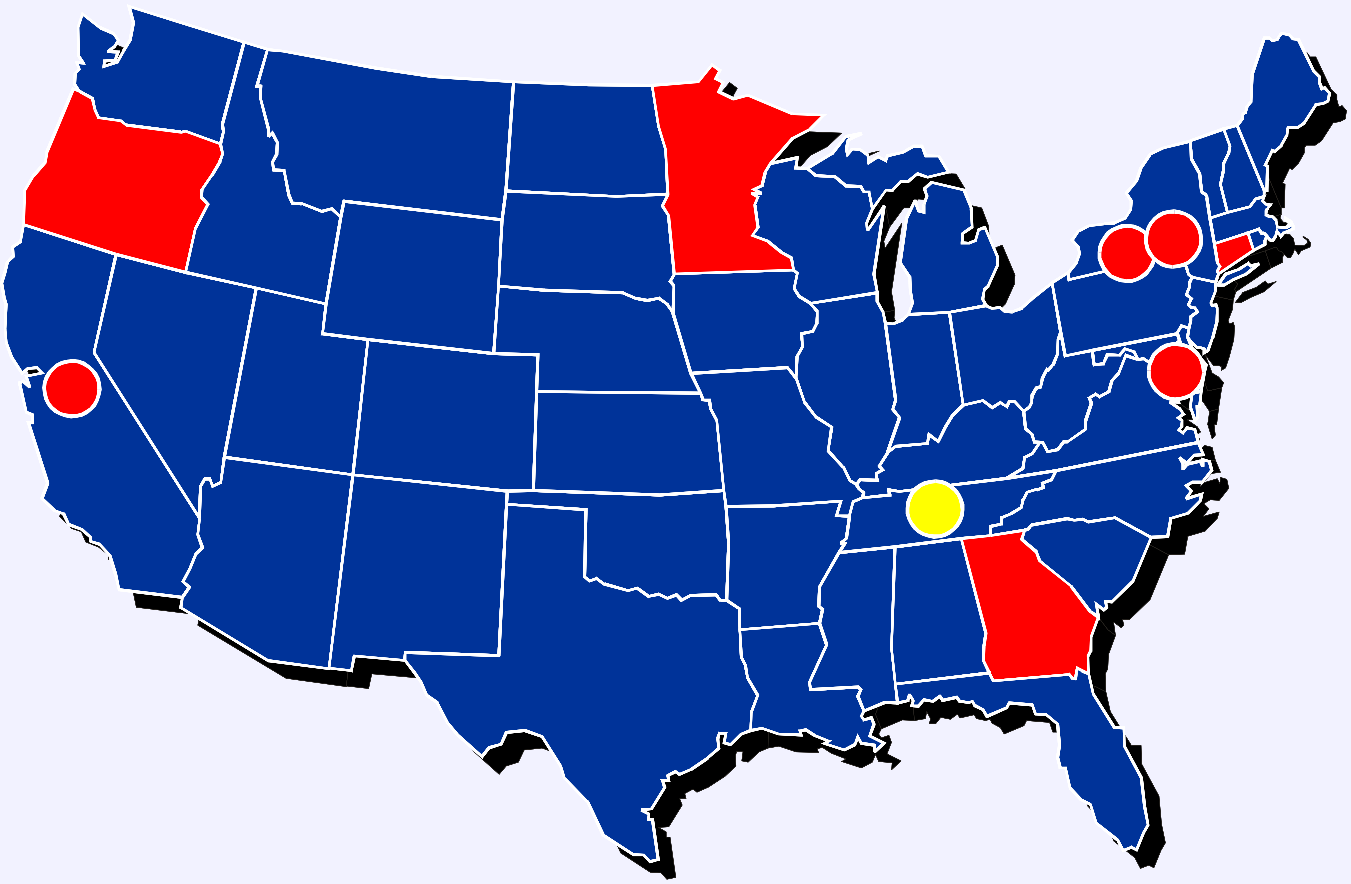
FoodNet Surveillance Report for 1999 (Final Report)



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

Centers for Disease Control and Prevention
Division of Bacterial and Mycotic Diseases
Foodborne and Diarrheal Diseases Branch
November 2000

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control and Prevention

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Prologue

The FoodNet Surveillance Report for 1999 (Final Report) summarizes the data collected through FoodNet's active surveillance sites during 1999. It represents the continued efforts of numerous individuals, and the collaboration of multiple federal, state, and local public health agencies. The FoodNet Surveillance Report for 1999 (Final Report) consists of two parts: Part I, Narrative Report, and Part II, Summary Tables and Graphs. The FoodNet Surveillance Report for 1999 (Final Report) includes two main revisions to the FoodNet 1999 Preliminary Report, which was published in March 2000. First, the Final Report uses the 1999 postcensus population estimates, which became available in August 2000, as the denominator. Second, the Final Report includes a small number of additional cases reported since the publication of the preliminary report. Therefore, Tables 1A and 1B found in Part II, Summary Tables and Graphs of the Final Report are updated, with recalculated incidence rates. Furthermore, revised surveillance data for hemolytic uremic syndrome for 1997 and 1998 are provided in the Final Report.

Further information concerning FoodNet, including previous surveillance reports, MMWR articles, and other FoodNet publications, can be obtained by contacting the Foodborne and Diarrheal Diseases Branch at telephone number 404.371.5465 or via the Internet at http://www.cdc.gov/ncidod/dbmd/foodnet.

