

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								Aust
		ACT	NSW	NT	Qld	SA	Tas	Vic	WA	
<i>Salmonella</i>	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
<i>Campylobacter</i>	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
<i>Listeria</i>	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
<i>Shigella</i>	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 <i>E. coli</i>	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

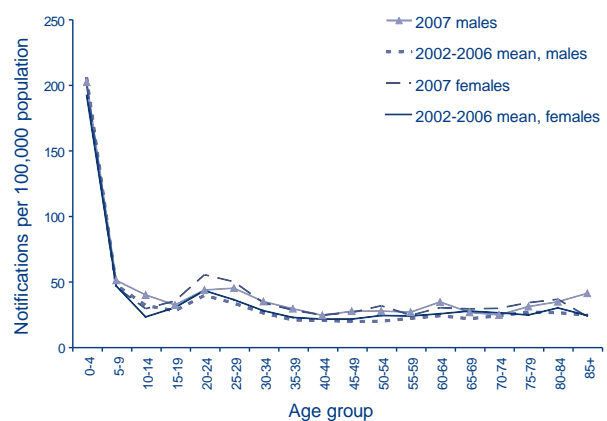


Table 2. Numbers, rates and proportions of the top 5 *Salmonella* infections, Australia (excluding Western Australia), 2006 to 2007, by OzFoodNet site*

OzFoodNet site	<i>Salmonella</i> 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	<i>Salmonella</i> 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			Total
	Yes	No	Unknown	
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

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

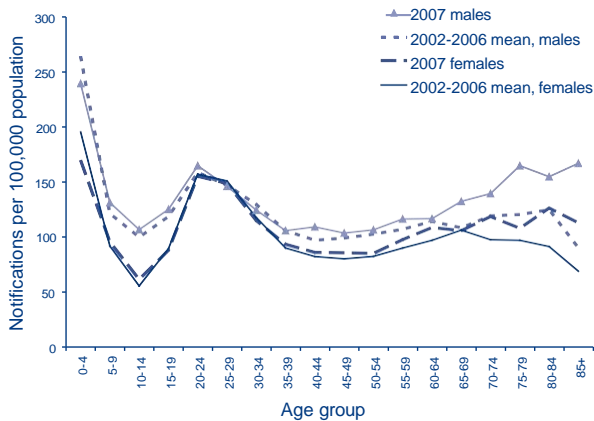
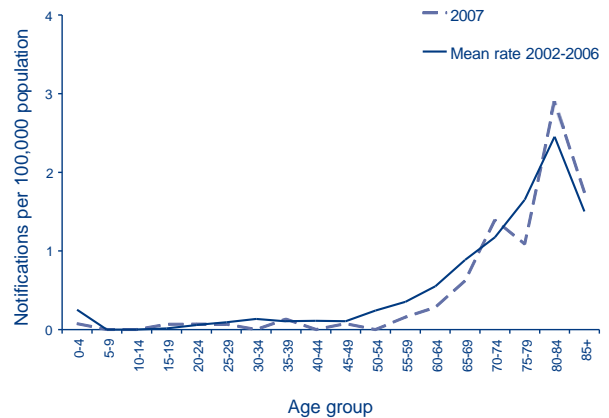


Figure 3. Notification rate of listeriosis, Australia, 2002 to 2007, by age group

