# Monitoring the incidence and causes of diseases potentially transmitted by food in Australia: Annual report of the OzFoodNet Network, 2007

The OzFoodNet Working Group

## Abstract

In 2007, OzFoodNet sites reported 27,332 notifications of 8 diseases or conditions that are commonly transmitted by food. The most frequently notified infections were *Campylobacter* (16,984 notifications) and *Salmonella* (9,484 notifications). Public health authorities provided complete serotype and phage type information on 96% of all *Salmonella* infections in 2007. The most common *Salmonella* serotype notified in Australia during 2007 was *Salmonella* Typhimurium, and the most common phage type was *Salmonella* Typhimurium 135. During 2007, OzFoodNet sites reported 1,882 outbreaks of gastrointestinal illness; the majority of these were spread person to person but included those transmitted by contaminated food. In total, these outbreaks affected 37,474 people and resulted in 1,034 people being admitted to hospital. During these outbreaks there were 114 deaths reported. Food was suspected or confirmed as the mode of transmission for 149 of these outbreaks, which affected 2,290 persons, hospitalised 266 persons and 5 deaths were reported during these outbreaks. For these foodborne outbreaks, *S.* Typhimurium was the most common aetiological agent and restaurants were the most common setting where foods were prepared. Twenty-four of these foodborne outbreaks were related to the consumption of eggs; the majority (n=22) of these outbreaks were due to various phage types of *S.* Typhimurium. This report summarises the incidence of disease potentially transmitted by food in Australia and details outbreaks associated with various food vehicles in 2007. These data assist agencies to identify emerging disease, develop food safety policies, and prevent foodborne illness. *Commun Dis Intell* 2008;32:400–424.

Keywords: foodborne disease, surveillance, disease outbreak

## Introduction

Foodborne diseases are important globally because of their high incidence, their cost to society, and their potential to manifest as outbreaks.[1] In Australia, it has been estimated that there are 5.4 million cases of foodborne disease annually, costing an estimated $1.2 billion dollars per year.[2] Health departments conduct surveillance for foodborne diseases and diseases potentially transmitted by food to monitor trends in illness, detect outbreaks, and inform prevention efforts.[3] Surveillance data collected by health departments are an under estimate of the true burden of disease. Only a proportion of cases are reported to health departments and this is dependent on several factors including: health care seeking behaviour, stool testing practices differing between general practitioners, a patient submitting a stool specimen, the laboratory testing for the pathogen, and the result of testing being reported to public health authorities. Additionally, some pathogens are not notifiable to jurisdictional health departments.[4,5]

OzFoodNet, Australia's enhanced foodborne disease surveillance system, was established by the Australian Government Department of Health and Ageing in 2000 to improve national surveillance of gastrointestinal and foodborne illness.[6] OzFoodNet monitors the incidence of diseases caused by pathogens commonly transmitted by food through population-based, passive and enhanced surveillance for notifiable enteric diseases and for outbreaks of gastroenteritis and enteric diseases. This report summarises surveillance data for 2007 and compares them with data from previous years. The network includes collaborators from the National Centre for Epidemiology and Population Health at the Australian National University, the Public Health Laboratory Network, Food Standards Australia New Zealand, and the Department of Agriculture Fisheries and Forestry. OzFoodNet is a member of the Communicable Diseases Network Australia (CDNA), which is Australia's peak body for communicable disease control.[7]

Surveillance data are used primarily to monitor trends in the incidence of disease and to detect outbreaks. Surveillance data provide a historical perspective to assess changes in incidence and as such assist in the identification of outbreaks and clusters of disease. Long-term trends identified in surveillance data can also provide an indication of the success or otherwise of public health interventions.[8]

## Methods

### Population under surveillance

In 2007, the network covered the whole of the Australian population, which was estimated to be 21,015,042 persons.[9] All states and territories in Australia (New South Wales, Victoria, Queensland, South Australia, Western Australia, Tasmania, the Northern Territory, and the Australian Capital Territory) participated in OzFoodNet in 2007.

### Data sources

*Notified infections*

All Australian states and territories have public health legislation that require doctors and/or pathology laboratories to notify cases of infectious diseases that are important to public health. In September 2007, the *National Health Security Act 2007 (National Health Security Act 2007, No. 174, 2007)* received royal assent. This Act provides a legislative basis for, and authorises the exchange of, health information, including personal information between Australian jurisdictions and the Commonwealth. The Act provides for the establishment of a National Notifiable Diseases List which specifies the diseases about which personal information can be provided. The National Health Security Agreement, signed by Health Ministers in April 2008, establishes operational arrangements to formalise and enhance existing surveillance and reporting systems – an important objective of the Act. De-identified data on these diseases are provided via the Australian Government Department of Health and Ageing's National Notifiable Diseases Surveillance System (NNDSS). OzFoodNet aggregated and analysed data from NNDSS and enhanced surveillance data from OzFoodNet sites on the following 8 diseases or conditions, a proportion of which may be transmitted by food:

- non-typhoidal *Salmonella* infections;
- *Campylobacter* infections (except in New South Wales);
- *Listeria* infections;
- *Shigella* infections;
- *Salmonella* Typhi infection;
- Shiga toxin-producing *Escherichia coli* (STEC) infections;
- haemolytic uraemic syndrome (HUS); and
- botulism.

This report used a NNDSS dataset extracted in September 2008 and was analysed by the date of diagnosis to estimate disease activity within the reporting period 1 January to 31 December 2007. The diagnosis date is the onset date or where this was not known, the earliest date of specimen date, notification date or notification received date was used. Crude and category-specific rates of disease were calculated using the estimated resident populations for each state or territory as at June 2007. Age standardised rates were calculated only for those diseases with more than 100 cases overall using the direct method and the estimated 2007 Australian population as the reference population.[10]

*Gastrointestinal and foodborne disease outbreaks*

OzFoodNet collected summary information on gastrointestinal and foodborne disease outbreaks that occurred in Australia during 2007. An outbreak of foodborne disease is defined as two or more people with a particular infection or illness associated with a common food or meal. A cluster is defined as an increase in infections that are epidemiologically related in time, place or person where investigators were unable to implicate a vehicle or determine a mode of transmission.

For foodborne and suspected foodborne outbreaks, the summary information collected on each outbreak included the setting where the outbreak occurred, where the food was prepared, the month the outbreak occurred, the aetiological agent, the number of persons exposed and affected (including hospitalisations and deaths), the type of investigation conducted, the level of evidence obtained, and the food vehicle responsible for the outbreak. To summarise the data, outbreaks were categorised by aetiological agents, food vehicles and settings where the implicated food was prepared. Data on outbreaks due to waterborne transmission and data from clusters investigated by jurisdictional health departments were also summarised. The number of outbreaks and documented causes reported here may vary from summaries previously published by individual jurisdictions as these can take time to finalise.

## Results

### Rates of notified infections

In 2007, OzFoodNet sites reported 27,332 notifications of 8 diseases or conditions that are commonly transmitted by food (Table 1). This represents a 13% increase over the mean of 24,155 notifications per year for the previous 5 years (2002 to 2006).

Salmonella *infections*

In 2007, OzFoodNet sites reported 9,484 cases of *Salmonella* infection, a rate of 45 cases per 100,000 population. The 2007 rate was a 15% increase over the mean of the previous 5 years (Table 1). Notification rates ranged from 32 cases per 100,000 population in the Australian Capital Territory to 244 cases per 100,000 population in the Northern Territory, which

## Table 1. Number of notified cases, crude rate and 5-year mean (2002–2006) rate per 100,000 population of diseases commonly transmitted by food, Australia, 2007, by disease and state or territory

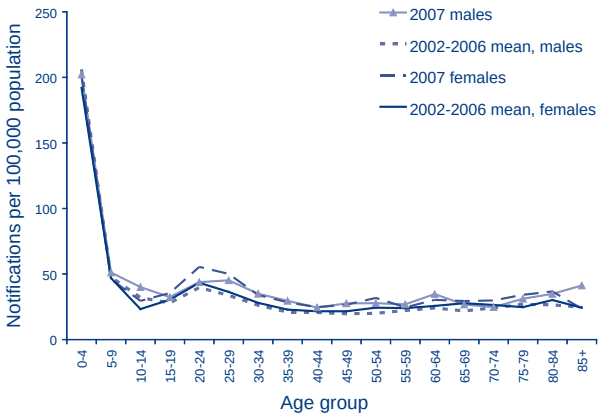
| Disease or aetiological agent | | State or territory | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ACT | NSW | NT | Qld | SA | Tas | Vic | WA | Aust |
| *Salmonella* | Notified cases, 2007 | 110 | 2,555 | 524 | 2,371 | 854 | 225 | 1,856 | 989 | 9,484 |
| | Crude rate, 2007 | 32.4 | 37.1 | 243.8 | 56.7 | 53.9 | 45.6 | 35.7 | 47.0 | 45.1 |
| | Mean rate, 2002–2006 | 30.1 | 30.6 | 187.2 | 66.6 | 34.3 | 38.3 | 26.2 | 36.2 | 39.0 |
| *Campylobacter* | Notified cases, 2007 | 418 | * | 289 | 4,438 | 2,675 | 712 | 6,352 | 2,100 | 16,984 |
| | Rate, 2007 | 123.0 | * | 134.5 | 106.1 | 168.9 | 144.3 | 122.0 | 99.7 | 120.2 |
| | Mean rate, 2002–2006 | 119.7 | * | 120.4 | 103.7 | 152.1 | 132.7 | 115.4 | 105.4 | 115.5 |
| *Listeria* | Notified cases, 2007 | 0 | 22 | 0 | 7 | 7 | 2 | 10 | 2 | 50 |
| | Rate, 2007 | 0.0 | 0.3 | 0.0 | 0.3 | 0.4 | 0.4 | 0.1 | 0.1 | 0.2 |
| | Mean rate, 2002–2006 | 0.4 | 0.4 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | 0.5 | 0.3 |
| Typhoid | Notified cases, 2007 | 0 | 34 | 3 | 6 | 5 | 3 | 30 | 9 | 90 |
| | Rate, 2007 | 0.0 | 0.5 | 1.4 | 0.1 | 0.3 | 0.6 | 0.6 | 0.4 | 0.4 |
| | Mean rate, 2002–2006 | 0.1 | 0.4 | 0.3 | 0.2 | 0.2 | 0.1 | 0.2 | 0.4 | 0.3 |
| *Shigella* | Notified cases, 2007 | 0 | 71 | 173 | 88 | 62 | 3 | 96 | 104 | 597 |
| | Rate, 2007 | 0.0 | 1.0 | 80.5 | 2.1 | 3.9 | 0.6 | 1.8 | 4.9 | 2.8 |
| | Mean rate, 2002–2006 | 0.9 | 1.3 | 66.9 | 2.0 | 2.6 | 0.7 | 1.5 | 6.4 | 2.7 |
| Shiga toxin-producing *E. coli* | Notified cases, 2007 | 1 | 23 | 3 | 24 | 41 | 0 | 13 | 2 | 107 |
| | Rate, 2007 | 0.3 | 0.3 | 1.4 | 0.6 | 2.6 | 0.0 | 0.3 | 0.1 | 0.5 |
| | Mean rate, 2002–2006 | 0.0 | 0.1 | 0.2 | 0.2 | 2.3 | 0.1 | 0.1 | 0.2 | 0.3 |
| Haemolytic uraemic syndrome | Notified cases, 2007 | 1 | 13 | 0 | 1 | 1 | 0 | 3 | 0 | 19 |
| | Rate, 2007 | 0.29 | 0.19 | 0.00 | 0.02 | 0.06 | 0.00 | 0.06 | 0.00 | 0.09 |
| | Mean rate, 2002–2006 | 0.00 | 0.13 | 0.03 | 0.03 | 0.10 | 0.08 | 0.05 | 0.03 | 0.08 |
| Botulism | Notified cases, 2007 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |
| | Rate, 2007 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Mean rate, 2002–2006 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

* *Campylobacter* is not a notifiable disease in New South Wales.

usually has the highest rate of salmonellosis. For all jurisdictions, age-standardised rates were not different from crude rates. The exception was the Northern Territory where the age-standardised rate of salmonellosis was 222 cases per 100,000 population. Half (50%) of *Salmonella* notifications were in males. The highest age-specific rate of *Salmonella* infection was 202 cases per 100,000 population in children aged 0–4 years (Figure 1).

