

## **Campylobacter infection in urban and rural populations in Scotland**

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*(Received 15 October 1984; accepted 12 January 1985)*

### SUMMARY

A review of campylobacter infection in Scotland over five years (1978–82), during which 7308 human isolates were recorded (mean annual isolation rate of 30 per 100 000), revealed differences in the epidemiology of the disease between rural and urban populations which were not apparent in the national data. The incidence of infection in the two rural areas studied was greatest in the early months of the year, whereas that in the two urban areas showed a third-quarter predominance. In both urban and rural populations, age-specific infection rates were highest in children less than 5 years old, but this trend was more pronounced in rural than urban populations. Conversely, secondary peaks in age-specific infection rates observed in young adults were more pronounced in the urban than rural populations.

It is postulated that rural children were being infected by campylobacters at an early age by drinking contaminated raw milk which was not normally available to city residents. The lower incidence in adults in the rural populations is interpreted as indicating more widespread immunity, resulting from greater exposure to infection during childhood. The effect of compulsory heat treatment of milk sold in Scotland, introduced in August 1983, is currently being studied.

### INTRODUCTION

Over 49 700 cases of campylobacter infection were recorded in England and Wales during the five years from 1978 to 1982 (Skirrow, 1982; Communicable Diseases Surveillance Centre, London, unpublished). This represents a mean annual isolation rate of 20 per 100 000. No outstanding regional variation was apparent, but Jones *et al.* (1984) reported higher isolation rates in rural than in urban populations. In Scotland raw milk, a well-known source of campylobacter infection, was until recently readily available in many rural areas but not in cities. The study now reported was designed to find out whether there were differences in the incidence and epidemiology of human campylobacter infection between urban and rural populations in Scotland, and whether such differences were related to raw milk consumption.

During the study period one of us (C.J.S.) regularly visited campylobacter

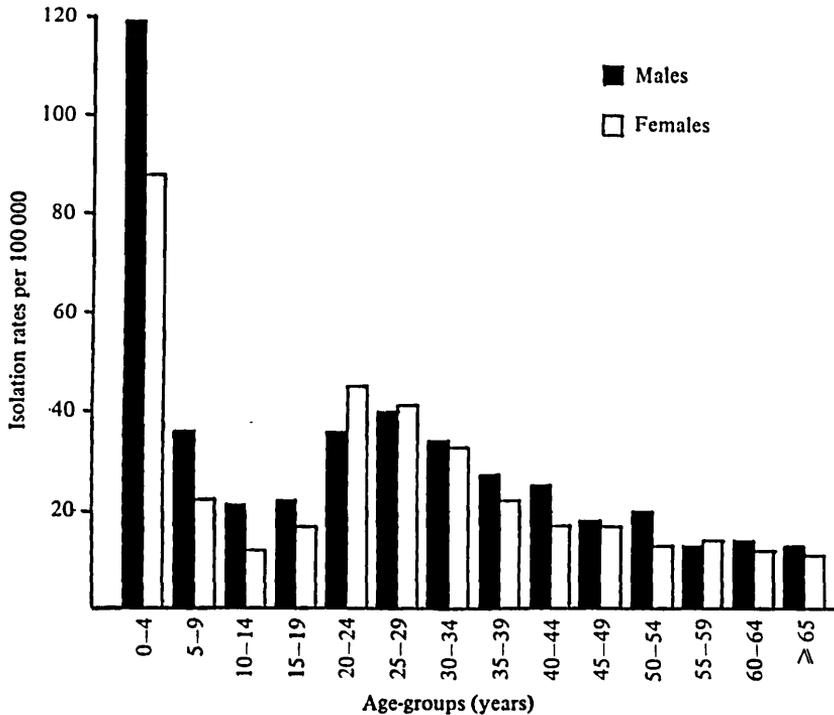


Fig. 1. Average annual age- and sex-specific isolation rates of *Campylobacter* spp. in Scotland, 1978-82.

patients resident in the city of Edinburgh in order to obtain details of food eaten and other relevant epidemiological data.

#### NATIONAL DATA

Reports of all isolates of *Campylobacter* spp. (predominantly *C. jejuni*) made by medical laboratories in Scotland are recorded weekly at the Communicable Diseases (Scotland) Unit, Glasgow.

#### *Incidence of infection*

During the five-year period 1978-82, a total of 7808 human faecal campylobacter isolations were recorded, representing an average annual infection rate of 30 per 100000. Of these infections, 298 (3.8%) were known to have been imported, and in 156 (2%) other pathogens such as salmonellae, shigellae and *Giardia intestinalis* were also isolated. Campylobacters were second only to salmonellae (9460 isolations) as a cause of enteritis. Most infections presented as sporadic cases or as household outbreaks affecting in particular the mother and/or young children.

