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Part I

Narrative Report

meat and poultry products reported by USDA.

The decline in the incidence of STEC O157 infections may also be attributed to enhanced food safety intervention efforts. In October 2002, FSIS notified manufacturers of raw ground beef products that they must reassess their HACCP plans regarding this pathogen. Many beef processing plants began testing ground beef for STEC O157 and did not distribute production lots of ground beef unless such tests were negative.

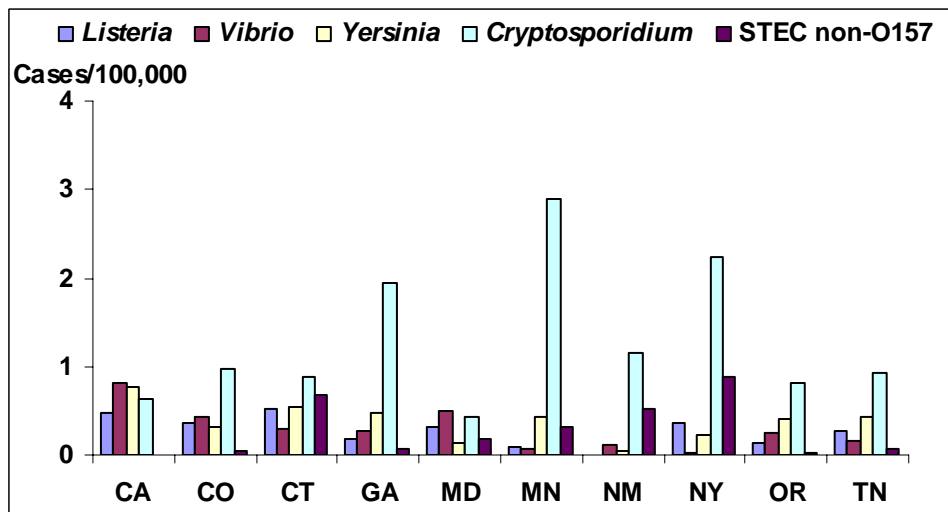
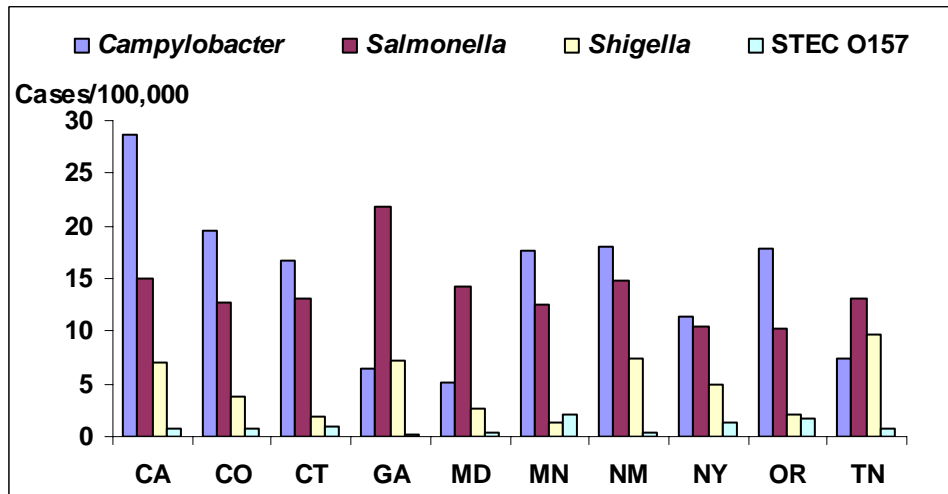
In 2004, FoodNet began collecting international travel history for *Salmonella* and STEC O157 cases and information to discern whether *Salmonella* and STEC O157 cases were outbreak-associated. By identifying domestically-acquired *Salmonella* and STEC O157 cases that are not outbreak-associated, FoodNet will be able to better attribute infections to U.S. regulated food commodities.

The incidence of foodborne diseases remains high despite important declines in the incidence for several foodborne diseases. Additional measures are needed to further reduce the incidence of these diseases and are particularly needed for *Salmonella* and *Vibrio* to achieve the Healthy People 2010 objectives, and to protect the public health. Efforts to reduce the incidence of foodborne diseases should include steps to reduce the prevalence of these pathogens in their respective important animal reservoirs; e.g., cattle (STEC O157), egg-laying and broiler chickens (*Salmonella* Enteritidis), and seafood, particularly oysters (*Vibrio*). Implementation of nationwide, consistent on-farm preventive controls, for example, would reduce the risk of human illness from *Salmonella* Enteritidis contaminated eggs.

Incidence in 2004

To compare the number of laboratory-confirmed cases among sites with different populations, incidence was calculated (incidence is the number of laboratory-confirmed cases divided by the population). The incidence reported here was calculated using the 2004 census population counts. The incidence for infections in 2004, ranked from highest to lowest, is *Salmonella* (14.61/100,000), *Campylobacter* (12.78/100,000), *Shigella* (5.06/100,000), *Cryptosporidium* (1.43/100,000), STEC O157 (0.90/100,000), *Yersinia* (0.40/100,000), *Vibrio* (0.28/100,000), *Listeria* (0.27/100,000), STEC non-O157 (0.25/100,000), and *Cyclospora* (0.03/100,000). The 2004 incidences of foodborne diseases caused by specific pathogens, by FoodNet site, are shown in Figure 2.

Figure 2. Cases per 100,000 population of foodborne disease caused by specific pathogens, FoodNet sites, 2004



***Hospitalizations
in 2004***

Hospitalization status was ascertained for 80% (12,864) of the FoodNet cases in 2004. Overall, 22% of persons with laboratory-confirmed infection were hospitalized; hospitalization rates differed markedly by pathogen. The percentage of persons hospitalized was highest for *Listeria* (97% of reported cases), followed by STEC O157 (42%), *Vibrio* (32%), *Cryptosporidium* (27%), *Yersinia* (27%), *Salmonella* (26%), STEC non-O157 (21%), *Shigella* (18%), and *Campylobacter* (15%). No persons with laboratory-confirmed *Cyclospora* infections were hospitalized.

***Deaths
in 2004***

Eighty-four persons with laboratory-confirmed infections in 2004 died; of those, 38 were infected with *Salmonella*, 19 with *Listeria*, nine with *Campylobacter*, five with *Cryptosporidium*, five with *Vibrio*, four with STEC O157, three with *Shigella*, and one with *Yersinia*. *Listeria* had the highest case-fatality rate; 16% of persons infected with *Listeria* died.

***Outbreaks
In 2004***

In 2004, FoodNet cases were part of 251 nationally reported foodborne disease outbreaks (defined as two or more illnesses from a common source); an etiology was confirmed in 173 (69%) outbreaks. The most common etiologies were norovirus (52%) and *Salmonella* (23%). Of the outbreaks reported, 140 (56%) were associated with restaurants. Cases associated with outbreaks influenced the incidence of laboratory-diagnosed infections. For example, the incidence of *S. Javiana* cases increased substantially in 2004, in part because of a multistate outbreak associated with Roma tomatoes that included 42 laboratory-diagnosed cases in Maryland (CDC, unpublished data, 2005).

