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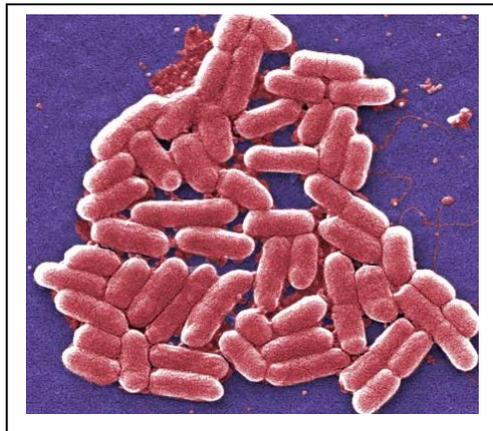
Shiga toxin-producing *Escherichia coli*

Vol. 20 No. 12

A recent outbreak of Shiga toxin-producing *Escherichia coli* involved 52 people infected with the outbreak strain of STEC O26 reported from nine states. The majority of illnesses were reported from Washington (27) and Oregon (13) during October 2015. Illness was associated with certain outlets of a restaurant chain and generated national media attention.

STEC Background

Most strains of *E. coli* are not harmful and many function as normal fecal organisms. Among the pathogenesis strains are those that produce Shiga toxin. Shiga toxin-producing *E. coli* (STEC), previously known as verocytotoxic *E. coli* or enterohemorrhagic *E. coli*, are a group of bacteria that share the characteristic of producing Shiga toxins. During intestinal infection the toxin typically causes diarrhea that can be bloody, severe abdominal cramps, and in some patients vomiting. Around 5–10% of infections develop hemolytic uremic syndrome (HUS), a potentially life-threatening complication affecting the kidneys. Most cases of HUS resolve but some result in permanent kidney damage. Pancreatic damage and neurological complications can also occur. Complications are more common in the very young



and the elderly, and can be fatal.

Treatment for STEC infection is supportive with an emphasis on prompt hydration and close medical monitoring, particularly for those at higher risk of complications. Antibiotic treatment likely increases toxin release into the intestine and therefore increases the risk of severe complications, so should be avoided. For similar reasons, anti-motility agents should not be used because they can extend the time the bacteria are in the intestine.

12.15



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Strain Characterization

E. coli are first classified by antigens in their surface cell walls (O types) and their flagella (H types). The most familiar STEC serogroup is *E. coli* O157. Other STEC serogroups (called non-O157 STECs) can cause disease in humans. In Washington State the most common non-O157 STECs are O26, O103, O111, O118, and O121. More detailed characterization of strains is done by pulsed field gel electrophoresis (PFGE) which is based on the chromosomal structure of the organism. Although PFGE is often called “fingerprinting” the procedure does not uniquely identify a strain.

While *E. coli* O157:H7 can be identified in culture with special growth medium due to its specific metabolic characteristics, other STEC are more difficult to detect. Clinical laboratories can confirm the presence of Shiga toxins by growing a stool sample in broth and testing the solution for the presence of Shiga toxins. The use of enzyme immunoassay (EIA) or polymerase chain reaction (PCR) to detect Shiga toxin or the genes that encode the toxins (*stx1* and *stx2*) has facilitated the diagnosis of both O157 and non-O157 STEC infections. However, the Shiga toxin-positive sample must then be cultured and tested at a public health laboratory using selective media to help identify the STEC colonies. Identification of the organism, serotyping and molecular characterization (e.g., pulsed-field gel electrophoresis [PFGE] patterns) are essential for detecting, investigating, and controlling STEC outbreaks.

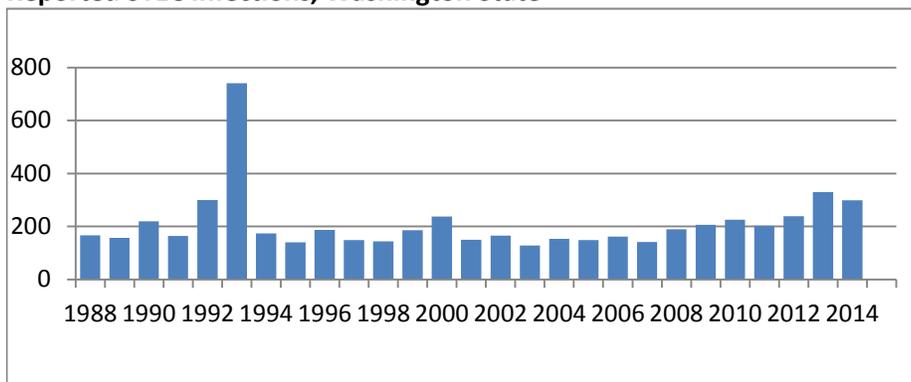
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Reported STEC Infections, Washington State



