin-producing *E. coli*

STEC
Where’s the beef?
Produce associated *E. coli* O157 Outbreaks USA/Canada, 1998-2008 (n=66)

Non-O157 STEC

- Less severe infections than O157
- Difficult to diagnosis in laboratory
- Sources not completely understood
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Sources of non-O157 STEC Outbreaks
1990-2010, USA

- Beef: 5%
- Unknown: 3%
- Group dining: 17%
- Daycare: 18%
- Person to person: 8%
- Fruit & veggies: 11%
- Dairy: 11%
- Water: 11%
- Animal contact: 11%
Blade tenderization
Blade tenderization

<160°
## Antibiotic Resistance

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Antimicrobial Resistance

- Food is a vehicle for transmission of AMR bacteria to humans
- Antimicrobial use in animals selects for AMR in commensal flora and in pathogens
- AMR does not always result in a “fitness cost” to bacteria.

Quinolone-resistance selection in poultry

Changes in regulations

- Certain “off-label” drug uses in veterinary medicine restricted
- Voluntary removal of all in-feed growth promotion antibiotics
- Stricter oversight of antibiotic use on farms

Foodborne (poultry) UTI’s?
Foodborne Urinary Tract Infections?

- Temporal Clusters of UTIs
- Community-acquired
  - Similar resistance type
  - Similar serotype
  - Similar virulence profile
  - Similar PFGE-type

NEJM 345,1 (2001)

ST131

- Predominate lineage of ExPEC
- Commonly resistant to extended-spectrum β-lactamases (ESBL)
- Present in food animals
- Present in foods (poultry)
- Present in companion animals

ST131

- Predominate lineage of ExPEC
- Commonly resistant to extended-spectrum β-lactamases (ESBL)
- Present in food animals
- Present in foods (poultry)
- Present in companion animals


Why?

(1) unidirectional transmission from one species to another,
(2) bidirectional transmission between the species,
(3) transmission to each species from a common external source, or
(4) completely independent pathogen transmission pathways
Summary

**Knowns**
- Fruits and vegetables sources of FBD
- Steaks and roast as sources of O157
- Foodborne AMR

**Unknowns**
- Sources of non-O157 STECs
- Role of foods in UTIs