National Enteric Disease Surveillance:
Shiga toxin-producing *Escherichia coli* (STEC) Annual Report, 2011

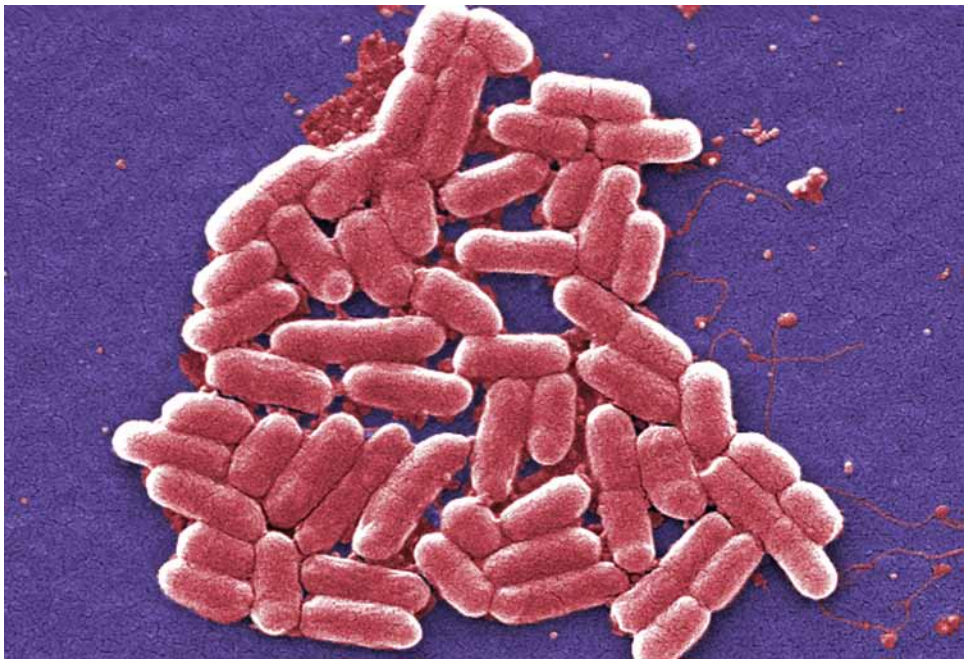
An overview of surveillance methods and systems for Shiga toxin-producing *Escherichia coli* (STEC) infections is available at http://www.cdc.gov/ncezid/dfwed/PDFs/national-stec-surveillance-overiew-508c.pdf (1).

Human Surveillance Data: Laboratory-based Enteric Disease Surveillance (LEDS)

The Laboratory-based Enteric Disease Surveillance (LEDS) system collects reports of isolates from laboratory-confirmed human STEC infections from state public health laboratories. Reporting to LEDS is voluntary, and the number of states submitting reports varies somewhat from year to year, although almost all states report every year. Occasionally, more than one isolate is reported from a single episode of infection in a person; this report includes only one isolate of a given STEC serotype per person within a 30-day period.

In this report, we summarize the number of infections reported, and also report incidence rates (cases per 100,000 population), which are calculated as the number of STEC infections in humans reported for a given year divided by the reporting state population for that year. For figures and maps, STEC infections reported as "undetermined" are categorized as non-O157 STEC infections.

Data in this report current as of 1/22/2013.



Colorized scanning electron micrograph (SEM) of Gram-negative *Escherichia coli* O157:H7.

National Center for Emerging and Zoonotic Infectious Diseases
Division of Foodborne Waterborne, and Environmental Diseases

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Table 1. Laboratory-confirmed STEC infections reported to CDC, with the 20 most frequently reported serogroups listed individually, United States, 2011

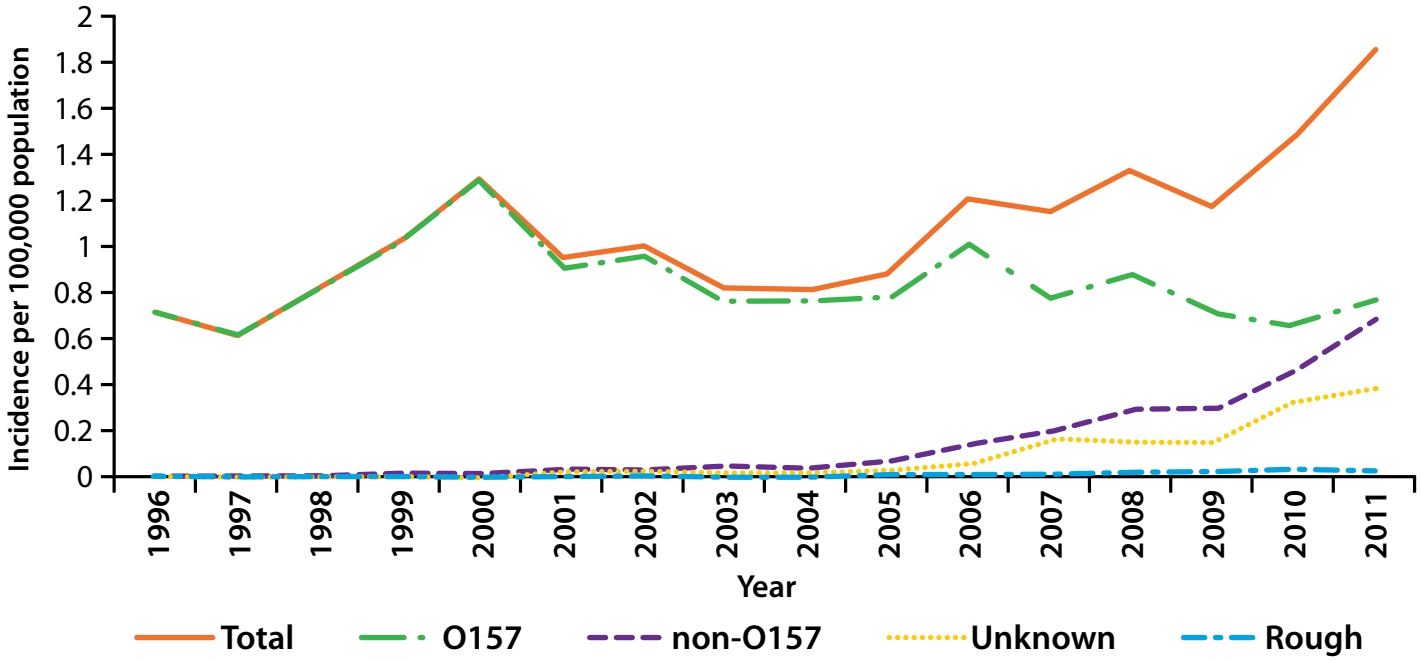
Rank	Serogroup	Number Reported	Percent
1	O157	2366	41.1
2	O26	611	10.6
3	O103	548	9.5
4	O111	322	5.6
5	O121	176	3.1
6	O45	135	2.3
7	O145	74	1.3
8	O118	47	0.8
9	O69	22	0.4
10	O76	14	0.2
11	O91	14	0.2
12	O5	9	0.2
13	O153	8	0.1
14	O104	7	0.1
15	O113	6	0.1
16	O165	6	0.1
17	O174	6	0.1
18	O71	6	0.1
19	O146	5	0.1
20	O80	5	0.1
	Sub Total	**4387**	**76.1**
	All other non-O157 STEC	89	1.5
	Unknown*	1200	20.8
	Rough	79	1.4
	Undetermined	8	0.1
	Sub Total	**1376**	**23.9**
		5763	**100**