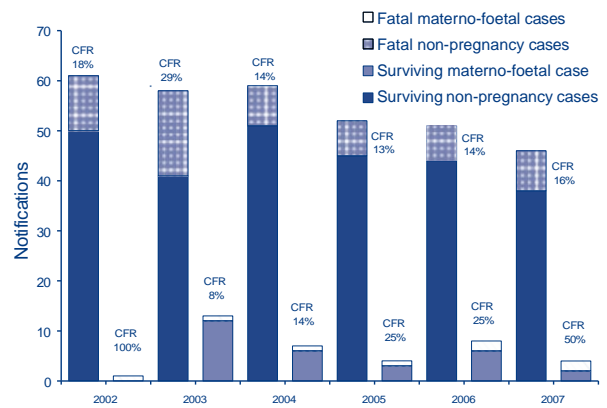


Listeria infections

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

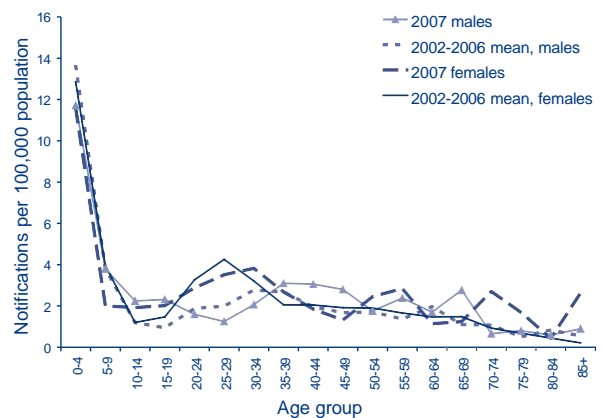


* The case-fatality rate (CFR) is the percentage of cases that were fatal.

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).

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



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

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†
<i>Shigella sonnei</i> biotype a	128	21	80	15	1.6
<i>Shigella sonnei</i> biotype g	98	16	76	14	1.3
<i>Shigella flexneri</i> 4a mannitol negative	69	12	94	17	0.7
<i>Shigella flexneri</i> 2a	64	11	54	10	1.2
<i>Shigella flexneri</i> 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).

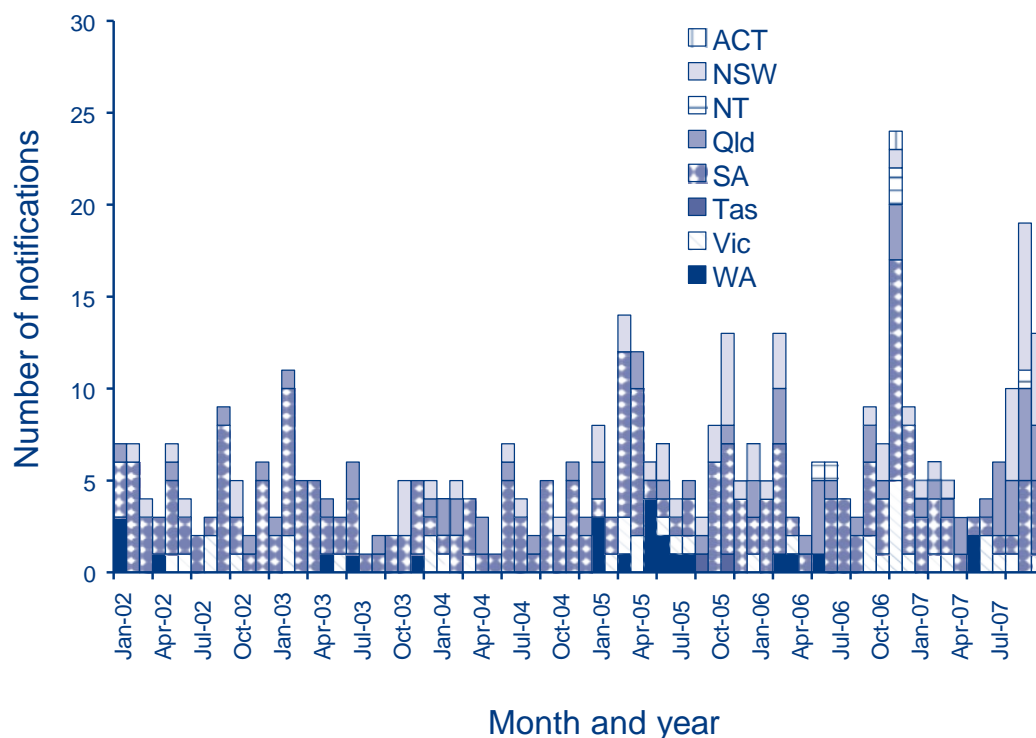
South Australia reported 38% (41/107) of the STEC notifications, followed by Queensland (22%, 24/107), New South Wales (22%, 23/107), Victoria (12%, 13/107), the Northern Territory (2.8%, 3/107), Western Australia (2%, 2/107) and the Australian Capital Territory (1%, 1/107). The highest notification 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			Total
	Yes	No	Unknown	
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 clini-

