

# National Enteric Disease Surveillance: Shiga toxin-producing *Escherichia coli* (STEC) Annual Report, 2014

The Laboratory-based Enteric Disease Surveillance (LEDS) system contributes to the understanding of human Shiga toxin-producing *Escherichia coli* (STEC) in the United States by collecting reports of infections submitted by state and regional public health laboratories.<sup>1</sup> Reporting to LEDS is voluntary; the number of laboratories submitting reports varies somewhat from year to year, although almost all public health laboratories 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 serogroup per person within a 30-day period.

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-overview-508c.pdf> (1).

Data in this report are current as of February 8, 2017.

## Summary

- In 2014, 51 state and regional public health laboratories reported 4,437 cases of culture-confirmed Shiga toxin-producing *Escherichia coli* (STEC) infections and 999 STEC infections of unknown serogroup to LEDS, 3% fewer and 1% more than in 2013, respectively.
- Whereas incidence of infection due to non-O157 serogroups continued to rise in 2014 (0.79 cases per 100,000 population), serogroup O157 infection incidence continued to decline (0.60 cases per 100,000 population in 2014), and overall national incidence of culture-confirmed STEC continued to decrease (1.39 cases per 100,000 population in 2014).
- Children 1–4 years old had the highest incidence of infection of all age groups for both O157 and non-O157 serogroups.
- Infants (<1 year old) had the largest difference in incidence between O157 and non-O157 serogroups of all age groups (1.19 vs. 1.97 cases per 100,000 population for girls and 0.69 vs. 2.18 cases per 100,000 population for boys).
- At least half of states in the Midwest and West regions<sup>2</sup> had incidence above the national average for culture-confirmed infection due to O157 and non-O157 serogroups (including IA, MN, MO, ND, SD, and WI in the Midwest and CO, HI, ID, MT, NM, OR, UT, WA, and WY in the West)
- The largest percentages of infections for both O157 and non-O157 serogroups were reported in the summer months.

<sup>1</sup>The practice of testing diarrheal stools for Shiga toxin without concomitant bacterial culture and serotyping has increased in recent years (2). The LEDS system is unable to differentiate reports of culture-confirmed STEC infection of unknown serogroup from reports of STEC diagnosed only by non-culture methods.

<sup>2</sup>Geographic regions in this report are consistent with those defined by the United States Census Bureau ([https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us\\_regdiv.pdf](https://www2.census.gov/geo/pdfs/maps-data/maps/reference/us_regdiv.pdf))

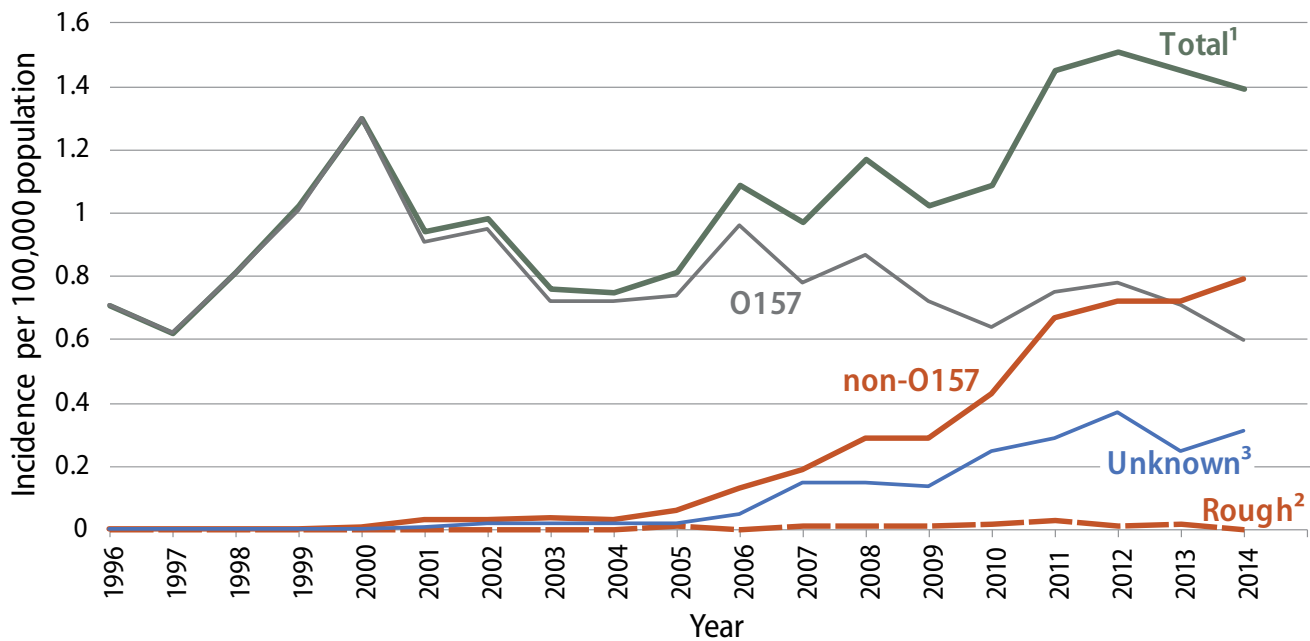
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**Figure 1.** Incidence rate of human Shiga toxin-producing *Escherichia coli* (STEC) infection reported to LEDS, by serogroup and year, United States, 1996–2014<sup>1</sup>



<sup>1</sup>The “Total” category includes culture-confirmed infections of serogroup O157, non-O157 serogroups, and rough isolates.

<sup>2</sup>When isolates are rough, the O group is not expressed and cannot be determined by phenotypic methods. These isolates can be O157 or non-O157.

<sup>3</sup>The “Unknown” category includes cases diagnosed by culture-based methods where an isolate was never serogrouped and may also include cases diagnosed by culture-independent diagnostic tests (CIDTs).

