FSIS Perspective on Pre-harvest Interventions

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Conclusions

- We are not losing the battle with E. coli O157:H7

- Unfortunately, we probably can’t win it either
Conclusions

• We are not losing the battle with E. coli O157:H7

• Unfortunately, we probably can’t win it either... maybe
It is “time to close the book” on the problem of infectious diseases. (1969)
Jesse Steinfeld, MD, U.S. Surgeon General, 1969-73

“The future of infectious diseases will be very dull. (1972)”
Macfarlane Burnet, 1960 Nobel Prize Winner In Medicine

Told students that there were “no new diseases to be discovered. (1976)”
Lewis Thomas, Dean Yale Medical School
Examples of Pathogenic Microbes Identified Since 1973

- 1973 Rotavirus
- 1977 Ebola virus
- 1977 Legionella pneumophila
- 1980 Human T-lymphotrophic
- 1981 Toxin-producing Staph aureus
- 1982 Escherichia coli O157:H7
- 1982 Borrelia burgdorferi
- 1983 HIV
- 1983 Helicobacter pylori
- 1989 Hepatitis C Virus
- 1992 Vibrio cholerae O139
- 1993 Hantavirus Virus
- 1994 Cryptosporidium
- 1995 Ehrlichiosis
- 1996 nvCJD Prion
- 1997 HVN1 Virus Influenza
- 1999 Nipah Virus

Source: US Institute of Medicine, 1997; WHO, 1999.
Environment factors

Changes in food production

- CAFOs & Manure glut
- Globalization of food supply
- Centralized production
E. coli O157


- Handling / preparing raw food (40%)
- Gardening / garden play (36%)
- Lived on / visited farm (20%)
- Direct / indirect contact with manure (17%)
- Private H₂O supply (12%)
- Recent high coliform counts in H₂O supplies (12%)

FoodNet Case-control

- farm animals
E. coli O157 case-control study, 1996-1997

Previously Identified Risk Factors for Sporadic Infection
✓ Eating at a table service restaurant

E. coli O157 Study, 1999-2000

✓ Restaurant consumption of pink hamburger was NOT associated with infection

* FoodNet case-control studies
Host factors

- Increased numbers of susceptible persons
  - Aging, HIV infection, immunosuppressive drugs

- Changing eating habits
  - Dietary, "fast food“, eating out,…

- Improved surveillance & detection
Molecular subtyping "DNA Fingerprinting"

- Converts genetic material into a “bar code”
- Can be scanned & transmitted electronically
- New lab methodology
Where do the microbes come from?

<table>
<thead>
<tr>
<th>Agent</th>
<th># of cases</th>
<th>reservoir</th>
<th>% food</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norwalk-like viruses</td>
<td>9,200,000</td>
<td>man</td>
<td>40</td>
</tr>
<tr>
<td><em>Campylobacter</em> spp.</td>
<td>1,963,141</td>
<td>poultry</td>
<td>80</td>
</tr>
<tr>
<td><em>Salmonella</em>, nontyphoidal</td>
<td>1,341,873</td>
<td>animal</td>
<td>95</td>
</tr>
<tr>
<td><em>Clostridium perfringens</em></td>
<td>248,520</td>
<td>soil, man, animal</td>
<td>100</td>
</tr>
<tr>
<td><em>Giardia lamblia</em></td>
<td>200,000</td>
<td>Man, animal</td>
<td>10</td>
</tr>
<tr>
<td>Staphylococcal</td>
<td>185,060</td>
<td>man</td>
<td>100</td>
</tr>
<tr>
<td><em>Toxoplasma gondii</em></td>
<td>112,500</td>
<td>cat</td>
<td>50</td>
</tr>
<tr>
<td>Shigella spp.</td>
<td>89,648</td>
<td>man</td>
<td>20</td>
</tr>
<tr>
<td><em>Yersinia enterocolitica</em></td>
<td>86,731</td>
<td>pig</td>
<td>90</td>
</tr>
<tr>
<td><em>Escherichia coli O157:H7</em></td>
<td>62,458</td>
<td>cow</td>
<td>85</td>
</tr>
</tbody>
</table>