#### *Age and sex*

A higher proportion of infections (all ages) were reported in males (54%) than females (46%), but in adults aged 20-24 years isolation rates were higher in women (45 per 100000) than men (36 per 100000) ( $\chi^2$ ;  $P < 0.005$ ). The highest rates were

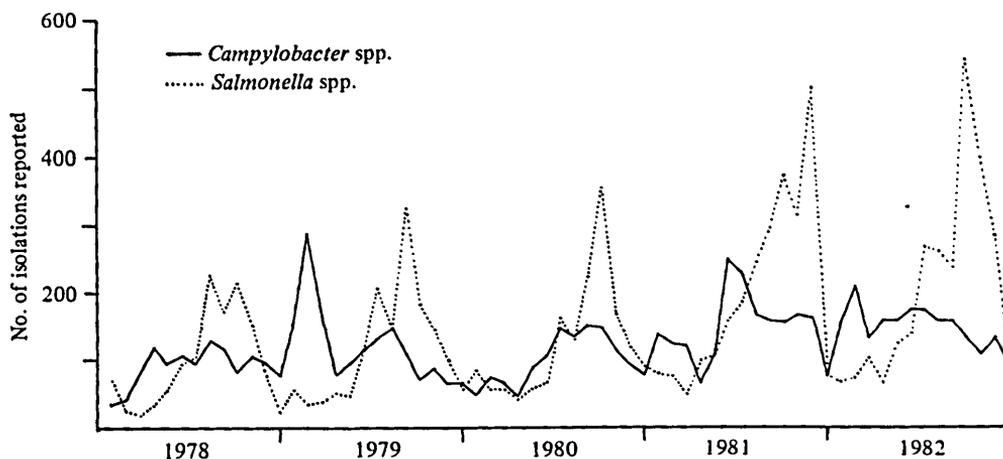


Fig. 2. Seasonal distribution of *Campylobacter* and *Salmonella* spp. reported in Scotland, 1978–82 – 4-weekly totals.

Table 1. Average annual isolation rates of *Campylobacter* spp. in urban and rural areas in Scotland, 1978–82

Type of area	Population*	No. of isolations reported	Isolation rates per 100000
<b>Urban</b>			
Edinburgh	452800	1848	81.6
Aberdeen	208900	567	54.3
<b>Rural</b>			
Grampian Rural	303300	1135	74.8
Dumfries and Galloway	142400	373	52.4
<b>Total</b>	<b>1 107 400</b>	<b>3923</b>	<b>70.0</b>
Scotland (all areas)	5 153 300	7808	30.3

\* Registrar-General's mid-year estimated population of Scotland, 1980.

in 0- to 4-year-old children, which contrasted with low rates in the 10–19 age groups (Fig. 1).

*Seasonal trends*

*Campylobacter* infections were most prevalent in the first six months of the year, with a peak towards the end of the second quarter (Fig. 2).

*Sources of infection*

Poultry meat, cooked meats and seafoods were periodically implicated as food vehicles. Only once did 'hot' food, namely barbecued mince, appear responsible for an outbreak. *Campylobacters* were isolated occasionally from raw pork and poultry meat during the investigation of outbreaks and in one incident in Glasgow from walnut cheese (E. Walker, personal communication). Raw milk was implicated as a source of infection in seven outbreaks; in the largest of these there were 648 known cases (Wallace, 1980; Porter & Reid, 1980) and in another 179 cases. In

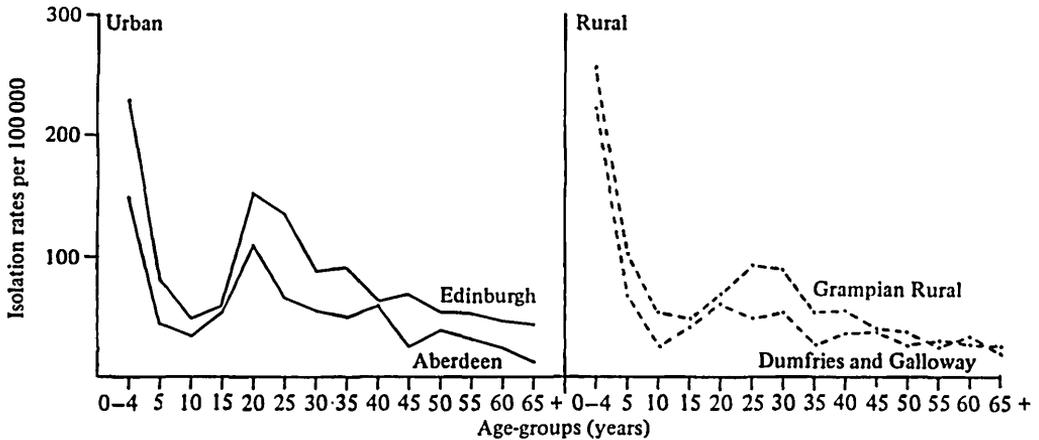


Fig. 3. Average annual age-specific isolation rates of *Campylobacter* spp. per 100000 in urban and rural populations, 1978-82.

