

Shiga toxin-producing *Escherichia coli* (STEC), Connecticut, 2000-2008

Shiga toxin-producing *Escherichia coli* (*E. coli*) causes an estimated 100,000 illnesses and 90 deaths annually in the United States (1). In the United States, *E. coli* O157 is the most commonly reported Shiga toxin-producing *E. coli* (STEC). Over 100 different non-O157 STEC serotypes have been found to be associated with human illness. All STEC are characterized by the production of Shiga toxins (Stx). While the epidemiology of O157 STEC is well-established, less is known about non-O157 STEC.

Infections with STEC can range from asymptomatic illness to acute, bloody diarrhea and life threatening hemolytic uremic syndrome (HUS) characterized by thrombocytopenia, hemolytic anemia and acute renal failure. Approximately 8% of all post diarrheal cases of O157 STEC infection develop HUS (2-4). Prompt identification of STEC infection is important for determining patient management.

Clinical laboratories culturing and using sorbitol-containing selective media can readily identify O157 STEC. However, non-O157 STEC cannot be readily identified using culture media. Commercially available rapid enzyme immunoassay (EIA) testing detects the presence of Stx and therefore, is capable of detecting both O157 and non-O157 strains.

The Centers for Disease Control and Prevention (CDC) recently released "Recommendations for Diagnosis of Shiga Toxin-Producing *Escherichia coli* Infections by Clinical Laboratories" (5) (<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5812a1.htm>). The report details recommendations that all stools obtained for enteric testing from patients with community acquired diarrhea be routinely cultured for *E. coli* O157 regardless of patient age, season, or presence of bloody diarrhea, and should be evaluated with an assay to determine the presence of non-O157 STEC.

STEC Surveillance and Epidemiology

Escherichia coli O157 has been reportable in Connecticut since the early 1990s. Beginning in 2000, Shiga toxin-related disease was also made laboratory reportable and clinical laboratories are required to submit all broths from positive EIA tests to the Department of Public Health (DPH) State Laboratory

In this issue...

Shiga toxin-producing <i>Escherichia coli</i> (STEC), Connecticut, 2000-2008	21
Campylobacteriosis in Connecticut, 1999-2008	23

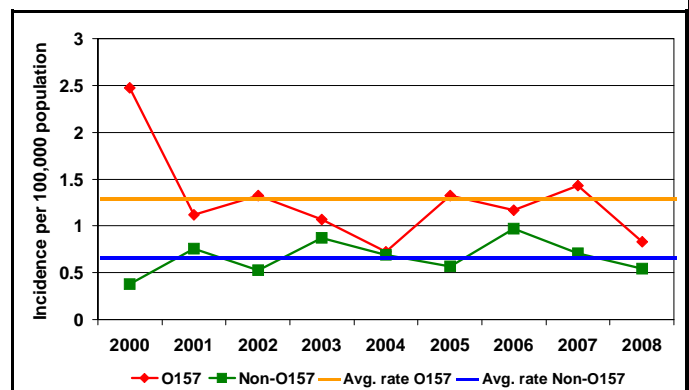
for confirmation and identification of the causative organism.

During 2000-2008, 596 STEC infections were reported to the DPH. Overall 390 (65%) were O157 STEC and 206 (35%) were identified as non-O157 STEC. Among the 350 (59%) infections detected initially by Stx testing, 144 (41%) were found to be O157 and 206 (59%) were non-O157 STEC. The four most common serotypes among the non-O157 isolates were: O111 (20%), O103 (18%), O26 (18%), and O45 (13%).

Overall, during 2000-2008, the average annual incidence was 1.3 cases per 100,000 population for O157 and 0.7 cases per 100,000 population for non-O157 STEC (Figure 1).

