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Annual reports

Annual report: surveillance of adverse events following immunisation in Australia, 2010

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Abstract

This report summarises Australian passive surveillance data for adverse events following immunisation (AEFI) reported to the Therapeutic Goods Administration (TGA) for 2010, and describes reporting trends over the 11-year period 2000 to 2010. There were 3,894 AEFI records for vaccines administered in 2010, the highest number reported in any year, and a 63% increase over the 2,396 in 2009. The increase was almost entirely attributable to the large number of reports following seasonal influenza (n=2,354) and pandemic H1N1 (pH1N1) influenza vaccines (n=514). In children <7 years of age, the number of reports following influenza vaccine increased almost 100-fold from 17 in 2009 to 1,693 in 2010 and, for people aged ≥18 years, from 135 to 496. For seasonal influenza vaccine, a disproportionate number of reports were from Western Australia (34%), consistent with more widespread influenza vaccination of children in that state, and 79% were identified as being associated with Fluvax® or Fluvax junior® (CSL Biotherapies). For pH1N1 vaccine, the number of reports in children <7 years of age increased from 23 in 2009 to 329 in 2010, but was available for this age group for only 1 month (December) in 2009. In those aged ≥18 years, for whom the pH1N1 vaccine was available from late September 2009, pH1N1 vaccine reports decreased from 1,209 in 2009 to 109 in 2010. For influenza vaccines, 79% of reports included fever, 45% allergic reactions and 15% malaise. In children aged <7 years, there were 169 reports of convulsions (127 febrile), compared with 19 in 2009. In contrast, for non-influenza vaccines, reporting rates in children <7 years of age increased only marginally from 14.1 per 100,000 in 2009 to 19.3 per 100,000 in 2010. Four deaths temporally associated with immunisation were reported but none were considered to have a causal association. *Commun Dis Intell* 2011;35(4):263–280.

Keywords: AEFI, adverse events, vaccines, surveillance, immunisation, vaccine safety

Introduction

An 'adverse event following immunisation' is generally regarded as any serious or unexpected event that occurs after the administration of a vaccine(s), which may be related to the vaccine itself or to its handling or administration. An adverse events following immunisation (AEFI) can be *coincidentally* associated with the *timing* of immunisation without necessarily being caused by the vaccine or the immunisation process. This report summarises national passive surveillance data for AEFI reported to the Therapeutic Goods Administration (TGA) to 28 February 2011. The report focuses on AEFI reported for vaccines administered during 2010 and trends in AEFI reporting for the 11-year period 2000 to 2010. Reports summarising national AEFI surveillance data have been published regularly since 2003.[1–15] Several important changes to both AEFI surveillance methods and the Australian childhood vaccination schedule have occurred since then that affect the AEFI surveillance data presented in this report.

Recent changes to vaccine funding and availability that had a significant impact on the AEFI surveillance data presented in this report include:

(i) In 2010, annual vaccination with seasonal trivalent influenza vaccine (TIV, containing 3 influenza strains: A/H1N1, A/H3N2 and B) was funded under the National Immunisation Program (NIP) for people aged ≥6 months with medical risk factors (previously subsidised through the Pharmaceutical Benefits Scheme) and all Indigenous people aged ≥15 years (previously all Indigenous adults ≥50 years and 15–49 years with medical risk factors).[16]

(ii) The pandemic H1N1 (pH1N1) influenza vaccine (Panvax®), which was introduced in Australia from 30 September 2009 for people aged ≥10 years and from 4 December 2009 for children aged 6 months to 10 years,remained available throughout 2010.[17]

(iii) On 23 April 2010, the use of the 2010 seasonal TIV in children <5 years of age was suspended by Australia's Chief Medical Officer due to an increased number of reports of fever and febrile convulsions post vaccination. A subsequent investigation identified that Fluvax® and Fluvax junior®(CSL Biotherapies), but neither of the other two available brands registered for use in young children, were associated with an

unacceptably high risk of febrile convulsions.[18] The recommendation to resume the use of seasonal influenza vaccine in children aged 6 months to 5 years, using brands other than Fluvax® and Fluvax junior®, occurred in August 2010.[19]

Other important changes to vaccine funding and availability that impact on the interpretation of trend data have been described in detail in previous reports .[1–15] These changes are listed in Table 1 in chronological order.[20–26] To assist readers a glossary of the abbreviations of the vaccines referred to in this report is at the end of this report.

Methods

AEFI are notified to the TGA by state and territory health departments, health professionals, vaccine manufacturers and members of the public.[20,22] All reports are assessed using internationally consistent criteria[27] and entered into the Australian Adverse Drug Reactions System (ADRS) database. All serious reports for drugs and vaccines are reviewed by the TGA. Other reports are used in data mining and signal detection activities.

Adverse events following immunisation data

De-identified information on all AEFI reported to the TGA from 1 January 2000 to 28 February 2011 and stored in the ADRS database were released to the National Centre for Immunisation Research and Surveillance. Readers are referred to previous AEFI surveillance reports for a description of the surveillance system.[1,2]

AEFI records* contained in the ADRS database were eligible for inclusion in the analysis if a vaccine was recorded as 'suspected'† of involvement in the reported adverse event and *either*

(a) the vaccination occurred between 1 January 2000 and 31 December 2010, *or*

(b) for records where the vaccination date was not recorded, the date of onset of symptoms or signs occurred between 1 January 2000 and 31 December 2010.

* The term 'AEFI record is used throughout this report because a single AEFI notification (report to the Therapeutic Goods Administration) may generate more than one 'AEFI record' in the Adverse Drug Reactions System database if a number of adverse events are described in the notification (e.g. a local injection site adverse event and a systemic adverse event).

† Records are classified as 'suspected' if the report contains sufficient information to be valid and the relationship between reported reactions and drugs is deemed as biologically plausible.

Study definitions of adverse events following immunisation outcomes and reactions

AEFI were defined as 'serious' or 'non-serious' based on information recorded in the ADRS database and criteria similar to those used by the World Health Organization[27] and the US Vaccine Adverse Events Reporting System.[28] In this report, an AEFI is defined as 'serious' if the record indicated that the person had recovered with sequelae, was admitted to a hospital, experienced a life-threatening event, or died.

The causality ratings of 'certain', 'probable' and 'possible' are assigned to individual AEFI records by the TGA. They describe the likelihood that a suspected vaccine or vaccines was/were associated with the reported reaction at the level of the individual vaccine recipient. Factors considered in assigning causality ratings include the timing of the reaction following vaccination (temporal association), the spatial correlation of symptoms and signs in relation to vaccination (for injection site reactions) and whether one or more vaccines were administered. These factors are outlined in more detail elsewhere.[1] In many instances a causal association between vaccines administered to an individual and events that occurred subsequently cannot be clearly ruled in or out. Children, in particular, often receive several vaccines at the same time. All co-administered vaccines are usually listed as 'suspected' of involvement in a systemic adverse event as it is usually not possible to attribute the AEFI to a single vaccine.

Typically, each AEFI record lists several symptoms, signs and/or diagnoses that had been coded by TGA staff from the reporter's description into standardised terms using the Medical Dictionary for Regulatory Activities (MedDRA®).[29] AEFI reports of suspected anaphylaxis and hypotonic-hyporesponsive episodes (HHE) were classified using the Brighton Collaboration case definitions when sufficient data were available.[30,31]

To analyse reported AEFI, MedDRA® coding terms were grouped to create a set of reaction categories. Firstly, reaction categories were created that were analogous to the AEFI listed and defined in *The Australian Immunisation Handbook* (9th edition).[22] Where MedDRA® coding terms could not be categorised into *Handbook* categories, additional categories were created for those that were listed in more than 1% of AEFI records (e.g. headache, dizziness, change in heart or respiratory rate or rhythm). Reaction terms listed in less than 1% of records were grouped into broader categories based on the organ system where the reaction was manifested (e.g. gastrointestinal, neurological).

Table 1: Changes to the Australian Standard Vaccination Schedule, 2003 to 2009[22–28]

Date	Intervention
2003	Commencement of the meningococcal C conjugate vaccine (MenCCV) immunisation program. 18-month dose of DTPa vaccine removed from the National Immunisation Program.
2004	dTpa funded at 15–17 years of age replacing the diphtheria-tetanus dose.
2005	**January 2005** Universal funded infant 7-valent pneumococcal conjugate vaccine (7vPCV) program replaced the previous targeted childhood program, with a catch-up program for children aged <2 years. Universal 23-valent pneumococcal polysaccharide vaccine (23vPPV) for adults aged ≥ 65 years replaced previous subsidy through the Pharmaceutical Benefits Scheme. **November 2005** Universal funded immunisation against varicella at 18 months of age from November 2005 with a school-based catch-up program for children at 10–12 years of age not previously vaccinated and without a history of varicella infection (no funded catch-up for children 2–10 years of age). IPV funded to replace OPV, in combination vaccines.
2007	**April 2007** Funded immunisation against human papillomavirus for all Australian girls aged 12–13 years delivered through a school-based program from April 2007, with a temporary catch-up program through schools or primary care providers for females aged 13–26 years until December 2009. **July 2007** Universal funded immunisation against rotavirus at 2 and 4 months of age (Rotarix®) or at 2, 4 and 6 months of age (Rotateq®).
2008	Western Australia commenced a seasonal influenza vaccination program for all children aged 6 months to < 5 years (born after 1 April 2003). In March 2008, Queensland, South Australia and Victoria changed from using two combination vaccines (quadrivalent DTPa-IPV and Hib-HepB) to the single hexavalent DTPa-IPV-HepB-Hib vaccine.
2009	By late 2009, all states and territories were using the single hexavalent DTPa-IPV-Hib-HepB (Infanrix hexa®) vaccine for all children at 2, 4 and 6 months of age, due to an international shortage of *Haemophilus influenzae* type b (Hib) (PedvaxHib® [monovalent] and Comvax® [Hib-HepB]) vaccines.

Data analysis

All data analyses were performed using SAS software version 9.2.[32] Average annual population-based reporting rates were calculated for each state and territory and by age group using population estimates obtained from the Australian Bureau of Statistics.

AEFI reporting rates per 100,000 administered doses were estimated where reliable information was available on the number of doses administered. This was done for 10 vaccines funded through the NIP for children aged <7 years, for influenza and pH1N1 vaccines in adults aged ≥18 years, and for 23vPPV in the ≥65-years age group.

Denominator data to estimate influenza and 23vPPV AEFI reporting rates were obtained from a national adult coverage survey conducted in 2009.[33] For 23vPPV, the number of people vaccinated in 2010 was derived from the number of people who reported receipt of the vaccine divided by 5. The number of administered doses of each of the 10 childhood vaccines was obtained from the Australian Childhood Immunisation Register (ACIR), a national population-based register of approximately 99% of children aged <7 years.[34]

Notes on interpretation

Caution is required when interpreting the AEFI data presented in this report. Due to reporting delays and late onset of some AEFI, the data are considered preliminary, particularly for the fourth quarter of 2010. Data published in previous reports for 2000–2009[1–15] may differ from that presented in this report for the same period because this report has been updated to include delayed notifications of AEFI to the TGA that were not included in prior publications.

The information collated in the ADRS database is intended primarily for signal detection and hypothesis generation. While AEFI reporting rates can be estimated using appropriate denominators, they cannot be interpreted as incidence rates due to underreporting and biased reporting of suspected AEFI, and the variable quality and completeness of information provided in individual AEFI notifications.[1–15,35]

It is important to note that this report is based on vaccine and reaction term information collated in the ADRS database and not on comprehensive clinical notes or case reviews. The reaction terms are created from available information and are similar, but not identical, to *The Australian Immunisation Handbook*[22] AEFI case definitions.

The reported symptoms, signs and diagnoses in most of the AEFI records, where possible, in the ADRS database are temporally associated with vaccination but are not necessarily causally associated with a vaccine or vaccines.

For reports where the date of vaccination was not recorded, the date of onset or date event reported to Therapeutic Goods Administration was used as a proxy for the vaccination date.

Results

The ADRS database included a total of 3,894 AEFI records where the date of vaccination (or onset of adverse event, if vaccination date was not reported) was between 1 January and 31 December 2010. Of these, 2,868 records (74%) related to influenza vaccines (seasonal influenza, 61%; pH1N1, 13%), accounting for an increase of 63% over the total records for 2009.

In 2010, 68% of AEFI (n=2,661) were reported to the TGA via states and territories, while the rest were reported directly to the TGA; 13% (n=502) were reported by members of the public, 16% (n=606) by doctors or health care providers, 2% (n=89) by hospitals, and 1% (n=36) by drug companies. The proportion reported by members of the public was less than in 2009 (n=664; 28%) but much higher than in 2008 (n=51; 3%), with 95% of the reports by members of the public following influenza vaccines.

Reporting trends

The overall AEFI reporting rate for 2010 was 17.4 per 100,000 population, compared with 11.0 per 100,000 population in 2009—the highest rate in the 11-year period from 2000 to 2010.