Part I

Narrative Report

Executive summary

Foodborne infections are an important public health challenge. The Centers for Disease Control and Prevention (CDC) is actively involved in preventing foodborne disease. CDC's principal role in the interagency national Food Safety Initiative has been to enhance surveillance for and investigation of infections that are often foodborne. These efforts will provide crucial data to identify control points, focus future prevention strategies and decision making within food safety regulatory agencies, measure changes in the burden of disease, and track trends in specific infections over time as prevention measures are implemented.

The Foodborne Diseases Active Surveillance Network (FoodNet) is the principal foodborne-disease component of the CDC's Emerging Infections Program (EIP). FoodNet is a collaborative project among CDC, the eight EIP state health department sites, the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA), and the Food and Drug Administration (FDA). FoodNet augments, but does not replace, longstanding activities at CDC, FSIS, FDA, and in states to identify, control, and prevent foodborne disease hazards.

FoodNet is a sentinel network that is producing more stable and accurate national estimates of the burden and sources of specific 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. Ongoing FoodNet surveillance is being used to document the effectiveness of new food safety control measures, such as the USDA Pathogen Reduction and Hazard Analysis and Critical Control Points (HACCP) Rule, in decreasing the number of cases of foodborne diseases in the United States each year.

The following are key findings of FoodNet surveillance activities during 1999:

- Since 1998, the overall incidence of bacterial foodborne infections has declined in the original five sites by 15%. Although this decline might reflect simple annual fluctuations in foodborne illness, it was also concurrent with several interventions, including the implementation of mandated changes in meat and poultry processing plants, increased attention to "good agricultural practices" on farms, and increased consumer awareness. The President's Food Safety Initiative has supported much of this work.
- *Campylobacter* infections continued to decline to an incidence now lower than that of *Salmonella* for

the first time since FoodNet began. In the original five sites in 1999, incidence decreased 18% from 1998 and 26% from 1996. As poultry is the most common source of *Campylobacter* infections, this decline is likely related to changes in poultry processing plants instituted by industry and encouraged by the Pathogen Reduction and Hazard Analysis and Critical Control Points (HACCP) rule of the U.S. Department of Agriculture.

- *Shigella* incidence demonstrated a 41% decline in the original five sites from 1998 to 1999, and a 44% decline from 1996 to 1999. This decline follows a large outbreak of shigellosis in 1998 traced to imported parsley, which focused attention on the problems of produce-associated shigellosis and the need for improving basic sanitation on produce farms throughout the continent. This outbreak highlighted the global nature of foodborne illness. The response to the 1998 outbreak suggests that international collaboration may lead to effective interventions.
- The rate of *Salmonella* infections increased 11% from 1998 to 1999 in the original five sites and caused nearly one-third of reported deaths. Infections due to the most common serotypes, Typhimurium, (3.7/100,000 persons in 1998, and 3.5 in 1999), and Enteritidis, (1.4 in 1998 and 1999) remained constant. Increases in other *Salmonella* serotypes may be related to large outbreaks in 1999 associated with unpasteurized orange juice, raw sprouts, and mangos.
- The rate of *Escherichia coli* O157 infections in the original five sites decreased 25% from 1998 to 1999. This decline occurred during a period of improved sanitation and hygiene in slaughter and processing plants and closer attention to hamburger cooking temperature. Further surveillance is needed to clarify whether this decline is the beginning of a trend.
- *Listeria* infections were associated with higher hospitalization rates than any other pathogen and caused over a quarter of reported deaths. FoodNet is conducting additional studies of *Listeria* infections to identify food sources and potential control points.
- In 1999, FoodNet completed the data collection phase of a case-control study of risk factors for *Campylobacter* infections. Preliminary analysis indicates that foreign travel is a risk factor. Among persons who had no foreign travel, the following exposures were associated with infection: eating undercooked poultry, eating chicken or turkey cooked outside the home, eating non-poultry meat cooked outside the home, eating raw seafood, drinking raw milk, living on or visiting a farm, and having contact with farm animals or puppies.

Background

Foodborne infections are an important public health challenge. The Centers for Disease Control and Prevention (CDC) estimates that in 1997, foodborne infections caused 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths. CDC, the Food Safety and Inspection Service (FSIS) of the United States Department of Agriculture (USDA), the Food and Drug Administration (FDA), and the eight Emerging Infections Program (EIP) sites are actively involved in preventing foodborne diseases. In 1997, the President's interagency national Food Safety Initiative was launched 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. FoodNet has been instrumental in accomplishing this mission.

Objectives FoodNet's objectives are to determine the frequency and severity of foodborne diseases, to determine the proportion of common foodborne diseases that result from eating specific foods, to describe the epidemiology of new and emerging bacterial, parasitic, and viral foodborne pathogens and to follow trends in these infections over time. To address these objectives, FoodNet actively surveys laboratories and conducts related epidemiologic studies. By monitoring the trends in foodborne diseases over time, FoodNet can document the effectiveness of new food safety initiatives, such as the USDA HACCP Rule, in decreasing the rate of foodborne diseases in the United States each year.

Methods In 1999, FoodNet conducted population-based active surveillance for confirmed cases of *Campylobacter*, *Cryptosporidium*, *Cyclospora*, Shiga toxin-producing *Escherichia coli* (including *E. coli* O157), *Listeria*, *Salmonella*, *Shigella*, *Vibrio*, and *Yersinia* infections in seven sites: Connecticut, Georgia, Minnesota, and Oregon and selected counties in California, Maryland, and New York (total population in bacterial surveillance catchment areas is 25.8 million, total population in parasitic surveillance catchment areas is 30.2 million).[1] To identify cases, FoodNet personnel contact each of the more than 300 clinical laboratories within the catchment areas either weekly or monthly, depending on the size of the clinical laboratory. FoodNet also conducts surveillance for Hemolytic uremic syndrome (HUS) through pediatric nephrologists as well as surveillance for foodborne disease outbreaks.

