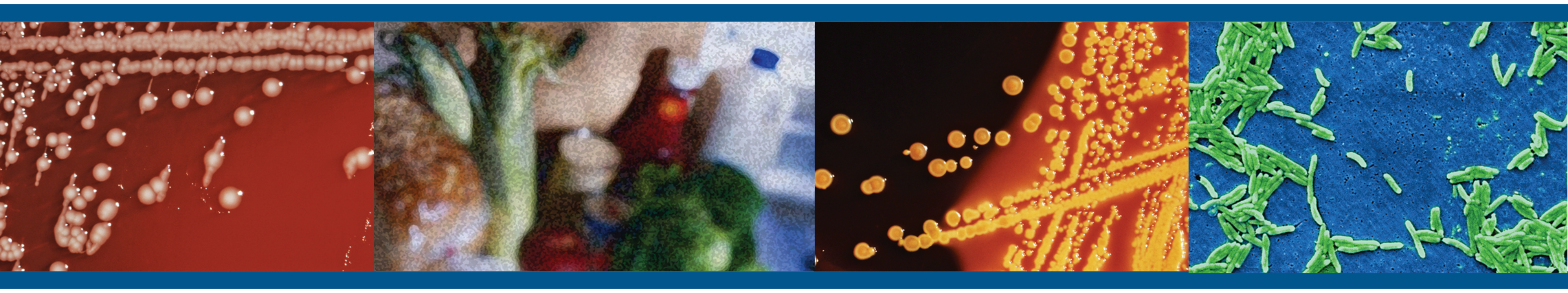
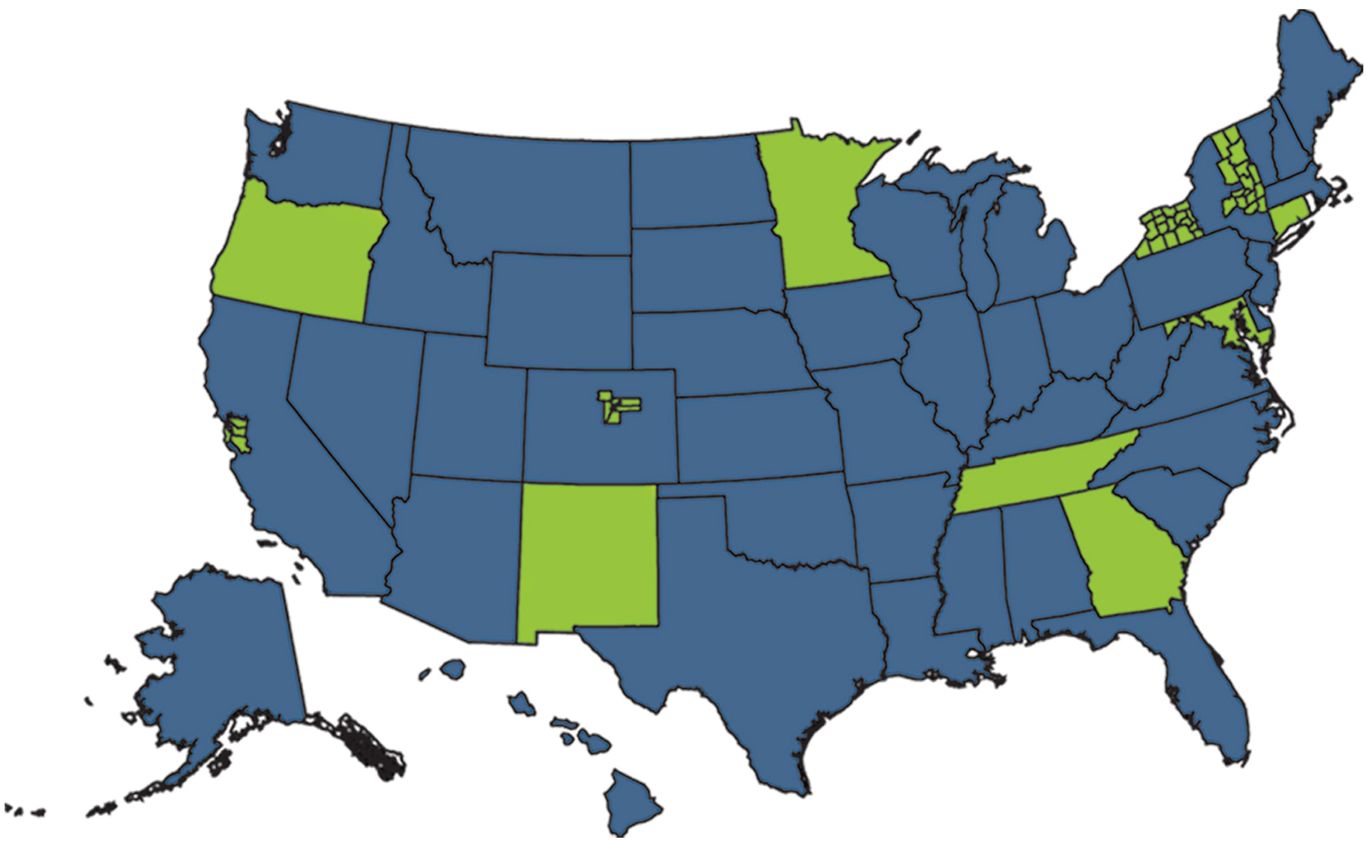
FoodNet Surveillance Report
2005





Foodborne Diseases Active Surveillance Network (FoodNet)
CDC's Emerging Infections Program

Centers for Disease Control and Prevention
Enteric Diseases Epidemiology Branch
Division of Foodborne, Bacterial, and Mycotic Diseases
National Center for Zoonotic, Vectorborne, and Enteric Diseases

The following persons from the FoodNet Team of the Enteric Diseases Epidemiology Branch contributed substantially to compiling this report:

Cherie Long, MPH
Anurag Jain, MS
Liane Ong, MPH
Mary Patrick, MPH
Ida Rosenblum, MPH
Hannah Gould, PhD
Olga Henao, PhD
Elaine Scallan, PhD

Suggested Citation:

CDC. Foodborne Diseases Active Surveillance Network (FoodNet): FoodNet Surveillance Final Report for 2005. Atlanta, Georgia: U.S. Department of Health and Human Services, CDC, 2008.

Table of Contents

Page

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 a sentinel network producing stable and accurate national estimates of the burden and sources of foodborne diseases in the United States through active surveillance and additional studies. Enhanced surveillance and investigation are integral parts of developing and evaluating new prevention and control strategies that can improve the safety of our food and the public's health.

In 2005, the FoodNet surveillance area included 44.9 million persons, which is 15.2% of the United States population. FoodNet ascertained demographic and clinical outcome information on 16,708 laboratory-confirmed infections of *Campylobacter*, *Cryptosporidium*, *Cyclospora*, Shiga toxin-producing *E. coli* (STEC) O157, *Listeria*, *Salmonella*, *Shigella*, *Vibrio* and *Yersinia*. Most infections were due to *Salmonella* (42%) or *Campylobacter* (37%). Infections were equally distributed between genders and the highest incidence occurred among children <1 year of age (163 cases/100,000 persons). Twenty-one percent of persons were hospitalized and 66 (0.4%) died; most deaths were in persons with *Salmonella* infection. Seven percent of cases were related to outbreaks; of these, 26% were associated with foodborne outbreaks. A history of international travel in the 7 days before illness began was obtained for *Salmonella* and STEC O157 cases; 13% of *Salmonella* infections and 3% STEC O157 infections were related to international travel.

Between 1996 and 2005 there were significant declines in the incidence of infections caused by *Campylobacter*, *Listeria*, *Salmonella*, *Shigella*, STEC O157, and *Yersinia*. Only one of the five most common *Salmonella* serotypes, Typhimurium, significantly declined. In contrast, there were significant increases in the incidence of *Salmonella* serotype Enteritidis and Javiana infections.

In 2004, FoodNet ascertained 56 cases of hemolytic uremic syndrome. The decline in the incidence of STEC O157 infections between 2002 and 2004 was mirrored by a decline in the incidence of pediatric diarrhea-associated HUS cases.

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 meet 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 that are usually foodborne. The Foodborne Diseases Active Surveillance Network (FoodNet) has been instrumental in accomplishing this mission.

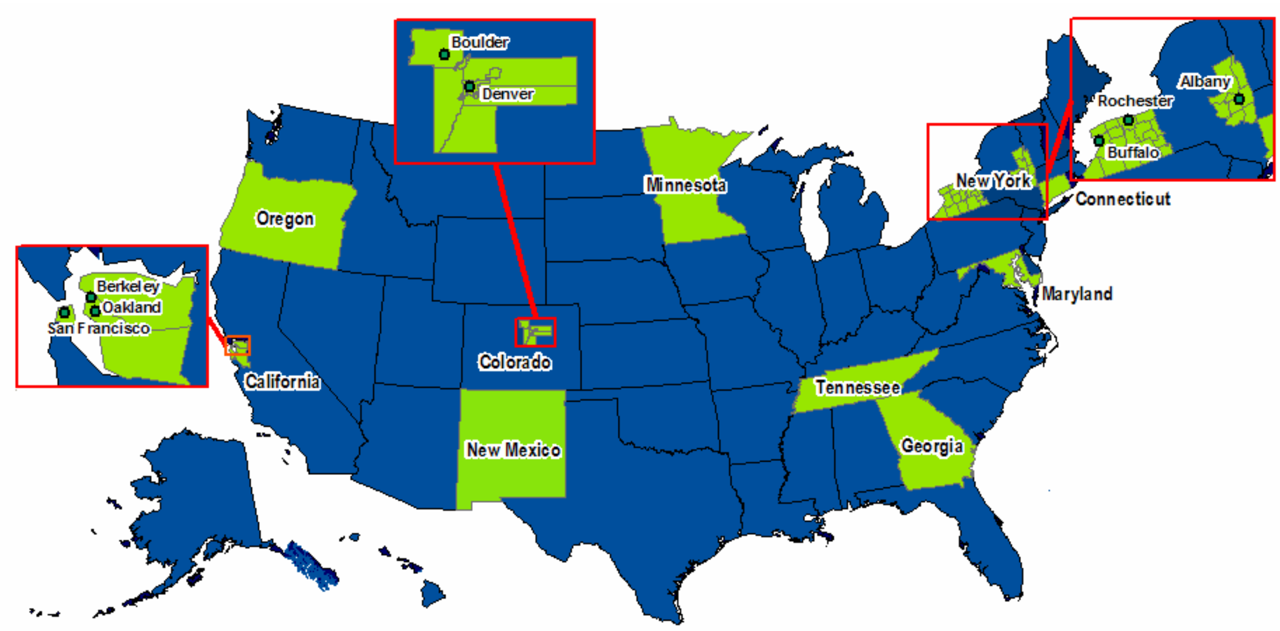
Objectives

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 address these objectives, FoodNet uses active surveillance and conducts related epidemiologic studies. By monitoring the burden of foodborne diseases over time and attributing foodborne disease to specific sources, FoodNet can document 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 to conduct population-based active surveillance in five sites; Minnesota, Oregon, and selected counties in California, Connecticut, and Georgia. By 2005 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 2005 included 44.9 million persons, which is 15.2% of the United States population (Table 1).

Figure 1. FoodNet surveillance sites, 2005



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. Population under FoodNet surveillance, 2005

FoodNet Site	Population	%
California	3,206,118	7.1
Colorado	2,586,568	5.8
Connecticut	3,510,297	7.8
Georgia	9,072,576	20.2
Maryland	5,600,388	12.5
Minnesota	5,132,799	11.4
New Mexico	1,928,384	4.3
New York	4,307,911	9.6
Oregon	3,641,056	8.1
Tennessee	5,962,959	13.3
Total	44,949,056	
FoodNet population as % of U.S. population		15.2

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, *Shigella*, *Vibrio*, and *Yersinia* infections in residents of the FoodNet surveillance area. A case was 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 each case. To identify cases, FoodNet personnel communicated with each of the 679 clinical laboratories serving the surveillance area either weekly or monthly, depending on laboratory volume. FoodNet also conducts surveillance for foodborne disease outbreaks and hemolytic uremic syndrome (HUS), the latter principally through reports from pediatric nephrologists.