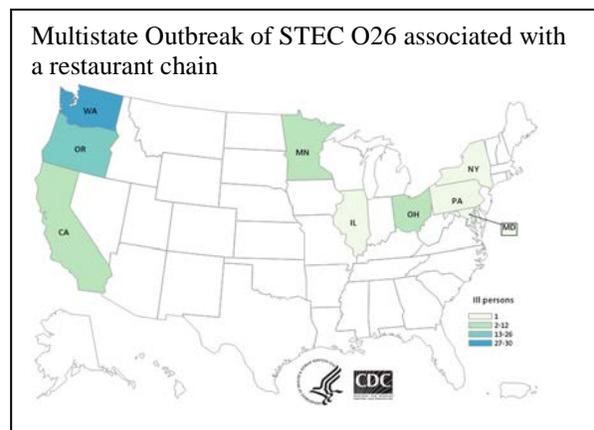
STEC Outbreaks

Annually there are around 150-300 reports of STEC in Washington, the majority reported as a single case or parts of a small cluster. The availability of new methods to detect Shiga toxins in stools may be responsible for the gradual increase in cases in the past few years. The spike of cases in 1993 was from a large outbreak.

Washington State has had a number of outbreaks of STEC, most markedly the 1993 fast food outbreak due to *E. coli* O157:H7 with around 500 cases and three deaths. Although commonly associated with beef products, particularly ground beef, STEC outbreaks in the United States have also been due to contaminated unpasteurized (raw) milk, soft cheeses made from raw milk, unpasteurized apple cider, lettuce, spinach, and alfalfa sprouts. The source of contamination for produce may be due to animals such as cows or deer grazing near crops, manure fertilizer applied to the fields, dirty water used to wash produce or make ice for transport of produce, or cross-contamination with raw meat juice in a kitchen during preparation. Other STEC outbreaks have resulted from exposures to petting zoos, farm animal exhibits, and lake water while swimming. There can also be person-to-person transmission, generally among younger children.

In October 2015, a cluster of *E. coli* O26 cases was recognized in Washington and Oregon as belonging to the same strain. Interviews by Washington State Department of Health Office of Communicable Disease Epidemiology over the weekend and a rapidly-conducted case-control study (with controls obtained from information from customer online ordering) linked the cases to a Mexican style restaurant chain. Cases in the region stopped when the chain closed all of its restaurants in Washington and the Portland-Metro area in Oregon for cleaning and restocking. After meeting strict cleaning, sanitation and sampling recommendations made by Washington State Department of Health Environmental Public Health, the company reopened for business in the affected area on November 11, 2015.

By early December there were 52 cases identified in nine states that were associated with the outbreak including cases with November onset. Trace-back was performed on several items including cilantro, red onions and beef. Although no specific food item was implicated in the outbreak, one of the produce ingredients was considered to be the likely the source of exposure.



In November 2015, Montana observed a cluster of cases of a strain of *E. coli* O157:H7. Based on detailed interviews, cases were associated with prepared chicken salad purchased from a warehouse chain of stores. By early December there were 19 cases in seven states. Preliminary laboratory results implicated celery and onion diced blend used in the chicken salad as the source of contamination. Recall of the celery eventually involved products going to multiple food service companies and grocery stores.

The recent experience of public health investigations is that only a small number of cases will be identified in outbreaks due to widely distributed food products. This is likely due to limited numbers of cases being cultured with the isolates then being fully characterized so they can be linked to the outbreak. To detect outbreaks it is essential that all laboratory-confirmed cases be interviewed and cultures be obtained so that complete strain typing can be done. Detailed information from interviews can identify a shared exposure and lead to appropriate public health interventions.

Washington State Department of Health Office of Communicable Disease Epidemiology has received a grant to promote foodborne outbreak investigations. A team of graduate students can conduct detailed interviews to more rapidly identify sources of exposure. Through cooperation with the state's local health jurisdictions, these efforts will allow more rapid intervention to prevent further exposures.

Resources

Mexican restaurant *E. coli* O26 outbreak: <http://www.cdc.gov/ecoli/2015/O26-11-15/index.html>

Chicken salad/celery *E. coli* O157:H7 outbreak: <http://www.cdc.gov/ecoli/2015/o157h7-11-15/index.html>

Recommendations for Diagnosis of Shiga Toxin-Producing *Escherichia coli* Infections by Clinical Laboratories. MMWR October 16, 2009 / 58(RR12;1-14
<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5812a1.htm>