tion. There are a number of possible reasons for this. First, the flying foxes may have been infected with a paramyxovirus related to equine morbillivirus but which does not infect humans. The fact that antibodies from flying foxes neutralise equine morbillivirus in vitro makes this explanation unlikely. Secondly, the infection in the flying foxes leading to the production of antibodies may be short lived, making it unlikely that a bat carer will have exposure to an infected flying fox. A further possible explanation is that equine morbillivirus infection is not readily transmitted from flying foxes to humans. As we did not test all bat carers our findings cannot totally exclude the possibility of transmission to humans. However if this has occurred it must be extremely rare.

Regardless of the explanation, our data suggest that neither prolonged close contact nor casual contact with flying foxes engenders a risk of equine morbillivirus infection in humans.

Acknowledgements

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A FIVE YEAR REVIEW OF *CAMPYLOBACTER* INFECTION IN QUEENSLAND

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Abstract

Campylobacter infection consistently has one of the highest annual notification rates of all communicable diseases. We reviewed the epidemiology of *Campylobacter* infection in Queensland by analysing notification data for a five year period (1991 to 1995). This included incidence, age and sex distribution, seasonality, geographic distribution, and socioeconomic status. The review found the highest notification rate in children aged 12 - 23 months. There was no distinct seasonal pattern of infection. *Campylobacter* infection was reported more frequently in urban areas and for persons residing in higher socioeconomic areas. It would appear that factors which influence notification rates in the general population do not necessarily have the same influence on the 0 - 4 years age group. ***Comm Dis Intell*** **1996;20:478-482.**

Introduction

Campylobacter infection has emerged during the past decade as the most frequently notified cause of acute bacterial diarrhoea in Australia. *Campylobacter* enteritis has been a notifiable disease in Queensland since 1990. There are around 10,000 cases of *Campylobacter* infection notified in Australia each year, and the illness consistently has one of the highest annual rates of notification of all communicable diseases[1]. Cases are predominantly caused by two species, *Campylobacter jejuni* and *Campylobacter coli*, with *C. jejuni* responsible for up to 90% of the infections[2].

Previous studies have shown that the notification rate for *Campylobacter* is highest in the 0 - 4 years age group[3,4,5]. Other studies have identified a number of potential risk factors associated with *Campylobacter* infection, including inadequately cooked chicken, domestic pets such as cats and dogs, raw milk, untreated water, and poor food hygiene and handling practices[6,7,8,9,10,11,12]. Large outbreaks and person-to-person transmission appear to be uncommon[4]. We are currently conducting a matched case control study in the southern part of Brisbane and the Gold Coast areas to determine whether the above or additional risk factors are associated with *Campylobacter* infection in children less than two years old. To provide background information for this study, we reviewed the epidemiology of *Campylobacter* infection in this State for the five year period 1991 to 1995.

Methods

All *Campylobacter* notifications to Queensland Health with reported onset dates between 1 January 1991 and 31 December 1995 were collated and analysed using Epi Info

Table 1.   *Campylobacter* **notifications in Queensland and Australia, 1991 to 1995**

Year	Queensland		Australia[1]	
	Number of cases	Age-adjusted notification rate per 100,000 population	Number of cases	Crude notification rate per 100,000 population
1991	2724	90.8	8672	75.8
1992	2968	97.1	9135	54.2
1993	2474	79.2	8111	69.6
1994	2131	66.6	10117	85.8
1995	1975	61.9	10,933	91.6

1. Refer reference 1.

(version 6.02). Crude and age-specific notification rates based on data collected over the total five year period were calculated using the 1991 census population as the denominator[13]. Yearly notification rates were calculated using the Australian Bureau of Statistics (ABS) mid-year estimated resident population figures as the denominator[14]. Queensland age-adjusted rates were calculated by direct standardisation using the 1991 Australian Standard Population[13]. Age-adjusted rates for socioeconomic status and geographic distribution were calculated by direct standardisation using the 1991 Queensland Census Population[15].

Statistically significant differences in notification rates between the same population over different periods or between populations from different geographic areas, socioeconomic groups, or age groups were determined by calculating 95% confidence intervals around the rates[16]. Confidence intervals around the rates were calculated using the following formula:

$$95\% \text{ CI} = r \pm 61.981 \sqrt{r/n}$$

where r = rate per 1,000 and n = denominator upon which the rate is based. Two independent rates were considered to differ significantly at the 5% level if their 95% confidence intervals did not overlap.