Of the 6,498 *Salmonella* cases ascertained, 352 (5%) were identified as being outbreak related. Of the outbreak-associated *Salmonella* cases, 78% were food-related, 20% were not food-related, and for 2% the mode of transmission was unknown. Of the 402 STEC O157 cases ascertained, 36 (9%) were identified as being outbreak related. Of these outbreak-associated STEC O157 cases, 58% were food-related, 39% were not food related, and for 3% the mode of transmission was unknown.

***International
Travel In 2004***

Information on international travel in the 7 days before illness onset was obtained from 4,060 (62%) persons with laboratory-confirmed *Salmonella* and 359 (89%) persons with laboratory-confirmed STEC O157 infections. Ten percent of *Salmonella* cases and 3% of the STEC O157 cases reported international travel in the 7 days before illness onset.

***Incidence,
2004 to 1996-1998***

The number of FoodNet sites has doubled and the population under surveillance has more than tripled since FoodNet began in 1996 (Table 3). Because of substantial variation in incidence among the sites, adding new sites influences overall incidence. To account for the increase in the number of FoodNet sites and populations under surveillance since 1996 and for variation in the incidence of infections among sites, a main-effects, log-linear Poisson regression model (negative binomial) was used to estimate

statistically significant changes in the incidence of pathogens (1). To create a baseline period, an average annual incidence for the first 3 years (2 years for *Cryptosporidium*) of FoodNet surveillance, 1996--1998, was calculated. The estimated change in incidence (relative rate) between the baseline period and 2004 was calculated, along with a 95% confidence interval (CI). The 3-year baseline, which differs from the 1996 baseline used in previous reports, resulted in more stable and precise relative rate estimates (Figures 4A to 4D). The relative change in incidence between 3-year baseline and 2004 was estimated and confidence intervals for those changes were calculated (Tables 4A to 4B).

Comparing 2004 with baseline (Table 4A), the estimated incidence of *Yersinia* decreased 44% (95% CI=55% to 32% decrease), STEC O157 decreased 42% (95% CI=54% to 28% decrease), *Listeria* decreased 41% (95% CI=52% to 26% decrease), *Campylobacter* decreased 31% (95% CI =36% to 25% decrease), and *Salmonella* decreased 8% (95% CI =15% to 1% decrease). Comparing 2004 with the 1996--1998 baseline (Table 4B), *S. Typhimurium* decreased 41% (95% CI=48% to 33% decrease) and *S. Javiana* increased 219% (95% CI=98% to 414% increase). There was no statistical difference between the 2004 incidence and baseline for *S. Enteritidis*, *S. Heidelberg*, and *S. Newport*.

The incidence of *Shigella* infections showed considerable variation by year and site with no statistical difference between the 2004 incidence and baseline. The incidence of *Vibrio* infections was 96% higher in 1997 than it was in 1996, reflecting the emergence of *Vibrio parahaemolyticus* O3:K6. When comparing 2004 with 1996--1998, *Vibrio* increases 46% (95% CI=6% to 100% increase). This increase was less than that reported previously because of the use of the combined 3-year baseline.

Surveillance for the parasitic pathogens *Cryptosporidium* and *Cyclospora* began in 1997. Comparing 2004 with 1997-1998, the incidence of *Cryptosporidium* infections decreased 39% (95% CI=51% to 24% decrease) (Figure 4D). Although the incidence of *Cyclospora* has decreased since 1997, the statistical model could not be applied to *Cyclospora* because of the rarity of cases (200 cases between 1997 and 2004).

Healthy People 2010 objectives have been established for four pathogens under FoodNet surveillance; the Healthy People 2010 objective for *Listeria* was subsequently accelerated to a 2005 objective. In 2004, the incidences of *Campylobacter*, STEC O157, and *Listeria* were approaching their targets of 12.3, 1.0, and 0.25 cases per 100,000 respectively. The incidence of *Salmonella* infections in 2004, however, remained much higher than the goal of 6.8 cases per 100,000 (Table 5).

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 2004;38(Suppl 3):S121--6

Table 3. Population under surveillance in FoodNet sites, 1996-2004

Site	1996	1997	1998	1999	2000	2001	2002	2003	2004
California	2,087,032	2,113,195	2,142,806	2,162,359	3,181,686	3,230,038	3,228,717	3,213,848	3,208,609
Colorado	-	-	-	-	-	2,155,324	2,507,484	2,526,245	2,555,636
Connecticut	1,622,809	2,453,483	3,272,563	3,282,031	3,411,956	3,434,602	3,460,503	3,483,375	3,503,604
Georgia	2,720,443	3,632,206	3,744,022	7,788,240	8,234,373	8,405,677	8,560,310	8,684,715	8,829,383
Maryland	-	-	2,441,279	2,450,566	2,516,889	4,253,665	5,458,137	5,508,909	5,558,058
Minnesota	4,647,723	4,687,726	4,726,411	4,775,508	4,934,248	4,984,535	5,019,720	5,059,375	5,100,958
New Mexico	-	-	-	-	-	-	-	-	1,903,289
New York	-	-	1,105,062	2,084,453	2,111,143	2,115,056	3,330,456	3,972,809	4,315,310
Oregon	3,195,087	3,243,254	3,282,055	3,316,154	3,431,137	3,473,441	3,521,515	3,559,596	3,594,586
Tennessee	-	-	-	-	2,825,539	2,848,426	2,874,846	5,841,748	5,900,962
TOTAL	14,273,094	16,129,864	20,714,198	25,859,311	30,646,971	34,900,764	37,961,688	41,850,620	44,470,395
FoodNet population as % of U.S. population	5.4	6	7.7	9.5	10.9	12.2	13.2	14.4	15.1

Bolded 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.

Figure 4A. Relative rates of laboratory-confirmed cases of *Campylobacter*, *Salmonella*, and *Shigella*, by year, 2004 to 1996-1998

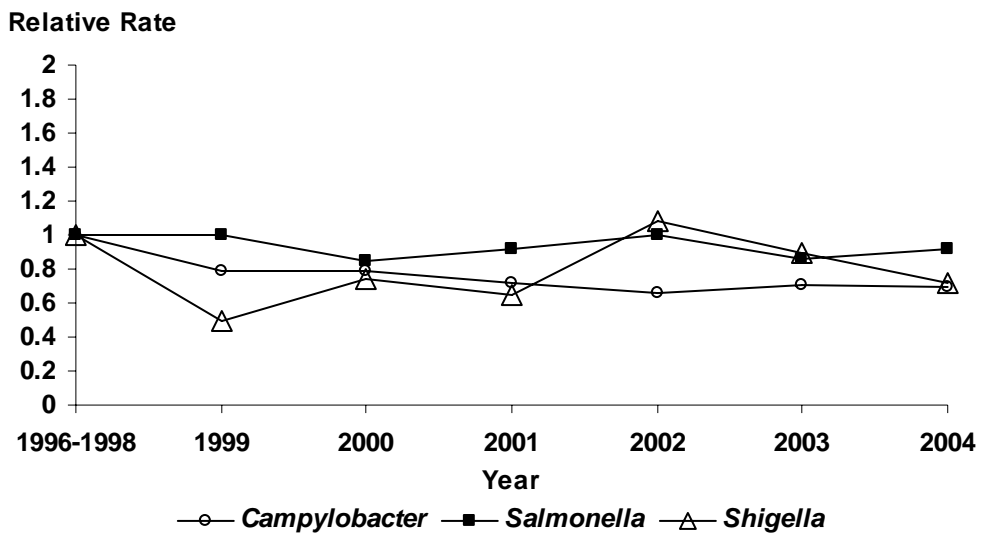


Figure 4B. Relative rates of laboratory-confirmed cases of STEC O157, *Listeria*, and *Yersinia*, by year, 2004 to 1996-1998