1. Tennessee joined FoodNet in 1999 and will contribute active surveillance data on January 1, 2000.

Results

Cases reported In 1999, a total of 10,717 confirmed infections caused by the pathogens under surveillance were identified in the seven sites. Of these, 10,248 were bacterial, including 3884 *Campylobacter* infections, 4488 *Salmonella* infections, 1040 *Shigella* infections, 510 *E. coli* O157 infections, 164 *Yersinia* infections, 114 *Listeria* infections, and 48 *Vibrio* infections (Table 1A). Among the 3917 serotyped *Salmonella* isolates, the most commonly identified serotypes were Typhimurium (992 cases), Enteritidis (437), Newport (355), Heidelberg (285), and Muenchen (224). Of the 1040 *Shigella* infections reported, 61% were *Shigella sonnei* and 29% were *Shigella flexneri*. In addition, 469 cases of parasitic diseases were reported, including 457 cases of *Cryptosporidium* infection and 12 cases of *Cyclospora* infection (Table 1B).

Table 1A. Infections caused by specific bacterial pathogens, reported by FoodNet sites, 1999

Pathogen	**CA**	**CT**	**GA**	**MD**	**MN**	**NY**	**OR**	**Total**
Campylobacter	696	564	722	166	785	358	593	**3884**
***E. coli* O157**	23	94	44	16	175	94	64	**510**
Listeria	15	27	20	12	18	6	16	**114**
Salmonella	318	533	1889	433	628	265	422	**4488**
Shigella	210	73	315	58	254	37	93	**1040**
Vibrio	10	5	17	8	4	1	3	**48**
Yersinia	17	13	61	9	37	8	19	**164**
Total	**1289**	**1309**	**3068**	**702**	**1901**	**769**	**1210**	**10248**

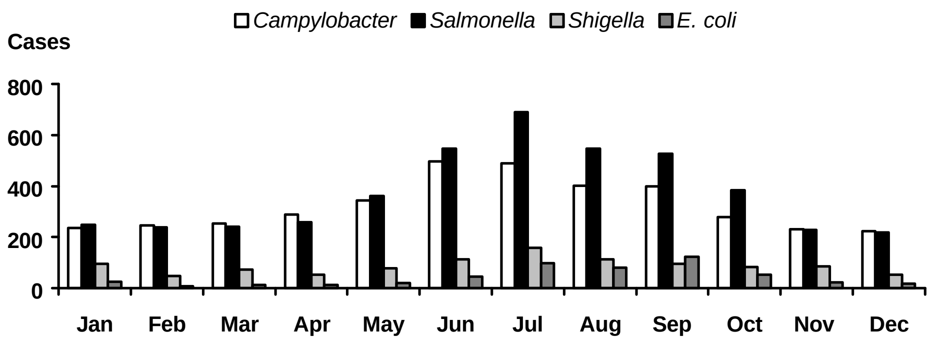
Table 1B. Infections caused by specific parasitic pathogens, reported by FoodNet sites, 1999

Pathogen	**CA**	**CT**	**GA**	**MD**	**MN**	**NY**	**OR**	**Total**
Cryptospordium	104	23	163	8	92	32	35	**457**
Cyclospora	2	4	6	0	0	0	0	**12**
Total	**106**	**31**	**169**	**8**	**92**	**32**	**35**	**469**

Seasonality

Isolation rates for several pathogens showed wide seasonal variation; 50% of *Vibrio*, 43% of *E. coli* O157, 40% of *Salmonella*, 37% of *Shigella*, and 36% of *Campylobacter* were isolated during June through August (Figure 1). Fifty percent of cyclosporiasis cases and 31% of cryptosporidiosis cases were identified during the summer months. *Yersinia* infections were more likely to have occurred in winter months with 35% of cases being reported during January, February, or December.

Figure 1. Cases of foodborne disease caused by specific pathogens, by month, FoodNet sites, 1999



