

National Enteric Disease Surveillance: Shiga toxin-producing *Escherichia coli* (STEC) Annual Report, 2015

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.¹ 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 2015, 49 state and regional public health laboratories reported 4,831 cases of culture-confirmed Shiga toxin-producing *Escherichia coli* (STEC) infections and 1,262 STEC infections of unknown serogroup to LEDS, 9% and 26% more than in 2014, respectively.
- Incidence of infection due to serogroup O157 and non-O157 serogroups continued to rise in 2015 (0.66 and 0.84 cases per 100,000 population, respectively).
- Children aged 1–4 years had the highest incidence of infection of all age groups for both O157 and non-O157 serogroups.
- The largest differences in incidence between O157 and non-O157 serogroups were seen in boys 1–4 years old (3.34 vs. 4.22 cases per 100,000 population) and in girls <1 year old (0.87 vs. 1.96 cases per 100,000 population).
- At least half of states in the Midwest and West regions² 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, OR, UT, and WA in the West).
- The largest percentages of infections for both O157 and non-O157 serogroups were reported in the summer months.

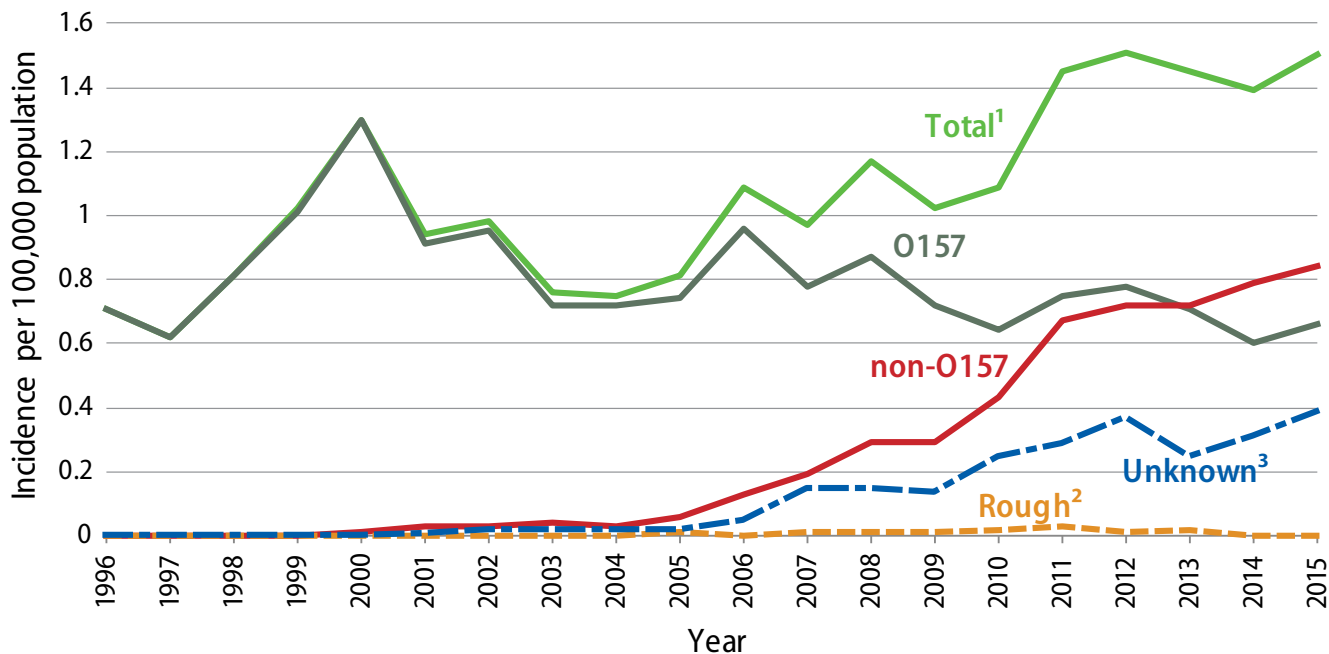
¹The practice of testing diarrheal stools for Shiga toxin without concomitant bacterial culture and serotyping has increased in recent years (2). The LEDS system is unable to differentiate reports of culture-confirmed STEC infection of unknown serogroup from reports of STEC diagnosed only by non-culture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

²Geographic 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)

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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, 1996–2015¹



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

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

³The “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 at: <https://www.cdc.gov/nationalsurveillance/data/stec2015/Figure1.xlsx>

Table 1a. Culture-confirmed human STEC infections reported to LEDS, with the 10 most frequently reported serogroups listed individually, United States, 2015