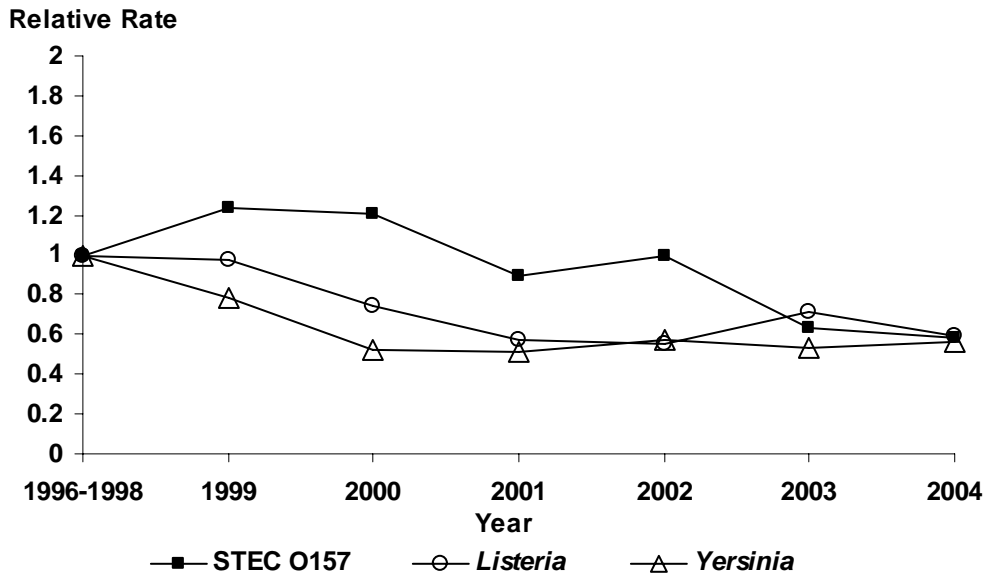


Figure 4C. Relative rates of laboratory- confirmed cases of *Vibrio*, by year, 2004 to 1996-1998

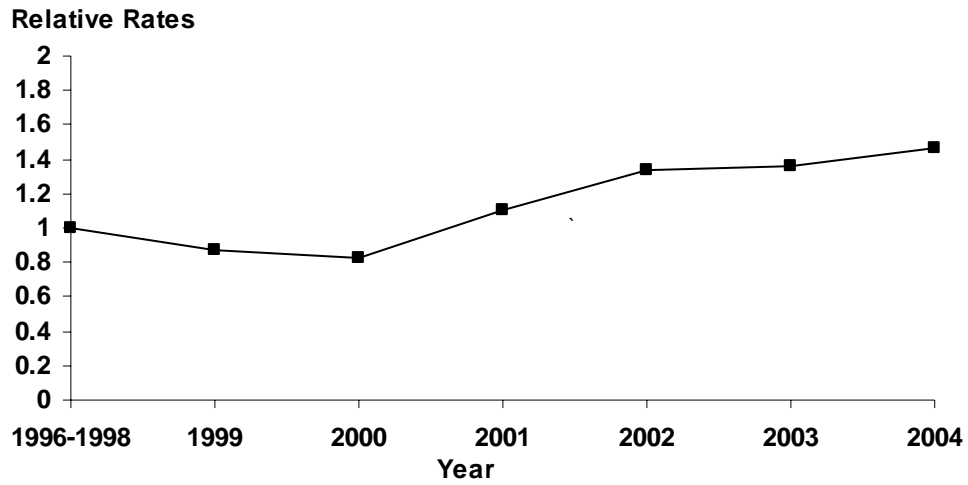


Figure 4D. Relative rates of laboratory- confirmed cases of *Cryptosporidium*, by year, 2004 to 1997-1998

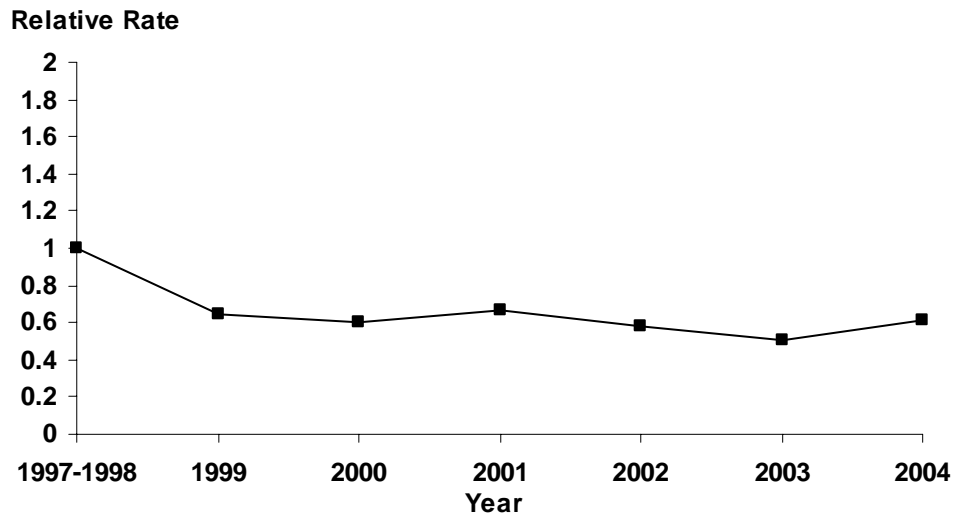


Table 4A. Percent change in incidence* of diagnosed infections for pathogens under surveillance in FoodNet, by pathogen, 2004 to 1996-1998

Bacterial Pathogen	Percent Change	95% Confidence Interval
<i>Campylobacter</i>	-31	36% to 25% decrease
<i>Listeria</i>	-41	52% to 26% decrease
<i>Salmonella</i>	-8	15% to 1% decrease
<i>Shigella</i>	-28	51% to 5% decrease
STEC O157	-42	54% to 28% decrease
<i>Vibrio</i>	46	6% to 100% increase
<i>Yersinia</i>	-44	55% to 32% decrease

*Cases per 100,000 population

Parasitic Pathogen	Percent Change*	95% Confidence Interval
<i>Cryptosporidium</i>	-39	51% to 24% decrease

