Campylobacter Infections: The Emerging National Pattern

ROBERT V. TAUXE, MD, MPH, DAVID A. PEGUES, MD, NANCY HARGRETT-BEAN, PHD

Abstract: In the United States, 8,837 *Campylobacter* isolates and eight outbreaks of *Campylobacter* infections were reported in 1984, a national isolation rate of 4.9/100,000. *C. jejuni* represented 99 per cent of reported isolates. Age-specific incidence was highest among infants (11/100,000), and young adults (8/100,000); infants in the second month of life were at highest risk. An unexplained nationwide November peak, not observed in previous years, occurred in all age groups and suggests there is an homogeneous nationwide source for this infection. (*Am J Public Health* 1987; 77:1219–1221.)

Introduction

To better understand the epidemiology of *Campylobacter* infections, the Centers for Disease Control (CDC) began surveillance in 11 states in 1982; national surveillance began in January 1983.[1,2] We review here the second year of national *Campylobacter* surveillance. The data suggest that person-to-person transmission and point source outbreaks are unusual, and are compatible with a single dominant nationwide source for this infection, such as poultry.

Methods

The national *Campylobacter* surveillance system is a passive laboratory-based surveillance system, similar to the national *Salmonella* and *Shigella* surveillance systems.[3,4] Weekly reports of laboratory isolates of *Campylobacter* from participating state health departments do not distinguish clinical from subclinical infections; deaths are not reported. The same panel of 42 states participated in 1983 and 1984. The 1980 census for non-participating states was subtracted from the national census to yield a denominator for age-specific isolation rates. Rates by month of age in infancy were calculated with a denominator of 1/12 of the infant population.

Results

In 1984, 8,837 isolates of *Campylobacter* species were reported. The isolation rate was 4.94 per 100,000 population, compared to 4.87 in 1983. Five states reported more *Campylobacter* than *Salmonella* isolates, and 16 states reported more *Campylobacter* than *Shigella* isolates.

As in 1982 and 1983, *Campylobacter* isolates displayed marked seasonality in the month of reporting, remaining low early in the year and rising sharply in June. Unlike previous years, a marked second November peak was observed (Figure 1). The summer peak in the western United States preceded the peak in the northeast and southeast regions, but all three parts of the country reported a prominent November peak. This temporal pattern was observed in all age groups.

Address reprint requests to Robert V. Tauxe, MD, MPH, Enteric Diseases Branch, Division of Bacterial Diseases, Center for Infectious Diseases, I-5428, Centers for Disease Control, Atlanta, GA 30333. Dr. Hargrett-Bean is with the Statistical Services Activity within the same division at CDC. Dr. Pegues was an epidemiology elective student with the CDC Epidemiology Program Office, presently at the Department of Medicine, Temple University. This paper, submitted to the Journal November 18, 1986, was revised and accepted for publication March 19, 1987.

The age-specific isolation rate for *Campylobacter* species was highest among infants, 11/100,000 (Figure 2). Among infants, the isolation rate was highest in the second month of life (17/100,000), decreased with increasing age, and the male-to-female ratio was 1.36:1. A broad peak in the isolation rate was observed in persons 15 to 34 years of age, with the highest rate of 8/100,000 in those aged 25–29 years. The age-specific isolation rate was higher in males below 40 years of age, and similar in both sexes above that age.

C. jejuni was usually isolated from stool (Table 1). *C. jejuni* blood isolates were reported from 20 persons (12 male and eight female) with a median age of 55 years, compared to a median age of 25 years for persons from whom stool isolates were reported. The median age of persons from whom *C. fetus* ssp *fetus* was isolated was also 55 years for blood isolates and 32 years for stool isolates.

Eight outbreaks of *Campylobacter* infections were reported; three were traced to raw milk, three to drinking untreated surface water, and one was related to foreign travel (Table 2).