In 2007, the most commonly notified *Salmonella* serotype was *S.* Typhimurium. The most commonly notified phage type was *S.* Typhimurium 135, with 722 notifications in 2007 (Table 2). *S.* Typhimurium 9 was the second most common phage type notified in Australia in 2007; a large outbreak of *S.* Typhimurium 9 affecting more than 300 people associated with Vietnamese pork rolls in New South Wales in March where *S.* Typhimurium 9 isolated in more than 170 cases contributed to the large number of notifications of this phage type. Western Australia ceased routine phage typing of *S.* Typhimurium, *S.* Enteritidis and *S.* Virchow in July 2007; the top 5 *Salmonella* infections by serotype only are presented for Western Australia. (Table 3).

## Figure 1. Notification rate of salmonellosis, Australia, 2007, by age group and sex



## Table 2. Numbers, rates and proportions of the top 5 *Salmonella* infections, Australia (excluding Western Australia), 2006 to 2007, by OzFoodNet site*

| OzFoodNet site | *Salmonella* sero/phage type | 2007 n | 2007 rate† | Proportion (%)‡ | 2006 n | 2006 rate | 2007/2006 ratio§ |
|---|---|---|---|---|---|---|---|
| Australian Capital Territory | Muenchen | 8 | 2.4 | 7.3 | 0 | 0.0 | – |
| | Typhimurium 135 | 8 | 2.4 | 7.3 | 12 | 3.6 | 0.7 |
| | Typhimurium U290 | 7 | 2.1 | 6.4 | 4 | 1.2 | 1.7 |
| | Typhimurium 44 | 6 | 1.8 | 5.5 | 6 | 1.8 | 1.0 |
| | Typhimurium 9 | 6 | 1.8 | 5.5 | 7 | 2.1 | 0.8 |
| New South Wales | Typhimurium 9 | 362 | 5.3 | 14.2 | 82 | 1.2 | 4.5 |
| | Typhimurium 135 | 231 | 3.4 | 9.0 | 206 | 3.0 | 1.1 |
| | Typhimurium 170/108 | 137 | 2.0 | 5.4 | 221 | 3.2 | 0.6 |
| | Birkenhead | 105 | 1.5 | 4.1 | 109 | 1.6 | 1.0 |
| | Typhimurium 44 | 86 | 1.3 | 3.4 | 42 | 0.6 | 2.1 |
| Northern Territory | Oslo | 48 | 22.3 | 9.2 | 2 | 1.0 | 23.2 |
| | Ball | 38 | 17.7 | 7.3 | 31 | 14.9 | 1.2 |
| | Saintpaul | 32 | 14.9 | 6.1 | 31 | 14.9 | 1.0 |
| | Chester | 20 | 9.3 | 3.8 | 17 | 8.2 | 1.1 |
| | Subsp I Ser 16:L,V:– | 20 | 9.3 | 3.8 | 13 | 6.3 | 1.5 |
| | Infantis | 20 | 9.3 | 3.8 | 15 | 7.2 | 1.3 |
| | Anatum | 17 | 7.9 | 3.2 | 10 | 4.8 | 1.6 |
| Queensland | Saintpaul | 219 | 5.2 | 9.2 | 271 | 6.6 | 0.8 |
| | Virchow 8 | 183 | 4.4 | 7.7 | 212 | 5.1 | 0.9 |
| | Typhimurium 135 | 155 | 3.7 | 6.5 | 171 | 4.2 | 0.9 |
| | Aberdeen | 121 | 2.9 | 5.1 | 136 | 3.3 | 0.9 |
| | Birkenhead | 116 | 2.8 | 4.9 | 152 | 3.7 | 0.8 |
| South Australia | Typhimurium 9 | 122 | 7.7 | 14.3 | 58 | 3.6 | 2.1 |
| | Typhimurium 29 | 75 | 4.7 | 8.8 | 6 | 0.4 | 12.6 |
| | Typhimurium 135 | 64 | 4.0 | 7.5 | 79 | 5.0 | 0.8 |
| | Typhimurium 44 | 51 | 3.2 | 6.0 | 17 | 1.1 | 3.0 |
| | Typhimurium 170/108 | 44 | 2.8 | 5.2 | 58 | 3.6 | 0.8 |
| Tasmania | Mississippi | 118 | 23.9 | 52.4 | 67 | 13.4 | 1.8 |
| | Typhimurium 135 | 43 | 8.7 | 19.1 | 39 | 7.8 | 1.1 |
| | Typhimurium 170/108 | 5 | 1.0 | 2.2 | 14 | 2.8 | 0.4 |
| | Subsp I Ser Rough :B:1,5 | 4 | 0.8 | 1.8 | 0 | 0.0 | – |
| | Typhimurium 9 | 4 | 0.8 | 1.8 | 14 | 2.8 | 0.3 |
| Victoria | Typhimurium 44 | 276 | 5.3 | 14.9 | 146 | 2.8 | 1.9 |
| | Typhimurium 135 | 211 | 4.1 | 11.4 | 146 | 2.8 | 1.4 |
| | Typhimurium 9 | 138 | 2.7 | 7.4 | 111 | 2.1 | 1.2 |
| | Typhimurium 170/108 | 112 | 2.2 | 6.0 | 106 | 2.0 | 1.1 |
| | Stanley | 44 | 0.9 | 2.4 | 26 | 0.5 | 1.7 |
| Australia (excluding Western Australia) | Typhimurium 135 | 722 | 3.4 | 8.5 | 673 | 3.6 | 1.0 |
| | Typhimurium 9 | 674 | 3.2 | 7.9 | 335 | 1.8 | 1.8 |
| | Typhimurium 44 | 460 | 2.2 | 5.4 | 245 | 1.3 | 1.7 |
| | Typhimurium 170/108 | 337 | 1.6 | 4.0 | 470 | 2.5 | 0.7 |
| | Saintpaul | 329 | 1.6 | 3.9 | 511 | 2.7 | 0.6 |

* Where there were multiple 5th ranking *Salmonella* types all data have been shown; Western Australia data not included due to incomplete phage typing in 2007.

† Rate per 100,000 population.

‡ Proportion of total *Salmonella* notified for this jurisdiction in 2007.

§ Ratio of the rate in 2007 compared to the rate in 2006.

The highest specific rates for a single serotype other than *S.* Typhimurium were for *S.* Mississippi (24 cases per 100,000 population) in Tasmania and *S.* Oslo (22 cases per 100,000 population), *S.* Ball (18 cases per 100,000 population), and *S.* Saintpaul (15 cases per 100,000 population) in the Northern Territory.

*Salmonella* Enteritidis

*Salmonella* Enteritidis is a globally important *Salmonella* serotype that can infect the internal contents of eggs, but is not endemic in Australian egg layer flocks. To monitor the emergence of this strain in Australia, OzFoodNet conducts enhanced surveillance, including travel history, to detect outbreaks of locally-acquired *S.* Enteritidis. The majority of cases in Australia are associated with overseas travel.

During 2007, OzFoodNet sites reported 396 cases of *S.* Enteritidis infection (Table 4). Of those cases where travel status was reported, 92% (297/322) had travelled overseas and cases often reported visiting several countries. A travel history could not be obtained for 19% (74/396) of cases, compared to 24% (72/305) of cases in 2006 and 11% (44/387) of cases in 2005.

We compared the incidence of salmonellosis in returned travellers with the number of travellers to that region using customs data derived from incoming passenger cards. The field 'country where you spent the most time abroad' was used as the numerator. Of the cases that were known to have been acquired overseas, 66% (195/297) reported travel to South East Asia. This compares with only 29% of returning travellers coming from South East Asia in 2006.[11] The most common country of acquisition for overseas acquired cases was Indonesia, with 33% (98/297) of cases reporting travel there, while comprising only 2.2% of travel undertaken in 2006. Thailand was the second most common country of acquisition with 15% (44/297) of all notifications that were known to have been acquired overseas, followed by Singapore with 7% (20/297) and Malaysia with 6% (18/297). The most common infecting phage types amongst overseas-acquired cases were 6a (21%) and 1b (12%) (Table 5).

**Table 3. Numbers, rates, and proportions of top 5 *Salmonella* infections, 2006 to 2007, Western Australia**

| OzFoodNet site | *Salmonella* serotype | 2007 n | 2007 rate* | Proportion (%)† | 2006 n | 2006 rate | 2007/2006 ratio‡ |
|---|---|---|---|---|---|---|---|
| Western Australia | Typhimurium | 391 | 18.6 | 39.5 | 212 | 10.2 | 1.8 |
| | Enteritidis | 104 | 4.9 | 10.5 | 69 | 3.3 | 1.5 |
| | Saintpaul | 48 | 2.3 | 4.9 | 59 | 2.8 | 0.8 |
| | Virchow | 36 | 1.7 | 3.6 | 12 | 0.6 | 3.0 |
| | Chester | 26 | 1.2 | 2.6 | 27 | 1.3 | 1.0 |

* Rate per 100,000 population (of Western Australia)

† Proportion of total *Salmonella* notified for this jurisdiction in 2007.

‡ Ratio of the rate in 2007 compared to the rate in 2006.

**Table 4. Number of *Salmonella* Enteritidis infections, Australia, 2007, by travel history and state or territory**

| State/territory | History of overseas travel | | | |
|---|---|---|---|---|
| | Yes | No | Unknown | Total |
| Australian Capital Territory | 2 | 0 | 0 | 2 |
| New South Wales | 68 | 6 | 27 | 101 |
| Northern Territory | 8 | 1 | 1 | 10 |
| Queensland | 31 | 5 | 44 | 80 |
| South Australia | 22 | 1 | 1 | 24 |
| Tasmania | 3 | 0 | 0 | 3 |
| Victoria | 62 | 7 | 0 | 69 |
| Western Australia | 102 | 5 | 0 | 107 |
| Total | 298 | 25 | 73 | 396 |

**Table 5. Number and percentage of each phage type for of overseas-acquired cases of *Salmonella* Enteritidis**

| Phage type | Number of cases | Percentage |
|---|---|---|
| 6a | 62 | 20.9 |
| 1b | 37 | 12.5 |
| 1 | 24 | 8.1 |
| 4 | 17 | 5.7 |
| Reaction does not conform (RDNC) | 15 | 5.1 |
| 21 | 14 | 4.7 |
| 26 | 10 | 3.4 |
| 21var1 | 9 | 3.0 |
| 8 | 6 | 2.0 |
| 21c | 6 | 2.0 |
| Other phage types | 33 | 11.1 |
| No phage type was provided | 64 | 22.5 |
| Total | 297 | 100 |

All states and territories except Tasmania and the Australian Capital Territory reported locally-acquired *S.* Enteritidis cases in 2007; 25 *S.* Enteritidis cases (6.3%) in 2007 were known to have acquired the infection locally, compared with an average of 48 cases per year between 2003 and 2006. The travel status of 44 cases from Queensland was unknown due to incomplete follow-up. A number of different phage types of *S.* Enteritidis were reported in locally-acquired cases, and no one phage type predominated, compared with 2003 to 2006, where *S.* Enteritidis 26 predominated. The number of locally acquired *S.* Enteritidis 26 in 2007 (n = 3) was lower than in previous years, where 15 to 34 cases of this phage type were reported per year between 2003 and 2006. This is likely due to incomplete follow-up of cases for travel history from Queensland during 2007 as the majority of locally-acquired *S.* Enteritidis cases (and particularly *S.* Enteritidis 26) are reported from Queensland each year.[12,13] Of the 44 *S.* Enteritidis cases from Queensland in 2007 where travel status was unknown, 22 (50%) were infected with *S.* Enteritidis 26.

