Estimate of the number of *Campylobacter* infections in the Hunter region, NSW, 2004–2007

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Abstract: Objectives: Campylobacteriosis is not notifiable in NSW and the number of cases of *Campylobacter* disease is thus not well described. **Methods:** De-identified campylobacteriosis records for 2004–2007 were requested from laboratories in the Hunter region of NSW. Based on notifying laboratory, a *Salmonella* notification weighting was applied to laboratory-confirmed campylobacteriosis cases to provide an overall estimate of *Campylobacter* disease in the area. **Results:** The estimated median of the annual number of laboratory-confirmed campylobacteriosis cases was 788 (range 700–1022). The ratio of estimated *Campylobacter* cases to *Salmonella* notifications was 5.5 : 1. **Conclusion:** *Campylobacter* infection causes considerable disease in the Hunter, and likely in NSW. Regular review of *Campylobacter* laboratory results may be valuable.

Campylobacteriosis is a bacterial infection that predominantly causes gastrointestinal illness within 2–5 days (range 1–10 days) of exposure to *Campylobacter*. Symptoms, which include diarrhoea (frequently with bloody stools), abdominal pain, fever, nausea and vomiting, generally persist for up to 7 days. Symptoms can be prolonged or recurrent and the sequelae of infection may include rheumatological disorders, peripheral neuropathies and Guillain-Barre Syndrome.[1,2] Without antibiotic treatment, infected individuals can excrete bacteria for up to 7 weeks.[1]

The reservoir for *Campylobacter* is domesticated and wild animals and the environment. *Campylobacter jejuni* causes the majority of human infections and most commonly occurs after ingestion of, or contact with, infected foods of animal origin, particularly poultry.[1,3–5] Ingestion of as few as 500–600 *Campylobacter* bacteria may cause illness.[3] In Australia, an estimated 75% of campylobacteriosis is thought to be foodborne.[6] Cases of foodborne *Campylobacter* infection are usually sporadic in nature and point-source foodborne outbreaks are not commonly identified.[7,8] Phenotypic methods currently used for distinguishing *Campylobacter* pathogens are of limited use so public health investigation or control activities occur rarely. In New South Wales (NSW), the inability to detect and control or prevent outbreaks of *Campylobacter* because of limitations in strain typing is the reason it is not a notifiable disease.[8] DNA methods for typing strains, including multi-locus sequence typing and polymerase chain reaction, are under development.[9]

In all Australian jurisdictions except NSW, confirmed *Campylobacter* infections are required to be notified to health departments under public health legislation. Campylobacteriosis is the most commonly notified enteric condition in Australia with 17 020 notifications in 2007. Between 2004 and 2007, the overall notification rate reached 120.5 per 100 000 population.[10] After campylobacteriosis, salmonellosis is the next most notified enteric disease in Australia. In 2007, there were 9546 notifications of *Salmonella* infections from all states and territories, with an overall notification rate of 45.4 per 100 000 population. All states and territories that notify both infections had more *Campylobacter* than *Salmonella* notifications annually between 2004 and 2007, except for the Northern Territory.[11] After accounting for underreporting, it has been estimated that approximately 227 000 *Campylobacter* infections occur annually in Australia.[12]

The number and epidemiology of cases of campylobacteriosis in NSW is currently poorly described, in part because it is not notifiable. This study describes the epidemiology of laboratory-confirmed *Campylobacter* infection in the Hunter region of the Hunter New England Area Health Service (HNEAHS) between 2004 and 2007.

NSW is divided into eight area health services. The Hunter region refers to the south-eastern part of the HNEAHS and includes the city of Newcastle. In the Hunter region three laboratories receive the majority of stool specimens; two private laboratories that service the private health sector and one public laboratory that services the public hospital

system and some private medical practices. In 2005, the estimated resident population of the Hunter region was 8.4% of NSW's population (i.e. 573 525 people).[13]

Methods

The three laboratories in the Hunter region were approached to participate in the study: the public laboratory and one large private laboratory agreed to participate by providing de-identified records of people whose *Campylobacter* infection was detected between 1 January 2004 and 31 December 2007. For each positive sample, a laboratory identifier, the person's date of birth, age, sex, residential postcode and specimen collection date were provided.