Epidemiologic data obtained from 262 cases between May 2004 through December 2008 were evaluated to determine the spectrum of clinical illness and risk factors associated with STEC infection. Information was obtained from 165 O157 and 97 non-O157 STEC cases. Compared to patients with non-O157 STEC, patients with O157 were more likely to report diarrhea (96% vs 82%, OR 4.8, $p < 0.0001$), bloody diarrhea (87% vs 53%, OR 5.8, $p < 0.0001$), vomiting (39% vs 18%, OR 3.1, $p < 0.0001$), hospitalization (43% vs 18%,

Figure 1: Incidence of Laboratory Confirmed Cases of *Escherichia coli* O157 and Non-O157 STEC in Connecticut, 2000-2008



OR 3.5, $p < 0.0001$) and HUS (9% vs 0%). There were no deaths reported during that time period. Overall, there was no significant difference between O157 and non-O157 STEC cases for risk factors commonly associated with O157 infection, such as consuming ground beef, visiting a farm or petting zoo, drinking raw milk, or swimming.

During 2000-2008, a total of 7 STEC outbreaks occurred; all were due to O157 STEC. Of the 7 outbreaks, 6 (86%) were due to contaminated food and 1 was associated with person-to-person transmission at a daycare facility. Vehicles implicated in the 6 foodborne outbreaks include ground beef (3), spinach (1), lettuce (1), and raw milk (1).

Physician and Laboratory STEC Survey

In 2009, a survey was mailed to 300 randomly selected physicians practicing in CT. The purpose of the survey was to determine their knowledge concerning the ordering and interpretation of STEC laboratory tests for patients with diarrheal illness, practices with regard to providing empiric antimicrobial treatment, and knowledge of public health reporting requirements. The response rate was 36% (108/300).

Among the 94 physicians practicing at least 8 hours per week, 55% reported being in practice twenty years or more; 23% were in practice ten or fewer years. Reported specialties included internal medicine (26%), family practice (23%), pediatrics (19%), emergency medicine (18%), and infectious diseases (14%).

Overall, physicians reported seeing a mean of 42 cases of diarrhea in the last 6 months (range 0-250). When asked about culturing practices, 56% of physicians reported rarely or never culturing non-bloody stools, while 80% culture bloody stools often or always. When ordering a culture, 50% of physicians believe that the laboratory always includes *E. coli* O157 in the routine culture panels and only 30% specify O157 when ordering a culture; 60% do not specify testing for non-O157 STEC. When asked about interpretation of a positive "Shiga toxin" result, 33% of physicians interpreted the result as Shiga toxin-positive *E. coli*; 28% Shigella; 20% both Shigella and STEC; and 17% were not sure what the result signified.

When prescribing antibiotics to patients with diarrhea, 94% of physicians reported rarely or never prescribing without doing a culture. Only 36% of respondents were aware that STEC and Shiga toxin-related disease were physician and laboratory reportable.

A survey of 32 clinical laboratories in CT conducted in 2007 showed that 27 (84%) laboratories test on site for STEC; 15 (56%) conducted only culture based

testing and did so routinely on all stool samples submitted. Of the 12 (44%) laboratories reporting use of non-culture based testing methods, 6 (50%) reported testing for STEC routinely. Other reported factors for conducting STEC testing included physician request, bloody stool, and patient age. Only 3 (11%) laboratories conducted both culture and non-culture based testing simultaneously.

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Editorial

Shiga toxin-producing *E. coli* (STEC) are a leading cause of bacterial enteric infections. Illnesses can be severe and life-threatening. The increase in testing that facilitates diagnosis for O157 and non-O157 STEC increases the potential to correctly diagnose and manage patients and to identify and respond to common-source outbreaks.

The identification and management of patients with STEC depends on a number of factors, beginning with the patient seeking medical care, the medical provider ordering and interpreting specimen testing, and the laboratory employing methodologies necessary to identify specific organisms. Any break in this chain of events may cause an episode of illness to go undetected, undocumented, and potentially improperly treated.

The recently published CDC guidelines (<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5812a1.htm>) address a number of these factors. While primarily intended for the clinical laboratory, this document can serve as a reference for providers as well as public health laboratories and authorities dealing with Shiga toxin-related illness and STEC. The document outlines specimen selection, handling and transport, as well as STEC detection methodologies, interpretation, and clinical considerations, all essential for appropriate patient evaluation, diagnosis and management.