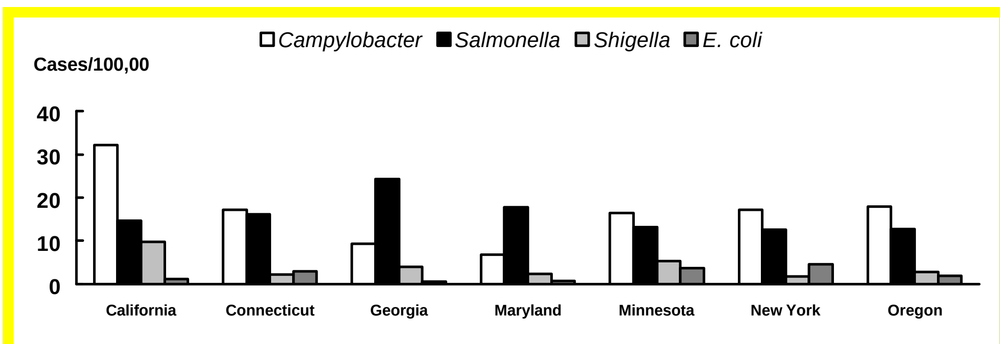
1999 Rates

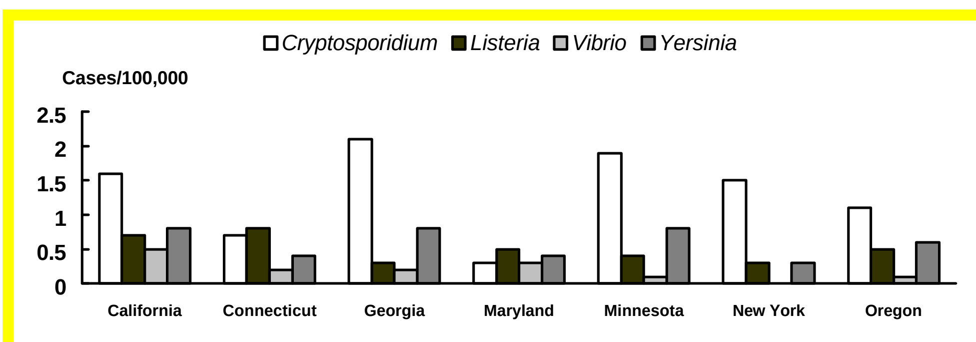
Annual incidence rates were calculated to compare the number of cases among sites with different populations. Incidence is the number of cases divided by the population. All 1999 rates reported here were calculated with 1999 Census population estimates. Overall incidence rates were highest for infections with *Salmonella* (17.4/100,000 population), *Campylobacter* (15.0/100,000), and *Shigella* (4.0/100,000). Lower overall incidence rates were reported for *E. coli* O157 (2.0/100,000), *Cryptosporidium* (1.5/100,000), *Yersinia* (0.6/100,000), *Listeria* (0.4/100,000), *Vibrio* (0.2/100,000), and *Cyclospora* (0.04/100,000).

Rates by site

Incidence rates per 100,000 population for many of these pathogens varied substantially among the sites (Figure 2). The incidence rates for *Campylobacter* infection varied from 6.8 in Maryland to 32.2 in California, and for *Shigella* infections, from 1.8 in New York to 9.7 in California. Incidence rates for aggregate *Salmonella* infections also varied among sites, from 12.7 in New York and Oregon to 24.3 in Georgia. Among the two most common serotypes of *Salmonella*, *S.* Typhimurium incidence ranged from 2.4 in New York to 4.9 in Connecticut and *S.* Enteriditis ranged from 0.9 in New York to 4.2 in Maryland. Incidence rates for *E. coli* O157 infection varied from 0.6 in Georgia to 4.5 in New York. Some of the New York cases were related to a large waterborne outbreak of *E. coli* O157 in 1999. Infections caused by *Yersinia* varied from 0.4 in Connecticut, Maryland, and New York to 0.8 in California, Georgia, and Minnesota. Incidence rates of *Cryptosporidium* cases ranged from 0.3 in Maryland to 2.1 in Georgia. Reasons for these regional differences in incidence rates are being investigated; many of these differences may be due to variations in testing practices.

Figure 2. Cases per 100,000 population of foodborne disease caused by specific pathogens, FoodNet sites, 1999

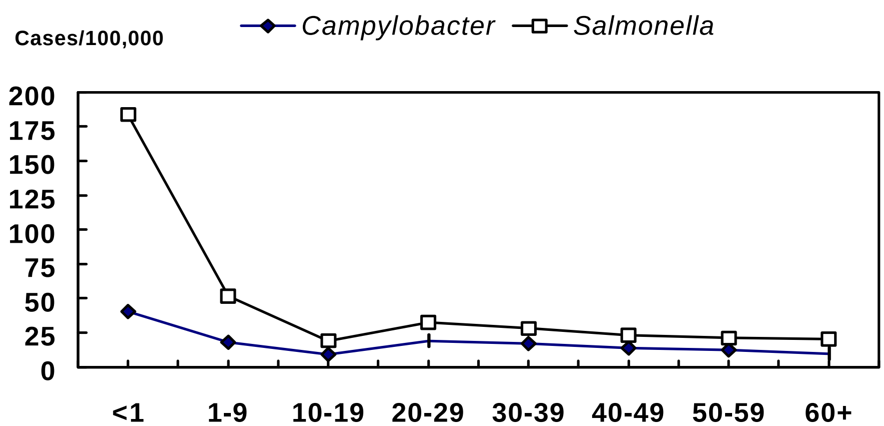




Rates by age

Annual incidence rates of foodborne illness varied by age, especially for *Campylobacter* and *Salmonella* infections (Figure 3). For children <1 year of age, the rate of *Salmonella* infection was 143.2/100,000, and the rate of *Campylobacter* infection was 40.5/100,000, rates substantially higher than for other age groups.

Figure 3. Incidence of *Campylobacter* and *Salmonella* infections by age group, FoodNet sites, 1999



Rates by sex

Incidence rates varied by sex (Table 2). Overall, males were more likely than females to be infected with one of these pathogens under surveillance. In particular, rates of *Campylobacter* infection were 27% higher among males than among females.

Table 2. Sex-specific incidence rates per 100,000 population, by pathogen, FoodNet sites, 1999

Pathogen	Male	Female	Overall
Campylobacter	**16.6**	**13.1**	**15.0**
Cryptosporidium	**2.2**	**0.9**	**1.5**
Cyclospora	**0.0**	**0.1**	**0.1**
***E. coli* O157**	**1.9**	**2.0**	**2.0**
Listeria	**0.4**	**0.5**	**0.4**
Salmonella	**16.8**	**16.3**	**17.4**
Shigella	**4.2**	**3.8**	**4.0**
Vibrio	**0.2**	**0.1**	**0.2**
Yersinia	**0.6**	**0.6**	**0.6**
Total	**37.3**	**43.0**	**41.2**