The number of FoodNet sites has doubled and the population under surveillance has more than tripled since FoodNet began in 1996 (Table 2). Because of substantial variation in incidence among the sites, adding new sites 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) was used to estimate statistically significant changes in the incidence of pathogens over time (*1*). To create a baseline period, an average annual incidence for the FoodNet surveillance period of 1996-1998 was calculated (1997-1998 for *Cryptosporidium*). The estimated change in incidence (relative rate) between the baseline period and 2005 was calculated, along with a 95% confidence interval (CI). This three-year baseline, which differs from the 1996 baseline used in previous reports, resulted in more stable and precise relative rate estimates (Figures 5A to 5E). The relative change in incidence between the three-year baseline and 2005 was estimated and confidence intervals for those changes were calculated.

---

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 2. Population under surveillance, by site, FoodNet 1996-2005

FoodNet Site	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
California	2,087,032	2,113,195	2,142,806	2,162,359	3,180,738	3,221,324	3,214,243	3,209,437	3,202,895	3,206,118
Colorado	-	-	-	-	-	2,152,966	2,500,859	2,524,797	2,552,607	2,586,568
Connecticut	1,622,809	2,453,483	**3,272,563**	**3,282,031**	**3,412,263**	**3,432,463**	**3,458,382**	**3,485,881**	**3,498,966**	**3,510,297**
Georgia	2,720,443	3,632,206	3,744,022	**7,788,240**	**8,230,155**	**8,415,600**	**8,581,731**	**8,746,849**	**8,918,129**	**9,072,576**
Maryland	-	-	2,441,279	2,450,566	2,516,621	4,247,991	**5,442,268**	**5,512,477**	**5,561,332**	**5,600,388**
Minnesota	**4,647,723**	**4,687,726**	**4,726,411**	**4,775,508**	**4,933,756**	**4,984,621**	**5,023,526**	**5,061,662**	**5,096,546**	**5,132,799**
New Mexico	-	-	-	-	-	-	-	-	**1,903,006**	**1,928,384**
New York	-	-	1,105,062	2,084,453	2,111,112	2,113,130	3,322,606	3,970,432	4,313,040	4,307,911
Oregon	**3,195,087**	**3,243,254**	**3,282,055**	**3,316,154**	**3,431,070**	**3,473,484**	**3,522,342**	**3,562,681**	**3,591,363**	**3,641,056**
Tennessee	-	-	-	-	2,825,397	2,848,922	2,871,735	5,841,585	**5,893,298**	**5,962,959**
Total	14,273,094	16,129,864	20,714,198	25,859,311	30,641,112	34,890,501	37,937,692	41,915,801	44,531,182	44,949,056
FoodNet population as % of U.S. population	5.4	6.0	7.7	9.5	10.9	12.2	13.2	14.4	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 <18 years of age) through a network of pediatric nephrologists and infection control practitioners who report all cases of HUS that they identify. FoodNet conducts passive surveillance for adult HUS cases (persons ≥18 years of age).

In 2004, FoodNet sites implemented a retrospective hospital discharge data review to validate HUS surveillance activities and identify additional HUS cases. HUS cases were identified using ICD-9 codes specifying HUS, acute renal failure with the hemolytic anemia and thrombocytopenia, or thrombotic thrombocytopenic purpura with diarrhea caused by STEC or an unknown pathogen. Hospital discharge records were reviewed from 2000 or date of site entry into FoodNet. Hospital discharge data review and validation of the diagnosis through medical record reviews can result in up to a two-year lag in reporting of HUS cases.

Part I

Narrative Report

2005 Surveillance Results

Cases reported

In 2005, FoodNet sites identified 16,708 laboratory-confirmed infections caused by the pathogens under surveillance. Of 15,317 bacterial, most (42%) were *Salmonella*, followed by *Campylobacter* (37%), *Shigella* (14%), STEC O157 (3%), *Yersinia* (1%), *Listeria* (0.89%), STEC non-O157 (0.84%), *Vibrio* (0.79%), and STEC O-antigen undetermined (0.04%) (Table 3A). Of the 1,391 cases of parasitic infections, 95% were *Cryptosporidium* and 5% were *Cyclospora* (Table 3B).

Of 6,061 (93%) *Salmonella* isolates that were serotyped, the most commonly identified serotypes were Typhimurium (1,158; 19%), Enteritidis (1,097; 18%), Newport (574; 9%), Heidelberg (367; 6%), and Javiana (321; 5%). Of 113 (93%) *Vibrio* isolates speciated, the most commonly identified species were *parahaemolyticus* (60; 53%) and *vulnificus* (16; 14%). Of the 1,957 (93%) *Shigella* isolates that were serotyped, the most commonly identified serotypes were *sonnei* (1,563; 80%) and *flexneri* (369; 19%). Of the 113 (88%) STEC non-O157 isolates for which an O antigen was determined, the most commonly identified O antigen were O26 (31; 27%), O103 (30; 27%), O111 (20; 18%), O121 (8; 7%), O45 (7; 6%).

Table 3A. Number of laboratory-confirmed infections caused by specific bacterial pathogens reported, by site, FoodNet 2005

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Total
Campylobacter	918	495	543	585	403	843	352	507	641	403	5,690
Listeria	10	2	20	25	19	15	4	18	11	12	136
Salmonella	466	341	468	1,928	791	579	252	488	376	816	6,505
Shigella	283	101	58	668	99	96	133	66	85	506	2,095
STEC O157	28	26	43	33	27	121	10	74	66	45	473
STEC non-O157	5	4	20	8	24	35	11	11	8	2	128
STEC O Ag Undet*	0	0	0	6	0	0	0	0	0	0	6
Vibrio	24	8	13	22	25	6	1	8	9	5	121
Yersinia	29	7	15	28	7	18	2	23	16	18	163
Total	1,763	984	1,180	3,303	1,395	1,713	765	1,195	1,212	1,807	15,317

***STEC O Antigen Undetermined**

Table 3B. Number of laboratory-confirmed infections caused by specific parasitic pathogens reported, by site, FoodNet 2005

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Total
Cryptosporidium	48	24	84	154	32	166	17	708	48	45	1,326
Cyclospora	2	0	35	13	3	0	4	1	4	3	65
Total	50	24	119	167	35	166	21	709	52	48	1,391

Seasonality

The number of infections reported varied by month (Figures 2A, 2B, and 2C). Thirty-eight percent of the *Campylobacter* infections occurred from June through August, 59% of *Salmonella* infections and 65% of STEC non-O157 infections from June through October, and 62% of STEC O157 infections occurred from June through September. Fifty-five percent of *Vibrio* infections and 46% of *Listeria* infections occurred from July through September.

The number of *Cyclospora* infections peaked earlier than other FoodNet pathogens with 82% of infections occurring from May through July. While *Cryptosporidium* and *Listeria* peaked later in the year; 65% of *Cryptosporidium* infections occurred from August through September and 34% *Shigella* infections occurred from August through October.

Normally, *Yersinia* peaks in the winter months, from December through February, but in 2005 three peaks were observed: one in January, April, and August.

Figure 2A. Cases of *Campylobacter*, *Cryptosporidium*, *Salmonella*, and *Shigella*, by month, FoodNet 2005