Figure 1 shows the increase in reporting by the general public direct to the TGA in 2009 and 2010, and that the vast majority of reported events (from all reporter types) were of a non-serious nature. Figures 2a, 2b and 2c show that the rise in the reporting rate in 2009 and in 2010 was due to reports following the receipt of pH1N1 and seasonal influenza vaccines, and that in 2010 this was predominantly in children (Table 2). Figures 2a, 2b and 2c also demonstrate marked variations of reporting levels in association with previous changes to the National Immunisation Program from 2000

Figure 1: Adverse events following immunisation, ADRS database, 2000 to 2010, by quarter

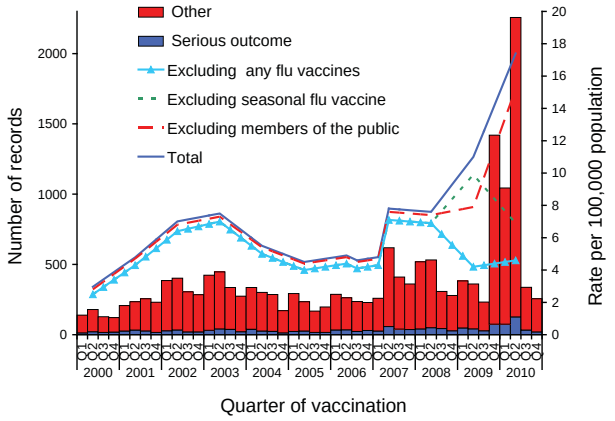


Figure 2a: Adverse events following immunisation for individuals aged > 7 years, ADRS database, 2000 to 2010, by quarter and vaccine type

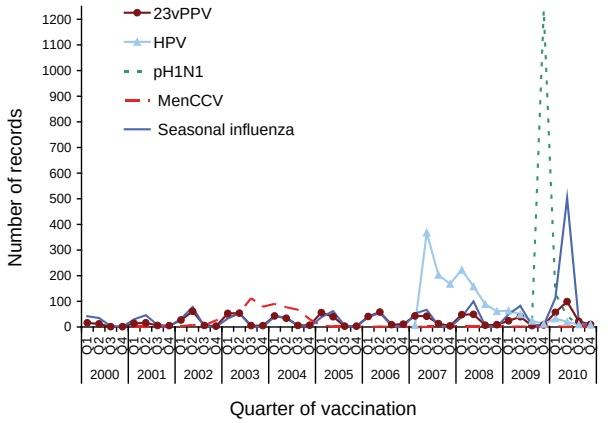


Figure 2b: Adverse events following immunisation for children aged 1 to < 7 years, ADRS database, 2000 to 2010, by quarter and vaccine type

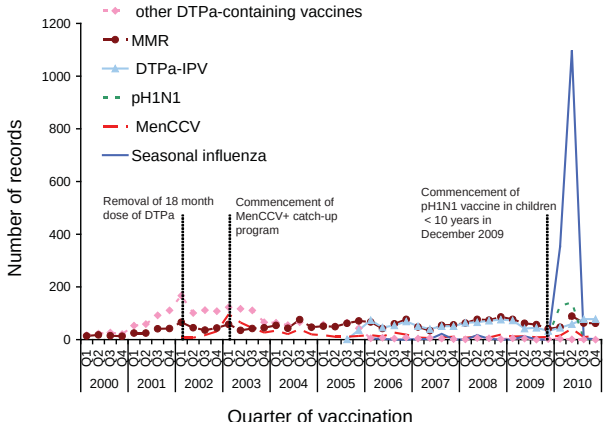
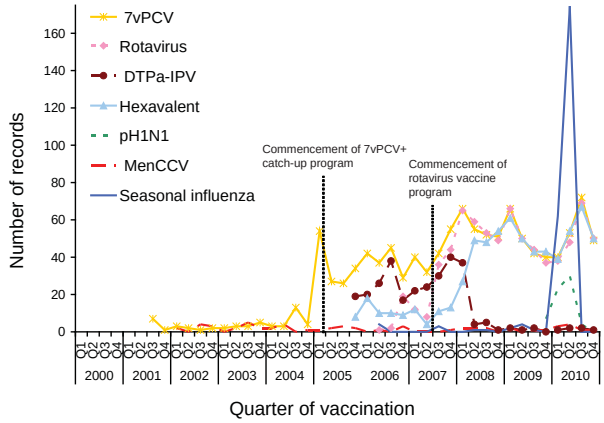


Figure 2c: Adverse events following immunisation for children aged < 1 year, ADRS database, 2000 to 2010, by quarter and vaccine type



* Meningococcal C conjugate vaccine (MenCCV) was introduced into the National Immunisation Program schedule on 1 January 2003; 7-valent pneumococcal conjugate vaccine (7vPCV) on 1 January 2005; DTPa-IPV and DTPa-IPV-HepB-Hib (hexavalent) vaccines in November 2005; rotavirus (RotaTeq® and Rotarix®) vaccines on 1 July 2007; pH1N1 influenza vaccine for children 6 months to 10 years on December 2009; and seasonal trivalent influenza vaccine in 2010 (Table 1).

onwards. Reporting rates usually increased with the commencement of a new vaccination program and then stabilised at lower rates.[2,5,7,8,14]

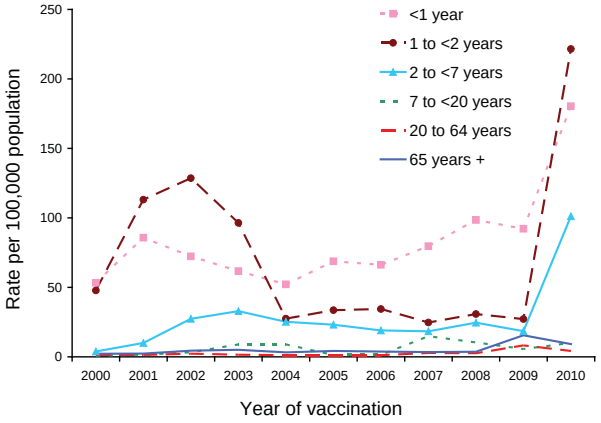
The usual seasonal pattern of AEFI reporting in adults, with peaks in the first half of the year, was also apparent in 2010 (Figure 2a), corresponding to the months when older Australians receive 23vPPV and influenza vaccine (March to June).

Age distribution

Compared with 2009, AEFI reporting rates in children increased substantially in all age groups but the magnitude differed: among the <1 year age group, it increased approximately 2-fold from 92.1 to 180.4 per 100,000 population, but in the 1 to <2 year age group it increased by a factor of almost 10 from 27.2 to 221.6, and in the 2 to <7 year age group the increase was just over 5-fold from 18.5 to 101.2 (Figure 3). These differences were almost entirely related to the increase in reports following influenza vaccines; primarily seasonal influenza vaccines.

In those over the age of 7 years, there were also increases in the reporting rates of most other individual vaccines given to these age groups in 2010, compared with 2009. However, AEFI reporting rates decreased for the 20–64 year age group (from 8.2 to 4.3 per 100,000 population) and the >65 year age group (from 15.5 to 9.2), mainly associated with the decline in reports following pH1N1 influenza vaccine in these age groups (Figures 2a and 3).

Figure 3: Rates of adverse events following immunisation per 100,000 population, ADRS database, 2000 to 2010, by age group and year of vaccination



Geographical distribution

AEFI reporting patterns varied between states and territories for vaccines received during 2010 (Table 3) as reported previously.[1,2,6–9,13,14] Western Australia, South Australia and the Australian Capital Territory had the highest reporting rates (42.1, 34.9 and 32.6 per 100,000 population, respectively) while New South Wales had the lowest rate (5.9 per 100,000 population). AEFI reporting rates increased in all jurisdictions in 2010 compared with 2009, except in Victoria and New South Wales.[14] After excluding influenza vaccines, there was a decrease in reporting rates in all jurisdictions and in all age groups (Figure 1).

Vaccines

Thirty-three different vaccines were included in the 3,894 AEFI records received in 2010 (Table 2). The percentage of records where only one vaccine was reported differed by vaccine, typically varying according to whether multiple vaccines were routinely co-administered for the patient's age. The percentage of AEFI records assigned causality ratings of 'certain' or 'probable' also varied, in accordance with the frequency of injection site reactions, for which the attribution of causality is more straightforward. There were also variations in the proportions with outcomes defined as 'serious'.

The most frequently reported individual vaccine was seasonal influenza vaccine with 2,354 records (61% of total) followed by pH1N1 (n=514; 13%) (Table 2).

Table 2: Vaccine types listed as 'suspected' in records of adverse events following immunisation, ADRS database, 2010

Suspected vaccine type*	AEFI records	One suspected vaccine or drug only†		'Certain'/ 'probable' causality rating		'Serious' outcome‡		Age group§			
								<7 years		≥7 years	
	n	n	%‖	n	%‖	n	%‖	n	%‖	n	%‖
Influenza	2,354	2,124	90	41	2	134	6	1,693	72	640	27
pH1N1	514	471	92	28	5	41	8	329	64	181	35
MMR	288	27	9	13	5	17	6	274	95	13	5
DTPa-IPV	269	101	38	52	19	8	3	266	99	3	1
DTPa-IPV-HepB-Hib	221	9	4	7	3	29	13	221	100	0	0
7vPCV	216	7	3	8	4	29	13	216	100	0	0
Rotavirus	210	29	14	7	3	37	18	209	100	1	0
23vPPV	201	122	61	38	19	15	7	11	5	188	94
dTpa	133	108	81	34	26	6	5	1	1	130	98
Varicella	118	40	34	2	2	16	14	97	82	18	15
Hib	91	5	5	0	0	7	8	89	98	2	2
Hepatitis B	90	30	33	1	1	4	4	10	11	79	88
MenCCV	86	4	5	3	3	6	7	84	98	2	2
HPV	72	37	51	6	8	2	3	0	0	72	100
DTPa	20	12	60	6	30	2	10	9	45	10	50
Hepatitis A	18	3	17	0	0	1	6	13	72	4	22
dT	14	8	57	2	14	0	0	2	14	12	86
Hepatitis A + B	10	5	50	0	0	2	20	0	0	10	100
10vPCV	10	4	40	2	20	2	20	9	90	1	10
BCG	9	8	89	4	44	1	11	5	56	4	44
Hepatitis A-Typhoid	8	3	38	0	0	0	0	0	0	8	100
Typhoid	7	1	14	0	0	2	29	3	43	3	43
Cholera	5	3	60	2	40	1	20	0	0	4	80
Men4PV	5	1	20	0	0	1	20	4	80	1	20
Rabies	5	4	80	1	20	0	0	1	20	4	80
Yellow fever	5	2	40	0	0	2	40	0	0	5	100
DTPa-IPV-HepB	4	1	25	0	0	0	0	4	100	0	0
Q fever	4	4	100	2	50	0	0	0	0	4	100
IPV	3	1	33	0	0	0	0	2	67	1	33
dTpa-IPV	2	0	0	0	0	0	0	0	0	2	100
Japanese encephalitis	1	0	0	0	0	0	0	0	0	1	100
Hib-Hepatitis B	1	0	0	0	0	0	0	1	100	0	0
Tetanus	1	1	100	0	0	0	0	0	0	1	100
Total¶	3,894	3,169	81	245	6	255	7	2,629	68	1,230	32

* See appendix for abbreviations of vaccine names.

† Adverse events following immunisation (AEFI) records where only one vaccine was suspected of involvement in a reported adverse event.

‡ 'Serious' outcomes are defined in the Methods section (see also Table 3).

§ AEFI records are not shown if both age and date of birth were not reported.

‖ Percentages are calculated for the number of AEFI records where the vaccine was suspected of involvement in the AEFI, e.g. HPV was 'suspected' in 72 AEFI records; this was the only suspected vaccine in 51% of the 72 AEFI records, 8% had 'certain' or 'probable' causality ratings, 3% were defined as 'serious' and 100% were for those aged ≥7 years.

¶ Total number of AEFI records analysed, not the total in each column as categories are not mutually exclusive and an AEFI record may list more than one vaccine.

Table 3: Adverse events following immunisation, ADRS database, 2010, by state or territory

State or territory	AEFI records n	AEFI records %	Annual reporting rate per 100,000 population* Overall	'Certain'/ 'probable' causality rating	'Serious' outcome†	Aged <7 years
Australian Capital Territory	117	3	32.6	2.0	1.4	216.6
New South Wales	424	11	5.9	0.4	0.5	38.0
Northern Territory	61	1	26.6	3.9	2.2	144.8
Queensland	1,048	27	23.2	2.0	1.5	164.8
South Australia	574	15	34.9	2.1	0.9	228.9
Tasmania	79	2	15.6	1.2	1.2	95.9
Victoria	575	15	10.4	0.6	0.7	81.9
Western Australia	966	25	42.1	1.2	3.2	376.4
Other‡	50	1	na	na	na	na
Total	3,894	100	17.4	1.1	1.1	130.9

* Average annual rates per 100,000 population calculated using mid-2010 population estimates (Australian Bureau of Statistics).

† Adverse events following immunisation (AEFI) records defined as 'serious' (i.e. recovery with sequelae, hospitalisation, life-threatening or death).

‡ Records where the jurisdiction in which the AEFI occurred was not reported or was unclear. AEFI records in this category were notified mainly by pharmaceutical companies (n = 36), members of the public (n = 9), states and territories (n = 3), and health care providers (n = 2).