*2004 to 1997-1998

Table 4B. Percent change in incidence* of diagnosed infections for the five most common *Salmonella* serotypes, by serotype, 2004 to 1996-1998

Pathogen	Percent Change	95% Confidence Interval
<i>Salmonella</i> Typhimurium	-41	48% to 33% decrease
<i>Salmonella</i> Enteritidis	0	20% decrease to 26% increase
<i>Salmonella</i> Heidelberg	3	16% decrease to 26% increase
<i>Salmonella</i> Newport	40	4% to 87% increase
<i>Salmonella</i> Javiana	219	98% to 414% increase

*Cases per 100,000 population

Table 5. Comparison of 2004 incidence with the National Health objectives

Pathogen	Incidence [†]	
	2004 Actual	Objective
<i>Campylobacter</i>	12.8	12.3*
<i>Listeria</i>	0.27	0.25**
<i>Salmonella</i>	14.6	6.8*
STEC O157	0.9	1.0*

[†]Cases per 100,000 population

*2010 Healthy People objective

**2005 objective

Surveillance of Hemolytic Uremic Syndrome

Background

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). STEC O157 is the most easily and frequently isolated STEC, but other serotypes can also cause HUS.

Methods

In 2003, HUS surveillance was conducted in Connecticut, Georgia, Maryland, Minnesota, Oregon, Tennessee and select counties in California, New York, and Colorado. Active surveillance was accomplished in all 9 sites through a network of pediatric nephrologists and infection control practitioners, who reported all cases of HUS. Data on adult HUS cases were collected in 8 of the 9 sites, but surveillance was passive and incomplete. In 8 sites hospital discharge data were reviewed to identify any HUS cases that may not have been reported through the networks or passive surveillance.

Cases reported in 2003

In 2003, 97 HUS cases were reported (Table 6A) and 4 (4%) died. Among children less than 15 years of age, 73 HUS cases were reported and 2 (3%) died. Fifty-three percent of HUS cases were diagnosed between June and September.

Incidence, 1997-2003

A total of 628 cases of HUS were reported between 1997 and 2003 (Table 6A). Fifty-eight percent were female. The median age was 5 years and the median length of hospitalization was 12 days. FoodNet identified 462 cases of HUS in children 0 to 14 years of age (rate of 1.06 per 100,000 children); 311 (67%) of these cases occurred in children under five years of age (rate of 2.21 per 100,000 children, Table 6B). STEC O157 was isolated from 54% of stools that were specifically tested for this pathogen (Table 6C), and Shiga toxin was detected in 66% of stools specifically tested for it. Only four STEC non-O157 were isolated, but it is unknown how rigorously they were sought. Serum samples from 47 cases were tested for antibodies to O157, O111, or O26 lipopolysaccharide (LPS); 26 cases (55%) had antibodies to O157 LPS and two cases (4%) had antibodies to O111 LPS.

Table 6A. HUS cases by site and year, 1997-2003*

State	1997		1998		1999		2000		2001		2002		2003		Total
	Age<15 years	Age≥15 years	Age<15 years	Age≥15 years	Age<15 years	Age≥15 years	Age<15 years	Age≥15 years	Age<15 years	Age≥15 years	Age<15 years	Age≥15 years	Age<15 years	Age≥15 years	
CA	10	0	10	0	5	1	18	6	10	2	8	3	11	3	87
CO	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	15	0	11	1	10	1	38
CT	1	0	0	0	8	2	11	5	3	1	7	2	2	1	43
GA	6	0	13	0	4	0	15	15	10	7	11	10	5	1	97
MD	n/a	n/a	n/a	n/a	3	0	4	3	11	5	4	5	5	7	47
MN	9	3	16	4	9	5	16	4	20	5	11	1	8	5	116
NY	n/a	n/a	n/a	n/a	15	6	5	3	2	3	4	3	10	1	52
OR	6	4	6	0	3	3	6	5	12	1	22	3	8	2	81
TN	n/a	n/a	n/a	n/a	n/a	n/a	10	6	12	7	7	3	14	3	62
Total	32	7	45	4	47	17	85	47	95	31	85	31	73	24	623

*5 HUS cases were missing both data of birth and diagnosis date

Table 6B. Pediatric HUS cases, by site and age, 1997–2003

State	Age < 5 years		Age 5–14 years	
	Cases	Rate per 100,000	Cases	Rate per 100,000
California	45	3.71	27	1.11
Colorado***	24	4.51	12	1.18
Connecticut	20	1.35	12	0.37
Georgia	44	1.20	20	0.28
Maryland*	13	0.86	14	0.43
Minnesota	60	2.67	29	0.58
New York*	26	2.93	10	0.49
Oregon	52	3.35	11	0.33
Tennessee**	27	2.77	16	0.81
Total	311	2.21	151	0.51

*Based only on 1999-2003 data

**Based only on 2000-2003 data

***Based only on 2001-2003 data

Table 6C. Results of microbiologic testing for STEC infection among HUS cases, 1997–2003

Diarrhea in three weeks before HUS diagnosis/ Total patients	549/628	87%
Stool specimen obtained/ Total patients	536/628	85%
Stool cultured for STEC O157/ Patients with stool specimen obtained	501/536	93%
STEC O157 isolated from stool/ Patients with stool cultured for STEC O157	272/501	54%
Stool tested for Shiga toxin/ Patients with stool specimen obtained	199/536	37%
Stool Shiga toxin-positive/ Patients with stool tested for Shiga toxin	131/199	66%
STEC non-O157 isolated from stool/ Patients with stool tested for Shiga toxin	4/199	2%
Stool yielding STEC O157, STEC non-O157 and/or Shiga toxin/ Total patients with stool cultured for STEC O157	287/501	57%

Comments

From 1996-2004, substantial declines occurred in the estimated incidence of infections with *Campylobacter*, *Cryptosporidium*, *Listeria*, *S. Typhimurium*, STEC O157, and *Yersinia*. The 2004 incidence of STEC O157 infections declined below the 2010 national target of 1.0 case per 100,000 persons in FoodNet overall and in seven of the 10 surveillance sites. In addition, the decline in *Campylobacter* incidence represents progress toward the national health objective of 12.3 cases per 100,000 persons (2); the renewed decline in *Listeria* incidence, to 0.27 cases per 100,000 population in 2004, suggests that the revised national objective to reduce foodborne listeriosis to 0.25 cases per 100,000 population by 2005 might be achievable with continued efforts (3).

The declines described in this report have occurred concurrently with several important food safety initiatives and education efforts (4). The substantial decline of STEC O157 infections first noted in 2003 and sustained in 2004 is consistent with declines in STEC O157 contamination of ground beef reported by the USDA-FSIS for 2003 (5) and 2004. Multiple interventions might have contributed to this decline, including industry response to the FSIS 2002 notice to manufacturers to reassess control strategies for STEC O157 in the production of ground beef and enhanced strategies for reduction of pathogens in live cattle and during slaughter (4). The overall decline in *Campylobacter* incidence from the baseline period to 2004, most of which occurred before 2001, might reflect efforts to reduce contamination of poultry and educate consumers about safe food-handling practices. Although the incidence of *Listeria* infections decreased from the period 1996--1998 through 2004, the incidence in 2004 was comparable to 2002, after an increase in 2003; efforts must continue to prevent foodborne listeriosis.