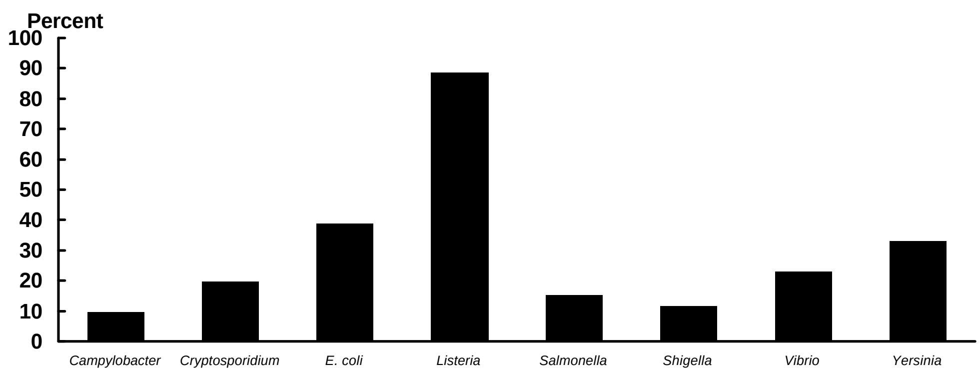
Rates by age and sex

The incidence rate of *Campylobacter* infection was higher for males than for females in all age groups. Rates of *Salmonella* and *E. coli* O157 infection were higher for male persons aged 1-19 years, and *Salmonella* rates were also higher for male persons aged 40-49 years; rates were higher among females for all other age groups.

Hospitalizations

Overall, 15% of patients with culture-confirmed illness were hospitalized; hospitalization rates differed markedly by pathogen (Figure 4). The percentage of hospitalizations was highest for persons infected with *Listeria* (89%) followed by those infected with *E. coli* O157 (39%), *Yersinia* (34%), *Vibrio* (23%), *Cryptosporidium* (20%), *Salmonella* (15%), *Shigella* (12%), and *Campylobacter* (10%).

Figure 4. Percentage of persons hospitalized with infections caused by specific pathogens, FoodNet sites, 1999



Deaths

Fifty-nine persons died; of those, 19 were infected with *Salmonella*, 17 with *Listeria*, seven with *E. coli* O157, five with *Campylobacter*, five with *Cryptosporidium,* two with *Yersinia*, and one with *Vibrio*. The pathogen with the highest case-fatality rate was *Listeria*; 15% of persons infected with *Listeria* died.

HUS

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 Shiga toxin-producing *Escherichia coli* (STEC). *E. coli* O157:H7 is the most easily and frequently isolated STEC, but many other serotypes can also cause HUS.

Active surveillance for pediatric HUS cases was established in 1997 in five FoodNet sites (California, Connecticut, Georgia, Minnesota, and Oregon). Surveillance was expanded to include areas of Maryland and New York in 1999. Active surveillance is accomplished through pediatric nephrologists, who report all cases of HUS, including those from outside the FoodNet catchment area. Data on HUS cases in adults are also collected, but surveillance is passive and often incomplete. The primary objectives of HUS surveillance are to 1) determine the incidence of HUS, 2) monitor long-term trends in STEC infection using HUS as a marker, and 3) identify and monitor STEC strains causing HUS over time. A total of 146 cases of HUS were reported between 1997 and 1999 (Table 3A). Sixty-one percent of reported cases occurred in females. The median age was 4 years and the median length of hospitalization was 11 days. In 1999, 60 HUS cases were reported, and deaths occurred in eight (13%) of these cases. Consistent with the temporal distribution of 1999 *E. coli* O157:H7 infections, 24 (40%) of the 1999 HUS cases were diagnosed between June and August (Figure 4). A peak in the number of HUS cases occurred in September 1999 following an *E. coli* O157:H7 outbreak in New York.

The overall rate of HUS among children under 15 years of age in the seven sites between 1997 and 1999 was 0.7/100,000, and among children under 5 years of age was 1.4/100,000 (Table 3B). *E. coli* O157:H7 was isolated from 62% of stools that were specifically tested for this pathogen (Table 3C). Four patients had stool samples that tested positive for Shiga toxin, but stool cultures did not yield *E. coli* O157:H7. No other STEC were identified, but it is unclear how rigorously they were sought.

Table 3A. HUS cases by site* and year, 1997-1999

State	1997		1998		1999	
	Age <15 years	Age ≥15 years	Age <15 years	Age ≥15 years	Age <15 years	Age ≥15 years
California	10	0	8	0	5	0
Connecticut	1	0	0	0	8	2
Georgia	6	0	13	0	4	0
Maryland	n/a	n/a	n/a	n/a	2	0
Minnesota	9	3	17	3	9	4
New York	n/a	n/a	n/a	n/a	15	5
Oregon	6	3	6	1	3	3
Total	**32**	**6**	**44**	**4**	**46**	**14**

**Includes cases among persons residing outside the formal catchment area.*

Table 3B. Pediatric HUS cases, by site† and age, 1997-1999

State	Age < 5 years		Age < 15 years	
	Cases	Rate per 100,000	Cases	Rate per 100,000
California	4	1.0	5	0.4
Connecticut	5	0.9	8	0.4
Georgia	11	1.0	14	0.4
Maryland**	0	0.0	1	0.2
Minnesota	25	2.6	35	1.1
New York**	8	5.6	11	2.5
Oregon	11	1.7	13	0.6
Total	64	1.4	87	0.7