Note: Full data table for graph <https://www.cdc.gov/nationalsurveillance/data/stec2014/Figure1.xlsx>

**Table 1a.** Culture-confirmed human STEC infections reported to LEDS, with the 10 most frequently reported serogroups listed individually, United States, 2014

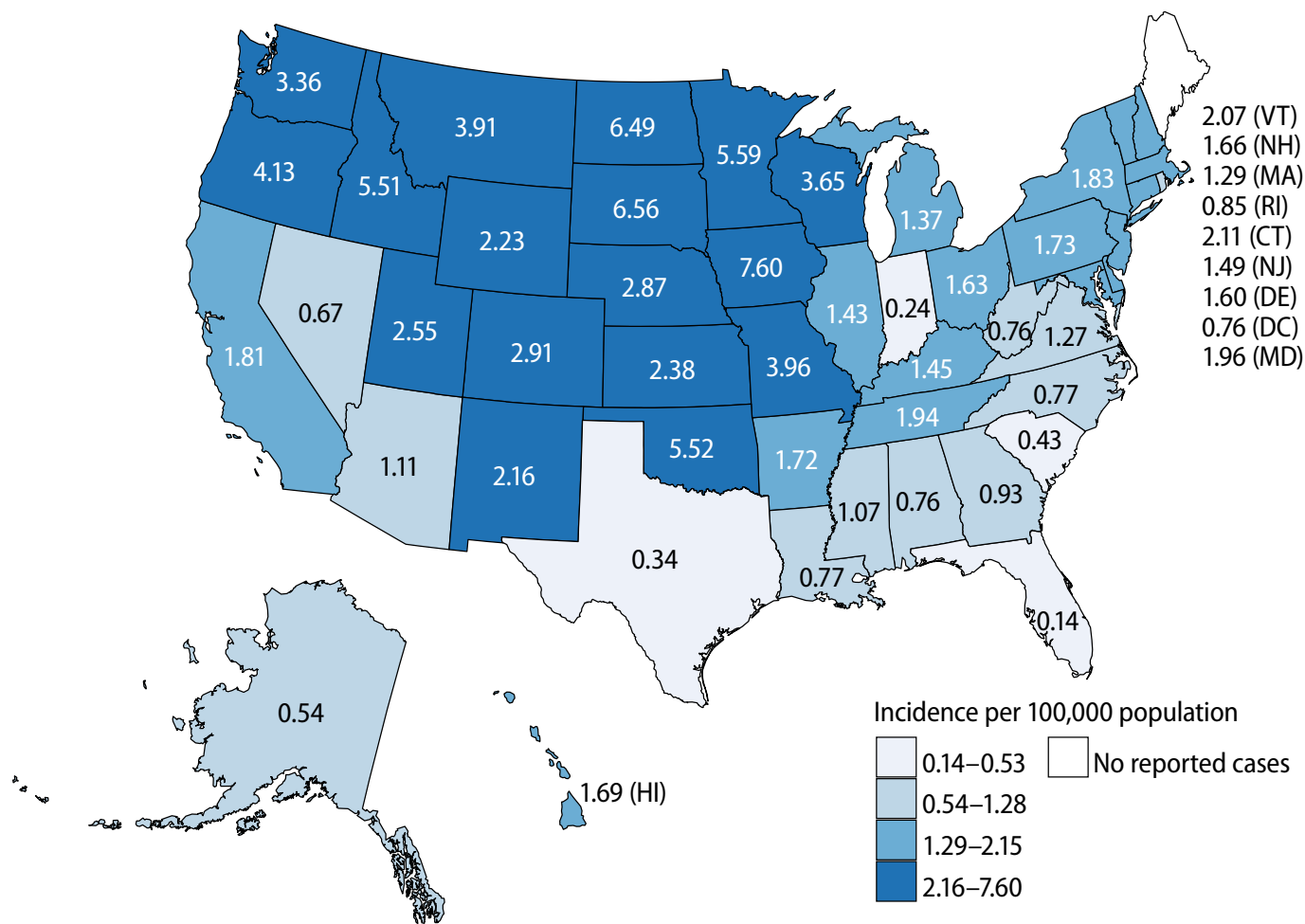
Rank	Serogroup	Number reported	Percent	Incidence per 100,000
1	<b>O157</b>	<b>1,919</b>	<b>43.2</b>	<b>0.60</b>
2	O26	722	16.3	0.23
3	O103	631	14.2	0.20
4	O111	501	11.3	0.16
5	O121	162	3.7	0.05
6	O45	114	2.6	0.04
7	O145	112	2.5	0.04
8	O186	42	0.9	<0.01
9	O118	33	0.7	<0.01
10	O69	17	0.4	<0.01
	Non-O157, other serogroups	161	6.4	0.05
	<b>Subtotal, all non-O157</b>	<b>2,512</b>	<b>56.6</b>	<b>0.79</b>
	Rough*	6	0.1	<0.01
	<b>All serogroups</b>	<b>4,437</b>	<b>100.0</b>	<b>1.39</b>

\* When isolates are rough, the O group is not expressed and cannot be determined by phenotypic methods. These isolates can be O157 or non-O157.