The decline in *Salmonella* incidence was modest compared with those of other foodborne bacterial pathogens. Only one of the five most common *Salmonella* serotypes, *S. Typhimurium*, declined significantly. To achieve the national health objective of reducing the number of cases to 6.8 per 100,000 persons, greater efforts are needed to understand the complex epidemiology of *Salmonella* and to identify effective pathogen-reduction strategies. The multistate tomato-associated *S. Javiana* outbreak that occurred in the summer of 2004 emphasizes the need to better understand *Salmonella* reservoirs and contamination of produce during production and harvest (6). The Food and

2 US Department of Health and Human Services. Healthy people 2010 (conference ed, in 2 vols). Washington, DC: US Department of Health and Human Services; 2000.

3 US Department of Agriculture, Food Safety and Inspection Service. 9 CFR Part 430. Control of *Listeria monocytogenes* in ready-to-eat meat and poultry products; final rule. Federal Register 2003;68:34,208--54.

4 Allos BM, Moore MR, Griffin PM, Tauxe RV. Surveillance for sporadic foodborne disease in the 21st century: the FoodNet perspective. Clin Infect Dis 2004;38(Suppl 3):S115--20.

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

6 CDC. Outbreaks of *Salmonella* infections associated with eating Roma tomatoes---United States and Canada, 2004. MMWR 2005;54:325--8.

Drug Administration recently developed a plan to decrease foodborne illness associated with fresh produce (7). Moreover, multidrug resistance is an emerging problem among *Salmonella* serotypes, particularly *S. Newport*; large multistate outbreaks associated with ground beef are cause for increased concern (8).

Enhanced efforts are needed across the farm-to-table continuum 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 efforts can be particularly focused when an animal reservoir species and transmission route for a pathogen are known. For example, many *Vibrio* infections are related to consumption of raw molluscan shellfish harvested from waters where *Vibrio* are present; ultra-high hydrostatic pressure treatment of oysters will likely prevent *Vibrio* infections. Other effective prevention measures, such as pasteurization of in-shell eggs and irradiation of ground meat and raw poultry, should be used more widely, particularly for foods eaten by persons at high risk. Consumers should follow safe food-handling recommendations and not consume raw or undercooked shellfish, eggs, ground beef, or poultry. In addition, efforts are needed to prevent transmission by nonfoodborne routes (e.g., via water, person-to-person, and exposure to animals or their environments). Guidelines to prevent disease associated with direct contact with animals or their environments in public settings (e.g., fairs and petting zoos) have recently been published (9).

7 Food and Drug Administration. Produce safety from production to consumption: 2004 action plan to minimize foodborne illness associated with fresh produce consumption. Rockville, MD: US Department of Health and Human Services, Food and Drug Administration; 2004. Available at <http://www.cfsan.fda.gov/~dms/prodpla2.html>.

8 CDC. Outbreak of multidrug-resistant *Salmonella* Newport--United States, January--April 2002. *MMWR* 2002;51:545--8.

9 CDC. Compendium of measures to prevent disease associated with animals in public settings, 2005: National Association of State Public Health Veterinarians, Inc. (NASPHV). *MMWR* 2005;54(No. RR-4).

Limitations

The findings in this report are subject to at least four limitations. First, FoodNet relies on laboratory diagnoses, and many foodborne illnesses are not laboratory diagnosed. For example, infections such as norovirus are not identified routinely in clinical laboratories. Second, protocols for isolation of enteric pathogens (e.g., STEC non-O157) in clinical laboratories vary and are not implemented uniformly within FoodNet sites (10). Third, reported illnesses might have been acquired through nonfoodborne sources; reported incidence rates do not represent foodborne sources exclusively. Fourth, although the FoodNet population is similar to the U.S. population (11), the findings might not be generalizable to the entire population of the United States.

10 Voetsch AC, Angulo FJ, Rabatsky-Ehr T, et al. 2004. 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.

11 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* 2004;38(Suppl 3):S121--6.

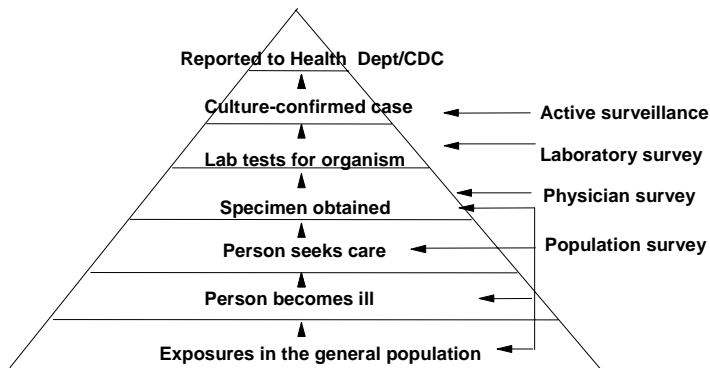
Other FoodNet Data Sources

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, physicians, and the general population in the participating EIP sites (Figure 5). Using these data, we can determine the proportion of people in the general population with a diarrheal illness, and from among those, the number 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 estimated that 76 million foodborne illnesses, 325,000 hospitalizations, and 5,000 deaths occurred in 1997 in the United States (12).

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. 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.

Figure 5. Burden of Illness Pyramid



12 Mead P, Slutsker L, Dietz V, et al. Food-related illness and death in the United States. *Emerging Infectious Disease* 1999;5:607-25. Available at <http://www.cdc.gov/ncidod/eid/vol5no5/mead.htm>

***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; infant salmonellosis; *Campylobacter*; *Cryptosporidium*; and *Listeria*. Case-control studies of infant *Salmonella* and *Campylobacter* infections were launched in 2002. 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 2004***

- Analysis of the *Listeria* case-control study, which enrolled 174 cases and 378 controls, was completed.
- Analysis for the *Salmonella* Newport and *Salmonella* Enteritidis case-control studies was completed. The *S. Newport* study was designed to identify behavioral, dietary, and medical risk factors for and medical consequences of *S. Newport* infections, including multidrug-resistant strains of *S. Newport*. This study enrolled 215 cases and 1154 controls. The *S. Enteritidis* study was designed to identify behavioral, dietary, and medical risk factors for and medical consequences of *S. Enteritidis* infections. This study enrolled 223 cases and 742 controls.
- Analysis for the infant salmonellosis and campylobacteriosis case-control studies, enrolling 566 cases and 928 controls, was completed. These studies were designed to identify behavioral, dietary, and medical risk factors for infections of infants with *Salmonella* or *Campylobacter*.
- Data analysis began on a retrospective cohort study to evaluate the impact that reduced susceptibility to fluoroquinolones has on clinical outcomes of *Salmonella* Typhi infection.