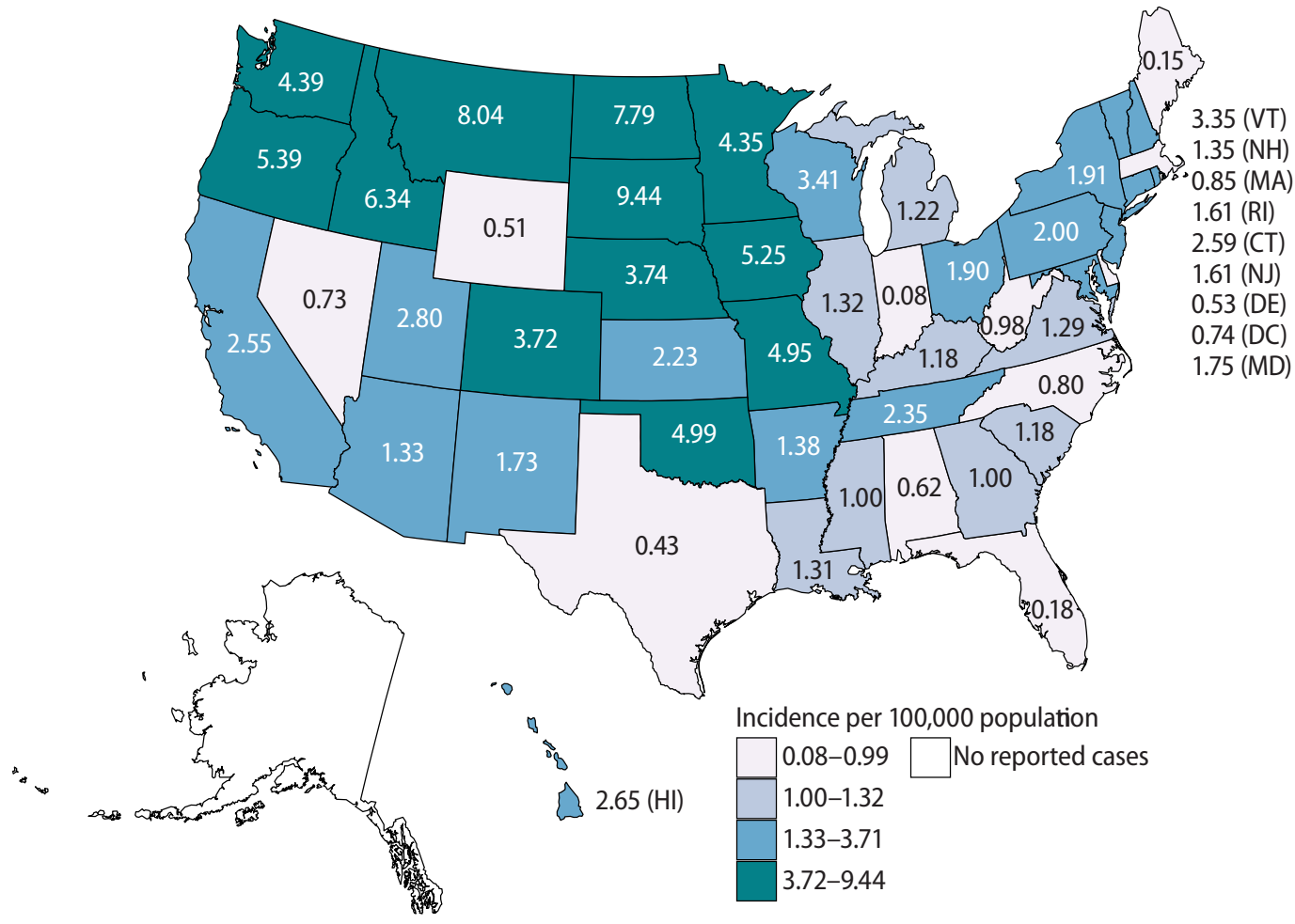
Rank	Serotype	Number reported	Percent	Incidence
1	O157	2,121	44.0	0.66
2	O26	869	18.0	0.27
3	O103	667	13.8	0.21
4	O111	497	10.3	0.15
5	O121	164	3.4	0.05
6	O145	128	2.7	0.04
7	O45	84	1.7	<0.01
8	O118	44	0.9	<0.01
9	O71	28	0.6	<0.01
10	O186	26	0.5	<0.01
	Non-O157, other serogroups	162	6.0	0.05
	Subtotal, all non-O157	2,701	56.1	0.84
	Rough*	9	0.2	<0.01
	All serogroups	4,831	100	1.50

* 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, 2015

Age group, years	O157 (n = 1,993)		Non-O157 (n = 2,614)	
	Female	Male	Female	Male
<1	0.87	2.21	1.96	2.11
1–4	2.7	3.34	3.26	4.22
5–9	1.51	1.6	1.09	1.25
10–19	0.87	0.94	1.29	1.28
20–29	0.65	0.49	1.16	0.69
30–39	0.35	0.16	0.64	0.29
40–49	0.23	0.14	0.41	0.22
50–59	0.29	0.15	0.42	0.18
60–69	0.33	0.31	0.48	0.29
70–79	0.36	0.33	0.5	0.46
≥80	0.31	0.24	0.56	0.26
Overall	0.62	0.62	0.87	0.76

