

Foodborne Illness—Major Pathogens, Expanded Tables

Table 2. Estimated annual number of episodes of illnesses caused by 31 pathogens, United States*

Pathogen	Laboratory-confirmed	Multipliers		Total, mean (90% CrI)	Travel-related, percentage	Domestically acquired, mean (90% CrI)	Foodborne, percentages	Domestically acquired foodborne, mean (90% CrI)
		Under-reporting†	Under-diagnosis‡					
Bacteria								
<i>Bacillus cereus</i> , foodborne¶	85 [§]	25.5	29.3	63,623 (15,770–147,827)	<1	63,411 (15,721–147,380)	100	63,400 (15,719–147,354)
<i>Brucella</i> spp.	120 ^{**}	1.1	15.2	2,003 (1,302–2,964)	16	1,679 (1,089–2,484)	50	839 (533–1,262)
<i>Campylobacter</i> spp.	43,696 ^{††}	1.0	30.3	1,322,137 (530,126–2,521,026)	20	1,058,387 (423,255–2,019,498)	80	845,024 (337,031–1,611,083)
<i>Clostridium botulinum</i> , foodborne¶	25 ^{**}	1.1	2.0	56 (34–92)	<1	55 (34–91)	100	55 (34–91)
<i>Clostridium perfringens</i> , foodborne¶	1,295 [§]	25.5	29.3	969,342 (192,977–2,492,003)	<1	966,120 (192,331–2,483,682)	100	965,958 (192,316–2,483,309)
STEC O157	3,704 ^{††}	1.0	26.1	96,534 (26,982–227,891)	4	93,094 (26,046–219,676)	68	63,153 (17,587–149,631)
STEC non-O157	1,579 ^{††}	1.0	106.8	168,698 (17,163–428,522)	18	138,063 (14,080–350,891)	82	112,752 (11,467–287,321)
ETEC, foodborne¶	53 [§]	25.5	29.3	39,781 (53–102,250)	55	17,897 (24–46,215)	100	17,894 (24–46,212)
Diarrheagenic <i>E. coli</i> other than STEC and ETEC	53	25.5	29.3	39,871 (53–102,378)	<1	39,739 (52–102,028)	30	11,982 (16–30,913)
<i>Listeria monocytogenes</i>	808 ^{††}	1.0	2.1	1,662 (582–3,302)	3	1,607 (563–3,193)	99	1,591 (557–3,161)
<i>Mycobacterium bovis</i>	195 ^{††}	1.0	1.1	208 (177–241)	70	63 (49–78)	95	60 (46–74)
<i>Salmonella</i> spp., nontyphoidal‡‡	41,930 ^{††}	1.0	29.3	1,229,007 (772,129–2,008,076)	11	1,095,079 (687,126–1,790,225)	94	1,027,561 (644,786–1,679,667)
<i>S. enterica</i> serotype Typhi	433 ^{††}	1.0	13.3	5,752 (299–17,357)	67	1,897 (91–5,756)	96	1,821 (87–5,522)
<i>Shigella</i> spp.	14,864 ^{††}	1.0	33.3	494,908 (93,877–1,420,877)	15	421,048 (79,844–1,208,445)	31	131,254 (24,511–374,789)
<i>Staphylococcus aureus</i> , foodborne¶	323 ^{§§}	25.5	29.3	241,994 (72,584–531,398)	<1	241,188 (72,352–529,509)	100	241,148 (72,341–529,417)
<i>Streptococcus</i> spp. group A, foodborne¶	15 [§]	25.5	29.3	11,257 (15–78,104)	<1	11,219 (15–77,875)	100	11,217 (15–77,875)
<i>Vibrio cholerae</i> , toxigenic	8 ^{**}	1.1	33.1	277 (94–630)	70	84 (19–212)	100	84 (19–213)
<i>V. vulnificus</i>	111 ^{**}	1.1	1.7	207 (138–287)	2	203 (136–281)	47	96 (60–139)
<i>V. parahaemolyticus</i>	287 ^{**}	1.1	142.4	44,950 (23,706–74,984)	10	40,309 (21,277–67,282)	86	34,664 (18,260–58,027)
<i>Vibrio</i> spp., other	220 ^{**}	1.1	142.7	34,585 (21,756–51,535)	11	30,727 (19,278–45,886)	57	17,564 (10,848–26,475)
<i>Yersinia enterocolitica</i>	950 ^{††}	1.0	122.8	116,716 (36,363–204,898)	7	108,490 (33,797–190,605)	90	97,656 (30,388–172,734)
Subtotal				4,883,568 (3,160,412–7,148,360)		4,330,358 (2,771,307–6,438,919)		3,645,773 (2,321,468–5,581,290)
Parasites								
<i>Cryptosporidium</i> spp.	7,594 ^{††}	1.0	98.6	748,123 (162,961–2,135,110)	9	678,828 (147,796–1,940,626)	8	57,616 (12,060–166,771)
<i>Cyclospora cayetanensis</i>	239 ^{††}	1.0	83.1	19,808 (239–65,135)	42	11,522 (139–38,031)	99	11,407 (137–37,673)
<i>Giardia intestinalis</i>	20,305 ^{**}	1.3	46.3	1,221,564 (892,393–1,633,965)	8	1,121,864 (818,627–1,501,290)	7	76,840 (51,148–109,739)
<i>Toxoplasma gondii</i>		1.0	0	173,995 (134,593–218,866)	<1	173,415 (134,172–218,169)	50	86,686 (64,861–111,912)
<i>Trichinella</i> spp.	13 ^{**}	1.3	9.8	162 (44–355)	4	156 (42–341)	100	156 (42–341)
Subtotal				2,163,652 (1,401,591–3,596,566)		1,985,785 (1,292,817–3,290,175)		232,705 (161,923–369,893)
Viruses								
Astrovirus	NA	NA	NA	3,090,384 (2,350,589–3,833,232)	0	3,089,868 (2,350,263–3,832,706)	<1	15,433 (5,569–26,643)
Hepatitis A virus	3,576 ^{**}	1.1	9.1	35,769 (21,505–60,715)	41	21,041 (12,455–35,918)	7	1,566 (702–3,024)
Norovirus	NA	NA	NA	20,865,958 (12,842,072–30,743,963)	<1	20,796,079 (12,798,628–30,638,633)	26	5,461,731 (3,227,078–8,309,480)
Rotavirus	NA	NA	NA	3,090,384 (2,350,589–3,833,232)	0	3,089,868 (2,350,263–3,832,706)	<1	15,433 (5,569–26,643)
Sapovirus	NA	NA	NA	3,090,384 (2,350,589–3,833,232)	0	3,089,868 (2,350,263–3,832,706)	<1	15,433 (5,569–26,643)
Subtotal				30,172,879 (21,795,012–40,272,501)		30,086,723 (21,733,225–40,154,878)		5,509,597 (3,273,623–8,355,568)
TOTAL				37,220,098 (28,434,745–47,630,066)		36,402,867 (27,698,948–46,716,681)		9,388,075 (6,641,440–12,745,709)