**Table 1b.** Incidence rates of culture-confirmed human STEC O157 and non-O157 infections reported to LEDS by age group and sex, United States, 2014

Age group, years	O157 (n = 1,839)		Non-O157 (n = 2,396)	
	Female	Male	Female	Male
<1	1.19	0.69	1.97	2.18
1–4	2.76	3.29	3.66	3.42
5–9	1.22	1.36	0.90	1.04
10–19	0.72	0.82	1.10	1.20
20–29	0.60	0.47	1.19	0.67
30–39	0.31	0.22	0.58	0.31
40–49	0.21	0.13	0.28	0.14
50–59	0.31	0.14	0.38	0.17
60–69	0.39	0.22	0.50	0.27
70–79	0.39	0.30	0.51	0.28
≥80	0.28	0.36	0.50	0.38
<b>Overall</b>	<b>0.59</b>	<b>0.57</b>	<b>0.83</b>	<b>0.67</b>

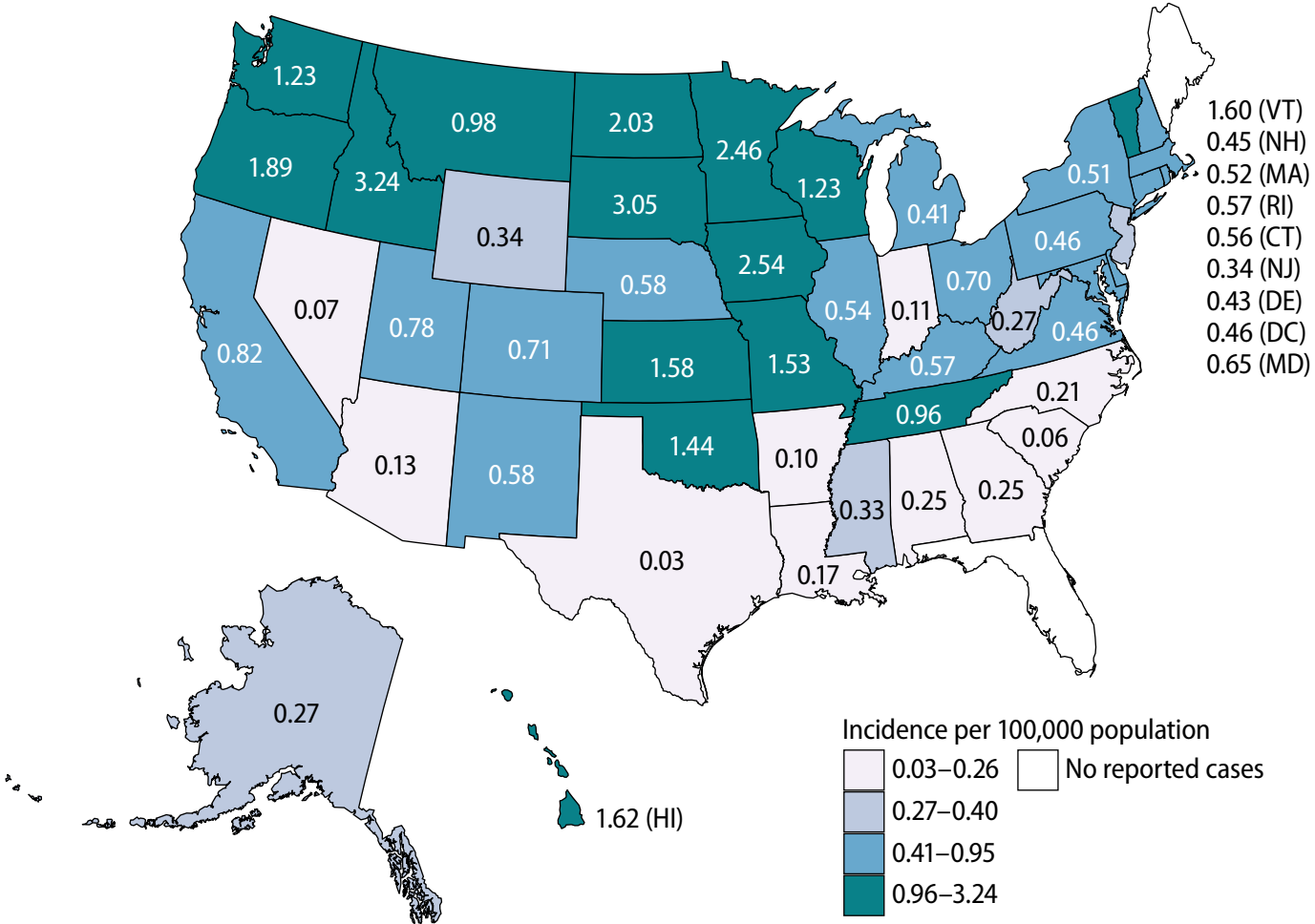
**Figure 2a.** Incidence rate of human Shiga toxin-producing *Escherichia coli* (STEC) infection reported to LEADS (all serogroups), by reporting jurisdiction, United States, 2014 (n = 5,436)\*



\* Includes infections of rough serotype and of unknown serogroup.