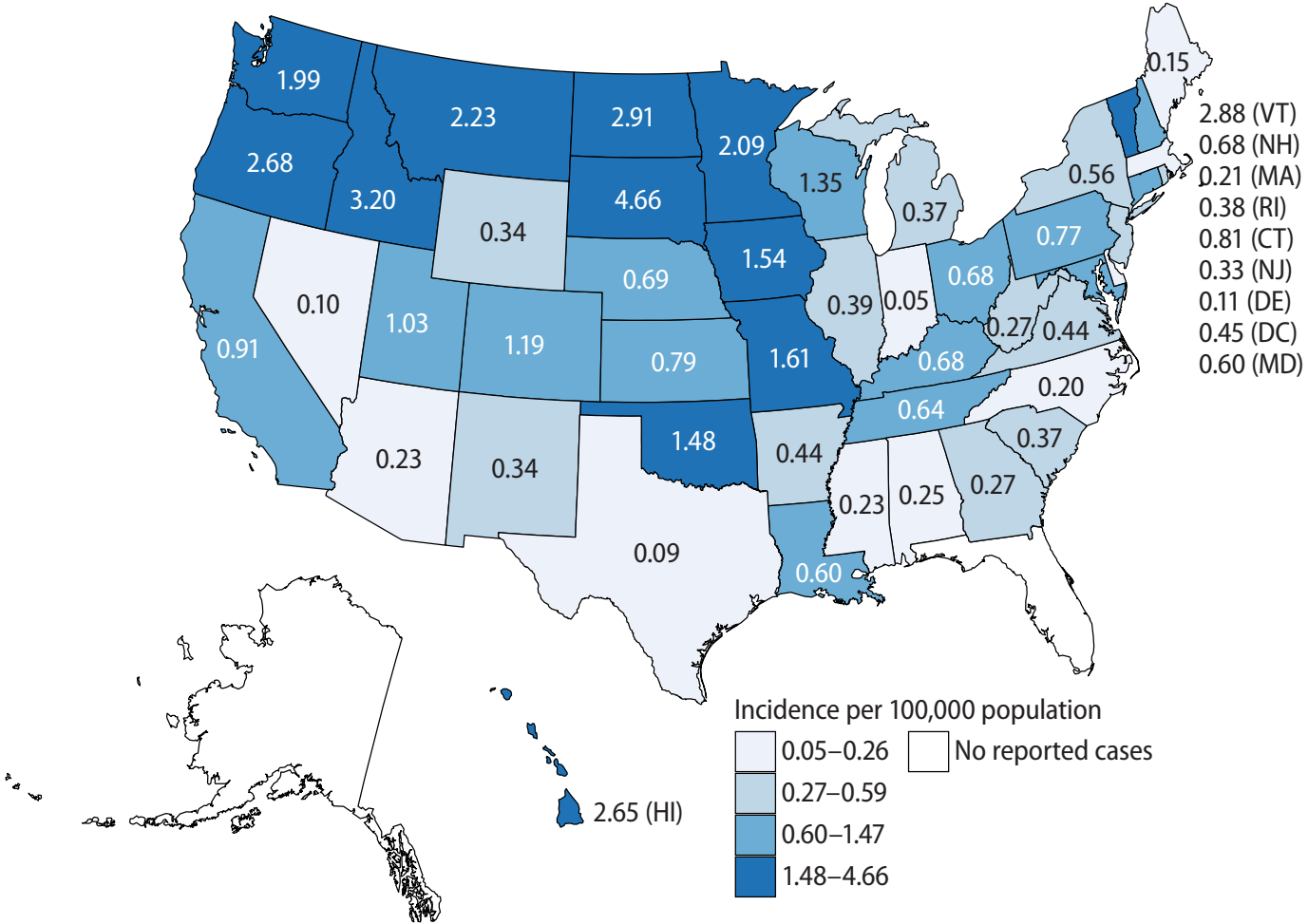
Figure 2a. Incidence rate of human Shiga toxin-producing *Escherichia coli* (STEC) infection reported to LEDS (all serogroups), by reporting jurisdiction, United States, 2015 (n = 6,093)*



* Includes infections of rough serotype and of unknown serogroup.