Discussion

Variation in state reporting systems makes interstate differences in isolation rates difficult to interpret.[1] In general, the number of isolates reported are a small fraction of the number of infections that occurred. *Campylobacter* infections are likely to be more common than *Salmonella* infections, although approximately 40,000 isolates of the latter are reported annually. The relative frequency of *Campylobacter* to *Salmonella* infections, when cultures for both were routinely performed, was 10:1 in college students,[5] 3:1 in members of a health maintenance organization,[6] and 2:1 in patients in a multicenter study.[7] If *Campylobacter* infections are twice as frequent as *Salmonella* infections, the reporting efficiency of the *Campylobacter* surveillance system is approximately 10 per cent of the efficiency of the *Salmonella* system.

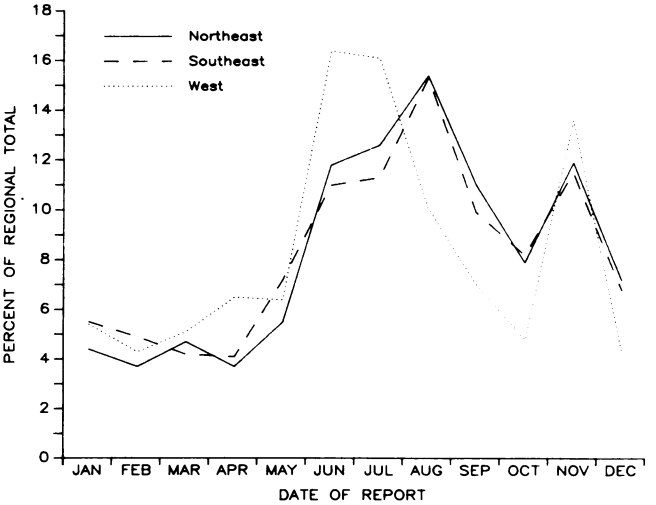

FIGURE 1—Seasonal Distribution of Reported *Campylobacter* Isolates by Geographic Region, United States, 1984

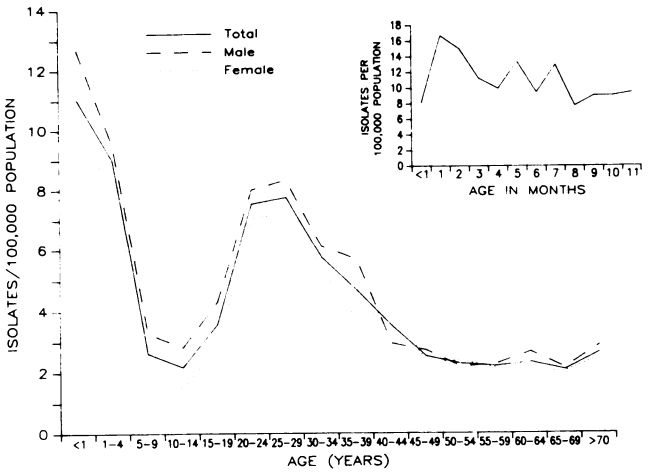

FIGURE 2—Rate of Reported Isolates of *Campylobacter* by Age Group and Sex, United States, 1984 (FIGURE 2, inset—Rate of Reported Isolates of *Campylobacter* in Infants by Age in Months, United States, 1984)

The seasonal distribution of *Campylobacter* isolations has remained relatively constant for three years, except for an unexplained November peak observed in 1984. The similarity of the seasonal distribution, including the November peak, in all age groups and geographical regions suggests that a single route of transmission could be the major source of *Campylobacter*. This source is likely to be retail poultry, since sporadic *Campylobacter* infections have frequently been associated with eating chicken, sometimes undercooked or raw.[8–11] *Campylobacter* contamination of retail poultry increases in the summer.[12] Most cases appear to be sporadic, as reported outbreaks are rare and account for only a tiny fraction of reported cases.[13]

The age-specific pattern of *Campylobacter* infections suggests specific hypotheses concerning transmission. The paucity of isolates from children aged two to four years and the rarity of outbreaks reported from day care centers argue strongly against person-to-person transmission. In the developing world, *Campylobacter* infections follow an infant's weaning.[14,15] The relatively high isolation rate among young adults, noted in other industrialized countries as well, suggests that some exposure specific to young adults is involved.[16–18] Infections in young adults may occur at the time of a "second weaning," when they leave their homes of origin and are first dependent on foods prepared by themselves or other inexperienced cooks.