Reactions

The distribution and frequency of reactions listed in AEFI records for vaccines received in 2010 are shown in Tables 4a and 4b. In Table 4a, only the reaction terms analogous to those listed in *The Australian Immunisation Handbook*[22] are shown. In Table 4b, other reaction categories are listed in descending order of frequency.

The most frequently reported adverse events were fever (61%), allergic reaction (39%), injection site reaction (ISR) (19%), malaise (13%), neurological/ psychological and headache (10% each), nausea (6%), and respiratory, myalgia, rash and convulsions (5% each) (Table 4a, Table 4b and Figure 4).

The number of reports in each reaction category has changed over time. In previous years, reports of allergic reactions peaked in 2003 and 2007, coinciding with the national school-based MenCCV immunisation program and the HPV school program.[2,7,8] Much of the variation in reporting of ISR related to specific changes in the immunisation schedules for vaccines that are known to have higher rates of ISR, including DTPa-containing vaccines, MenCCV, 23vPPV and HPV vaccine.[5–19,36,37] Increases in reports of fever were largely associated with the new vaccines added to the NIP in the reporting period, including rotavirus and HPV in 2007. However, by far the largest peaks in reports since 2000 have been associated with the pH1N1 and seasonal influenza 2010 vaccines (Figure 4). In particular, there were large peaks of reports of fever and allergic reactions in 2009 associated with the pH1N1 vaccine, and in 2010 associated with both pH1N1 and seasonal influenza vaccines. Reports of convulsions peaked in 2010, mainly associated with seasonal influenza but also to a lesser extent with pH1N1. The peaks in neurological or psychological conditions in both years is mainly related to pH1N1 and seasonal influenza vaccine, while the increase in ISR was particularly associated with non-influenza vaccines, particularly 23vPPV.

Severity of outcomes

Summary data on outcomes are presented in Table 5. Sixty-seven per cent of reported AEFI in 2010 were defined as 'non-serious' while 7% were defined as 'serious' (i.e. recovery with sequelae, requiring hospitalisation, experiencing a life-threatening event or death). This is similar to the proportions of serious AEFI observed in previous

Figure 4: Selected frequently reported adverse events following immunisation, ADRS database, 2000 to 2010, by event type and quarter

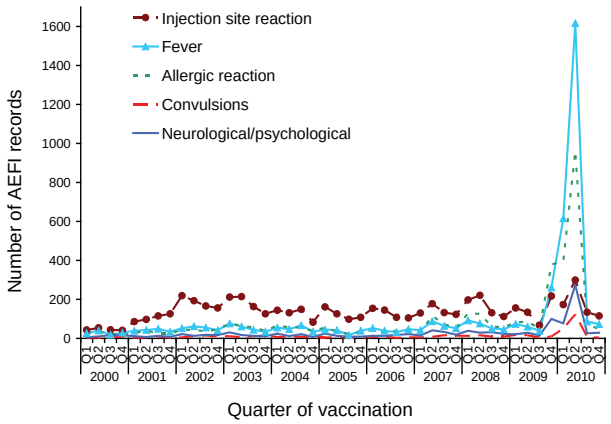


Table 4a: Reaction categories of interest* mentioned in records of adverse events following immunisation, 2010

Reaction category*	AEFI records	Only reaction reported†		'Certain'/'probable' causality rating		Age group‡ <7 years		≥7 years	
	n	n	%§	n	%§	n	%§	n	%§
Fever	2,392	261	11	40	2	1,989	83	381	16
Allergic reaction‖	1,534	82	5	27	2	1,197	78	322	21
Injection site reaction	721	126	17	185	26	312	43	404	56
Rash¶	196	53	27	6	3	149	76	45	23
Convulsions	185	54	29	0	–	174	94	11	6
Abnormal crying	161	3	2	2	1	157	98	4	2
Syncope	84	44	52	13	15	19	23	65	77
Arthralgia	66	2	3	1	2	5	8	58	88
Lymphadenopathy/itis**	48	4	8	4	8	5	10	42	88
Hypotonic-hyporesponsive episodes	39	22	56	2	5	38	97	1	3
Arthritis	22	4	18	1	5	5	23	16	73
Anaphylactic reaction	16	14	88	1	6	4	25	12	75
Guillain-Barré syndrome	10	10	100	0	–	0	–	10	100
Intussusception	10	7	70	1	10	10	100	0	–
Death††	3	1	33	0	–	2	67	1	33
Abscess	3	1	33	2	67	2	67	1	33
Sepsis	2	0	–	0	–	2	100	0	–
Thrombocytopenia	2	1	50	0	–	1	50	1	50
Brachial neuritis	1	1	100	0	–	0	–	1	100
Parotitis	1	0	–	0	–	1	100	0	–
Orchitis	0	0	–	0	–	0	–	0	–
Encephalitis	0	0	–	0	–	0	–	0	–
Osteitis	0	0	–	0	–	0	–	0	–
Encephalopathy	0	0	–	0	–	0	–	0	–
Total‡‡	3,894	3,169	81	245	6	2,629	68	1,230	32

* Reaction categories were created for the adverse events following immunisation (AEFI) of interest listed and defined in *The Australian Immunisation Handbook*, (9th edition, p 58–65 and 360–3)[22] as described in the Methods section.

† AEFI records where only one reaction was reported.

‡ Not shown if neither age nor date of birth were recorded.

§ Percentages relate to the number of AEFI records in which the specific reaction term was listed, e.g. of 721 AEFI records listing injection site reaction, 17% listed only one type of reaction while 26% had a causality rating of 'certain' or 'probable' and 43% were for children aged <7 years.

‖ Allergic reaction includes skin reactions including pruritus, urticaria, periorbital oedema, facial oedema, erythema multiforme etc. (excludes skin reactions presented elsewhere in this table); and/or gastrointestinal (e.g. diarrhoea, vomiting) symptoms and signs but does not include other abdominal symptoms like abdominal pain, nausea, flatulence, abnormal faeces, haematochesia, etc. Does not include anaphylaxis.

¶ Includes general terms of rash but does not include pruritic rash.

** Includes lymphadenitis following BCG vaccination and the more general term of 'lymphadenopathy'.

†† A fourth case of intra-uterine foetal death at 22 weeks gestation not included as the child was not born and does not fit in the age group categories.

‡‡ Total number of AEFI records analysed, not the total in each column as categories are not mutually exclusive and an AEFI record may list more than one reaction term.

Table 4b: 'Other'* reaction terms listed in records of adverse events following immunisation, 2010

Reaction term*	AEFI records	Only reaction reported†		'Certain'/'probable' causality rating		Age group‡			
						<7 years		≥7 years	
	n	n	%§	n	%§	n	%§	n	%§
Malaise	505	1	0.2	11	2	334	66	166	33
Neurological/psychological	406	0	–	7	2	337	83	67	17
Headache	388	2	1	7	2	162	42	225	58
Nausea	220	0	–	2	1	59	27	161	73
Respiratory	201	12	6	3	1	140	70	61	30
Myalgia	199	4	2	4	2	6	3	130	65
Pain	153	3	2	4	3	53	35	98	64
Tremor	148	0	–	0	–	121	82	27	18
Dizziness	119	3	3	4	3	17	14	101	85
Somnolence	113	2	2	3	3	97	86	15	13
Pallor	107	5	5	3	3	82	77	24	22
Abdominal pain	105	2	2	3	3	63	60	41	39
Circulatory	86	3	3	2	2	48	56	38	44
Increased sweating	75	2	3	1	1	28	37	47	63
Gastrointestinal – RVV‖	71	12	17	3	4	70	99	1	1
Reduced sensation	54	6	11	0	–	3	6	50	93
ENT	49	3	6	1	2	6	12	42	86
Erythema	47	7	15	1	2	28	60	19	40
Oedema	47	1	2	1	2	22	47	25	53
Flushing	25	0	–	0	–	11	44	13	52
Vision impaired	24	1	4	0	–	8	33	16	67
Weakness	21	0	–	1	5	5	24	16	76
Other	409	34	8	15	4	230	56	173	42
eye or ear	65	1	2	1	2	42	65	23	35
cardiovascular	57	2	4	2	4	38	67	18	32
general non-specific	37	9	24	2	5	17	46	19	51
infection	32	4	13	1	3	17	53	14	44
respiratory	28	1	4	–	–	17	61	11	39
psychological	26	0	–	1	4	20	77	6	23
neurological	28	6	21	1	4	13	46	15	54
skin¶	17	2	12	1	6	11	65	6	35
renal/urogenital	16	1	6	0	–	7	44	9	56
gastrointestinal**	15	1	7	2	13	7	47	6	40
musculoskeletal	12	1	8	1	8	3	25	9	75
metabolic/endocrine	12	0	–	0	–	9	75	3	25
pregnancy/congenital	9	5	56	0	–	0	–	9	100
miscellaneous	8	1	13	0	–	2	25	5	63
haematological	9	0	–	0	–	4	44	5	56

* Reaction terms not listed in *The Australian Immunisation Handbook*[22] but included in adverse events following immunisation (AEFI) records in the Adverse Drug Reactions System database. The top part of the table shows reaction terms included in 1% or more of AEFI records; the bottom part of the table shows reaction terms, grouped by organ system, that were included in less than 1% of AEFI records.

† AEFI records where only one reaction was reported.

‡ Not shown if neither age nor date of birth were recorded.

§ Percentages relate to the number of AEFI records in which the specific reaction term was listed, e.g. of 721 AEFI records listing injection site reaction, 17% listed only one type of reaction while 26% had a causality rating of 'certain' or 'probable' and 43% were for children aged <7 years.

‖ Gastrointestinal – RVV includes GI reactions following rotavirus vaccination only.

¶ Other, skin includes purpura, petechie, blister, burning, dermatitis, dry skin etc. but does not include skin reactions.

** Other, gastrointestinal does not include reaction categories coded as GI reactions or gastrointestinal – RVV signs and symptoms.

years.[13,14] A further 11% were recorded as not fully recovered at the time of reporting and 56% of these were following receipt of pH1N1 and seasonal influenza vaccine. Eighty-eight per cent of cases recorded as 'not fully recovered' had missing information on hospitalisation; 57% were reported by states and territories, 27% by health care providers and 12% by members of the public. Information on severity could not be determined for 15% (n=597) of records due to insufficient data. Of these, 79% were following receipt of influenza vaccines and the majority of these reports came from either states and territories (46%) or members of public (34%), with little specific information provided. Thirty-three per cent of these reports were reported by Western Australia and 68% were for children <7 years of age. Of those without information describing severity, the most commonly reported adverse reactions were: fever (63%); allergic reactions (41%); injection site reaction (14%); malaise (11%); headache (10%); rash (6%); convulsion and myalgia (5% each); and nausea (4%).

A total of 245 (6%) AEFI records were assigned causality ratings of either 'certain' (n=175; 4%) or 'probable' (n=70; 2%) and the rest (94%) were rated as 'possible'. A similar number of 'serious' AEFI were assigned certain or probable causality ratings compared with 'non-serious' AEFI (5% versus 6%) (Table 5).

The reactions recorded as 'serious' (n=255) were fever (n=119; 47%); allergic reactions (n=71; 27%); convulsions (n=65; 25%), including 52 febrile convulsions; injection site reactions (n=28; 11%); diarrhoea/vomiting (n=17; 7%); HHE (n=9; 4%); anaphylaxis (n=8; 3%); Guillain-Barré syndrome (GBS) (n=7; 3%); intussusception (n=7; 3%); 5 cases of syncope (2%); 4 reports of death (2%); and 1 case of idiopathic thrombocytopenic purpura (ITP). Other relatively severe reactions that were not classified as 'serious', either because they did not satisfy the criteria, or due to a lack of information about their outcome and/or hospitalisation status, included: convulsion (n=120; 120/185=65%), including 75 febrile convulsions; HHE (n=30; 30/39=77%); anaphylaxis (n=8; 8/16=50%); GBS (n=3; 3/10=30%); and intussusception (n=3; 3/10=30%).

Of the total 185 cases of convulsion, 169 (91%) were children aged <5 years and 66% were reported in the second quarter of 2010. Thirty-eight per cent of reports (n=71) were from Western Australia followed by Queensland (19%; n=35) and New South Wales (16%; n=29). The most commonly suspected vaccines were seasonal influenza vaccine (n=119) and pH1N1 (n=44), either given alone or co-administered with other vaccines. There were 127 cases classified as febrile convulsions across Australia in all age groups during 2010, of which 73% (n=124) were reported in children <5 years of age.

Table 5: Outcomes of adverse events following immunisation, ADRS database, 2010

Outcome	AEFI records		'Certain'/ 'probable' causality rating†		Age group‡ <7 years		≥7 years	
	n	%	n	%	n	%	n	%
Non-serious	2,624	67	147	6	1,865	71	742	28
Not recovered at time of report	418	11	53	13	183	44	231	55
Not known (missing data) – total	597	15	32	5	403	68	180	30
Not known (missing data)‖	394	10	25	6	252	64	129	33
Serious:	255	7	13	5	178	70	77	30
recovered with sequelae	3		–		2		1	
hospital treatment – admission	227		13		158		69	
life-threatening event	20		–		15		5	
Death¶	3		–		2		1	
Total	3,894	100	245	6	2,629	68	1,230	32

* Percentages relate to the total number of adverse events following immunisation (AEFI) records (n=3,894).