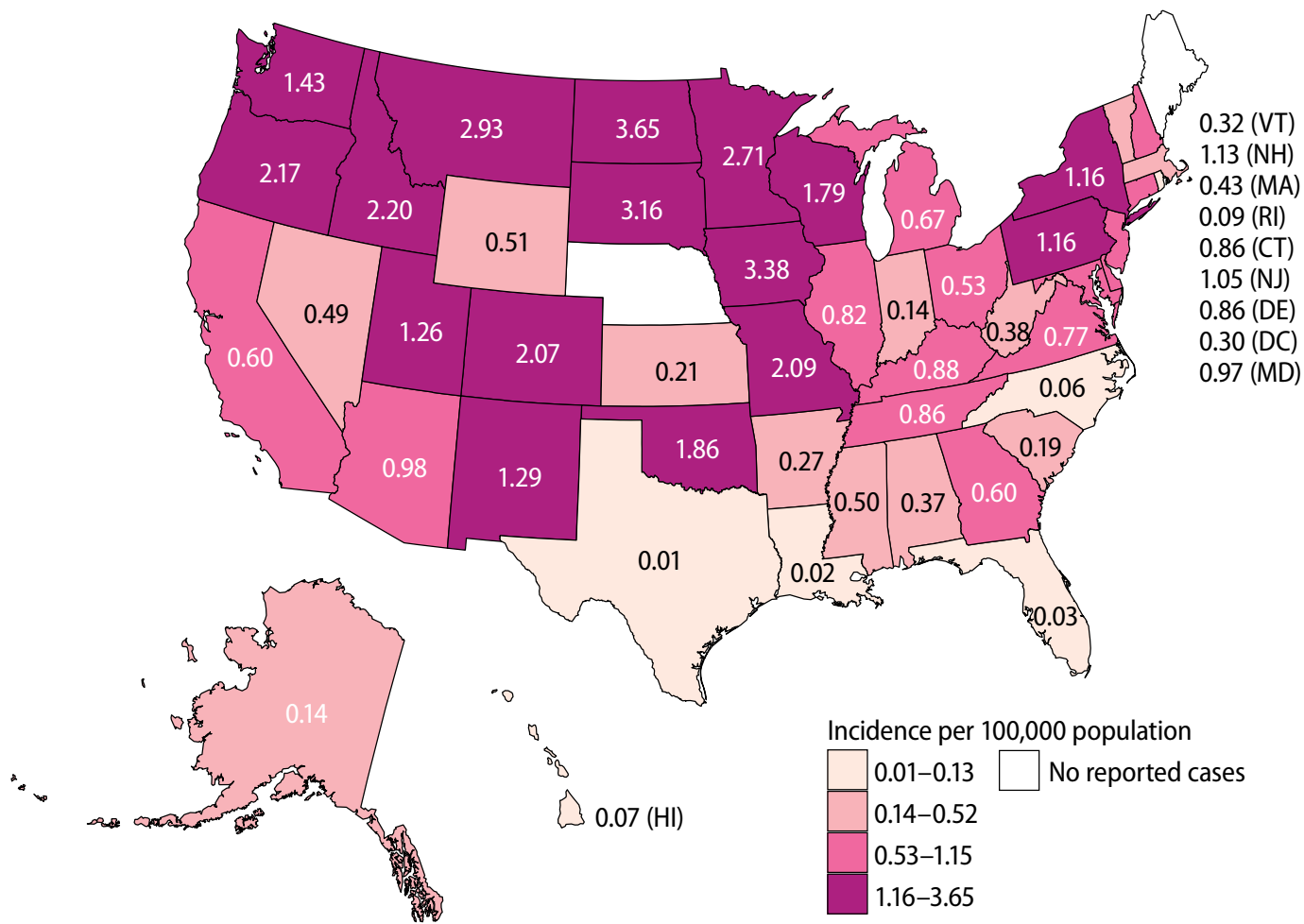
Note: Full data table for all states at <https://www.cdc.gov/nationalsurveillance/data/stec2014/fig2a.csv>

**Figure 2b.** Incidence rate of culture-confirmed human Shiga toxin-producing *Escherichia coli* (STEC) O157 infection reported to LEADS, by reporting jurisdiction, United States, 2014 (n = 1,919)



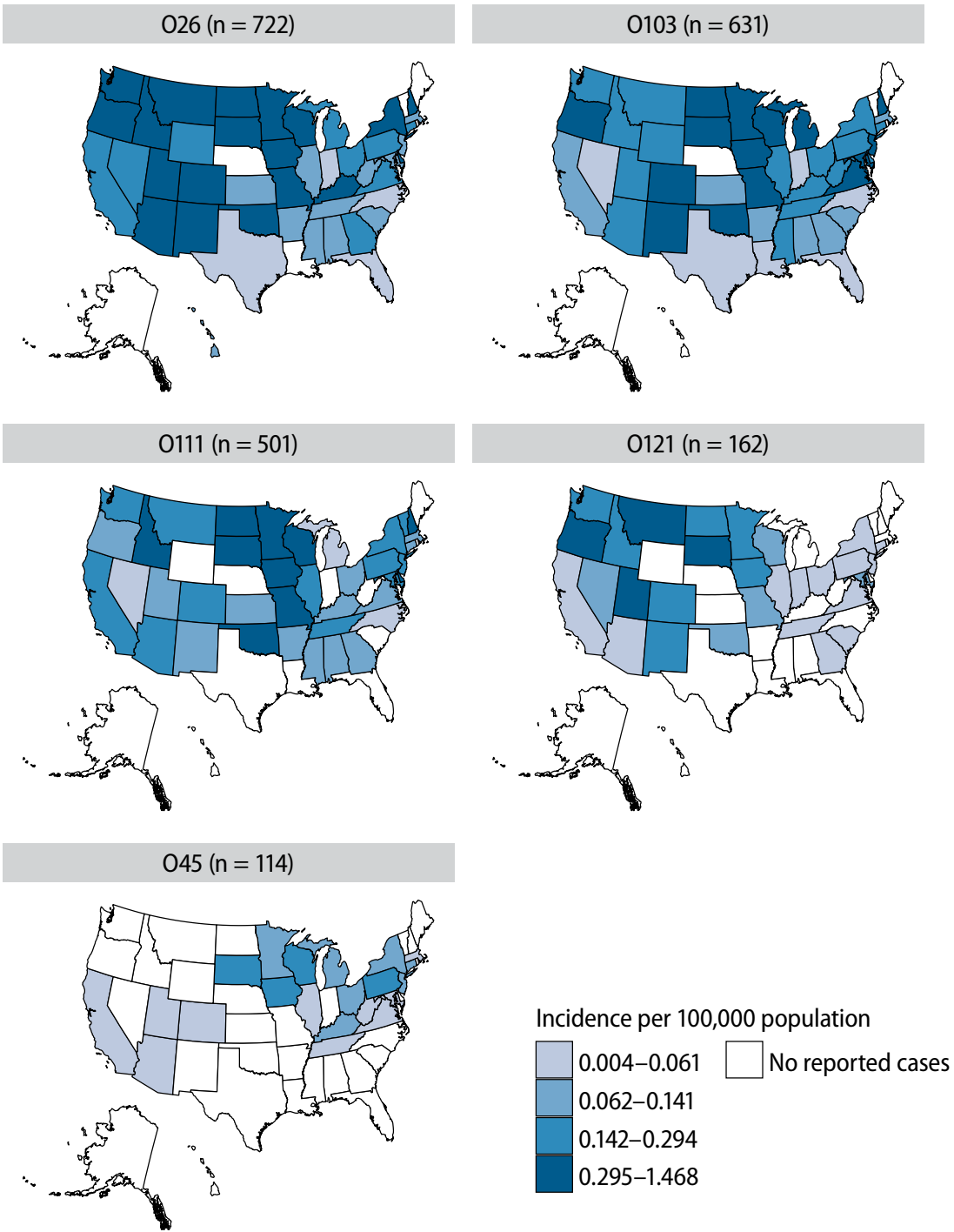
Note: Full data table for all states at <https://www.cdc.gov/nationalsurveillance/data/stec2014/fig2b.csv>

