ICD-9-CM Diagnostic Coding for Shiga Toxin-Producing Escherichia Coli

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At the request of the American Academy of Pediatrics, the FY 2012 ICD-9-CM code update expanded subcategory 041.4, Escherichia coli, to create unique codes for Shiga toxin-producing Escherichia coli (STEC). This article describes STEC and its clinical features and summarizes the new STEC ICD-9-CM diagnostic codes.

What Is STEC?

While most strains of common intestinal bacteria of the E. coli species are harmless, some strains are highly pathogenic. STEC is a major cause of bacterial enteric infections in the United States. It produces a toxin called Shiga toxin, which is sometimes referred to as verotoxin or verocytotoxin (VTEC). STEC and VTEC that cause human illness are also referred to as enterohemorrhagic E. coli (EHEC).

The most common STEC transmission is foodborne, such as the consumption of undercooked ground beef, unpasteurized juice or milk, and raw produce. Additional transmission modes include ingestion of contaminated water, contact with animals, and direct person-to-person contact.

The most commonly identified STEC serotype that causes foodborne outbreaks in the United States is E. coli O157:H7 (O157 STEC). The name originates from the serogroup classification: it has the 157th type of somatic (O) antigen and the seventh type of flagellar (H) antigen.

Many non-O157 STEC serotypes also contribute to foodborne outbreaks. They can present serious complications, as some strains can be very virulent.

The Centers for Disease Control and Prevention (CDC) have identified six non-O157 STEC serogroups (O26, O45, O103, O111, O121, and O145) responsible for emerging non-O157 STEC illnesses, hospitalizations, and deaths in the United States.

Clinical Features and Diagnostic Testing

The CDC defines STEC as an "infection of variable severity characterized by diarrhea (often bloody) and abdominal cramps. Illness may be complicated by hemolytic uremic syndrome (HUS) or thrombotic thrombocytopenic purpura (TTP); asymptomatic infections also may occur and the organism may cause extraintestinal infections."[1]

HUS can begin as the diarrhea is improving and can occur among all patient populations; however, the pediatric and geriatric patient populations are most susceptible to HUS. Laboratory criteria for STEC diagnosis are defined by the CDC's National Notifiable Disease Surveillance System as "isolation of Shiga toxin-producing Escherichia coli from a clinical specimen. Escherichia coli O157:H7 isolates may be assumed to be Shiga toxin-producing. For all other E. coli isolates, Shiga toxin production or the presence of Shiga toxin genes must be determined to be considered STEC."[2]

Regardless of the patient population type, the CDC's comprehensive guidance for STEC testing by clinical laboratories recommends that all stools submitted for routine testing from patients with acute community-acquired diarrhea be simultaneously cultured for O157 STEC and tested with an assay that detects Shiga toxins to detect non-O157 STEC. Nonculture assays such as the Shiga toxin enzyme immunoassays are also effective in the detection of both O157 and non-O157 STEC.

Rapid identification of STEC is critical for patient management and disease control. Supportive care, including hydration, is the primary treatment method for STEC infections. Clinicians also closely monitor the patient's renal function, hemoglobin, and

platelets.

It is not recommended to give antibiotics to patients with suspected STEC infections until all diagnostic testing is completed and STEC infection is ruled out.

Documentation of STEC Test Results in Final Laboratory Reports

The table below provides clinical documentation examples that support final positive and negative STEC test results.

Test	Results	Examples of documentation in final report
Culture for O157 STEC	Positive	*Escherichia coli* O157:H7 or Shiga toxin–producing *E. coli* O157 isolated
	Negative	*Escherichia coli* O157:H7 or Shiga toxin–producing *E. coli* O157 not isolated
Culture for STEC	Positive	Shiga toxin–producing *Escherichia coli* O___:H_ isolated*
	Negative	Shiga toxin–producing *Escherichia coli* not isolated, suggesting that Shiga toxin–producing *E. coli* is not present
Immunoassay detection of Shiga toxin antigen	Positive	Shiga toxin detected by immunoassay, indicating the likely presence of a Shiga toxin–producing *Escherichia coli* such as *E. coli* O157:H7
	Negative	Shiga toxin not detected by immunoassay, suggesting that a Shiga toxin–producing *Escherichia coli*, such as *E. coli* O157, is not present
Detection of Shiga toxin DNA (i.e., Shiga toxin genes)	Positive for Shiga toxin 1 gene (stx1), Shiga toxin 2 gene (stx2), or both	Genes for Shiga toxin 1, Shiga toxin 2, or both were detected by polymerase chain reaction, indicating the likely presence of a Shiga toxin–producing *Escherichia coli* such as O157:H7
	Negative for Shiga toxin genes	Shiga toxin genes not detected by polymerase chain reaction, suggesting that a Shiga toxin–producing *Escherichia coli*, such as O157, is not present

*Public health laboratories may determine the O antigen or send the specimen to CDC for O antigen and H antigen determination.