† Causality ratings were assigned to AEFI records using criteria described previously.[1]

‡ AEFI records where both age and date of birth were not recorded are not shown (35 missing).

§ Percentages relate to the number of AEFI records with the specific outcome, e.g. of 2,624 AEFI records with a 'non-serious' outcome, 6% had causality ratings of 'certain' or 'probable' and 71% were for children aged <7 years.

‖ AEFI records with missing data reported by health care providers and states or territories only (excluding reports from members of the public).

¶ A fourth case of intra-uterine foetal death at 22 weeks gestation is not included as the child was not born and does not fit in the age group categories.

Of the 39 reported HHE, 38 (97%) were from children aged <7 years. Thirty reports (77%) were following administration of hexavalent/pneumococcal and rotavirus vaccines while only 3 reports were following influenza vaccines administered alone. The only case of HHE aged >7 years was aged 49 years and followed administration of the adult formulation dTpa vaccine. All the 10 cases of GBS were in people aged ≥35 years. Eight reports followed seasonal flu vaccine (6 following vaccination with Fluvax®, and one each with Influvac® and Vaxigrip®); one followed pH1N1 and another one followed adult dTpa. The timing in relation to administration of vaccine and onset of symptoms varied from 11 days to >4 months.

All 10 reports of intussusception were from infants (<1 year of age) following rotavirus vaccine administered alone or in combination with other vaccines.

Twelve of the 16 reports of anaphylaxis in 2010 occurred following receipt of one of the influenza vaccines administered alone or in combination with other vaccines (seasonal influenza vaccine n=8; pH1N1 n=4), while others occurred following the receipt of MMR (n=3), varicella (n=2), and one each following DTPa-IPV, HPV, HepA, HepB, DT, and adult dTpa.

Four deaths were recorded as being temporally associated with the receipt of vaccines; two following receipt of seasonal influenza vaccine.

- One case was a 2-year-old child who was found deceased on the morning following receipt of seasonal influenza vaccine (Fluvax Junior®, CSL Biotherapies). A post-mortem determined that a causal relationship between vaccination and death was not established.[15]
- The second case was an infant with a history of prematurity and apnoea, who had an apnoeic episode and died 5 days post vaccination with hexavalent, 7vPCV and rotavirus vaccines.
- The third death was a very elderly person 4 days following receipt of 23vPPV vaccine. He had pneumonia and was bacteraemic with *Streptococcus pneumoniae* (serotype 11A).

The fourth case was an intra-uterine foetal death at 22 weeks gestation following vaccination of a 20-year-old pregnant female who received the seasonal influenza vaccine (Influvac®, Solvay Biosciences) 16 days prior to the event. The cause of death was reported to be most likely because of intra-uterine infection. This case was not included in both the Tables 4 and 5 because of the nature of the death (see footnote of the Table 4 and 5). All deaths were investigated by the TGA and classified as not causally related to vaccination.

Adverse events following immunisation reports not including influenza vaccines

There were 1,316 reports in 2010 that related to non-influenza vaccines, of which 290 (22%) were co-administered with pH1N1 or seasonal influenza vaccine. Of those not co-administered with influenza vaccines (n=1,026), only 23 cases (2%) were reported by members of the public.

The most commonly reported vaccines in this category were those containing diphtheria, tetanus and acellular pertussis antigens (including combination DTPa-containing vaccines and dTpa [adult/adolescent formulation]) (649; 17% of the total 3,894 AEFI records) (Table 2). DTPa-IPV (269 records; 7%) and hexavalent DTPa-IPV-HepB-Hib (221 records; 6%) were the most frequently reported vaccines in this group. In the <1 year age group, reports that included DTPa-IPV decreased and reports of DTPa-IPV-HepB-Hib increased, in line with the changes in usage of those vaccines as outlined in the Introduction (Figure 2c). The other frequently reported vaccines were MMR (288 records; 7%), 7vPCV (216 records; 6%), and rotavirus (210 records; 5%).

In comparison to the number reported in 2009, AEFI reports were substantially reduced for HPV vaccine (153 in 2009 vs 72 in 2010) following the peak during the catch-up program in 2008–2009, and for Hib-HepB (10 in 2009 vs 1 in 2010) following the reduction in its use.[14] The number of reports for all other vaccines increased in 2010 (Figures 2a and 2b), which appears related to these vaccines being either co-administered with the influenza vaccines, and/or stimulated reporting associated with general heightened awareness of vaccine safety issues (associated with the childhood influenza vaccine suspension) that may have resulted in increased reporting of milder AEFI for other vaccines.

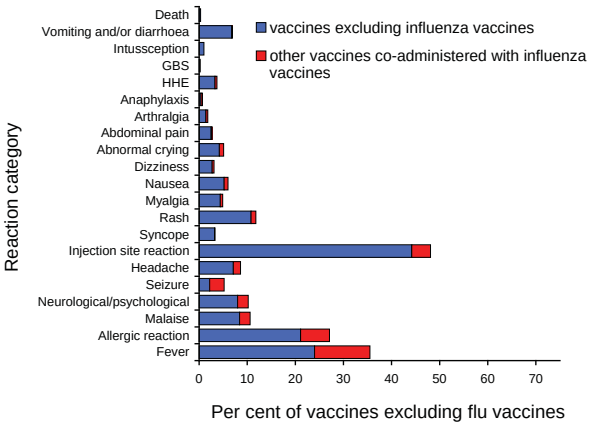
Eight per cent (n=80) of the non-influenza (n=1,026) AEFI records had outcomes defined as 'serious' (i.e. recovery with sequelae, hospitalisation, life-threatening event or death) and 74% (n=59) were for children <7 years of age. There were no reports of life-threatening events; 77 people (96%) were admitted to hospital and there were 2 reports of death (described previously).

Serious AEFI included injection site reactions (44%), diarrhoea (21%), fever (24%), allergic reactions (21%), HHE (3%), and seizure (2%). There were 10 reports of intussusception, 4 reports of anaphylaxis and 1 report each of GBS and ITP.

The only case of ITP classified as serious was 17 days following administration of varicella vaccine. However, due to an alternate cause (febrile

intercurrent viral infection), the causality rating of 'unlikely' to be related to the vaccine was assigned. The distribution of more commonly reported AEFI is listed in Figure 5a.

Figure 5a: Frequently reported adverse events following immunisation with non-influenza vaccines, ADRS database, 2010



Pneumococcal vaccine and adults aged ≥65 years

There were 155 AEFI reports for older adults that included 23vPPV, of which 14 (9%) were coded as serious. Of the 14 serious cases, 6 cases were following receipt of 23vPPV vaccine administered alone while 8 cases were following receipt of one of the influenza vaccines co-administered with 23vPPV vaccine. The reports included 126 (81%) ISR, 33 (21%) fever, and 1 each of GBS, anaphylaxis and death. Forty-two per cent of reports in 2010 were following 23vPPV vaccine conjointly administered with one of the influenza vaccines, compared with 24% in 2009. Using the 2009 estimate of the number of doses of 23vPPV administered to people aged ≥65 years (n=317,400), the AEFI reporting rate was 48.8 per 100,000 doses, with rates of 4.4 per 100,000 for events classified as serious and 39.7 per 100,000 for ISR. This is substantially higher than the rates reported for 2009 and 2008 (13.3 and 18.9 respectively) (Table 6). The reporting rates for ISR for 23vPPV not co-administered with influenza vaccines was 22.1 per 100,000 doses for 2010 compared with 11.3 in 2009 and 14.8 in 2008.

Adverse events following immunisation reports including influenza vaccines

Of 3,894 total AEFI records reported in 2010, 74% (n=2,868) of records were related to influenza vaccines (seasonal influenza – 61% (n=2,354); pH1N1 – 13% (n=514)). This was a sharp contrast to 2009 (seasonal influenza vaccine – 162; pH1N1 – 1,312).[14]

The large number of reports following pH1N1 vaccination in 2009 was mainly attributed to more pH1N1 vaccine being used in 2009 than in 2010.

2010 seasonal influenza vaccine

The majority of the reports for seasonal influenza vaccine were for either Fluvax® or Fluvax junior® (CSL Biotherapies) (n=1,855; 79%) while another 15% did not specify the vaccine brand and were coded only as influenza vaccine. There were 86 adverse event reports following vaccination with Influvac® (Solvay Biosciences), 66 with Vaxigrip® (Sanofi Pasteur) and 1 with Fluarix® (GlaxoSmithKline); 82 (3%) were co-administered with 23vPPV.

A large proportion of the AEFI following seasonal influenza vaccine was reported to TGA via states and territories (70%). Of the remaining AEFI reports, 18% were provided by doctors and other health care providers and 12% were reported by members of the public. A large proportion of the total number of reports for seasonal influenza vaccine was from Western Australia (34%), compared with only 11% of reports for other vaccine types from that state. The increased proportion of reports from Western Australia is consistent with the greater use of seasonal influenza vaccine in that state due to their vaccine program for children <5 years of age.[38] Seventy-five per cent of the reports following seasonal influenza vaccine were defined as 'non-serious', 6% (n=134) were defined as 'serious' and an additional 11% were not categorised because of the non-availability of data on hospitalisation and outcome.

In 2010, there were 1,693 reported adverse events following seasonal influenza vaccination in children <7 years of age and 496 in people aged ≥18 years. The AEFI reporting rate in those aged ≥18 years was 10.4 per 100,000 administered doses, which was more than 3-fold higher than in 2009. As seen in previous years, the overall AEFI reporting rates were higher for vaccinees aged 18–64 years than among older people. However, there was an increase in the reporting rate of serious AEFI in all age groups and particularly among older people (aged ≥65 years). The most frequently reported adverse events were ISR (3.4 per 100,000 doses), fever (3.1), allergic reaction (2.4), headache (1.9), malaise (1.6), myalgia (1.4), nausea (1.4) and dizziness (0.9). The rate for each of these reactions was higher in the 18–64 year age group. There were 8 reports of GBS following seasonal influenza vaccination in 2010; 6 reports of anaphylaxis and 1 case of ITP. There were two reported deaths following seasonal vaccination as described previously.

The distribution of reaction types for seasonal influenza vaccine is presented in Figure 5b. The spectrum of reactions for seasonal influenza vac-

Table 6: Vaccine types listed as 'suspected' in records of adverse events following immunisation for four age groups (< 7, 7–17, 18–64 and ≥ 65 years), ADRS database, 2010

Vaccines*	AEFI records† (n)	Vaccine doses‡ (n)	Reporting rate per 100,000 doses§ 2010	2009	2008
<7 years					
DTPa-containing vaccines	491	1,115,696	44.0	37.4	46.3
DTPa-IPV	266	282,567	94.1	72.1	92.1
Pentavalent (DTPa-IPV-HepB)	4	387	1,033.6	28.4	22.5
Hexavalent (DTPa-IPV-HepB-Hib)	221	832,742	26.5	25.0	25.0
Haemophilus influenzae type b	89	279,263	31.9	16.3	19.4
Haemophilus influenzae type b-hepatitis B	1	829	120.6	163.6	39.6
Measles-mumps-rubella	274	568,799	48.2	34.0	38.5
Meningococcal C conjugate	84	293,499	28.6	16.4	17.5
Pneumococcal conjugate	216	822,514	26.3	25.4	27.0
Rotavirus vaccine	209	525,383	39.8	38.2	43.1
Varicella	97	275,893	35.2	8.3	14.9
Seasonal influenza	1,693	na	na	na	na
pH1N1	329	na	na	na	na
Total (<7 years)‖	750	3,881,876	19.3	14.1	17.8
7–17 years					
HPV	71	na	na	na	na
Hepatitis B	62	na	na	na	na
dTpa	52	na	na	na	na
Varicella	11	na	na	na	na
Seasonal influenza	144	na	na	na	na
pH1N1	72	na	na	na	na
Total (7–17 years)	412	na	na	na	na
18–64 years					
Seasonal influenza¶	343	3,170,300	10.8	3.8	3.4
pH1N1	90	na	na	na	na
dTpa	72	na	na	na	na
23vPPV¶	30	132,520	22.6	9.2	15.9
Total (18–64 years)	535	3,302,820	11.3	4.3	4.5
≥65 years					
23vPPV¶	155	317,400	48.8	13.3	18.9
Seasonal influenza¶	153	2,176,000	7.0	1.6	1.7
pH1N1	19	na	na	na	na
dTpa	6	na	na	na	na
Total ≥65 years	333	2,493,400	12.4	3.6	4.6

* Records where at least one of the vaccines shown in the table was suspected of involvement in the reported adverse event.

† Number of adverse events following immunisation (AEFI) records in which the vaccine was coded as 'suspected' of involvement in the reported adverse event and the vaccination was administered between 1 January and 31 December 2010. More than one vaccine may be coded as 'suspected' if several were administered at the same time.

‡ Number of vaccine doses recorded on the Australian Childhood Immunisation Register and administered between 1 January and 31 December 2010.

§ The estimated AEFI reporting rate per 100,000 vaccine doses recorded.