**Figure 2c.** Incidence rate of culture-confirmed human Shiga toxin-producing *Escherichia coli* (STEC) non-O157 infection reported to LEADS, by reporting jurisdiction, United States, 2014 (n = 2,512)



Note: Full data table for all states at <https://www.cdc.gov/nationalsurveillance/data/stec2014/fig2c.csv>

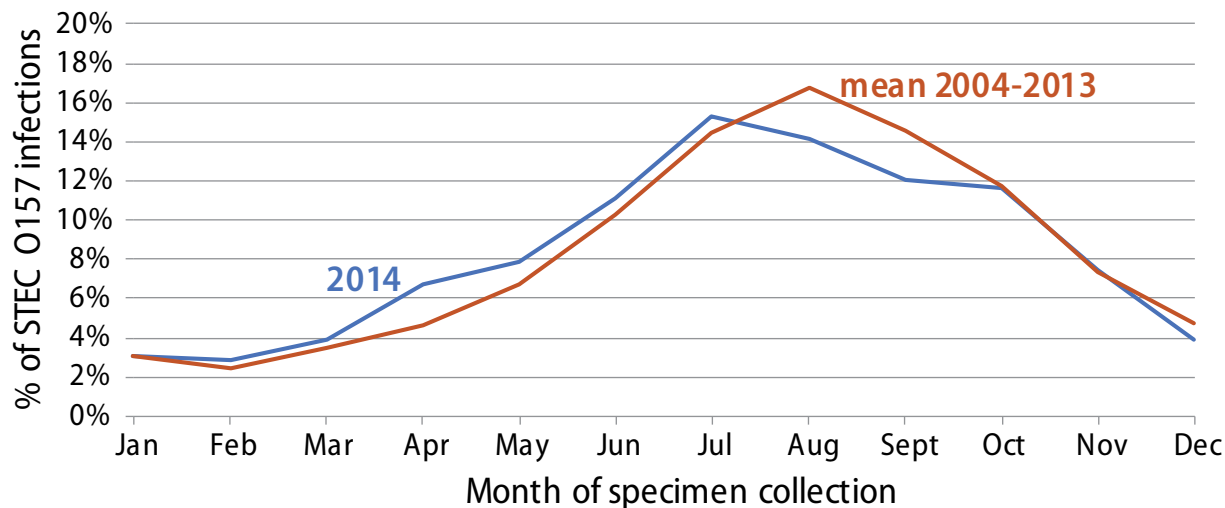
**Figure 2d.** Incidence rate of culture-confirmed human Shiga toxin-producing *Escherichia coli* (STEC) non-O157 infection, top 5 non-O157 serogroups reported to LEDS, by reporting jurisdiction, United States, 2014



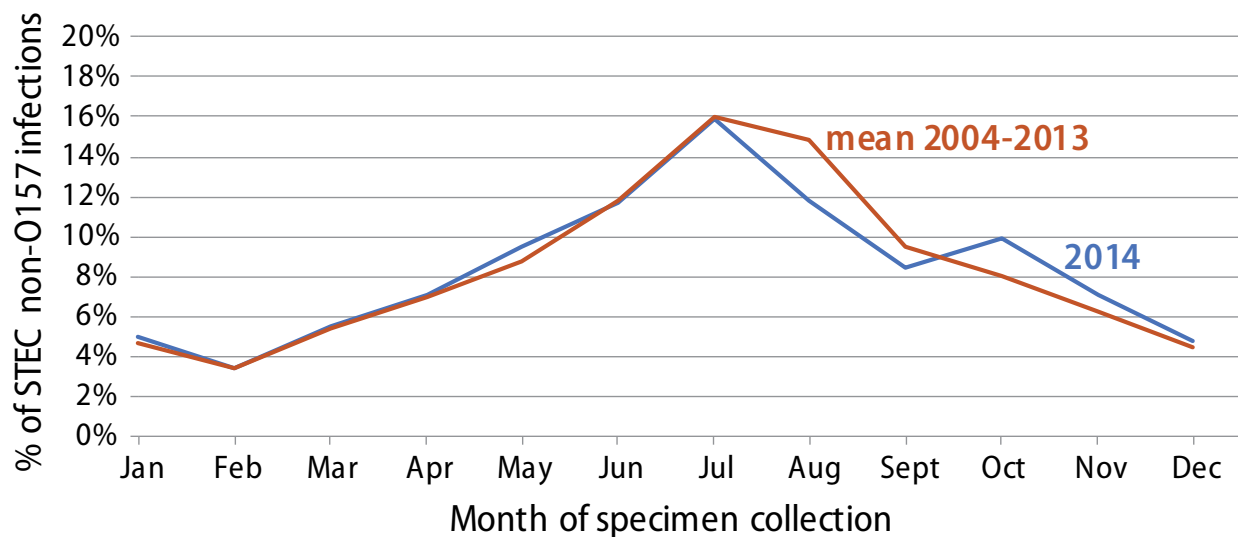
Note: Full data for all states at <https://www.cdc.gov/nationalsurveillance/data/stec2014/fig2d.csv>



**Figure 4.** Percentage of culture-confirmed STEC O157 infections reported to LEDS, by month of specimen collection, United States, 2014 and mean annual percentage during 2004–2013



**Figure 5.** Percentage of culture-confirmed non-O157 STEC infections reported to LEDS, by month of specimen collection, United States, 2014 and mean annual percentage during 2004–2013



Note: Full data tables for Figure 4 and 5 at <https://www.cdc.gov/nationalsurveillance/data/stec2014/Figures4and5.xlsx>

## References

1. Centers for Disease Control and Prevention (CDC). National STEC Surveillance Overview. Atlanta, Georgia: US Department of Health and Human Services, CDC, 2012.
2. Iwamoto, Martha, et al. "Bacterial enteric infections detected by culture-independent diagnostic tests—FoodNet, United States, 2012–2014." *MMWR Morb Mortal Wkly Rep* 64 (2015): 252-7.