## Completeness of Salmonella serotyping and phage typing

Overall, 96% of *Salmonella* notifications on state and territory notification databases contained information about serotype and/or phage type. In Australia, 6 serotypes are routinely phage typed – Bovismorbificans, Enteritidis, Hadar, Heidelberg, Typhimurium and Virchow. Phage typing was greater than 90% complete for serotypes Typhimurium and Bovismorbificans (Table 6). All states and territories (with the exception of Western Australia which ceased routine phage typing in June 2007) had greater than 97% complete serotype and phage type information for all *Salmonella* notifications during 2007.

## Campylobacter *infections*

In 2007, OzFoodNet sites (excluding New South Wales) reported 16,984 cases of *Campylobacter* infection; a rate of 120 cases per 100,000 population (Table 1). The lowest and highest rates of *Campylobacter* notification were in Western Australia (100 cases per 100,000 population) and in South Australia (169 cases per 100,000 population), respectively. Age-standardised rates were not different from crude rates for all jurisdictions except the Northern Territory (age standardised rate 131 cases per 100,000 population) and the Australian Capital Territory (age standardised rate 125 cases per 100,000 population). Fifty-five per cent of notified cases were male. The highest age-specific rate of notifications was in the 0–4 year age group for both males and females (239 cases per 100,000 population and 169 cases per 100,000 population, respectively) with additional peaks in the 20–29 year age group for both males and females and the 70–85+ year age group for males (Figure 2).

**Table 6. Proportion of *Salmonella* infections for 6 serotypes notified to state and territory health departments with phage type information available, Australia, 2002 to 2007**

| *Salmonella* serotype | 2002 % | 2003 % | 2004 % | 2005 % | 2006 % | 2007 % | 2007* % |
|---|---|---|---|---|---|---|---|
| *S.* Bovismorbificans | 98.1 | 97.3 | 96.1 | 96.6 | 98.3 | 98.5 | 98.2 |
| *S.* Enteritidis | 96.5 | 98.3 | 95.8 | 97.6 | 98.3 | 79.2 | 96.1 |
| *S.* Hadar | 90.7 | 97.1 | 90.0 | 91.7 | 100.0 | 88.9 | 90.0 |
| *S.* Heidelberg | 93.3 | 96.4 | 94.7 | 97.6 | 98.4 | 86.5 | 86.3 |
| *S.* Typhimurium | 98.5 | 99.0 | 99.2 | 99.1 | 98.7 | 93.6 | 98.9 |
| *S.* Virchow | 97.6 | 98.3 | 97.1 | 96.8 | 98.6 | 89.7 | 94.9 |

* 2007 data excluding Western Australia have incomplete phage typing from June 2007.

**Figure 2. Notification rate of campylobacteriosis, Australia, 2002 to 2007, by age group and sex**

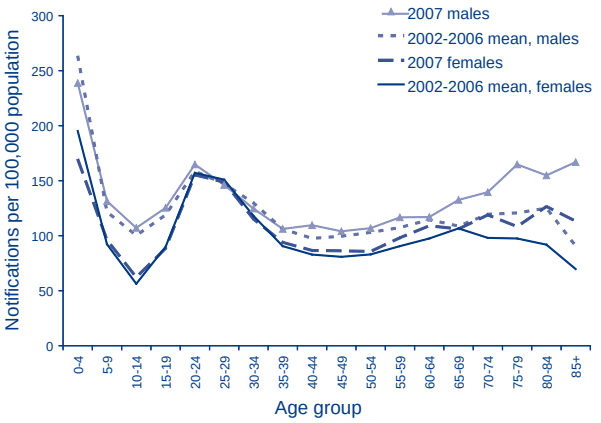
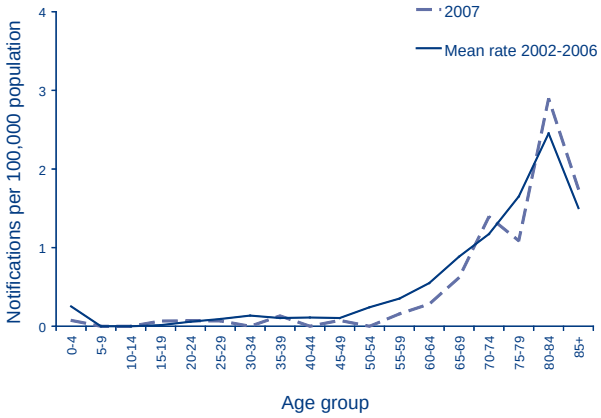



**Figure 3. Notification rate of listeriosis, Australia, 2002 to 2007, by age group**

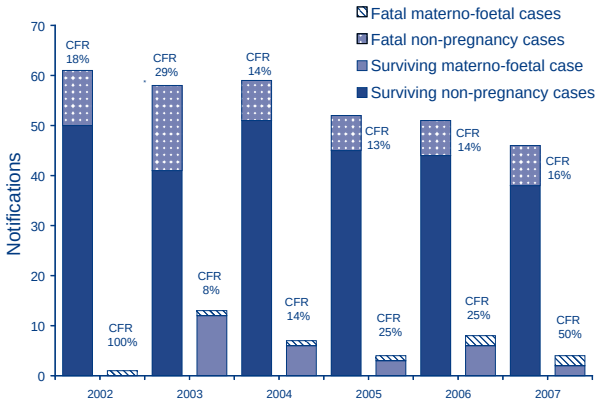



Listeria *infections*

OzFoodNet sites reported 50 cases of *Listeria monocytogenes* infection in 2007, a crude rate of 0.2 cases per 100,000 population. The 2007 notification rate was similar to the 5-year historical mean (0.3 cases per 100,000 population) (Table 1).

Seventy-six per cent (38/50) of notifications were in people aged 60 years or more. The highest age-specific notification rate was in 80–84 year-olds, with a notification rate of 2.9 cases per 100,000 population (Figure 3). Forty-eight per cent (22/46) of the non-pregnancy related cases, and 52% of all cases, were female. Only four of the 50 listeriosis cases notified in 2007 were pregnancy related, which is similar to previous years. Half (2/4) of pregnancy-related cases and 16% (8/38) of the non-pregnancy associated cases in 2007 were fatal (Figure 4).

**Figure 4. Notifications of listeriosis showing non-pregnancy related cases and deaths, and materno-foetal infections and deaths, Australia, 2002 to 2007**




* The case-fatality rate (CFR) is the percentage of cases that were fatal.

Shigella *infections*

In 2007, OzFoodNet sites reported 597 cases of shigellosis, with a crude rate of 2.8 cases per 100,000 population compared with a mean of 2.7 per 100,000 population between 2002 and 2006 (Table 1). As in previous years, the highest notification rate was in the Northern Territory (age standardised rate 79.8 cases per 100,000 population) (Table 1). The highest age-specific notification rates were amongst males and females aged 0–4 years, with age-specific rates of 11.6 and 11.7 notifications per 100,000 population. Females from 20 to 35 have higher age-specific rates than males of the same age. (Figure 5).

The most common biotypes in 2007 were *Shigella sonnei* biotype a (21%) and *Shigella sonnei* biotype g (16%). In 2007, these 2 biotypes increased in number

**Figure 5. Notification rate of shigellosis, Australia, 2002 to 2007, by age group and sex**

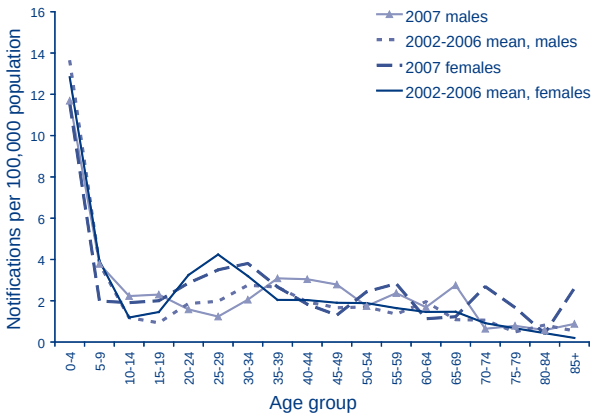


**Table 7. Number, percentage and ratio of the top 5 *Shigella* infections, Australia, 2006 to 2007**

| | 2007 n | Proportion* % | 2006 n | Proportion % | 2007/2006 ratio† |
|---|---|---|---|---|---|
| *Shigella sonnei* biotype a | 128 | 21 | 80 | 15 | 1.6 |
| *Shigella sonnei* biotype g | 98 | 16 | 76 | 14 | 1.3 |
| *Shigella flexneri* 4a mannitol negative | 69 | 12 | 94 | 17 | 0.7 |
| *Shigella flexneri* 2a | 64 | 11 | 54 | 10 | 1.2 |
| *Shigella flexneri* 4 | 47 | 8 | 83 | 15 | 0.6 |

* Proportion of total *Shigella* notified in 2007.

† Ratio of the number of reported cases in 2007 compared to the number reported in 2006.

and proportion of notified cases compared to 2006 (Table 7) In 2006 the most common biotype was *Shigella flexneri* 4a mannitol negative.[12]

### Salmonella *Typhi infections*

OzFoodNet sites reported 90 cases of typhoid (*Salmonella* Typhi) infection during 2007; a crude rate of 0.4 cases per 100,000 population (Table 1) compared with a mean of 0.3 cases per 100,000 for the previous 5 years. Overseas travel is a significant risk factor for typhoid infection in Australia; in 2007, 92% (83/90) of cases reported overseas travel (Table 8).

More than half of all overseas-acquired cases reporting overseas travel had travelled to India (51%, 42/83). Bangladesh was the second most frequently reported country or region with 13% (11/83) of overseas-acquired cases reporting travel there. The predominant phage types isolated from cases returning from travel to India were E1 (19 cases) and E9 (9 cases), similarly in cases returning from travel to Bangladesh, the most common infecting phage type was E9 (4 cases) (Table 9).

The highest rates of typhoid notification were in people aged 20–24, with 0.8 cases per 100,000 and 25–29 with 1.1 cases per 100,000 population, compared with the overall notification rate of 0.4 per 100,000 population, which is likely to be due to high rates of overseas travel in this age-group.

### *Shiga toxin-producing Escherichia coli infections*

In 2007, OzFoodNet sites reported 107 cases of Shiga toxin-producing *Escherichia coli* infections (STEC), a crude rate of 0.5 notifications per 100,000 population and an increase of 65% compared with an annual mean of 0.3 notifications per 100,000 population per year between 2002 and 2006 (Figure 6, Table 1).

South Australia reported 38% (41/107) of the STEC notifications, followed by Queensland (22%, 24/107), New South Wales (22%, 23/107), Victoria (12%, 13/107), the Northern Territory (2.8%, 3/107), Western Australia (2%, 2/107) and the Australian Capital Territory (1%, 1/107). The highest notification rates were in South Australia (2.6 cases per 100,000) and the Northern Territory (1.4 case per 100,000 population) (Table 1).