Publications and Abstracts, 2004

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. Allos BM, Moore MR, Griffin PM, Tauxe RV. Surveillance for sporadic foodborne disease in the 21st century: the FoodNet perspective. *Clinical Infectious Diseases* 2004;38(Suppl 3):S115-120.
2. Bender JB, Smith KE, McNees AA, Rabatsky-Ehr TR, Segler SD, Hawkins MA, Spina NL, Keene WE, Kennedy MH, Van Gilder TJ, Hedberg CW. Factors affecting surveillance data on *Escherichia coli* O157 infections collected from FoodNet sites, 1996-1999. *Clinical Infectious Diseases* 2004;38(Suppl 3):S157-164.
3. Chatterjee NK, Moore DW, Monroe SS, Glass RI, Cambridge MJ, Kondracki SF, Morse DF. Molecular epidemiology of outbreaks of viral gastroenteritis in New York state, 1998-1999. *Clinical Infectious Diseases* 2004;38(Suppl 3):S303-310.
4. Friedman CR, Hoekstra RM, Samuel M, Marcus R, Bender J, Shiferaw B, Reddy S, Ahuja SD, Helfrick DL, Hardnett F, Carter M, Anderson B, Tauxe RV. Risk factors for sporadic *Campylobacter* infection in the United States: a case-control study in FoodNet sites. *Clinical Infectious Diseases* 2004;38(Suppl 3):S286-296.
5. Glynn MK, Reddy V, Hutwagner L, Rabatsky-Ehr T, Shiferaw B, Vugia DJ, Segler S, Bender J, Barrett TJ, Angulo FJ; Emerging Infections Program FoodNet Working Group. Prior antimicrobial agent use increases the risk of sporadic infections with multidrug-resistant *Salmonella enterica* serotype Typhimurium: a FoodNet case-control study, 1996-1997. *Clinical Infectious Diseases* 2004;38(Suppl 3):S227-236.
6. Gupta A, Nelson JM, Barrett TJ, Tauxe RV, Rossiter SP, Friedman CR, Joyce KW, Smith KE, Jones TF, Hawkins MA, Shiferaw B, Beebe JL, Vugia DJ, Rabatsky-Ehr T, Benson JA, Root TP, Angulo FJ. Antimicrobial resistance among *Campylobacter* strains, United States, 1997-2001. *Emerging Infectious Diseases* 2004;10(6):1102-1109.
7. Haber P, DeStefano F, Angulo FJ, Iskander J, Shadomy SV, Weintraub E, Chen RT. Guillain-Barré syndrome following influenza vaccination. *JAMA* 2004;292(20):2478-2481.
8. Hardnett FP, Hoekstra RM, Kennedy M, Charles L, Angulo FJ. Epidemiologic issues in study design and data analysis related to FoodNet activities. *Clinical Infectious Diseases* 2004;38(Suppl 3):S121-126.
9. Hennessy TW, Marcus R, Deneen V, Reddy S, Vugia D, Townes J, Bardsley M, Swerdlow D, Angulo FJ. Survey of physician diagnostic practices for patients with acute diarrhea: clinical and public health implications. *Clinical Infectious Diseases* 2004;38(Suppl 3):S203-211.

10. Hennessy TW, Cheng LR, Kassenborg H, Ahuja SD, Mohle-Boetani J, Marcus R, Shiferaw B, Angulo FJ. Group egg consumption is the principal risk factor for sporadic *Salmonella* serotype Heidelberg infections: a case-control study in FoodNet sites. *Clinical Infectious Diseases* 2004;38(Suppl 3):S237-243.
11. Imhoff B, Morse D, Shiferaw B, Hawkins M, Vugia D, Lance-Parker S, Hadler J, Medus C, Kennedy M, Moore MR, Van Gilder T. Burden of self-reported acute diarrheal illness in FoodNet surveillance areas, 1998-1999. *Clinical Infectious Diseases* 2004;38(Suppl 3):S219-226.
12. Jones JL, Lopez A, Wahlquist SP, Nadle J, Wilson M. Survey of clinical laboratory practices for parasitic diseases. *Clinical Infectious Diseases* 2004;38(Suppl 3):S198-202.
13. Jones TF, Imhoff B, Samuel M, Mshar P, McCombs PG, Hawkins M, Deneen V, Cambridge M, Olsen SJ. Limitations to successful investigation and reporting of foodborne outbreaks: an analysis of foodborne disease outbreaks in FoodNet catchment areas, 1998-1999. *Clinical Infectious Diseases* 2004;38(Suppl 3):S297-302.
14. Jones TF, Bulens SN, Gettner S, Garman RL, Vugia DJ, Blythe D, Hawkins MA, Monroe SS, Angulo FJ, Parashar UD. Use of stool collection kits delivered to patients can improve confirmation of etiology in foodborne disease outbreaks. *Clinical Infectious Diseases* 2004;39(10):1454-1459.
15. Kassenborg HD, Hedberg CW, Hoekstra M, Evans MC, Chin AE, Marcus R, Vugia DJ, Smith K, Ahuja SD, Slutsker L, Griffin PM. Farm visits and undercooked hamburgers as major risk factors for sporadic *Escherichia coli* O157:H7 infection: data from a case-control study in 5 FoodNet sites. *Clinical Infectious Diseases* 2004;38(Suppl 3):S271-278.
16. Kassenborg HD, Smith KE, Vugia DJ, Rabatsky-Ehr T, Bates MR, Carter MA, Dumas NB, Cassidy MP, Marano N, Tauxe RV, Angulo FJ; Emerging Infections Program FoodNet Working Group. Fluoroquinolone-resistant *Campylobacter* infections: eating poultry outside of the home and foreign travel are risk factors. *Clinical Infectious Diseases* 2004;38(Suppl 3):S279-284.
17. Kassenborg HD, Smith KE, Hoekstra RM, Carter MA, Tauxe RV, Angulo FJ. Reply to Cox. *Clinical Infectious Diseases* 2004;39(9):1400-1401.
18. Kennedy M, Villar R, Vugia DJ, Rabatsky-Ehr T, Farley MM, Pass M, Smith K, Smith P, Cieslak PR, Imhoff B, Griffin PM. Hospitalizations and deaths due to *Salmonella* infections, FoodNet, 1996-1999. *Clinical Infectious Diseases Supplement* 2004;38(Suppl 3):S142-148.
19. Kimura AC, Reddy V, Marcus R, Cieslak PR, Mohle-Boetani JC, Kassenborg HD, Segler SD, Hardnett FP, Barrett T, Swerdlow DL. Chicken consumption is a newly identified risk factor for sporadic *Salmonella enterica* serotype Enteritidis infections in the United States: a case-control study in FoodNet sites. *Clinical Infectious Diseases* 2004;38(Suppl 3):S244-252.
20. Lee R, Beatty ME, Bogard AK, Esko M, Angulo F, Selman C. Prevalence of high-risk egg-preparation practices in restaurants that prepare breakfast egg entrées: an EHS-Net study. *Journal of Food Protection* 2004;67(7):1444-1450.