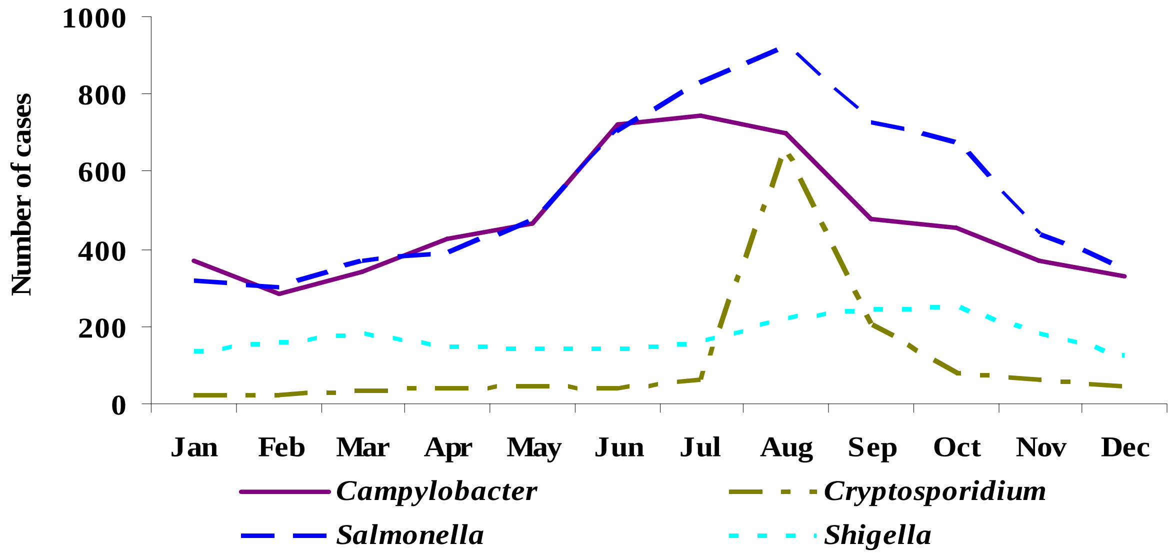


Figure 2B. Cases of STEC O157 and STEC non-O157, by month, FoodNet 2005

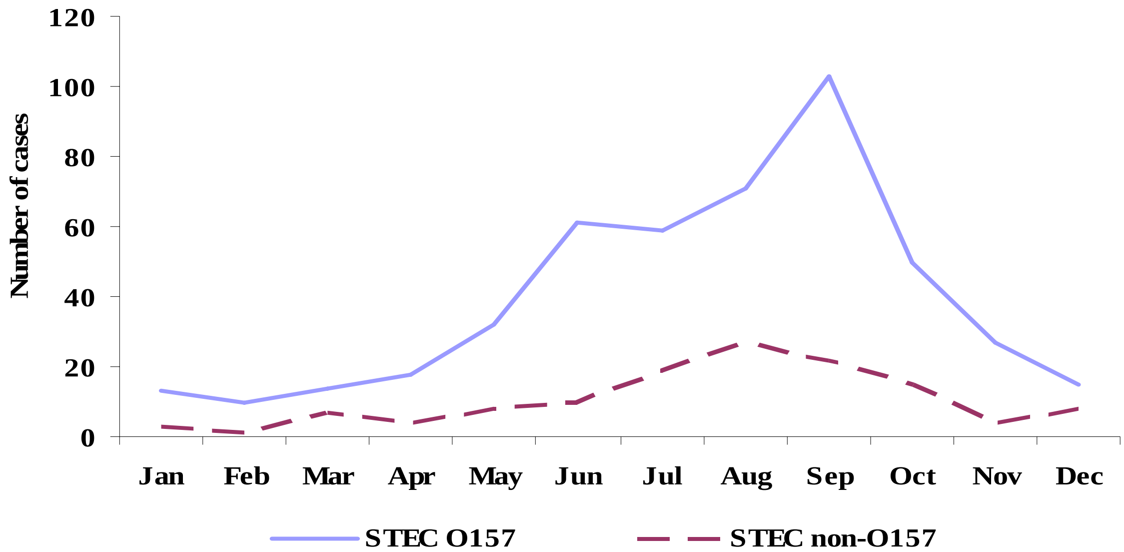
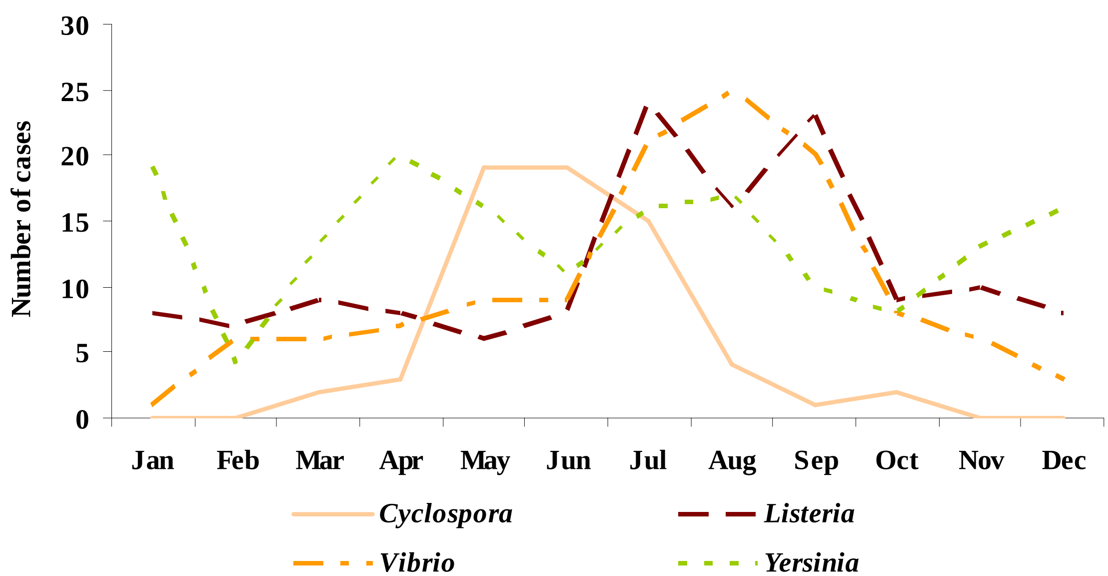


Figure 2C. Cases of *Cyclospora*, *Listeria*, *Vibrio*, and *Yersinia*, by month, FoodNet 2005



Incidence

To compare the number of laboratory-confirmed cases across sites with different populations, an incidence was calculated (the number of laboratory-confirmed cases divided by the population). The incidence reported in Tables 4A and 4B and Figures 3A, 3B, and 3C were calculated using the 2005 census population counts. The incidence of infections in 2005, ranked from highest to lowest, were *Salmonella* (14.47/100,000), *Campylobacter* (12.66/100,000), *Shigella* (4.66/100,000), *Cryptosporidium* (2.95/100,000), STEC O157 (1.05/100,000), *Yersinia* (0.36/100,000), *Listeria* (0.30/100,000), STEC non-O157 (0.28/100,000), *Vibrio* (0.27/100,000), and *Cyclospora* (0.14/100,000).

Table 4A. Incidence of laboratory-confirmed infections caused by specific bacterial pathogens reported, by site, FoodNet 2005

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Overall
Campylobacter	28.63	19.14	15.47	6.45	7.20	16.42	18.25	11.77	17.60	6.76	12.66
Listeria	0.31	0.08	0.57	0.28	0.34	0.29	0.21	0.42	0.30	0.20	0.30
Salmonella	14.53	13.18	13.33	21.25	14.12	11.28	13.07	11.33	10.33	13.68	14.47
Shigella	8.83	3.90	1.65	7.36	1.77	1.87	6.90	1.53	2.33	8.49	4.66
STEC O157	0.87	1.01	1.22	0.36	0.48	2.36	0.52	1.72	1.81	0.75	1.05
STEC non-O157	0.16	0.15	0.57	0.09	0.43	0.68	0.57	0.26	0.22	0.03	0.28
STEC O Ag Undet*	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.01
Vibrio	0.75	0.31	0.37	0.24	0.45	0.12	0.05	0.19	0.25	0.08	0.27
Yersinia	0.90	0.27	0.43	0.31	0.12	0.35	0.10	0.53	0.44	0.30	0.36

***STEC O Antigen Undetermined**

Table 4B. Incidence of laboratory-confirmed infections caused by specific parasitic pathogens reported, by site, FoodNet 2005

Pathogen	CA	CO	CT	GA	MD	MN	NM	NY	OR	TN	Overall
Cryptosporidium	1.50	0.93	2.39	1.70	0.57	3.23	0.88	16.43	1.32	0.75	2.95
Cyclospora	0.06	0.00	1.00	0.14	0.05	0.00	0.21	0.02	0.11	0.05	0.14

Figure 3A. Incidence of *Campylobacter*, *Cryptosporidium*, *Salmonella*, and *Shigella* per 100,000 population, by site, FoodNet 2005

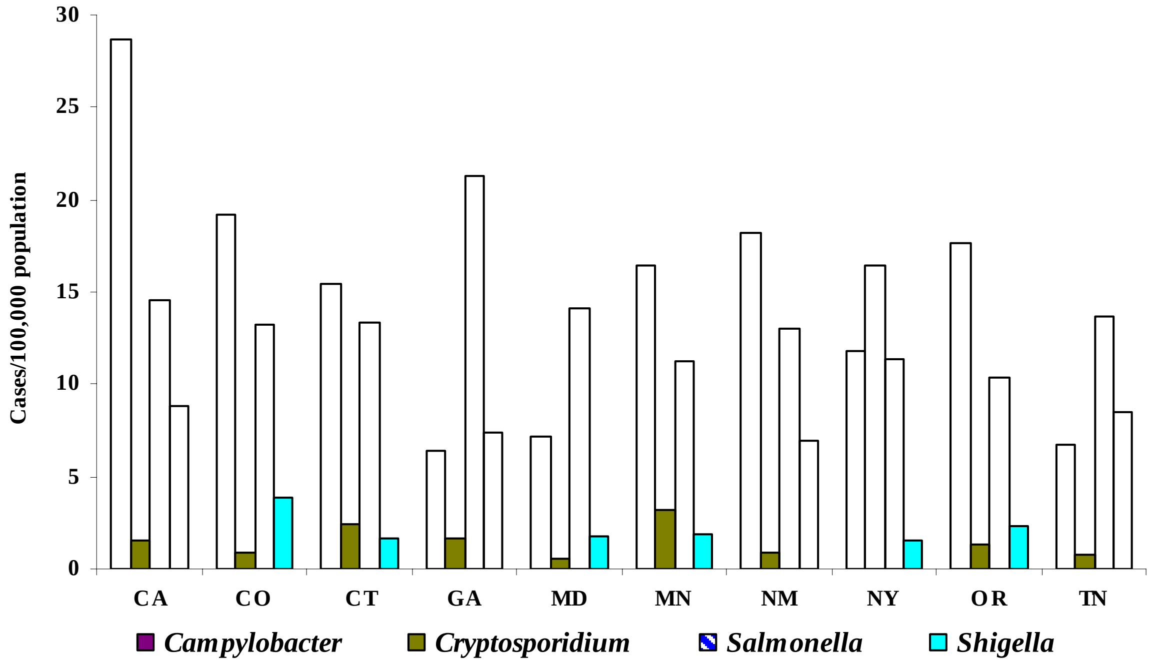


Figure 3B. Incidence of STEC O157 and STEC non-O157 per 100,000 population, by site, FoodNet 2005

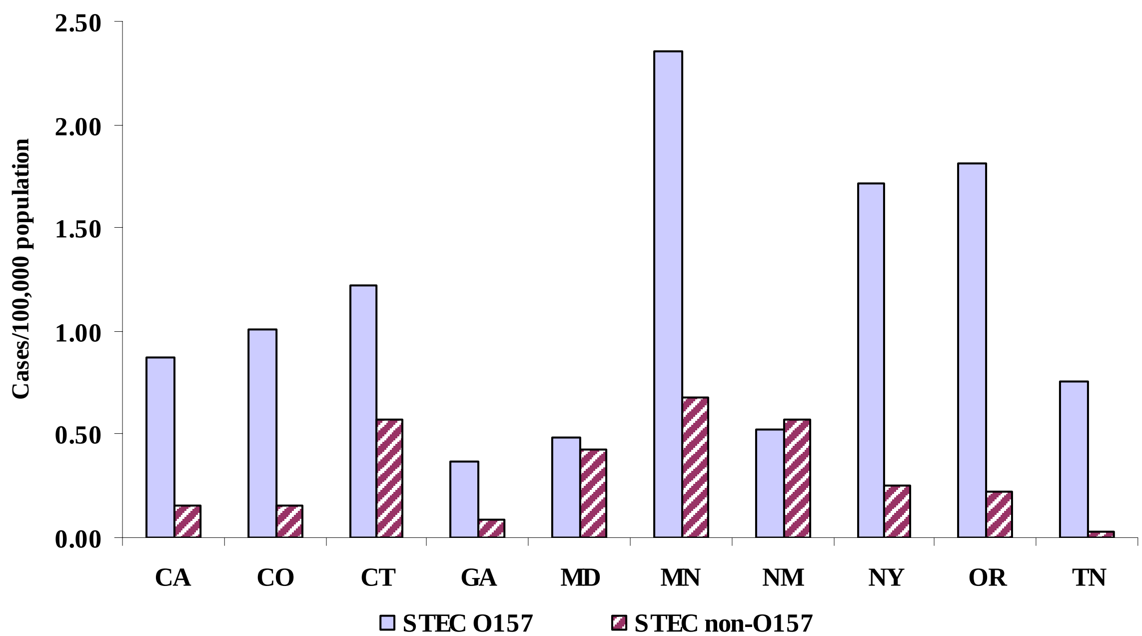
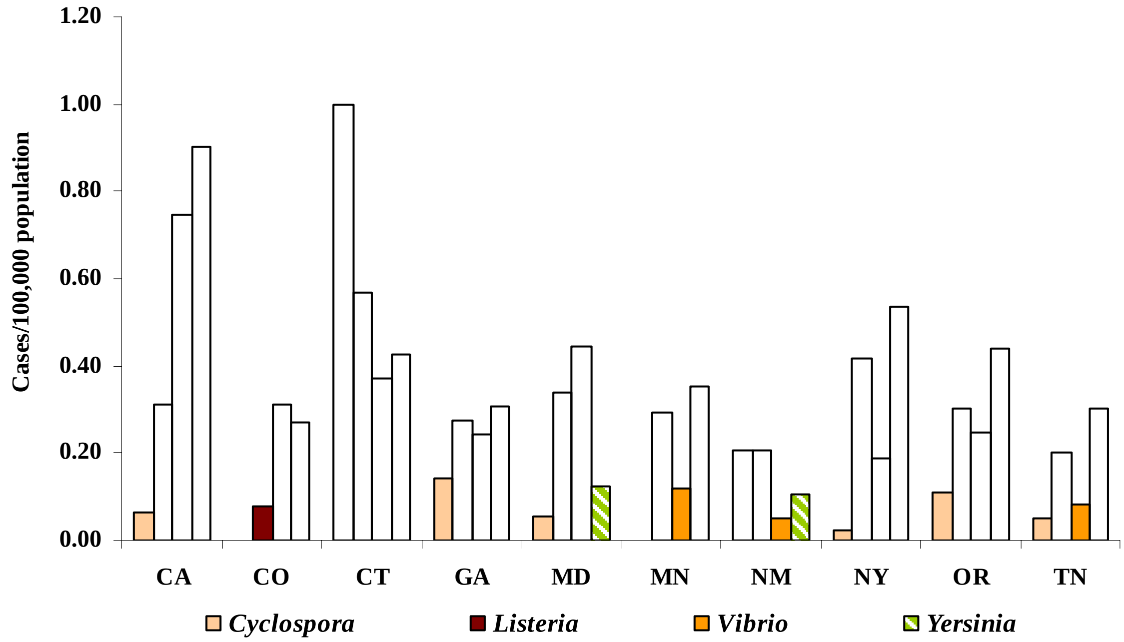


Figure 3C. Incidence of *Clyclospora*, *Listeria*, *Vibrio*, and *Yersinia* per 100,000 population, by site, FoodNet 2005



Incidence by age

The incidence of foodborne infections varied by age, especially for *Campylobacter, Cryptosporidium*, *Salmonella*, and *Shigella* (Figure 4A and 4B). The incidence of infections of *Salmonella* and *Campylobacter* were substantially higher for children <1 year of age compared to other age groups (115.49 per 100,000 versus 13.06 per 100,000 and 27.39 per 100,000 versus 12.45 per 100,000, respectively). The incidence of *Shigella* and *Cryptosporidium* infections was highest among children 1-9 years of age (19.67 per 100,000 versus 2.61 per 100,000 and 10.92 per 100,000 versus 1.88 per 100,000 respectively).