Results of the physician survey demonstrate that knowledge and practice with regard to Shiga toxin testing and interpretation varies widely among physicians. This, coupled with the results from the laboratory survey, underscores the importance of concise and detailed recommendations. The CDC STEC recommendations can be instrumental in guiding practices to assure timely diagnosis and patient management. In addition, the timely diagnosis and reporting of STEC cases to public health authorities is essential to identifying, investigating, and controlling outbreaks.

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Campylobacteriosis in Connecticut, 1999-2008

Campylobacter jejuni is the most common bacterial cause of diarrheal illness in the United States (U.S.) and the most common bacterial foodborne pathogen reported in Connecticut. Campylobacteriosis is one of the illnesses targeted for active laboratory-based surveillance in the Connecticut Emerging Infections Program, Foodborne Diseases Active Surveillance Network (FoodNet). The national incidence among FoodNet sites in 2008 was estimated to be 12.7 cases per 100,000 population (1). The following summarizes *Campylobacter* spp. surveillance data in Connecticut from 1999 through 2008.

Cumulative Surveillance Data

From January 1999 through December 2008, 5,416 cases of campylobacteriosis were reported to the Connecticut Department of Public Health (DPH). The average annual incidence over the 10-year period was 15.7 cases per 100,000 population with little variation from year to year (Figure 1).

Of the 5,416 infections reported, 53% occurred among males. Information on race and ethnicity was obtained

for 2,607 (48%) cases. Of these, 2,164 (83%) were white, 88 (3%) were black, 58 (2%) Asian, 6 (0.2%) were American Indian/Alaskan Native and 291 (11%) were Hispanic. The majority of cases, 3,375 (62%), occurred in people aged 20 to 59 years; 107 (2%) were infants <1 year of age. Overall, 11% of patients with *Campylobacter* infection were hospitalized. On average, mortality occurred in 1.3 persons annually. Information regarding international travel was collected for 816 of the 2,686 cases occurring between 2004-2008. Of these, 216 (26%) cases reported a history of international travel during the 7 days prior to illness onset. *Campylobacter* infections occurred primarily during the early summer months. The highest number of cases for each year occurred between June and August, most commonly in July.

2008 Surveillance Data

During 2008, 531 cases of campylobacteriosis were reported to the DPH (15.2 cases per 100,000 population); 52% were male. Information regarding race and ethnicity was available for 326 (61%) cases. Of these, 264 (81%) were white, 9 (3%) black, 8 (2%) Asian, and 45 Hispanic (14%). Incidence rates varied among age groups with the highest infection rate occurring in those <1 year of age (Figure 2). Of the 237 (45%) cases with travel information, 63 (27%) reported a history of international travel.

Incidence varied by county with the highest incidence reported from Middlesex County (21 cases per 100,000 population) and Fairfield County (20 cases per 100,000 population).

Information on hospitalization was obtained on 522 (98%) cases; among these, 77 (15%) were hospitalized. In 2008, 2 deaths occurred among persons with *Campylobacter* infections (case fatality rate of 0.38%).

Similar to the seasonal variation trend seen in the cumulative surveillance data, 38% of campylobacteriosis cases reported in 2008 occurred