21. Marcus R, Rabatsky-Ehr T, Mohle-Boetani JC, Farley M, Medus C, Shiferaw B, Carter M, Zansky S, Kennedy M, Van Gilder TJ, and Hadler JL. Dramatic decrease in the incidence of *Salmonella* serotype Enteritidis infections in 5 FoodNet sites: 1996-1999. *Clinical Infectious Diseases* 2004;38(Suppl 3):S135-141.
22. Mermin J, Hutwagner L, Vugia D, Shallow S, Daily P, Bender J, Koehler J, Marcus R, Angulo FJ. Reptiles, amphibians, and human *Salmonella* infection: a population-based, case-control study. *Clinical Infectious Diseases* 2004;38(Suppl 3):S253-261.
23. Nelson JM, Smith KE, Vugia DJ, Rabatsky-Ehr T, Segler SD, Kassenborg HD, Zansky SM, Joyce K, Marano N, Hoekstra RM, Angulo FJ. Prolonged diarrhea due to ciprofloxacin-resistant *Campylobacter* infection. *Journal of Infectious Diseases* 2004;150:1150-1157.
24. Ray SM, Ahuja SD, Blake PA, Farley MM, Samuel M, Fiorentino T, Swanson E, Cassidy M, Lay JC, Van Gilder T. Population-based surveillance for *Yersinia enterocolitica* infections in FoodNet sites, 1996 - 1999: higher risk of disease in infants and minority populations. *Clinical Infectious Diseases* 2004;38(Suppl 3):S181-189.
25. Rees JR, Pannier MA, McNees A, Shallow S, Angulo FJ, Vugia DJ. Persistent diarrhea, arthritis, and other complications of enteric infections: a pilot survey based on California FoodNet surveillance, 1998-1999. *Clinical Infectious Diseases* 2004;38(Suppl 3):S311-317.
26. Rowe SY, Rocourt JR, Shiferaw B, Kassenborg HD, Segler SD, Marcus R, Daily PJ, Hardnett FP, Slutsker L. Breast-feeding decreases the risk of sporadic Salmonellosis among infants in FoodNet sites. *Clinical Infectious Diseases* 2004;38(Suppl 3):S262-270.
27. Roy SL, DeLong SM, Stenzel SA, Shiferaw B, Roberts JM, Khalakdina A, Marcus R, Segler SD, Shah DD, Thomas S, Vugia DJ, Zansky SM, Dietz V, Beach MJ; Emerging Infections Program FoodNet Working Group. Risk factors for sporadic Cryptosporidiosis among immunocompetent persons in the United States from 1999 to 2001. *Journal of Clinical Microbiology* 2004;42(7):2944-2951.
28. Samuel MC, Vugia DJ, Shallow S, Marcus R, Segler S, McGivern T, Kassenborg H, Reilly K, Kennedy M, Angulo FJ, Tauxe RV. Epidemiology of sporadic *Campylobacter* infection in the United States and declining trend in incidence, FoodNet 1996-1999. *Clinical Infectious Diseases* 2004;38(Suppl 3):S165-174.
29. Shiferaw B, Shallow S, Marcus R, Segler S, Soderlund D, Hardnett FP, Van Gilder T. Trends in population-based active surveillance for Shigellosis and demographic variability in FoodNet sites, 1996-1999. *Clinical Infectious Diseases* 2004;38(Suppl 3):S175-180.
30. Sivapalasingam S, Hoekstra RM, McQuiston JR, Fields PI, Tauxe RV. *Salmonella* Bacteriuria: an increasing entity in elderly women in the United States. *Epidemiology Infect* 2004;1-6.

31. Voetsch AC, Angulo FJ, Rabatsky-Ehr TR, Shallow S, Cassidy M, Thomas SM, Swanson E, Zansky SM, Hawkins MA, Jones TF, Shillam PJ, Van Gilder TJ, Wells JG, Griffin PM. Laboratory practices for stool-specimen culture for bacterial pathogens, including *Escherichia coli* O157:H7, in the FoodNet sites, 1995-2000. *Clinical Infectious Diseases* 2004;38(Suppl 3):S190-197.
32. Voetsch AC, Van Gilder TJ, Angulo FJ, Farley MM, Shallow S, Marcus R, Cieslak PR, Deneen VC, Tauxe RV. FoodNet estimate of the burden of illness caused by nontyphoidal *Salmonella* infections in the United States. *Clinical Infectious Diseases* 2004;38(Suppl 3):S127-134.
33. Vugia DJ, Samuel M, Farley MM, Marcus R, Shiferaw B, Shallow S, Smith K, Angulo FJ. Invasive *Salmonella* infections in the United States, FoodNet, 1996 - 1999: incidence, serotype distribution, and outcome. *Clinical Infectious Diseases* 2004;38(Suppl 3):S149-156.
34. Wong S, Marcus R, Hawkins M, Shallow S, McCombs KG, Swanson E, Anderson B, Shiferaw B, Garman R, Noonan K, Van Gilder T. Physicians as food-safety educators: a practices and perceptions survey. *Clinical Infectious Diseases* 2004;38(Suppl 3):S212-218.

Abstracts

1. Adhikari BB, Angulo FJ, Meltzer MI. Gastrointestinal and invasive *Salmonella* infections in the United States: medical costs and productivity loss using FoodNet burden of illness estimates international. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
2. Ailes EC, Vugia DJ, Segler SD, Hurd S, Megginson M, Stenzel SA, Hidalgo C, Ingram LA, Moore MR; Emerging Infections Program FoodNet Working Group; Rates of hospitalization for specific foodborne pathogens, FoodNet, 1996-2001. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
3. Bair HD, Rafi W, Angulo FJ, the Zoonoses Working Group; Healthy Pets Healthy People: an internet resource for health risks associated with pets. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
4. Devasia RA, Varma JK, Whichard J, Gettner S, Cronquist AB, Hurd S, Segler S, Smith K, Hoefler D, Shiferaw B, Angulo FJ, Jones TF; Emerging Infections Program FoodNet Working Group. Health consequences of infection with multidrug-resistant and pan-susceptible *Salmonella* Newport reported to Foodborne Diseases Active Surveillance Network (FoodNet) -United States, 2002-2003. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
5. DuBois A, Vugia DJ, Farley MM, Zansky SM, Smith KE, Snider CJ, Hoekstra M, Angulo FJ; Emerging Infections Program FoodNet Working Group. Decline in *Salmonella* deaths in the United States? Data from the Foodborne Diseases Active Surveillance Network and the National Death Index, 1996-2000. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.

