Rate of *Campylobacter* spp. Isolation in Three Regions of Ontario, Canada, from 1978 to 1985

J. Stephen Thompson,¹* Frederic E. Cahoon,² and Donna S. Hodge³

Regional Public Health Laboratory, Laboratory Services Branch, Ontario Ministry of Health, Peterborough, Ontario K9J 6Y8;¹ Regional Public Health Laboratory, Laboratory Services Branch, Ontario Ministry of Health, Timmins, Ontario P4N 255;² and Central Public Health Laboratory, Laboratory Services Branch, Ontario Ministry of Health, Toronto, Ontario M5W 1R5,³ Canada

Received 9 May 1986/Accepted 6 August 1986

Isolation rates of *Campylobacter* spp. were analyzed for an 8-year period, 1978 through 1985. Three laboratories of the Ontario Ministry of Health examined 146,842 human feces samples for bacterial pathogens, including *Campylobacter jejuni* and *Campylobacter coli*. *Campylobacter* spp. were isolated from 5,580 specimens (3.8%), with monthly isolation rates ranging from 1.1 to 7.4%. The data showed a seasonal distribution of isolations, with peaks during the summer months (June to September). Most infections were in children, adolescents, and young adults. More males were infected than females; this finding was most pronounced in the age groups under 25 years. In Northern and Central Ontario, a strikingly higher incidence was observed among farm residents than among rural nonfarm or urban residents. Of 89 farm residents, 63 had consumed raw milk (61 bovine, 2 goat) within 72 h before becoming ill.

Since 1977, when Skirrow described a culture medium that facilitates the isolation of *Campylobacter* spp. in routine bacteriology laboratories (8), *Campylobacter jejuni* and *Campylobacter coli* have been established as important etiological agents of diarrhea in industrialized and developing countries. Although some of the earlier work focused on campylobacteriosis as a disease of infants and children (5), *C. jejuni* and *C. coli* can be isolated from patients of all ages (1, 2).

We examined data for laboratory-confirmed cases of *Campylobacter* infection from three laboratories for the period 1978 to 1985 to establish the age and sex distribution of patients and seasonality of infection and to examine residence on a farm as a possible risk factor in such infections.

Two of the three participating laboratories represented distinct areas of Ontario with mixed rural and urban populations, one in Northeastern Ontario, with a predominantly mining and lumber economy, and the other in Central Ontario, with a tourism, light-industrial, and agricultural economy. For much of the study period, these two laboratories were the only ones in each region culturing stools for *Campylobacter* spp. Isolates from the third laboratory (Toronto) were from an essentially urban population.

Feces specimens, submitted in Cary-Blair transport medium, were inoculated onto Skirrow medium (8) using Columbia agar base (GIBCO Diagnostics), and the plates were incubated at 43°C under an atmosphere of 5% O₂–10% CO₂–85% N₂ for 36 to 48 h. Beginning in 1984, specimens were also inoculated into liquid enrichment medium (4).

*Campylobacter* isolates were identified on the basis of Gram-stain morphology, oxidase and catalase reactions, growth at 25, 36, and 43°C, susceptibility to nalidixic acid and cephalothin, and hippurate hydrolysis (10). *C. jejuni* accounted for 5,429 isolates (97.3%), *C. coli* accounted for 123 isolates (2.2%), and *Campylobacter laridis* accounted for 28 isolates (0.5%).

To examine the association of infection with residence on a farm, we reviewed the 1983-to-1985 data for all cases of laboratory-confirmed campylobacteriosis from patients residing in Peterborough County and Timiskaming District, both of which have significant rural (34.2 and 33.4%, respectively) and farm (5.6% and 6.2%, respectively) populations (6). Urban residents were defined as those whose drinking water and sanitary sewer systems were operated and maintained by an organized municipality under the jurisdiction of local public health authorities and the Ontario Ministry of the Environment.

The results (Table 1) showed a strikingly higher incidence among farm residents when compared with rural nonfarm and urban residents. In fact, the overall incidence among rural nonfarm and urban residents from the two areas combined was virtually the same (79 and 82, respectively). Of the 89 farm residents, it was determined by interview that 63 had consumed raw milk (61 bovine, 2 goat) within 72 h before becoming ill (11).