cian 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

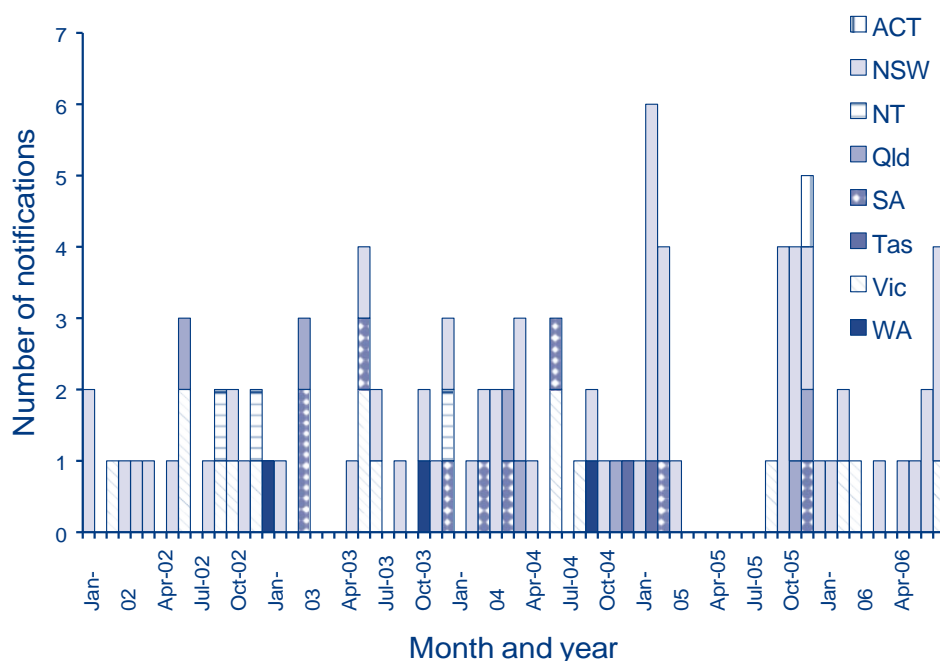


Table 10. Outbreaks of gastroenteritis including foodborne disease reported to state and territory health departments, Australia, 2007

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 (<i>Salmonella</i> 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

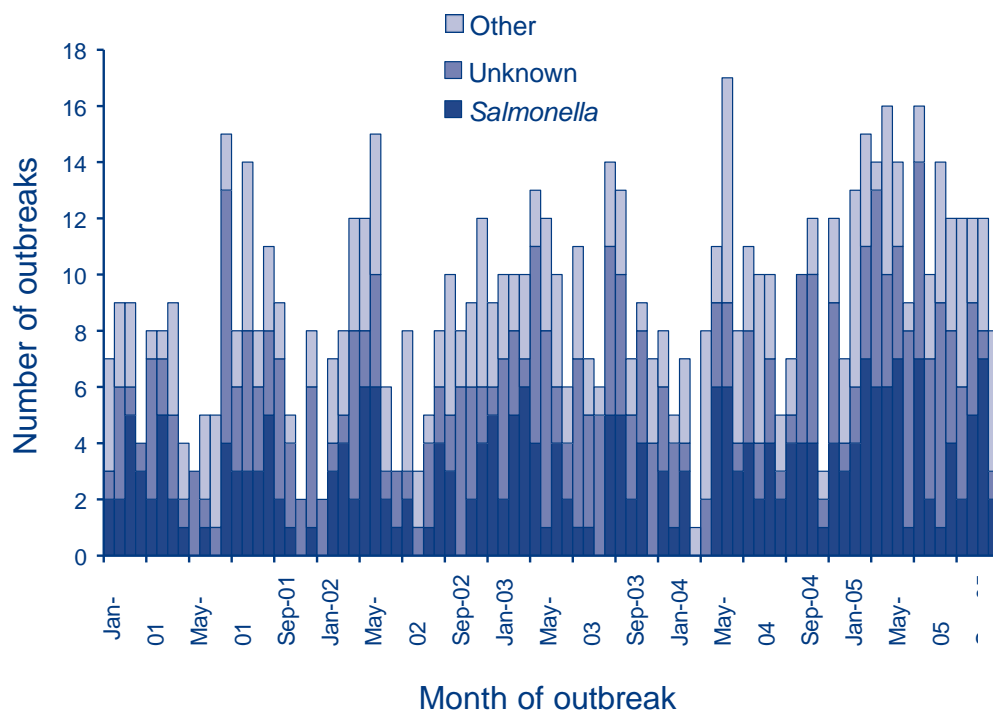
In 2007, there were 149 outbreaks of foodborne disease affecting 2,290 people, which resulted in 266 people being hospitalised. There were 5 deaths reported during these outbreaks (Appendix). This compares to 115 and 102 foodborne outbreaks in 2006 and 2005, respectively.