The peak in age-specific isolation rate in the second month of life differs from the peaks for *Salmonella* (two to four months of age), and *Shigella* (two to four years of age).[3,4] The male-to-female ratio among infants is similar to that seen in 1984 for *Shigella* (1.34:1) and considerably higher than that seen for *Salmonella* (1.08:1) (CDC unpublished data). Risk factors that explain this concentration of *Campylobacter* infections among very young and male infants have not been described.

TABLE 1—Reported Isolates of *Campylobacter* by Species and Site of Isolation, United States, 1984

Species	Stool	Blood	Other	Not Reported	Total
C. jejuni	6542[a]	20[a]	4[b]	1631	8197
C. fetus ssp *fetus*	7	14	2[c]	9	32
C. coli	10	0	0	1	11
C. laridis	2	0	0	0	2
Not Reported	438	2	0	155	595
Total	6999	36	6	1795	8837

[a]One patient reported with *C. jejuni* isolated from both blood and stool.
[b]Gallbladder (2), sputum (1), vagina (1).
[c]Wound (1), femoral wall (1).

TABLE 2—Reported outbreaks of *Campylobacter* infections, United States, 1984

State	Species	Number Affected	Source
New York	*C. jejuni*	4	Nonchlorinated spring water in a private park
Minnesota	*C. jejuni*	9	Rural residential drinking water near a barnyard
Jamaica	*C. jejuni*	150	Two tourist groups
Oregon	*C. jejuni*	2	Community well/creek
Idaho	*C. jejuni*	6	Community spring
Washington	*C. jejuni*	2	Raw milk
California	*C. jejuni*	27	Raw milk
California	*C. jejuni*	12	Raw milk

Campylobacter species other than *C. jejuni* are likely to go unrecognized and thus unreported more often than *C. jejuni*. The large proportion of *C. fetus* ssp *fetus* isolates which come from blood may reflect the serum resistance of this species, but also the difficulty of isolating it on routine *Campylobacter* stool culture media containing cephalothin, to which it is sensitive, and incubated at 42°C, at which few strains will grow.[19] *C. coli* can be isolated in the same fashion as *C. jejuni*, and differentiated from *C. jejuni* by the hippurated hydrolysis test; this test may not always be applied. *C. laridis*, a new potential enteric pathogen, can also be isolated routinely, but may be mistaken for *C. jejuni* if nalidixic acid resistance is not determined.[20]