6. Fullerton K, Ishill N, Vugia DJ, Haubert N, Hurd S, Ray S, Ryan P, Wedel S, Anderson BJ, Jones T, Kretsinger K. Trends in population-based incidence of *Campylobacter* and *Salmonella* among infants in FoodNet, 1996-2003. Presented at the Infectious Diseases Society of America, Boston, MA, 2004.
7. Hurd S, Scheftel J, Snider CJ, Shin S, Hatch J, Thomas SM, Gerber DE, Smith G, Burnite S, Holtry RS, Strockbine N, Moore MR; Emerging Infections Program FoodNet Working Group. Clinical laboratory practices for the identification of shiga toxin-producing *Escherichia coli* in FoodNet sites. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
8. Kretsinger K, Vugia DJ, Cronquist AB, Hadler J, Thomas S, Megginson M, Swanson E, Zansky S, Jones T, Hoekstra R, and Angulo FJ. Declines in the incidence of many foodborne illnesses, including *Escherichia coli* O157 -FoodNet 2003. Presented at the Infectious Diseases Society of America, Boston, MA, 2004.
9. Kretsinger K, Crump JA, Joyce KW, Vugia DJ, Megginson M, Segler SD, Hurd S, Luedeman J, Shiferaw B, Hanna SS, Angulo FJ, Moore MR; Emerging Infections Program FoodNet Working Group. FoodNet retrospective cohort study: infection with nalidixic acid-resistant *Salmonella* Typhi is associated with poor clinical outcomes. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
10. Marcus R, Gerber DE, Smith KE, Keene W, Holtry R, Vugia DJ, Chaves S, Hoefler D, Moore MR; Emerging Infections Program FoodNet working Group. The influence of outbreak cases on trends in *E. coli* O157 infection, FoodNet Sites, 1996-2002. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
11. Malone S, Marcus R, Hadler JL, Zansky SM, Hoefler D, Frenzen PD, Banerjee A, Angulo FJ; Emerging Infections Program FoodNet Working Group. Knowledge, attitude, and practice of the use of irradiation among respondents to the FoodNet Population Survey in Connecticut and New York. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
12. McMillian M, Jones T, Scallan E, Thomas S, Cronquist A, Frenzen P, Angulo FJ. Burden of diarrheal illness in FoodNet, 1996-2003. Presented at the Infectious Diseases Society of America, Boston, MA, 2004.
13. McMillian M, Jones TF, Banerjee A, Vugia D, Cronquist A, Segler S, Ryan P, Medus C, Smith P, Shiferaw B, Angulo FJ. The burden of diarrheal illness in FoodNet, 2002-2003. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
14. Moore MR, Varma J K, Medus C, Crume T, Marcus R, Zansky SM, Boothe E, Boxrud D, Tauxe RV; Emerging Infections Program FoodNet Working Group. Risk factors for sporadic infection caused by *Salmonella* Enteritidis in the United States, 2002-2003. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.

15. Nelson JM, D Vugia, Daniels A, Hurd S, Park M, Blythe D, Wedel S, Anderson B, Ingram A, Joyce K, Angulo FJ. Increasing incidence of nalidixic acid-resistant *Salmonella*: FoodNet and NARMS 1996-2002. Presented at the Infectious Diseases Society of America, Boston, MA, 2004.
16. Nelson JM, Vugia DJ, Cronquist AB, Marcus R, Shiferaw B, Farley MM, Ryan PA, Swanson E, Morse DL, Jones TF, Moore MR; Emerging Infections Program FoodNet Working Group. Incidence of foodborne illnesses in the United States, FoodNet, 2002. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
17. Scallan E, Ishill N, Vugia DJ, Haubert N, Marcus R, Megginson M, Medus C, Zansky S, Shiferaw B, Gerber D, Scallan E. Ethnic Disparities in Listeriosis incidence, FoodNet 1996-2003. Presented at the Infectious Diseases Society of America, Boston, MA, 2004.
18. Scallan E, Banerjee A, Majowicz S, Hall G, Bowman C, Jones T, Daly L, Kirk M, Angulo FJ. Prevalence of diarrhea in the community in Australia, Canada, Ireland and the United States. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
19. Shiferaw B, Chaves S, Ryan P, Medus C, Vugia DJ, Zansky S, Jones TF, Angulo F; Emerging Infections Program FoodNet Working Group. Is eating outside the home associated with gastrointestinal illness? Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
20. Snider C, Vugia DJ, Burnite S, Hurd S, Hayes T, Scheftel J, Smith G, Shiferaw B, Boothe E, Griffin PM. Post-diarrheal Hemolytic Uremic Syndrome (D+ 2 HUS) in adults, FoodNet, 1997-2002. Presented at the Infectious Diseases Society of America, Boston, MA, 2004.
21. Townes JM, Sobel J, Swanson E, Smith KE, Duck W, Wagner MM, Cieslak PR. The FoodNet reactive arthritis study: antibiotic use among persons with culture confirmed enteric infections. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
22. Vally H, Kirk MD, Scallan E, Angulo FJ, Hall GV. Higher incidence of *Campylobacter* infection in Australia compared with the United States in 2001. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
23. Varma JK, Samuel MC, Marcus R, Hoekstra M, Medus C, Segler SD, Anderson BJ, Gerber DE, Shiferaw B, Haubert N, Megginson M, McCarthy PV, De Witt W, Van Gilder TJ, Angulo FJ. Dietary and medical risk factors for sporadic *Listeria monocytogenes* infection: a FoodNet case-control study - United States, 2000-2003. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.
24. Varma JK, Marcus R, Stenzel SA, Hanna SS, Gettner S, Anderson BJ, Hayes T, Shiferaw B, Crume TL, Joyce K, Angulo FJ. Taking antimicrobial agents and eating cheese made from non-pasteurized milk are risk factors for infection with multi-drug resistant *Salmonella* serotype Newport-United States, 2002-2003. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.

25. Voetsch AC, Vugia DJ, Klontz KC, Megginson M, Scheftel J, Ingram LA, Hurd S, Thomas SM, Burnite S, Anderson BJ, Moore MR; Emerging Infections Program FoodNet Working Group. Trends in sporadic *Vibrio* infections in Foodborne Diseases Active Surveillance Network (FoodNet) sites, 1996-2002. Presented at the International Conference on Emerging Infectious Diseases, Atlanta, GA, 2004.

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 (404) 639-3680.

Materials Available On-Line

The following reports are available on the FoodNet Web site:

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

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. 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; 2004

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

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

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; 48:189-94.
CDC. Preliminary FoodNet data on the incidence of foodborne illnesses – selected sites, United States, 1999. Morbidity and Mortality Weekly Report. 2000; 49: 201-5.
CDC. Preliminary FoodNet data on the incidence of foodborne illnesses – selected sites, United States, 2000. Morbidity and Mortality Weekly Report. 2001; 50: 241-46.
CDC. Preliminary FoodNet data on the incidence of foodborne illnesses – selected sites, United States, 2001. Morbidity and Mortality Weekly Report. 2002; 51: 325-29.
CDC. Preliminary FoodNet data on the incidence of foodborne illnesses – selected sites, United States, 2002. Morbidity and Mortality Weekly Report. 2003; 52: 340-43.
CDC. Preliminary FoodNet data on the incidence of foodborne illnesses – selected sites, United States, 2003. Morbidity and Mortality Weekly Report. 2004; 53: 338-343
CDC. Preliminary FoodNet data on the incidence of foodborne illnesses – selected sites, United States, 2004. Morbidity and Mortality Weekly Report. 2005; 54: 352-356

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/ncidod/dbmd/diseaseinfo/foodborneinfections_g.htm
<http://www.cdc.gov/health/diseases.htm>

FoodNet Working Group, 2004

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