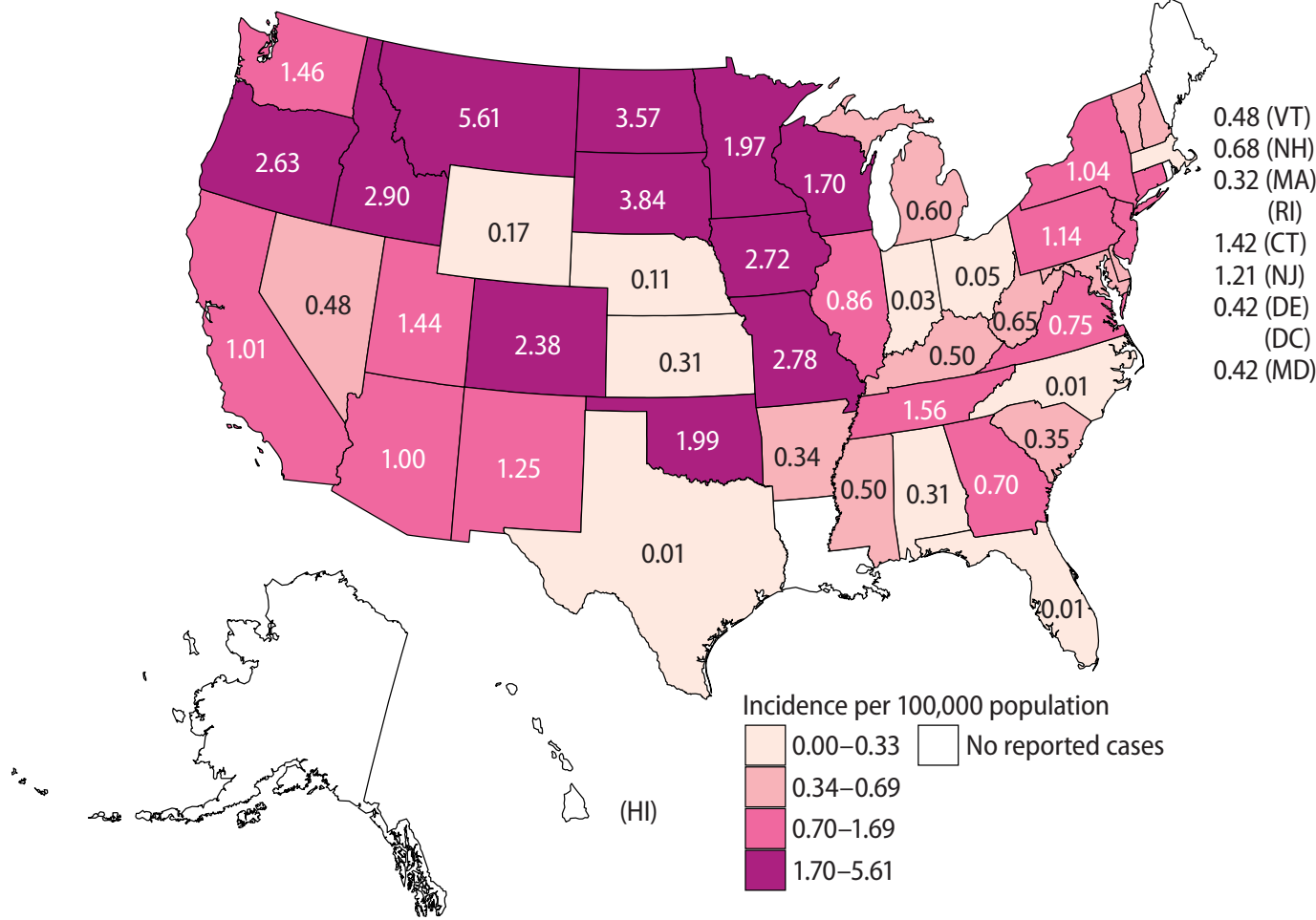
Note: Full data for all states at: https://www.cdc.gov/nationalsurveillance/data/stec2015/fig_2a.csv

Figure 2b. Incidence rate of culture-confirmed human Shiga toxin-producing *Escherichia coli* (STEC) O157 infection reported to LEDS, by reporting jurisdiction, United States, 2015 (n = 2,121)