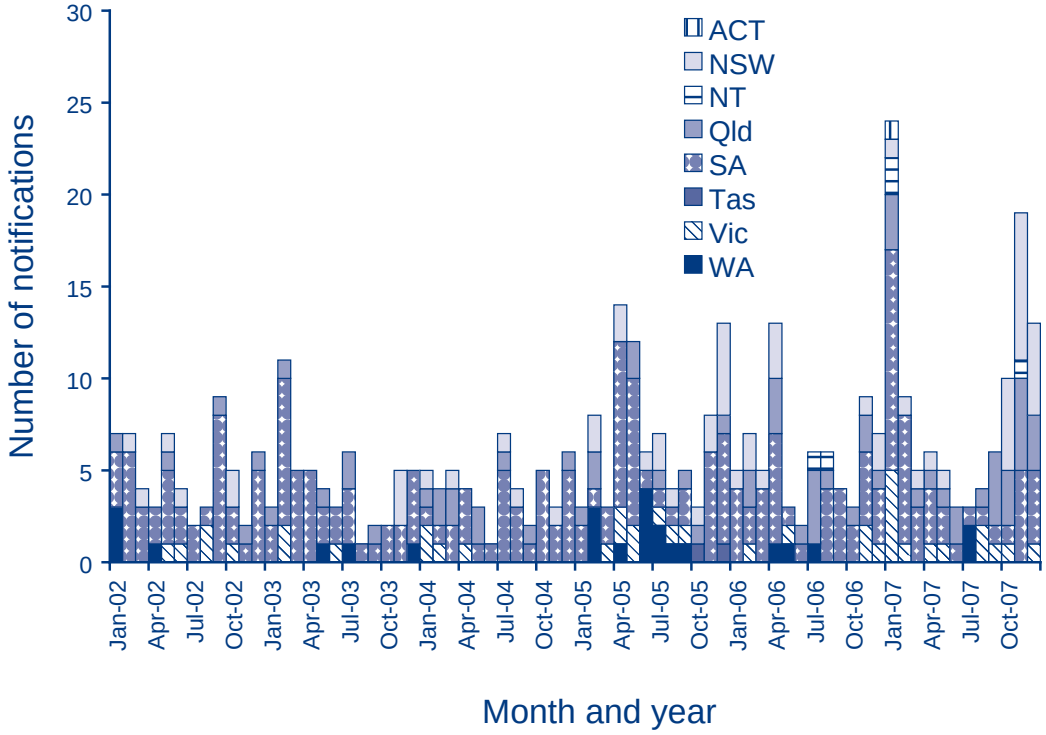
**Table 8. Travel status for notified cases of typhoid, Australia, 2007**

| State or territory | History of overseas travel | | | |
|---|---|---|---|---|
| | Yes | No | Unknown | Total |
| Australian Capital Territory | 0 | 0 | 0 | 0 |
| New South Wales | 32 | 1 | 1 | 34 |
| Northern Territory | 2 | 1 | 0 | 3 |
| Queensland | 4 | 1 | 1 | 6 |
| South Australia | 5 | 0 | 0 | 5 |
| Tasmania | 3 | 0 | 0 | 3 |
| Victoria | 30 | 0 | 0 | 30 |
| Western Australia | 7 | 2 | 0 | 9 |
| Total | 83 | 5 | 2 | 90 |

**Table 9. *Salmonella* Typhi phage types isolated from cases (n=90), Australia, 2007, by place of acquisition**

| Place of acquisition | Number of cases | Phage types isolated from cases (n) |
|---|---|---|
| Africa (country not specified) | 1 | Degraded/ untypeable (1) |
| Bangladesh | 11 | E9 (4), untypeable/degraded (2), 59 (1), C2 (1), D2 (1), E1 (1), unknown (1), |
| Egypt | 1 | 40 (1) |
| El Salvador | 2 | 59 (1), untypeable/degraded (1) |
| India | 41 | E1 (19), E9 (8), untypeable/degraded (4), unknown (2), E1 (1), 28 (1), A (1), D1 (1), D2 (1), E2 (1), E3 (1), O variant (1) |
| India + Thailand | 1 | E9 (1) |
| Indonesia | 9 | E2 (4), D2 (2), untypeable/degraded (2), A degraded (1) |
| Liberia | 2 | D1 (2) |
| Morocco | 1 | C1 (1) |
| Nepal | 2 | Untypeable/degraded (2) |
| Pakistan | 7 | E1 (2), E9 (2), untypeable/degraded (2), D1 (1) |
| Papua New Guinea | 2 | D2 (2) |
| Samoa | 2 | E9 (2) |
| Thailand | 1 | Untypeable/degraded (1) |
| Unknown | 2 | E1 (2) |
| No overseas travel reported | 5 | E1 (3), D1 (1) |

**Figure 6. Number of notifications of Shiga toxin-producing *Escherichia coli*, 2002 to 2007, by date of diagnosis and state or territory, Australia**




The highest age specific notification rate was amongst children aged 0–4 years (1.5 cases per 100,000 population), with peaks in older ages as well, with 1.0 cases per 100,000 amongst the 60–65 year age group and 0.8 notifications per 100,000 amongst the 70–74 year age group. During 2007, O157 was the most common serotype of STEC identified, with 38% (41/107) of cases due to this serotype, which was similar to previous years. The next most common serotypes reported were *E. coli* O111 and O26 (8 and

7 notifications respectively). In 36% (38/107) of cases, the organism either was not isolated or typed, or no information was provided.

*Haemolytic uraemic syndrome*

During 2007, OzFoodNet sites reported 19 cases of haemolytic uraemic syndrome (HUS); a rate of 0.09 cases per 100,000 population (Table 1) compared with a mean of 0.08 cases per 100,000 between 2002 and 2006. The majority of these were reported from New South Wales (13 cases). The median age of notifications was 6 years, with a range of 1–44 years. Similar to previous years, the highest notification rate was in children aged 0–4 years, with eight of the 19 notifications in this age group (0.6 notifications per 100,000 population).

In 2007, HUS notifications showed a seasonal pattern, similar to previous years, tending to increase during the warmer months, with 11 of 19 cases diagnosed in either January, November or December 2007 (Figure 7). There was little information available on the aetiological agents of HUS cases, with *E. coli* (unknown serotype) isolated from only 1 case. One case was known to have been due to infection with bacteria other than *E. coli* (*S. pneumoniae*).

*Botulism*

There was one case of botulism notified in 2007. In January, the Victorian Department of Human Services (DHS) was notified of a case of suspected botulism in a 25 year old male. The notifying clinician gave a history of onset of dizziness, lethargy, blurred vision and respiratory distress followed by a rapid decline which included respiratory failure requiring intubation and ventilation in ICU. A provisional diagnosis of stroke or multiple sclerosis was made but initial investigations were negative. The day following notification to DHS, the case became completely paralysed. A faecal enema specimen was forwarded to the University of Melbourne, Microbiological Diagnostic Unit for confirmation of the diagnosis. *Clostridium botulinum* toxin was detected in the faecal specimen, which was later identified as A2. An extensive investigation of a possible food source was conducted by DHS. At the time of the case notification, extensive case finding was conducted and no other cases were identified.

## Gastrointestinal and foodborne disease outbreaks

During 2007, OzFoodNet sites reported 1,882 outbreaks of gastroenteritis, including foodborne disease, which affected 37,474 people. Associated with these outbreaks, 1,034 people were hospitalised and there were 114 deaths (Table 10). This compared with 1,544 and 624 outbreaks reported across Australia in 2006 and 2005, respectively. The number of outbreaks reported in 2007 was the largest since national surveillance began in 2001.

## Outbreaks spread person-to-person

In 2007, 83% (1,556/1,882) of all gastroenteritis outbreaks were spread from person to person. There were

**Figure 7. Number of notifications of haemolytic uraemic syndrome, Australia, 2002 to 2007, by state or territory and date of diagnosis**

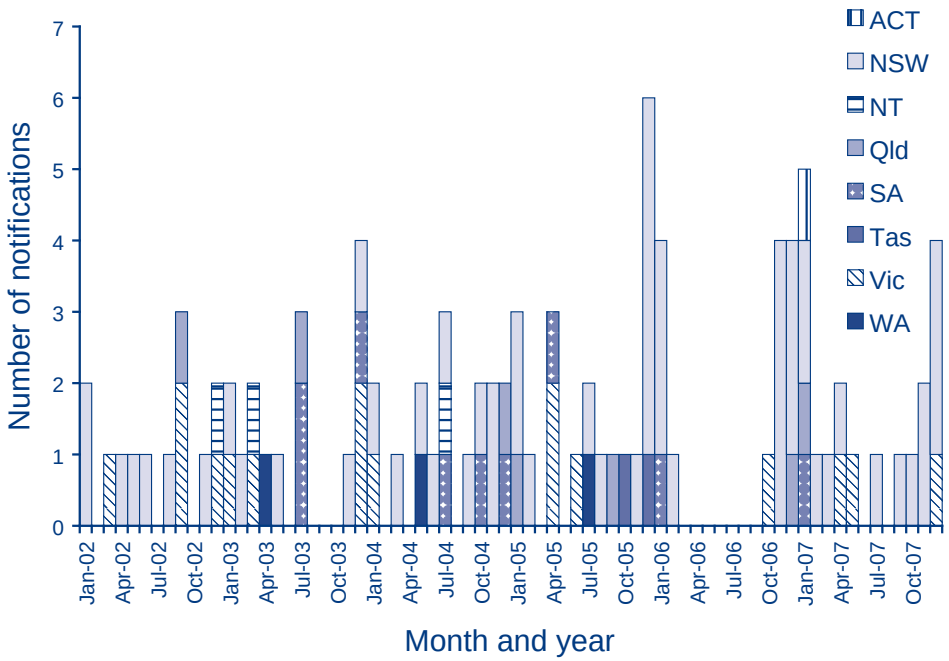


**Table 10. Outbreaks of gastroenteritis including foodborne disease reported to state and territory health departments, Australia, 2007**

| Mode of transmission | Number of outbreaks | Number affected | Hospitalised | Fatalities |
|---|---|---|---|---|
| Foodborne | 149 | 2,290 | 266 | 5 |
| Person-to-person | 1,556 | 32,988 | 652 | 108 |
| Unknown mode (*Salmonella* cluster) | 54 | 565 | 47 | 0 |
| Unknown mode (other pathogen) | 18 | 682 | 47 | 0 |
| Unknown mode (unknown aetiology) | 105 | 949 | 22 | 1 |
| Total | 1,882 | 37,474 | 1,034 | 114 |

32,988 people affected as part of these outbreaks and 108 deaths. Person-to-person outbreaks were most common in aged care homes, with 60% (939/1,556) of outbreaks occurring in this setting, followed by 19% (288/1,556) and 13% (208/1,556) in hospitals and child care centres respectively. Approximately 51% (789/1,556) of outbreaks spread from person to person were caused by norovirus, which was followed by 3% of outbreaks caused by rotavirus. Forty-three per cent (679/1,556) of person-to-person outbreaks were of unknown aetiology. Spring was the peak season for outbreaks of person-to-person transmission, with 46% (709/1,556) of outbreaks reported in the months of September to November 2007.

### Outbreaks with unknown mode of transmission

There were 177 outbreaks where the mode of transmission was not determined, affecting a total of 2,196 people. There were 54 clusters of *Salmonella* and 18 clusters due to other pathogens that were clustered in time, place or person, where investigators were unable to develop an adequate hypothesis for the source of illness. There were 105 outbreaks where investigators were unable to determine the mode of transmission and the aetiology.