*Infections of an unknown serogroup may represent Shiga toxin-positive stool specimens from which no STEC was isolated that were reported as STEC; although they would not meet the current case definition for laboratory-confirmed infection, we do not have a way to identify them.

5,763 laboratory-confirmed human STEC infections were reported to CDC through LEDS

- The top 7 serogroups in 2011 were O157 (41.1%), O26 (10.6%), O103 (9.5%), O111 (5.6%), O121 (3.1%), O45 (2.3%), and O145 (1.3%)

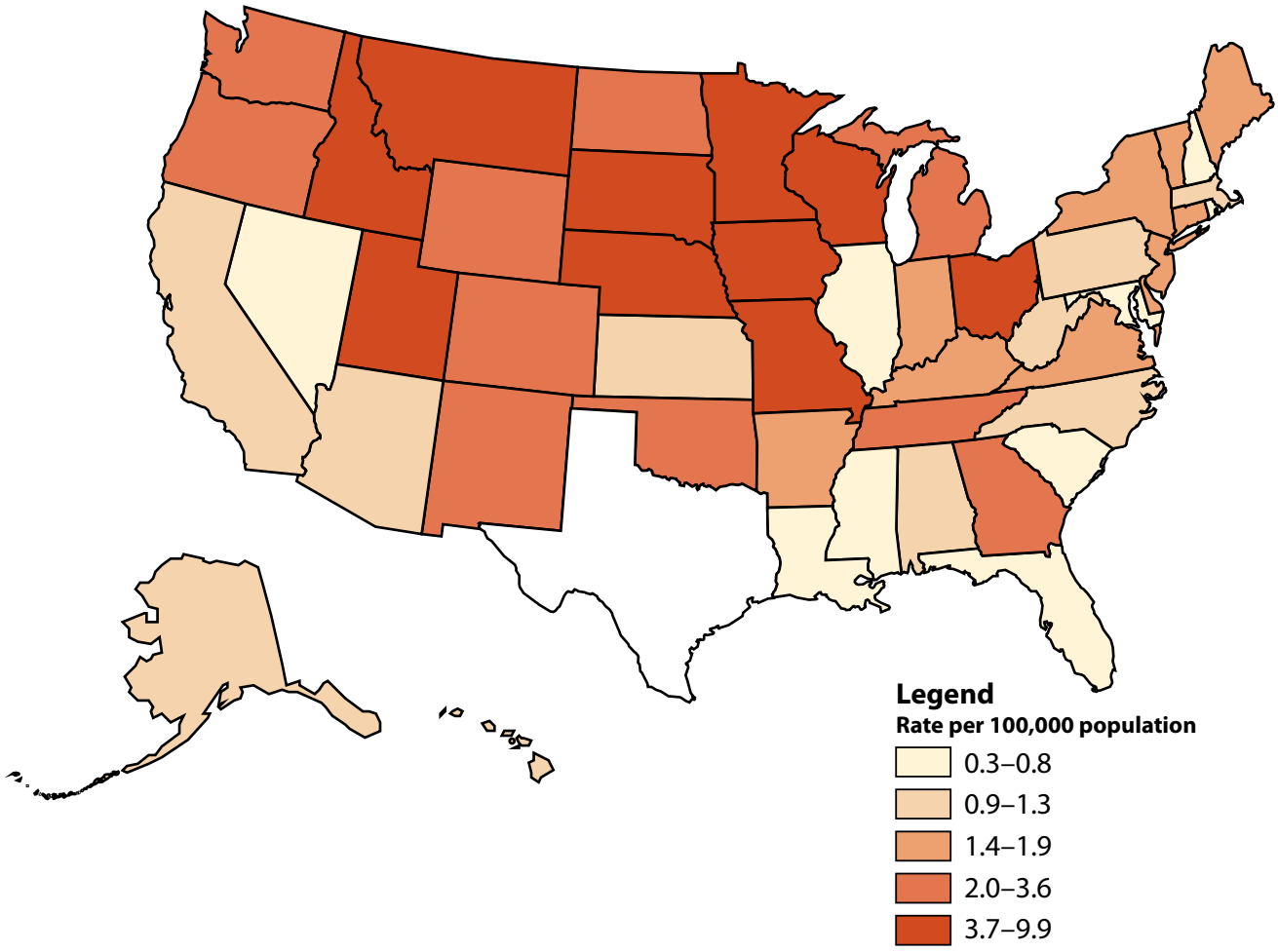
Figure 1. Incidence rate of laboratory-confirmed human STEC infection reported to CDC per 100,000 population, by serogroup and year, United States, 1996–2011 (n=50,158)