*All estimates were based on US population in 2006. Modal or mean value shown unless otherwise stated; see online Technical Appendix 3 (www.cdc.gov/EID/content/17/1/7-Techapp3.pdf) for the parameters of these distributions. The credible interval (CrI) lower bound for total illnesses was replaced with the number of laboratory-confirmed illnesses when that lower bound was zero. The observed lower bound was then carried forward using the travel-related and foodborne percentages. STEC, Shiga toxin-producing *Escherichia coli*; ETEC, enterotoxigenic *E. coli*; NA, not applicable.

†Adjustment for underreporting because of surveillance method; underreporting multiplier for passive surveillance systems (Cholera and Other *Vibrio* Illness Surveillance [COVIS] or the National Notifiable Disease Surveillance System [NNDSS]) derived by comparing the incidence of laboratory-confirmed illnesses for *Listeria*, non-typhoidal *Salmonella* spp., *Shigella*, and STEC O157 (for bacteria) and *Cryptosporidium* spp. and *Cyclospora cayetanensis* (for parasites) ascertained in the Foodborne Diseases Active Surveillance Network (FoodNet) to the incidence of laboratory-confirmed illnesses for the same pathogens reportable to NNDSS; underreporting multiplier for outbreak-associated illness reported through the Foodborne Disease Outbreak Surveillance System (FDOSS) derived by comparing the incidence of laboratory-confirmed illnesses caused by *Campylobacter* spp., *Cryptosporidium* spp., *Cyclospora cayetanensis*, STEC, *Listeria monocytogenes*, *Salmonella* spp., *Shigella* spp., *Vibrio* spp., and *Yersinia enterocolitica* ascertained in FoodNet to the incidence of laboratory-confirmed illnesses of these bacterial infections reported to FDOSS. The modal value is presented here; online Technical Appendix 3 has the low and high values of these PERT distributions. More detail on the data used to estimate underreporting multipliers is given in online Technical Appendix 4 (www.cdc.gov/EID/content/17/1/7-Techapp4.pdf).

‡Adjustment for underdiagnosis because of variations in medical care seeking, specimen submission, laboratory testing, and test sensitivity. The modal value is presented here; online Technical Appendix 3 describes the low and high values of these PERT distributions.

§Percent foodborne among domestically acquired illnesses.

¶Estimates based on the number of foodborne illnesses ascertained in surveillance and therefore assumed to reflect only foodborne transmission.

#Passive surveillance data on outbreak-associated illnesses from FDOSS.

**Passive surveillance data from COVIS or NNDSS.

††Active surveillance data from FoodNet, adjusted for geographical coverage; data from the NTSS for *M. bovis*.

‡‡For all analyses in this article, *S. enterica* serotype *Paratyphi* is grouped with nontyphoidal *Salmonella* spp.