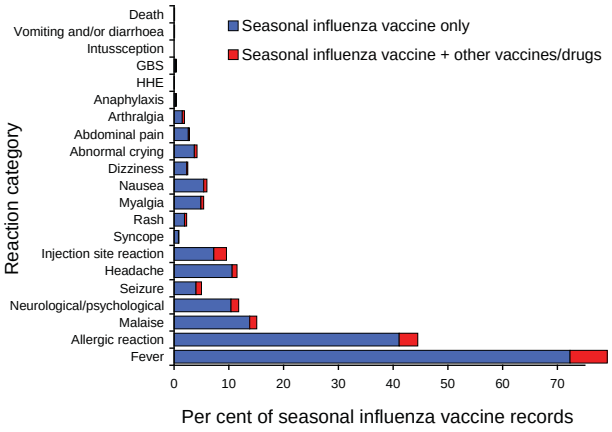
‖ Number of AEFI records excluding influenza vaccines administered alone. Most reports include more than one vaccine.

¶ Number of administered doses of 23vPPV and seasonal influenza vaccine estimated from the 2009 Australian Institute of Health and Welfare national adult vaccination survey.[35]

na Not applicable

cine was different to that for non-influenza vaccines with a substantially higher proportion of fever (79% compared with 24% for non-influenza vaccines) and allergic reaction (45% vs 21%) and a lower proportion of ISR (7% vs 44%). There were 119 (5%) reports of convulsions, including 88 febrile convulsions; 20 (1%) syncope; 8 (0.3%) each of anaphylaxis and GBS; and 2 (0.1%) reports of death following seasonal influenza vaccine. A higher proportion of reports following seasonal influenza vaccine came from members of the public (12% compared with 2% for non-influenza vaccines).

Figure 5b: Frequently reported adverse events following seasonal influenza immunisation administered alone as well as in combination with other vaccines,* ADRS database, 2010



* pH1N1 (% of 514 adverse events following immunisation (AEFI) records); seasonal influenza vaccine (% of 2,354 AEFI records); and vaccines excluding influenza vaccines (% of 1,030 AEFI records), where the corresponding vaccines were listed as suspected of involvement in the reported adverse event following immunisation.

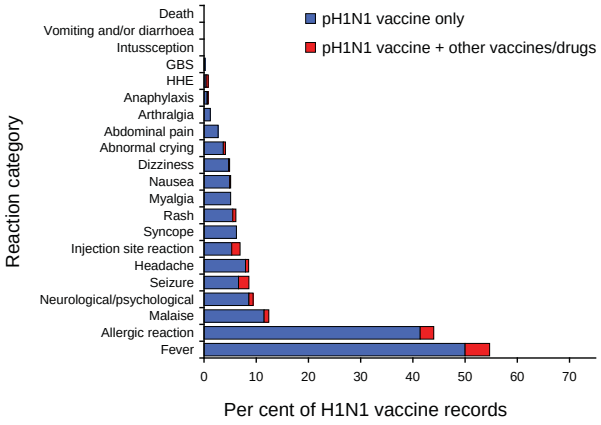
Monovalent pH1N1 influenza vaccine

There was a total of 514 AEFI reports received for 2010 where pH1N1 influenza vaccine was listed as a suspected vaccine (Table 3). It was the only suspected vaccine in 471 (92%) reports. Twenty-eight reports (5%) had causality classified as 'certain' or 'probable' while the other 486 cases (95%) were classified as 'possible'. Forty-one cases (8%) were defined as 'serious' (Table 3). Thirty-three per cent of reports (n=171) came from Queensland, 25% (n=126) from New South Wales, 10% (n=50) from Victoria, 9% each from Western Australia (n=47) and the Australian Capital Territory (n=44), 5% each from South Australia (n=28) and Tasmania (n=25), and 3% (n=13) from the Northern Territory.

The reporting rate for people aged ≥18 years was 3.1 per 100,000 doses, which was a substantial decline from 2009 (34.2). However, the overall rates were higher for vaccinees aged 18–64 years than among older people. The majority (41%; n=211) were reported by states and territories, 38% (n=196) by members of the public, 18% (n=90) by doctors and health care providers, 2% (n=12) by hospitals and 1% (n=5) by drug companies.

The spectrum of reactions for the pH1N1 influenza vaccine was similar to that for seasonal influenza vaccine, showing higher rates for fever (55%), allergic reaction (44%), malaise (13%), and convulsion (9%), including 28 reports of febrile convulsions (27 of which were in children <5 years of age). There was a total of 4 reports each of anaphylactic reaction and HHE, and 1 case reported as GBS following pH1N1 influenza vaccine (Figure 5c).

Figure 5c: Frequently reported adverse events following pH1N1 administered alone as well as in combination with other vaccines, ADRS database, 2010



Discussion

There has been a substantial increase in both the number of AEFI reports and population-based reporting rates in both 2009 and 2010, predominantly due to the substantial increase in reports in children following vaccination with two influenza vaccines: the 2010 seasonal trivalent influenza vaccine and the pandemic (pH1N1) influenza vaccine.

The pH1N1 vaccine program for adults that commenced in September 2009 resulted in a large peak in reports for that age group in the last quarter of that year, followed by lower levels of AEFI reported in adults in 2010. Reports in children peaked in early 2010 following the roll-out to children aged 6 months to 10 years from 4 December 2009. The safety of the pH1N1 vaccine has been examined closely both nationally and internationally. The World Health

Organization reports that approximately 30 different pH1N1 vaccines have been developed using a range of methods.[39] All progressed successfully through vaccine trials to licensure, showing satisfactory safety profiles. In general, the safety profile, including that for the Australian pH1N1 vaccine, has been similar to those of other vaccines, with predominantly mild transient events and a small number of serious reactions reported.[40] In Australia, reports of febrile convulsions in children aged ≤4 years of age following Panvax® administration were found to be between 7 and 18 per 100,000 doses using denominator data from a number of sources, and based on estimated doses administered up to 31 May 2010.[41] Febrile convulsions have been identified as a rare AEFI in children based on post-marketing surveillance data.[42] Rare side effects are generally regarded as those that occur at a rate between 1 per 1,000 and 1 per 10,000 doses. This rate is substantially less (at least 25-fold lower) than the estimated rate of 700 per 100,000 febrile convulsions seen with Fluvax®/Fluvax junior® following the extensive epidemiologic investigation of the safety profile of that vaccine, which occurred following the vaccine suspension in 2010.[41] Active surveillance for GBS following pH1N1 vaccine has resulted in no evidence of an increased incidence, and reports of anaphylaxis are also rare and within expectations.[43]

The very large number of reports following pH1N1 can be attributed, in part, to the active promotion to both health professionals and consumers of reporting to the TGA. They also reflect the fact that immunisation providers are more likely to report milder, less serious AEFI for vaccines they are not familiar with. This tendency to report an AEFI for newer vaccines increases the sensitivity of the system to detect signals of serious, rare or previously unknown events, but also complicates the interpretation of trends.

The trends in AEFI rates in 2010 were also greatly influenced by the emergence of a new vaccine safety concern regarding the use of seasonal influenza vaccines in children. Epidemiological studies determined that the 2010 seasonal influenza vaccine produced by CSL Biotherapies (Fluvax® and Fluvax junior®) was associated with an increased number of febrile adverse events in young children,[44] and particularly with an unacceptably high rate of febrile convulsions within 24 hours of administration (500–700 per 100,000 doses).[45] This rate was between 5 and 20 times higher than for other seasonal influenza vaccines (Influvac® [Solvay Biosciences] and Vaxigrip® [Sanofi Pasteur]) and pH1N1 vaccine (Panvax®, CSL Biotherapies), which were also in use in this age group throughout 2010. These epidemiologic data were supported by two retrospective cohort studies of children given influenza vaccines, including Fluvax®/Fluvax junior® in Australia and in New Zealand.[45] The use of the 2010 seasonal TIV in children <5 years of age was suspended in April 2010,[3] after which reporting of AEFI from seasonal influenza vaccine declined. The recommendation to resume the use of seasonal influenza vaccine in children aged 6 months to 5 years, using brands other than Fluvax® and Fluvax junior®, was subsequently made in August 2010.[4] This issue was initially detected in Western Australia, where a funded influenza vaccine was provided for all children aged 6 months to 5 years via a state-based program. In other jurisdictions, NIP-funded influenza vaccine is only provided to children with medical risk factors. While dose-based reporting rates were difficult to estimate due to lack of consistent reporting of influenza vaccines to the ACIR, subsequent analyses found a similar rate of febrile convulsions following Fluvax® in other jurisdictions to that in Western Australia.[45] A biologic cause for the increased rate of fever and febrile convulsions in young children following the 2010 Fluvax®/Fluvax junior® vaccine has not yet been determined; however, investigations are ongoing.

Stimulated reporting associated with a new vaccine (pH1N1) and a vaccine safety issue (Fluvax®) is likely to have resulted in increased reporting of milder AEFI and for other vaccines. AEFI reporting rates for non-influenza vaccines in children were higher in 2010 compared with 2009. However, after excluding reports of influenza vaccines, the population-based AEFI reporting rate in children aged <7 years (31.1 per 100,000 population) was approximately one-quarter that of the overall rate for 2010 in that age group (134.1). This is consistent with AEFI reporting rates in 2004–2008.

The recent increase in reports from members of the public (13% in 2010 compared with 3% in 2008) indicates a high level of public interest in both the pH1N1 and seasonal influenza vaccines. This is likely to be due at least in part to the active promotion of the reporting of events following pH1N1 vaccination directly to TGA,[40] as well as the issues mentioned above.

Conclusion

There was a 58% higher rate of AEFIs per 100,000 population in 2010 compared with 2009. The high rate in 2010 was attributable to a large number of reports following receipt of the pH1N1 vaccines across all age groups, and seasonal influenza vaccines, particularly in children. A higher proportion of these events were reported directly to the TGA by members of the public following promotion of this for pH1N1. The majority of reports were of mild transient events. Increases in reporting following introduction of a new vaccine (pH1N1) are

expected. However, high rates of febrile convulsions and fever following seasonal influenza vaccine, predominantly in Western Australia where the vaccine was offered to all children aged 6 months to <5 years, ultimately resulted in the removal of the indication for the use of Fluvax® and Fluvax junior® in children of that age, nationally.[3] A joint working party of the Australian Technical Advisory Group on Immunisation and the TGA was established to consider the reports of febrile convulsion in children and to provide advice around the possible resumption of the program. The working party returned its findings in July 2010, with the result that the Chief Medical Officer recommended Fluvax Junior® not be used in children <5 years of age, and that the other seasonal influenza vaccines available in Australia and registered for use in young children (Vaxigrip® and Influvac®) be used instead.[4] Subsequent advice was provided in March 2011 stating that Fluvax® can only be used in children aged 5 to <10 years if other brands are unavailable. The regular analysis of AEFI surveillance data is very important in examining trends in AEFI and stimulating investigations into potential safety signals.

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Abbreviations of vaccine types

BCG	Bacille Calmette-Guérin (i.e. tuberculosis)
dT	diphtheria-tetanus – adolescent and adult formulation
DTPa	diphtheria-tetanus-pertussis (acellular) – paediatric formulation
dTpa	diphtheria-tetanus-pertussis (acellular) – adolescent and adult formulation
dTpa-IPV	combined dTpa and inactivated poliovirus
DTPa-HepB	combined diphtheria-tetanus-pertussis (acellular) and hepatitis B
DTPa-IPV	combined diphtheria-tetanus-pertussis (acellular) and inactivated poliovirus (quadrivalent)
DTPa-IPV-HepB	combined diphtheria-tetanus-pertussis (acellular), inactivated poliovirus and hepatitis B (pentavalent)
DTPa-IPV-HepB-Hib	combined diphtheria-tetanus-pertussis (acellular), inactivated poliovirus, hepatitis B and *Haemophilus influenzae* type b vaccine (hexavalent)
HepB	hepatitis B
Hib	*Haemophilus influenzae* type b
Hib-HepB	combined *Haemophilus influenzae* type b and hepatitis B
HPV	human papillomavirus
IPV	inactivated poliovirus vaccine
Men4PV	meningococcal polysaccharide tetravalent vaccine
MenCCV	meningococcal C conjugate vaccine
MMR	measles-mumps-rubella
OPV	oral poliovirus vaccine
pH1N1	pandemic H1N1 influenza 2009
7vPCV	7-valent pneumococcal conjugate vaccine
10vPCV	10-valent pneumococcal conjugate vaccine
23vPPV	23-valent pneumococcal polysaccharide vaccine

Australian Rotavirus Surveillance Program annual report, 2010/11

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Abstract

The Australian Rotavirus Surveillance Program together with collaborating laboratories Australia-wide conducts a laboratory based rotavirus surveillance program. This report describes the genotypes of rotavirus strains responsible for the hospitalisation of children with acute gastroenteritis during 1 July 2010 to 30 June 2011. This report represents the fourth year of surveillance following introduction of rotavirus vaccines into the National Immunisation Program. One thousand one hundred and twenty-seven faecal samples were referred to the centre for G and P genotype analysis using hemi-nested multiplex reverse transcription-polymerase chain reaction. Eight hundred and sixteen samples were confirmed as rotavirus positive. Of these, 551 were collected from children under 5 years of age, while 265 were from older children and adults. Genotype analysis revealed that a change in the dominant type occurred in this reporting period, such that genotype G2P[4] was the dominant type nationally, representing 51% of samples, followed by genotype G1P[8] (26.1%). Genotypes G3P[8] represented 11% of samples while G4P[8] re-emerged as an important genotype, and was identified in 6% of samples. Uncommon rotavirus G and P combinations continue to be identified, with G2P[8] and G9P[4] identified during this survey. Differences in genotype distribution based on vaccine usage continue to be evident in Australian states. This survey continues to highlight the fluctuations in rotavirus genotypes, with an annual change in dominant genotypes suggesting a more dynamic wild-type population. *Commun Dis Intell* 2011;35(4):281–287.