The overall incidence rate of STEC infection, 1.8 per 100,000 population, was the highest since surveillance began in 1996

- The incidence rate of STEC O157 infection increased in 2011 to 0.76
- The incidence rate of infection with non-O157 STEC and STEC serogroups reported as "unknown serogroup" increased markedly from 2000 to 2011, likely caused by increased testing of diarrheal stools for Shiga toxin in clinical laboratories It is possible that some of the "unknown serogroup" STEC may represent Shiga toxin-positive stool specimens from which no STEC was isolated that were reported as STEC; although they would not meet the current case definition for laboratory-confirmed infection, we do not have a way to identify them

Figure 2a. Incidence rate of laboratory-confirmed STEC infection reported to CDC, by state, United States, 2011 (n=5,763)*

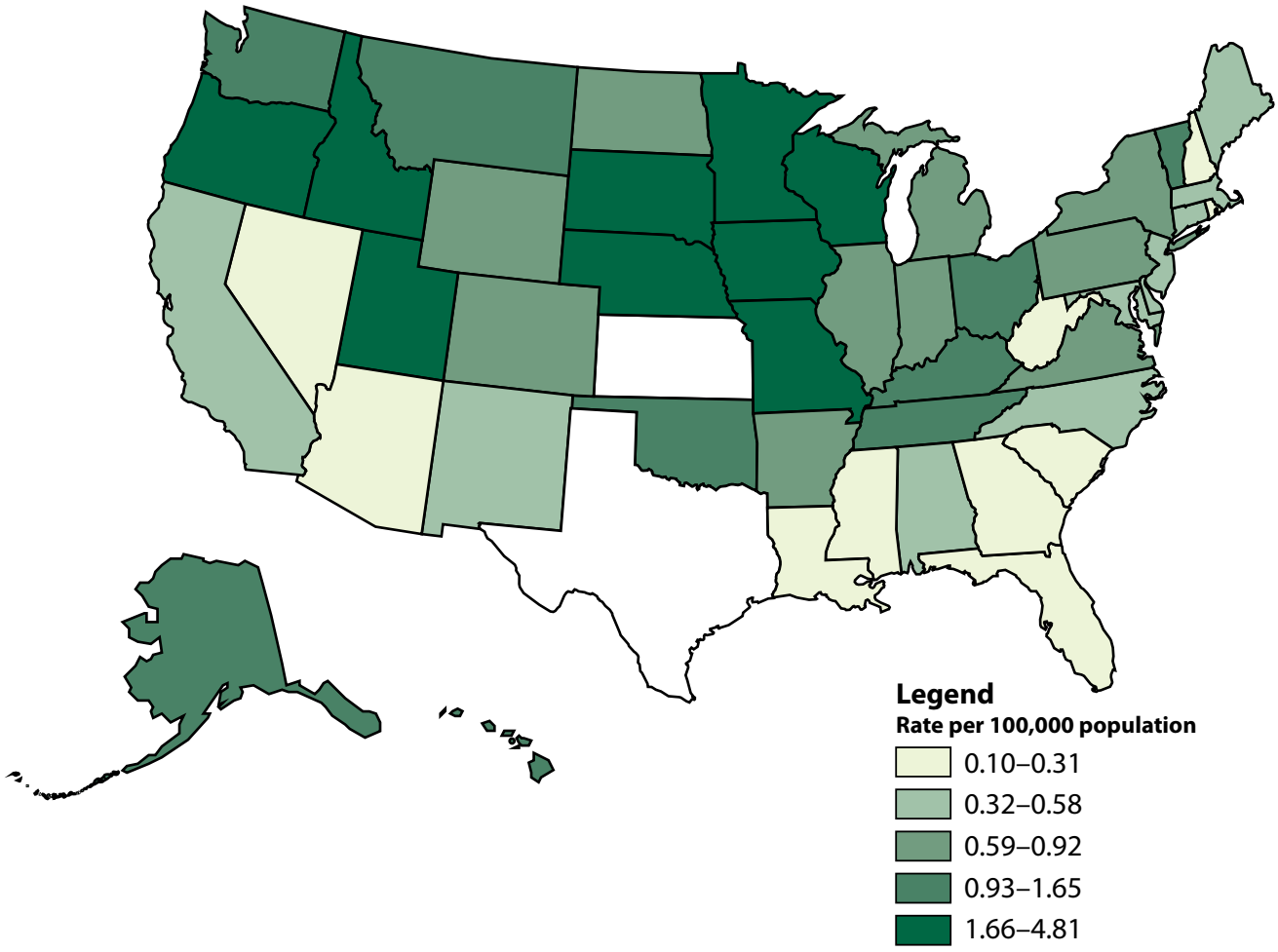


* Unshaded states are those that reported no STEC infections (no infections were diagnosed or the state did not report to CDC).