Figure 4A. Incidence of *Campylobacter* and *Salmonella* infections, by age group, FoodNet 2005

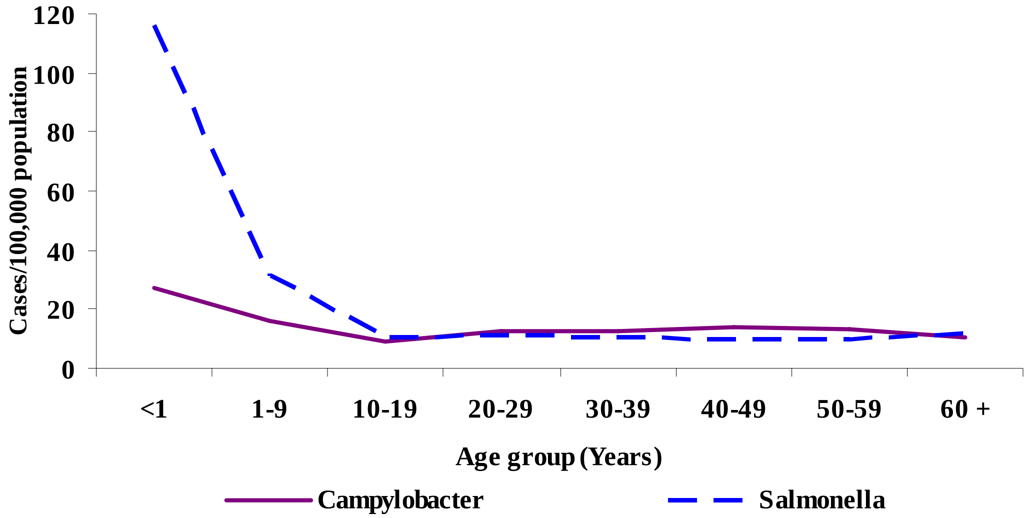
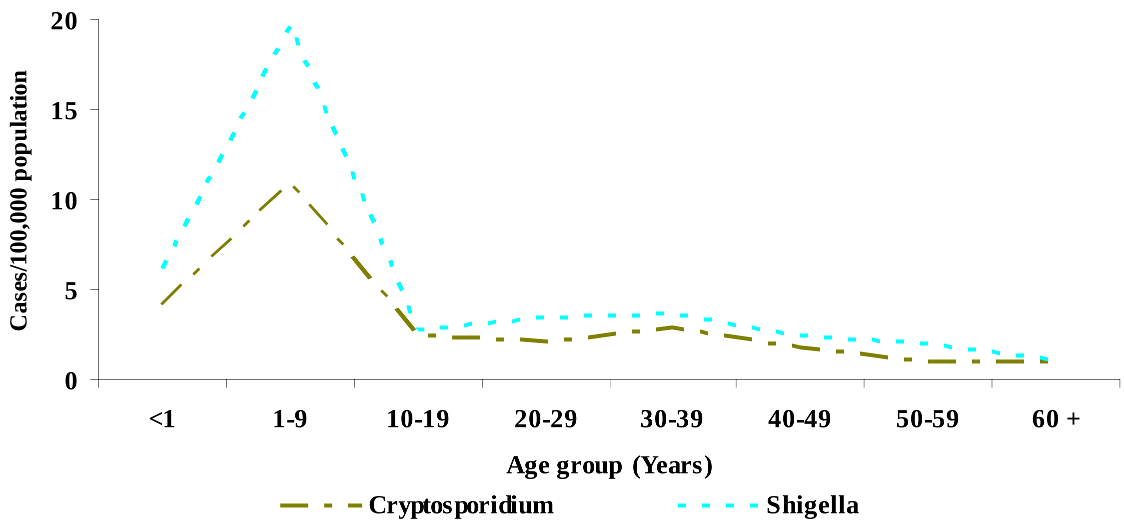


Figure 4B. Incidence of *Cryptosporidium* and *Shigella* infections, by age group, FoodNet 2005



Incidence by sex The incidence was higher in males for *Vibrio* (74% higher), *Cyclospora* (36% higher), *Campylobacter* (26% higher), *Cryptosporidium* (5% higher), and *Listeria* (3% higher), and in females for STEC non-O157 (21% higher), *Yersinia* (20% higher), STEC O157 (11% higher), and *Salmonella* (6% higher) (Table 5).

Table 5. Sex-specific incidence (per 100,000 population), by pathogen, FoodNet 2005

Pathogen	Male	Female
Campylobacter	14.14	11.20
Cryptosporidium	3.02	2.88
Cyclospora	0.17	0.12
Listeria	0.31	0.30
Salmonella	13.96	14.76
Shigella	4.52	4.56
STEC O157	1.00	1.10
Vibrio	0.34	0.20
Yersinia	0.33	0.39

Hospitalizations Hospitalization status was determined for 92% (15,288) of FoodNet cases in 2005. Overall, 21% of persons with a laboratory-confirmed infection were hospitalized; hospitalization rates differed markedly by pathogen. The percentage of persons hospitalized was highest for *Listeria* (91% of reported cases), followed by STEC O157 (41%), *Yersinia* (36%), *Vibrio* (31%), *Salmonella* (27%), *Campylobacter* (13%), *Cryptosporidium* (13%), *Shigella* (18%), STEC non-O157 (10%), and *Cyclospora* (3%).

Deaths Sixty-six persons with laboratory-confirmed infections in 2005 died; of those, 28 were infected with *Salmonella*, 16 with *Listeria*, 11 with *Vibrio*, 3 with *Shigella*, 2 with *Cryptosporidium*, 2 with STEC O157, 2 with *Yersinia*, 1 with *Campylobacter*, and 1 with STEC non-O157. *Listeria* had the highest case-fatality rate; 12% of persons infected with *Listeria* died.

International travel FoodNet obtained information on international travel in the seven days before illness onset from persons with *Salmonella* and STEC O157 infections (Table 6). Of the 406 (85%) STEC O157 cases with travel information, 3% reported international travel and of 4,072 (63%) *Salmonella* cases, 14% reported international travel.

Table 6. Frequency of international travel among persons with *Salmonella* and STEC O157 infections, by pathogen, FoodNet 2005

Pathogen	Yes No. (%)	No No. (%)	Total cases with travel No. (%)	Unknown No. (%)	Total cases reported No.
Salmonella	537 (13)	3,535 (87)	**4,072 (63)**	2,433 (37)	6,505
STEC O157	13 (3)	393 (97)	**406 (86)**	67 (14)	473

Outbreak-related cases

Seven percent of the cases reported to FoodNet were known to be outbreak related; 26% of these outbreaks were foodborne. The most common outbreak-related etiologies were *Salmonella* and STEC O157; accounting for 36% of all outbreak-related cases. Of the 473 STEC O157 cases ascertained, 107 (23%) were identified as being outbreak-related. Of these, 50% were foodborne, 43% were not food-related, and for 7% the mode of transmission was unknown. Of the 6,505 *Salmonella* cases ascertained, 296 (5%) were identified as being outbreak-related. Of these, 74% were foodborne, 21% were not food-related, and for 4% the mode of transmission was unknown.

Outbreaks can influence the number of laboratory-diagnosed infections reported. For example, the incidences for both *Cyclospora* and *Cryptosporidium* were higher in 2005 than in 2004 due to outbreaks. The 2005 incidence for *Cyclospora* was more than four times higher than the 2004 incidence due to an outbreak associated with basil in Connecticut which resulted in 30 ill persons (14 of whom were culture-confirmed). Of the 65 *Cyclospora* cases reported to FoodNet, 35 (53%) were reported by Connecticut; of which 19 (54%) were reported as part of a foodborne outbreak. The 2005 incidence for *Cryptosporidium* was more than double that reported in 2004 due to an outbreak associated with a water park in New York. Of the 1,326 *Cryptosporidium* cases reported to FoodNet, 708 (53%) were reported by New York; of which 577 (81%) were reported as outbreak-related.

Outbreaks

In 2005, FoodNet sites reported 225 outbreaks to the national electronic Foodborne Outbreak Reporting System (eFORS). Of reported outbreaks, 205 (91%) were known to be foodborne. A foodborne-disease outbreak is defined as an incident in which two or more persons experience a similar illness resulting from the ingestion of a common food. In 125 (61%) of these outbreaks the implicated food item was prepared in a restaurant or deli. An etiology was reported for 173 (84%) outbreaks (Table 7). The most common confirmed etiologies were norovirus (33%) and *Salmonella* (14%).

Table 7. Summary of foodborne outbreaks with ≥2 persons ill, by site, FoodNet 2005

Site	Outbreaks reported	Rate*	Median Number Ill	Known etiology No. (%)	Etiology (confirmed and suspected)	Known vehicle No. (%)	Restaurant-associated No. (%)
CA	21	6.55	21	20 (95)	Norovirus (6), *Salmonella* (5), *Vibrio* (2), *C. perfringens* (2), *Clostridium/Bacillus cereus* (1), Scromboid toxin (2), Other bacterial (2)	15 (71)	13 (62)
CO	13	5.03	19	12 (93)	*Salmonella* (3), *C. perfringens* (2), Norovirus (3), *Campylobacter/Bacillus cereus* (1), *Campylobacter* (2), *Shigella* (1)	12 (92)	8 (62)
CT	16	4.56	11	14 (88)	Norovirus (11), *Salmonella* (1), *Cyclospora* (1), STEC O157 (1)	9 (64)	7 (50)
GA	29	3.20	23	21 (72)	Norovirus (8), *Salmonella* (6), *Staph. aureus* (4), *C. perfringens* (1), STEC O157 (1), Other chemical (1)	23 (79)	15 (52)
MD	20	3.57	19	8 (40)	Norovirus (6), *Staph. aureus* (1), *Campylobacter* (1)	6 (33)	15 (79)
MN	39	7.60	15	43 (97)	Norovirus (28), *C. perfringens* (5), *Salmonella* (5), Scromboid toxin (1), STEC O157 (1), *Bacillus cereus* (1), Other bacterial (1), Scromboid/Other etiology (1)	29 (67)	34 (77)
NM	1	0.52	35	1 (100)	Norovirus (1)	0 (0)	0 (0)
NY	18	4.18	15	12 (75)	*Salmonella* (3), STEC O157 (2), *Vibrio* (1), Rotavirus (1), *Giardia* (1), Hepatitis A (1), Heavy metals (1)	13 (81)	6 (38)
OR	32	8.79	14	30 (98)	Norovirus (19), *Salmonella* (6) , STEC O157 (2), Scromboid toxin (1), *Bacillus cereus* /*Staph. aureus* (1), *C. perfringens* (1)	11(35)	17 (55)
TN	16	2.68	31	12 (75)	Norovirus (4), Hepatitis A (3), *Staph. aureus* (2), *Salmonella* (2), STEC O157 (1)	10 (63)	10 (63)
Total	**205**	**4.56**	**18**	**173 (84)**		**128 (63)**	**125 (61)**

*number of outbreaks reported per 1,000,000 persons

Incidence in 2005 compared with 1996-1998

Between 1996 and 2005 there were significant declines in the incidence of infections caused by *Campylobacter*, *Listeria*, *Salmonella*, *Shigella*, STEC O157, and *Yersinia* infections (Table 8A and Figures 5A and5B). The estimated incidence of *Yersinia* decreased 48% (95% CI=58% to 35% decrease), *Shigella* decreased 43% (95% CI=60% to 19% decrease), *Listeria* decreased 33% (95% CI=46% to 17% decrease), *Campylobacter* decreased 31% (95% C.I.=36% to 25% decrease), STEC O157 decreased 29% (95% CI=43% to 13% decrease), and *Salmonella* decreased 9% (95% CI=16% to 3% decrease).