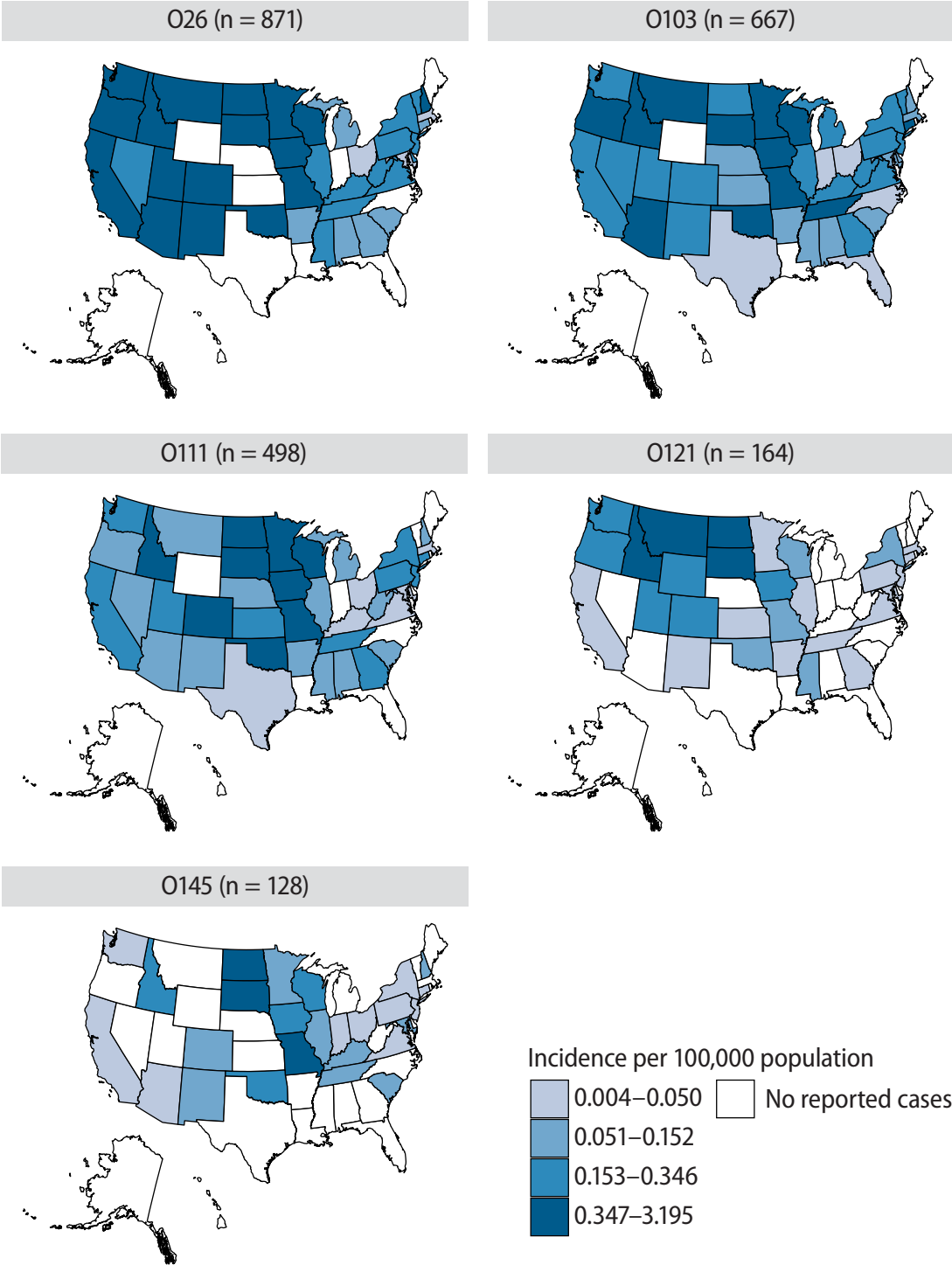
Note: Full data table for all states at: https://www.cdc.gov/nationalsurveillance/data/stec2015/fig_2b.csv

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, 2015 (n = 2,701)



Note: Full data table for all states at: https://www.cdc.gov/nationalsurveillance/data/stec2015/fig_2c.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, 2015



Note: Full data tables for all states at: https://www.cdc.gov/nationalsurveillance/data/stec2015/fig_2d.csv

Figure 4. Percentage of culture-confirmed STEC O157 infections reported to LEDS, by month of specimen collection, United States, 2015 and mean annual percentage during 2005–2014

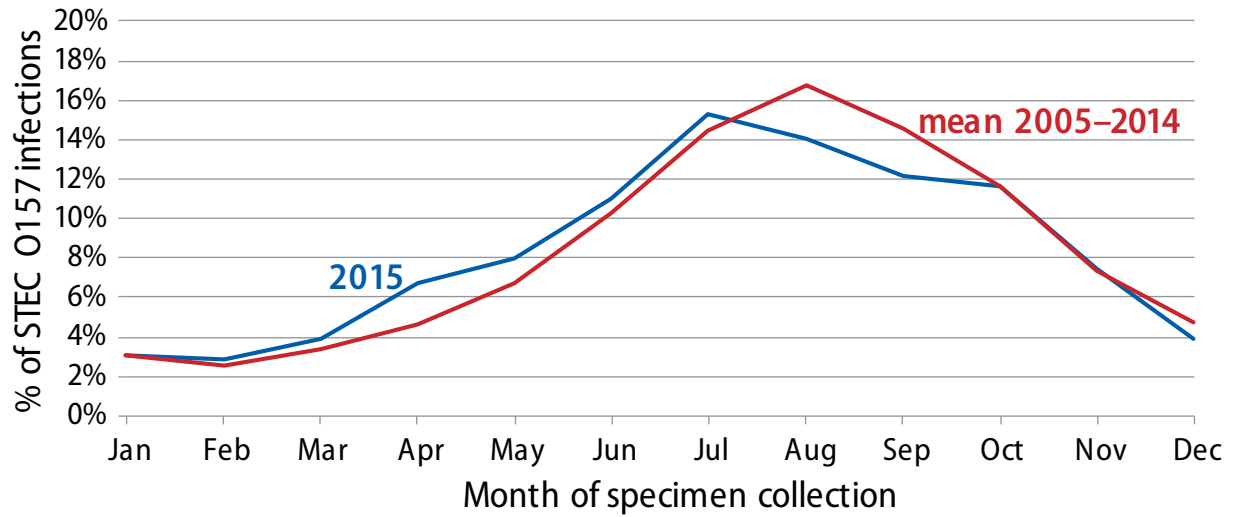
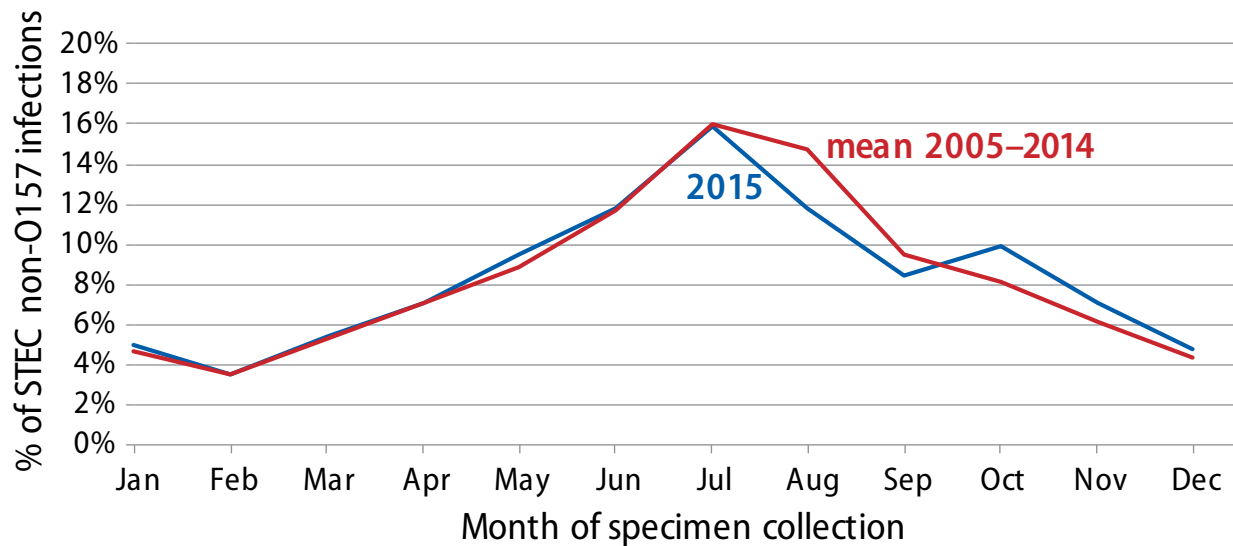


