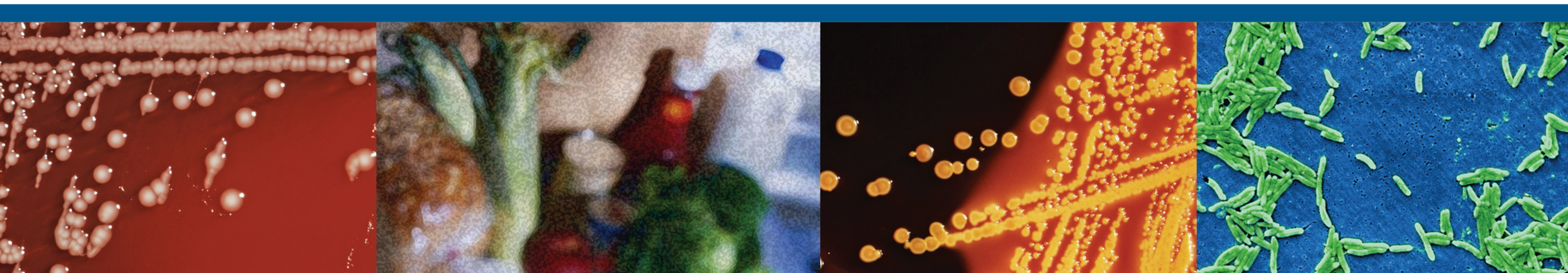
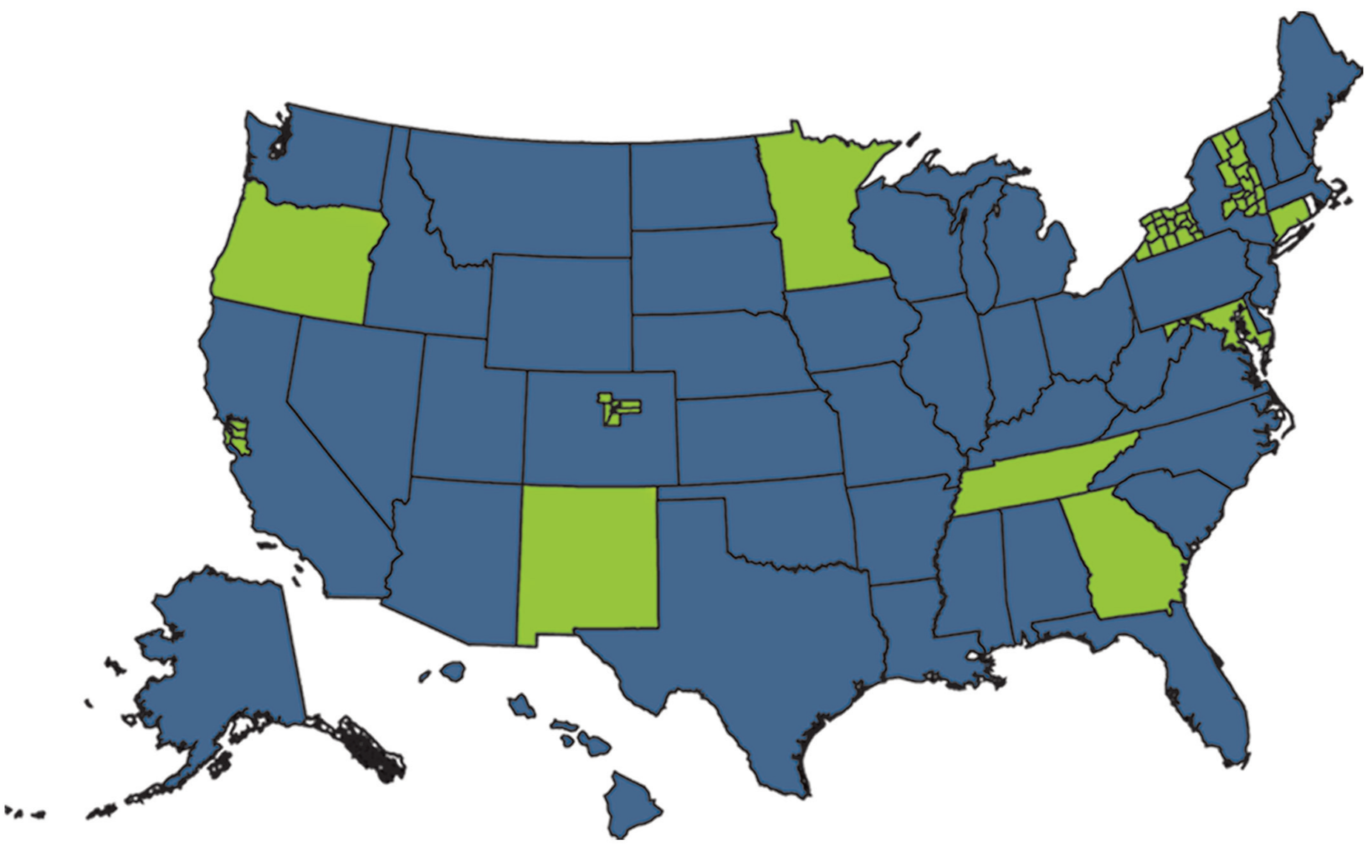
Foodborne Active Disease Surveillance Network (FoodNet)

2006 Surveillance Report





U.S. Department of Health & Human Services
Centers for Disease Control and Prevention

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Executive Summary

The Foodborne Diseases Active Surveillance Network (FoodNet) is the principal foodborne disease component of the Centers for Disease Control and Prevention's (CDC's) Emerging Infections Program (EIP). FoodNet is a collaborative project among CDC, ten state health departments, the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA), and the Center for Food Safety and Applied Nutrition (CFSAN) and the Center for Veterinary Medication (CVM) of the United States Food and Drug Administration (FDA). FoodNet is an active sentinel surveillance network designed to produce stable and accurate national estimates of the burden and sources of foodborne diseases in the United States through active surveillance and additional studies. This enhanced surveillance and investigation conducted by FoodNet are integral to developing and evaluating new prevention and control strategies to improve the safety of our food and the public's health.

In 2006, the FoodNet surveillance area included 45.5 million persons, or 15.2% of the United States population. FoodNet ascertained 17,432 laboratory-confirmed infections of *Campylobacter*, *Cryptosporidium*, *Cyclospora*, *Listeria*, *Salmonella*, *Shigella*, Shiga toxin-producing *Escherichia coli* (STEC) O157, STEC non-O157, *Vibrio* and *Yersinia*. Most infections were due to *Salmonella* (38%) or *Campylobacter* (33%). Infections were approximately equally distributed between genders, and, for many pathogens, the highest risk of reported infection occurred among children <1 year of age (162 cases/100,000 population). Twenty-two percent of the persons reported with infections were hospitalized, and 74 (0.4%) persons died. The greatest number of deaths occurred in persons with *Salmonella* infections. Five percent of cases were outbreak-related; of these, 62% were associated with foodborne outbreaks. A history of international travel was obtained for *Salmonella* and STEC O157 cases; 9% of *Salmonella* infections and 4% STEC O157 infections were related to international travel.

Compared with the 1996-1998 period, in 2006, the estimated incidence rates of *Campylobacter*, *Listeria*, *Shigella*, and *Yersinia* infections were significantly lower. However, most of the declines in the incidence of these infections occurred before 2006. Although not a significant increase compared with the 1996-1998 time period, estimated 2006 incidence of STEC O157 increased again after the substantial declines in 2003 and 2004. The incidence of *Listeria* infections remained above its 2002 minimum, and the incidence of *Vibrio* infections increased to its highest level since FoodNet began conducting surveillance in 1996.

Of the six most common *Salmonella* serotypes, only serotype.Typhimurium decreased significantly compared with 1996-1998 period. By contrast, there were significant increases in the incidence of infections of *Salmonella* serotypes Enteritidis, Heidelberg, Javiana, and Newport.

Due to the time required to complete hospital discharge data review for HUS cases, there is a one-year delay in the reporting of final HUS surveillance results compared with FoodNet active surveillance results. In 2005, FoodNet ascertained 72 post-diarrheal HUS cases. Sixty-seven cases (93%) were reported in persons less than 18 years of age. Overall, the crude incidence rates of pediatric STEC O157 infection and HUS demonstrate a general correlation in trends over time.

Background

Foodborne infections are an important public health challenge. In 1999, the Centers for Disease Control and Prevention (CDC) estimated that foodborne infections caused 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths each year. CDC, the Emerging Infections Program (EIP) sites, the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA), and the Center for Food Safety and Applied Nutrition (CFSAN) and the Center for Veterinary Medication (CVM) of the United States Food and Drug Administration (FDA) are actively involved in preventing foodborne diseases. In 1997, the interagency national Food Safety Initiative was established to address the public health challenge of foodborne diseases. CDC's principal role in the Food Safety Initiative has been to enhance surveillance and investigation of infections caused by pathogens transmitted commonly through food. The Foodborne Diseases Active Surveillance Network (FoodNet) has been the program primarily responsible for accomplishing this mission.

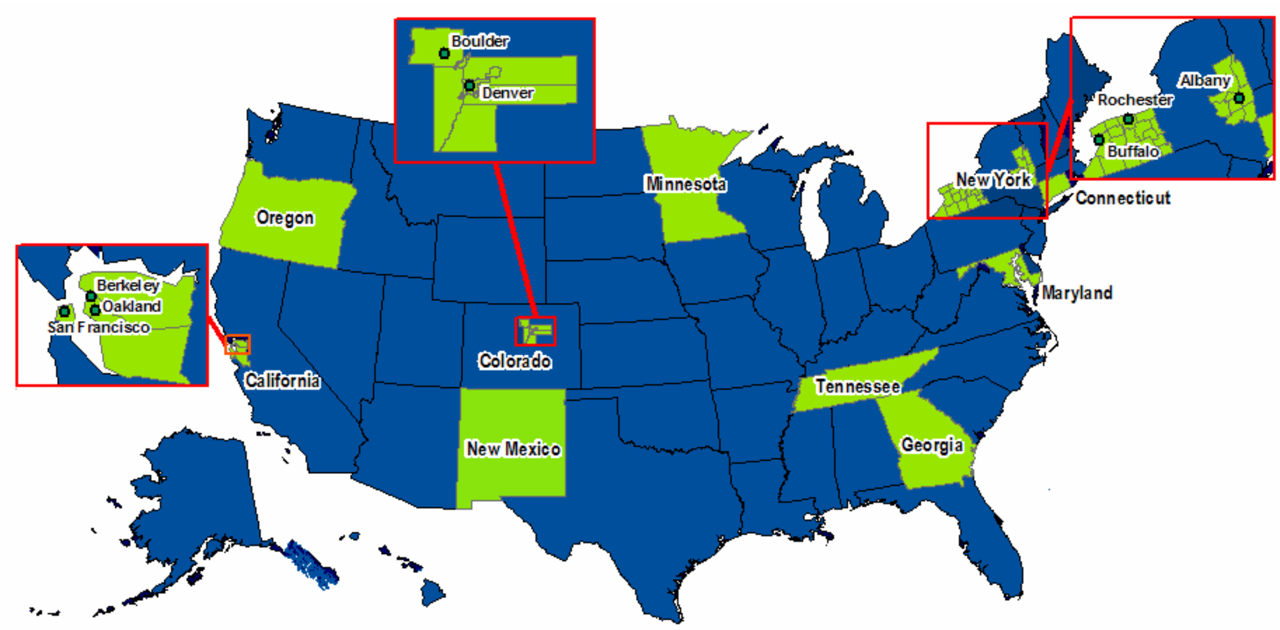
Objectives

The objectives of FoodNet are to determine the burden of foodborne diseases in the United States, monitor trends in the burden of specific foodborne illnesses over time; attribute the burden of foodborne illnesses to specific foods and settings; and develop and assess interventions to reduce the burden of foodborne illness. To meet these objectives, FoodNet conducts active surveillance and related epidemiologic studies. By monitoring the burden of foodborne diseases over time and attributing foodborne disease to specific sources, FoodNet can provide information to assess the effectiveness of new food safety initiatives, such as the USDA Hazard Analysis and Critical Control Points (HACCP) system, in decreasing the burden of foodborne disease in the United States.