Almost all states reported infections. The overall incidence rate (cases per 100,000 population) was 1.8, the highest since surveillance began in 1996

- Incidence rates were generally highest in the northern latitude states. The states with the highest reported incidence rates were Wisconsin (9.9), Utah (8.3), and Idaho (6.6).

Figure 2b. Incidence rate of laboratory-confirmed STEC O157 infection reported to CDC, by state, United States, 2011 (n=2,366)*

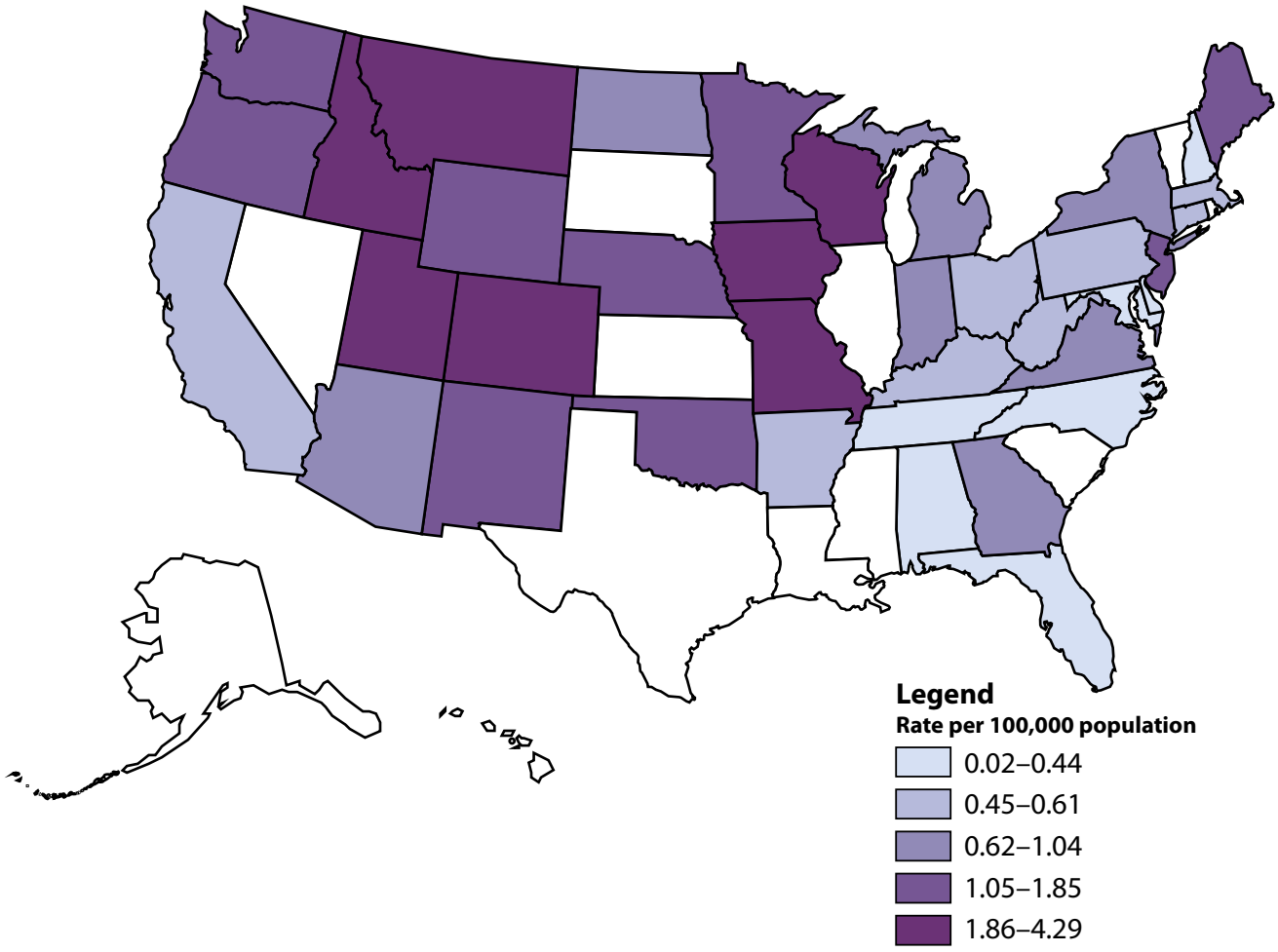


* Unshaded states are those that reported no STEC O157 infections (no infections were diagnosed or the state did not report to CDC).

48 states reported a total of 2,366 laboratory-confirmed STEC O157 infections, corresponding to an incidence rate (cases per 100,000 population) of 0.76

- States in the upper Midwest generally had the highest incidence rate, whereas states in the south generally had the lowest incidence rates. The states with the highest reported incidence rates were Wisconsin (4.8), South Dakota (4.1), and Iowa (2.9)

Figure 2c. Incidence rate of laboratory-confirmed non-O157 STEC infection reported to CDC, by state, United States, 2011 (n=2,118)*

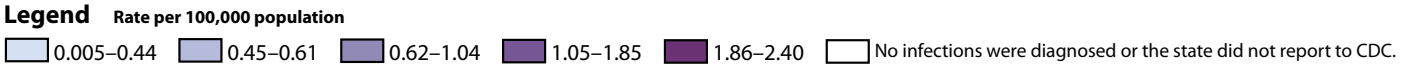


* Unshaded states are those that reported no STEC non-O157 infections (no infections were diagnosed or the state did not report to CDC).