Mead, et al, *Emerging Infectious Diseases* 1999:5(5); 607-625
Illnesses due to Shiga-toxin Producing *E. coli*

Illnesses reported from CDC Morbidity and Mortality Weekly Report
http://www.cdc.gov/mmwr
What does the FSIS sampling program say?
FSIS Testing Results for Raw Ground Beef: Percentage of Samples that Tested Positive for *E. coli* O157:H7

Number of Beef Recalls Associated with *E. coli* O157:H7

# 2007 Recalls Associated with Raw Beef Products Contaminated with *E. coli* O157:H7

<table>
<thead>
<tr>
<th>Month</th>
<th>States</th>
<th>Number of Recalls</th>
<th>Pounds Recalled</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>Arkansas</td>
<td>1</td>
<td>4,240</td>
</tr>
<tr>
<td>March</td>
<td>Washington</td>
<td>1</td>
<td>16,743</td>
</tr>
<tr>
<td>April</td>
<td>California</td>
<td>1</td>
<td>107,943</td>
</tr>
<tr>
<td>May</td>
<td>Minnesota, Michigan</td>
<td>2</td>
<td>107,943</td>
</tr>
<tr>
<td>June</td>
<td>California, Texas</td>
<td>2</td>
<td>5,740,440</td>
</tr>
<tr>
<td>July</td>
<td>Michigan, Nebraska</td>
<td>2</td>
<td>32,589</td>
</tr>
<tr>
<td>September</td>
<td>New York, New Jersey, Maryland</td>
<td>3</td>
<td>21,700,949</td>
</tr>
<tr>
<td>October</td>
<td>Wisconsin, Georgia, Illinois, Florida, New York</td>
<td>5</td>
<td>1,028,704</td>
</tr>
<tr>
<td>November</td>
<td>Pennsylvania, Wisconsin</td>
<td>2</td>
<td>1,180,311</td>
</tr>
<tr>
<td>December</td>
<td>Tennessee</td>
<td>1</td>
<td>102</td>
</tr>
</tbody>
</table>

What We Are Doing to Combat

*E. coli O157:H7*

- Expanding our microbiological testing
- Using specially trained investigators to verify that plants are helping to control *E. coli O157:H7*
- Having inspection personnel complete checklists to evaluate control measures
What We Are Doing to Combat E. coli O157:H7

- Testing all materials that are used as components in raw ground beef
- Testing imported trim
- Using a more sensitive enrichment broth for E. Coli O157:H7 sampling
Pre-harvest activities as FSIS

- Responsibility transferred from APHIS to FSIS in 1994
  - Voluntary - no legal authority over animals on farm
  - Information, Education, Collaboration
  - Government, Industry, Academia Partnerships
  - Food animal production industry changes will be market-driven
- Outreach and liaison activities to develop and sustain risk reduction strategies in animal and egg production
- HACCP rule goes into effect, 1996
  - Identify and promote programs that encourage food animal producers to adopt production practices that support HACCP and reduce food safety hazards in animals presented for slaughter.
Conclusions

• We are not losing the battle with E. coli O157:H7
  • Better at identifying the agent
    • Risk-based sampling
    • New detection methods

• Unfortunately, we probably can’t win it either… maybe
  • HACCP for 10 years
  • Pre-harvest interventions such as vaccines
    • Current risk-assessment will provide options for risk managers to consider
  • Non-O157:H7 Shigatoxin producing E. coli

• Minimization of contamination at slaughter/ dressing and diversion via testing cannot be completely successful without a fully integrated approach that adds pre-harvest to the mix
**The Red Queen Principle**
- Leigh van Valen (evolutionary biologist, 1973)

“...in this place it takes all the running you can do, to keep in the same place."

- Red Queen to Alice in *Through the Looking Glass*