Figure 5. Percentage of culture-confirmed non-O157 STEC infections reported to LEDS, by month of specimen collection, United States, 2015 and mean annual percentage during 2005–2014



Note: Full data tables for graphs at: <https://www.cdc.gov/nationalsurveillance/data/stec2015/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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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

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

National Enteric Disease Surveillance: Shiga toxin-producing *Escherichia coli* (STEC) Annual Report Appendices, 2015

Recommended Citation

Centers for Disease Control and Prevention (CDC). National Shiga toxin-producing *Escherichia coli* (STEC) Surveillance Annual Report, 2015. Atlanta, Georgia: US Department of Health and Human Services, CDC, 2017.

Appendices

Appendix 1. Culture-confirmed Shiga toxin-producing <i>Escherichia coli</i> (STEC) infections reported to LEDS by serogroup, age group, and sex, 2015	12
Appendix 2a. Culture-confirmed Shiga toxin-producing <i>Escherichia coli</i> (STEC) infections reported to LEDS by serogroup and reporting jurisdiction, 2015 (Alaska to Kansas ¹)	14
Appendix 2b. Culture-confirmed Shiga toxin-producing <i>Escherichia coli</i> (STEC) infections reported to LEDS by serogroup and reporting jurisdiction, 2015 (Kentucky to Nevada ¹)	16
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Appendix 1. Culture-confirmed Shiga toxin-producing *Escherichia coli* (STEC) infections reported to LEDS by serogroup, age group, and sex, 2015

Serogroup	Age Group (years)	Sex			Total
		Female	Male	Unknown	
All	<1	55	88	5	122
	1–4	466	616	63	1088
	5–9	260	298	21	483
	10–19	441	474	27	831
	20–29	401	274	29	681
	30–39	210	95	9	308
	40–49	133	75	5	163
	50–59	160	72	9	237
	60–69	150	99	9	241
	70–79	91	70	3	147
	≥80	65	23	10	98
	Unknown	5	9	11	38
	Total		2437	2193	201

Serogroup	Age Group (years)	Sex			Total
		Female	Male	Unknown	
Non-O157	<1	38	43	2	83
	1–4	254	344	16	614
	5–9	109	131	6	246
	10–19	263	272	14	549
	20–29	257	160	17	434
	30–39	135	61	7	203
	40–49	84	45	2	131
	50–59	95	39	2	136
	60–69	88	48	2	138
	70–79	53	41	0	94
	≥80	42	12	4	58
	Unknown	2	7	6	15
	Total		1420	1203	78

Serogroup	Age Group (years)	Sex			Total
		Female	Male	Unknown	
O157	<1	17	45	3	65
	1-4	210	272	47	529
	5-9	151	167	15	333
	10-19	178	201	13	392
	20-29	144	114	12	270
	30-39	73	34	2	109
	40-49	48	29	3	80
	50-59	65	32	7	104
	60-69	61	51	7	119
	70-79	38	29	3	70
	≥80	23	11	6	40
	Unknown	3	2	5	10
Total		1011	987	123	2121