The data from both laboratories were merged into a single dataset, which was cleaned and checked for duplicates. A specimen was identified as a duplicate if it was collected from an individual up to 8 weeks after a previous specimen. Only infections in residents of the Hunter region were included in the analyses.

One private laboratory did not participate in the study so the total number of laboratory-confirmed *Campylobacter* infections diagnosed in the Hunter region for 2004–2007 was estimated. As salmonellosis is notifiable to the NSW Department of Health by all laboratories, internal quality assurance data were used to identify the notifying laboratory for each case of salmonellosis notified in the Hunter between 2004 and 2007. The proportion of salmonellosis notifications received from all laboratories in the region, and the annual median proportion of salmonellosis notifications (2004–2007 data) from the two participating laboratories were determined. The annual median proportion of salmonellosis notifications was applied to the *Campylobacter* diagnoses to permit an estimate of the total number of cases diagnosed from all laboratories in the area.

We assumed that the proportional distribution of *Campylobacter* infections and salmonellosis notifications across the three Hunter area laboratories was similar because:

- both bacteria are detected using stool culture by local laboratories
- salmonellosis and campylobacteriosis generally have similar transmission modes.[1]

We further assumed that the proportional distribution was stable throughout the study period.

Hunter region campylobacteriosis cases were described and compared to national descriptive notification data.

Results

There were 2010 isolates of *Campylobacter* detected by the two participating laboratories between 2004 and 2007. Of these, 357 (18%) were excluded as duplicate records and 91 (4.5%) were excluded as isolates from people who were not resident in the study area. Sixty percent of the

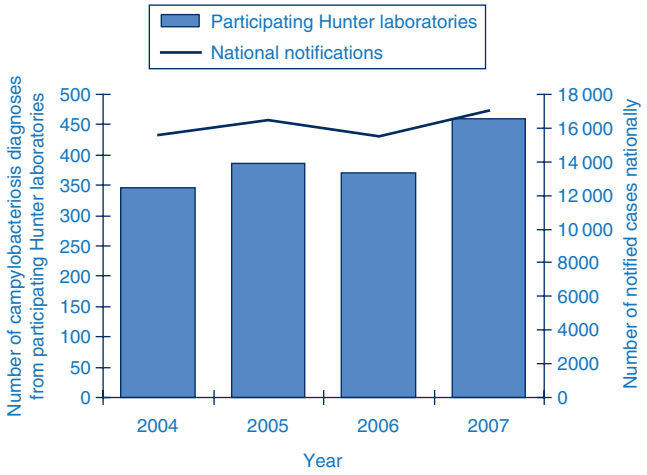

Figure 1. Number of laboratory-confirmed campylobacteriosis cases diagnosed by participating laboratories in the Hunter region of NSW, and the number of campylobacteriosis notifications in Australia*, for the period 2004–2007. *Excludes NSW where campylobacteriosis infection is not notifiable.
Source: Campylobacteriosis diagnosis data of laboratories participating in the study and the National Notifiable Diseases Surveillance System.

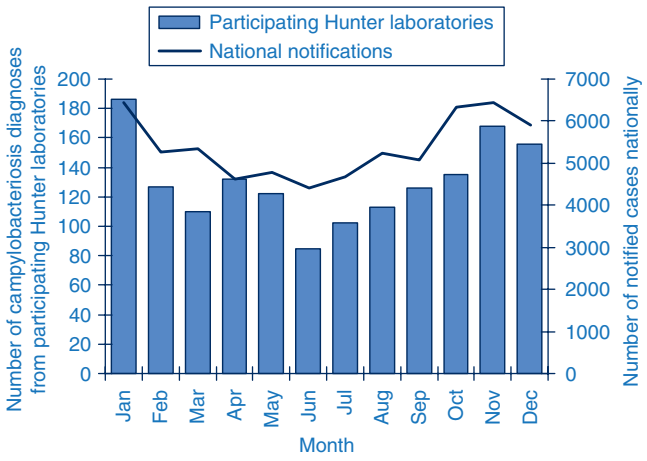

Figure 2. Number of laboratory-confirmed campylobacteriosis cases from participating laboratories in the Hunter region of NSW, and the number of campylobacteriosis notifications in Australia*, by month, for the period 2004–2007. *Excludes NSW where campylobacteriosis is not notifiable.
Source: Campylobacteriosis diagnosis data of laboratories participating in the study and the National Notifiable Diseases Surveillance System.

remaining 1562 isolates were detected by the public laboratory ($n = 944$).