Keywords: Rotavirus, gastroenteritis, genotypes, disease surveillance

Introduction

Rotaviruses are a major cause of severe diarrhoea in young children worldwide.[1] The development of two live oral rotavirus vaccines Rotarix® (GlaxoSmithKline) and RotaTeq® (Merck) was undertaken in an effort to decrease the substantial disease burden. Extensive clinical trials have shown both vaccines to be safe and highly effective in the prevention of severe diarrhoea and hospitalisation due to rotavirus infections.[2,3]

In Australia, rotavirus vaccines were introduced into the National Immunisation Program (NIP) for all infants from 1 July 2007, with all state health departments making independent decisions on which vaccine to use. RotaTeq is administered in Victoria, South Australia, Western Australia (since May 2009) and Queensland, while Rotarix is in use in New South Wales, the Northern Territory, Tasmania and the Australian Capital Territory. In the pre-vaccine era, rotavirus infection accounted for up to 10,000 childhood hospitalisations for diarrhoea each year.[4] The introduction of rotavirus vaccines into the NIP has shown an early impact on the large disease burden of rotavirus, with significant declines in hospitalisation and emergency room visits reported since vaccine introduction.[5] Postmarketing surveillance for intussusception following rotavirus vaccination has revealed no overall increase, although there is some evidence of a slight elevated risk after the first dose of both vaccines.[6]

The National Rotavirus Surveillance Program has been reporting the changing annual pattern of dominant genotypes in the Australian population since 1999. Over this period, results have highlighted the diversity of rotavirus strains capable of causing disease in children, and provided the baseline information of the pattern of circulating strains prior to vaccine introduction.[7]

The introduction of rotavirus vaccines into Australia will increase the population immunity to rotavirus, this in turn is likely to impact on the epidemiology of circulating wild-type strains. Changes in the prevalence of common genotypes, as well as emergence of new or rare genotypes are all possible. Therefore, investigation of circulating rotavirus genotypes will provide insight into whether vaccine introduction has impacted on virus epidemiology, and provide findings that can validate prior assumptions concerning the consequences of vaccination programs.

This report describes the genotype characterisation of rotavirus strains causing severe gastroenteritis in children in Australia for the period 1 July 2010 to 30 June 2011.

Methods

Rotavirus positive specimens detected by enzyme immunoassay (EIA) or latex agglutination in collaborating laboratories across Australia were col-

lected, stored frozen and forwarded to the National Rotavirus Reference Centre in Melbourne, together with relevant age and sex details.

Viral ribonucleic acid (RNA) was extracted from each specimen using an RNA extraction kit (Qiamp Viral mini extraction kit, Qiagen) according to the manufacturers instructions. The G and P genotype of each specimen was determined by hemi-nested multiplex reverse transcription/polymerase chain reaction (RT-PCR) assays. The first round RT-PCR was performed using the Qiagen one step RT-PCR kit, using VP7 conserved primers VP7F and VP7R, or VP4 conserved primers VP4F and VP4R. The second round genotyping PCR reaction was conducted using specific oligonucleotide primers.[8–10] A G and P genotype was assigned for each sample based on agarose gel analysis of second round PCR products.

Results

Number of isolates

A total of 1,127 specimens were received for analysis from 16 collaborating centres across Australia; located in Victoria, Western Australia, the Northern Territory, New South Wales, Queensland, South Australia and Tasmania.

Eight hundred and sixteen samples were confirmed as rotavirus positive by EIA (ProspecT, OXOID) or RT-PCR analysis. Of these, 551 were from children under 5 years of age and 265 samples were from older children and adults. The remaining 311 specimens contained either insufficient specimen for genotyping (n = 42), or the specimen was not confirmed to be positive for rotavirus (n = 269), and were not analysed further.

Age distribution

In the current survey period 551 specimens were from children aged 5 or less. In this cohort, 20.2% of cases were from infants 0–6 months of age, 10.2% were from infants 7–12 months of age, 20.7% from infants 13–24 months of age, 15.3% from infants 25–36 months of age, 18% from children 37–48 months of age and 15.5% from children 49–60 months of age. Sixty-six samples were obtained from children 5–10 years of age, 24 were from individuals aged 10–20 years, 72 were from individuals aged 21–80 years, and 103 were from individuals aged 80–100 years.

Genotype distribution

The rotavirus genotypes identified in Australian children 5 years of age or younger, from 1 July 2010 to 30 June 2011 are shown in the Table.

G2P[4] strains were the most common genotype identified, representing 51% of all specimens analysed, and was identified in all states and territories. It was the dominant type in five locations, New South Wales, Western Australia, South Australia, Queensland and Victoria, representing between 36% and 71% of strains in these locations. In the Northern Territory G2P[4] represented 4.2% of samples.

G1P[8] strains were the second most common type nationally, representing 26.1% of all specimens, and was the dominant type only in the Northern Territory, representing 86.1% of strains. It was the second most common strain in another four locations, Queensland, Western Australia, South Australia and Victoria.

G3P[8] strains were identified in all locations, representing 11.1% of strains nationally. It was the second most common strain in New South Wales (15.7%), and was the third most common strain in Queensland, Western Australia and Victoria (24%, 12.5% and 9%).

G4P[8] strains represented the fourth most common type Australia-wide, being identified in four locations (Western Australia, Queensland, New South Wales and Victoria). In New South Wales and Western Australia it represented 12.3% and 8.4% of strains respectively.

Three G9P[8] strains were identified, one each in New South Wales, the Northern Territory and South Australia. A G3P[6] strain was identified during this study period in Western Australia.

Eleven samples were found to possess uncommon genotype combinations of VP4 and VP7; five G2P[8] strains were identified in New South Wales (n = 2), the Northern Territory (n = 2), and Western Australia. Three G9P[4] strains were identified in Victoria (n = 2) and Queensland, while additional P[4] strains identified associated with G4, G8 or G9 VP7 proteins in New South Wales, Tasmania Queensland and Victoria. Two G8P[9] strains were identified in the Northern Territory and Western Australia. A single G2P[5] strain which resembles the genotype of a component of the RotaTeq vaccine was identified in Western Australia.

Thirteen samples containing multiple G and/or P genotypes were identified. While, in less than 1% of samples either a G- or P-Type could not be assigned. These are likely to be samples with virus numbers below the detection limits of our typing assays, or could have contained inhibitors in extracted RNA to prevent the function of the enzymes used in RT and/or PCR steps.

Table: Rotavirus G and P genotype distribution in Australian children ≤ 5 years, 1 July 2010 to 30 June 2011

Centre	Type Total	G1P[8] %	G1P[8] n	G2P[4] %	G2P[4] n	G3P[8] %	G3P[8] n	G4P[8] %	G4P[8] n	G9P[8] %	G9P[8] n	Mix %	Mix n	Other* %	Other* n	Non-type %	Non-type n
New South Wales																	
Sydney (POW)	27	15	4	41	11	44	12	0	0	0	0	0	0	0	0	0	0
Sydney (Westmead)	35	14	5	71	25	3	1	0	0	3	1	0	0	6	2	3	1
Newcastle	27	11	3	30	8	7	2	41	11	0	0	4	1	4	1	4	1
Total	89	40	12	142	44	54	15	41	11	3	1	4	1	10	3	7	2
Northern Territory																	
Alice Springs	18	61	11	11	2	11	2	0	0	6	1	0	0	11	2	0	0
Darwin	39	97	38	0	0	0	0	0	0	0	0	0	0	3	1	0	0
Western Diagnostic	15	87	13	7	1	7	1	0	0	0	0	0	0	0	0	0	0
Total	72	245	62	18	3	18	3	0	0	6	1	0	0	14	3	0	0
Queensland																	
Qld Health	7	0	0	29	2	43	3	0	0	0	0	0	0	14	1	14	1
Qld Royal Children's Hospital	26	27	7	35	9	31	8	4	1	0	0	4	1	0	0	0	0
Pathology (Townsville)	7	86	6	14	1	0	0	0	0	0	0	0	0	0	0	0	0
Pathology (Gold Coast)	5	20	1	80	4	0	0	0	0	0	0	0	0	0	0	0	0
Total	45	133	14	158	16	74	11	4	1	0	0	4	1	14	1	14	1
South Australia																	
Adelaide	65	18	12	71	46	5	3	0	0	2	1	5	3	0	0	0	0
Tasmania																	
Hobart	4	25	1	25	1	25	1	0	0	0	0	0	0	25	1	0	0
Victoria																	
Melbourne Path	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Royal Children's Hospital	50	32	16	40	20	14	7	8	4	0	0	2	1	4	2	0	0
Monash	14	21	3	64	9	7	1	0	0	0	0	7	1	0	0	0	0
Total	64	53	19	104	29	21	8	8	4	0	0	9	2	4	2	0	0
Western Australia																	
PathWest	172	13	22	65	112	9	15	8	13	0	0	3	5	2	4	1	1
Perth	40	10	4	70	28	5	2	13	5	0	0	3	1	0	0	0	0
Total	212	23	26	135	140	14	17	21	18	0	0	6	6	2	4	1	1
Total Australia	**551**	**26**	**146**	**51**	**279**	**11**	**58**	**6**	**34**	**1**	**3**	**2**	**13**	**3**	**14**	**1**	**4**

Other genotypes identified:

G2P[5] PathWest

G2P[8] Westmead/ Newcastle/ Alice Springs (x2)/ PathWest

G3P[6] PathWest

G4P[4] Westmead

G8P[9] Darwin/ PathWest

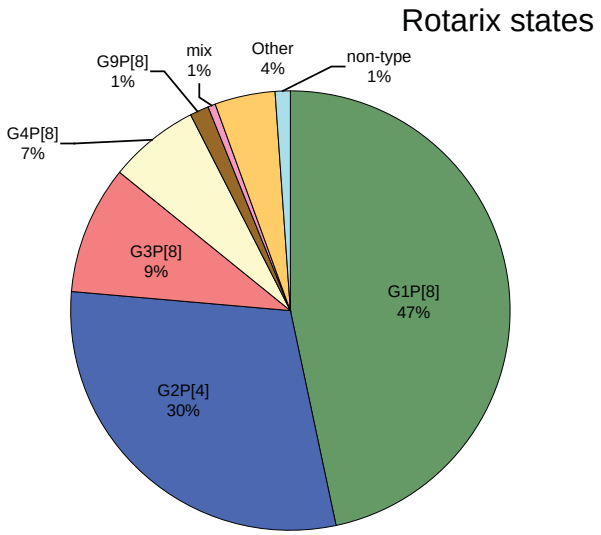
G8P[4] Hobart

G9P[4] Qld health/ Royal Children's Hospital (x2)

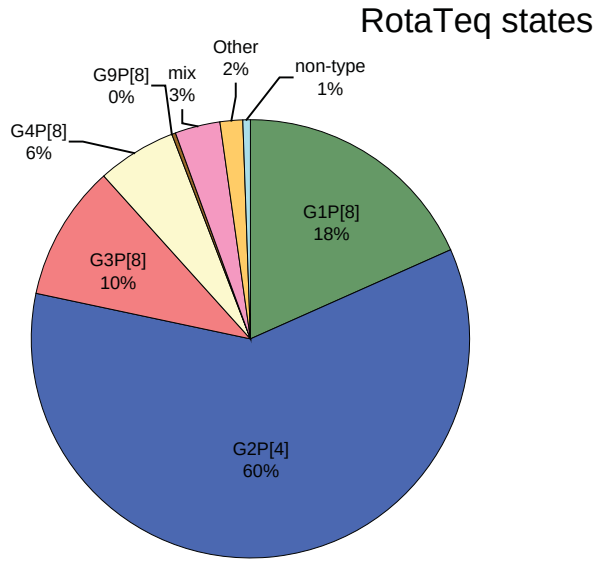
Over 300 rotavirus samples were collected from older children and adults. The majority of these that were confirmed as rotavirus and genotyped were collected from South Australia and Western Australia (168/199). Genotype analysis of the rotavirus samples from older individuals (> 10 years of age) showed a similar distribution to that observed in young children, with G2P[4] being the dominant genotype.

The Figure details the distribution of rotavirus G and P genotypes in states using Rotarix (New South Wales, the Northern Territory and Tasmania) compared with the distribution in states using RotaTeq (Victoria, Queensland, South Australia and Western Australia). Analysis of fully G and P typeable samples revealed that in RotaTeq states, G2P[4] was the dominant genotype, identified in 59.8% of strains, while G1P[8] comprised 18.4% of strains. In Rotarix states, G1P[8] strains were dominant (46.6%), while G2P[4] strains comprised 29.8% of specimens. G3P[8], G4P[8] and G9P[8] strains were all identified at similar rates in both settings. Rare or uncommon strains appeared to occur at slightly higher rate in Rotarix studies (4.3%) when compared with RotaTeq states at 1.8%.