For the period studied, the isolation rate for *Campylobacter* spp. was 3.8%, compared with 7.9% for *Salmonella* spp., 0.2% for *Shigella* spp., and 0.2% for *Yersinia enterocolitica*. *Campylobacter* spp. were isolated from 5,580 specimens collected from 3,608 patients.

<p>| TABLE 1. Association of urban or rural residence with <em>Campylobacter</em> infection in 412 residents of Peterborough County and Timiskaming District, 1983 to 1985 |
|---------------------------------|----------|---------|---------------|</p>
<table>
<thead>
<tr>
<th>Residence</th>
<th>Population</th>
<th>No. of cases</th>
<th>Annual case rate (no. of cases/100,000 population)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Peterborough County</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm</td>
<td>5,573</td>
<td>58</td>
<td>350</td>
</tr>
<tr>
<td>Nonfarm</td>
<td>28,633</td>
<td>73</td>
<td>85</td>
</tr>
<tr>
<td>Urban</td>
<td>65,724</td>
<td>153</td>
<td>78</td>
</tr>
<tr>
<td><strong>Timiskaming District</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rural</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Farm</td>
<td>2,573</td>
<td>31</td>
<td>401</td>
</tr>
<tr>
<td>Nonfarm</td>
<td>11,219</td>
<td>22</td>
<td>65</td>
</tr>
<tr>
<td>Urban</td>
<td>27,496</td>
<td>75</td>
<td>91</td>
</tr>
</tbody>
</table>

* Corresponding author.
A seasonal relationship was observed (Fig. 1), with the highest incidence of infection consistently occurring during the summer months (June to September). Finding higher isolation rates from June to September is consistent with reports from the United States (1), Belgium (2), Britain (9), Spain (13), and Sweden (14). This seasonality was apparent for data from each laboratory separately (Fig. 1) and cumulatively. Campylobacter isolation rates gradually increased from 1978 to 1985. These findings are similar to those for data in Ontario (3) indicated an isolation rate of 1.3%. The average isolation rate for the period 1978 to 1985 was 3.4%. The isolation rate for 1985 alone was 4.1%. The increase in isolation rates is attributable to increased knowledge and skill in recognizing and characterizing Campylobacter spp.

Data for 3,570 patients were used to demonstrate age- and sex-specific Campylobacter isolations (Fig. 2). A subset of these data from 1,218 patients residing in Cochrane and Timiskaming districts and Peterborough, Victoria, and Northumberland counties was examined to determine age- and sex-specific case rates per 100,000 population within each cohort (Fig. 3). Demographic information was obtained from Census Canada data. The rates were highest for children less than 1 year of age, with males being affected approximately twice as frequently as females. There is a strong similarity between these data and those presented by Butzler and Skirrow (2) for all age groups. The highest but declining incidence occurred for ages 0 to 15 years, a slight rise occurred for ages 16 to 30 years, and the incidence slowly declined from ages 36 to 65 years. As was found in the United States, more isolations were made from patients aged 1 to 30 years than from patients of other age groups. Consistent with those studies (1, 7), we found that males were affected more often than females in the age groups with the highest incidence.

This study emphasizes the strong association of Campylobacter infection with residence on a farm. The study also updated information from previous reports by showing a much higher incidence of Campylobacter isolation in Ontario than was reported some years ago (3, 5, 12).

We gratefully acknowledge the assistance of the Porcupine Health Unit, the Timiskaming Health Unit, the Peterborough County-City Health Unit, and the Haliburton, Kawartha, Pine Ridge District Health Unit, and, in particular, we acknowledge A. Hukowich, G. R. Humphreys, M. Gravel, S. Lee, and L. Sones for assistance in data collection. We also appreciate the assistance of the Ontario Ministry of Agriculture and Food, the Ontario Ministry of Revenue, Assessment Offices, and the County of Peterborough in sharing census data. We thank R. W. Martin and J. F. Prescott for reviewing the manuscript. Finally, we appreciate the support, suggestions, and critical review of the manuscript by S. Toma, A. A. Borczyk, and A. Prytula.

**LITERATURE CITED**