Edinburgh during four years 22 cases of infection – 12 of which were children under 5 years old – were associated with infected pet dogs shown to be excreting campylobacter organisms.

## INFECTION IN URBAN AND RURAL POPULATIONS

### *Populations studied*

#### *Urban populations*

Edinburgh (City of Edinburgh District); Aberdeen (City of Aberdeen District).

#### *Rural populations*

Dumfries and Galloway (Dumfries and Galloway Health Board); Grampian Rural (Grampian, Orkney and Shetland Health Boards – excluding Aberdeen city).

These populations (Table 1) were served by laboratories in Edinburgh, Aberdeen and Dumfries, each with well-defined catchment areas, which together had accounted for 50% of all human campylobacter infections reported in Scotland during 1978-82. The Regional Laboratory, Aberdeen, served both the city of Aberdeen and its mainly rural hinterland of Grampian, along with the islands of Orkney and Shetland. All these laboratories used similar non-enrichment isolation methods, with selective media at 42 or 43 °C.

## RESULTS

### *Incidence of infection*

The highest average annual infection rate (82 per 100000) was observed in Edinburgh (Table 1). This was believed to be due, in part, to more extensive investigation. Routine sampling of all family contacts was undertaken during the first two years, when 43 symptom-free excretors were identified, but this practice was discontinued thereafter.

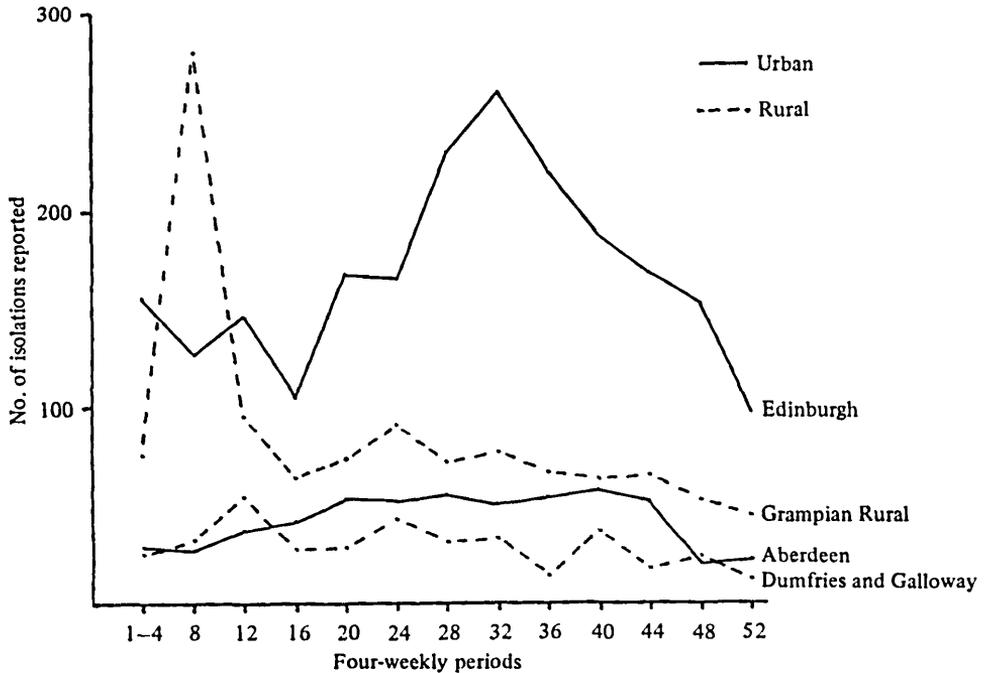


Fig. 4. Seasonal distribution of isolations of *Campylobacter* spp. in urban and rural populations in Scotland, 1978-82.