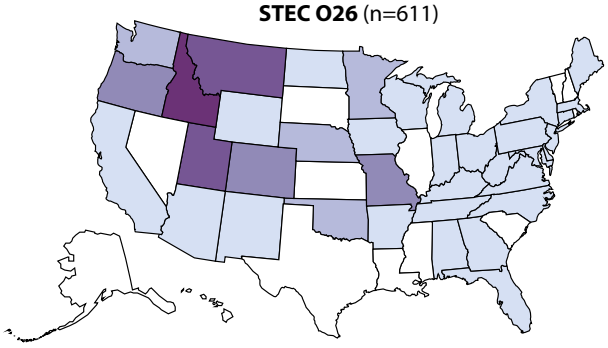
39 states reported a total of 2,118 laboratory-confirmed non-O157 STEC infections, corresponding to an overall incidence rate (cases per 100,000 population) of 0.68

- The states with the highest reported incidence rates of non-O157 STEC infection were Idaho (4.3), Utah (2.9), and Missouri (2.5)

Figure 2d. Incidence rate of laboratory-confirmed non-O157 STEC infection, top 6 non-O157 STEC serogroups, reported to CDC by state, United States, 2011 (n=1,866)

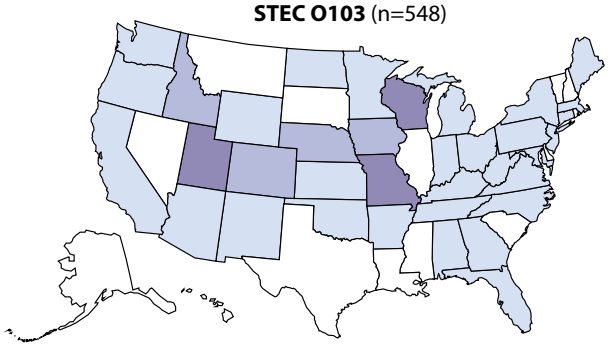


STEC O26 (n=611)



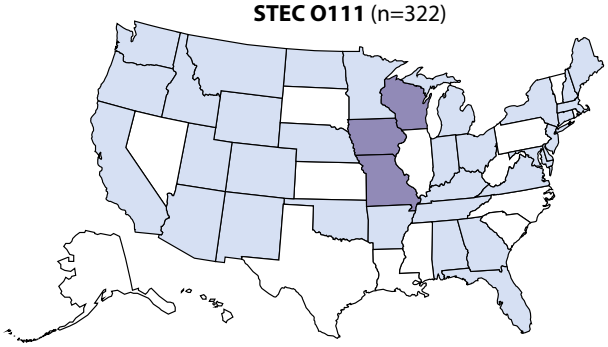
- 37 states reported 611 laboratory-confirmed STEC O26 infections, corresponding to an incidence rate (cases per 100,000 population) of 0.20

STEC O103 (n=548)



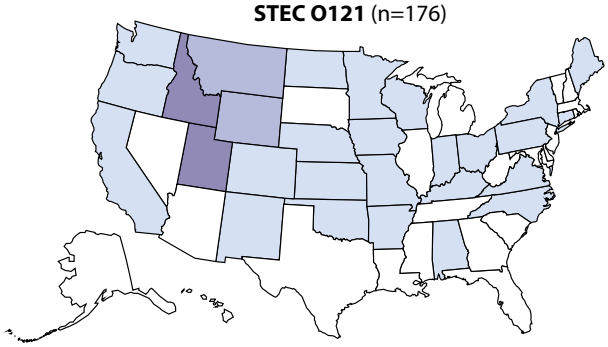
- 36 states reported 548 laboratory-confirmed STEC O103 infections, corresponding to an incidence rate of 0.18

STEC O111 (n=322)



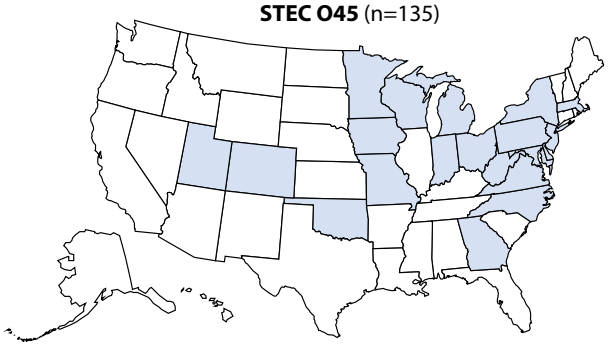
- 36 states reported 322 laboratory-confirmed STEC O111 infections, corresponding to an incidence rate of 0.10

STEC O121 (n=176)



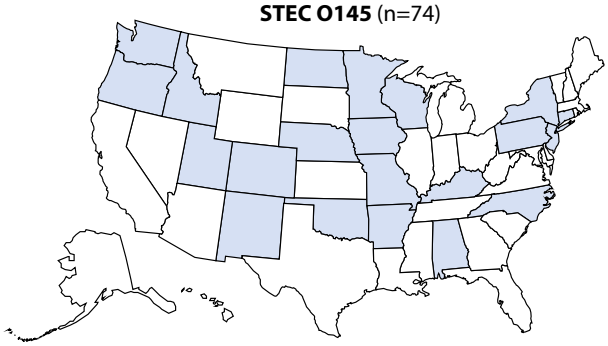
- 31 states reported 176 laboratory-confirmed STEC O121 infections, corresponding to an incidence rate of 0.06

STEC O45 (n=135)



- 21 states reported 135 laboratory-confirmed STEC O45 infections, corresponding to an incidence rate of 0.04

STEC O145 (n=74)