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
<i>S. Typhimurium</i>	39	914	23	225
Norovirus	16	520	33	6
<i>S. other</i>	11	125	11	15
Ciguatoxin	8	24	3	1
Histamine poisoning	7	17	2	4
Bacterial toxin	5	78	16	0
<i>Campylobacter</i>	4	20	5	1
Plant toxins	1	2	2	2
<i>Shigella</i>	1	55	55	3
<i>Cyclospora</i>	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 ciguatera toxin, 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	<i>Salmonella</i> Typhimurium 9	319	M	Pork/chicken and salad rolls (with raw egg mayonnaise)	Vietnamese pork rolls; <i>S. Tm</i> 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	<i>Salmonella</i> Typhimurium	27	D	Cheese or cream cake	Suspected raw egg in cake
	June	Bakery	Unknown	15	D	Raw egg mayonnaise, suspected	
	May	Restaurant	<i>Salmonella</i> Typhimurium 9	12	M	Fried ice cream	<i>S. Tm</i> 9 found in pre-prepared ice cream
	November	Private residence	<i>Salmonella</i> Typhimurium 9	3	M	Egg nog or undercooked chicken	
	November	Private residence	<i>Salmonella</i> Typhimurium 9	11	D	Raw eggs	Same MLVA* pattern as outbreak implicating Vietnamese pork rolls in March
Qld	January	Not applicable	<i>Salmonella</i> Typhimurium 197	25	M	Egg-based dish, suspected	25 community cases with same MLVA profile as environmental swabs positive for <i>S. Tm</i> 197 from egg farm A
	January	Restaurant	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> Typhimurium 135a	7	M	Cheesecake	Bakery used raw eggs; instructed to stop
Tas	March	Other	<i>Salmonella</i> 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	<i>Salmonella</i> Typhimurium 44	4	M	Milkshake	Raw egg milkshake; blender used was positive for <i>S. Tm</i> 44
	January	Private residence	<i>Salmonella</i> Typhimurium 44	11	A	Trifle	Made with raw egg
	January	Private residence	<i>Salmonella</i> Typhimurium 44	10	A	Tiramisu	Made with raw egg, accounted for 90% of cases
	January	Restaurant	<i>Salmonella</i> Typhimurium 44	15	D	Caesar salad dressing	Made with raw egg
	May	Private residence	<i>Salmonella</i> Typhimurium 9	8	M	Chocolate mousse	Made with raw egg, mousse was positive for <i>S. Tm</i> 9
	May	Private residence	<i>Salmonella</i> Typhimurium 9	3	D	Chocolate mousse, suspected	Made with raw eggs
	June	Bakery	<i>Salmonella</i> Typhimurium 44	45	M	Pork rolls	Vietnamese pork rolls, leftover rolls and pate positive for <i>S. Tm</i> 44, raw egg mayonnaise used on all rolls.
	October	Restaurant	<i>Salmonella</i> Typhimurium 44	16	M	Chicken foccacia with raw egg aioli	Aioli made with raw egg, blender used to make aioli positive for <i>S. Tm</i> 44
	December	Restaurant	<i>Salmonella</i> Typhimurium 44	14	M	Risottini, undercooked	Risottini positive for <i>S. Tm</i> 44
WA	September	Takeaway	<i>Salmonella</i> 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 <i>Salmonella</i>