The decline in *Salmonella* incidence was modest compared with other bacterial pathogens under surveillance. Comparing 2005 with the 1996-1998 baseline for the top five *Salmonella* serotypes (Table 8B), *S*. Typhimurium decreased 42% (95% CI=48% to 34% decrease), *S*. Enteritidis increased 26% (95% CI=2% to 77% increase), and *S*. Javiana increased 81% (95% CI=13% to 189% increase). There was no statistical difference between the 2005 incidence and baseline for *S*. Heidelberg and *S*. Newport.

Most of the decline in *S*. Typhimurium occurred before 2001. This observation may reflect the fact that the sources of human *Salmonella* infections are multifaceted. Food animals are the most important source of human *Salmonella* infections. Transmission of *Salmonella* to humans can occur via numerous food vehicles, including eggs, meat, poultry, and produce, and via direct contact with animals and their environments. Testing by the USDA-FSIS at slaughter and processing plants has demonstrated declines in *Salmonella* contamination of ground beef since 1998 (*2*). However, FSIS reported an increase in the percentage of broiler chicken carcasses testing positive for *Salmonella* between 2002 and 2005 and subsequently launched an initiative to reduce *Salmonella* in raw meat and poultry products (*2,3*). Although sources of infection with the most common *Salmonella* serotypes have been identified, further investigation is needed to identify sources of emerging *Salmonella* serotypes, such as *S*. Javiana and *S*. I 4,[5],12:i:-, a monophasic *S*. Typhimurium(*4*).

The largest increase in the incidence of *Vibrio* infections occurred from 1996 to 1998, and this increase was associated with the emergence of *Vibrio parahaemolyticus* O3:K65 (*5*). When comparing 2005 with 1996--1998, *Vibrio* increased 42% (95% CI=4% to 94% increase) (Figure 5D). This

---

2 US Department of Agriculture, Food Safety and Inspection Service. Progress report on *Salmonella* testing of raw meat and poultry products, 1998--2005. Washington, DC: US Department of Agriculture; 2006. Available at http://www.fsis.usda.gov/science/progress_report_salmonella_testing/index.asp.

3 US 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. Available at http://www.fsis.usda.gov/OPPDE/rdad/FRPubs/04-026N.pdf.

4 Agasan A, Kornblum J, Williams G, et al. Profile of *Salmonella enterica* subsp. *enterica* (subspecies I) serotype 4,5,12:i:- strains causing food-borne infections in New York City. J Clin Microbiol 2002;40:1924--9.

5 Daniels NA, Ray B, Easton A, et al. Emergence of new *Vibtio parahaemolyticus* serotype in raw oysters: a prevemtion quandary. JAMA 2000;284:1541—5.

increase is lower than that reported previously due to the use of the combined three-year baseline.

Comparing 2005 with 1997-1998, the incidence of *Cryptosporidium* infections increased 39% (95% CI=7% decrease to 109% increase) (Figure 5E). Although the incidence of *Cyclospora* has decreased since 1997, the statistical model could not be applied to *Cyclospora* because of the small number of cases (265 cases between 1997 and 2005).

All of these declines indicate important progress toward achieving the Healthy People 2010 objectives of reducing the incidence of several foodborne diseases by the end of the decade. In 2005, the incidences of *Campylobacter*, STEC O157, and *Listeria* approached their targets of 12.3, 1.0, and 0.25 cases per 100,000 respectively; however, the majority of this progress occurred before 2005. Most of the decline in *Campylobacter* incidence occurred in 2001, with continued small decreases since then. The incidence of *Listeria* infections in 2005 was higher than its lowest point in 2002 and most of the decline in STEC O157 incidence occurred during 2003 and 2004. In addition, the incidence of *Salmonella* infections in 2005 remained much higher than the goal of 6.8 cases per 100,000 (Table 9). This, coupled with the observed sustained increase in *Vibrio* incidence, highlights the need for continued prevention efforts.

Figure 5A. Relative rates compared with 1996-1998 baseline period of laboratory-diagnosed cases of infection with *Campylobacter, Salmonella*, and *Shigella*, by year, FoodNet 1996-2005

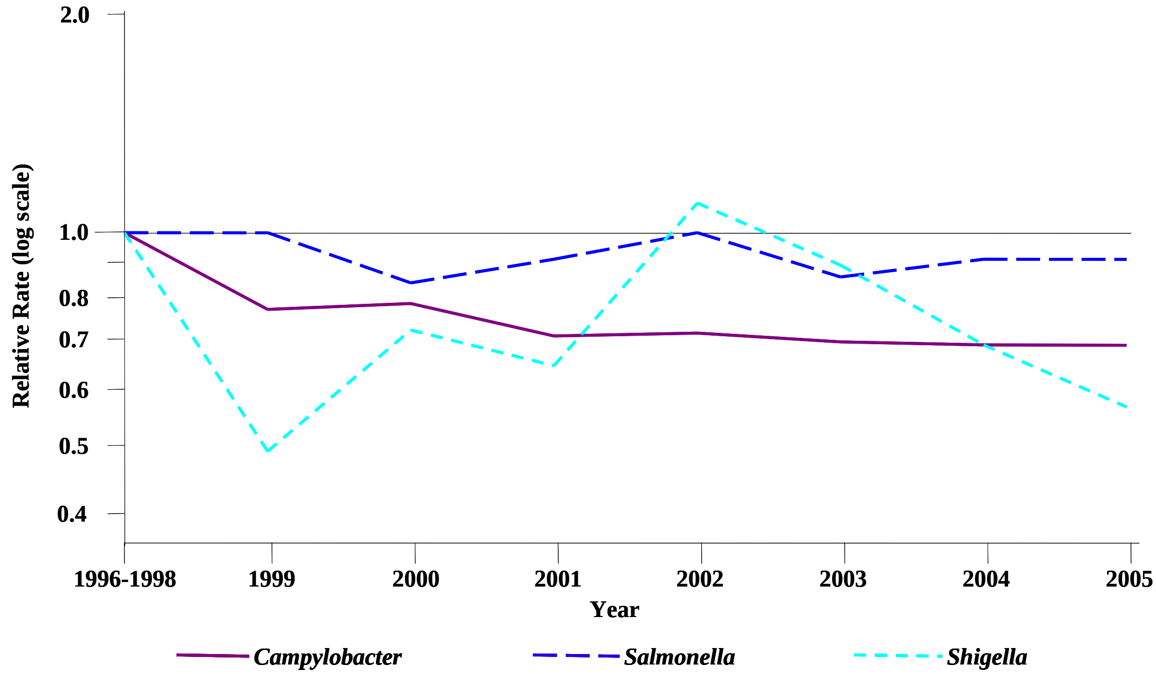


Figure 5B. Relative rates compared with 1996-1998 baseline period of laboratory-diagnosed cases of infection with *Listeria*, STEC O157, and *Yersinia*, by year, FoodNet 1996-2005

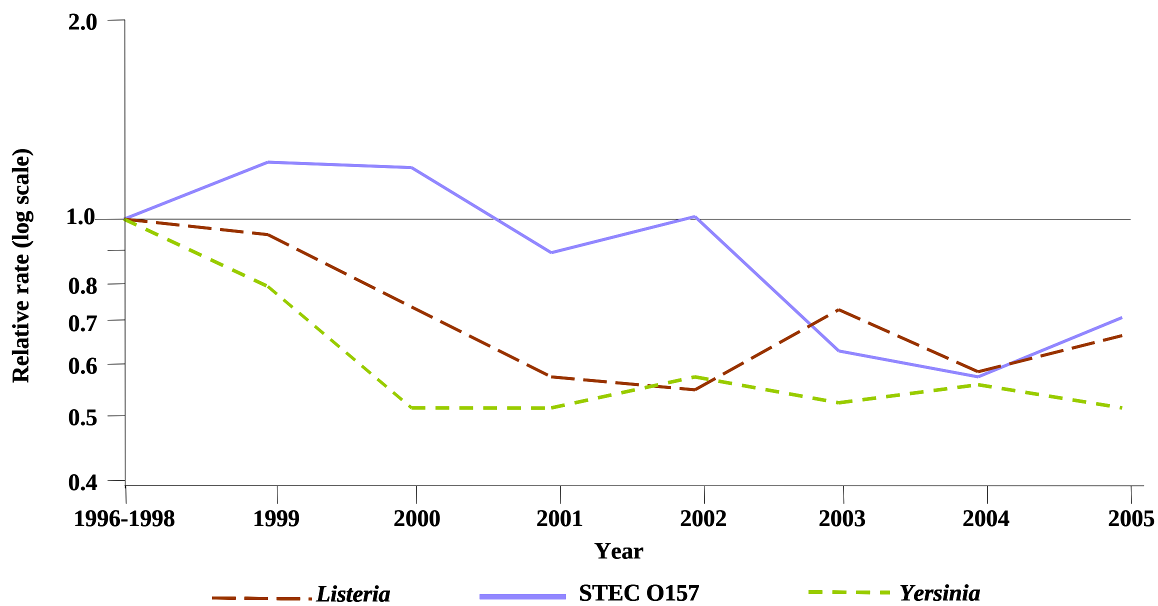


Figure 5C. Relative rates compared with 1996-1998 baseline period of laboratory-diagnosed cases of infection with the five most commonly isolated *Salmonella* serotypes, by year, FoodNet 1996-2005

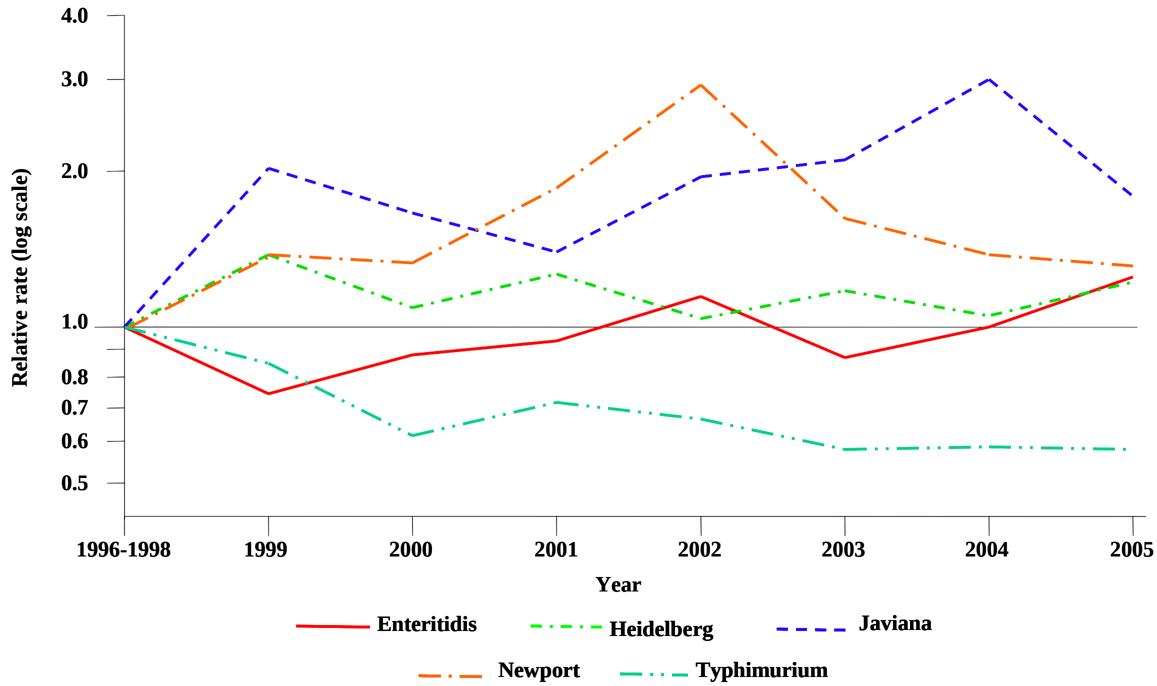


Figure 5D. Relative rates compared with 1996-1998 baseline period of laboratory-diagnosed cases of infection with *Vibrio*, by year, FoodNet 1996-2005