Figure: Overall distribution of rotavirus G and P genotypes identified in Australian children based on vaccine usage for 1 July 2010 to 30 June 2011



Rotarix was used in New South Wales, Tasmania, and the Northern Territory



RotaTeq was used in Victoria, South Australia, Western Australia and Queensland

The number of samples analysed differed significantly between Rotarix and RotaTeq sites, with 386 samples analysed from RotaTeq locations and 161 from Rotarix locations. This in part is due the large number of samples obtained during this reporting period from Western Australia. In a subset analysis where Western Australia genotypes were removed, the genotype distributions in the remaining samples did not differ significantly than those obtained using the complete dataset.

Faecal specimens were received from 19 children who developed rotavirus gastroenteritis after being vaccinated with either RotaTeq or Rotarix. RotaTeq vaccine virus was identified in two of these cases by RT-PCR and sequence analysis.

Discussion

The Australian Rotavirus Surveillance Program report for 1 July 2010 to 30 June 2011 describes the annual cases and geographic distribution of rotavirus genotypes causing disease in Australian children. The surveillance program identified that genotype G2P[4] emerged as the dominant genotype nationally, representing 49.8% of all strains. This genotype was the dominant type in five of the seven states or territories where samples were collected. Genotype G1P[8] was the second predominant type nationally, comprising 26.3% of all strains, however it was the dominant type only in the Northern Territory and Queensland. Genotype G3P[8] represented the third most common genotype, representing more than 10% of strains nationally. The emergence of G4P[8] as an important cause of disease in this period is the first time during the past 5 years that it has been an important genotype. Previously, G4 strains have represented less than 1% of the circulating strains.[5] This report highlights the continual fluctuations in genotypes, and reveals that G2P[4] re-emerged as the dominant genotype, an occurrence observed previously during 2008–09 season.[11]

The fluctuations in rotavirus genotypes appear more pronounced than in the pre-vaccine period. In the 4 years since vaccine introduction, a different genotype has emerged as the dominant type each

year. In contrast, in the 11 years pre-vaccine introduction, G1P[8] was the dominant type in eight of the 11 rotavirus seasons.[7,11–13]

Australia continues to provide a unique opportunity to compare the effect of each vaccine on the circulating wild-type strains. During the first 2 years post-vaccine introduction, differences have been observed in genotype distribution depending on the vaccine used.[13] As previously reported, the emergence of G2P[4] strains were more commonly identified in locations using Rotarix vaccine, while G3P[8] strains were more common in locations using RotaTeq.[13] In the third season post vaccine ,G2P[4] strains were dominant in RotaTeq locations and G1P[8] in Rotarix locations.[14] During this reporting period G2P[4] remained dominant in RotaTeq locations, as well as two of the three states using Rotarix: New South Wales and Tasmania. In the remaining Rotarix state, G1P[8] remained the dominant type. Thus differences were evident in genotype distribution, however it is unclear whether this is a selection process specific for each type of vaccine or a generic effect.

The worldwide interest in uncommon rotavirus genotypes continues because of the possible impact they could have on rotavirus vaccine programs. Several uncommon VP7/VP4 genotype combinations were again identified; including G1P[4], G2P[8], and G9P[4]. These continue to persist in low numbers at similar levels, as reported in two previous surveillance reports. Since vaccine introduction, the prevalence of these uncommon types has increased. However, it is not clear whether this is due to vaccine introduction exerting an increase selective pressure or simply natural variation is unclear at the moment.

This report details a significant increase in rotavirus positive samples in adults. This is considered to be a real increase demonstrated by an increasing proportion of rotavirus positive samples among adults compared with previous years and not an artefact of increased overall sample numbers. The increase of severe diarrhoea in adults in South Australia and Western Australia may reflect the first evidence that changes in antigenic profile of commonly circulating genotypes is occurring. The changes in recently circulating strains may allow them to evade immune protection generated by exposure to older historical strains. Ongoing analysis of the outbreaks are underway, however, the emergence of rotavirus in these settings may be due to waning of existing immunity, and/or changes in antigenic makeup of the current wild-type strains. Recent reports from the United States of America (USA) have also detailed several rotavirus diarrhoeal outbreaks in the elderly in nursing homes.[15] Rotavirus has previously been shown to cause 16% of diarrhoeal outbreaks in elderly populations,[16] but whether the rates have increased in past years is unclear. Further study is required to understand the role rotavirus has in the elderly population in settings such as nursing homes.

Surveillance of genotype distribution post vaccine introduction has been investigated in several other countries including the USA and Belgium.[17,18] In Belgium, where Rotarix is mainly in use, a significant increase in G2P[4] has been observed for the first 2 years of vaccine use,[17] while in the USA where RotaTeq is predominantly used, G3P[8] has predominated for several years post vaccine introduction.[18,19] Further evaluation of genotype distribution in multiple countries is required to understand whether vaccine driven selection is indeed present.

This survey has further highlighted the continued fluctuations in rotavirus genotypes across Australia. However, the rapidly changing genotype patterns do illustrate a more dynamic wild-type population thus suggesting that vaccine pressure may be speeding up the selection process. This is supported by the observation of an increase in cases in older children and adults during the current survey period. Therefore the ongoing evolution of the wild-type strains circulating in Australia will require close monitoring to identify any changes that may emerge and impact on vaccine effectiveness.

Acknowledgements

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Rotavirus positive specimens were collected from numerous centres throughout Australia. The significant time and effort involved in the collection, storage, packaging, compiling data and forwarding of specimens was much appreciated.

The laboratories contributing samples were:

Princess Margaret Hospital for Children, Subiaco, Western Australia

Division of Microbiology, PathWest LM, The Queen Elizabeth Medical Centre, Nedlands, Western Australia

The Microbiology Department, Royal Darwin Hospital, Casuarina, Northern Territory

The Department of Microbiology, Western Diagnostic Pathology, Northern Territory and Western Australia

The Microbiology Department, Alice Springs Hospital, Alice Springs, Northern Territory

The Virology Division, Prince of Wales Hospital, New South Wales

The Microbiology Department, The Children's Hospital at Westmead, New South Wales

The Microbiology Department, John Hunter Hospital, Newcastle, New South Wales

Forensic and Scientific Services, Queensland Health, Herston, Queensland

Pathology Queensland, Herston, Queensland

The Queensland Paediatric Infectious Diseases Laboratory, Royal Children's Hospital, Brisbane, Queensland

The Queensland Health laboratories in Townsville, Cairns and Gold Coast, Queensland

The Virus Laboratory Institute of Medical and Veterinary Science, Adelaide, South Australia

Royal Hobart Hospital and the Communicable Disease Prevention Unit, Department of Health and Human Services, Hobart, Tasmania

The Virology Department, Royal Children's Hospital, Parkville, Victoria

The Department of Microbiology, Melbourne Pathology, Victoria

The National Rotavirus Surveillance Group includes:

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Dr A Kesson, Ms I Tam and members of the Microbiology Department, The Children's Hospital at Westmead

Dr R Givney and members of the Microbiology Department, John Hunter Hospital, Newcastle

Northern Territory

Dr P Southwell, Ms J Hennessy and members of the Microbiology Department, Royal Darwin Hospital, Casuarina

Dr M Leung, Ms E Langford and members of the Department of Microbiology, Western Diagnostic Pathology, Northern Territory and Western Australia

Mr J McLeod and members of the Microbiology Department, Alice Springs Hospital, Alice Springs

Ms H Cook, Centres for Disease Control, Darwin

Queensland

Dr M Lyon, Mr M Finger, Forensic and Scientific Services, Queensland Health, Herston

Dr M Nissen and department members, Pathology Queensland, Herston

Dr S Lambert, Miss Narelle George and members of the Queensland Paediatric Infectious Diseases Laboratory, Royal Children's Hospital, Brisbane

Mr R Enbom, Ms G Gilmore, Ms P Derrington and members of the Queensland Health laboratories in Townsville, Cairns and Gold Coast

South Australia

Professor G Higgins, Ms L Payne and members of the Virus Laboratory Institute of Medical and Veterinary Science, Adelaide

Tasmania

Mr D Coleman, Mr D Jones and members of the Communicable Disease Prevention Unit, Department of Health and Human Services, Hobart

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Dr R Alexander and members of the Virology Department, Royal Children's Hospital, Parkville

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Flutracking weekly online community survey of influenza-like illness annual report, 2010

Craig B Dalton, Sandra J Carlson, Michelle T Butler, John Fejsa, Elissa Elvidge, David N Durrheim

Abstract

Flutracking is a national weekly online survey of influenza-like illness (ILI) completed by community members. Flutracking integrates participants' ILI symptom information with their influenza vaccination status to monitor influenza activity and field vaccine effectiveness (FVE). This report summarises results from the 2010 Flutracking season compared with previous seasons. Nationally, participation in Flutracking has more than doubled between 2008 and 2010, with 5,346 new participants enrolled or recruited in 2010 and a peak weekly participation of 10,773. By the end of the 2010 season, 5,904 of 9,109 (64.8%) participants had received the monovalent pandemic vaccine and/or the 2010 seasonal vaccine. From 2007 to 2010 FVE calculations demonstrated that the seasonal vaccine was effective except in 2009 during the pandemic. Peak 2010 ILI activity occurred in early June and August, and peak weekly 2010 ILI rates (4.2% among unvaccinated participants) were lower than the peak ILI rates during the 2009 pandemic (6.0% among unvaccinated participants). However, the decrease in laboratory notifications was much larger than the decrease in Flutracking rates. In summary, the number of Flutracking participants continued to steadily increase over the 2010 influenza season. The system has shown value in providing weekly vaccination uptake data during and beyond the 2009 influenza pandemic, as well as rapid FVE estimates that are qualitatively aligned with findings from other analyses of vaccine efficacy. Flutracking has also provided estimates of weekly community ILI activity that were not biased by health seeking behaviour and clinician testing practices. *Commun Dis Intell* 2011;35(4):288–293.

Keywords: influenza, surveillance, syndromic surveillance, influenza-like illness, survey, Flutracking.

Background

Influenza activity in the Australian community is monitored by the Australian Government Department of Health and Ageing using a variety of surveillance systems.[1] Flutracking is a national weekly online survey of influenza-like illness (ILI) completed by community members.[2–5] Flutracking was originally trialled in 2006 in the Hunter New England regional health service of New South Wales with a view to contributing broader population information on ILI. Flutracking was progressively expanded nationally in 2007, and by 2010 approximately 9,000 community members participated each week.

The main aims of Flutracking are to:

1. compare ILI syndrome rates between vaccinated and unvaccinated participants to detect inter-pandemic and pandemic influenza and provide early confirmation of vaccine effectiveness or failure;
2. provide consistent surveillance of influenza activity across all jurisdictions and over time unbiased by health seeking behaviour or patient testing practices;
3. provide a year-to-year comparison of the timing, incidence, and severity of influenza; and
4. from 2011, construct a burden of illness pyramid for influenza.

Flutracking integrates participants' ILI symptom information with their influenza vaccination status to detect influenza activity and monitor vaccine efficacy. Surveys take less than 15 seconds to complete and it is the only ILI surveillance system that provides comparable data across Australia's states and territories. Flutracking surveillance has correlated well with other Australian influenza surveillance systems in describing the timing and scale of the 2007 and 2008 seasonal influenza epidemics.[3,4] During the 2009 influenza pandemic, Flutracking was able to accurately detect the timing and peak of community ILI with less influence from treatment seeking behaviour and laboratory testing protocols than health-system based surveillance.[5]

This article will report on the 2010 findings from the Flutracking ILI surveillance system, including participation numbers compared with previous years, participant vaccination uptake for both the H1N1 pandemic (H1N1) 2009 monovalent and seasonal trivalent influenza vaccines, field vaccine effectiveness (FVE) estimates, weekly estimates of ILI and comparison of these estimates with other Australian influenza surveillance systems.

Methods

Survey methodology

In a typical influenza season, Flutracking operates from May to October. However, due to the 2009 influenza pandemic, the Flutracking surveillance system remained operational from May 2009 through to October 2010 in case of a second pandemic wave. All participants received an email advising that they could opt out between November 2009 and April 2010 and rejoin in winter of 2010.

Recruitment methodology

The methodology for recruitment in 2010 was similar to that used in 2007–09.[2] From 2008 recruitment expanded to allow a household member to respond to the survey on behalf of other members of their household of any age, and for children 12 years of age and above to complete their own survey online. However, in 2010 more focus was placed on recruitment of state-based government organisations rather than national organisations. Organisations in Western Australia, South Australia, the Northern Territory and the Australian Capital Territory were targeted in 2010, with a view to expanding Flutracking to be a truly national surveillance system to improve its representativeness and allow ILI rate comparison across states and territories. In 2010, 156 organisations were contacted and requested to participate in Flutracking.

The methodology for weekly data collection in 2010 was similar to that used in 2007–09.[5] However, in October 2009 an additional question was included in the online questionnaire asking whether the participant had been vaccinated with the pandemic (H1N1) 2009 monovalent vaccine to coincide with the roll-out of the national Pandemic (H1N1) 2009 Vaccination Program.