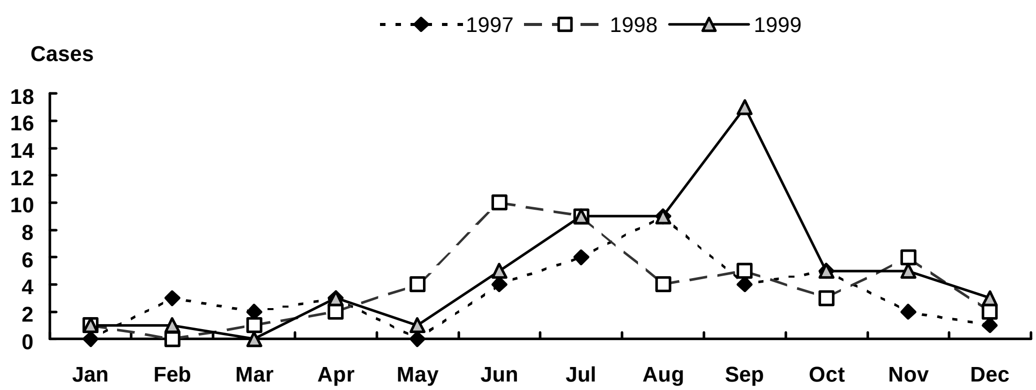
†Includes cases among persons residing within catchment area only

***Based only on 1999 data*

Table 3C. Results of microbiologic testing for STEC infection among HUS cases, 1997-1999

Diarrhea in 3 weeks before HUS diagnosis/ Total patients	139/146 (95%)
Stool specimen obtained/ Total patients with information available	136/145 (94%)
Stool cultured for *E. coli* O157:H7/ Patients with stool specimen obtained	133/136 (98%)
E. coli O157:H7 isolated from stool/ Patients with stool cultured for *E. coli* O157:H7	82/133 (62%)
Stool tested for Shiga toxin/ Patients with stool obtained and information available	31/131 (24%)
Stool Shiga toxin positive/ Patients with stool tested for Shiga toxin and information available	22/29 (76%)
Stool yielding *E. coli* O157:H7 and/or Shiga toxin/ total patients with information available	86/136 (63%)

Figure 4. Total Cases of HUS, by year and month, 1997-1999



Outbreaks

A foodborne disease outbreak is defined as an incident in which two or more persons experience an illness resulting from the ingestion of a common food. The overall rate of foodborne disease outbreaks reported in FoodNet sites in which 10 or more persons became ill was 3.2 outbreaks per million people, ranging from 0.9 outbreaks per million in California to 6 outbreaks per million in Oregon (Table 4).

Table 4: Summary of foodborne outbreaks among outbreaks with 10 or more persons ill, by FoodNet site, 1999

Site	Outbreaks reported	1999 population	Rate/1,000,000 population	Median no. ill	Known etiology No. (%)	Likely vehicle No. (%)	Restaurant-associated No. (%)*
CA	2	2,162,359	0.9	24	1 (50)	2 (100)	2 (100)
CT	5	3,282,031	1.5	17	4 (80)	1 (20)	3 (60)
GA	13	7,788,240	1.7	41	10 (77)	8 (62)	4 (36)
MD	13	2,450,566	5.3	28	5 (39)	4 (31)	7 (54)
MN	24	4,775,508	5.0	17	8 (33)	19 (79)	9 (38)
NY	6	2,084,453	2.9	21	1 (17)	4 (67)	5 (100)
OR	20	3,316,154	6.0	31	10 (50)	10 (50)	2 (20)
Total	**83**	**25,859,311**	**3.2**	**21**	**39 (47)**	**48 (58)**	**32 (46)**

*Among outbreaks with known location

1996-1999 Rates

To avoid confusion created by an expanding FoodNet catchment area, we compared the incidence rates in the five original sites to determine the trends from 1996 to 1999. Overall incidence rates of illness caused by bacterial pathogens under surveillance declined in the five original sites from 1996 to 1999 (Table 5a). Infections caused by *Salmonella* decreased from 14.5/100,000 in 1996 to 13.6/100,000 in 1999. This decrease was particularly pronounced for serotype Enteritidis, which dropped from 2.5/100,000 to 1.4/100,000. However, *S*. Typhimurium remained similar, 3.9 in 1996 and 3.5 in 1999. The continued decline of *Salmonella* Enteritidis, an egg-associated serotype, occurred in the setting of increased farm-to-table control measures. *Campylobacter* rates declined 18% from 21.4/100,000 in 1998 to 17.5/100,00 in 1999, continuing the substantial decline noted from 1997 to 1998 (25.3/100,000 to 21.4/100,000). Although *E. coli* O157 rates increased from 1997 to 1998 (2.3/100,000 to 2.8/100,000), *E. coli* O157 infections decreased in 1999 to 2.1/100,000. The incidence of *Vibrio* infections decreased for the first time in 4 years to 0.2/100,000. *Shigella* rates dropped dramatically (44%) from 8.9/100,000 in 1996 to 5/100,000 in 1999. Incidence rates for *Yersinia* infections declined 18% from 1998 to 1999 and 21% from 1996 to 1999.

Table 5a. Cases per 100,000 of specific bacterial foodborne pathogens for the five original FoodNet sites, 1996-1999*

Pathogen	**1996**	**1997**	**1998**	**1999**	**% change**	
					1996-1999	**1998-1999**
Campylobacter	23.5	25.3	21.4	17.5	-25.6	-18.2
***E. coli* O157**	2.7	2.3	2.8	2.1	-23.3	-25.3
Listeria	0.5	0.5	0.6	0.5	+15.6	-5.9
Salmonella	14.5	13.6	12.3	13.6	-5.9	+11.3
Shigella	8.9	7.5	8.5	5.0	-44.2	-41.3
Vibrio	0.2	0.3	0.3	0.2	+33.4	-22.5
Yersinia	1.0	0.9	1.0	0.8	-20.9	-18.4
Total	**51.3**	**50.3**	**46.8**	**39.8**	**-22.4**	**-14.9**

*Urine isolates were collected in 1999 but were excluded from this table.