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Centers for Disease Control and Prevention (CDC). National STEC Surveillance Annual Report, 2014. Atlanta, Georgia: US Department of Health and Human Services, CDC, 2017.

## Other Sources of National Shiga toxin-producing *Escherichia coli* (STEC) Surveillance Data

### National Notifiable Diseases Surveillance System (NNDSS)

The National Notifiable Disease Surveillance System (NNDSS) collects and compiles case counts of nationally notifiable infectious diseases, including STEC. STEC cases are not currently reported by serogroup to NNDSS.

**Annual reports:** [http://www.cdc.gov/mmwr/mmwr\\_nd/index.html](http://www.cdc.gov/mmwr/mmwr_nd/index.html)

**Data:** <https://data.cdc.gov/browse?category=NNDSS>

### National Antimicrobial Resistance Monitoring System (NARMS)

The National Antimicrobial Resistance Monitoring System (NARMS) Annual Human Isolates Report includes antimicrobial resistance data on enteric bacteria (including STEC) isolated from humans.

**Annual reports:** <https://www.cdc.gov/narms/reports/index.html>

**Data:** <https://wwwn.cdc.gov/narmsnow/>

### National Outbreak Reporting System (NORS)

The National Outbreak Reporting System (NORS) is a web-based platform used by local, state, and territorial health departments in the United States to report waterborne and foodborne disease outbreaks and enteric disease outbreaks transmitted by contact with environmental sources, infected persons or animals, or unknown modes of transmission to CDC.

**Annual reports—Foodborne:** <https://www.cdc.gov/foodsafety/fdoss/data/annual-summaries/index.html>

**Data—Foodborne:** <https://wwwn.cdc.gov/foodborneoutbreaks/>

**NCEZID Atlanta:**

**For more information please contact Centers for Disease Control and Prevention  
1600 Clifton Road NE, Atlanta, GA 30329-4027 MS C-09**

**Telephone: 1-404-639-2206**

**Email: [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov)**

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**Appendix 1.** Culture-confirmed Shiga toxin-producing *Escherichia coli* (STEC) infections reported to LEDS by serogroup, age group, and sex, 2014

Serogroup	Age Group (years)	Sex			Total
		Female	Male	Unknown	
<b>All</b>	<1	61	58	3	122
	1-4	500	546	42	1088
	5-9	212	252	19	483
	10-19	371	432	28	831
	20-29	396	260	25	681
	30-39	185	111	12	308
	40-49	102	57	4	163
	50-59	158	68	11	237
	60-69	159	79	3	241
	70-79	93	50	4	147
	≥80	58	33	7	98
	Unknown	7	11	20	38
	<b>Total</b>		<b>2302</b>	<b>1957</b>	<b>178</b>

Serogroup	Age Group (years)	Sex			Total
		Female	Male	Unknown	
<b>Non-O157</b>	<1	38	44	1	83
	1-4	285	278	24	587
	5-9	90	109	12	211
	10-19	224	255	16	495
	20-29	262	153	18	433
	30-39	120	65	9	194
	40-49	59	29	1	89
	50-59	85	37	7	129
	60-69	89	43	2	134
	70-79	53	24	2	79
	≥80	37	17	3	57
	Unknown	5	4	12	21
	<b>Total</b>		<b>1366</b>	<b>1083</b>	<b>109</b>

Serogroup	Age Group (years)	Sex			Total
		Female	Male	Unknown	
<b>O157</b>	<1	23	14	2	39
	1-4	215	268	18	501
	5-9	122	143	7	272
	10-19	147	176	12	335
	20-29	133	107	7	247
	30-39	65	46	3	114
	40-49	43	27	3	73
	50-59	71	31	4	106
	60-69	69	36	1	106
	70-79	40	26	2	68
	≥80	21	16	4	41
	Unknown	2	7	8	17
	<b>Total</b>		<b>951</b>	<b>897</b>	<b>71</b>

**Appendix 2a.** Culture-confirmed Shiga toxin-producing *Escherichia coli* (STEC) infections reported to LEDS by serogroup and reporting jurisdiction, 2014 (Alaska to Kansas<sup>1</sup>)

Serogroup	AK	AL	AR	AZ	CA	CO	CT	DC	DE	FL	GA	HI	IA	ID	IL	IN	KS
O1										1							
O3										1							
O5						6					1				3		
O8																	
O18											1						
O21						1											
O22											1						
O26		5	3	36	96	27	8		3		18		17	24	18	4	
O28																	
O45				1	2	1	5						7		3		
O50																	
O55																	
O69						1					3				1		
O71						2	1				3				1		
O73																	
O74						1											
O76	1				1												
O77						2									1		
O78																	
O79																	
O80																	
O81															1		
O84																	
O88																	
O91						1	1				1				1		
O98						1											
O103		6	2	10	47	27	6	1	2		11		31	4	30	2	
O105																	
O110																	
O111		6	3	16	58	14	5		3		7		34	5	17		
O112															1		
O113						1											
O115																	
O116																	
O117						1											
O118					1	3	2				6				2		
O119											1						
O121				2	12	9	1				1		5	4	5	1	
O128						1											
O129																	

<sup>1</sup> The key to state name abbreviations can be found at [http://www.census.gov/geo/reference/ansi\\_statetables.html](http://www.census.gov/geo/reference/ansi_statetables.html).