Appendix 2a. Culture-confirmed Shiga toxin-producing *Escherichia coli* (STEC) infections reported to LEDS by serogroup and reporting jurisdiction, 2015 (Alaska to Kansas¹)

Serogroup	AK	AL	AR	AZ	CA	CO	CT	DC	DE	FL	GA	HI	IA	ID	IL	IN	KS
O1						1											
O2																	
O3																	
O5					1	5	2								4		
O8							1										
O22						1											
O25																	
O26		5	3	32	200	42	5		3		14		15	20	19		
O28							1										
O30											1						
O32																	
O43																	
O45							1						5	1	5		
O49																	
O55						1											
O61																	
O65																	
O66																	
O68							1										
O69											1				1		
O71						3	1				1				4		
O74																	
O76					1										1		
O77					1	1	1										
O78																	
O80															1		
O84																	
O85																	
O91						1	1										
O98							1										
O103		5	2	25	67	17	17		1		21		23	9	30		
O104						1											
O108																	
O109																	
O111		5	4	9	98	25	6				16		27	6	18		
O113							1				1						
O116																	
O117						4									1		
O118					3	4	6				5				5		
O119																	

¹ The key to state name abbreviations can be found at 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
O121			1		13	12	1				1		10	12	1		
O126																	
O128						1	1								2		
O130																	
O136						1											
O145				1	7	3	1						9	3	10		
O146					1												
O153																	
O156						2					2						
O157		11	15	16	355	65	26	2	1		26	39	51	55	46		19
O163																	
O165																	
O172																	
O174						1											
O175																	
O177					1												
O178											1						
O181					1		1								1		
O183							1										
O186					3	2	1				6				2		
Undetermined ¹						1					1				1		
Rough										1					1		
Total	0	26	25	83	752	194	77	2	5	1	97	39	140	106	153	0	19

¹STEC 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, 2015 (Kentucky to Nevada¹)

Serogroup	KY	LA	MA	MD	ME	MI	MN	MO	MS	MT	NC	ND	NE	NH	NJ	NM	NV
O1																	
O2																	
O3																	
O5																1	
O8			1														
O22																	
O25																	
O26	7		3	1		14	34	53	5	33		8		5	30	8	5
O28																	
O30																	
O32				1													
O43				1													
O45			1			13	5	2				1			5		1
O49																	
O55																	
O61																	
O65																	
O66															1		
O68																	
O69	1			2						2		1			4		
O71				2								2			6		
O74																	
O76	1																
O77																1	
O78																	
O80																	
O84															1		
O85																	
O91															1	2	
O98																1	
O103	9		9	9		23	37	46	4	6		2		1	25	4	5
O104																	
O108																	
O109																	
O111	2		2	2		9	21	51	4	1		3		2	20	3	2
O113										1							
O116										1							
O117			1														
O118			1	1								1				1	
O119																	

¹The key to state name abbreviations can be found at 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
O121			1				2	9	2	10		5			4	1	
O126																	
O128																	
O130																	
O136																	
O145	3			4			8	22				3		1	3	2	
O146										1					2	1	
O153															1		
O156																	
O157	31	28	15	36		35	115	104	8	23	19	22	9	9	32	7	3
O163										1							
O165										1							
O172																1	
O174																	1
O175																	
O177																	
O178																	
O181																	
O183												1					
O186			2												3		
Undetermined ¹			1							1					1		
Rough										1		1			1		
Total	54	28	37	59	0	94	222	287	23	82	19	50	16	18	140	33	17

¹STEC 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, 2015 (New York to Wyoming¹)

Serogroup	NY	OH	OK	OR	PA	RI	SC	SD	TN	TX	UT	VA	VT	WA	WI	WV	WY
O1																	
O2	1																
O3				1													
O5	1			1					2		1	1					
O8					1												
O22																	
O25			1														
O26	44	1	14	55	38		3	7	20		21	18	2	57	22	3	
O28																	
O30																	
O32	1																
O43																	
O45	13		1	1	17			2	1			2			5	2	
O49																1	
O55	2		1														
O61			1														
O65									1								
O66																	
O68																	
O69	1		2	1	2				1								
O71			4	1					3			1					
O74					1												
O76					1				1			1					
O77									2								
O78					1												
O80																	
O84			1	1	1				1								
O85			1														
O91	3		1	1					1			1					
O98									1								
O103	64	2	17	17	41		5	8	27	1	10	24	1	15	34	4	
O104							2										
O108	1																
O109					1												
O111	42	2	17	4	20		4	7	21		5	4		11	22	2	
O113				2													
O116																	
O117	1								1								
O118	2		2	5					7			1					
O119			1	1													

¹The key to state name abbreviations can be found at 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
O121	18		2	10	6			4	3		8	2		18	7	1	
O126			2		1							1					
O128	3			1													
O130									1								
O136												1					
O145	8	1	7		2		3	6	6		1	3		1	10		
O146																	
O153					1												
O156	2																
O157	117	80	57	107	98		18	41	41	20	37	38	18	144	76	6	
O163																	
O165			2	1	1												
O172																	
O174				1													
O175	1																
O177				1	1												
O178																	
O181			1		5												
O183				1													
O186					1				3			3					
Undetermined ¹					3												
Rough					1							3					
Total	325	86	135	213	244	4	35	75	144	23	83	104	21	246	176	19	0