### Foodborne outbreaks

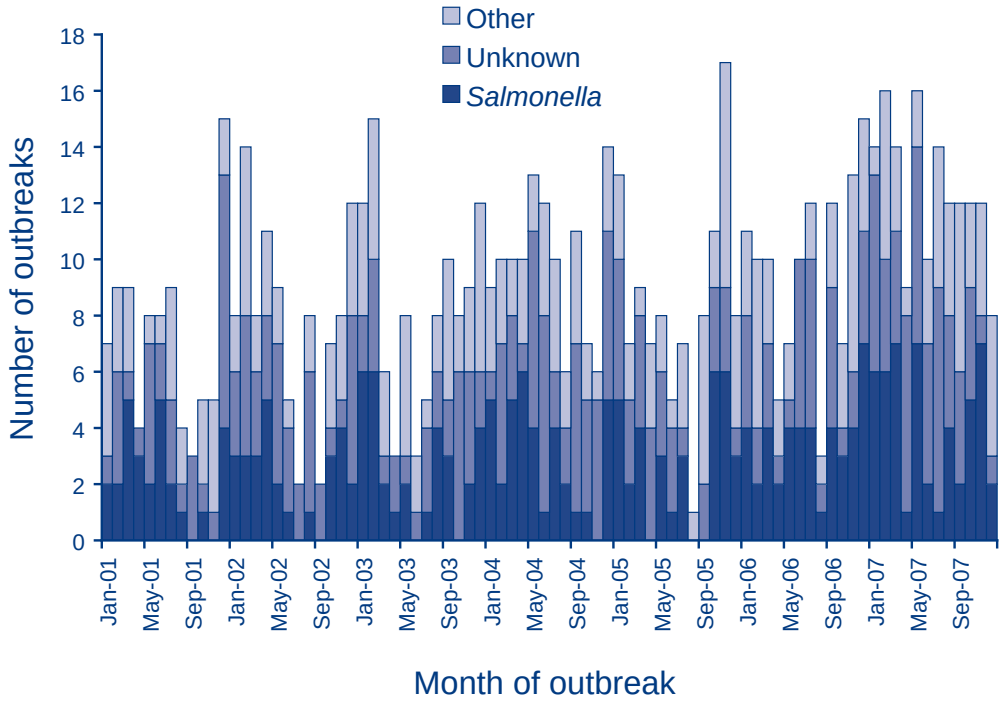
In 2007, there were 149 outbreaks of foodborne disease affecting 2,290 people, which resulted in 266 people being hospitalised. There were 5 deaths reported during these outbreaks (Appendix). This compares to 115 and 102 foodborne outbreaks in 2006 and 2005, respectively.

The overall rate of reported foodborne disease outbreaks for Australia was 7.1 per million population in 2007 (Table 11). The highest rates of reporting were from the Northern Territory (23.3 per million population) and Tasmania (10.1 per million population), although these represent a small number of outbreaks. Outbreaks in the Northern Territory were smaller in size, with a mean of 5.2 persons affected per outbreak, when compared to the mean of 15.4 persons for all outbreaks. The rates of outbreak reporting for the 3 most populous states of Queensland, New South Wales, and Victoria, were similar (7.7, 7.7, and 6.9 per million population, respectively). Outbreaks were more common in warmer months, with *Salmonella* outbreaks being most common in summer, as in previous years (Figure 8).

**Table 11. Outbreaks of foodborne disease in Australia, 2007, by OzFoodNet site**

| State or territory | Number of outbreaks | Number affected | Mean size (persons) | Hospitalised | Outbreaks per million population |
|---|---|---|---|---|---|
| ACT | 3 | 46 | 15.3 | 0 | 8.8 |
| NSW | 53 | 829 | 15.6 | 187 | 7.7 |
| NT | 5 | 26 | 5.2 | 3 | 23.3 |
| Qld | 32 | 406 | 12.7 | 19 | 7.7 |
| SA | 6 | 115 | 19.2 | 0 | 3.8 |
| Tas | 5 | 55 | 11 | 2 | 10.1 |
| Vic | 36 | 642 | 17.8 | 39 | 6.9 |
| WA | 9 | 171 | 19 | 16 | 4.3 |
| Total | 149 | 2,290 | 15.4 | 266 | 7.1 |

**Figure 8. Outbreaks of foodborne disease reported to state and territory health departments (n=760), Australia, 2001 to 2007, by month of outbreak**




*Aetiological agents*

The most common agent responsible for foodborne disease outbreaks was *Salmonella*, which caused 34% (50/149) of outbreaks (Table 12). *S.* Typhimurium was responsible for 78% (39/50) of foodborne *Salmonella* outbreaks.

Seventy-one per cent (15/21) of the toxin-mediated outbreaks in 2007 were related to fish toxins. As in previous years, outbreaks of ciguatera fish poisoning (8 outbreaks) and histamine poisoning (7 outbreaks) were small with a mean of three and 2 persons affected, respectively. There were 3 outbreaks of *Clostridium perfringens* and 2 outbreaks of *Bacillus cereus* intoxication. There was 1 small outbreak of lupin intoxication from flour affecting 2 people.

In 2007, there were 16 foodborne outbreaks due to norovirus affecting 520 people, compared with 11 foodborne outbreaks due to norovirus affecting 369 people in 2006. There were also 4 small out-

**Table 12. Aetiological agents responsible for foodborne disease outbreaks, number of outbreaks and persons affected, Australia, 2007**

| Agent category | Number of outbreaks | Number affected | Mean size (persons) | Hospitalised |
|---|---|---|---|---|
| *S.* Typhimurium | 39 | 914 | 23 | 225 |
| Norovirus | 16 | 520 | 33 | 6 |
| *S.* other | 11 | 125 | 11 | 15 |
| Ciguatoxin | 8 | 24 | 3 | 1 |
| Histamine poisoning | 7 | 17 | 2 | 4 |
| Bacterial toxin | 5 | 78 | 16 | 0 |
| *Campylobacter* | 4 | 20 | 5 | 1 |
| Plant toxins | 1 | 2 | 2 | 2 |
| *Shigella* | 1 | 55 | 55 | 3 |
| *Cyclospora* | 1 | 8 | 1 | 0 |
| Unknown | 56 | 527 | 9 | 9 |
| Total | 149 | 2,290 | 15 | 266 |

**Table 13. Categories of food vehicles implicated in foodborne disease outbreaks, Australia, 2007**

| Vehicle category | Number of outbreaks | Number affected | Mean size (persons) | Hospitalised |
|---|---|---|---|---|
| Fish | 17 | 75 | 4 | 7 |
| Mixed foods | 13 | 550 | 42 | 151 |
| Egg-containing dish | 11 | 129 | 12 | 15 |
| Dessert | 9 | 124 | 14 | 23 |
| Meat & meat products | 7 | 46 | 7 | 3 |
| Fresh produce | 7 | 186 | 27 | 13 |
| Poultry | 5 | 41 | 8 | 1 |
| Water | 4 | 85 | 21 | 3 |
| Beverage | 3 | 16 | 5 | 2 |
| Seafood | 3 | 42 | 14 | 0 |
| Dips | 2 | 77 | 39 | 10 |
| Egg-based sauce/dressing | 2 | 31 | 16 | 9 |
| Pasta | 2 | 34 | 17 | 0 |
| Sushi | 2 | 35 | 18 | 5 |
| Cheese | 1 | 10 | 10 | 0 |
| Sandwich | 1 | 6 | 6 | 0 |
| Unknown | 60 | 803 | 13 | 24 |
| Total | 149 | 2,290 | 15 | 266 |

breaks of *Campylobacter* affecting 20 people, 1 outbreak of *Shigella sonnei* biotype a (55 persons), and 1 outbreak of cyclosporiasis (8 persons).

Thirty-eight per cent (56/149) of foodborne outbreaks in 2007 were of unknown aetiology, compared with 31% for the previous year. These outbreaks of unknown aetiology affected 527 people.

*Food vehicles*

There was a wide variety of foods implicated in outbreaks of foodborne disease during 2007 (Table 13), although investigators were unable to identify a specific food vehicle in 40% (60/149) of outbreaks.

There were 24 outbreaks associated with eggs in 2007; this was 16% (24/149) of all foodborne outbreaks and included all outbreaks that investigators considered were egg-associated, including 11 due to egg-containing dishes, seven due to desserts, two due to egg based sauces/dressings, two due to mixed foods, and one each due to beverages and sushi (Table 14). These outbreaks affected a total of 629 people and hospitalised 195 people.

Contaminated fish was the most common food vehicle and was responsible for 11% (17/149) of foodborne outbreaks. Of the 8 outbreaks of ciguatoxin, Queensland reported seven and the Northern Territory reported one. The types of fish implicated in these outbreaks included: mackerel (4 outbreaks), coral trout (3 outbreaks) and 'mother-in-law fish' (1 outbreak). Histamine poisoning outbreaks from consumption of tuna were reported in New South Wales (2 outbreaks), Queensland (2 outbreaks), the Northern Territory (1 outbreak), and Victoria (1 outbreak). Victoria also reported an outbreak of suspected histamine poisoning following consumption of Mahi Mahi. Contaminated fish also caused an outbreak of *Bacillus cereus* following consumption of Gelfite fish balls, and an outbreak of unknown aetiology following tuna consumption.

Thirteen outbreaks were associated with mixed foods, which include multiple ingredients or buffet meals where a wide variety of foods and dishes were served. Consumption of poultry was responsible for 5 outbreaks and meat other than poultry for 7 outbreaks. There were 7 outbreaks associated with fresh produce, such as fresh fruits and vegetables. These food vehicles included: salads (3 outbreaks) and single outbreaks associated with watermelon, baby corn, fruit salad and lupin flour.

*Settings where food was prepared*

The most common settings where food was prepared in outbreaks was in restaurants (38%, 57/149), and private residences (11%, 17/149; Table 15). Foods prepared at a takeaway or by commercial caterers were responsible for 15 and 12 outbreaks, respectively. Foods that were contaminated in primary production environments ('primary produce'), such as fish contaminated with ciguatera toxin and fresh fruits and vegetables contaminated with *Salmonella*,

## Table 14. Outbreaks of foodborne illness associated with eggs, Australia, 2007 (n=24)

| State | Month of outbreak | Setting prepared | Agent responsible | Number affected | Evidence | Responsible vehicles | Comments |
|---|---|---|---|---|---|---|---|
| NSW | March | Bakery | *Salmonella* Typhimurium 9 | 319 | M | Pork/chicken and salad rolls (with raw egg mayonnaise) | Vietnamese pork rolls; *S.* Tm 9 isolated from multiple foods at bakery including raw egg mayonnaise, ham, cooked chicken, pate, roast pork, shell eggs, and from environmental swabs. Traceback of shell eggs and chicken livers did not identify source of contamination. |
| | October | Bakery | *Salmonella* Typhimurium | 27 | D | Cheese or cream cake | Suspected raw egg in cake |
| | June | Bakery | Unknown | 15 | D | Raw egg mayonnaise, suspected | |
| | May | Restaurant | *Salmonella* Typhimurium 9 | 12 | M | Fried ice cream | *S.* Tm 9 found in pre-prepared ice cream |
| | November | Private residence | *Salmonella* Typhimurium 9 | 3 | M | Egg nog or undercooked chicken | |
| | November | Private residence | *Salmonella* Typhimurium 9 | 11 | D | Raw eggs | Same MLVA* pattern as outbreak implicating Vietnamese pork rolls in March |
| Qld | January | Not applicable | *Salmonella* Typhimurium 197 | 25 | M | Egg-based dish, suspected | 25 community cases with same MLVA profile as environmental swabs positive for *S.* Tm 197 from egg farm A |
| | January | Restaurant | *Salmonella* Typhimurium 197 | 3 | M | Egg-based dish, suspected | Restaurant supplied eggs from egg farm A and cases had matching MLVA to environmental swabs from egg farm A |
| | February | Restaurant | *Salmonella* Typhimurium 197 | 12 | M | Egg-based dish, suspected | Restaurant supplied eggs from egg farm A and cases had matching MLVA to environmental swabs from egg farm A |
| | February | Restaurant | *Salmonella* Typhimurium 197 | 6 | M | Egg-based dish, suspected | Restaurant supplied eggs from egg farm A and cases had matching MLVA to environmental swabs from egg farm A |
| | February | Restaurant | *Salmonella* Typhimurium 197 | 2 | M | Egg-based dish, suspected | Restaurant supplied eggs from egg farm A and cases had matching MLVA to environmental swabs from egg farm A |
| | March | Restaurant | *Salmonella* Typhimurium U302 | 18 | D | Egg-based dish, suspected | Raw eggs used in foods served at restaurant. Proprietor advised not to use raw eggs. |
| | May | Bakery | *Salmonella* Typhimurium 135a | 7 | M | Cheesecake | Bakery used raw eggs; instructed to stop |
| Tas | March | Other | *Salmonella* Typhimurium 135a | 20 | D | Eggs, suspected | Cases consumed salad rolls from bakery (n=18) and eggs (n=2) from same farm that provided eggs to bakery; cracked and dirty eggs being sold |