Surveillance Area

FoodNet was established in 1996 and initially conducted population-based active surveillance in five sites; Minnesota, Oregon, and selected counties in California, Connecticut, and Georgia. By 2004, the FoodNet surveillance area had expanded to include 10 sites: Connecticut, Georgia, Maryland, Minnesota, New Mexico, Oregon, and Tennessee, and selected counties in California, Colorado, and New York (Figure 1). The FoodNet surveillance area in 2006 included 45.5 million persons, which represented 15.2% of the United States population (Table 1). The gender, race and ethnic distribution of FoodNet surveillance population was similar to that of the United States population as whole, except for an under-representation of the Hispanic population (Table 2).

Figure 1. FoodNet surveillance sites, 2006



California: Alameda, Contra Costa, San Francisco

Colorado: Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson

New York: Albany, Allegany, Cattaraugus, Chautauqua, Chemung, Clinton, Columbia, Delaware, Erie, Essex, Franklin, Fulton, Genesee, Greene, Hamilton, Livingston, Ontario, Orleans, Otsego, Monroe, Montgomery, Niagara, Rensselaer, Saratoga, Schenectady, Schoharie, Schuyler, Seneca, Steuben, Warren, Washington, Wayne, Wyoming, Yates

Table 1. United States population under FoodNet surveillance, 2006

FoodNet Site	Population	%
California	3,225,786	7.1
Colorado	2,636,544	5.8
Connecticut	3,504,809	7.7
Georgia	9,363,941	20.6
Maryland	5,615,727	12.3
Minnesota	5,167,101	11.4
New Mexico	1,954,599	4.3
New York	4,291,545	9.4
Oregon	3,700,758	8.1
Tennessee	6,038,803	13.3
Total	45,499,613	
FoodNet population as a percentage of total U.S. population		15.2

Table 2. Comparison of FoodNet surveillance population to United States population, 2006

	FoodNet Surveillance population		United States population	
	N	(%)	N	(%)
Total population	45,499,613		299,398,484	
Gender				
Male	22,386,898	(49.2)	147,512,152	(49.3)
Female	23,112,715	(50.8)	151,886,332	(50.7)
Age				
<1	604,857	(1.3)	4,130,153	(1.4)
1-9	5,379,240	(11.8)	35,997,370	(12.0)
10-19	6,289,332	(13.8)	41,951,583	(14.0)
20-20	6,276,082	(13.8)	41,820,720	(14.0)
30-39	6,343,050	(13.9)	40,892,284	(13.7)
40-49	7,086,877	(15.6)	45,278,734	(15.1)
50-59	6,066,998	(13.3)	38,705,050	(12.9)
60+	7,453,177	(16.4)	50,622,590	(16.9)
Race				
Non-Hispanic white	31,243,892	(68.7)	198,744,494	(66.4)
Non-Hispanic black	6,845,747	(15.0)	36,689,680	(12.3)
Non-Hispanic other	2,995,592	(6.6)	19,643,272	(6.6)
Hispanic	4,414,382	(9.7)	44,321,038	(14.8)

Methods

FoodNet Active Surveillance

FoodNet conducts surveillance for all laboratory-confirmed isolations of *Campylobacter*, *Cryptosporidium*, *Cyclospora*, *Listeria monocytogenes*, *Salmonella*, Shiga toxin-producing *Escherichia coli* (STEC)—including STEC O157 and STEC non-O157—*Shigella*, *Vibrio*, and *Yersinia* infections in residents of the FoodNet surveillance area. A case is defined as isolation (for bacteria) or identification (for parasites) of an organism from a clinical specimen. For simplicity, in this report all isolations are referred to as infections, although not all strains of all pathogens have been proven to cause illness in humans. To identify cases, FoodNet personnel communicated with each of the 650 clinical laboratories serving the surveillance area either weekly or monthly, depending on laboratory volume.

Once a case is identified, FoodNet personnel at each site complete a set of core FoodNet variables and enter this information into an electronic database. Standardized definitions for hospitalization, patient outcome and international travel are used. Hospitalization status in the seven days before or after specimen collection is noted. Patient outcome is recorded seven days after specimen collection, or if patient is hospitalized, at the time of hospital discharge. International travel within seven days of illness onset is captured routinely for all *Salmonella* and STEC O157 cases.

The number of FoodNet sites has doubled, and the population under surveillance has more than tripled, since FoodNet began in 1996 (Table 3). Because of the substantial variation in incidence of infection due to various pathogens among the sites, adding new sites in itself influences the overall crude incidence. To account for the increase in the FoodNet surveillance area and for variation in the incidence of infections across sites, a main-effects, log-linear Poisson regression model (negative binomial model) was used to estimate the statistical significance of changes in the incidence of pathogens over time (*1*). For comparison, the average annual incidence of each pathogen for the FoodNet surveillance period of 1996-1998 was calculated (1997-1998 for *Cryptosporidium*). The estimated change in incidence (relative rate) between this comparison period and 2006 was calculated, along with a 95% confidence interval (CI). Using this average incidence during 1996-1998, rather than the incidence in the single year of 1996, as in previous FoodNet reports, yielded more stable and precise relative rate estimates.

1 Hardnett FP, Hoekstra RM, Kennedy M, Charles L, Angulo FJ; Emerging Infections Program FoodNet Working Group. Epidemiologic issues in study design and data analysis related to FoodNet activities. *Clin Infect Dis* 2005;38(Suppl 3):S121--6

Table 3. Population under surveillance, by site, FoodNet, 1996-2006

FoodNet Site	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
California	2,087,032	2,113,195	2,142,806	2,162,359	3,181,392	3,224,045	3,218,492	3,211,317	3,203,841	3,209,734	3,225,786
Colorado	-	-	-	-	-	2,154,309	2,502,467	2,524,177	2,551,617	2,587,452	2,636,544
Connecticut	1,622,809	2,453,483	**3,272,563**	**3,282,031**	**3,412,539**	**3,433,201**	**3,457,927**	**3,482,326**	**3,493,893**	**3,500,701**	**3,504,809**
Georgia	2,720,443	3,632,206	3,744,022	**7,788,240**	**8,230,550**	**8,424,033**	**8,597,927**	**8,750,259**	**8,935,151**	**9,132,553**	**9,363,941**
Maryland	-	-	2,441,279	2,450,566	2,516,640	4,248,280	**5,441,349**	**5,506,684**	**5,553,249**	**5,589,599**	**5,615,727**
Minnesota	**4,647,723**	**4,687,726**	**4,726,411**	**4,775,508**	**4,934,275**	**4,985,851**	**5,024,570**	**5,059,023**	**5,094,304**	**5,126,739**	**5,167,101**
New Mexico	-	-	-	-	-	-	-	-	**1,900,620**	**1,925,985**	**1,954,599**
New York	-	-	1,105,062	2,084,453	2,111,241	2,113,240	3,321,831	3,966,402	4,307,993	4,298,616	4,291,545
Oregon	**3,195,087**	**3,243,254**	**3,282,055**	**3,316,154**	**3,431,530**	**3,474,183**	**3,523,529**	**3,561,155**	**3,589,168**	**3,638,871**	**3,700,758**
Tennessee	-	-	-	-	2,825,464	2,848,550	2,870,378	**5,834,358**	**5,885,597**	**5,955,745**	**6,038,803**
Total	14,273,094	16,129,864	20,714,198	25,859,311	30,643,631	34,905,692	37,958,470	41,895,701	44,515,433	44,965,995	45,499,613
FoodNet population as percentage of U.S. population	5.4	6.0	7.7	9.5	10.9	12.2	13.2	14.4	15.2	15.2	15.2

Bold indicates active surveillance was conducted statewide, including all counties within a state; otherwise surveillance was conducted in select counties.
"-" Indicates state was not a FoodNet site during indicated year.

HUS Surveillance

FoodNet conducts surveillance for cases of hemolytic uremic syndrome (HUS). Active surveillance is conducted for pediatric HUS (persons younger than18 years of age at disease diagnosis) through a network of pediatric nephrologists and infection control practitioners who report all cases of HUS that they identify. FoodNet also conducts passive surveillance for adult HUS cases (persons 18 years of age or older).

In 2000, FoodNet sites began hospital discharge data review for pediatric HUS cases to validate HUS surveillance activities and identify additional HUS cases. HUS cases are identified using ICD-9 codes specifying HUS, acute renal failure with hemolytic anemia and thrombocytopenia, or thrombotic thrombocytopenic purpura with diarrhea caused by STEC or another pathogen. The time needed for hospital discharge data review and validation of the HUS diagnosis through medical record reviews results in a one-year lag in complete reporting of HUS surveillance results compared with FoodNet active surveillance results.

Narrative Report

2006 Surveillance Results

Cases Reported

In 2006, FoodNet sites identified 17,432 laboratory-confirmed infections caused by the pathogens under surveillance. Of 16,510 bacterial infections, most were *Salmonella* (41%), followed by *Campylobacter* (35%), *Shigella* (17%), STEC O157 (4%), STEC non-O157 (1%), *Yersinia* (0.99%), *Vibrio* (0.94%), *Listeria* (0.84%), and STEC O Antigen undetermined (0.16%) (Table 4A). Of the 922 cases of parasitic infections, 95% were *Cryptosporidium* and 5% were *Cyclospora* (Table 4B).

Of 6,342 (95%) serotyped *Salmonella* isolates, the seven most commonly identified serotypes were Typhimurium (1,187; 19%), Enteritidis (1,112; 18%), Newport (553; 9%), Javiana (313; 5%), I 4,[5],12:i:- (296; 5%), Montevideo (249; 4%), and Heidelberg (242; 4%). Of 149 (96%) *Vibrio* isolates speciated, the most commonly identified species were *V. parahaemolyticus* (97; 62%), *V. vulnificus* (18; 12%), and *V. alginolyticus* (14; 9%). Of 2,629 (95%) *Shigella* isolates serotyped, the most commonly identified serotypes were *S. sonnei* (2,201; 83%) and *S. flexneri* (399; 15%). Of 193 (91%) STEC non-O157 isolates for which an O antigen was determined, the most commonly identified O antigens were O26 (57; 30%), O103 (49; 25%), O111 (25; 13%), O45 (8; 4%), and O121 (6; 3%).