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.

Acknowledgements

We thank Katrina Knope, Australian Government Department of Health and Ageing for her contributions (analysis and writing) to this report. We thank the many epidemiologists, project officers, interviewers and research assistants at each of the OzFoodNet sites who contributed to this report. We acknowledge the work of various public health professionals and laboratory staff around Australia who interviewed patients, tested specimens, typed isolates and investigated outbreaks. We would particularly like to thank jurisdictional laboratories, the Microbiological Diagnostic Unit Public Health Laboratory, the Australian Salmonella Reference Centre at the Institute of Medical and Veterinary Science, and the National Enteric Pathogen Surveillance Scheme for their help with foodborne

disease surveillance in 2007. The quality of their work was the foundation of this report. OzFoodNet is an initiative of the Australian Government.

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

References

- Mead PS, Slutsker L, Dietz V, McCaig LF, Bresee JS, Shapiro C, et al. Food-related illness and death in the United States. *Emerg Infect Dis* 1999;5:607–625.
- Hall G, Kirk MD, Becker N, Gregory JE, Unicomb L, Millard G, et al. Estimating foodborne gastroenteritis, Australia. *Emerg Infect Dis* 2005;11:1257–1264.
- Allos BM, Moore MR, Griffin PM, Tauxe RV. Surveillance for sporadic foodborne disease in the 21st century: the FoodNet perspective. *Clin Infect Dis* 2004;38:S115–S120.
- Majowicz SE, Edge VL, Fazil A, McNab WB, Dore KA, Sockett PN, et al. Estimating the under-reporting rate for infectious gastrointestinal illness in Ontario. *Can J Public Health* 2005;96:178–181.
- Hall G, Yohannes K, Raupach J, Becker N, Kirk M. Estimating community incidence of *Salmonella*, *Campylobacter*, and Shiga toxin-producing *Escherichia coli* infections, Australia. *Emerg Infect Dis* 2008;14:1601–1609.
- Kirk MD, McKay I, Hall GV, Dalton CB, Stafford R, Unicomb L, et al. Food Safety: Foodborne disease in Australia: the OzFoodNet experience. *Clin Infect Dis* 2008;47:392–400.
- Lindenmayer P. Networking for health protection: the Communicable Diseases Network Australia. *Commun Dis Intell* 2001;25:266–269.
- Rothman KJ, Greenland S, eds. *Modern Epidemiology*. Pennsylvania: Lippincott-Raven Publishers; 1998.
- Australian Bureau of Statistics. Population by Age and Sex, Australian States and Territories, June 2008. ABS Cat. no. 3201.0. Canberra; 2008.
- Teutsch SM, Churchill RE, eds. *Principles and Practice of Public Health Surveillance*. 2nd edn. New York: Oxford University Press; 2000.