## Table 14. Outbreaks of foodborne illness associated with eggs, Australia, 2007, *continued*

| State | Month of outbreak | Setting prepared | Agent responsible | Number affected | Evidence | Responsible vehicles | Comments |
|---|---|---|---|---|---|---|---|
| Vic | January | Private residence | *Salmonella* Typhimurium 44 | 4 | M | Milkshake | Raw egg milkshake; blender used was positive for *S.* Tm 44 |
| | January | Private residence | *Salmonella* Typhimurium 44 | 11 | A | Trifle | Made with raw egg |
| | January | Private residence | *Salmonella* Typhimurium 44 | 10 | A | Tiramisu | Made with raw egg, accounted for 90% of cases |
| | January | Restaurant | *Salmonella* Typhimurium 44 | 15 | D | Caesar salad dressing | Made with raw egg |
| | May | Private residence | *Salmonella* Typhimurium 9 | 8 | M | Chocolate mousse | Made with raw egg, mousse was positive for *S.* Tm 9 |
| | May | Private residence | *Salmonella* Typhimurium 9 | 3 | D | Chocolate mousse, suspected | Made with raw eggs |
| | June | Bakery | *Salmonella* Typhimurium 44 | 45 | M | Pork rolls | Vietnamese pork rolls, leftover rolls and pate positive for *S.* Tm 44, raw egg mayonnaise used on all rolls. |
| | October | Restaurant | *Salmonella* Typhimurium 44 | 16 | M | Chicken foccacia with raw egg aioli | Aioli made with raw egg, blender used to make aioli positive for *S.* Tm 44 |
| | December | Restaurant | *Salmonella* Typhimurium 44 | 14 | M | Risottini, undercooked | Risottini positive for *S.* Tm 44 |
| WA | September | Takeaway | *Salmonella* Virchow 45 | 23 | D | Sushi and Katsudon (served with raw egg mayonnaise) | Implicated premises made and used a raw egg mayonnaise; all food samples negative for *Salmonella* |

D Descriptive evidence implicating the vehicle.

A Analytical epidemiological association between illness and vehicle.

M Microbiological confirmation of aetiology in vehicle and cases.

* Multilocus Variable-number tandem repeat Analysis (MLVA).

**Table 15. Food preparation settings implicated in disease outbreaks, Australia, 2007**

| Setting prepared | Number of outbreaks | Proportion of all outbreaks (%) | Number affected (persons) |
|---|---|---|---|
| Restaurant | 57 | 38 | 714 |
| Private residence | 17 | 11 | 134 |
| Takeaway | 15 | 10 | 152 |
| Commercial caterer | 12 | 8 | 285 |
| Aged care facility | 10 | 7 | 107 |
| Primary produce | 9 | 6 | 79 |
| Institution – other | 6 | 4 | 108 |
| Bakery | 5 | 3 | 413 |
| Camp | 4 | 3 | 85 |
| Other | 4 | 3 | 84 |
| Unknown | 3 | 2 | 94 |
| Commercial manufactured food | 3 | 2 | 17 |
| Cruise/airline | 1 | 1 | 8 |
| Hospital | 1 | 1 | 4 |
| National franchised fast food restaurant | 1 | 1 | 4 |
| Grocery store/delicatessen | 1 | 1 | 2 |
| Total | 149 | 100 | 2,290 |

accounted for another 9 outbreaks. Ten outbreaks were associated with food prepared in aged care facilities, while food prepared in other institutions was responsible for a further 6 outbreaks. There were 5 outbreaks associated with foods prepared at bakeries.

*Investigative methods and levels of evidence*

States and territories investigated 29 outbreaks using retrospective cohort studies and 4 outbreaks using case control studies. In 83 outbreaks, case series information was collected during the investigation. To attribute the cause of the outbreak to a specific food vehicle, investigators obtained analytical evidence from epidemiological studies in 19 outbreaks. Microbiological evidence of contaminated food was found in 20 outbreaks, with a further 2 outbreak investigations obtaining both microbiological and analytical evidence. Investigators obtained analytical and/or microbiological evidence for 46% (23/50) of *Salmonella* outbreaks, which was similar to the proportion in 2006 (41%). Seventy-two per cent (108/149) of outbreaks relied on descriptive evidence to implicate a food or foodborne transmission.

*Significant outbreaks*

There were 11 outbreaks affecting 40 or more persons in 2007. Five of these outbreaks were due to *Salmonella*, five were due to norovirus and one was due to *Shigella sonnei* biotype a. In total, these significant outbreaks affected 909 people, with a median of 55 persons affected per outbreak (range 45–319 people), and 163 people hospitalised.

New South Wales reported the largest of these outbreaks, which was an explosive outbreak of *S.* Typhimurium 9 in March 2007 due to Vietnamese pork rolls, which affected over 300 people, 170 of whom were laboratory-confirmed *S.* Typhimurium 9 cases. This outbreak was the largest single foodborne outbreak reported in New South Wales in several years. Victoria also reported a large outbreak of *S.* Typhimurium 44 associated with Vietnamese pork rolls in June 2007, which affected at least 45 people.

Queensland reported a large outbreak of shigellosis affecting 55 people, which was due to contaminated baby corn imported from Thailand. This outbreak was linked concurrently with a large outbreak in Denmark, to the same product from Thailand. An international investigation traced the source of the baby corn that both countries had received to the same packing shed in Thailand.

In addition, Queensland investigated 5 outbreaks of *S.* Typhimurium 197 associated with a single egg farm, which affected at least 48 people in total. These outbreaks were all detected by routine molecular subtyping following isolation of *S.* Typhimurium 197 with a specific multilocus

variable-number tandem repeat analysis (MLVA) pattern from environmental samples taken at the egg farm that matched the MLVA pattern of human cases of *S.* Typhimurium 197. The egg farm conducted a voluntary withdrawal of eggs in February 2007. However, eggs from the farm were still being sold in the community from several outlets in Brisbane after this date. After cases continued to be notified, a state-wide consumer level recall was initiated in early March 2007. The recall included a media release, which provided information to the public on the nature of the *Salmonella* outbreak. No further cases of *S.* Typhimurium PT 197 infection associated with the implicated eggs were detected in 2 months of surveillance following these interventions. The farm was prosecuted and pleaded guilty to selling cracked and dirty eggs to a retailer. A conviction was recorded and the farm was fined $1,500. The outbreak investigation identified problems with tracing eggs back to the farm due to the lack of labelling or stamping of the eggs.

## Discussion

This report summarises the rates of gastrointestinal diseases commonly transmitted by foods in Australia. While notification rates in Australia have remained stable in recent years, the incidence of *Salmonella* and *Campylobacter* infections in particular, are high compared with other developed countries.[14] In contrast to *Salmonella, Campylobacter* infections in Australia are predominately sporadic, that is, they do not occur as part of a recognised outbreak and may be related to the lack of a robust typing scheme for *Campylobacter*.[15] In 2007, there were 4 outbreaks of campylobacteriosis, which affected 20 people compared with 16,984 notifications in 2007. It is also of note that in 2007 there was an increase in the rate of *Campylobacter* notifications in males aged over 65 compared with the mean notification rate in this age group for the last 5 years. Risk factors for *Campylobacter* infection in Australia are well-characterised[16–18] and it is estimated that in a typical year 50,500 (95% credible interval 10,000–105,500) cases of *Campylobacter* infection in persons over 5 years of age could be directly attributed each year to the consumption of chicken in Australia.[19] A primary piece of work for the OzFoodNet network in the coming year is to summarise existing epidemiological and microbiological data on *Campylobacter* infections to identify areas to target further research and prevention efforts.

In 2007 more than 96% of *Salmonella* notifications contained complete information about serotype and phage type. In Australia, serotyping is conducted by public health reference laboratories in Queensland, New South Wales, Victoria, South Australia, and Western Australia. The smaller jurisdictions, Tasmania, the Australian Capital Territory, and the Northern Territory, forward their *Salmonella* isolates to the Microbiological Diagnostic Unit at the University of Melbourne in Victoria and/or the Australian Salmonella Reference Centre at the Institute of Medical and Veterinary Sciences in South Australia, where phage typing is also performed. In particular, *S.* Typhimurium, the most common serotype in Australia, is routinely phage typed by state reference laboratories to provide epidemiologically relevant discrimination within the serotype to assist in outbreak detection and investigation. In 2007, 3 jurisdictions, Queensland, New South Wales, and Western Australia, introduced alternative subtyping methods to complement existing routine subtyping. In Queensland and New South Wales, MLVA is routinely done in addition to routine phage typing of *S.* Typhimurium. While no MLVA data are presented in this annual report, MLVA patterns are increasingly being used by New South Wales and Queensland to identify and investigate outbreaks of *S.* Typhimurium. In July 2007, Western Australia began to routinely type *S.* Typhimurium isolates with pulsed field gel electrophoresis (PFGE), which has been used by that state since June 2004 and is conducted in accordance to international PulseNet protocols (http://www.cdc.gov/pulsenet/protocols.htm). However, since Western Australia is the only jurisdiction in Australia to routinely use PFGE for *Salmonella* subtyping, OzFoodNet's ability to detect multi-state clusters, particularly of *S.* Typhimurium, that include Western Australia is hampered. Australia continues to work towards a harmonised approach to subtyping of *Salmonella* so that timely identification and investigation of *Salmonella* clusters can occur.

South Australia had the highest notification rate of STEC in 2007, as in previous years. South Australian pathology laboratories refer all stool specimens with macroscopic blood to a reference laboratory for screening using polymerase chain reaction tests to identify the presence of STEC toxin genes. This screening process results in higher ascertainment of cases in South Australia compared with other states and territories.[20]

In 2007, OzFoodNet sites reported 1,882 outbreaks of gastroenteritis, the largest number recorded since surveillance began in 2001. The majority of these outbreaks were due to person-to-person transmission and reflect the large burden of these outbreaks in institutions around Australia. In addition, outbreaks of gastroenteritis are easier to identify in institutions, such as aged care homes and hospitals, and are more likely to be reported from these settings. Just over half of the person-to-person outbreaks in 2007 were due to norovirus, which is highly infectious. A strain which had been circulating in recent years (strain 2006b), was the main cause of the spike in reported outbreaks in spring 2007. OzFoodNet epidemiologists contributed to the creation of the *Guidelines for the Public Health Management of Gastroenteritis*

*Outbreaks Due to Norovirus or Suspected Viral Agents in Australia,* targeted at aged care facilities, which will be circulated to states and territories under the auspices of CDNA.

In 2007, the rate of foodborne outbreaks in Australia was 7.1 outbreaks per million population and the mean size of these outbreaks was 15 people. This compares with an estimated rate of 18 foodborne outbreaks per million people in New Zealand,[21] and an estimated rate of 4.1 foodborne outbreaks per million people in the United States of America.[22]

Eggs continue to be the most commonly identified food vehicle in foodborne disease outbreaks in 2007. In 2007, there were 24 outbreaks associated with eggs, compared with 16 outbreaks reported in 2006. These outbreaks were due to a variety of dishes and food items containing raw or undercooked eggs. As highlighted in Table 13 and the Appendix, the assignment of outbreak vehicles into summary vehicle categories is a complex process, into which investigator experience, epidemiologic context and concurrent events contribute. In 2007, the risks associated with using raw egg products in foods are illustrated by the 2 large outbreaks associated with the consumption of Vietnamese pork rolls (made with a homemade raw egg mayonnaise) in New South Wales and Victoria. In August 2007 Federal, State and Territory governments met with industry at the National Egg Food Safety Summit to discuss how to address egg-associated illness. The increased number of egg-related outbreaks across Australia in 2007 highlights the need for a national primary production and processing standard for eggs and egg products. Currently, the Food Standards Code does not prohibit cracked and dirty eggs being sold to non-retail food businesses, provided eggs undergo adequate heat treatment. This standard does not address the risk of cross-contamination occurring in the kitchen of non-retail businesses such as restaurants and catering firms, when staff handle soiled eggs.