¹ 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, 2005–2015

Serogroup	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
O1		1	1			1	1	3	8	2	1	18
O2			1			1	1				1	4
O3		3	1							1	1	6
O4		1										1
O5						3	9	25	20	15	19	91
O6			1		1	1	1	1				5
O7							2		1			3
O8	1	1	2		5	3	2	3	3	1	3	24
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
O20			1									1
O21			1					2		2		5
O22			1	1	1		3			1	1	8
O23							1					1
O24						1						1
O25					1			1			1	3
O26	53	113	153	222	243	404	605	645	711	722	869	4740
O28	2	5	3	1	3	1		1	2	1	1	20
O30											1	1
O32									1		2	3
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				1	5
O44			1									1
O45	13	25	32	65	65	68	135	115	117	114	84	833
O49		1				4	2	1			1	9
O50			1	3				2	3	1		10
O51								1				1
O52							2					2
O54							1					1
O55							2	3		2	4	11
O60					1		1					2

Serogroup	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
O61											1	1
O63	1											1
O65											1	1
O66											1	1
O68								2			1	3
O69		4	7	6	15	10	22	26	19	17	19	145
O70				1					1			2
O71		1			1	3	6	25	15	17	28	96
O73								1		1		2
O74				1	1	2	3		1	1	1	10
O75						1			1			2
O76	1	4	4	3	3	9	14	9	7	8	6	68
O77							1	3	2	5	6	17
O78								1		1	1	3
O79		2					1	1	3	2		9
O80		1					5	3	2	2	1	14
O81										1		1
O82			2	1	1							4
O84	1	1	2	1	2	2	5	7	5	2	5	33
O85									1		1	2
O86						1						1
O87								1				1
O88			3			1	1	1		1		7
O91	4	3	5	6	8	13	13	18	8	14	12	104
O93								1				1
O96			1				1					2
O98			1			1	1	2	3	1	3	12
O100				2		1						3
O101				1					1			2
O103	42	81	101	180	233	344	541	557	602	631	667	3979
O104			1				7	3	2		3	16
O105										1		1
O107						1						1
O108						2					1	3
O109			2	1					2		1	6
O110	1		1	1	1	3	1		1	1		10
O111	30	64	111	241	150	229	316	362	375	501	497	2876
O112						1	1	1		1		4
O113			1	3	1	2	6	5	5	4	5	32
O114						1						1
O115										1		1
O116	1				1		1			2	1	6
O117	1			1	1				1	1	8	13

Serogroup	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
O118	1	7	4	8	19	22	46	38	20	33	44	242
O119			3	1	1	2	2	1	1	4	2	17
O121	16	21	58	54	60	67	168	161	148	162	164	1079
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	2		2	1	2	3	1	2	5		4	22
O127						2						2
O128		3	3	4	1	2	3	5	4	3	8	36
O129										1		1
O130		1	1	1	1	4	2	2	5	1	1	19
O134			1									1
O135			1							1		2
O136						1				2	2	5
O137			1				1	1				3
O140						1	1					2
O141				1				3		1		5
O142									1			1
O143			1			1	1		2			5
O145	8	16	19	35	24	72	71	106	63	112	128	654
O146			2	4	2	6	5	13	2	6	5	45
O149				1								1
O151			1		2	1						4
O152			1				2		1	1		5
O153	2		5	1	2	3	8	1	2	3	2	29
O154			1									1
O156	1	4	2		4	2	2	4	2	5	6	32
O157	2205	2877	2338	2637	2206	1969	2343	2449	2230	1919	2121	25294
O158						1	1	1				3
O159							1			4		5
O160				1								1
O162	1		2							1		4
O163				1	2	2	2	1	1	2	1	12
O164							1					1
O165		8	5	5	4	6	6	11	9	6	5	65
O166		1				3				1		5
O168			1							1		2
O169			1									1
O171		1					1					2
O172			1	1	2	3	1	2	3		1	14
O174			3	2	2	1	6	4	6	1	3	28
O175		1			1		2	1	1		1	7
O177	3	3	1		2	2	4	4	5	3	3	30

Serogroup	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
O178			2	4	1	3	2	4	5	1	1	23
O179		4		1				2				7
O181	2					4	2	8	5	5	9	35
O182								1		1		2
O183									1	1	3	5
O185							1					1
O186							4	27	30	42	26	129
Rough	15	9	27	34	37	52	73	37	82	6	9	381
Undetermined ¹						4	8	7	10	29	9	67
Unknown	73	160	466	443	429	782	916	1174	781	999	1262	7485
Total	2480	3434	3401	3999	3557	4169	5422	5909	5353	5436	6080	49240

¹ STEC infections reported as “undetermined” are categorized as non-O157 STEC infections.

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