The least number of laboratory-confirmed cases of campylobacteriosis occurred in 2004 ($n = 346$) and the greatest in 2007 ($n = 460$). The pattern of a yearly increase in the number of cases in the Hunter (except 2006) was also observed in the national data (Figure 1). In the Hunter and nationally, the number of laboratory-confirmed cases peaked between November and January (Figure 2).

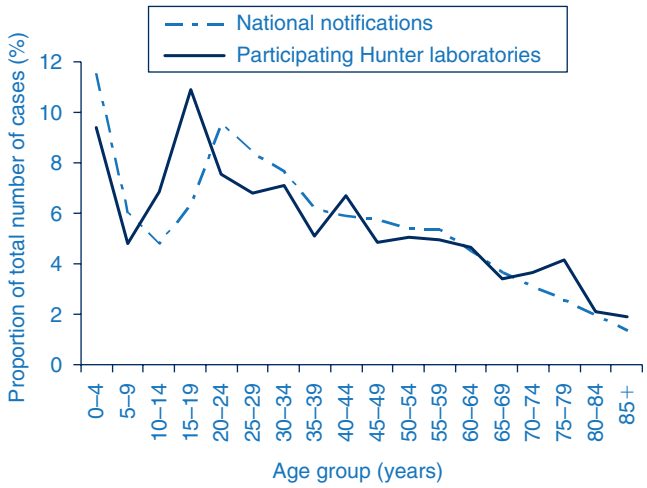

Figure 3. Proportional age distribution of laboratory-confirmed cases of campylobacteriosis from participating laboratories in the Hunter region of NSW, and notified nationally in Australia*, by 5-year age group, for the period 2004–2007. *Excludes NSW where campylobacteriosis is not notifiable.
Source: Campylobacteriosis diagnosis data of laboratories participating in the study and the National Notifiable Diseases Surveillance System.

Between 2004 and 2007, 54% (844/1562) of laboratory-confirmed *Campylobacter* infections in the Hunter region were diagnosed in males. For the same period nationally, males comprised 55% of notifications. In the Hunter region, there was a predominance of males in all age groups up to 50 years, after which age case counts in males and females were similar. The median age of diagnosis for males was 31 years (inter-quartile range 16–50 years) compared with 35 years (inter-quartile range 21–58 years) in females. In children aged under 5 years in the Hunter, 99 *Campylobacter* infections were diagnosed in boys compared with 48 in girls. This gives a boy to girl ratio of 2.1 : 1, compared with a national notification ratio in this age group of 1.5 : 1.

The age distribution of laboratory-confirmed cases of campylobacterosis in the Hunter was similar to that of nationally notified cases (Figure 3), with a high proportion of cases in children aged under 5 years. Secondary peaks in the number of cases occurred in the 15–19-year age group in the Hunter region (10.8%) and 20–24-year age group nationally (9.6%).

The local quality assurance data contained 584 salmonellosis notifications for residents of the Hunter between 2004 and 2007. The median annual proportion of Salmonella notifications processed by the participating laboratories was 48% (range 37–54%). Applying this proportion and range to the number of laboratory-confirmed *Campylobacter* infections identified by participating laboratories, the estimated median of the annual number of laboratory-confirmed cases of campylobacteriosis in the Hunter region was 788 (range 700–1022) between 2004 and 2007 (Table 1). The ratio of the estimated annual number of *Campylobacter* infections to salmonellosis notifications in the Hunter ranged between 5.3 and 6.0:1, with a median of 5.5:1 (Table 2). The lower and upper estimates of the median annual number of *Campylobacter* diagnoses produced ratios ranging from 4.9 to 7.1:1.

Discussion

This study estimated that in the Hunter region of NSW, campylobacteriosis is approximately five times more common than salmonellosis. The epidemiology of *Campylobacter* infection in the Hunter appears to be similar to other temperate areas of Australia in terms of trends in gender distribution, the number of cases occurring each year and seasonality. These similarities in demographics support the validity of this estimation process.

The ratios of annual counts of *Campylobacter* infection to *Salmonella* notifications in other Australian jurisdictions range from 5.7 : 1 in Victoria to 0.6 : 1 in the Northern Territory. If the assumptions in the Hunter are valid, the lower estimate of the *Campylobacter* to *Salmonella* infection ratio in Hunter residents is similar to that of Victorian residents.