Table 4A. Number of laboratory-confirmed infections caused by specific bacterial pathogens reported, by site, FoodNet, 2006

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Total
Campylobacter	866	479	532	580	432	899	383	522	634	443	5,770
Listeria	8	5	19	20	28	7	5	22	11	14	139
Salmonella	486	358	506	1841	776	725	259	495	401	842	6,689
Shigella	244	180	67	1375	128	259	172	48	94	198	2,765
STEC O157	42	35	41	41	40	147	20	53	83	88	590
STEC non-O157	6	16	34	18	33	44	23	19	9	10	212
STEC O Ag Undet*	0	0	0	4	17	0	0	0	0	5	26
Vibrio	41	3	19	25	31	4	2	12	10	9	156
Yersinia	10	6	18	32	11	23	5	14	15	29	163
Total	1,703	1,082	1,236	3,936	1,496	2,108	869	1,185	1,257	1,638	16,510

*STEC O Antigen undetermined.

Table 4B. Number of laboratory-confirmed infections caused by specific parasitic pathogens reported, by site, FoodNet, 2006

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Total
Cryptosporidium	47	37	38	276	20	242	41	54	77	47	879
Cyclospora	0	0	11	19	2	4	1	0	2	4	43
Total	47	37	49	295	22	246	42	54	79	51	922

Seasonality

The number of infections reported varied by pathogen and month (Figures 2A, 2B, and 2C). More infections with pathogens under FoodNet surveillance occur during the summer months. In 2006, 60% of *Cyclospora* infections occurred during June and July; 39% of STEC non-O157 infections occurred from June through August; 63% of STEC O157 infections occurred from June through September; 54% of *Campylobacter* infections and 58% *Salmonella* infections occurred from June through October; 58% of *Vibrio* infections occurred from July through August; and 43% percent of *Listeria* infections occurred from July through September.

Cryptosporidium and *Listeria* peaked later in the year. Thirty-two percent of *Cryptosporidium* infections occurred from August through September and 40% *Shigella* infections occurred from September through November.

In most years, *Yersinia* infections peak during the winter months, from December through February, but in 2006 there was little variation in the number of infections across months.

Figure 2A. Cases of *Campylobacter*, *Cryptosporidium*, *Salmonella*, and *Shigella* infection, by month, FoodNet, 2006

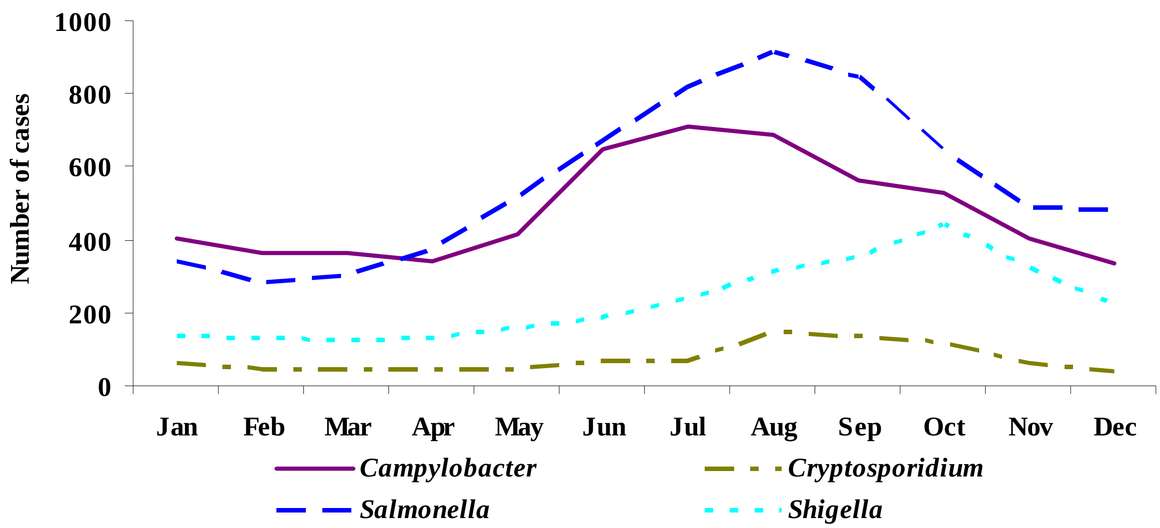


Figure 2B. Cases of STEC O157 and STEC non-O157 infection, by month, FoodNet, 2006

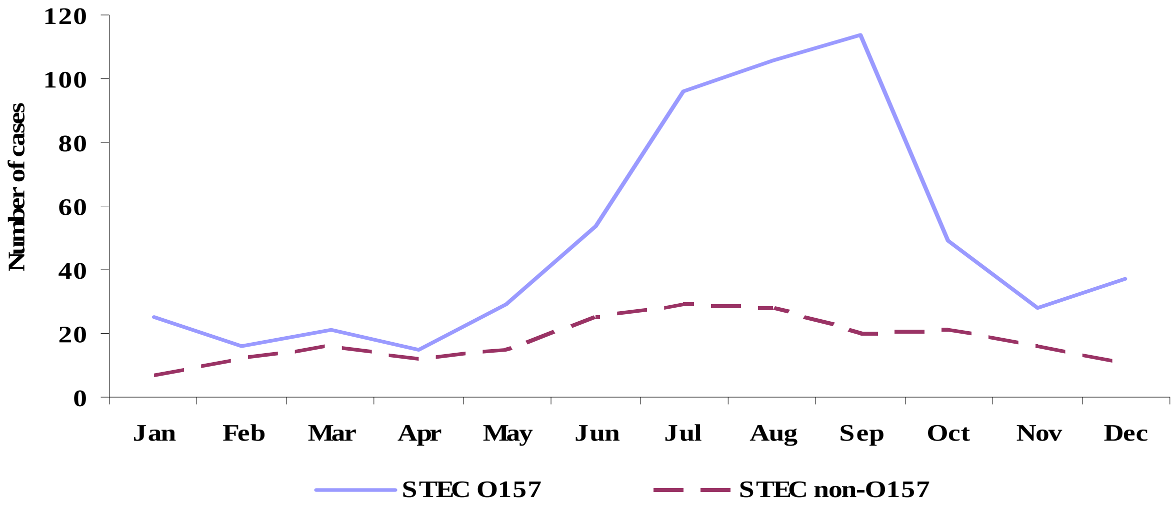
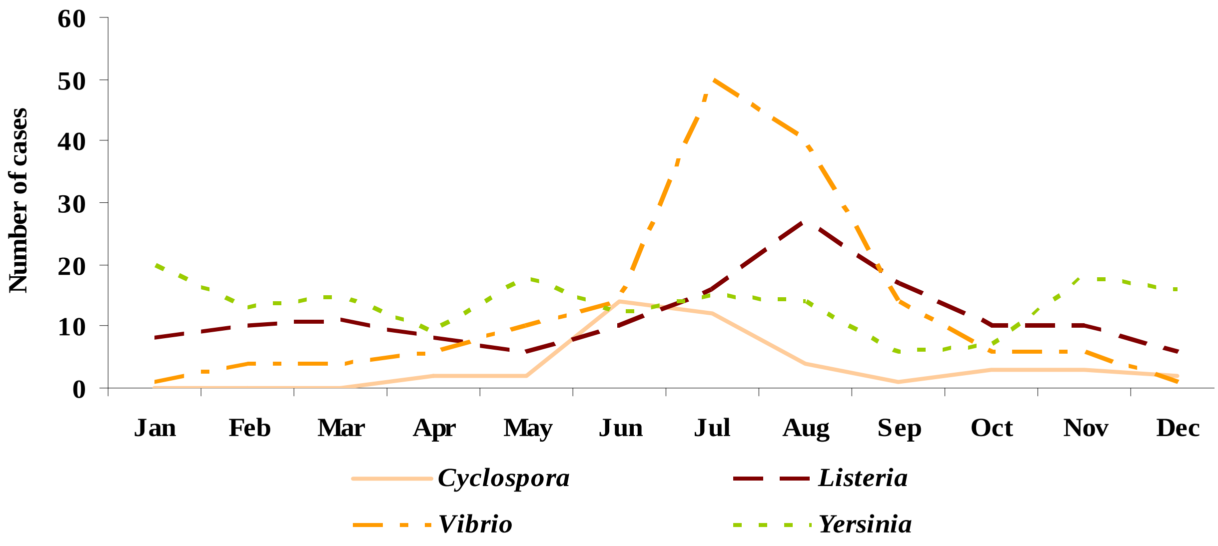


Figure 2C. Cases of *Cyclospora*, *Listeria*, *Vibrio*, and *Yersinia* infection, by month, FoodNet, 2006



Incidence

To compare the incidence of infections with pathogens under FoodNet surveillance across sites, incidence per 100,000 population was calculated. The incidence figures reported in Tables 5A and 5B and Figures 3A, 3B, and 3C were calculated using 2006 census population counts. The incidence of infections in 2006 was highest for *Salmonella* (14.70/100,000 population) followed by *Campylobacter* (12.68), *Shigella* (6.08), *Cryptosporidium* (1.93), STEC O157 (1.30), STEC non-O157 (0.47), *Yersinia* (0.36), *Vibrio* (0.34), *Listeria* (0.31), *Cyclospora* (0.09), and STEC O Antigen Undetermined (0.06).

Table 5A. Incidence* of laboratory-confirmed infections caused by specific bacterial pathogens reported, by site, FoodNet, 2006

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Overall
Campylobacter	26.85	18.17	15.18	6.19	7.69	17.40	19.59	12.16	17.13	7.34	12.68
Listeria	0.25	0.19	0.54	0.21	0.50	0.14	0.26	0.51	0.30	0.23	0.31
Salmonella	15.07	13.58	14.44	19.66	13.82	14.03	13.25	11.53	10.84	13.94	14.70
Shigella	7.56	6.83	1.91	14.68	2.28	5.01	8.80	1.12	2.54	3.28	6.08
STEC O157	1.30	1.33	1.17	0.44	0.71	2.84	1.02	1.23	2.24	1.46	1.30
STEC non-O157	0.19	0.61	0.97	0.19	0.59	0.85	1.18	0.44	0.24	0.17	0.47
STEC O Ag Undet[†]	0.00	0.00	0.00	0.04	0.30	0.00	0.00	0.00	0.00	0.08	0.06
Vibrio	1.27	0.11	0.54	0.27	0.55	0.08	0.10	0.28	0.27	0.15	0.34
Yersinia	0.31	0.23	0.51	0.34	0.20	0.45	0.26	0.33	0.41	0.48	0.36

*Cases per 100,000 population.

[†]STEC O Antigen undetermined.

Table 5B. Incidence* of laboratory-confirmed infections caused by specific parasitic pathogens reported, by site, FoodNet, 2006

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Overall
Cryptosporidium	1.46	1.40	1.08	2.95	0.36	4.68	2.10	1.26	2.08	0.78	1.93
Cyclospora	0.00	0.00	0.31	0.20	0.04	0.08	0.05	0.00	0.05	0.07	0.09

*Cases per 100,000 population.