Fresh produce was associated with 7 outbreaks in 2007, an increase from the 4 produce-associated outbreaks reported in 2006. The outbreak associated with baby corn was linked to an international outbreak of shigellosis that affected Denmark and Australia and was due to baby corn imported from Thailand. This outbreak was identified in Australia by comparing antibiotic resistance patterns with those published from the Danish outbreak in the monthly publication *Eurosurveillance*.[23,24] After identification of the cluster in Australia, international communications through the World Health Organization (WHO) International Food Safety Authorities Network and under the auspices of the International Health Regulations (2005), enabled trace back of the baby corn to the same packing shed in Thailand.[25]

In 2007, OzFoodNet continued its international collaboration with the WHO Global Salmonella Surveillance (WHO Global Salm-Surv) Network (http://www.who.int/salmsurv/en/), a capacity building network focussed on foodborne disease epidemiology and microbiology. WHO Global Salm-Surv is part of WHO's endeavours to strengthen the capacities of its member states in the surveillance and control of major foodborne diseases and to contribute to the global effort of containment of antimicrobial resistance in foodborne pathogens. OzFoodNet has been a steering committee member of WHO Global Salm-Surv since 2004 and in 2007 OzFoodNet epidemiologists attended regional training courses in Thailand and Papua New Guinea as epidemiology trainers.

It is important to recognise some of the limitations of the data used in this report. Some of the most common enteric pathogens are not notifiable, particularly norovirus and *Clostridium perfringens*. These organisms may be notified as the cause of outbreaks, but not as individual cases of disease. A limitation of the outbreak data provided by OzFoodNet sites for this report is the potential for variation in categorising features of outbreaks depending on investigator interpretation and circumstances. States and territories are working towards harmonising surveillance and outbreak data to address some of these issues.

Foodborne disease surveillance provides information to assist in not only immediate public health action and the prevention of these diseases, but also contributes to the assessment of food safety policies and campaigns. A national program of surveillance for foodborne diseases and outbreak investigation has many benefits including identifying foods that cause human illness. Ongoing efforts to strengthen the quality of these data will ensure continued use by agencies to develop food safety policy and prevent foodborne illness.

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In 2007, the OzFoodNet Working Group was (in alphabetical order): Adam Craig (NSW), Gillian Barber (DoHA), Mary Barker (WA), Robert Bell (Qld), Charlie Blumer (ACT), Roy Byun (NSW), Craig Dalton (HNE Health), Gerard Fitzsimmons (DoHA), Kathleen Fullerton (DoHA), Robyn Gibbs (WA), Joy Gregory (Vic), Gillian Hall (NCEPH), Michelle Harlock (NT), Geoff Hogg (MDU), Rebecca Hundy (ACT), Martyn Kirk (DoHA), Karin Lalor (Vic), Meeyin Lam (NSW), Deon Mahoney (FSANZ), Michelle McPherson (SA), Tony Merritt (HNE Health), Sally Munnoch (HNE Health), Jennie Musto (NSW), Lillian Mwanri (SA), Chris Oxenford (ACT), Raj Patil (DAFF), Nevada Pingault (WA), Jane Raupach (SA), Mark Salter (FSANZ), Cameron Sault (Tas), Craig Shadbolt (NSWFA), Frances Sheehan (Qld), Russell Stafford (Qld), Nicola Stephens (Tas), Barbara Telfer (NSW), Hassan Vally (NCEPH, WA), Shellee Williams (NT), Tory Worgan (HNE Health).

## Author details

Correspondence: Ms Kathleen Fullerton, Coordinating Epidemiologist, OzFoodNet, Office of Health Protection, Australian Government Department of Health and Ageing, GPO Box 9848, MDP 14, CANBERRA ACT 2601. Telephone: +61 2 6289 2751. Facsimile: +61 2 6289 2500. Email: Kathleen.Fullerton@health.gov.au

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## Appendix. Foodborne outbreak summary for OzFoodNet sites, Australia, 2007 (n=149)

| State | Month of outbreak | Setting prepared | Aetiology | Number affected | Hospitalised | Fatalities | Evidence | Vehicle | Vehicle category |
|---|---|---|---|---|---|---|---|---|---|
| ACT | April | Restaurant | Unknown | 29 | 0 | 0 | A | Unknown | Unknown |
| | May | Restaurant | Unknown | 8 | 0 | 0 | D | Unknown | Unknown |
| | October | Restaurant | Unknown | 9 | 0 | 0 | D | Unknown | Unknown |
| NSW | January | Unknown | Norovirus | 58 | 0 | 0 | D | Unknown | Unknown |
| | January | Restaurant | Unknown | 9 | 0 | 0 | D | Chicken stirfry or beef massaman | Mixed foods |
| | January | Institution – other | Unknown | 7 | 0 | 0 | D | Unknown | Unknown |
| | January | National franchised fast food restaurant | Unknown | 4 | 1 | 0 | D | Deep fried chicken, suspected | Poultry |
| | January | Restaurant | Unknown | 3 | 0 | 0 | D | Unknown | Unknown |
| | February | Commercial caterer | Bacillus cereus | 32 | 0 | 0 | AM | Boiled gefilte fish (fish balls) | Fish |
| | February | Restaurant | *Salmonella* Typhimurium 12 | 6 | 1 | 0 | D | Unknown | Beverage |
| | February | Commercially manufactured | Unknown | 6 | 0 | 0 | D | Flavoured drink | Dips |
| | February | Takeaway | Clostridium perfringens | 6 | 0 | 0 | M | Hommus | Unknown |
| | February | Restaurant | Unknown | 5 | 0 | 0 | D | Unknown | Unknown |
| | February | Restaurant | Unknown | 4 | 0 | 0 | D | Seafood platter | Seafood |
| | February | Private residence | Histamine | 3 | 2 | 0 | M | Tuna kebab steaks | Fish |
| | February | Restaurant | Unknown | 3 | 0 | 0 | D | Butter chicken or boiled rice, suspected | Mixed foods |
| | February | Restaurant | Histamine | 2 | 2 | 0 | D | Tuna steak | Fish |
| | March | Bakery | *Salmonella* Typhimurium 9 | 319 | 136 | 0 | M | Pork/chicken and salad rolls (with raw egg mayonnaise) | Mixed foods |
| | March | Takeaway | *Salmonella* Typhimurium U302 | 71 | 10 | 0 | M | Hommus and tabouli | Dips |
| | March | Restaurant | Unknown | 5 | 0 | 0 | D | Banquet style meal | Mixed foods |
| | April | Commercially manufactured | Unknown | 9 | 3 | 0 | A | Commercially prepared cake, suspected | Dessert |
| | April | Restaurant | Unknown | 7 | 0 | 0 | D | Fried rice, suspected | Mixed foods |
| | April | Takeaway | Unknown | 5 | 0 | 0 | D | Hot dogs | Meat & meat products |
| | May | Restaurant | Unknown | 14 | 0 | 0 | D | Raw capsicum, onions, fresh herbs, chicken and/or beef | Mixed foods |

## Appendix. Foodborne outbreak summary for OzFoodNet sites, Australia, 2007 (n=149), *continued*

| State | Month of outbreak | Setting prepared | Aetiology | Number affected | Hospitalised | Fatalities | Evidence | Vehicle | Vehicle category |
|---|---|---|---|---|---|---|---|---|---|
| NSW, *cont'd* | May | Restaurant | *Salmonella* Typhimurium 9 | 12 | 4 | 0 | M | Fried ice cream | Dessert |
| | May | Takeaway | Unknown | 6 | 0 | 0 | D | Fresh fruit juices, suspected | Beverage |
| | May | Restaurant | Unknown | 6 | 0 | 0 | D | Unknown | Unknown |
| | June | Bakery | Unknown | 15 | 0 | 0 | D | Raw egg mayonnaise, suspected | Egg-containing dish |
| | June | Takeaway | Unknown | 2 | 2 | 0 | D | Grilled tuna | Fish |
| | June | Takeaway | Unknown | 2 | 0 | 0 | D | Unknown | Unknown |
| | June | Takeaway | Unknown | 2 | 0 | 0 | D | Unknown | Unknown |
| | July | Restaurant | Unknown | 6 | 0 | 0 | D | Sandwich | Sandwich |
| | July | Restaurant | Unknown | 5 | 1 | 0 | D | Unknown | Unknown |
| | July | Restaurant | Unknown | 5 | 0 | 0 | D | Unknown | Unknown |
| | July | Restaurant | Unknown | 5 | 0 | 0 | D | Unknown | Unknown |
| | July | Restaurant | Unknown | 3 | 0 | 0 | D | Unknown | Unknown |
| | July | Restaurant | Unknown | 3 | 0 | 0 | D | Unknown | Unknown |
| | July | Restaurant | Unknown | 3 | 0 | 0 | D | Unknown | Unknown |
| | July | Restaurant | Unknown | 3 | 0 | 0 | D | Unknown | Unknown |
| | August | Aged care facility | Unknown | 9 | 0 | 0 | D | Unknown | Unknown |
| | August | Takeaway | Unknown | 4 | 0 | 0 | D | Beef or lamb kebab, suspected | Meat & meat products |
| | August | Takeaway | Unknown | 2 | 0 | 0 | D | Fried rice or Singapore noodles | Mixed foods |
| | September | Restaurant | Unknown | 19 | 0 | 0 | D | Oysters | Seafood |
| | September | Commercial caterer | Unknown | 15 | 1 | 0 | D | Unknown | Unknown |
| | September | Aged care facility | Unknown | 6 | 0 | 0 | D | Unknown | Unknown |
| | September | Takeaway | Unknown | 3 | 0 | 0 | D | Unknown | Unknown |
| | October | Bakery | *Salmonella* Typhimurium | 27 | 10 | 0 | D | Cheese or cream cake | Dessert |
| | October | Private residence | Unknown | 7 | 0 | 0 | D | Watermelon | Fresh produce |
| | October | Takeaway | Unknown | 4 | 0 | 0 | D | Chicken kebab | Poultry |
| | November | Private residence | *Salmonella* Typhimurium 9 | 11 | 4 | 0 | D | Raw eggs | Egg-containing dish |
| | November | Private residence | *Salmonella* Typhimurium | 8 | 2 | 0 | D | Beef patties | Meat & meat products |