Figure 1: Incidence of Campylobacteriosis by Year, Connecticut, 1999-2008

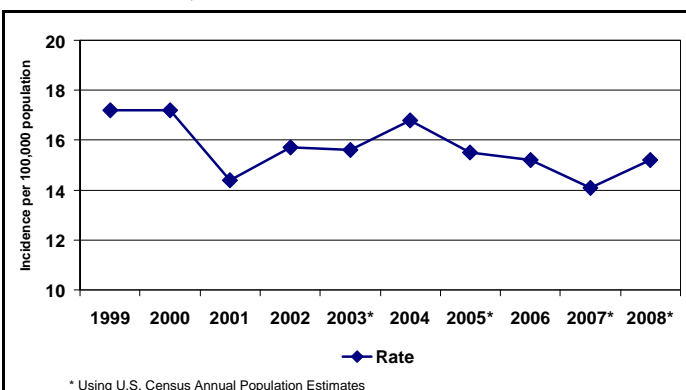
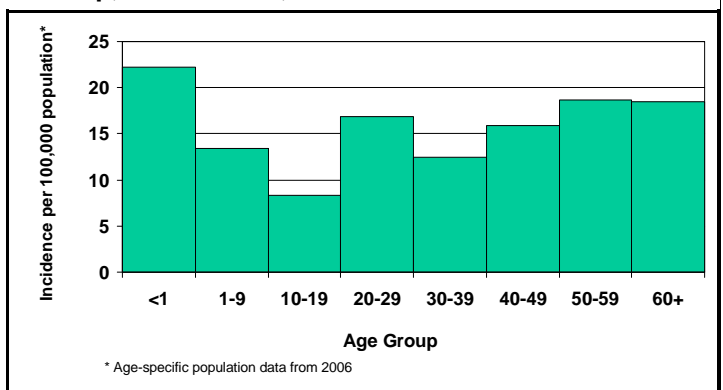


Figure 2: Incidence of Campylobacteriosis by Age Group, Connecticut, 2008



during the summer months (June to August) with the highest number of cases reported in July.

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Editorial

Campylobacter spp. causes diarrhea (often bloody), cramping, and abdominal pain among infected persons. The majority of those infected experience mild illness with few deaths and hospitalizations reported. An estimated 2.4 million infections and 124 deaths occur in the U.S. annually (2). *Campylobacter* spp. is one of the most commonly occurring enteric pathogens transmitted through food.

The CDC's FoodNet consists of 10 participating states, including Connecticut, that conduct active, population-based surveillance for laboratory-confirmed cases of infection caused by several foodborne pathogens including *Campylobacter*. In 2008, FoodNet reported 5,825 laboratory-confirmed cases of *Campylobacter* (incidence 12.7 per 100,000 population) (1). Campylobacteriosis rates varied widely by geographic site with the highest rates in California (30.2) and the lowest in Maryland (6.7). Rates of campylobacteriosis are highest among children under the age of 4 years (28.5) compared to all other age groups.

Outbreaks of campylobacteriosis are infrequent but exposure to untreated water, raw milk, and undercooked chicken have been implicated as vehicles for transmission. In Connecticut, a rare outbreak of *Campylobacter* infection was associated with consumption of sweet potatoes that were potentially contaminated with raw meat at a senior center (3). Additionally, during 1999–2008, 5 outbreaks of campylobacteriosis occurred in Connecticut (unpublished data). One outbreak was associated with consumption of unpasteurized cheese, 1 was associated with lettuce that was potentially cross-contaminated; vehicle for the remaining 3 outbreaks could not be determined.

In a FoodNet case-control study conducted from 1998-1999, international travel in the 7 days before illness onset accounted for approximately 13% of cases (4). Additional risk factors for infection included eating chicken and non-poultry meat at a restaurant.

Incidence was highest in infants <1 year of age. A FoodNet case-control study of infants with campylobacteriosis also identified international travel as a risk factor for infection (5). Infants aged 0-6 months with *Campylobacter* infection were less likely to be breast-fed, more likely to drink well water, and more likely to ride in a shopping cart next to meat or poultry than controls. Infants 7-11 months of age were more likely to visit or live on a farm, have a pet with diarrhea in their home, or eat fruits or vegetables at home than controls.

A laboratory survey conducted by FoodNet in 2005 showed that all Connecticut laboratories performing enteric testing on-site routinely culture for *Campylobacter*. However, with the recent Food and Drug Administration approval of a new enzyme immunoassay test, which measures bacterial antigen rather than viability of the organism, it will be necessary to monitor testing methods used for the diagnosis of campylobacteriosis to explain possible changes in trends. Currently, no laboratories in Connecticut have adopted non-culture methods of *Campylobacter* testing.

In Connecticut, the incidence of *Campylobacter* infection has remained relatively steady over the past decade. In depth analysis of surveillance data for the past year has shown variations by age and seasonality; specifically, incidence is highest among persons <1 year of age and the number of cases peaks in the summer months.

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