Figure 3A. Incidence of *Campylobacter*, *Cryptosporidium*, *Salmonella*, and *Shigella* infections per 100,000 population, by site, FoodNet, 2006

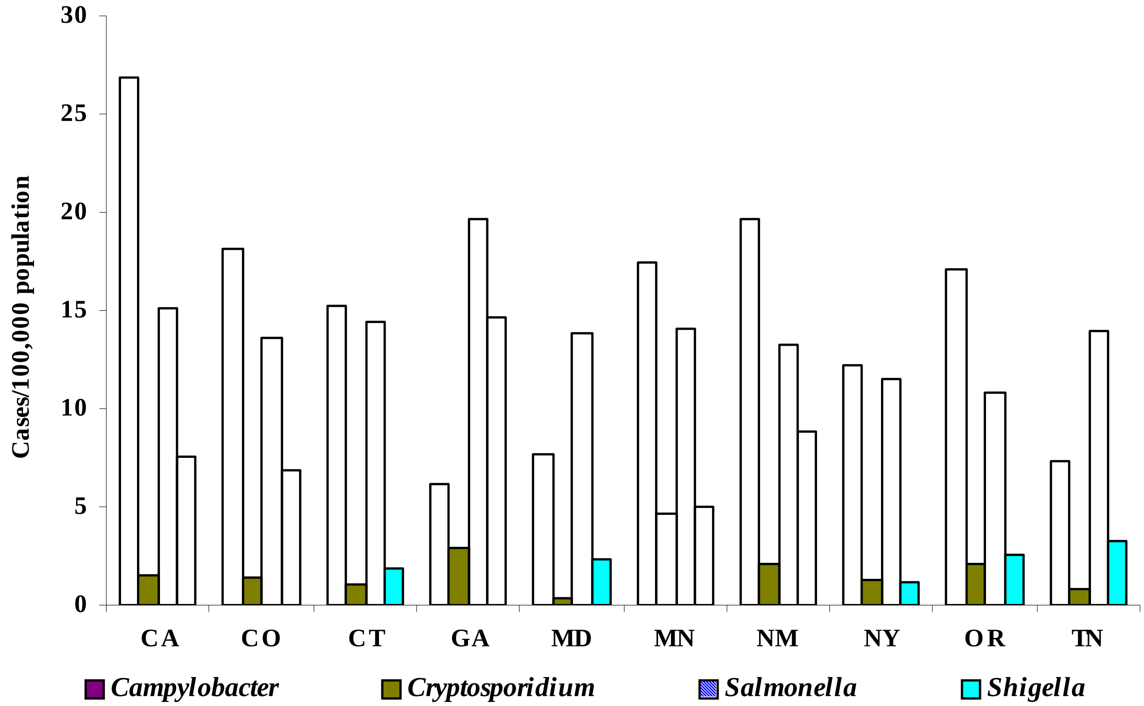


Figure 3B. Incidence of STEC O157 and STEC non-O157 infections per 100,000 population, by site, FoodNet, 2006

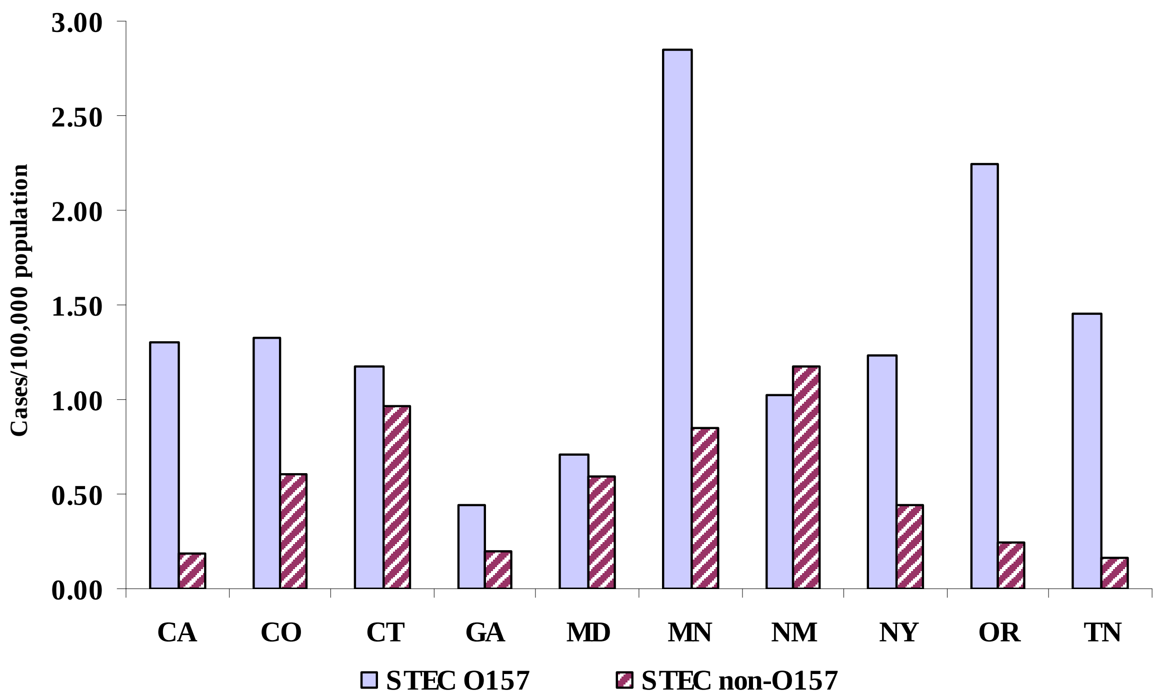
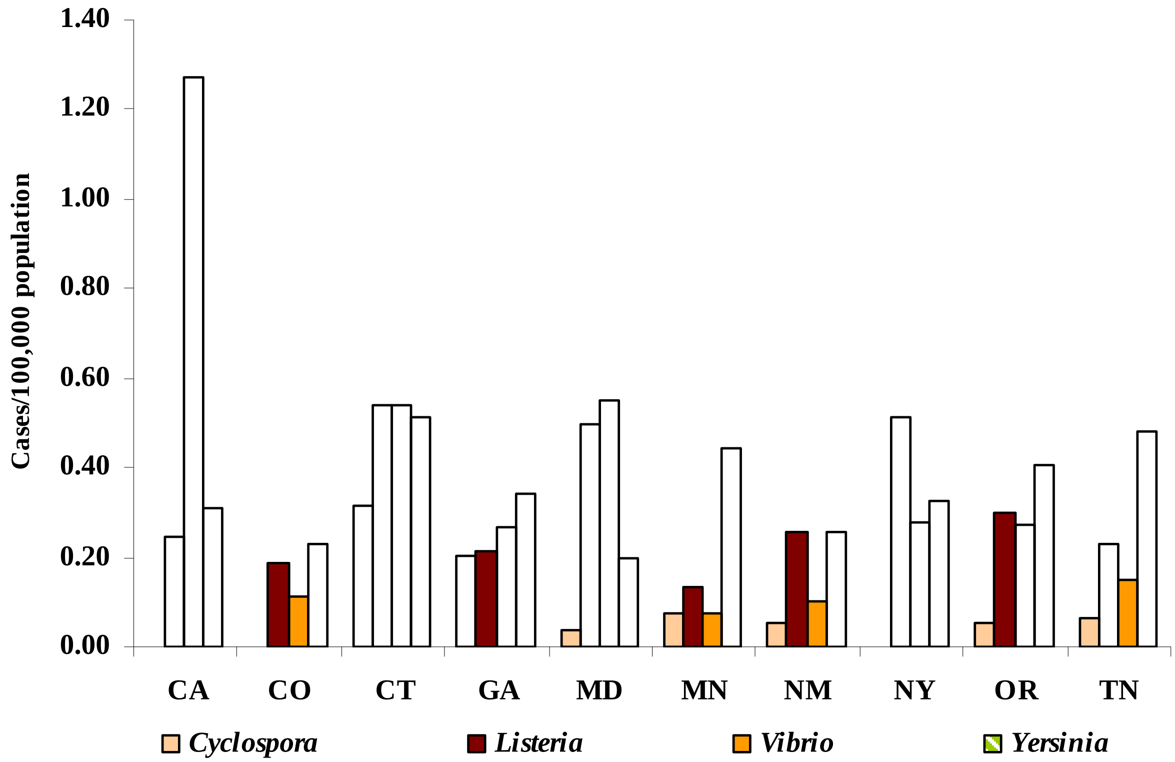


Figure 3C. Incidence of *Cyclospora*, *Listeria*, *Vibrio*, and *Yersinia* infections per 100,000 population, by site, FoodNet, 2006



Incidence by Age The incidence of infections caused by pathogens under FoodNet surveillance varied by age group (Figures 4A and 4B). The incidence of infections in children <1 year of age was substantially higher for *Salmonella*, *Campylobacter*, *and Yersinia* compared with other age groups (112.26 per 100,000 population versus 13.35 per 100,000 population; 29.26 versus 12.45; and 5.46 versus 0.20, respectively). The incidences of *Shigella*, STEC O157, and *Cryptosporidium* infections were highest among children 1-9 years of age (27.92 per 100,000 versus 3.13 per 100,000 population; 3.85 versus 0.95; and 3.74 versus 1.69, respectively).

Figure 4A. Incidence of *Campylobacter*, *Salmonella*, and *Shigella* infections, by age group, FoodNet, 2006

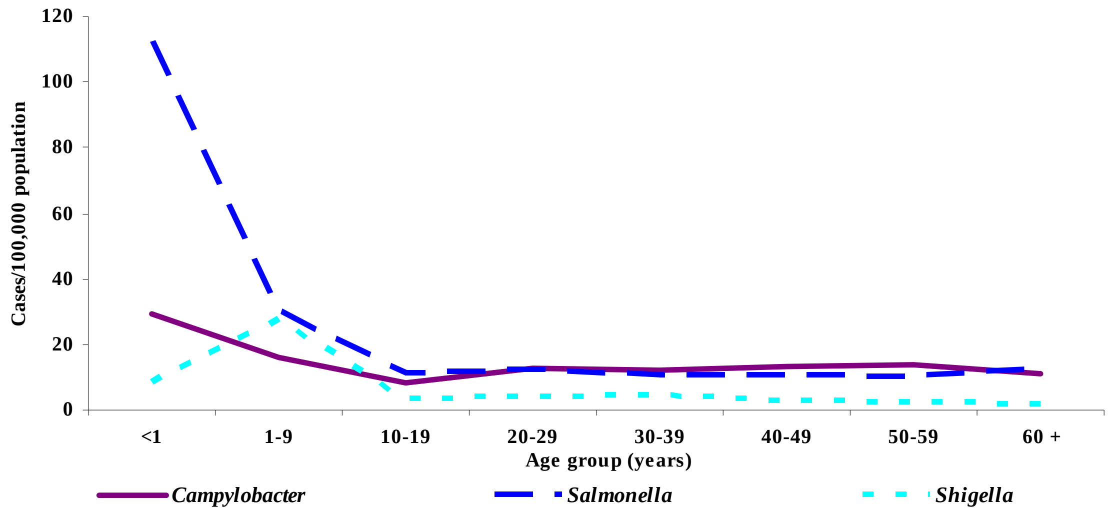
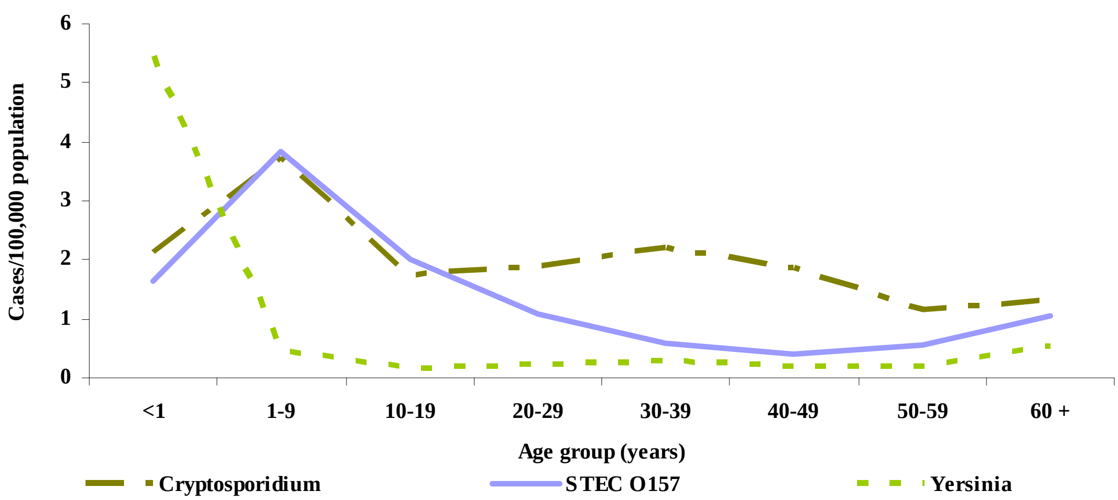


Figure 4B. Incidence of *Cryptosporidium*, STEC O157, and *Yersinia* infections, by age group, FoodNet, 2006



Incidence by Sex The incidence of *Vibrio*, *Campylobacter*, *Cryptosporidium*, *Yersinia*, and STEC O157 infections was somewhat higher among males; whereas the incidence of *Listeria*, *Salmonella*, *Shigella*, *and Cyclospora* infections was somewhat higher among females (Table 6).