- Australian Customs Service. Check-in ports 2006. 2007.
- OzFoodNet Working Group. Monitoring the incidence and causes of diseases potentially transmitted by food in Australia: annual report of the OzFoodNet network, 2006. *Commun Dis Intell* 2007;31:345–365.
- Stafford R, Bell R. OzFoodNet annual report 2007. Communicable Diseases Unit, Queensland Health; 2008.
- Centers for Disease Control and Prevention. Preliminary FoodNet data on the incidence of infection with pathogens transmitted commonly through food—10 states, 2007. *MMWR Morbid Mortal Wkly Rep* 2008;57:366–370.
- Unicomb L. Outbreaks of campylobacteriosis in Australia, 2001 to 2006. In Preparation 2008.
- Stafford RJ, Schluter P, Kirk M, Wilson A, Unicomb L, Ashbolt R, et al. A multi-centre prospective case-control study of *Campylobacter* infection in persons aged 5 years and older in Australia. *Epidemiol Infect* 2007;135:978–988.
- Unicomb LE, Dalton CB, Gilbert GL, Becker NG, Patel MS. Age-specific risk factors for sporadic *Campylobacter* infection in regional Australia. *Foodborne Pathog Dis* 2008;5:79–85.
- Stephens N, Stafford RJ, Fullerton K, Ashbolt R, Kirk M, Gregory J, et al. Sporadic *Campylobacter* infection in children aged 0–4 years in Australia: A multi-centre prospective case-control study. In Preparation 2008.
- Stafford RJ, Schluter PJ, Wilson AJ, Kirk MD, Hall G, Unicomb L, et al. Population-attributable risk estimates for risk factors associated with *Campylobacter* infection, Australia. *Emerg Infect Dis* 2008;14:895–901.
- Combs BG, Raupach JC, Kirk MD. Surveillance of Shiga toxin-producing *Escherichia coli* in Australia. *Commun Dis Intell* 2005;29:366–369.
- Population Health Surveillance. Annual Outbreaks Summary 2007. Institute of Environmental Science and Research Limited, New Zealand; 2008.
- Centers for Disease Control and Prevention. Summary Statistics for Foodborne Outbreaks, 2006. Centers for Disease Control and Prevention, Atlanta, Georgia.
- Lewis HC, Ethelberg S, Olsen KEP, Nielsen EM, Lisby M, Madsen SB, et al. Outbreaks of *Shigella sonnei* in Denmark and Australia linked to the consumption of raw baby corn. *Epidemiol Infect* 2009;9:1–9. [Epub ahead of print].
- Lewis HC, Kirk M, Ethelberg S, Stafford R, Olsen K, Nielsen EM, et al. Outbreaks of shigellosis in Denmark and Australia associated with imported baby corn, August 2007—final summary. *Euro Surveill* 2007;12:E071004.2.
- Kirk M, Musto J, Gregory J, Fullerton K. Obligations to report outbreaks of foodborne disease under the International Health Regulations (2005). *Emerg Infect Dis* 2008;14:1440–1442.