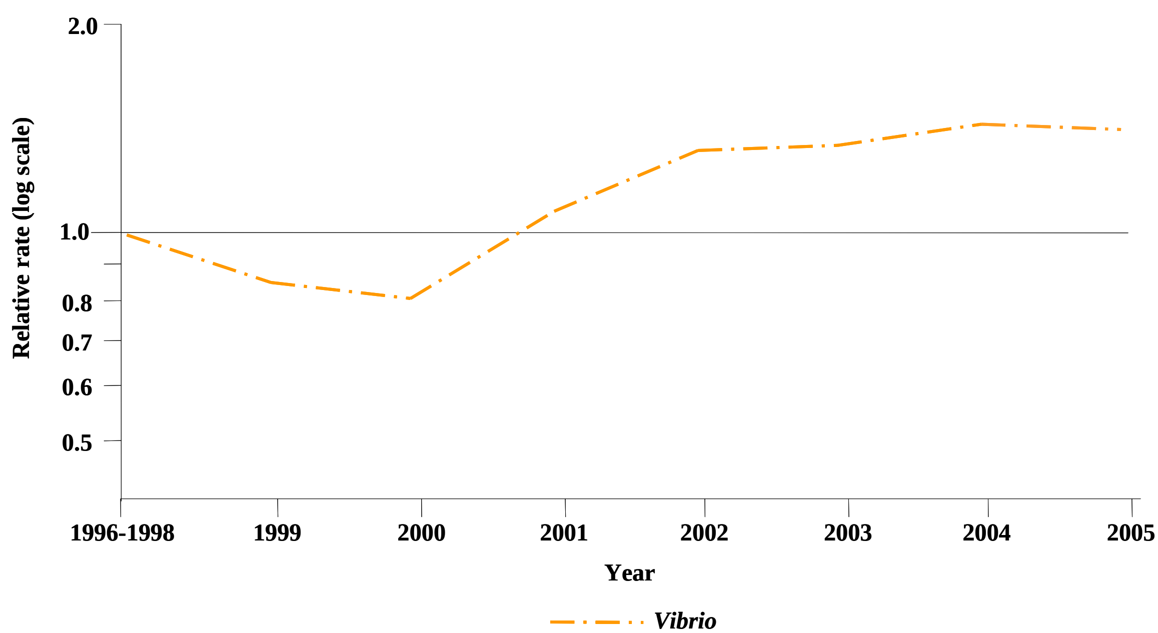


Figure 5E. Relative rates compared with 1997-1998 baseline period of laboratory-diagnosed cases of infection with *Cryptosporidium*, by year, FoodNet 1997-2005

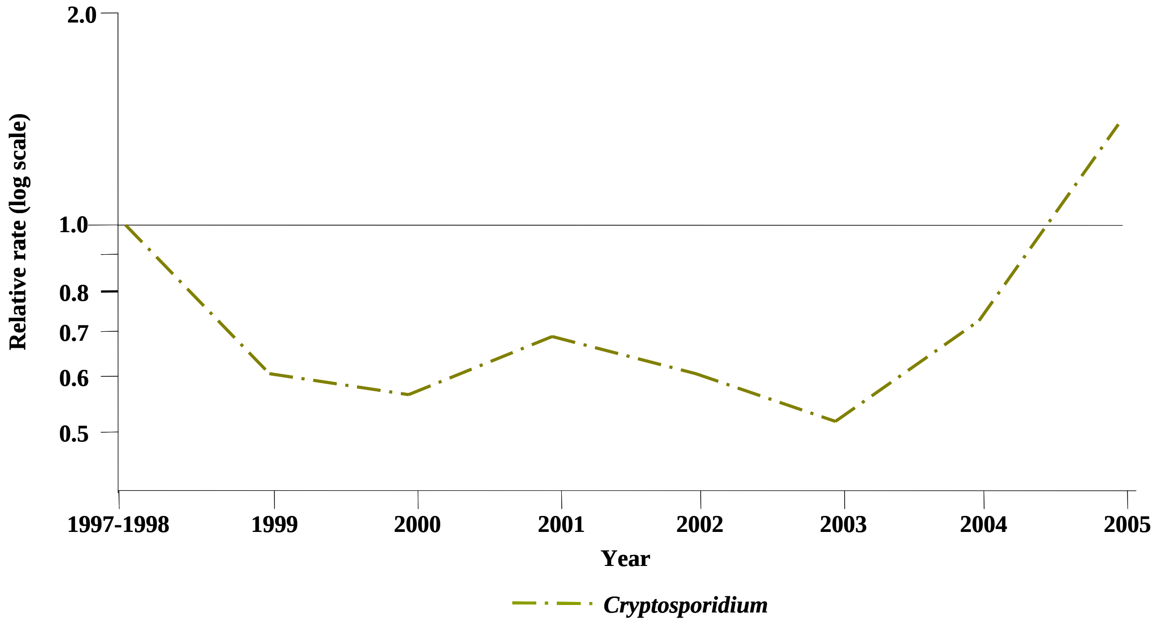


Table 8A. Percent change in incidence* of diagnosed infections for pathogens under surveillance in FoodNet, by pathogen, 2005 compared with 1996-1998

Bacterial Pathogen	Percent Change	95% Confidence Interval
Campylobacter	-31	36% to 25% decrease
Listeria	-33	46% to 17% decrease
Salmonella	-9	16% to 3% decrease
Shigella	-43	60% to 19% decrease
STEC O157	-29	43% to 13% decrease
Vibrio	42	4% to 94% increase
Yersinia	-48	58% to 35% decrease

*Cases per 100,000 population

Parasitic Pathogen	Percent Change†	95% Confidence Interval
Cryptosporidium	39	7% decrease to 109% increase

*Cases per 100,000 population

†2005 to 1997-1998

Table 8B. Percent change in incidence* of diagnosed infections for the five most common *Salmonella* serotypes, by serotype, 2005 compared with 1996-1998

Pathogen	Percent Change	95% Confidence Interval
Salmonella Typhimurium	-42	48% to 34% decrease
Salmonella Enteritidis	26	2% to 56% increase
Salmonella Heidelberg	23	1% decrease to 52% increase
Salmonella Newport	32	1% decrease to 77% increase
Salmonella Javiana	81	13% to 189% increase

*Cases per 100,000 population

Table 9. Comparison of 2005 incidence* with the National Health objectives

Pathogen	2005 Crude Rate	Objective
Campylobacter	12.70	12.30†
Listeria	0.30	0.25‡
Salmonella	14.50	6.80†
STEC O157	1.10	1.00†

*Cases per 100,000 population

†2010 Healthy People objective

‡2005 objective

Hemolytic Uremic Syndrome Surveillance

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

Cases reported, 2004

In 2004, FoodNet ascertained 56 HUS cases in catchment; 2 (4%) persons died. Fifty-three cases (95%) were reported in persons less than 18 years of age, including both deaths. Among pediatric cases, 35 (66%) cases were reported in children less than five years of age. Sixty-eight percent of HUS cases were diagnosed during June through September.

Results, 1997-2004

A total of 569 HUS cases were reported in catchment from 1997 through 2004 (Table 10). Most HUS cases were in females (57%) and the median age was five years old. Ninety-five percent of the cases were hospitalized with a median length of hospitalization of 12 days.

Stool specimens were cultured for STEC O157 in 471 (94%) HUS cases. Of those tested, STEC O157 was isolated from 257 (55%) stools. Shiga-toxin was tested for in 191 (38%) HUS cases and was detected in 125 (65%) stools. Seven (4%) cases had non-O157 STEC isolated, but it is unknown how often non-O157 STEC were sought. Of the non-O157 STEC cases identified, three were caused by O111 and two were caused by O145. Although a non-O157 STEC was identified in two additional cases, the O antigen was not determined. Serum samples from 56 cases were tested for antibodies to O157, O111 or O26 lipopolysaccharide (LPS). Thirty-two cases (57%) had antibodies to O157 LPS. There were no cases with antibodies to O111 or O26 LPS (Table 11).

Table 10. Summary of HUS cases, 1997-2004

Number of HUS cases	569
Median Age (age range)	4.9 (0-88)
Percent female	57%
Median Hospitalization (duration)	12 days
Deaths	37

Table 11. Results of microbiologic testing for STEC infection among HUS cases, 1997–2004

Diarrhea in three weeks before HUS diagnosis / Total patients	503/569	88%
Stool specimen obtained / Total patients	502/569	88%
Stool cultured for *E. coli* O157 / Patients with stool specimen obtained	471/502	94%
E. coli O157 isolated from stool / Patients with stool cultured for *E. coli* O157	257/471	55%
Stool tested for Shiga toxin / Patients with stool specimen obtained	191/502	38%
Stool Shiga toxin-positive / Patients with stool tested for Shiga toxin	125/191	65%
Non-O157 STEC isolated from stool / Patients tested for Shiga toxin	7/191	4%
Stool yielding *E. coli* O157, non-O157 STEC and/or Shiga toxin / Total patients with stool cultured for *E. coli* O157	270/472	57%

Pediatric HUS

FoodNet identified 429 (75%) HUS cases in children <18 years of age. The overall incidence rate was 0.68 per 100,000 children. However, in children under five years of age, the rate was 1.70 per 100,000 children and among children 5-14 years of age it was 0.37 per 100,000 (Table 12).

Hospital discharge data review was used to validate pediatric HUS surveillance activities and identify additional HUS cases. Between 2000 and 2004, 34% of the pediatric cases reported to FoodNet were identified through active surveillance alone, 17% were identified through hospital discharge data review alone, and 36% were identified by both active surveillance and hospital discharge data review (Table 13).

HUS surveillance information can be used to corroborate patterns in the incidence of STEC O157 seen in FoodNet. A comparison of the crude incidence of pediatric STEC O157 and pediatric HUS cases are seen in Figure 6. Although the magnitude of incidence differs between STEC O157 and HUS, the general pattern of decreases in incidence starting in 2002 for STEC O157 are mirrored by decreases in the incidence of HUS during the same time period.