Table 6. Sex-specific incidence per 100,000 population, by pathogen, FoodNet, 2006

Pathogen	Male	Female
Campylobacter	13.89	11.50
Cryptosporidium	2.11	1.76
Cyclospora	0.09	0.10
Listeria	0.26	0.35
Salmonella	14.16	15.09
Shigella	5.82	6.25
STEC O157	1.31	1.27
STEC non-O157	0.42	0.51
Vibrio	0.44	0.25
Yersinia	0.37	0.34

Hospitalizations Hospitalization status was determined for 88% (15,424) of FoodNet cases (Table 7). Overall, 22% of persons with a laboratory-confirmed infection were hospitalized. The percentage of persons hospitalized was highest for *Listeria* (89% of reported cases), followed by STEC O157 (48%), *Yersinia* (37%), *Salmonella* (27%), *Vibrio* (26%), *Cryptosporidium* (23%), *Shigella* (18%), *Campylobacter* (13%), STEC non-O157 (13%), and *Cyclospora* (5%).

Table 7. Frequency of hospitalization status, by pathogen, FoodNet, 2006

	Hospitalized		**Outpatient**		**Total cases with hospitalization information**		**Unknown hospitalization status**		**Total cases reported**
Pathogen	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**	**(%)**	**No.**
Campylobacter	773	(13)	4,133	(72)	**4,906**	**(85)**	864	(15)	5,770
Cryptosporidium	200	(23)	617	(70)	**817**	**(93)**	62	(7)	879
Cyclospora	2	(5)	39	(91)	**41**	**(95)**	2	(5)	43
Listeria	124	(89)	12	(9)	**136**	**(98)**	3	(2)	139
Salmonella	1,814	(27)	4,112	(61)	**5,926**	**(89)**	763	(11)	6,689
Shigella	492	(18)	2,063	(75)	**2,555**	**(92)**	210	(8)	2,765
STEC O157	285	(48)	285	(48)	**570**	**(97)**	20	(3)	590
STEC non-O157	27	(13)	150	(71)	**177**	**(83)**	35	(17)	212
STEC O Ag Undet*	0	(-)	9	(35)	**9**	**(35)**	17	(65)	26
Vibrio	41	(26)	95	(61)	**136**	**(87)**	20	(13)	156
Yersinia	61	(37)	90	(55)	**151**	**(93)**	12	(7)	163
Total	3,819	(22)	11,605	(67)	**15,424**	**(88)**	2,008	(12)	17,432

*STEC O Antigen undetermined.

Deaths

In 2006, 74 persons with laboratory-confirmed infections were reported to have died. Of these, 34 were infected with *Salmonella*, 14 with *Listeria*, 7 with *Yersinia*, 6 with *Vibrio*, 5 with *Campylobacter*, 4 with *Cryptosporidium*, 3 with *Shigella*, 1 with STEC O157. No deaths were reported for *Cyclospora* or STEC non-O157. *Listeria* had the highest case-fatality rate (10%, Table 8).

Table 8. Frequency of patient outcome, by pathogen, FoodNet, 2006

Pathogen	Alive No.	Dead No.	Total cases with outcome information No.	(%)	Unknown No.	(%)	Total cases reported No.	Case fatality rate (CFR)*
Campylobacter	4,755	5	**4,760**	**(82)**	1,010	(18)	5,770	0.09
Cryptosporidium	780	4	**784**	**(89)**	95	(11)	879	0.46
Cyclospora	38	0	**38**	**(88)**	5	(12)	43	-
Listeria	119	14	**133**	**(96)**	6	(4)	139	10.07
Salmonella	6,092	34	**6,126**	**(92)**	563	(8)	6,689	0.51
Shigella	2,124	3	**2,127**	**(77)**	638	(23)	2,765	0.11
STEC O157	577	1	**578**	**(98)**	12	(2)	590	0.17
STEC non-O157	206	0	**206**	**(97)**	6	(3)	212	-
STEC O Ag Undet†	26	0	**26**	**(100)**	0	(-)	26	-
Vibrio	133	6	**139**	**(89)**	17	(11)	156	3.85
Yersinia	140	7	**147**	**(90)**	16	(10)	163	4.29
Total	14,990	74	**15,064**	**(86)**	2,368	(14)	17,432	

*CFR = (number of patients reported to have died/total number of cases) x 100.

†STEC O Antigen undetermined.

International Travel

Of the 555 (94%) persons with STEC O157 infection for whom travel information was available, 4% reported international travel, and of 5,145 (77%) persons with *Salmonella* infection for whom travel information was available, 12% reported international travel (Table 9).

Table 9. Frequency of international travel among persons with *Salmonella* and STEC O157 infections, by pathogen, FoodNet, 2006

Pathogen	Yes No.	(%)	No No.	(%)	Total cases with travel information No.	(%)	Unknown No.	(%)	Total cases reported No.
Salmonella	622	(12)	4,523	(88)	**5,145**	**(77)**	1,544	(23)	6,689
STEC O157	24	(4)	531	(96)	**555**	**(94)**	35	(6)	590

Outbreak-related Cases

Five percent of the cases reported to FoodNet were reported to be outbreak-related by the state health department; 62% of these outbreaks were foodborne (Table 10). The most common outbreak-related etiologies were *Salmonella*, *Shigella*, and STEC O157, which accounted for 88% of all outbreak-related cases. Of the 6,689 *Salmonella* cases ascertained, 478 (7%) were reported as being outbreak-related. Of these, 80% were foodborne, 19% were nonfoodborne related, and, for <1% the mode of transmission was unknown. Of the 2,765 *Shigella* cases ascertained, 159 (6%) were identified as being outbreak-related. Of these, 15% were foodborne, 82% were nonfoodborne related, and for 3% the mode of transmission was unknown. Of the 590 STEC O157 cases ascertained, 91 (16%) were identified as being outbreak-related. Of these, 73% were foodborne and 27% were nonfoodborne related (Table 10).

Table 10. Frequency of outbreak-related cases, by pathogen, FoodNet, 2006

Pathogen	Outbreak-related cases		Foodborne related		Nonfoodborne related		Unknown	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)
Campylobacter	33	(1)	16	(48)	17	(52)	0	(-)
Cryptosporidium	39	(4)	0	(-)	38	(97)	1	(3)
Cyclospora	6	(14)	6	(100)	0	(-)	0	(-)
Listeria	6	(16)	6	(100)	0	(-)	0	(-)
Salmonella	478	(4)	386	(81)	90	(19)	2	(0.4)
Shigella	159	(7)	24	(15)	131	(82)	4	(3)
STEC O157	94	(6)	69	(73)	25	(27)	0	(-)
STEC non-O157	4	(2)	1	(25)	3	(75)	0	(-)
Vibrio	7	(4)	7	(100)	0	(-)	0	(-)
Total	826	(5)	515	(62)	304	(37)	7	(1)

Progress Towards National Health Objectives

Healthy People 2010 national health objectives exist for four of the FoodNet pathogens under surveillance; *Campylobacter*, *Listeria*, *Salmonella*, and STEC O157. Although the incidence of infections with *Campylobacter*, *Listeria* and STEC O157 are close to meeting their respective objectives the incidence of *Salmonella* infections substantially exceeds its objective (Table 11).

Table 11. Comparison of 2006 incidence* with the Healthy People 2010 Objectives

Pathogen	2006 crude rate	National health objective
Campylobacter	12.68	12.30†
Listeria	0.31	0.25‡
Salmonella	14.70	6.80†
STEC O157	1.30	1.00†

*Cases per 100,000 population.

†Healthy People 2010 objective.

‡2005 objective.

Incidence in 2006 Compared with 1996-1998

The incidence of several infections in 2006 differed significantly when compared with the 1996-1998 period**.** The incidence of infections caused by *Campylobacter*, *Listeria*, *Shigella*, and *Yersinia* was significantly lower, while the incidence of *Vibrio* infections was higher (Table 12 and Figures 5A, 5B, 5C).

The estimated incidence of *Yersinia* infection was 48% lower (95% CI=-59% to -35%), *Shigella* was 35% lower (95% CI=-54% to -8%), *Listeria* was 34% lower (95% CI=-47% to -18%), *Campylobacter* was 30% lower (95% CI=-35% to -24%), and *Salmonella* was 7% lower (95% CI=-13% to 0%). The estimated incidence of *Vibrio* infections was 75% higher (95% CI=34% to 139%). The estimated incidence of *Cryptosporidium* and STEC O157 infections was not significantly different from the comparison period.

Of the most commonly reported *Salmonella* serotypes in 2006, only serotype Typhimurium showed a significantly lower estimated incidence (41% lower; 95% CI=-48% to -33%) compared with the 1996-1998 period (Table 13 and Figure 6). Significantly higher estimated incidences were seen for serotypes Javiana (94% higher; 95% CI=23% to 205%), Newport (44% higher; 95% CI=9% to 90%), Enteritidis (27% higher; 95% CI=4% to 56%), and Heidelberg (20% higher; 95% CI=36% to 0%). For serotype Montevideo, the estimated incidence in 2006 was similar to that of the comparison period.

Table 12. Percent change in incidence* of laboratory-confirmed infections with pathogens under surveillance in FoodNet, by pathogen, 2006 compared with 1996-1998

Pathogen	Change	95% confidence interval
Bacterial		
Campylobacter	-30%	-35% to -24%
Listeria	-34%	-47% to -18%
Salmonella	-7%	-13% to 0%
Shigella	-35%	-54% to -8%
STEC O157	-15%	-30% to 4%
Vibrio	75%	34% to 139%
Yersinia	-48%	-59% to 35%
Parasitic		
Cryptosporidium†	18%	-45% to 23%

*Cases per 100,000 population.

†2006 compared with 1997-1998.