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	<i>Salmonella</i> 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	<i>Salmonella</i> Typhimurium 9	319	136	0	M	Pork/chicken and salad rolls (with raw egg mayonnaise)	Mixed foods
	March	Takeaway	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> Typhimurium 9	11	4	0	D	Raw eggs	Egg-containing dish
	November	Private residence	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> Oslo	3	0	0	D	Roast pork, suspected	Meat & meat products
	September	Commercial caterer	Norovirus	8	1	0	D	Unknown	Unknown
Qld	January	Unknown	<i>Salmonella</i> Typhimurium 197	25	6	0	M	Egg-based dish, suspected	Egg-containing dish
	January	Restaurant	<i>Salmonella</i> Typhimurium 197	3	1	0	M	Egg-based dish, suspected	Egg-containing dish
	February	Camp	<i>Salmonella</i> Saintpaul	24	0	0	M	Bore water	Water
	February	Restaurant	<i>Salmonella</i> Typhimurium 197	12	1	0	M	Egg-based dish, suspected	Egg-containing dish
	February	Restaurant	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> Virchow 8	15	1	0	D	Unknown	Unknown
	May	Bakery	<i>Salmonella</i> Typhimurium 135a	7	1	0	M	Cheesecake	Dessert
	May	Private residence	Unknown	7	0	0	D	Wurst	Meat & meat products
	May	Restaurant	<i>Salmonella</i> 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, <i>cont'd</i>	June	Private residence	Histamine	4	0	0	D	Tuna kebabs	Fish
	August	Primary produce	<i>Shigella sonnei</i> biotype g	55	3	0	M	Baby corn	Fresh produce
	August	Restaurant	Norovirus	24	0	0	A	Mixed salad	Fresh produce
	August	Restaurant	<i>Salmonella</i> 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	<i>Salmonella</i> Kiambu	2	0	0	D	Unknown	Unknown
	November	Institution – other	<i>Salmonella</i> Typhimurium U307	6	4	0	D	Unknown	Unknown
	November	Takeaway	<i>Bacillus cereus</i>	3	0	0	M	Fried rice and honey chicken	Mixed foods
	November	Restaurant	<i>Salmonella</i> 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	<i>Salmonella</i> Typhimurium 9	46	0	0	A	Multiple food items
April		Commercial caterer	Unknown	12	0	0	A	Sushi	Sushi
July		Restaurant	Norovirus	14	0	0	D	Unknown	Unknown
July		Private residence	<i>Salmonella</i> Typhimurium 193	13	0	0	A	Unknown	Unknown
August		Aged care facility	<i>Campylobacter</i>	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	<i>Salmonella</i> Typhimurium 135a	20	2	0	D	Eggs, suspected	Egg-containing dish
	September	Restaurant	<i>Salmonella</i> Typhimurium 135a	2	0	0	D	Unknown	Unknown
	October	Restaurant	Unknown	12	0	0	D	Unknown	Unknown
	October	Restaurant	<i>Salmonella</i> 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	<i>Salmonella</i> Typhimurium 44	15	2	0	D	Caesar salad dressing	Egg-based sauce/dressing
	January	Private residence	<i>Salmonella</i> Typhimurium 44	11	4	0	A	Trifle	Dessert
	January	Private residence	<i>Salmonella</i> Typhimurium 44	10	1	0	A	Tiramisu	Dessert
	January	Private residence	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> 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	<i>Salmonella</i> Typhimurium 9	8	0	0	M	Chocolate mousse	Dessert
	May	Hospital	<i>Salmonella</i> Typhimurium 9	4	0	0	D	Unknown	Unknown
	May	Private residence	<i>Salmonella</i> Typhimurium 9	3	0	0	D	Chocolate mousse, suspected	Dessert
	June	Bakery	<i>Salmonella</i> 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	<i>Clostridium perfringens</i>	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	<i>Campylobacter</i>	6	0	0	D	Unknown	Unknown
	August	Commercial caterer	Unknown	20	0	0	A	Roast chicken and/or stuffing	Poultry
	August	Aged care facility	<i>Campylobacter</i>	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, <i>cont'd</i>	August	Restaurant	<i>Salmonella</i> 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	<i>Salmonella</i> Typhimurium 44	16	7	0	M	Chicken foccacia with raw egg aioli	Egg-based sauce/dressing
	October	Aged care facility	<i>Salmonella</i> Saintpaul	3	0	0	D	Unknown	Unknown
	November	Private residence	<i>Salmonella</i> Typhimurium 44	13	0	0	D	Unknown	Unknown
	November	Institution – other	<i>Clostridium perfringens</i>	7	0	0	D	Unknown	Unknown
	December	Restaurant	<i>Salmonella</i> Typhimurium 44	14	0	0	M	Risottini, undercooked	Egg-containing dish
WA	February	Restaurant	<i>Salmonella</i> Mbandaka	4	0	0	D	Unknown	Unknown
	March	Restaurant	<i>Salmonella</i> Typhimurium U307	75	6	0	A	Caesar salad	Fresh produce
	June	Restaurant	Norovirus	26	2	0	A	Unknown	Unknown
	August	Institution – other	<i>Salmonella</i> Typhimurium 44	8	1	0	D	Unknown	Unknown
	September	Takeaway	<i>Salmonella</i> 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	<i>Salmonella</i> Tennessee	12	0	0	D	Drinking water	Water
	December	Restaurant	Norovirus	13	0	0	D	Unknown	Unknown
	December	Cruise/airline	<i>Cyclospora cayetanensis</i>	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.