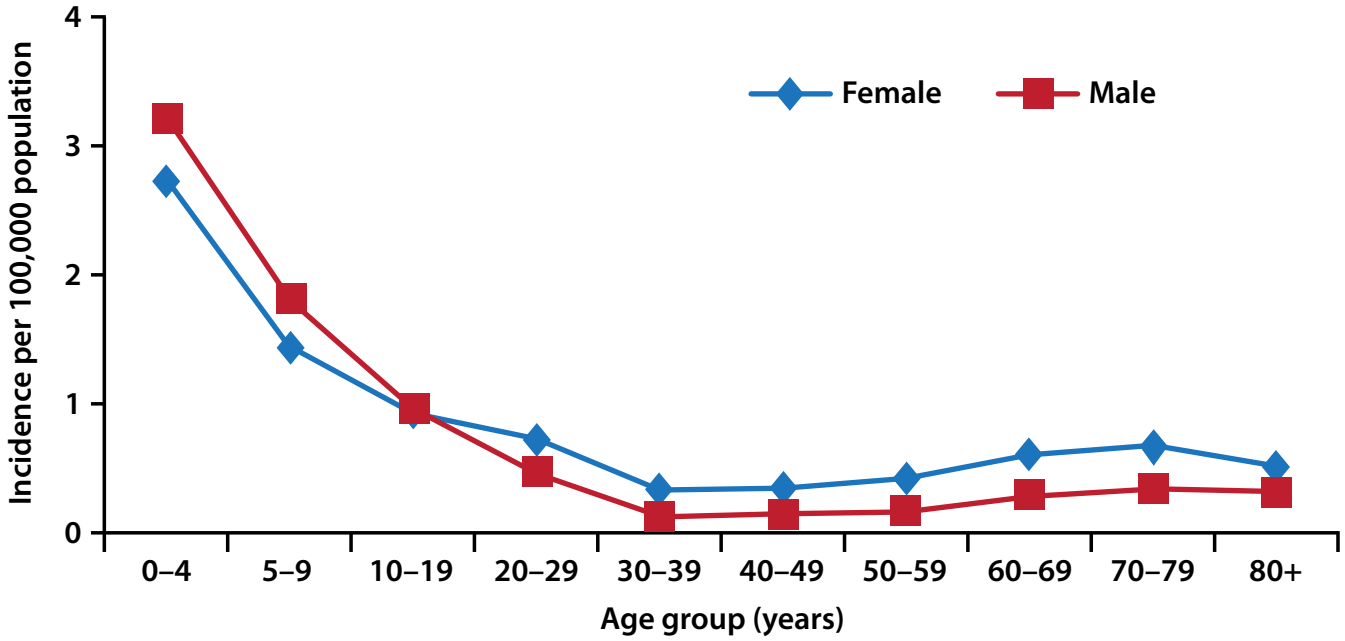


- 25 states reported 74 laboratory-confirmed STEC O145 infections, corresponding to an incidence rate of 0.02

The 6 non-O157 STEC serogroups that caused the most infections during 2010 were O26, O103, O111, O145, O121 and O45. Fewer states reported laboratory-confirmed non-O157 STEC infections to LEDS than reported laboratory-confirmed STEC O157 infections. This reflects substantial state-to-state variation in clinical testing practices and public health reporting practices. See the National STEC Surveillance Overview http://www.cdc.gov/ncezid/dfwed/PDFs/national-stec-surveillance-overiew-508c.pdf for further information.

- Idaho had the highest reported incidence rate of laboratory-confirmed STEC O26 and O121 infections, while Wisconsin had the highest incidence rate of laboratory-confirmed STEC O103 and STEC O45 infections, and Iowa had the highest incidence rate of laboratory-confirmed STEC O111 and STEC O145 infections.

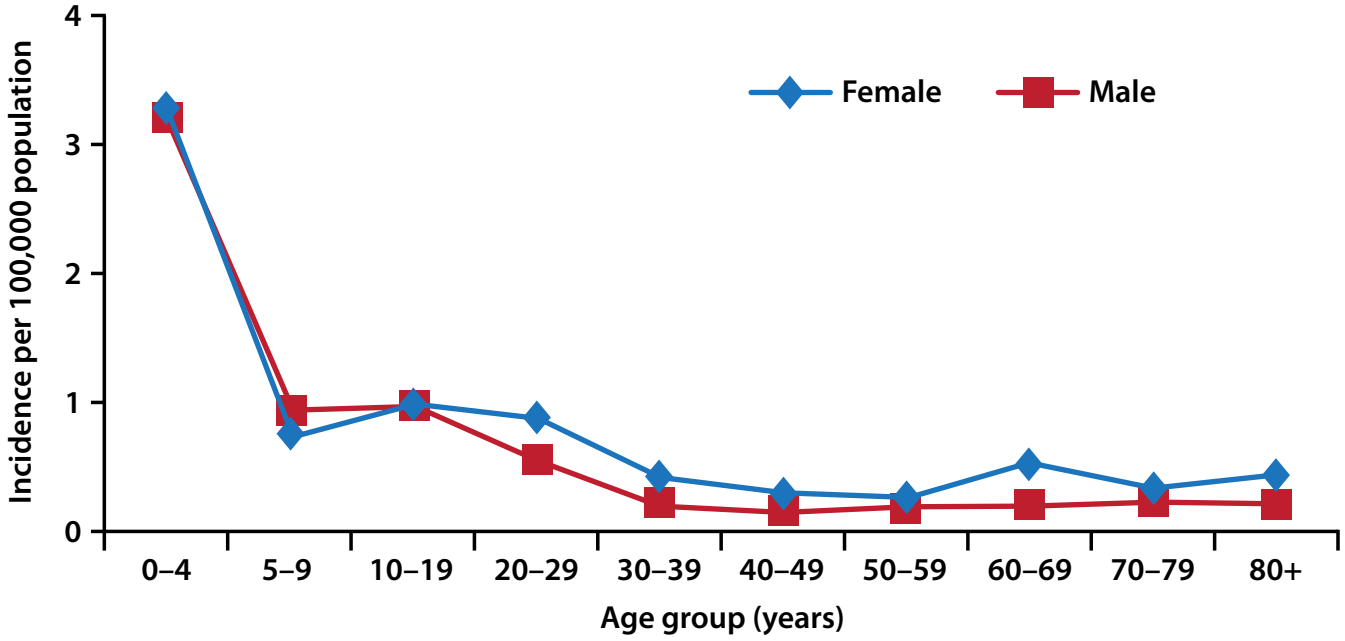
Figure 3a. Incidence rate of laboratory-confirmed STEC O157 infection reported to CDC, by age group and sex, United States, 2011 (n=2,235)



