PUBLIC HEALTH REFERENCE SHEET
Escherichia coli, Shiga Toxin producing (STEC)

Name	*Escherichia coli* (*E. Coli*), Shiga toxin producing
Reservoir & Transmission	Cattle most frequently; also, sheep, goats, and deer. Humans may serve as reservoir for person-to-person transmission. Ingestion of food or water contaminated with ruminant feces, direct contact with animals or their environment
Incubation Period	Usually 2–10 days; median of 3–4 days for most serotypes
Common Symptoms	Diarrhea (often bloody), severe abdominal pain, hemolytic uremic syndrome (HUS), thrombotic thrombocytopenic purpura (TTP)
Gold Standard Diagnostic Test	Culture from any clinical specimen, commonly stool
Risk Groups	All ages; primarily children, elderly, and immunocompromised
Geographic Significance	North America, Europe, Japan, Australia, the southern cone of South America, and Southern Africa

What is *Escherichia coli*?
Escherichia coli (*E. coli*) are a large and diverse group of bacteria. Although most strains of *E. coli* are part of the normal human intestinal microbiota, others can cause illnesses such as diarrhea, urinary tract infections, respiratory illness, and pneumonia. Some strains of *E. coli* are used as markers for water contamination (e.g., coliforms in drinking water or swimming pools), which may not be harmful but could indicate the presence of disease-causing bacteria and/or inadequate disinfection.

What is Shiga toxin-producing E. coli (STEC)?
STEC is a heterogeneous group of *E. coli* bacteria that express cytotoxins called Shiga toxins 1 and 2. STEC may also be referred to as Verocytotoxin-producing *E.* coli (VTEC) or enterohemorrhagic *E. coli* (EHEC). Over 70 STEC serogroups have been isolated from ill persons. STEC strains vary in virulence to include no apparent human virulence, mild or bloody diarrhea, or hemolytic uremic syndrome (HUS), which is the most severe manifestation. STEC O157 is an enterohemorrhagic bacterial strain, which is a food and waterborne pathogen that causes diarrhea, hemorrhagic colitis, and HUS in humans.

What is the occurrence of STEC infections?
An estimated 265,000 STEC infections occur each year in the United States. STEC O157 causes about 36% of these cases, and non-O157 serogroups cause the rest of the cases. These are estimates as not all STEC infections are diagnosed. This is because not many people seek medical care; of those who do seek care, a stool specimen may not be submitted for testing; and not all laboratories test for non-O157 STEC.

How are STEC infections transmitted?
STEC lives in the gut of ruminant animals, including cattle, goats, sheep, deer, and elk. Cattle are the major source of human STEC infections. STEC that cause human illness generally do not cause illness in animals. Pigs and birds may contract STEC from the environment and may spread it. Infections start when STEC is ingested. Exposures that result in illness include consumption of contaminated food, consumption of unpasteurized milk (raw milk) or water that has not been disinfected, contact with cattle, or contact with the feces of infected people. A high risk of *E. coli* O157 is from unpasteurized milk, unpasteurized apple cider, and soft cheeses made from raw milk. Infection may occur by swallowing lake water, touching the animals and surfaces in petting zoos and other animal exhibits, and by eating contaminated food.

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Who is at risk for STEC infection?
People of any age can become infected. Very young children and the elderly are more likely than others to develop severe illness and HUS; however, healthy older children and young adults can become seriously ill.

What are the signs and symptoms of STEC infections?
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. The symptoms often begin slowly with mild stomach pain or non-bloody diarrhea that worsens over several days. HUS, if it occurs, develops an average 7 days after the first symptoms, when the diarrhea is improving. The symptoms of STEC infections include severe stomach cramps, diarrhea (often bloody), and vomiting. If there is fever, it is usually low grade (less than 101˚F/38.5˚C). Some infections are very mild, but others are severe or even life-threatening.

Young children tend to carry STEC longer than adults. Some people can keep shedding these bacteria for several months. Policies for return to school and work differ by local jurisdiction.

What are potential complications of STEC infections?
Most people recover from a STEC infection within 5–7 days. Approximately 5–10% of those who are diagnosed with STEC infection develop HUS, a potentially life-threatening complication. Indications that a person is developing HUS include decreased frequency of urination, fatigue, and loss of pink color in cheeks and inside the lower eyelids. Persons with HUS should be hospitalized. Most persons with HUS recover within a few weeks, but some suffer permanent damage or die.

How are STEC infections diagnosed?
STEC infections are diagnosed through laboratory testing of stool specimens. Once the illness is resolved, STEC may not be found in the feces, but it may be shed for several weeks, even after symptoms resolve. Identifying the specific strain of STEC is essential for outbreak investigations. Many labs can determine if STEC are present, and most can identify *E. coli* O157. Labs that test for the presence of Shiga toxins in stool can detect non-O157 STEC infections. However, for the O group (serogroup) and other characteristics of non-O157 STEC to be identified, Shiga toxin-positive specimens must be sent to a state public health laboratory.

How are STEC infections treated?
STEC infections are treated with supportive therapy, including hydration. Do not use antidiarrheal agents and antibiotics which may increase the risk of HUS.

How can STEC infections be prevented?
STEC infections can be prevented by—

- Washing hands after using the bathroom or changing diapers, after contact with animals or their environments (at farms, petting zoos, fairs), and before preparing or eating food.
- Cooking meats thoroughly. Ground beef and meat that has been needle-tenderized should be cooked to a temperature of at least 160°F/ 70°C as measured with a thermometer.
- Preventing cross-contamination in food preparation areas by thoroughly washing hands, counters, cutting boards, and utensils after contact with raw meat.
- Avoiding raw milk, unpasteurized dairy products, and unpasteurized juices.

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- Avoiding swallowing water when swimming or playing in lakes, ponds, streams, or pools.

What are some public health considerations?

- Report: *E. coli* O157:H7, *E. coli* O113, *E. coli* O118, *E. coli* O111, *E. coli* O26
  - Do not report: Enterotoxigenic *E. coli* (ETEC), Enteropathogenic *E. coli* (EPEC), Enteroinvasive *E. coli* (EIEC), Enteroaggregative *E. coli (EAEC)*
- Document if the case patient works, lives, or attends a high transmission setting such as food handling, daycare, school, group living, health care, training center, or ship.
- Document the source of the infection, if known.
- Document relevant travel and deployment history occurring within the incubation period (2–10 days).

References

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Heymann, David L. ed. 2022. *Control of Communicable Diseases Manual*. 21st Edition. Washington, DC: APHA Press.