Serogroup	AK	AL	AR	AZ	CA	CO	CT	DC	DE	FL	GA	HI	IA	ID	IL	IN	KS
O130																	
O135						1											
O136						1											
O141																	
O145		1		2	10	2	1			1			11		4	1	
O146						2									1		
O152											1						
O153															1		
O156						1									1		
O157	1	12	3	9	315	37	20	3	3		25	28	77	52	62	4	37
O159															1		
O162																	
O163																	
O165															1		
O166						1											
O168																	
O174															1		
O177															1		
O178																	
O181						1											
O182																	
O183															1		
O186						2					6				5		
Rough										1					1		
Undetermined <sup>1</sup>					8	1		1							2		
<b>Total</b>	<b>2</b>	<b>30</b>	<b>11</b>	<b>76</b>	<b>550</b>	<b>148</b>	<b>50</b>	<b>5</b>	<b>11</b>	<b>4</b>	<b>86</b>	<b>28</b>	<b>182</b>	<b>89</b>	<b>166</b>	<b>12</b>	<b>37</b>

<sup>1</sup> STEC infections reported as "undetermined" are categorized as non-O157 STEC infections.

**Appendix 2b.** Culture-confirmed Shiga toxin-producing *Escherichia coli* (STEC) infections reported to LEDS by serogroup and reporting jurisdiction, 2014 (Kentucky to Nevada<sup>1</sup>)

Serogroup	KY	LA	MA	MD	ME	MI	MN	MO	MS	MT	NC	ND	NE	NH	NJ	NM	NV
O1			1														
O3																	
O5																	
O8															1		
O18																	
O21																	
O22																	
O26	13		5	5		17	40	28	3	11	1	10		4	11	11	3
O28																	
O45	2		1	1		11	5								6		
O50																	
O55	1																
O69															2		
O71			1	1						1		1			3	2	
O73															1		
O74																	
O76															2		1
O77										1							
O78															1		
O79				2													
O80																	
O81																	
O84																	
O88															1		
O91															1		
O98																	
O103	12		6	22		30	33	52	6	2	3	4		7	28	8	1
O105																	
O110																	
O111	3		7	14		6	51	31	4	3	1	6		4	14	1	1
O112																	
O113	1																
O115										1							
O116																	
O117																	
O118				2								1			4		
O119				2													
O121				5			11	7		8		2			3	3	1
O128															1		
O129																	

<sup>1</sup>The key to state name abbreviations can be found at [http://www.census.gov/geo/reference/ansi\\_statetables.html](http://www.census.gov/geo/reference/ansi_statetables.html).



Serogroup	KY	LA	MA	MD	ME	MI	MN	MO	MS	MT	NC	ND	NE	NH	NJ	NM	NV
O130																	
O135																	
O136																	
O141																	
O145	2		2			2	7	16	2	2		2		1	2		1
O146															1	1	1
O152																	
O153										1					1		
O156															1		
O157	27	7	38	37		41	133	109	10	10	21	15	9	6	30	12	2
O159																	
O162																	
O163																	
O165	1																
O166																	
O168																	
O174																	
O177	1																
O178																	
O181			1												1		
O182																	
O183																	
O186			2	4											7		1
Rough															2		
Undetermined <sup>1</sup>			5	1											1		1
<b>Total</b>	<b>63</b>	<b>7</b>	<b>69</b>	<b>96</b>	<b>0</b>	<b>107</b>	<b>280</b>	<b>243</b>	<b>25</b>	<b>40</b>	<b>26</b>	<b>41</b>	<b>9</b>	<b>22</b>	<b>125</b>	<b>38</b>	<b>13</b>

<sup>1</sup> STEC infections reported as “undetermined” are categorized as non-O157 STEC infections

**Appendix 2c.** Culture-confirmed Shiga toxin-producing *Escherichia coli* (STEC) infections reported to LEDS by serogroup and reporting jurisdiction, 2014 (New York to Wyoming<sup>1</sup>)

Serogroup	NY	OH	OK	OR	PA	RI	SC	SD	TN	TX	UT	VA	VT	WA	WI	WV	WY
O1																	
O3																	
O5				2				1	1			1					
O8																	
O18																	
O21	1																
O22																	
O26	65	18	23	38	26		3	7	8	1	18	15		53	23	2	1
O28												1					
O45	15	10			27			2	2		1	2			9	1	
O50									1								
O55					1												
O69	3		3		1				1			2					
O71	1																
O73																	
O74																	
O76	1		1		1												
O77									1								
O78																	
O79																	
O80	1				1												
O81																	
O84					2												
O88																	
O91	7				1							1					
O98																	
O103	46	22	13	13	35		4	4	18	1	6	28		17	25	5	1
O105					1												
O110	1																
O111	45	11	15	3	31			8	12		5	8	1	10	38		
O112																	
O113	1				1												
O115																	
O116	2																
O117																	
O118	4		1	3	2				1				1				
O119	1																
O121	8	2	4	18	7		1	3	3		10	2		18	6		
O128					1												
O129												1					

<sup>1</sup>The key to state name abbreviations can be found at [http://www.census.gov/geo/reference/ansi\\_statetables.html](http://www.census.gov/geo/reference/ansi_statetables.html).