Table 12. Pediatric HUS cases*, by site and age, 1997-2004

State	Age <5 years		Age 5-14 years		Age 15-18 years	
	Cases	Rate per 100,000	Cases	Rate per 100,000	Cases	Rate per 100,000
CA	16	1.12	13	0.46	0	0.00
CO†	15	2.07	9	0.66	2	0.51
CT	20	1.18	15	0.40	1	0.10
GA	47	1.08	12	0.14	3	0.12
MD†	17	0.91	12	0.30	0	0.00
MN	66	2.55	33	0.58	1	0.06
NM†	0	0.00	0	0.00	0	0.00
NY†	24	2.13	10	0.38	2	0.25
OR	55	3.09	14	0.37	1	0.08
TN†	27	1.98	13	0.47	1	0.12
Total	287	1.70	131	0.37	11	0.10

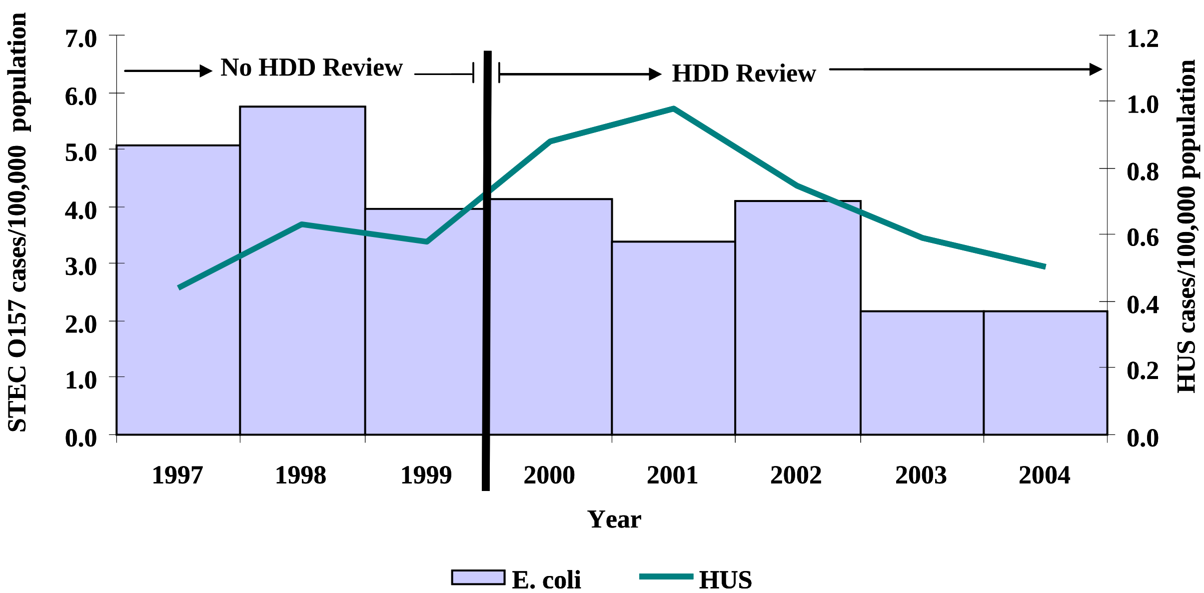
*Includes cases among persons residing within catchment area only

†CO 2001-2004, MD 1999-2004, NM 2004, and TN 2000-2004

Table 13. Surveillance technique used to identify pediatric HUS cases, by year, 2000-2004

	2000		2001		2002		2003		2004*		Total	
	n	%	n	%	n	%	n	%	n	%	n	%
Active Surveillance Only	14	20.6	39	45.3	23	32.4	17	27.9	23	42.0%	116	34%
Hospital Discharge Data Only (HDD)	16	23.5	17	19.8	7	9.9	12	19.7	7	13.0%	59	17%
Active and HDD	15	22.1	25	29.1	32	45.1	28	45.9	24	44.4%	124	36%
Unknown	23	33.8	5	5.8	9	12.7	4	6.6	0	0.0%	41	12%
Total cases	68		86		71		61		54		340	

Figure 6. Comparison of pediatric incidence rates of STEC O157 and HUS, 1997-2004



Discussion

Much remains to be done to reach the national health objectives for foodborne illnesses. Continued research is needed to understand and control pathogens in animals and plants, to reduce or prevent contamination during processing, and to educate consumers about risks and prevention measures. Such measures can be particularly focused when the source of human infections (i.e., animal reservoir species and transmission route) are known. The declines in the incidence of STEC O157 infections observed in recent years suggest that coordinated efforts by regulators and industry have been effective in reducing contamination and illness related to ground beef (*6,7*).

Consumers can reduce their risk for foodborne illness by following safe food-handling recommendations and by avoiding consumption of unpasteurized milk and milk products, raw or undercooked oysters, raw or undercooked eggs, raw or undercooked ground beef, and undercooked poultry. Pasteurization of in-shell eggs, irradiation of ground meat, and pressure treatment of oysters are other effective prevention measures which can also decrease the risk for foodborne illness.

6 Naugle AL, Holt KG, Levine P, Eckel R. Food Safety and Inspection Service regulatory testing program for *Escherichia coli* O157:H7 in raw ground beef. J Food Prot 2005;68:462--8.

7 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.

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 and thus do not have a laboratory result. Second, protocols for isolation of certain enteric pathogens (e.g., STEC non-O157) in clinical laboratories vary and are not uniform within and among FoodNet sites (*8*); others (e.g., norovirus) cannot readily be identified by clinical laboratories. Both of these situations lead to an under-representation of the true number of cases. Third, reported illnesses might have been acquired through nonfoodborne sources, and reported incidence rates do not reflect foodborne transmission exclusively. Finally, the FoodNet surveillance population is very similar to the U.S. population except for an under-representation of the Hispanic population.

8 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.

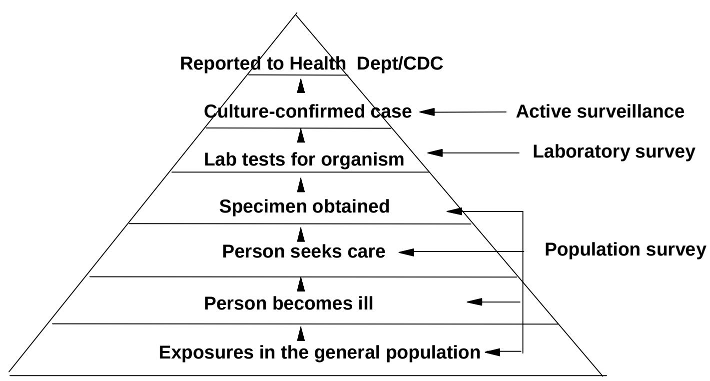
Other FoodNet Data Sources

Burden of illness

Cases reported through active surveillance represent only a fraction of the 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 5). Using these data, we can determine the proportion of persons in the general population with a diarrheal illness, and from those, the number who seek medical care for the illness and 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 that 76 million foodborne illnesses, 325,000 hospitalizations, and 5,000 deaths occurred in 1999 in the United States (*9*).

This model can be used to develop estimates of 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 (*10*).

Figure 5. Burden of Illness Pyramid



9 Mead P, Slutsker L, Dietz V, et al. Food-related illness and death in the United States. Emerging Infectious Disease 1999;5:607-25.
10 Voetsch A, Van Gilder T, et al. FoodNet esitmate of burden of illness caused by nontyphoidal *Salmonella* infection in the United States. *Clinical Infectious Diseases* 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 caused by specific foods or 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*; *Listeria* and studies of infant *Salmonella* and *Campylobacter* infections. By determining the contribution to these foodborne diseases made by specific foods or food preparation and handling practices, prevention efforts can be made more specific and their effectiveness documented.

Other FoodNet activities in 2005

- 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 5^{th} 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, 2005

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

Publications

1. Devasia RA, Varma JK, Whichard J, Gettner S, Cronquist AB, Hurd S, Segler S, Smith K, Hoefer D, Shiferaw B, Angulo FJ, Jones TF. Antimicrobial use and outcomes in patients with multidrug-resistant and pansusceptible *Salmonella* Newport infections, 2002-2003. *Microbial Drug Resistance* 2005;11(4):371-377.

2. Flint JA,Van Duynhoven YT, Angulo FJ, DeLong SM, Braun P, Kirk M, Scallan E, Fitzgerald M, Adak GK, Sockett P, Ellis A, Hall G, Gargouri N, Walke H, Braam P. Estimating the burden of acute gastroenteritis, foodborne disease, and pathogens commonly transmitted by food: an international review. *Clinical Infectious Diseases* 2005;41:698–704.

3. Frenzen PD, Drake A, Angulo FJ, The Emerging Infections Program FoodNet Working Group. Economic cost of illness due to *Escherichia coli* O157 infections in the United States. *Journal of Food Protection* 2005;68(12): 2623–2630.

4. Green LR, Selman C, Scallan E, Jones TF, Marcus R, and the FoodNet Population Survey Working Group. Beliefs about meals eaten outside the home as sources of gastrointestinal illness. *Journal of Food Protection* 2005;68(10);2184–2189.

5. Green L, Selman C, Banerjee A, Marcus R, Medus C, Angulo FJ, Radke V, Buchanan S, EHS-Net Working Group. Food service workers' self-reported food preparation practices: an EHS-Net study. *International Journal of Hygiene and Environmental Health* 2005;208:27–35.

6. Gupta A, Tauxe RV, Angulo FJ. Fluoroquinolone use in food animals. *Emerging Infectious Diseases* 2005;11(11):1791-1792.

7. Nelson JM, Tauxe RV, and Angulo FJ. Reply to Cox et al. *Journal of Infectious Diseases* 2005;191(9):1566-1567.

8. Scallan E, Majowicz SE, Hall G, Banerjee A, Bowman CL, Daly L, Jones T, Kirk MD, Fitzgerald M, and Angulo FJ. Prevalence of diarrhoea in the community in Australia, Canada, Ireland, and the United States. *International Journal of Epidemiology* 2005;34(2):454–460.

9. Schroeder CM, Naugle AL, Schlosser WD, Hogue AT, Angulo FJ, Rose JS, Ebel ED, Disney WT, Holt KB, Goldman DP. Estimate of illnesses from *Salmonella* Enteriditis in eggs, United States, 2000. *Emerging Infectious Diseases* 2005;11(1):113-115.

10. Varma JK, Mølbak K, Jones TF, Smith KE, Vugia DJ, Barrett TJ, Rabatsky-Ehr T, Angulo FJ. Reply to Cox and Phillips. *Journal of Infectious Diseases* 2005;192(11):2030-2031.

11. Varma JK, Mølbak K, Barrett TJ, Beebe JL, Jones TF, Rabatsky-Ehr T, Smith KE, Vugia DJ, Chang HH, and Angulo FJ. Antimicrobial-resistant nontyphoidal *Salmonella* is associated with excess bloodstream infections and hospitalizations. *Journal of Infectious Diseases* 2005;191(4):554-561.

Abstracts

1. Ailes E, Henao O, Norton D, Cronquist A, Phan Q, Thomas S, Megginson M, Wedel S, Dumas N, Cieslak P, Angulo FJ. The emergence of *Salmonella* serotype I 4,[5],12:i:- in the FoodNet sites, 1996-2004**.** Presented at the Infectious Diseases Society of America, San Francisco, CA, 2005.

2. Angulo FJ, Dunn JR, Griffin PM, Vugia D, Hadler J, Smith K, Cieslak P, Morse D, Megginson M, Lindsay LC, Cronquist A, Thorton K, Tauxe RV, and the EIP FoodNet Working Group. Trends in foodborne illness from FoodNet, 1996-2004**.** Presented at the Infectious Diseases Society of America, San Francisco, CA, 2005.

3. Choudhuri JA, Henao OL, Cronquist A, Hurd S, Thomas S, Megginson M, Scheftel JM, Hatch J, McMillian M, Angulo FJ. Surveillance trends for *Vibrio* infections in FoodNet sites, 1996-2004. Presented at the Infectious Diseases Society of America, San Francisco, CA, 2005.