Using *Salmonella* notification data to help estimate the total number of laboratory-confirmed cases of campylobacterosis is logical given the similarities in laboratory diagnostic methods and the nature of the bacteria. The use of this methodology and the assumptions made are supported by the ratio of *Campylobacter* to *Salmonella* cases in other jurisdictions, which has a limited range. We are not aware of any reasons why this should differ in the Hunter region.

Limitations to the validity of this method include the use of quality assurance data, which may have contained some duplicate *Salmonella* reports. There may also have been some misclassification by laboratories for the *Salmonella* data. As each case could have been notified by multiple laboratories, we assumed that the laboratory with the earliest notification date initially diagnosed the case. It is possible that specimens from laboratories with slower notification processes are underrepresented, although we detected no evidence of this bias in practice. Furthermore, it is unknown whether the annual variability in the proportion of *Salmonella* notifications received from participating laboratories was due to inaccuracies in the data, changes in notification processes or other factors.

Age-specific rates, age-standardised rates and the rate of laboratory-confirmed infection with campylobacterosis by smaller geographical area were not calculated because

Table 1. Number of *Salmonella* isolates from all laboratories in the Hunter region of NSW, proportion from participating laboratories, number of *Campylobacter* isolates from participating laboratories and estimated total number of campylobacteriosis cases from all laboratories, 2004–2007

Year	Notified *Salmonella* cases, all laboratories (*N*)	Notified *Salmonella* cases, participating laboratories (*N*)	Proportion of *Salmonella* notifications from participating laboratories (%)	Laboratory-confirmed *Campylobacter*, participating laboratories (*N*)	Estimated median *Campylobacter*, all laboratories* (*N*) (range)
2004	136	66	49	346	721 (641–935)
2005	147	80	54	386	804 (715–1043)
2006	140	52	37	370	771 (685–1000)
2007	161	76	47	460	958 (852–1243)
Median	144	71	48	378	788 (700–1022)

*An estimate of the median and range of total laboratory-confirmed *Campylobacter* infections in the Hunter region was calculated by applying the overall proportion of salmonellosis notifications from participating laboratories (median 48%, range 37–54%) to the number of *Campylobacter* infections identified by these laboratories.
Source: Campylobacteriosis diagnosis data of laboratories participating in the study and the National Notifiable Diseases Surveillance System.

Table 2. Ratio of *Campylobacter* to *Salmonella* infection notifications for Australian states and territories* and the Hunter region of NSW, 2004–2007**

Year	ACT	NT	Qld	SA	Tas	Vic	WA	Hunter
2004	3.8	0.6	1.5	3.7	5.1	5.7	3.0	5.3
2005	4.3	0.6	1.7	3.6	2.5	4.2	3.1	5.5
2006	3.3	0.7	1.5	4.5	3.1	4.1	2.4	5.5
2007	3.8	0.6	1.9	3.0	3.2	3.4	2.1	6.0
Median	3.8	0.7	1.6	4.0	3.2	4.3	2.5	5.5

*The ratio for Australia has been calculated using the number of notifications for all states and territories, excluding NSW, where campylobacteriosis is not notifiable.
**Using an estimated total number of *campylobacteriosis* diagnoses from all participating laboratories.
ACT, Australian Capital Territory NT, Northern Territory Qld, Queensland SA, South Australia.
Tas, Tasmania Vic, Victoria WA, Western Australia Hunter, part of the Hunter New England Area Health Service.

the population of Hunter residents serviced by the two participating laboratories is unknown.

Campylobacterosis causes a considerable morbidity and has potentially serious sequelae, so there is value in monitoring the longer-term trends in infection, particularly to determine the impact of measures implemented to reduce infection rates in humans. Measures have included initiatives in domestic and food production settings, especially in the poultry industry.[5,14] Regular review of the demographic details of people in NSW with laboratory-diagnosed *Campylobacter* infection would provide baseline data against which the effectiveness of control measures could be determined.

Conclusions

This study provides evidence that the number of cases of laboratory-confirmed campylobacteriosis in the Hunter region is considerably greater than the number of notifications of salmonellosis. The trends in the Hunter are likely to be similar to other regions of NSW. Regular review of *Campylobacter* laboratory results may be valuable over time.

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