During 2011, the highest incidence rates of STEC O157 infection were in children under 5 years old; this rate was nearly double the incidence rate in children 5 to 9 years old for both males and females

- The incidence rate of STEC O157 infection was slightly higher in males aged 0 to 19 years than females in the same age group but higher in females than males 20 years and older

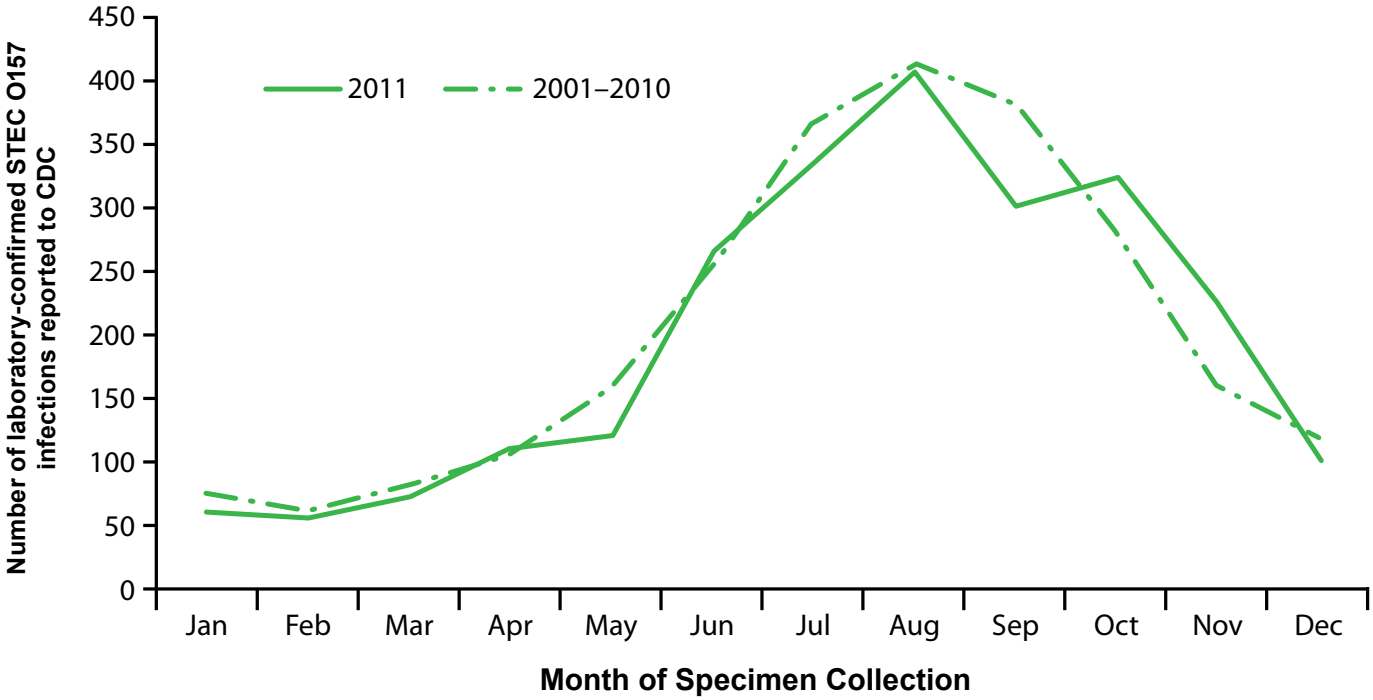
Figure 3b. Incidence rate of laboratory-confirmed non-O157 STEC infection reported to CDC, by age group and sex, United States, 2011 (n=2,014)



During 2011, the highest incidence rates of infection with non-O157 STEC were in children under 5 years old; this rate was nearly 3 to 4 times the incidence rate in children 5 to 9 years old