Figure 5A. Relative rates of laboratory-confirmed infections with *Campylobacter, Salmonella,* and *Shigella* compared with 1996-1998 rates, by year, FoodNet, 1996-2006

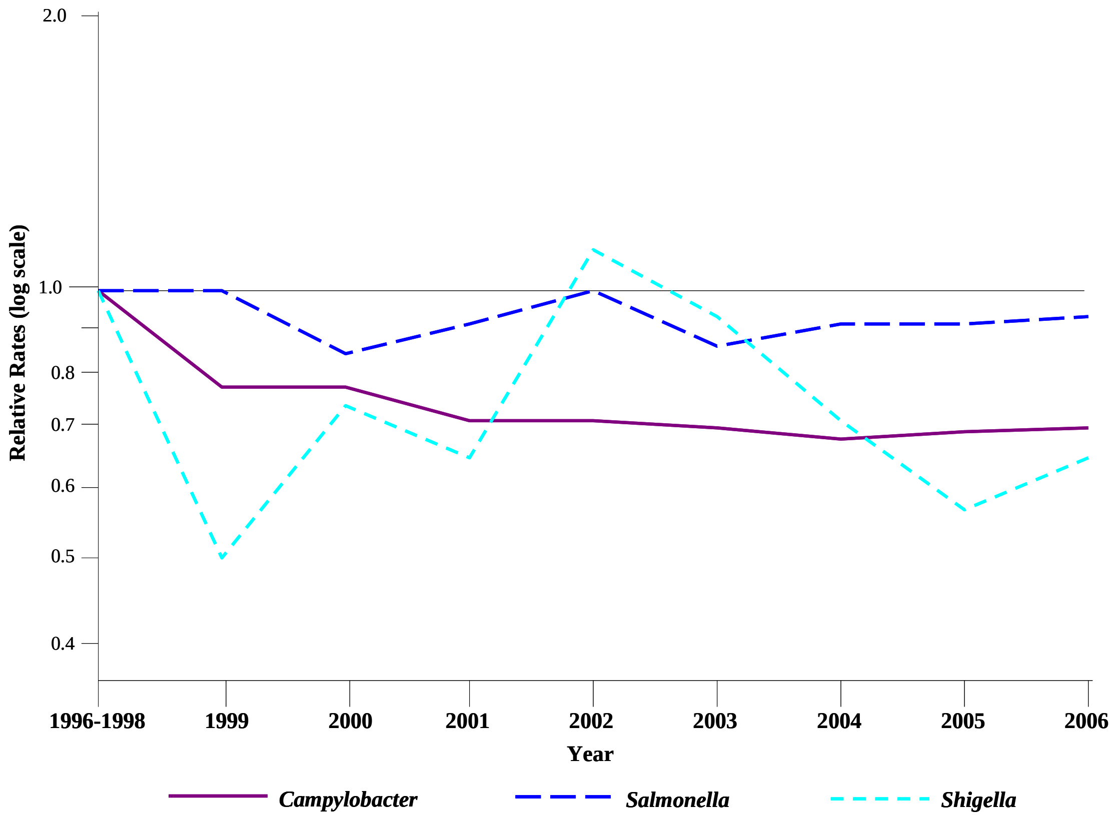


Figure 5B. Relative rates of laboratory-confirmed infections with *Listeria*, STEC O157, *Vibrio*, and *Yersinia* compared with 1996-1998 rates, by year, FoodNet, 1996-2006

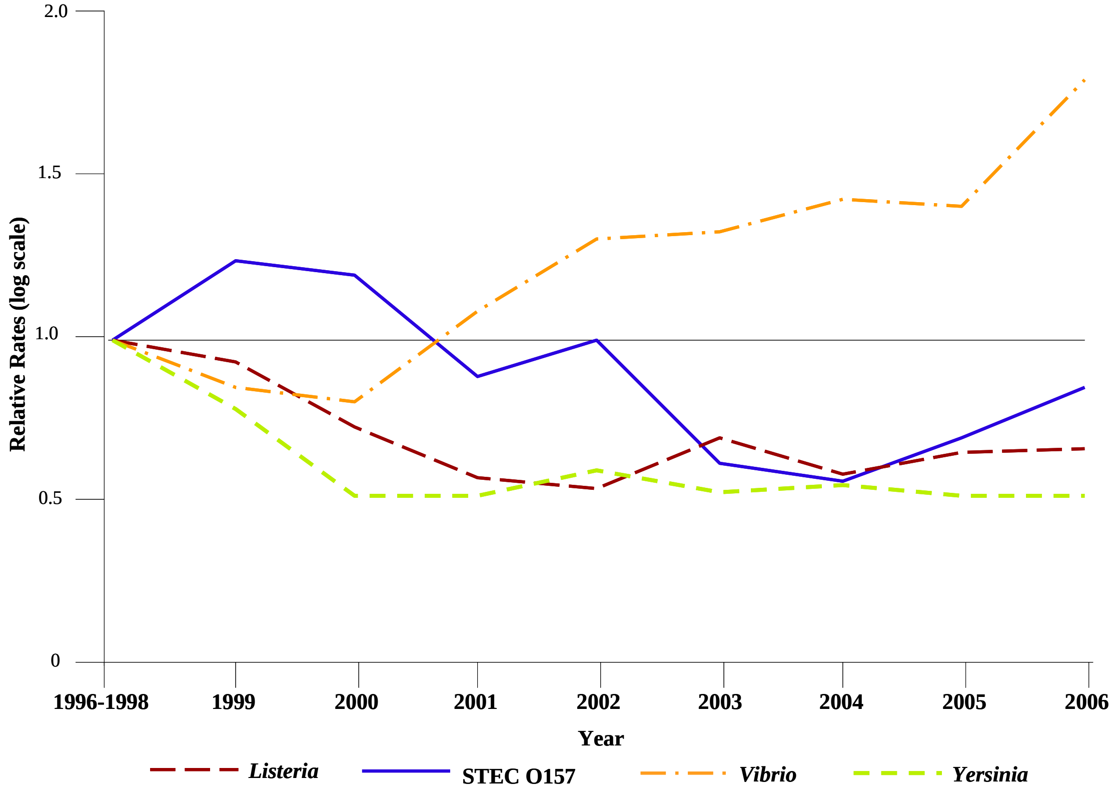


Figure 5C. Relative rates of laboratory-confirmed infections with *Cryptosporidium* compared with 1997-1998 rates, by year, FoodNet, 1997-2006

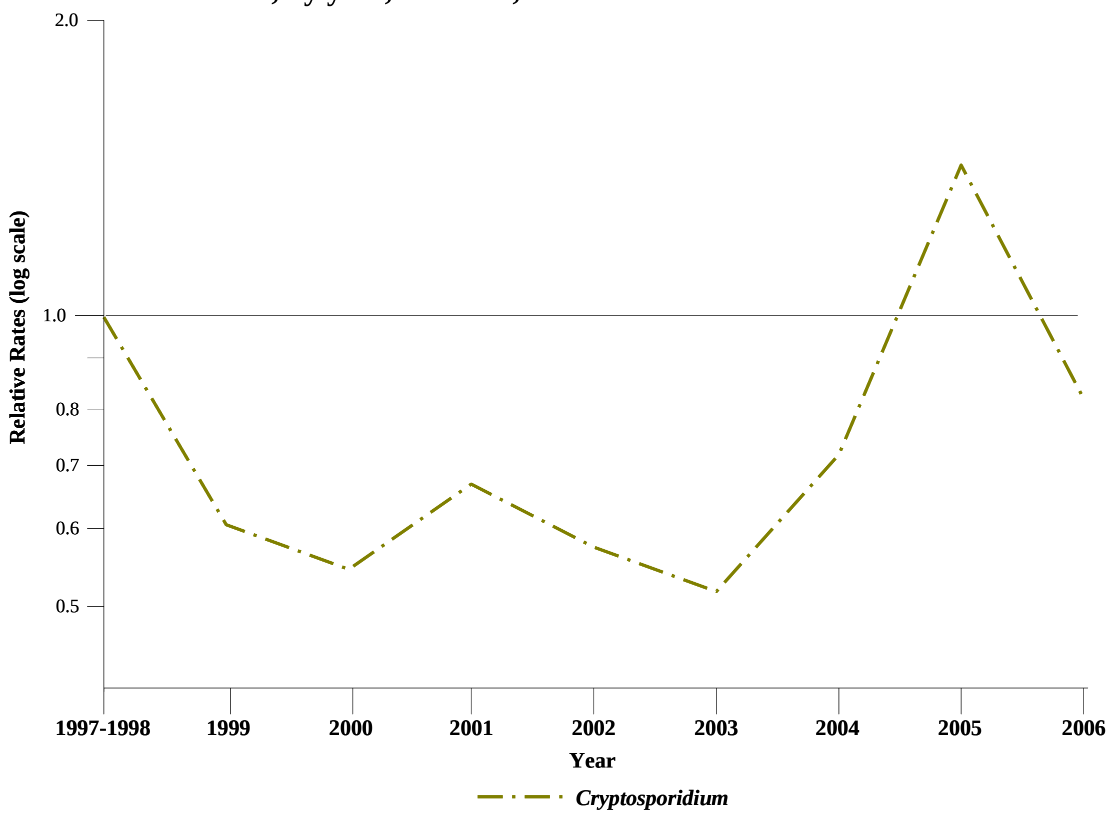
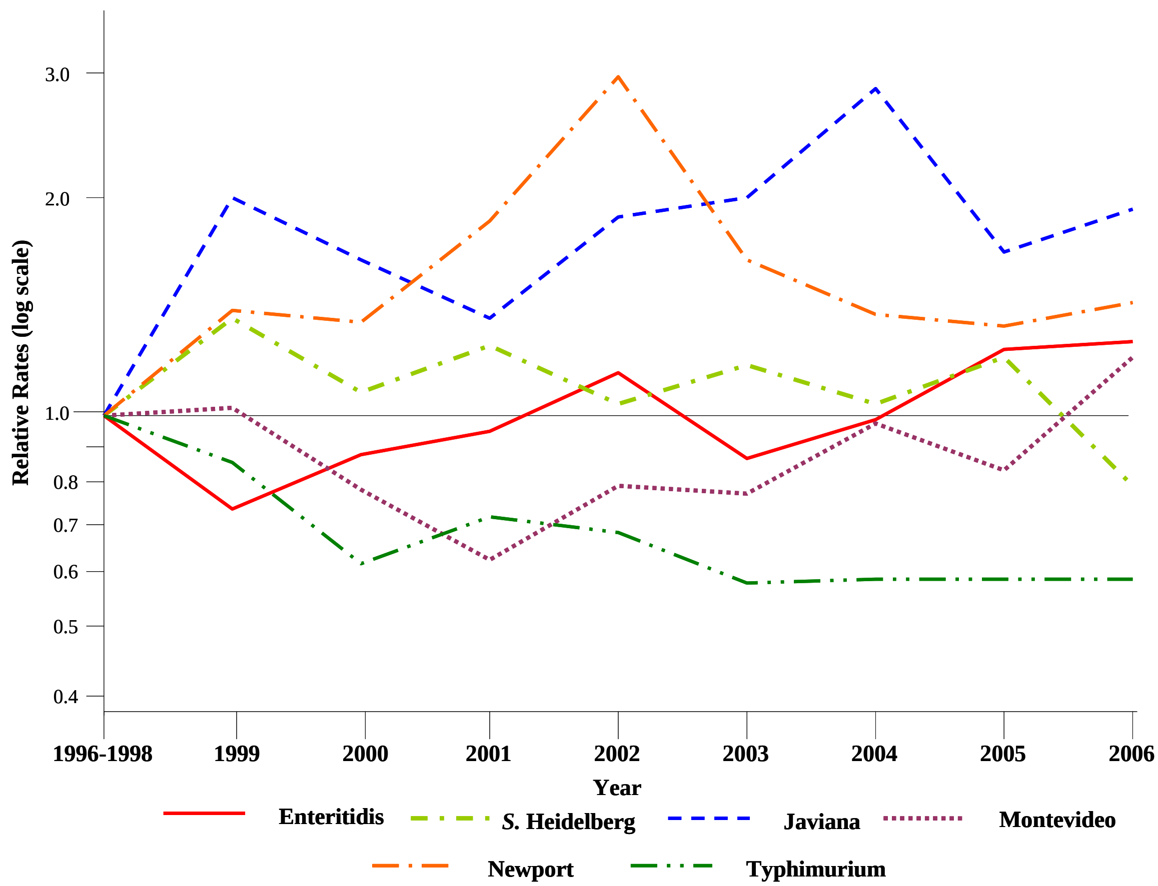


Table 13. Percent change in incidence* of laboratory-confirmed infections with selected *Salmonella* serotypes under surveillance in FoodNet, by serotype, 2006 compared with 1996-1998

Serotype	Change	95% confidence interval
Enteritidis	27%	4% to 56%
Heidelberg	20%	36% to 0%
Javiana	94%	23% to 205%
Montevideo	21%	-14% to 70%
Newport	44%	9% to 90%
Typhimurium	-41%	-48% to -33%

*Cases per 100,000 population.

