SHIGA-TOXIN PRODUCING ESCHERICHIA COLI
STEC Update

Roshan Reporter, MD, MPH
Rita Bagby, PS-PHN
Leticia Martinez, PS-PHN
Objectives

At the conclusion of this presentation the participant should be able to:

– Know the clinical signs and symptoms of the disease caused by Shiga toxin-producing *Escherichia coli* (STEC)
– Know the epidemiology of STEC infection in Los Angeles County.
– Know the case management of patients with STEC infection.
– Identify laboratory tests used to diagnose Shiga toxin-producing *Escherichia coli* infections
WHAT IS *ESCHERICHIA COLI*?

- Gram Negative Bacteria
- Sources can be: Urine, Resp, Blood, and Stool
- Considered normal flora in intestines of many mammals including humans
- **Some** E. coli causes GI disease
  - These are pathogenic E.coli; they posses ability to produce toxin
  - STEC is the type of E.coli are the topic today.
What are Shiga Toxin-producing E. coli?

• Certain bacteria produce a toxin called shiga toxin: some E. coli can do this
• These E. coli are called “Shiga toxin-producing” E. coli, or STEC.
• You may hear them called verocytotoxictic E. coli (VTEC) or enterohemorrhagic E. coli (EHEC)
INCUBATION

The incubation period is usually 3-4 days after the exposure, but may be as short as 1 day or as long as 10 days.
Signs and Symptoms

- Diarrhea (blood is common)
- Abdominal cramps (usually severe)
- Little or no Fever (less than 101F)
Pathophysiology

• Infection
  – Body’s response
  – Organism is replicating and producing toxin

• Effects of toxin(s)
  – Adheres to cell
    • Epithelial intestinal
    • Endothelial Blood vessels
    • Renal Endothelial cells
    • Red blood cells
Sequence of events in STEC infection

- **STEC ingested**
  - 3-4 days
- **non-bloody diarrhea, abdominal cramps**
  - 40%-80%
  - 1-2 days
- **bloody diarrhea**
  - 98%
  - 5-6 days
  - Rare-6%

  - resolution
  - HUS
Major modes of Transmission

- **Food**
  - cattle products, e.g., beef, raw milk
  - food contaminated with cattle or human feces e.g., lettuce, spinach, and cookie dough.
- **Water**
  - Drinking water
  - Recreational water
- **Animal contact**
  - contact with farm animals, e.g. petting zoos
  - contact with farm animals’ environment
- **Human contact**
  - With the feces of infected persons
Transmission

<table>
<thead>
<tr>
<th>Mode</th>
<th>No. outbreaks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food</td>
<td>11</td>
</tr>
<tr>
<td>Person-to-person</td>
<td>6</td>
</tr>
<tr>
<td>Lake water</td>
<td>3</td>
</tr>
<tr>
<td>Animal contact</td>
<td>2</td>
</tr>
<tr>
<td>Undetermined</td>
<td>1</td>
</tr>
</tbody>
</table>
Seasonality of human non-O157 STEC isolates submitted to CDC, 1983-2002

(N=940 isolates)

Brooks, JID 2005
Public Health Implications

• As infectious as *Shigella*
  – Low infectious dose (10-100)
  – SOS assessment critical
  – If congregate setting, assess for other ills

• Increased morbidity/mortality
  – Hemolytic Uremic Syndrome (HUS)
  – Thrombotic thrombocytopenic purpura (TTP)

• Outbreaks
  – Local
  – National
STEAK vs Ground Beef
Special considerations

- Hamburger vs steak
- Pre washed vs washed
- Aged cheese vs fresh/soft cheese
- Pasteurized vs unpasteurized
PHN Observations/Considerations

- Food preferences
- Food at home
- Kitchen technique
- Animal exposure
- SOS
- Patient Education/comprehension
- Remember the focus should be on the case and identifying any potential source.
Two Possible Means of Transmission
Prevention

• Wash your hands
• Cook meats thoroughly.
• Avoid unpasteurized milk/milk products
• Avoid swallowing un-chlorinated water
• Be cautious around animals
• Wash produce
• Avoid cross-contamination
FBI or No FBI?

• Focus on the incubation period
• Ground Beef: Well cooked vs uncooked
• Vegetarian
• Kitchen technique
• Food Preferences
• FBI should be based on your best assessment of the situation
Exposed to STEC
Person becomes ill
Person seeks care
Specimen obtained
Clinical lab tests for STEC
STEC isolated
Reported to health department & CDC
Pyramid of Surveillance
Milestones in STEC Follow-up

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td><em>E. coli</em> O157 infection made reportable</td>
</tr>
<tr>
<td>1995</td>
<td>Commercial Shiga toxin enzyme immunoassay (EIA) introduced</td>
</tr>
<tr>
<td>2000</td>
<td>Non-O157 STEC infections made nationally reportable</td>
</tr>
<tr>
<td>2009</td>
<td>CDC recommending that all diarrheal stool should be cultured for STEC and tested for the detection of Shiga toxins.</td>
</tr>
</tbody>
</table>
Testing for STEC using the Shiga toxin EIA

• Clinical lab processes stool specimen in broth
  – Tests broth for Shiga toxin using EIA
  – Positive test is reportable
• Clinical lab should send Shiga toxin-positive broth to Public Health lab
  – PH lab isolates STEC
  – PHL serotypes
  – If unable to serotype, will refer (State or CDC)
Challenges related to use of the Shiga toxin EIA

- After adopting the EIA, some clinical labs stopped testing for \textit{E. coli} O157 using selective media
  - \textit{E. coli} O157 outbreaks could be missed
- Some clinical labs discard Shiga toxin-positive specimens without obtaining an isolate, so
  - simply report “Shiga toxin positive” to doctor
  - serogroup not determined
    - \textit{E. coli} O157 strains not identified and sub-typed for outbreak detection
    - Non-O157 outbreaks less likely identified
E. coli serotyping

Lipopolysaccharide (LPS) = O antigen
O1-O181

Flagella = H antigen
H1-H56
In House PHL Testing

• O157
• O111
• O103
• O121
• O26
Top Non-O157 Serotypes (CDC)

- O26 22% of non-O157 STEC
- O111 16% of non-O157 STEC
- O103 12% of non-O157 STEC
- O121 9% of non-O157 STEC
- O45 7% of non-O157 STEC
- O145 5% of non-O157 STEC
Case History Form

• Why was it changed?
• Why is it better than the old form?
• What is new?
• What stayed the same?
QUESTIONS