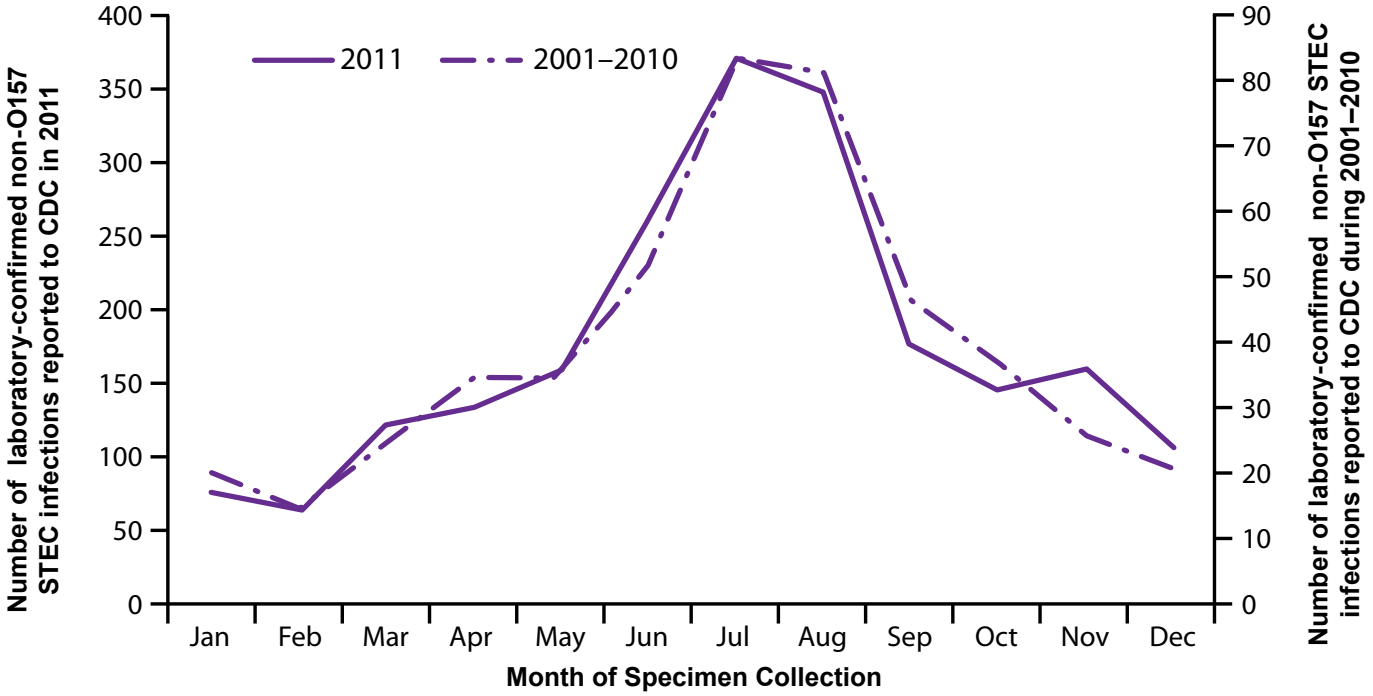
- Incidence rates of non-O157 STEC infection in females were higher than males in the same age groups, except in males 5 to 19 years old

Figure 4. Number of laboratory-confirmed STEC O157 infections reported to CDC by month of specimen collection, United States, 2011 and average annual number during 2001–2010



During 2011, laboratory-confirmed STEC O157 infections peaked in the summer and fall

Figure 5. Number of laboratory-confirmed non-O157 STEC infections reported to CDC by month of specimen collection, United States, 2011 and average annual number during 2001–2010



During 2011, non-O157 STEC infections peaked in the summer and the seasonality was similar to the average annual number during 2001–2010

- For the first year, there were more laboratory-confirmed non-O157 STEC infections than STEC O157 infections from December through May

Human Reference Laboratory Data: National *Escherichia coli* Reference Laboratory Data

The National *Escherichia coli* Reference Laboratory receives unusual or untypable isolates from state public health laboratories for further characterization, including identification and serotyping of non-O157 STEC and identification of Shiga toxins and other virulence factors. It also receives clinical specimens for isolation of STEC. The number of isolates submitted to the National *Escherichia coli* Reference Laboratory are reported with specimen submission rates. The non-O157 STEC specimen submission rate is the number of presumptive non-O157 STEC isolates and Shiga toxin-positive enrichment culture broths submitted to CDC for further characterization for a given year, divided by the population for that year. Submission to the National *Escherichia coli* Reference Laboratory is voluntary, and the number of states submitting isolates varies from year to year.

- Data from the National *Escherichia coli* Reference Laboratory will be included here when available.

Human Surveillance Data: National Notifiable Diseases Surveillance Systems (NNDSS)

The National Notifiable Disease Surveillance System (NNDSS) collects and compiles reports of nationally notifiable infectious diseases, including STEC. This system includes reports of culture-confirmed, probable and suspected cases. The case definition is available at http://wwwn.cdc.gov/nndss/document/2012_Case%20Definitions.pdf.

The 2011 NNDSS report is not yet available, but when available will be posted at: http://www.cdc.gov/mmwr/mmwr_nd/index.html

Human Antimicrobial Resistance Data: National Antimicrobial Resistance Monitoring System (NARMS)

The National Antimicrobial Resistance Monitoring System (NARMS) monitors antimicrobial resistance among enteric bacteria isolated from humans. NARMS uses the classes of antimicrobial agents defined by the Clinical and Laboratory Standards Institute (CLSI). The 2011 NARMS report on human isolates is not yet available, but when available, it will be posted at http://www.cdc.gov/narms/reports.html (2).

Human Outbreak Data: Foodborne Disease Outbreak Surveillance System (FDOSS) and Waterborne Disease Outbreak Surveillance System (WBDOSS)

The Foodborne Disease Outbreak Surveillance System (FDOSS) collects reports of foodborne disease outbreaks from local, state, tribal, and territorial public health agencies. Reports can be found at http://www.cdc.gov/outbreaknet/surveillance_data.html.

The Waterborne Disease and Outbreak Surveillance System (WBDOSS) collects reports of disease outbreaks associated with drinking water and recreational water from local, state, tribal, and territorial public health agencies. Reports can be found at http://www.cdc.gov/healthywater/statistics/wbdoss/surveillance.html.

References

1. Centers for Disease Control and Prevention (CDC). National STEC Surveillance Overview. Atlanta, Georgia: US Department of Health and Human Services, CDC, 2011.
2. Centers for Disease Control and Prevention (CDC). National Antimicrobial Resistance Monitoring System for Enteric Bacteria (NARMS): Human Isolates Final Report, 2010. Atlanta, Georgia: U.S. Department of Health and Human Services, CDC, 2012.

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