## Appendix. Foodborne outbreak summary for OzFoodNet sites, Australia, 2007 (n=149), *continued*

| State | Month of outbreak | Setting prepared | Aetiology | Number affected | Hospitalised | Fatalities | Evidence | Vehicle | Vehicle category |
|---|---|---|---|---|---|---|---|---|---|
| NSW, *cont'd* | November | Private residence | *Salmonella* Typhimurium 9 | 3 | 0 | 0 | M | Egg nog or undercooked chicken | Egg-containing dish |
| | November | Restaurant | Unknown | 3 | 0 | 0 | D | Unknown | Unknown |
| | November | Takeaway | Campylobacter | 2 | 1 | 0 | D | Meat kebab | Meat & meat products |
| | December | Commercial caterer | Unknown | 28 | 0 | 0 | A | Unknown | Unknown |
| | December | Private residence | *Salmonella* Virchow 8 | 22 | 7 | 0 | D | Chicken or eggs, suspected | Mixed foods |
| NT | June | Unknown | Mixed | 11 | 2 | 0 | D | Unknown | Unknown |
| | June | Commercial manufactured food | Histamine | 2 | 0 | 0 | D | Tinned tuna | Fish |
| | July | Primary produce | Ciguatoxin | 2 | 0 | 0 | D | Reef cod | Fish |
| | August | Commercial caterer | *Salmonella* Oslo | 3 | 0 | 0 | D | Roast pork, suspected | Meat & meat products |
| | September | Commercial caterer | Norovirus | 8 | 1 | 0 | D | Unknown | Unknown |
| Qld | January | Unknown | *Salmonella* Typhimurium 197 | 25 | 6 | 0 | M | Egg-based dish, suspected | Egg-containing dish |
| | January | Restaurant | *Salmonella* Typhimurium 197 | 3 | 1 | 0 | M | Egg-based dish, suspected | Egg-containing dish |
| | February | Camp | *Salmonella* Saintpaul | 24 | 0 | 0 | M | Bore water | Water |
| | February | Restaurant | *Salmonella* Typhimurium 197 | 12 | 1 | 0 | M | Egg-based dish, suspected | Egg-containing dish |
| | February | Restaurant | *Salmonella* Typhimurium 197 | 6 | 1 | 0 | M | Egg-based dish, suspected | Egg-containing dish |
| | February | Private residence | Histamine | 2 | 0 | 0 | D | Imported Indonesian Tuna | Fish |
| | February | Primary produce | Ciguatoxin | 2 | 0 | 0 | D | Mackerel | Fish |
| | February | Restaurant | *Salmonella* Typhimurium 197 | 2 | 0 | 0 | M | Egg-based dish, suspected | Egg-containing dish |
| | March | Institution – other | Norovirus | 45 | 0 | 0 | A | Ham; salad; bread | Mixed foods |
| | March | Restaurant | *Salmonella* Typhimurium U302 | 18 | 0 | 0 | D | Egg-based dish, suspected | Egg-containing dish |
| | March | Primary produce | Ciguatoxin | 6 | 0 | 0 | D | Mackerel | Fish |
| | April | Other | Unknown | 21 | 0 | 0 | D | Unknown | Unknown |
| | May | Restaurant | *Salmonella* Virchow 8 | 15 | 1 | 0 | D | Unknown | Unknown |
| | May | Bakery | *Salmonella* Typhimurium 135a | 7 | 1 | 0 | M | Cheesecake | Dessert |
| | May | Private residence | Unknown | 7 | 0 | 0 | D | Wurst | Meat & meat products |
| | May | Restaurant | *Salmonella* Typhimurium 135a | 6 | 0 | 0 | D | Unknown | Unknown |
| | May | Primary produce | Ciguatoxin | 3 | 1 | 0 | D | Coral trout | Fish |
| | May | Primary produce | Ciguatoxin | 2 | 0 | 0 | D | Mackerel | Fish |

## Appendix. Foodborne outbreak summary for OzFoodNet sites, Australia, 2007 (n=149), *continued*

| State | Month of outbreak | Setting prepared | Aetiology | Number affected | Hospitalised | Fatalities | Evidence | Vehicle | Vehicle category |
|---|---|---|---|---|---|---|---|---|---|
| Qld, *cont'd* | June | Private residence | Histamine | 4 | 0 | 0 | D | Tuna kebabs | Fish |
| | August | Primary produce | *Shigella sonnei* biotype g | 55 | 3 | 0 | M | Baby corn | Fresh produce |
| | August | Restaurant | Norovirus | 24 | 0 | 0 | A | Mixed salad | Fresh produce |
| | August | Restaurant | *Salmonella* Typhimurium 135 | 8 | 0 | 0 | M | Duck pate | Poultry |
| | September | Institution – other | Norovirus | 35 | 0 | 0 | D | Unknown | Unknown |
| | September | Primary produce | Ciguatoxin | 5 | 0 | 0 | D | Coral trout | Fish |
| | October | Aged care facility | *Salmonella* Kiambu | 2 | 0 | 0 | D | Unknown | Unknown |
| | November | Institution – other | *Salmonella* Typhimurium U307 | 6 | 4 | 0 | D | Unknown | Unknown |
| | November | Takeaway | Bacillus cereus | 3 | 0 | 0 | M | Fried rice and honey chicken | Mixed foods |
| | November | Restaurant | *Salmonella* Typhimurium U307 | 3 | 0 | 0 | D | Unknown | Unknown |
| | November | Primary produce | Ciguatoxin | 2 | 0 | 0 | D | Coral trout | Fish |
| | December | Restaurant | Norovirus | 46 | 0 | 0 | D | Unknown | Unknown |
| | December | Private residence | Norovirus | 5 | 0 | 0 | D | Salad, suspected | Fresh produce |
| | December | Primary produce | Ciguatoxin | 2 | 0 | 0 | D | Spanish mackerel | Fish |
| SA | March | Restaurant | *Salmonella* Typhimurium 9 | 46 | 0 | 0 | A | Multiple food items | Mixed foods |
| | April | Commercial caterer | Unknown | 12 | 0 | 0 | A | Sushi | Sushi |
| | July | Restaurant | Norovirus | 14 | 0 | 0 | D | Unknown | Unknown |
| | July | Private residence | *Salmonella* Typhimurium 193 | 13 | 0 | 0 | A | Unknown | Unknown |
| | August | Aged care facility | *Campylobacter* | 6 | 0 | 0 | D | Unknown | Unknown |
| | September | Other | Norovirus | 24 | 0 | 0 | D | Unknown | Unknown |
| Tas | January | Other | Unknown | 19 | 0 | 0 | D | Oysters, suspected | Seafood |
| | March | Other | *Salmonella* Typhimurium 135a | 20 | 2 | 0 | D | Eggs, suspected | Egg-containing dish |
| | September | Restaurant | *Salmonella* Typhimurium 135a | 2 | 0 | 0 | D | Unknown | Unknown |
| | October | Restaurant | Unknown | 12 | 0 | 0 | D | Unknown | Unknown |
| | October | Restaurant | *Salmonella* Typhimurium 135a | 2 | 0 | 0 | D | Unknown | Unknown |

## Appendix. Foodborne outbreak summary for OzFoodNet sites, Australia, 2007 (n=149), *continued*

| State | Month of outbreak | Setting prepared | Aetiology | Number affected | Hospitalised | Fatalities | Evidence | Vehicle | Vehicle category |
|---|---|---|---|---|---|---|---|---|---|
| Vic | January | Takeaway | Unknown | 17 | 0 | 0 | A | Meat curry, suspected | Meat & meat products |
| | January | Restaurant | *Salmonella* Typhimurium 44 | 15 | 2 | 0 | D | Caesar salad dressing | Egg-based sauce/dressing |
| | January | Private residence | *Salmonella* Typhimurium 44 | 11 | 4 | 0 | A | Trifle | Dessert |
| | January | Private residence | *Salmonella* Typhimurium 44 | 10 | 1 | 0 | A | Tiramisu | Dessert |
| | January | Private residence | *Salmonella* Typhimurium 44 | 4 | 2 | 0 | M | Milkshake | Beverage |
| | January | Restaurant | Unknown | 4 | 1 | 0 | D | Unknown | Unknown |
| | March | Commercial caterer | Unknown | 37 | 0 | 0 | A | Passionfruit coulis, suspected | Dessert |
| | March | Camp | *Salmonella* Typhimurium 9 | 30 | 3 | 0 | AM | Water | Water |
| | March | Camp | Unknown | 19 | 0 | 0 | D | Water, suspected | Water |
| | March | Restaurant | Unknown | 10 | 0 | 0 | A | Fetta cheese, suspected | Cheese |
| | March | Restaurant | Histamine | 2 | 0 | 0 | D | Tuna | Fish |
| | April | Commercial caterer | Unknown | 25 | 0 | 0 | A | Penne pasta salad, suspected | Pasta |
| | April | Aged care facility | *Salmonella* Typhimurium 44 | 22 | 8 | 5 | A | Unknown | Unknown |
| | April | Restaurant | Histamine | 2 | 0 | 0 | D | Mahi Mahi fish | Fish |
| | May | Aged care facility | Unknown | 17 | 0 | 0 | D | Unknown | Unknown |
| | May | Restaurant | Unknown | 9 | 0 | 0 | D | Lasagne | Pasta |
| | May | Private residence | *Salmonella* Typhimurium 9 | 8 | 0 | 0 | M | Chocolate mousse | Dessert |
| | May | Hospital | *Salmonella* Typhimurium 9 | 4 | 0 | 0 | D | Unknown | Unknown |
| | May | Private residence | *Salmonella* Typhimurium 9 | 3 | 0 | 0 | D | Chocolate mousse, suspected | Dessert |
| | June | Bakery | *Salmonella* Typhimurium 44 | 45 | 8 | 0 | M | Pork Rolls | Mixed foods |
| | June | Restaurant | Unknown | 5 | 0 | 0 | D | Chicken massaman curry suspected | Poultry |
| | July | Aged care facility | *Clostridium perfringens* | 30 | 0 | 0 | D | Multiple food items | Mixed foods |
| | July | Restaurant | Norovirus | 21 | 0 | 0 | D | Unknown; ill food handler suspected | Unknown |
| | July | Aged care facility | *Campylobacter* | 6 | 0 | 0 | D | Unknown | Unknown |
| | August | Commercial caterer | Unknown | 20 | 0 | 0 | A | Roast chicken and/or stuffing | Poultry |
| | August | Aged care facility | *Campylobacter* | 6 | 0 | 0 | D | Unknown | Unknown |

## Appendix. Foodborne outbreak summary for OzFoodNet sites, Australia, 2007 (n=149), *continued*

| State | Month of outbreak | Setting prepared | Aetiology | Number affected | Hospitalised | Fatalities | Evidence | Vehicle | Vehicle category |
|---|---|---|---|---|---|---|---|---|---|
| Vic, *cont'd* | August | Restaurant | *Salmonella* Dublin | 6 | 0 | 0 | D | Unknown | Unknown |
| | September | Restaurant | Norovirus | 96 | 0 | 0 | D | Unknown; ill food handler suspected | Unknown |
| | October | Commercial caterer | Norovirus | 53 | 0 | 0 | D | Unknown | Unknown |
| | October | Commercial caterer | Norovirus | 34 | 1 | 0 | D | Unknown | Unknown |
| | October | Commercial caterer | Norovirus | 18 | 2 | 0 | A | Fruit salad | Fresh produce |
| | October | Restaurant | *Salmonella* Typhimurium 44 | 16 | 7 | 0 | M | Chicken foccacia with raw egg aioli | Egg-based sauce/dressing |
| | October | Aged care facility | *Salmonella* Saintpaul | 3 | 0 | 0 | D | Unknown | Unknown |
| | November | Private residence | *Salmonella* Typhimurium 44 | 13 | 0 | 0 | D | Unknown | Unknown |
| | November | Institution – other | Clostridium perfringens | 7 | 0 | 0 | D | Unknown | Unknown |
| | December | Restaurant | *Salmonella* Typhimurium 44 | 14 | 0 | 0 | M | Risottini, undercooked | Egg-containing dish |
| WA | Febuary | Restaurant | *Salmonella* Mbandaka | 4 | 0 | 0 | D | Unknown | Unknown |
| | March | Restaurant | *Salmonella* Typhimurium U307 | 75 | 6 | 0 | A | Caesar salad | Fresh produce |
| | June | Restaurant | Norovirus | 26 | 2 | 0 | A | Unknown | Unknown |
| | August | Institution – other | *Salmonella* Typhimurium 44 | 8 | 1 | 0 | D | Unknown | Unknown |
| | September | Takeaway | *Salmonella* Virchow 45 | 23 | 5 | 0 | D | Sushi and Katsudon (made with eggs) | Sushi |
| | September | Grocery store/ delicatessen | Alkaloids (plant toxin) | 2 | 2 | 0 | D | Bitter lupin flour | Fresh produce |
| | November | Camp | *Salmonella* Tennessee | 12 | 0 | 0 | D | Drinking water | Water |
| | December | Restaurant | Norovirus | 13 | 0 | 0 | D | Unknown | Unknown |
| | December | Cruise/airline | Cyclospora cayetanensis | 8 | 0 | 0 | D | Unknown | Unknown |

D Descriptive evidence implicating the vehicle.

A Analytical epidemiological association between illness and vehicle.

M Microbiological confirmation of aetiology in vehicle and cases.