The Queensland Index of the ABS Index of Relative Socio-Economic Disadvantage, at the level of statistical local area (SLA) was used as an indicator of the population's socioeconomic status[17]. This measure focuses on attributes such as low income, low educational attainment and high unemployment, and provides a general socioeconomic index for a defined geographic area. SLAs are categorised into one of five quintiles according to their index. Cases residing in SLAs belonging to quintile 1 were classified as persons from high socioeconomic areas, and cases residing in SLAs of quintile 5 were classified as persons from low socioeconomic areas. For the purposes of this review, cases grouped in quintiles 2 to 4 were considered as residing in average socioeconomic areas.

The Commonwealth Government Rural, Remote and Metropolitan Areas Classification was used as a method of classifying *Campylobacter* infection according to geographic location[18]. This classification categorises SLAs into metropolitan areas (capital city and other major urban areas), rural zones and remote zones. We further classified these categories into two main groups: urban and rural and remote areas. Aboriginal and non-English speaking background status were not examined because of incomplete notification data.

Results

Incidence

For the five year period of surveillance, 12,272 cases of *Campylobacter* infection were reported in Queensland, representing an age-adjusted average annual rate of 82.3 cases per 100,000 population (crude rate, 82.5 per 100,000 population). Since 1992, *Campylobacter* notification rates in Queensland have been declining, whereas for Australia they have been increasing (Table 1). Queensland rates were significantly higher than the overall Australian rates between 1991 and 1993. However, for 1994 and 1995, notification rates in Queensland were significantly lower than the national figures.

Age and sex distribution

The age distribution for the five year period was found to be bimodal, with the highest incidence in the 0 - 4 years age group (251.3 per100,000 population) and a secondary peak occurring in the 20 - 24 and 25 - 29 years age groups (123.7 per 100,000 population and 112.6 per 100,000 popu-

Figure 1.   **Average annual notification rate of** *Campylobacter* **infection in Queensland, 1991 to 1995, by age group**
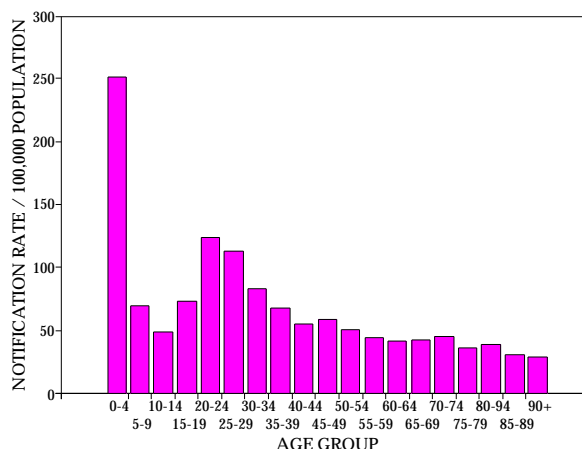
Table 2. Average annual notification rate of campylobacteriosis in Queensland, 1991 to 1995, for children aged 0 - 4 years

Age (months)	Total number of cases	Rate per 100,000 population
0-11	494	215.7
12-23	988	446.9
24-35	632	283.7
36-47	401	185.1
48-59	268	123.0

Figure 2. Total number of notifications of *Campylobacter* infection in Queensland, 1991 to 1995, by month of disease

lation respectively) (Figure 1). The notification rate was higher in males (269.9 per 100,000 population) than females (225.1 per 100,000 population) in the 0 - 4 years age group, although this difference was not statistically significant. The rates for males and females in the 20 - 24 and 25 - 29 years age groups were very similar (118.5 versus 126.2, and 114.3 versus 108.9 respectively).

Seventy-one per cent of cases were found to occur in persons aged less than 35 years, and 23% of cases were in children under five years of age. For the 0 - 4 years age group, the highest incidence occurred in children aged 12 - 23 months (446.9 per 100,000 population), and this was significantly higher than the rate in each of the other 12-month age groups (Table 2). The annual *Campylobacter* notification rates in Queensland for the 0 - 4 years age group also declined, from 310.9 per 100,000 population in 1992 to 183.4 per 100,000 population in 1995. Fifty-two per cent of all notifications were male and 46% were female. For 2%, the gender was not available.