Overall incidence rates of illness caused by parasitic pathogens under surveillance declined in the five original sites from 1997 to 1999 (Table 5b). The incidence of illness caused by *Cryptosporidium* dropped from 3.0/100,000 in 1997 to 2.4/100,000 in 1999, and *Cyclospora* incidence decreased from 0.3/100,000 in 1997 to 0.04/100,000 in 1999.

Table 5b. Cases per 100,000 of specific parasitic foodborne pathogens for the five original FoodNet sites, 1997-1999

Pathogen	1997	1998	1999	% change	
				1997-1999	1998-1999
Cryptosporidium	3.04	3.4	2.4	-22.4	-30.9
Cyclospora	0.3	.06	.04	-86.7	-33.3
Total	3.34	3.46	2.44	-26.9	-29.5

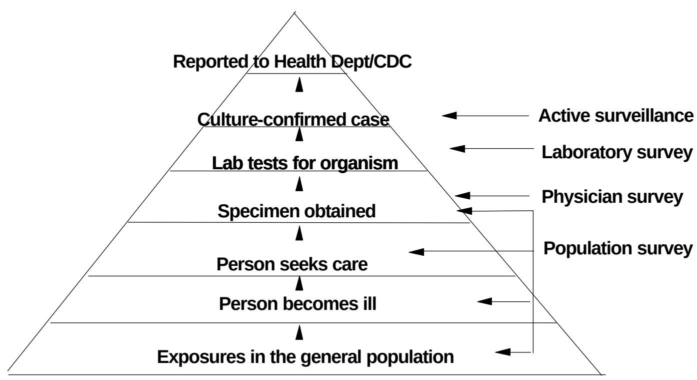
Compared with 1997, Georgia reported an overall increase in the incidence of illnesses caused by the pathogens under surveillance while California, Connecticut, Minnesota, and Oregon reported decreases.

Additional Studies

Burden of illness

Cases reported through active surveillance represent only a fraction of the number of cases in the community. To estimate better the number of cases of foodborne disease in the community, FoodNet conducts surveys of laboratories, physicians, and the general population in the participating EIP sites (Figure 5). Using these data, one can determine the proportion of persons in the general population with a diarrheal illness and from among those, the numbers who seek medical care for the illness. We can estimate the proportion of physicians who ordered a bacterial stool culture for patients with diarrhea, and we can evaluate how variations in laboratory testing for bacterial pathogens influence the number of culture-confirmed cases. Using FoodNet and other data, CDC estimates that there were 76 million illnesses, 325,000 hospitalizations, and 5,000 deaths in 1997 in the United States. [1]

Figure 5. Burden of Illness Pyramid



This model can be used for developing estimates of the burden of illness caused by each foodborne pathogen. For example, data from this model suggest that in 1997 there were 1,400,000 *Salmonella* infections, resulting in 113,000 physician office visits, and 37,200 culture-confirmed cases in this country. Culture-confirmed cases alone resulted in an estimated 8500 hospitalizations and 300 deaths; additional hospitalizations and deaths occur among persons whose illness is not culture-confirmed.

1. Mead P, Slutsker L, Dietz V, McCaig L, Bresee J, Shapiro C, Griffin P, and Tauxe R. Food-related illness and death in the United States. Emerging Infectious Diseases, Vol 5 (5). P. 607-625.

Causes of Foodborne Diseases

As part of FoodNet, case-control studies are conducted to determine the proportion of foodborne diseases that are caused by specific foods or food preparation and handling practices. By determining this proportion, prevention efforts can become more specific and their effectiveness can be documented.

- ***E. coli* O157 case-control studies**

  A 1997 FoodNet case-control study of *E. coli* O157:H7 found undercooked ground beef was the principal food source associated with these infections. In spring 1999, FoodNet began data collection for a follow-up *E. coli* O157 case-control study that will more precisely determine risk and prevention factors for *E. coli* O157 infections.

- ***Salmonella* case-control studies**

  Eating chicken and undercooked eggs was associated with sporadic *Salmonella* Enteritidis and *Salmonella* Heidelberg infections. Antimicrobial use in the month before illness was associated with multiresistant *Salmonella* Typhimurium DT104 infections. Breast-feeding was protective against infant salmonellosis. Reptile contact was associated with salmonellosis.

- ***Campylobacter* case-control study**

  In 1999, FoodNet completed data collection for the *Campylobacter* case-control study to determine risk and prevention factors for *Campylobacter* infection. More than 1200 case-patients and 1200 controls were enrolled in the study. Preliminary analysis indicates that foreign travel is a risk factor. Among persons who had no foreign travel, the following exposures were associated with infection: eating undercooked poultry, eating chicken or turkey cooked outside the home, eating non-poultry meat cooked outside the home, eating raw seafood, drinking raw milk, living on or visiting a farm, and having contact with farm animals or puppies.

- ***Listeria* case-control study**

  To determine sources and risk factors for listeriosis, a FoodNet case-control will begin in February 2000 and will be administered for 2 years.

- ***Cryptosporidium* case-control study**

  A FoodNet case-control study to determine sources and risk factors for *Cryptosporidium* infection began in Spring 1999 and will continue for 2 years.