Figure 6. Relative rates of laboratory-confirmed infections with selected *Salmonella* serotypes compared with 1996-1998 rates, by year, FoodNet, 1996-2006



Hemolytic Uremic Syndrome Surveillance

Hemolytic uremic syndrome (HUS) is a life-threatening illness characterized by microangiopathic hemolytic anemia, thrombocytopenia, and acute renal failure. Most cases of HUS in the United States are preceded by diarrhea due to infection with STEC. STEC O157 is the most frequently isolated STEC among HUS cases, but other serotypes can also cause HUS.

Data from HUS surveillance are reported one year later than data from FoodNet Active Surveillance because of the time required for review of medical records and hospital discharge data for HUS cases.

Cases Reported, 2005

In 2005, FoodNet ascertained 86 HUS cases, including 72 (84%) post-diarrheal cases. Among post-diarrheal HUS cases, 3 (4%) persons died. Sixty-seven (93%) pediatric (in persons less than 18 years of age) post-diarrheal HUS cases were reported; among these, 44 (61%) cases were in children less than five years of age. Sixty-four percent of HUS cases were diagnosed from June through September.

Results, 1997-2005

A total of 653 HUS cases were reported from 1997 through 2005; 572 (88%) of these cases were post-diarrheal (Table 14). Most post-diarrheal HUS cases were in females (57%), and the median age of patients was five years. Ninety-six percent of the cases were hospitalized, with a median length of hospitalization of 12 days.

Stool specimens were obtained from 546 (95%) post-diarrheal HUS cases; 516 (95%) were cultured for STEC O157, and STEC O157 was isolated from 288 (56%) stools. Only 214 (39%) stool specimens were tested for Shiga toxin and, of these, 144 (67%) tested positive for the presence of Shiga toxin. Stool specimens from 18 (3%) post-diarrheal HUS cases were reported to have been cultured for non-O157 STEC. Non-O157 STEC were isolated from seven (39%) of these stools; two infections were caused by O111, and two were caused by O145. Three additional cases were reported in which a non-O157 STEC was identified but the O antigen was not determined (Table 15). Serum samples from 48 post-diarrheal cases were tested for antibodies to O157, O111 or O26 lipopolysaccharide (LPS). Fifteen (31%) cases had antibodies to O157 LPS and none had antibodies to O111 LPS or O26 LPS.

Table 14. Summary of post-diarrheal HUS cases, FoodNet, 1997-2005

Number of post-diarrheal HUS cases	572
Median Age, years (age range)	4.5 (0-87)
Percent female	57%
Median Hospitalization (days)	12 days
Deaths (%)	38 (7)

Table 15. Results of microbiologic testing for STEC infection among post-diarrheal HUS cases, FoodNet, 1997–2005

Stool specimen obtained / Total patients	546/572	95%
Stool cultured for *E. coli* O157 / Patients with stool specimen obtained	516/546	95%
E. coli O157 isolated from stool / Patients with stool cultured for *E. coli* O157	288/516	56%
Stool tested for Shiga toxin / Patients with stool specimen obtained	214/546	39%
Stool Shiga toxin-positive / Patients with stool tested for Shiga toxin	144/214	67%
Stool cultured for non-O157 STEC / Patients with stool Shiga toxin-positive	18/144	13%
Non-O157 STEC isolated from stool / Patients with stool cultured for non-O157 STEC	7/18	39%
Stool yielding *E. coli* O157, non-O157 STEC and/or Shiga toxin + / Total patients with stool cultured for Shiga toxin-producing *E. coli*	302/516	59%

Pediatric HUS, 1997-2005

FoodNet identified 457 (80%) post-diarrheal HUS cases in children less than 18 years of age. The overall incidence rate was 0.62 per 100,000 population and was highest in children under five years of age (1.52 per 100,000 population) (Table 16).

Hospital discharge data review was used to validate pediatric HUS diagnoses and to identify additional HUS cases. Between 2000 and 2005, 41% of the post-diarrheal pediatric HUS cases reported to FoodNet were identified through active surveillance alone, 12% were identified through hospital discharge data review alone, and 43% were identified by both active surveillance and hospital discharge data review (Table 17).

HUS surveillance can be used to corroborate incidence patterns of STEC O157 seen in FoodNet. A comparison of the crude incidence of pediatric STEC O157 and pediatric HUS cases is seen in Figure 7. Overall, the crude incidence rates of pediatric STEC O157 infection and HUS demonstrate a general correlation in trends.

Table 16. Number and incidence rate* of pediatric post-diarrheal HUS cases, by site and age group, FoodNet, 1997-2005

	Age <5 years		**Age 5-14 years**		**Age 15-17 years**		**Total**	
State	Cases	Rate	Cases	Rate	Cases	Rate	Cases	Rate
CA	21	1.29	14	0.43	0	0.00	35	0.61
CO†	16	1.74	7	0.41	1	0.20	24	0.77
CT	22	1.16	17	0.41	2	0.16	41	0.56
GA	39	0.77	13	0.13	2	0.07	54	0.30
MD†	18	0.81	13	0.27	0	0.00	31	0.37
MN	72	2.43	38	0.59	1	0.05	111	0.97
NM†	1	0.36	0	0.00	0	0.00	1	0.10
NY†	26	1.91	10	0.32	3	0.30	39	0.71
OR	57	2.84	14	0.33	1	0.08	72	0.95
TN†	33	1.87	15	0.42	1	0.09	49	0.76
Total	305	1.52	141	0.34	11	0.09	457	0.62

*Cases per 100,000 population.

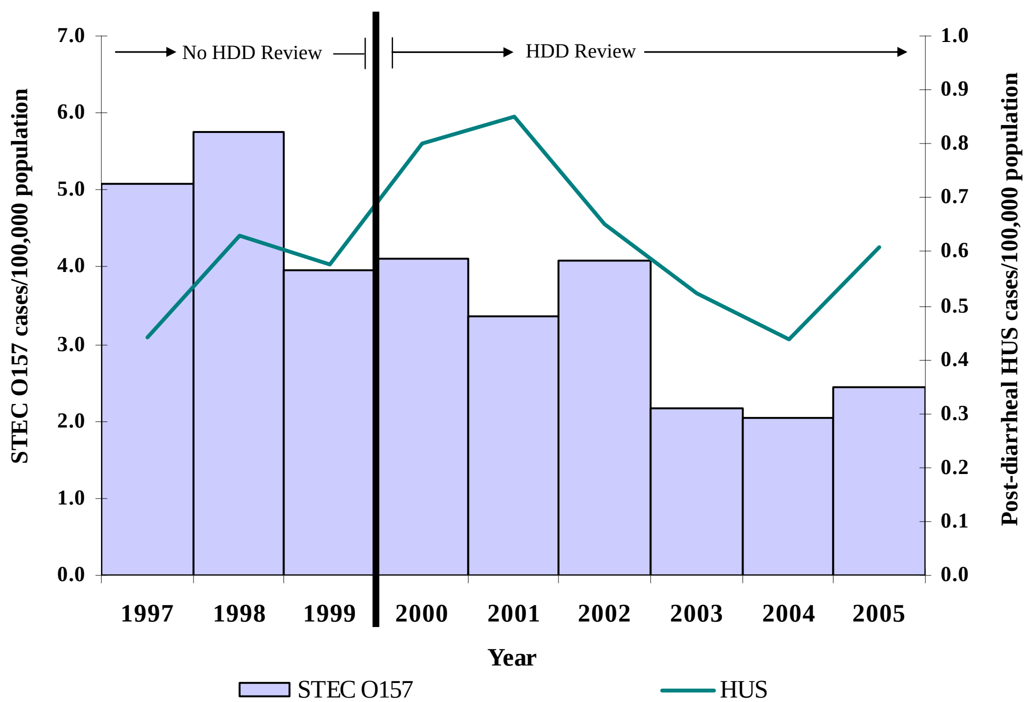
†HUS surveillance started in CO in 2001, MD in 1999, NM in 2004, and TN in 2000.

Table 17. Method of identification of post-diarrheal pediatric HUS cases, by year, FoodNet, 2000-2005

	2000		2001		2002		2003		2004*		2005*		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Active Surveillance Only	26	42	42	56	30	48	18	33	16	33	19	28	151	41
Hospital Discharge Data Only (HDD)	10	16	8	11	6	10	7	13	3	6	10	15	44	12
Active and HDD	15	24	24	32	26	42	26	48	29	60	37	56	157	43
Unknown	11	18	1	1	0	0	3	6	0	0	0	0	15	4
Total cases	62		75		62		54		48		66		367	

*NM is excluded because they do not conduct hospital discharge data review.

Figure 7. Comparison of pediatric incidence rates of STEC O157 and HUS, FoodNet, 1997-2005



Discussion

STEC

After substantial declines in 2003 and 2004, the incidence of STEC O157 infections increased in 2005 (*2*) and again in 2006. The earlier decline in incidence was temporally associated with the implementation of measures by the U.S. Department of Agriculture's Food Safety and Inspection Service (USDA-FSIS) and the beef-processing industry to reduce the contamination of ground beef. These measures were accompanied by a decline in the frequency of isolation of STEC O157 from ground beef in 2003 and 2004 (*3*). In 2005 and 2006, however, the frequency of isolation of STEC O157 from ground beef remained similar to 2004. Reasons for the increases in human STEC O157 infections in 2005 and 2006 are not known. However, STEC O157 outbreaks caused by contaminated spinach and lettuce in 2006 highlight the need to more effectively prevent contamination of produce that is consumed raw (*4*). In a measure to reduce the risk of illness caused by contamination of fresh produce, the Food and Drug Administration recently published draft guidance advising processors on steps to minimize microbial food-safety hazards common to the processing of most fresh-cut fruits and vegetables (*5*).