Serogroup	NY	OH	OK	OR	PA	RI	SC	SD	TN	TX	UT	VA	VT	WA	WI	WV	WY
O130									1								
O135																	
O136			1														
O141				1													
O145	10	2	8	2	3			3	2			2		4	3		1
O146																	
O152																	
O153																	
O156				2													
O157	103	83	56	72	58	5	2	26	63	7	31	42	9	88	75	4	
O159	2			1													
O162												1					
O163	2																
O165	2			1					1								
O166																	
O168			1														
O174																	
O177				1													
O178									1								
O181	1								1								
O182					1												
O183																	
O186	8		1		4							2					
Rough												1				1	
Undetermined <sup>1</sup>	2		2		3		1					1					
<b>Total</b>	<b>332</b>	<b>148</b>	<b>129</b>	<b>157</b>	<b>207</b>	<b>5</b>	<b>11</b>	<b>54</b>	<b>117</b>	<b>9</b>	<b>71</b>	<b>110</b>	<b>11</b>	<b>190</b>	<b>179</b>	<b>13</b>	<b>3</b>

<sup>1</sup> STEC infections reported as "undetermined" are categorized as non-O157 STEC infections.

**Appendix 3.** Human Shiga toxin-producing *Escherichia coli* (STEC) infections reported to LEDS by serogroup and year, 2004–2014

Serogroup	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
O1			1	1			1	1	3	8	2	17
O2				1			1	1				3
O3			3	1							1	5
O4			1									1
O5							3	9	25	20	15	72
O6				1		1	1	1	1			5
O7								2		1		3
O8		1	1	2		5	3	2	3	3	1	21
O9			1									1
O10			1									1
O11			1	1	1			1				4
O12			1									1
O13							1					1
O14					2							2
O15			1	1			1					3
O18			1		2						1	4
O19	1											1
O20				1								1
O21				1					2		2	5
O22	1			1	1	1		3			1	8
O23								1				1
O24							1					1
O25						1			1			2
O26	25	53	113	153	222	243	404	605	645	711	722	3896
O28		2	5	3	1	3	1		1	2	1	19
O32										1		1
O33									1			1
O36										1		1
O38					1			1	2	2		6
O39								1	2	1		4
O42					2		1	1				4
O43			2				1	1				4
O44				1								1
O45	9	13	25	32	65	65	68	135	115	117	114	758
O49			1				4	2	1			8
O50				1	3				2	3	1	10
O51									1			1
O52								2				2
O54								1				1
O55								2	3		2	7
O60						1		1				2

Serogroup	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
O63		1										1
O68									2			2
O69			4	7	6	15	10	22	26	19	17	126
O70					1					1		2
O71			1			1	3	6	25	15	17	68
O73									1		1	2
O74					1	1	2	3		1	1	9
O75							1			1		2
O76		1	4	4	3	3	9	14	9	7	8	62
O77								1	3	2	5	11
O78									1		1	2
O79			2					1	1	3	2	9
O80			1					5	3	2	2	13
O81											1	1
O82				2	1	1						4
O84		1	1	2	1	2	2	5	7	5	2	28
O85										1		1
O86							1					1
O87									1			1
O88				3			1	1	1		1	7
O91		4	3	5	6	8	13	13	18	8	14	92
O93									1			1
O96				1				1				2
O98				1			1	1	2	3	1	9
O100					2		1					3
O101					1					1		2
O103	15	42	81	101	180	233	344	541	557	602	631	3327
O104				1				7	3	2		13
O105											1	1
O107							1					1
O108							2					2
O109				2	1					2		5
O110	1	1		1	1	1	3	1		1	1	11
O111	17	30	64	111	241	150	229	316	362	375	501	2396
O112							1	1	1		1	4
O113				1	3	1	2	6	5	5	4	27
O114							1					1
O115											1	1
O116		1				1		1			2	5
O117		1			1	1				1	1	5
O118	1	1	7	4	8	19	22	46	38	20	33	199
O119				3	1	1	2	2	1	1	4	15
O121	8	16	21	58	54	60	67	168	161	148	162	923

Serogroup	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
O123				1	1	4	3	4	1			14
O124				1		5	2	3	2	6		19
O125				1	3	1	1	3	1	6		16
O126	1	2		2	1	2	3	1	2	5		19
O127							2					2
O128			3	3	4	1	2	3	5	4	3	28
O129											1	1
O130			1	1	1	1	4	2	2	5	1	18
O132	1											1
O134				1								1
O135				1							1	2
O136							1				2	3
O137				1				1	1			3
O140							1	1				2
O141					1				3		1	5
O142										1		1
O143				1			1	1		2		5
O145	5	8	16	19	35	24	72	71	106	63	112	531
O146				2	4	2	6	5	13	2	6	40
O149					1							1
O151				1		2	1					4
O152				1				2		1	1	5
O153		2		5	1	2	3	8	1	2	3	27
O154				1								1
O156		1	4	2		4	2	2	4	2	5	26
O157	2107	2205	2877	2338	2637	2206	1969	2343	2449	2230	1919	25280
O158	1						1	1	1			4
O159								1			4	5
O160					1							1
O162		1		2							1	4
O163					1	2	2	2	1	1	2	11
O164								1				1
O165	1		8	5	5	4	6	6	11	9	6	61
O166			1				3				1	5
O168				1							1	2
O169				1								1
O171			1					1				2
O172				1	1	2	3	1	2	3		13
O174	2			3	2	2	1	6	4	6	1	27
O175			1			1		2	1	1		6
O177		3	3	1		2	2	4	4	5	3	27
O178				2	4	1	3	2	4	5	1	22
O179			4		1				2			7

Serogroup	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total
O181		2					4	2	8	5	5	26
O182									1		1	2
O183										1	1	2
O185								1				1
O186								4	27	30	42	103
Rough	1	15	8	29	40	42	76	79	35	71	6	402
Undetermined <sup>1</sup>							4	8	7	10	29	58
Unknown	48	73	160	466	443	429	782	916	1174	781	999	6271
<b>Total</b>	<b>2245</b>	<b>2480</b>	<b>3434</b>	<b>3401</b>	<b>3999</b>	<b>3557</b>	<b>4169</b>	<b>5422</b>	<b>5909</b>	<b>5353</b>	<b>5436</b>	<b>45405</b>

<sup>1</sup> STEC infections reported as “undetermined” are categorized as non-O157 STEC infections.

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