*Age specific infection rates*

The highest infection rates were observed throughout in children under 5 years of age (Fig. 3), although the ratio of childhood to adult infections was much higher in the rural areas. Reports from the Aberdeen laboratory in particular revealed differences between infection rates in children in the urban and rural populations served. The Grampian Rural rate for 0- to 4-year-old children (256 per 100000) contrasted significantly with the urban rate (149 per 100000) ( $\chi^2$ ;  $P < 0.001$ ); similarly the rate in rural children aged 5-9 years (102 per 100000) differed from that in city children (43 per 100000) ( $\chi^2$ ;  $P < 0.001$ ). In both Edinburgh and Aberdeen there were pronounced secondary peaks in the rates of infection in adults aged 20-24 years, whereas in the two rural populations more gentle rises spanning the ages 20-34 years were observed. In the combined rural populations the ratio of infection rates in children aged 0-4 years to those in adults aged 20-24 years was 3.76:1; by contrast the ratio for the combined urban populations was only 1.47:1.

*Seasonal trends*

The seasonal distribution of infection also differed between urban and rural populations (Fig. 4). In the cities isolations were more frequent in the third quarter, more noticeably in Edinburgh than in Aberdeen, whereas in rural populations they were predominant in the first quarter, especially in Grampian Rural, where the figures were inflated by three milk-borne outbreaks.

*Sources of infection*

Unpasteurized milk did not appear to be a significant source of infection in either of the two cities. In fewer than 1 % of reported cases in Edinburgh had the patients consumed raw milk, those doing so having obtained it outside the city and not from their regular supplier. The foods most commonly implicated epidemiologically were delicatessen-type cold meats purchased pre-cooked from premises where raw meats, in particular poultry meats, were also on sale and where a considerable risk of cross-contamination existed. Fuller details of these sources of infection in Edinburgh have been published elsewhere (Sibbald, 1984).

## DISCUSSION

The compilation of data centrally can mask differences in the epidemiology of a disease within a country. In the present study variations were observed in the incidence of campylobacter infection between urban and rural populations in Scotland which were not apparent in the national data.

Although the accessibility of laboratory services favoured the city population, 67 % of cases reported by the Regional Laboratory, Aberdeen, resided in the Grampian Rural area. Almost twice the isolation rate was observed in rural children under 10 years of age (177 per 100 000) than in urban children (91 per 100 000). This high incidence of childhood infection in both rural areas studied, unlike that in the two cities, contrasted sharply with the incidence reported in older age-groups. This suggests that early exposure to infection in rural children resulted in immunity acquired and maintained by repeated ingestion of campylobacter organisms (Jones, Robinson & Eldridge, 1981). Although it is likely that young children are investigated more thoroughly than adults, this source of error would be roughly equal in all four populations studied, so comparisons should be valid. Denominators were not available in these studies.

Rural children appear to be exposed to a source not present in the cities. One possibility might be access to farm animals, but inquiries indicated that only a small proportion of infected children had such contacts. A notable finding was that whereas no child case in Aberdeen had drunk raw milk during the few days before infection, at least one-third residing elsewhere in Grampian regularly did so (J. M. Wallace, personal communication). The secondary peak of infection observed in the 25- to 34-year age groups in Grampian Rural was not so evident in Dumfries and Galloway. Many of these Grampian adults included newcomers to the area who had settled in satellite towns near Aberdeen. Consequently they may have been experiencing rural factors such as raw milk for the first time and, unlike their 'immunized' local contemporaries, were susceptible to clinical infection.

Increased consumption of pre-cooked meats, salads and other cold 'risk' foods, during summer is common throughout Scotland. Yet the highest seasonal incidence of rural infection was invariably in the earlier months of the year, with the 0- to 4-year age groups in particular peaking coincidentally with the spring calving periods. This contrasted with the third-quarter predominance in the cities where

raw milk did not feature. Such a third-quarter predominance is the norm for England and Wales and most other European and North American countries.

It is postulated therefore that many rural children were being infected by contaminated raw milk. City children were not thus exposed, but acquired their infection, like adults, from a variety of other sources. If raw milk was the major dietary factor leading to increased morbidity amongst rural children, it will be interesting to observe the effect of legislation which has prohibited the retail sale of virtually all untreated milk in Scotland since August 1983. This is presently under study.

We wish to thank Drs T. M. S. Reid, F. J. Bone, B. A. S. Dale and R. M. Macrae and other members of the laboratory staffs in Aberdeen, Dumfries and Edinburgh whose reports formed the basis of this study. We also wish to thank Edinburgh District Council for their support and interest, Mr T. W. Hill for assistance with the statistical analysis, Dr W. Charles Cockburn for his invaluable constructive criticism during the preparation of this paper, and Mrs M. Graham for secretarial assistance.

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