4. Drake AL, Snider C, Vugia D, Hurd S, Scheftel J, Zansky S, Shiferaw B, Voetsch AC, Angulo FJ, Griffin PM, and the FoodNet EIP Working Group. Risk factors for developing hemolytic uremic syndrome or death among persons with *Escherichia coli* O157 infection, FoodNet sites, 1997-2002. Presented at the Infectious Diseases Society of America, San Francisco, CA, 2005.

5. Fullerton KE, Vugia DJ., Hurd S, Haubert N, Anderson BJ, Shiferaw B, Ingram A, Hayes T, Segler SD, Wedel S, Henao OL, Scallan E, Jones TF, Angulo FJ, and EIP FoodNetWorking Group. Risk factors for infant *Campylobacter* infections: a FoodNet case-control study. Presented at the Infectious Diseases Society of America, San Francisco, CA, 2005.

6. Henao OL, Ryan PA, Scallan E, Choudhuri J, Norton DM, Edge K, Tobin- D'Angelo M, Nelson JM, Hanna SS, Jones TF, Angulo FJ, and the EIP FoodNet Working Group. Proportion of visits to health care providers resulting in request of stool samples: data from the National Ambulatory Medical Care Survey (NAMCS) and the Foodborne Diseases Active Surveillance Network (FoodNet) Population Survey. Presented at the Infectious Diseases Society of America, San Francisco, CA, 2005.

7. Ingram LA, Fullerton KE, Marcus R, Anderson BJ, Shiferaw B, Haubert B, Vugia D, Wedel S, McCarthy PV, Angulo FJ, Jones TF, and the EIP FoodNet Working Group. A case-control study of *Salmonella* infection in infants, FoodNet, 2002-2004. Infectious Diseases Society of America, October 2005.

8. Nelson JM, Ailes E, Henao O, Shin S, Hurd S, Haubert N, Megginson M, Swanson E, Zansky SM, Hatch J, Hanna S, Angulo FJ, and the EIP FoodNet Working Group. Regional

variation in *Campylobacter* infections in the US FoodNet sites, 1996-2004. Presented at the *Campylobacter*, *Helicobacter* and Related Organisms, Queensland, Australia, 2005.

9. Nelson JM, Voetsch AC, Fullerton KE, Swanson E, Shiferaw B, Hurd S, Mohle- Boetani JC, Anderson BJ, Angulo FJ, and the EIP FoodNet Working Group. Antimicrobial use in persons with *E. coli* O157 infection in FoodNet Sites**.** Presented at the Infectious Diseases Society of America, San Francisco, CA, 2005.

10. Scallan E, Ryan PA, Cronquist AB, Thomas SM, Ryan PA, Hoefer D, Jones TF, Frenzen PD, Angulo FJ, McMillian M, and the EIP FoodNet Working Group. Clinical features associated with diagnostic stool tests, FoodNet Population Survey (2000-2003). Presented at the Infectious Diseases Society of America, San Francisco, CA, 2005.

11. Snider CJ, Phan Q, Gettner S, Edwards L, Morse DL, Vugia DJ, Cronquist AB Burnett C, Swanson E, Keene WE, Lynch M, Jones TF, and the EIP FoodNet Working Group. Epidemiology of Foodborne Outbreaks of Undetermined Etiology, FoodNet Sites, 2001-2004. Presented at the Infectious Diseases Society of America, San Francisco, CA, 2005.

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.

Materials available on-line

The following reports are available on the FoodNet Web site:

http://www.cdc.gov/foodnet/reports.htm

CDC. 1998 Final FoodNet Surveillance Report. Atlanta: Centers for Disease Control and Prevention; 1998.
CDC. 1997 Final FoodNet Surveillance Report. Atlanta: Centers for Disease Control and Prevention; 1998.
CDC. 1998 Final FoodNet Surveillance Report. Atlanta: Centers for Disease Control and Prevention; 1998.
CDC. 1999 Final FoodNet Surveillance Report. Atlanta: Centers for Disease Control and Prevention; 2000.
CDC. 2000 Final FoodNet Surveillance Report. Atlanta: Centers for Disease Control and Prevention; 2002.
CDC. 2001 Final FoodNet Surveillance Report. Atlanta: Centers for Disease Control and Prevention; 2002.
CDC. 2002 Final FoodNet Surveillance Report. Atlanta: Centers for Disease Control and Prevention; 2003.
CDC. 2003 Final FoodNet Surveillance Report. Atlanta: Centers for Disease Control and Prevention; 2005.
CDC. 2004 Final FoodNet Surveillance Report. Atlanta: Centers for Disease Control and Prevention; 2006.

The following *MMWR* articles about FoodNet are available at this Web site:

http://www.cdc.gov/mmwr/

CDC. Foodborne Diseases Active Surveillance Network, 1996. Morbidity and Mortality Weekly Report 1997;46(12):258-61.

CDC. Incidence of Foodborne Illnesses -- FoodNet, 1997. Morbidity and Mortality Weekly Report 1998;47(37):782-786.

CDC. Incidence of Foodborne Illnesses: Preliminary Data from the Foodborne Diseases Active Surveillance Network (FoodNet) -- United States, 1998. Morbidity and Mortality Weekly Report 1999;48(09):189-94.

CDC. Preliminary FoodNet Data on the Incidence of Foodborne Illnesses --- Selected Sites, United States, 1999. Morbidity and Mortality Weekly Report 2000;49(10):201-205.

CDC. Preliminary FoodNet Data on the Incidence of Foodborne Illnesses --- Selected Sites, United States, 2000. Morbidity and Mortality Weekly Report 2001;50(13):241-246.

CDC. Preliminary FoodNet Data on the Incidence of Foodborne Illnesses --- Selected Sites, United States, 2001. Morbidity and Mortality Weekly Report 2002;51(15):325-329.

CDC. Preliminary FoodNet Data on the Incidence of Foodborne Illnesses --- Selected Sites, United States, 2002. Morbidity and Mortality Weekly Report 2003;52(15):340-343.

CDC. Preliminary FoodNet Data on the Incidence of Infection with Pathogens Transmitted Commonly Through Food --- Selected Sites, United States, 2003. Morbidity and Mortality Weekly Report 2004;53(16):338-343

CDC. Preliminary FoodNet Data on the Incidence of Infection with Pathogens Transmitted Commonly Through Food --- 10 Sites, United States, 2004. Morbidity and Mortality Weekly Report 2005;54(14):352-356

CDC. Preliminary FoodNet Data on the Incidence of Infection with Pathogens Transmitted Commonly Through Food --- 10 States, United States, 2005, United States, 2005. Morbidity and Mortality Weekly Report 2006;55(14):392-395

The following *FoodNet News* newsletters are available at the FoodNet Web site:

http://www.cdc.gov/foodnet/news.htm

FoodNet News. Volume 1, No. 1, Fall 1998
FoodNet News. Volume 1, No. 3, Fall 1999
FoodNet News. Volume 1, No. 2, Winter 1999
FoodNet News. Volume 3, No. 1, Spring 2000
FoodNet News. Volume 3, No. 2, Winter 2000
FoodNet News. Volume 4, No. 1, Fall 2002
FoodNet News. Volume 4, No. 2, Spring 2003
FoodNet News. Volume 5, No. 1, Fall/Winter 2003
FoodNet News. Volume 5, No. 1, Spring 2005

A list of FoodNet publications and presentations is available at the following FoodNet Web site:

http://www.cdc.gov/foodnet/publications.htm

Additional information about the pathogens under FoodNet surveillance is available at the following Web sites:

http://www.cdc.gov/foodnet/surveillance_pages/pathogens_conditions.htm
http://www.cdc.gov/ncidod/dbmd/diseaseinfo/foodborneinfections_g.htm

FoodNet Working Group, 2005

CDC
Frederick Angulo
Heather Bair-Brake
Timothy Barrett
Ezra Barzilay
Michael Beach
Nancy Bean
Richard Bishop
Chris Braden
Tom Chiller
Linda Demma
Patricia Fields
Kathleen Fullerton
Peter Gerner-Smidt
Sharon Greene
Patricia Griffin
Olga Henao
Mike Hoekstra
Anurag Jain
Jeff Jones
Kevin Joyce
Cherie Long
Jennifer Nelson
Liane Ong
Nadine Oosmanally
Robert Pinner
Cathy Rebmann
Ida Rosenblum
Elaine Scallan
Bala Swaminathan
Kathryn Teates
Robert Tauxe
Jean Whichard
Sridevi Wilmore
Andrew Voetsch

California
Richard Alexander
Mirasol Apostol
Susan Brooks
Claudia Crandall
Pam Daily
Lisa Gelling
Janet Mohle-Boetani
Joelle Nadle
Dawn Norton
Nytzia Perez
Jan O'Connell
Gretchen Rothrock
Sam Shin
Duc Vugia
Katie Wymore

Colorado
James Beebe
Steve Burnite
Nicole Comstock
Alicia Cronquist
Allison Daniels
Ken Gershman
Joyce Knutsen

Connecticut
Matthew Cartter
Paula Clogher
James Hadler
Robert Heimer
Robert Howard
Sharon Hurd
Kati Kelley
Aristea Kinney
Mona Mandour
Laurn Mank
Ruthanne Marcus
Patricia Mshar
Quyen Phan
Charles Welles

Georgia
Wendy Baughman
Paul Blake
Tracy Brown
Cindy Burnett
Monica Farley
Betty Franko
Jennifer Gillespie
Tameka Hayes
James Howgate
Matthew Johns
Susan Lance
Paul Malpiedi
Pat Martell-Cleary
Mahin Park
Christina Payne
Kate Phillips
Lynett Poventud
Laura Rainer
Susan Ray
Suzanne Segler
Stepy Thomas
Melissa Tobin-D'Angelo

Maryland
Nicholas Bennett
David Blythe
Leslie Edwards
Jon Furuno
Kim Holmes
Julie Kiehlbauch
Kirsten Larson
Melanie Megginson
Stephanie Mickelson
J. Glenn Morris, Jr.
Robert Myers
Adam Newirth
Dale Rohn
Patricia Ryan
Amber Starn
Mary Warren
Tinika Watters

Minnesota
April Bogard
Candace Fuller
Kirk Smith
Ellen Swanson Laine
Carlota Medus
Joni Scheftel
Brian Lee
Stephanie Wedel
John Besser
Dawn Kaehler
Stephen Swanson
Theresa Weber

New Mexico
Joan Baumbach
Karen Edge
Lisa Butler
Karen Johnson
Joanne Keefe
Sarah Lathrop
Kathy Villa

New York
Bridget Anderson
Robyn Atkinson
Hwa-Gan Chang
Nellie Dumas
Dina Hoefer
Jillian Karr
Dale Morse
David Nicholas
Candace Noonan-Toly
Tim Root
Dianna Schoonmaker-Bopp
Glenda Smith
Perry Smith
Nancy Spina
Shelley Zansky

Oregon
Cathy Ciaffoni
Paul Cieslak
Emilio DeBess
Julie Hatch
Bill Keene
James Mack
Melissa Plantenga
Beletshachew Shiferaw
Janie Tierheimer
Rob Vega

Tennessee
Effie Boothe
Allen Craig
Samir Hanna
Henrietta Hardin
Amanda Ingram
Timothy Jones
Leonard Lindsay
Ryan Mason
Marcy McMillian

USDA-FSIS
Janice Adams-King
Kristina Barlow
L. Victor Cook
Moshe Dreyfuss
Peter Evans
Myra Gardner
David Goldman
Jane Harman
Kristin Holt
Lynn Larsen
Priscilla Levine
Celine Nadon
Alecia Larew Naugle
Nisha Oatman
Heather H. Quesenberry
Bonnie Rose
Bernard Salamone
Carl Schroeder
Scott Seys
Reuben Varghese
Patricia White

FDA-CFSAN
Jack Guzewich
Patrick McCarthy
Eileen Parish
Clifford Purdy
Patrick McDermott

FDA-CVM
David White