Seasonality

For the total five year period, a slight decline in incidence was seen during the winter months (Figure 2). The seasonal trend for *Campylobacter* notifications varied from year to year during this period. However, the numbers of cases were always elevated slightly during the warmer months, with peaks occurring either in spring or autumn.
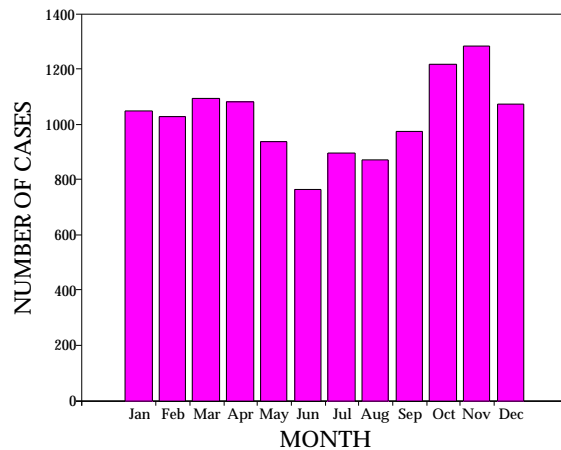
Geographic distribution

Information on geographic distribution was available for 10,997 or 89.6% of the cases. The age-adjusted average annual notification rate was significantly higher in urban areas of Queensland compared with rural and remote areas (Table 3). Furthermore, the age-adjusted average

annual notification rate was significantly higher in Brisbane and the surrounding metropolitan area compared with other major urban areas. This trend was seen in most age groups. For the 0 - 4 years age group, notification rates were similar in urban areas and in rural and remote areas.

Socioeconomic status

Information on socioeconomic status was available for 10,533 or 85.8% of the cases. The highest age-adjusted average annual notification rate occurred in the higher socioeconomic areas of Queensland (Table 4). This was significantly greater than the notification rates found in both the average and lower socioeconomic areas. These differences were greatest among the 20 - 24 years age group (quintile 1, 192.8 per 100,000 population; quintile 5, 130.2 per 100,000 population). In contrast, there was a reverse trend in the 0 - 4 years age group, with the average annual notification rate being highest in the lower socioeconomic areas of Queensland. However, this rate was not significantly greater than the rates found in the average and higher socioeconomic areas.

Discussion

The notification rates for campylobacteriosis in Queensland and Australia have consistently been among the highest of all the notified communicable diseases. The reason for the decreasing trend in *Campylobacter* notification rates in Queensland since 1992 in contrast with the

Table 3. Average annual notification rates of campylobacteriosis, 1991 to 1995, by geographical area in Queensland

Area	Total Population		0 - 4 years age group	
	Total number of cases	Age-adjusted rate per 100,000	Total number of cases	Age-specific rate per 100,000
Brisbane metro	6091	102.1	1024	267.4
Other major urban	1838	85.5	358	248.7
Total urban	7929	97.9	1382	262.4
Rural and remote	3068	61.1	977	264.0

Table 4.   Average annual notification rates of campylobacteriosis in Queensland, 1991 to 1995, by level of socioeconomic status

Quintile (socioeconomic status)	Total population		0 - 4 years age group	
	Total number of cases	Age-adjusted rate per 100,000	Total number of cases	Age-specific rate per 100,000
1 (high)	1909	109.7	285	250.7
2-4 (average)	6163	81.2	1459	261.9
5 (low)	2461	82.2	573	273.1

increasing trend for Australia is unknown. There are certain unquantifiable biases which affect notification data. These include the decision by the treating medical practitioner to collect a specimen for diagnostic testing (which is often dependent on the severity of the illness), the number of specimens collected, a patient's access to, and use of, health care services, and compliance with notification procedures by laboratories and medical practitioners. In addition, many infected patients with relatively mild symptoms do not seek medical care[19]. The actual incidence of *Campylobacter* infection in Australia is probably much greater than the currently reported rates. In England for example, the actual incidence has been conservatively estimated at about ten times the reported number[2].

The bimodal age distribution is characteristic of other developed countries, with the highest rate reported for the 0 - 4 years age group. In Queensland, the highest rate in this age group was for children aged 12 - 23 months, whereas in the United States of America the highest rate has been in children less than 12 months of age[4]. The reasons for the high notification rate in young children is unknown, but may be partly due to parents being more likely to seek medical care for these types of illnesses compared with adults. To account for this, Skirrow conducted a two year survey of *Campylobacter* isolates from five laboratories and calculated infection rates based on the number of faecal specimens tested[20]. When this denominator was used, the infection rate was highest in young adults (15 - 24 years old) and lowest in infants less than one year of age. This suggests that the higher notification rates found in our study for young children may be biased due to a higher sampling rate for this age group.