REFERENCES

1. Finch MJ, Riley LE: *Campylobacter* infection in the United States: results of an 11-state surveillance. Arch Intern Med 1984; 144:1610–1612.
2. Riley LE, Finch MJ: Results of the first year of national surveillance of *Campylobacter* infection in the United States. J Infect Dis 1985; 151:956–959.
3. Centers for Disease Control: Salmonella Surveillance Annual Summary, 1981. Atlanta: CDC, March 5, 1985.
4. Centers for Disease Control: Shigellosis—United States, 1984. MMWR 1985; 34:600–602.
5. Tauxe RV, Deming MS, Blake PA: *Campylobacter jejuni* infections on college campuses: A national survey. Am J Public Health 1985; 75:659–660.
6. Communicable Disease Control Section, Seattle-King County Department of Public Health: Surveillance of the flow of *Salmonella* and *Campylobacter* in a community. Seattle, Washington: The County, 1984.
7. Blaser MJ, Wells JG, Feldman RA, Pollard RA, Allen JR, *et al: Campylobacter* enteritis in the United States: A multicenter study. Ann Intern Med 1983; 98:360–365.
8. Hopkins RS, Scott AS: Handling raw chicken as a source for sporadic *Campylobacter jejuni* infections. J Infect Dis 1983; 148:770.
9. Hopkins RS, Olmsted R, Istre GR: Endemic *Campylobacter jejuni* in Colorado: identified risk factors. Am J Public Health 1984; 74:249–250.
10. Deming MS, Tauxe RV, Blake PA, *et al: Campylobacter* enteritis at a university: transmission from chicken and cats. Am J Epidemiol (in press).
11. Harris NV, Weiss NS, Nolan CM: The role of poultry and meats in the etiology of *Campylobacter jejuni/coli* enteritis. Am J Public Health 1986; 76:407–411.
12. Harris NV, Thompson D, Martin DC, Nolan CM: A survey of *Campylobacter* and other bacterial contaminants of pre-market chicken and retail poultry and meats, King County, Washington. Am J Public Health 1986; 76:401–406.
13. Finch MJ, Blake PA: Foodborne outbreaks of campylobacteriosis: the United States experience, 1980–1982. Am J Epidemiol 1985; 122:262–268.
14. Glass RI, Stoll BJ, Huq MI, Struelens MJ, Blaser M, Kibriya AKMG:

Epidemiologic and clinical features of endemic *Campylobacter jejuni* infection in Bangladesh. J Infect Dis 1983; 148:292–296.
15. Demol P, Bosmans E: *Campylobacter* enteritis in Central Africa. The Lancet 1978; 1:604.
16. Kendall EJ, Tanner EI: *Campylobacter* enteritis in general practice. Br J Hyg 1982; 88:155–163.
17. Kist M: Infektionen durch *Campylobacter jejuni/coli*. Dtsch Med Wschr 1983; 108:67–72.
18. Lassen J, Kapperud G: Epidemiological aspects of enteritis due to *Campylobacter* spp. in Norway. J Clin Microbiol 1984; 19:153–156.
19. Blaser MJ, Smith PF, Kohler PF: Susceptibility of *Campylobacter* isolates to the bactericidal activity of human serum. J Infect Dis 1985; 151:227–235.
20. Tauxe RV, Patton CM, Edmonds P, *et al:* Illness associated with *Campylobacter laridis*, a newly recognized *Campylobacter* species. J Clin Microbiol 1985; 21:222–225.

JHU School of Public Health Receives International Award

The John Hopkins School of Public Health was one of nine organizations from throughout the world to be recognized for scientific and technological contributions to developing nations during the last 25 years. The award was presented recently in Washington by the National Research Council of the Academy of Sciences and the Agency for International Development, in celebration of its 25th anniversary. The School was the only university center to be so recognized.

Dean Donald A. Henderson, MD, MPH, accepted the Award for Scientific and Technological Contributions to International Development, which cited the School "as an outstanding example of a private US university whose research, education, information and technology transfer activities have profoundly influenced health, nutrition, sanitation and family-planning practices in the developing world.

"The recognition comes at a time when we are expanding rapidly our programs in health and family planning in countries throughout the world as we are planning a major effort to cope with AIDS," Henderson says.

During the presentation ceremony, Henderson noted that the School currently has faculty, graduate students and staff working in 35 counties on programs such as child-survival initiatives, immunization, the prevention and treatment of diarrheal disease, infant nutrition, occupational health and the problems of providing safe water and sewerage systems. He paid tribute to "the more than 1,200 alumni from 100 countries who have graduated from the School in the last 65 years." The Hopkins School of Public Health is the largest in the world and the first in the Western Hemisphere. On July 1, the School celebrated the opening of International House, a Baltimore residential complex for faculty, visiting faculty and students from around the world.