Salmonella

Transmission of *Salmonella* to humans can occur via many vehicles, including produce, eggs, poultry and other meat, and direct contact with animals and their environments. The two outbreaks of salmonellosis associated with tomatoes in 2006 underscore the need to more effectively prevent contamination of produce that is consumed raw (*6*). Poultry is an important source of human *Salmonella* infections. USDA-FSIS reported an increase in the frequency of isolation of *Salmonella*, particularly *S.* Enteriditis, in chicken-broiler carcasses during 2000-2005 (*7,8*). The predominant *S.* Enteriditis phage type strains isolated from chickens matched those isolated from persons in a FoodNet case-control study who reported eating chicken (*5,9*), suggesting that chicken is an important source of human *S.* Enteriditis infections. In early 2006, USDA-FSIS launched an initiative to reduce *Salmonella* in poultry and other meat (*10*). A USDA-FSIS testing

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2 CDC. Preliminary FoodNet data on the incidence of infection with pathogens transmitted commonly through food—10 states, United States, 2005. *MMWR* 2006;55:392–5.
3 Naugle AL, Holt KG, Levine P, Eckel R. Sustained decrease in the rate of *Escherichia coli* O157:H7-positive raw ground beef samples tested by the Food Safety and Inspection Service. *J Food Prot*. 2006;69:480–1.
4 CDC. Ongoing Multistate Outbreak of *Escherichia coli* serotype O157-H7 Infections Associated with Consumption of Fresh Spinach---United States, September 2006. *MMWR* 2006;55(38):1045-1046.
5 U.S. Food and Drug Administration. Draft final guidance for industry: guide to minimize food safety hazards for fresh-cut fruits and vegetables. *Fed Regist*. 2007;72:11364–8. U.S. Food and Drug Administration Web site. http://www.cfsan.fda.gov/~dms/prodgui3.html.
6 CDC. Multistate Outbreaks of Salmonella Infections Associated with Raw Tomatoes Eaten in Restaurants---United States, 2005---2006. *MMWR* 2007; 56(35): 909-911.
7 Altekruse SF, Bauer N, Chanlongbutra A, et al. *Salmonella* Enteritidis in broiler chickens, United States, 2000–2005. *Emerg Infect Dis*. 2006;12:1848–52.
8 Progress report on *Salmonella* testing of raw meat and poultry products, 1998–2006. Washington, DC: U.S. Department of Agriculture; 2007. U.S. Department of Agriculture, Food Safety and Inspection Service Web site. http://www.fsis.usda.gov/science/progress_report_salmonella_testing/index.asp.
9 Marcus R, Varma JK, Medus C, et al. Re-assessment of risk factors for sporadic *Salmonella* serotype Enteritidis infections: a case-control study in five FoodNet sites, 2002–2003*. Epidemiol Infect*. 2007;135:84–92.
10 U.S. Department of Agriculture, Food Safety and Inspection Service. *Salmonella* verification sample result reporting: agency policy and use in public health protection. *Fed Regist*. 2006;71:9772–7. U.S. Department of Agriculture, Food Safety and Inspection Service Web site.

program found a lower percentage of chickens that tested positive for *Salmonella* in 2006 than in any other year from 2001-2006 (*6*).

Vibrio

The incidence of *Vibrio* infection has increased to the highest level since FoodNet began conducting surveillance in 1996. These infections are most often associated with the consumption of raw seafood, particularly oysters, which suggested that additional measures to reduce contamination of seafood may be warranted. Consumers, especially persons who are immunocompromised, should be informed that they are at increased risk for *Vibrio* infections when they consume raw seafood.

National health objectives

Much remains to be done to reach the national health objectives for foodborne illnesses. Enhanced measures are needed to control pathogens in animals and plants; to reduce or prevent contamination during growing, harvesting, and processing; and to educate consumers more effectively about risks and prevention measures. Such measures can be better focused when the source of human infections (i.e., animal reservoir species and transmission route) is known. In particular, further research is needed to understand how contamination of fresh produce occurs, so that new measures to reduce such contamination can be developed and implemented.

How consumers can reduce risk

Consumers can reduce their risk for foodborne illness by following safe food-handling recommendations and by avoiding consumption of unpasteurized milk, raw or undercooked oysters, raw or undercooked eggs, raw or undercooked ground beef, and undercooked poultry. The risk for foodborne illness also can be decreased by choosing in-shell pasteurized eggs, irradiated ground meat, and high-pressure-treated oysters.

http://www.fsis.usda.gov/oppde/rdad/frpubs/04-026n.pdf.

Limitations

The findings in this report are subject to at least four limitations. First, FoodNet case definitions rely on laboratory diagnoses. However, many foodborne illnesses are unreported, either because ill persons do not seek medical care, or because stool cultures or other diagnostic tests are not ordered. Second, protocols for isolation of certain enteric pathogens (e.g., STEC non-O157) in clinical laboratories vary and are not uniform either within or among FoodNet sites (*11*). Both of these situations lead to an under-estimation of the true number of cases. Third, reported illnesses might have been acquired through nonfoodborne transmission: reported incidence rates do not reflect foodborne transmission exclusively. Finally, results may not be generalizable to the entire population. However, the Foodnet surveillance population is demographically similar to the United States population, except for an under-representation of Hispanics.

11 Voetsch AC, Angulo FJ, Rabatsky-Ehr T, et al. Laboratory practices for stool-specimen culture for bacterial pathogens, including *Escherichia coli* O157:H7, in the FoodNet sites, 1995–2000. *Clin Infect Dis*. 2004;38(suppl 3):S190–7.

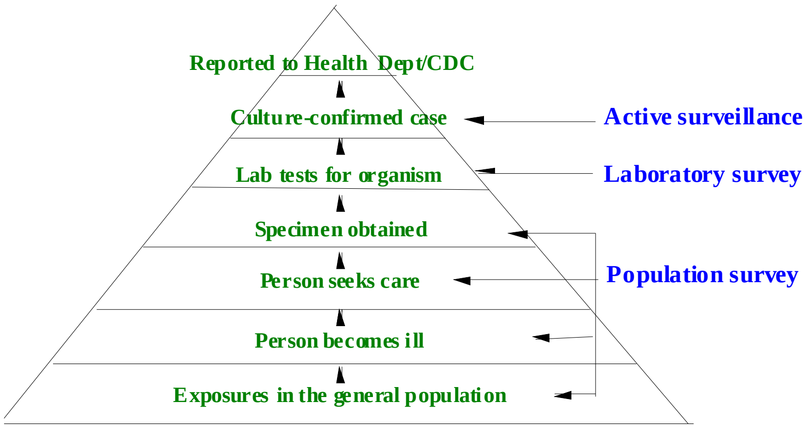
Other FoodNet Data Sources

Burden of Illness

Cases reported through active surveillance are only a fraction of the true number of cases in the community. To better estimate the number of cases of foodborne disease in the community, FoodNet conducts surveys of laboratories and the general population in the FoodNet sites (Figure 8). Using these data, we can determine the proportion of persons in the general population who experience a diarrheal illness over a given period of time, and, among those, the number who seek medical care for the illness and who submit a bacterial stool culture. We can evaluate how variations in laboratory testing for bacterial pathogens influence the number of laboratory-confirmed cases. Using FoodNet and other data, CDC estimated in 1999 that 76 million foodborne illnesses, 325,000 hospitalizations, and 5,000 deaths occurred in the United States (*12*).

This model can be used to estimate the burden of illness caused by each foodborne pathogen. For example, data from this model suggest that during 1996-1999 there were 1.4 million nontyphoidal *Salmonella* infections per year, resulting in 113,000 physician office visits and 36,242 culture-confirmed cases in this country. Laboratory-confirmed cases alone resulted in an estimated 8,500 hospitalizations and 300 deaths; additional hospitalizations and deaths occur among persons whose illness is not laboratory diagnosed (*13*).

Figure 8. Burden of illness pyramid



12 Mead P, Slutsker L, Dietz V, et al. Food-related illness and death in the United States. *Emerg Infect Dis*. 1999;5:607–25.
13 Voetsch A, Van Gilder T, Angulo F, et al. FoodNet estimate of burden of illness caused by nontyphoidal *Salmonella* infection in the United States. *Clin Infect Dis.* 2004;38(3):S127–134.

Routes of Transmission of Foodborne Pathogens

FoodNet conducts case-control studies to determine the proportion of foodborne diseases that are associated with consumption of specific foods or are related to specific food preparation and handling practices. To date, FoodNet has conducted case-control studies of STEC O157; *Salmonella* serotypes Enteritidis, Heidelberg, Newport, and Typhimurium; *Campylobacter*; *Cryptosporidium*; and *Listeria* infection as well as infant *Salmonella* and *Campylobacter* infections. By determining the contribution to foodborne disease of specific foods or food preparation and handling practices, prevention efforts can be designed and targeted appropriately.

Other FoodNet Activities in 2006

- Successfully incorporated TN NEDSS data into the FoodNet active surveillance data
- Developed prospective cohort study to provide an estimate of the association between antibiotic exposure and HUS among persons infected with STEC O157. Other putative risk factors and predictors of HUS will be evaluated including other therapies, the microbiologic characteristics of infecting *E. coli* O157 strains, and host factors. The study is set to begin in 2006.
- Burden working group prepared two papers on the FoodNet Population Survey: a paper comparing the burden of diarrheal illness across the four cycles of the population survey and a paper examining the factors associated with seeking medical care and submitting a stool sample.
- Completed the *Shigella* risk factors study. All sites interviewed *Shigella* cases to collect risk factor information over a 12-month period. This data was incorporated into the FoodNet active surveillance data.
- Identify potential data sources to validate 'multipliers' for burden of illness calculations from the population survey.
- Continued prospective and retrospective linking of FoodNet and NARMS data.
- Linked HUS surveillance data with STEC active surveillance data 1996-2004.
- Drafted questionnaire for the 5th cycle of the population survey and submitted protocol to Internal Review Board (IRB). Projected launch date is April 2006.
- Manuscript in preparation for the Food Safety in Nursing Homes survey.
- Manuscript in preparation for the *Campylobacter* laboratory survey.
- Protocol submitted to IRB for the *Salmonella* Javiana case-control study.
- Initiated study of the adverse human health consequences of antimicrobial resistant enteric infections. Study scheduled to launch in 2006.
- Continued international collaboration to describe the burden and causes of foodborne diseases. The International Collaboration on Eneric Disease Burden of Illness annual meeting was held in Madrid, Spain in June 2005. Next meeting will take place in Atlanta, GA, in March 2006.

Publications and Abstracts, 2006

A list of FoodNet publications and presentations is also available at the following FoodNet Web site: http://www.cdc.gov/foodnet/pub.htm

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1. Collignon P, Angulo FJ. Fluoroquinolone-Resistant *Escherichia coli*: Food for Thought. *Am J Infect Dis.*2006;194:8–10.

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Further information concerning FoodNet, including previous surveillance reports, *MMWR* articles, and other FoodNet publications, can be obtained by contacting the Enteric Diseases Epidemiology Branch at (404) 639-2206.

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Additional FoodNet publications and presentations are available at:
http://www.cdc.gov/enterics/publications_search.html

Additional information about the pathogens under FoodNet surveillance are available at:
http://www.cdc.gov/foodnet/surveillance_pages/pathogens_conditions.htm
http://www.cdc.gov/ncidod/dbmd/diseaseinfo/foodborneinfections_g.htm

FoodNet Working Group, 2006

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