The high isolation rate in the 0 - 4 years age group followed by a large secondary peak in the 20 - 29 years age range is characteristic of *Campylobacter* infection. However, other bacterial gastrointestinal infections may have a similar age distribution but less pronounced peaks[2,4]. *Campylobacter* infections are a common cause of travellers' diarrhoea, and some investigators have suggested that the increased isolation rate seen in the 20 - 29 years age group is not unexpected, since young adults travel more than other age groups[3]. In Australia, recent data from the National Salmonella Surveillance Scheme would further support this argument, as notification rates for typhoid are highest in the 15 - 29 years age group and most infections are known to be acquired overseas[21].

It is generally accepted that in temperate zones, *Campylobacter* infection shows a seasonal distribution with a well defined summer peak[3,5,20]. In contrast, notifications in Queensland have a somewhat less marked seasonal trend, a feature which may be related to the State's mild winters. However, the seasonal distribution of notified cases for Australia overall shows a similar trend to Queensland, suggesting that factors other than climate may be involved[1]. It is possible that the observed seasonal trends overseas may be affected by other factors such as increased travel during summer holidays or increased consumption of poultry during the summer months, which may be less pronounced in Australia. Alternatively, the distinct seasonal trend seen in some European and North American countries may be related to other characteristics of these Northern Hemisphere countries. Imported cases of *Campylobacter* infection by travellers may be an important factor influencing seasonal trends in Australia.

The known risk factors associated with *Campylobacter* infection imply that the expected incidence of infection in rural communities would be higher than in residential areas, as has been reported in the United Kingdom[20] and New Zealand[5] (cattle, sheep, pigs and poultry are primary sources of human infection). Our results, however, show a significantly higher rate for urban areas compared with rural and remote areas. Similar results were also reported in a Norwegian study in which urban rates were more than twice those of rural areas[3]. However, this difference was attributed to a higher proportion of imported cases (from travel abroad) in urban areas. Overseas travel should therefore be considered as a contributing factor to the elevated rates in urban areas that were observed in our study. The recording of travel history data should be considered as part of the routine information collected on notifiable diseases. Another factor which is likely to contribute to this difference is that residents of urban areas, and in particular the capital city areas, are thought to have a higher sampling rate than residents in rural and remote areas. Furthermore, persons from non-metropolitan areas of Australia are, in general, significantly (10% to 20%) less likely to visit a medical practitioner than persons from metropolitan areas[22]. The similarity in geographic notification rates among the 0 - 4 years age group may be due to similar sampling rates or similar risk factors in this age group.

The data also showed that socioeconomic status may be related to the incidence of *Campylobacter* infection in Queensland. Reasons for the elevated notification rates

among persons from higher socioeconomic areas, with the exception of 0 - 4 year olds, is unknown. It is possible that elevated notification rates among higher socioeconomic groups are related to factors such as a higher rate of travel, greater use of medical services, or different food consumption patterns. Further investigations into the possible association between *Campylobacter* infection and socioeconomic status would be of interest.

In conclusion, this review of *Campylobacter* infection between 1991 and 1995 has shown that: the incidence in Queensland was highest in children aged 12 - 23 months; the distinct summer peak in incidence of the disease that is reported in other developed countries was not seen in Queensland; *Campylobacter* infection was reported more frequently from urban areas and from high socioeconomic areas of Queensland; and that factors which influence notification rates in the general population do not necessarily have the same influence on the 0 - 4 years age group. Case control studies of *Campylobacter* infection in young children are warranted to identify age-specific risk factors. These factors would enable the development of interventions to reduce the incidence of infection.

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OVERSEAS BRIEFS

Source: World Health Organization

Ebola haemorrhagic fever, Gabon

The government of Gabon and the World Health Organization (WHO) have confirmed that a virus of Ebola type is responsible for the outbreak of haemorrhagic fever in the Booué region of north-eastern Gabon. As at 19 October, the total number of cases was 19, of which 11 were fatal; 86 contacts remained under surveillance. According to the Ministry of Health of Gabon, the first case would have occurred on July 24 in a hunter who probably became infected in the forest and who later died.

An isolation ward has been prepared in Booué Hospital. Samples for laboratory investigation have been collected from patients and close contacts. The first analysis, done with locally available reagents, confirmed that an Ebola-like virus is responsible for the outbreak, but further tests on blood and tissue samples collected from patients are underway at the WHO Collaborating Centre for Haemorrhagic Fevers, the Centers for Disease Control and Prevention in Atlanta, United States of America. An education and information campaign for health workers has been undertaken in regions where the epidemic has occurred and in bordering areas where there have been no reports of suspected cases.

An International Committee for Technical and Scientific Coordination was established in Gabon with the collabo-