Future activities

- Continue population-based surveillance for *Campylobacter*, *Cryptosporidium*, *Cyclospora*, *Salmonella*, *Shigella*, Shiga toxin-producing *Escherichia coli*, *Listeria*, *Yersinia*, and *Vibrio* infections and for hemolytic uremic syndrome.
- Conduct the third cycle of the FoodNet population survey. Scheduled to begin in February 2000 in the 8 FoodNet sites, it will run for 12 months. The purpose of the survey is to estimate more precisely the burden of acute diarrheal illness in the United States. FoodNet population survey data help determine the prevalence and severity of self-reported diarrheal illness, common symptoms associated with diarrhea, the proportion of persons with diarrhea who seek care, and exposures that may be associated with foodborne illness.
- Conduct surveillance for foodborne disease outbreaks of any cause that occur within the FoodNet sites and pilot electronic reporting of outbreaks.
- Expand the population under active surveillance by including additional counties in Tennessee in 2000 and preparing Colorado for participation starting 2001. In 2000, the population within the catchment areas will include 32.6 million persons or 12% of the U.S. population.
- Continue the *E. coli* O157 case-control study.
- Continue the *Cryptosporidium* case-control study.
- Conduct a *Listeria* case-control study.
- Conduct a physician survey on food safety education practices.
- Conduct the third survey of clinical laboratories in FoodNet sites to determine changes in laboratory practices.
- Collaborate with environmental health specialists to form a network (EHS-Net) to strengthen relationships between epidemiology, laboratory and food protection programs and to better identify factors contributing to foodborne illness and foodborne disease outbreaks, particularly in retail establishments.
- Conduct pilot surveillance of reactive arthritis and pilot case-control studies to estimate the proportion of inflammatory arthritis cases attributable to enteric infections.

The following reports are available at the FoodNet web site:

http://www.cdc.gov/ncidod/dbmd/foodnet

CDC. 1996 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. FoodNet Surveillance Report for 1998: Final Report. Atlanta: Centers for Disease Control and Prevention; 1998.

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

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

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

CDC. Incidence of foodborne illness-FoodNet, 1997. Morbidity and Mortality Weekly Report. 1998; 47:782-86.

CDC. Incidence of foodborne illness: Preliminary data from the Foodborne Diseases Active Surveillance Network (FoodNet) – United States, 1998. Morbidity and Mortality Weekly Report. 1999; 48(9):189-94.

The following FoodNet News newsletters are available at this web site:

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

FoodNet News. Volume 3, No. 1, Spring 2000

FoodNet News. Volume 1, No. 3, Fall 1999

FoodNet News. Volume 1, No. 2, Winter 1999

FoodNet News. Volume 1, No. 1, Fall 1998

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

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

http://www.cdc.gov/health/diseases.htm

1999 FoodNet Publications / Presentations

The following is a list of FoodNet manuscripts and abstracts published in 1999. A complete listing of all FoodNet manuscripts and abstracts is available at the FoodNet website: http://www.cdc.gov/ncidod/dbmd/foodnet

Manuscripts

Frenzen P, Riggs T, Buzby J, Breuer T, Roberts T, Voetsch D, Reddy S, and the FoodNet Working Group. *Salmonella* cost estimate update using FoodNet data. Food Review 1999; 22 (2): 10-15.

Mead P, Slutsker L, Dietz A, McCaig L, Bresee J, Shapiro C, Griffin P, Tauxe R. Food-related illness and death in the United States. Emerging Infectious Diseases 1999; 5: 607-625.

Abstracts

Angulo F, Marano N, Mackinson C, Wang Y, Sokolow R, DeBess E, Koehler J, Benson J, Hill B, McDonald C. Isolation of quinupristin-dalfopristin-resistant *Enterococcus faecium* from human stool specimens and retail chicken products in the United States. 39th Interscience Conference on Antimicrobial Agents and Chemotherapy. San Francisco, CA, September 1999.

Fiorentino T, Howard R, Kinney A, Marcus R, Mshar P, Marano N, Westerman J, Reddy S, Angulo F. Routine Subtyping of *Salmonella* serotype typhimurium by PFGE facilitates focused epidemiological investigations in Connecticut. 39th Interscience Conference on Antimicrobial Agents and Chemotherapy. San Francisco, CA, September 1999.

Marano N, Benson J, Koehler J, Mackinson C, Wang Y, Madden J, Debess E, Hill B, Archbald L, Boel J, Wegener H, Angulo F. Presence of high-level gentamicin-resistant (HLGR) enterococci in humans and retail chicken products in the US, but not Denmark. 39th Interscience Conference on Antimicrobial Agents and Chemotherapy. San Francisco, CA, September 1999.

Van Gilder T, Christensen D, Shallow S, Fiorentino T, Desai S, Pass M, Wicklund J, Stone C, Cassidy M. Variations in stool handling and culturing practices among clinical microbiology laboratories within the Foodborne Diseases Active Surveillance network (FoodNet): Do we need practice guidelines? 99th General Meeting of the American Society for Microbiology. Chicago, IL, June 1999.

Van Gilder T, Vugia D, Fiorentino T, Segler S, Carter M, Smith K, Morse D, Cassidy M, Angulo F. Decline in *Salmonella* and *Campylobacter* but not *E. coli* O157 isolation rates in FoodNet sites: Farm, food, or fluctuation? 37th Annual Meeting of the Infectious Disease Society of America, Philadelphia, PA, November 1999.

Wicklund J, Nadle J, Nelson R, Soderlund D, Dietz V, and the FoodNet Working Group. Survey of *Cryptosporidium* testing practices among FoodNet laboratories, 1997. 37th Annual Meeting of the Infectious Disease Society of America, Philadelphia, PA, November 1999.

1999 FoodNet Working Group

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