Source: Centers for Disease Control and Prevention. "Recommendations for Diagnosis of Shiga Toxin–Producing Escherichia coli Infections by Clinical Laboratories." Morbidity and Mortality Weekly Report 52, no. RR-12 (Oct. 16, 2009). www.cdc.gov/mmwr/pdf/rr/rr5812.pdf.

STEC-Related ICD-9-CM Diagnostic Codes

In the ICD-9-CM tabular the expanded category for 041.4, Escherichia coli, now includes the following specific STEC codes:

- 041.41, Shiga toxin-producing Escherichia coli (STEC) O157
- 041.42, Other specified Shiga toxin-producing Escherich-ia coli (STEC)
- 041.43, Shiga toxin-producing Escherichia coli (STEC), unspecified

For accurate code assignment, it is important to become familiar with all the terms listed under each new STEC code. For example, E. coli O157 with confirmation of Shiga toxin when H antigen is unknown is listed under code 041.41, and non-O157 Shiga toxin-producing Escherichia coli with known O group is included under code 041.42.

National STEC Detection and Prevention Initiatives

In the US, multiple collaborative public health systems are used to identify STEC infections, control outbreaks, and monitor prevention initiatives. A few of the initiatives are highlighted below.

The Division of Preparedness and Emerging Infections has included Escherichia coli O157:H7 under the Bioterrorism Category B Food Safety Threat. Category B is defined as the second highest priority agent that is moderately easy to disseminate, results in moderate morbidity rates and low mortality rates, and requires specific enhancements of CDC's diagnostic capacity and enhanced disease surveillance.

The National Notifiable Diseases Surveillance System requires healthcare providers and laboratory professionals report individual cases of disease when selected pathogens are identified in patient specimens or specific clinical syndromes are recognized. Foodborne diseases that are reportable include botulism, hemolytic uremic syndrome, listeriosis, salmonellosis, STEC infections, and vibriosis.

The Foodborne Diseases Active Surveillance Network (FoodNet) conducts surveillance for Campylobacter, Cryptosporidium, Cyclospora, Listeria, Salmonella, STEC O157 and non-O157, Shigella, Vibrio, and Yersinia infections diagnosed by laboratory testing of samples from patients.

PulseNet detects and investigates foodborne disease outbreaks across the country. Investigations have linked multistate E. coli O157:H7 foodborne outbreaks to the ingestion of beef, refrigerated prepackaged cookie dough, and cheese products. In addition, outbreaks of E. coli O157:H7 have been associated with confined environments such as children who attend child care centers or visit petting zoos and elderly residents who reside in nursing homes.

Beginning in March 2012, the Food Safety and Inspection Service (FSIS) of the US Department of Agriculture intends to carry out verification procedures, including sampling and testing manufacturing trim and other raw ground beef product components, to ensure control of six non-O157 STEC serogroups (O26, O45, O103, O111, O121, and O145). FSIS has determined that the six non-O157 STEC serogroups, as well as O157, are all adulterants of nonintact raw beef products and product components within the Federal Meat Inspection Act.

The National Healthy People 2010 initiative reported that the incidence of STEC O157 infection has declined to reach the 2010 national health objective target of <=1 case per 100,000.

Notes

1. Centers for Disease Control and Prevention. "Shiga Toxin-Producing *Escherichia Coli* (STEC)." 2005 Case Definition. CSTE Position Statement Number: 09-ID-30. February 11, 2011. www.cdc.gov/osels/ph_surveillance/nndss/casedef/shiga_current.htm.
2. Ibid.

References

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CDC. "FoodNet-Foodborne Diseases Active Surveillance Network." September 21, 2011. www.cdc.gov/foodnet.

CDC. "ICD-9-CM Coordination and Maintenance Committee Meeting." March 10, 2010. www.cdc.gov/nchs/data/icd9/TopicpacketforMarch2010.pdf.

CDC. "Recommendations for Diagnosis of Shiga Toxin–Producing *Escherichia coli* Infections by Clinical Laboratories." *Morbidity and Mortality Weekly Report* 52, no. RR-12 (Oct. 16, 2009). www.cdc.gov/mmwr/pdf/rr/rr5812.pdf.

CDC. "Table 1. Estimated Annual Number of Domestically Acquired, Foodborne Illnesses, Hospitalizations, and Deaths due to 31 Pathogens and Unspecified Agents Transmitted through Food, United States." April 19, 2011. www.cdc.gov/foodborneburden/2011-foodborne-estimates.html#annual.

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