Participation and vaccination rate

Participation numbers were reported for the 2010 peak week in Flutracking (the week with the highest number of participants) at the national and state or territory level and compared with 2008 participation numbers. The rate of participation (per 100,000) in the Australian population was calculated using 2010 Flutracking participation numbers in the peak week of participation and the June 2010 Estimated Resident Population for each state and territory from the Australian Bureau of Statistics.[6]

Vaccination rates were calculated for the monovalent pandemic vaccine on a weekly basis at both the national and state or territory level from the time the vaccine was made available in October 2009. The denominator was the number of persons who completed at least one survey since the release of the H1N1 pandemic vaccine. The numerator was the number of participants who had received the monovalent pandemic vaccine since it became available. Once the 2010 trivalent seasonal vaccine, which included the pandemic (H1N1) 2009 strain, became available in April 2010, a combined vaccination rate for the seasonal and monovalent pandemic vaccine was reported at the national level on a weekly basis.

Field vaccine effectiveness

An FVE analysis was conducted for 2010 using New South Wales data, which has the highest concentration of participants in Flutracking, and compared with results from 2007, 2008 and 2009. As 2007 data did not include persons under the age of 18 years, FVE analyses for all years of data were restricted to participants 18 years of age or older. FVE was calculated as follows:

FVE = 100 x (1 – relative risk)
= 100 x (1 – (ILI rate in vaccinated group/ILI rate in unvaccinated group))

The ILI rate was calculated as the proportion of participants who had both fever and cough during the peak influenza period for each year. The peak influenza period was defined as the four consecutive weeks with the highest weekly Flutracking ILI rates. In 2007, this period included the Flutracking survey week ending 29 July to survey week ending 19 August, in 2008 this period included the Flutracking survey week ending 17 August to survey week ending 7 September, in 2009 this period included the Flutracking survey week ending 5 July to survey week ending 26 July, and in 2010 this period included the Flutracking survey week ending 15 August to survey week ending 5 September.

The denominators for the ILI rates over each of these peak periods was defined as the number of participants who had completed at least one survey during the peak influenza period in the unvaccinated and vaccinated groups. The numerators for the ILI rates for the peak influenza periods was defined as the number of participants who experienced at least one episode of fever and cough during the peak influenza period in the unvaccinated and vaccinated groups. A participant was defined as being vaccinated if they responded 'yes' to the survey question about influenza vaccination at the beginning of the peak influenza period. Participants who changed their vaccination status during the peak influenza period were excluded

from the VE analysis. The 95% confidence intervals for each VE estimate were calculated using method B, outlined in Ewell (1996).[7]

Weekly influenza-like illness attack rates and comparison with national laboratory influenza notifications

An analysis of the difference in ILI attack rates amongst vaccinated and unvaccinated participants was conducted at both the national level and state or territory level for states and territories with greater than 1,000 participants. Vaccination was defined as having received either the monovalent pandemic vaccine since it was made available or the seasonal vaccine in 2010. ILI rates were reported using a definition of fever and cough in the preceding week. The unstratified (by vaccination status) ILI rates were compared with laboratory confirmed influenza notifications from the National Notifiable Diseases Surveillance System[8] for 2009 to 2010.

Results

Participation in 2010

Flutracking has achieved a marked increase in the number of participants between 2008 and 2010 (Table 1). Nationally, participation has more than doubled. At a state or territory level, increases have been most marked in the Northern Territory, South Australia, and Queensland. Tasmania has the highest rate of Flutracking participation per 100,000 persons, followed by South Australia and the Northern Territory.

Table 2 shows the number of participants who joined the Flutracking survey in 2010, as compared with 2009. Most participants registering for the first time in 2010 did so in May and June, most likely as a direct result of targeted recruitment strategies.

Overall, compared with 2009, there was an 18.5% increase in the number of participants who registered to participate in Flutracking for the first time in 2010. Of the 12,603 participants who completed at least one survey in 2010, 58% have participated for more than one season.

Comparing the average number of weekly participants before and after the 2009/2010 summer opt-out option was introduced, 81% (5,541/6,850) of participants remained active over summer.

Vaccination rates

By the end of 2009 (data for the week ending 13 December 2009), 2,121 participants (or 27.9% of those who responded to at least one survey since the 2009 H1N1 pandemic) had received the monovalent pandemic vaccine. Of the 1,975 Flutrackers who worked face-to-face with patients, 799 (40.5%) had received this vaccine. Figure 1 shows that by

Figure 1: Per cent of participants vaccinated for pandemic (H1N1) 2009, February to April 2010, by state and survey week

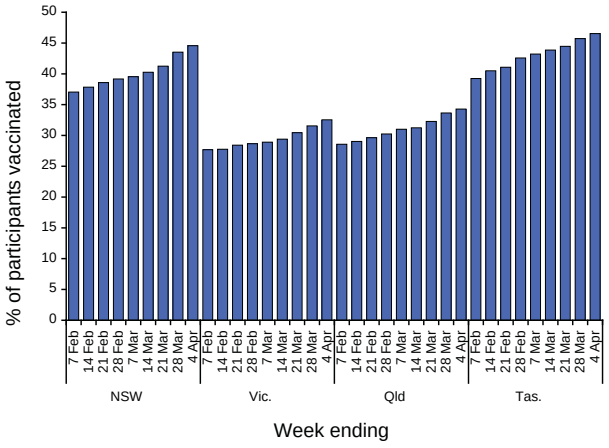


Table 1: Recruitment to Flutracking, 2008 to 2010, by state or territory

State or territory	Number of respondents (peak week) 2008	Number of respondents (peak week) 2010	Percentage positive change	Population (from June 2010 ERP,* ABS†)	Rate of Flutracking participation per 100,000 population
ACT	159	229	44.0	358,571	63.9
NSW	2,689	3,216	19.6	7,232,589	44.5
NT	2	329	16,350.0	229,711	143.2
Qld	158	1,077	581.6	4,513,850	23.9
SA	52	2,694	5,080.8	1,644,582	163.8
Tas	1,235	1,296	4.9	507,643	255.3
Vic	404	1,495	270.0	5,545,932	27.0
WA	128	437	241.4	2,293,510	19.1
Total	4,827	10,773	123.2	22,328,847	48.2

* Estimated Resident Population

† Australian Bureau of Statistics

Table 2: Number of participants who registered for themselves (primary respondents) and other household members to participate in Flutracking for the first time in 2009 and 2010

Month of registration	Total joined in 2009	Primary respondents joined in 2010	Household members of primary respondents joined in 2010	Total joined in 2010	% change in registration by month from 2009 to 2010
Jan	2	14	18	32	1,500.0
Feb	412	17	19	36	–91.3
Mar	39	200	94	294	653.8
Apr	611	93	68	161	–73.6
May	2,710	2,224	680	2,904	7.2
Jun	428	741	400	1141	166.6
Jul	123	62	59	121	–1.6
Aug	70	526	123	649	827.1
Sep	52	10	5	15	–71.2
Oct	32	3	8	11	–65.6
Nov	21	0	0	0	–100.0
Dec	26	0	0	0	–100.0
Total	4,526	3,890	1,474	5,364	18.5

April 2010 (soon after the 2010 seasonal influenza vaccine was made available) Flutracking participants from New South Wales and Tasmania had the highest vaccination rates against pandemic (H1N1) 2009 for those states with sufficient Flutracking participants to allow a stable analysis.

By the end of the 2010 season (week ending 17 October 2010), 5,904 of 9,109 (64.8%) participants had received the monovalent pandemic vaccine and/or the 2010 seasonal vaccine. Of the 2,059 participants who identified as working face-to-face with patients, 1,596 (77.5%) received one or both of these vaccines.

Field vaccine effectiveness

From 2007 to 2010 our FVE calculation for New South Wales participants demonstrated that the seasonal vaccine was effective except in 2009 during the pandemic (Figure 2).

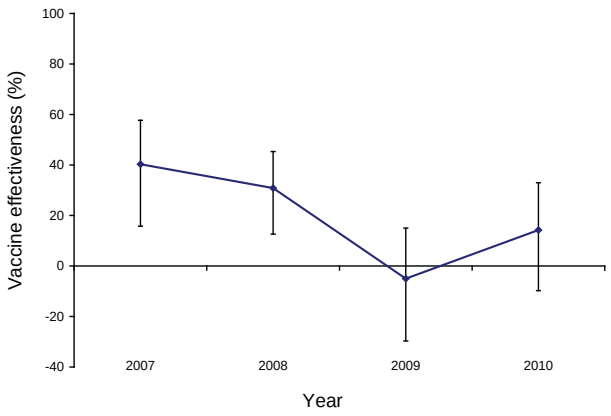
Detection of influenza-like illness

Figure 3 shows the 2010 weekly ILI rates stratified by vaccination status. This figure shows that the divergence between the vaccinated and unvaccinated participant's ILI rates was largest in early June and August, and that peak 2010 ILI rates (4.2% among unvaccinated participants) were much lower than the peak ILI rates during the 2009 pandemic (6.0% among unvaccinated participants).

Comparison with national laboratory influenza notifications

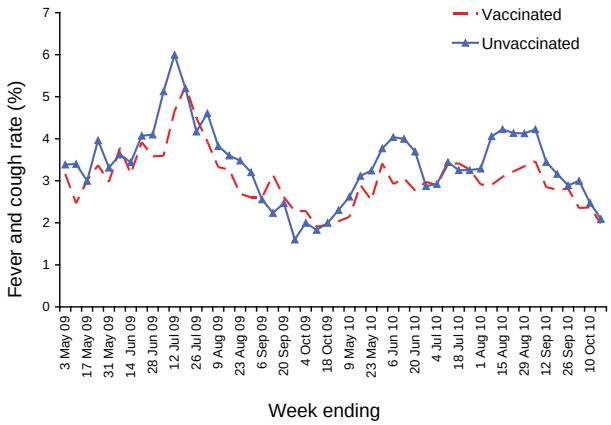
From Figure 4 it can be seen that there was a substantial reduction in weekly notified cases of influenza from 2009 to 2010. Although Flutracking also

Figure 2: Field vaccine effectiveness for peak four weeks in New South Wales in participants greater than or equal to 18 years of age



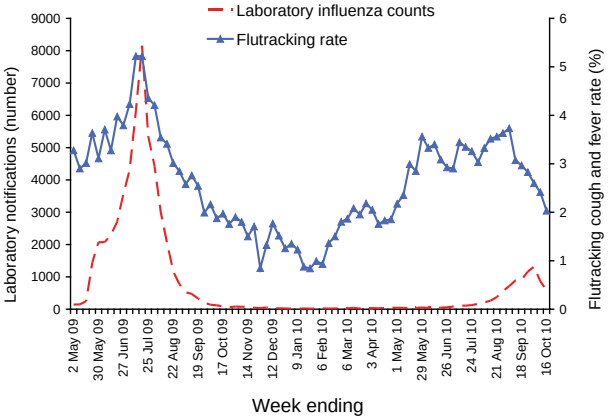
95% confidence intervals are represented by the bars in the figure.

Figure 3: Weekly national fever and cough rates stratified by vaccination status, 2009 to 2010



showed a reduction in ILI attack rates from 2009 to 2010, this decrease was small compared with the decrease seen in laboratory notifications.

Figure 4: Percentage with fever and cough among Flutracking participants compared with influenza laboratory notifications, by week, Australia, 2009 to 2010



Discussion

Participation in the Flutracking survey has continued to grow during 2010 in each state and territory. The rate of recruitment to Flutracking compares favourably with other online influenza surveillance systems globally including Italy, which has grown to 3,454 participants from 2008[9] and Portugal, which has accumulated 2,538 participants since the 2005–06 influenza season.[9] Flutracking has a larger participant cohort than any of the online influenza surveillance systems in Europe[9] or the United States of America[10] apart from the Netherlands with a cohort of 17,952 participants.[9] However, the Dutch participant base has decreased over the last few years while Flutracking has increased. The United Kingdom Flusurvey decreased from 5,500 in 2009–10 to 703 in 2010–11.[9]

The steady growth in participants of Flutracking is most likely due to a combination of organic growth in participants who enrol due to referrals from existing participants, discovering the program on the Internet and enrolment from direct recruitment activities, including media releases and promotion of organisational email invitations.

Flutracking was the only surveillance system providing weekly updates of vaccination uptake when the new monovalent pandemic vaccine was released. The Flutracking surveillance system was able to identity differences in community uptake of pandemic vaccine at the jurisdictional level on a week by week basis.

The FVE calculated for 2010 was much lower than in 2007 and 2008, despite the vaccine composition matching the circulating strains.[11] Flutracking calculates an FVE using a clinical case definition which provides a lower estimate of FVE than a laboratory confirmed case definition and the effectiveness estimate will be even lower in years when influenza activity is low relative to other causes of ILI, which appears to be the case in 2010. Additionally, high rates of asymptomatic infection occurred with the pandemic (H1N1) 2009 influenza virus in 2009, likely leading to high rates of immunity in 2010.[12,13] High levels of naturally acquired immunity to influenza in 2010 combined with low attack rates could further blunt the calculated FVE. At the very least it appears that Flutracking FVE calculations are able to differentiate between a vaccine that is protective versus a vaccine failure/mismatch as occurred in 2009 due to the circulating novel pandemic strain.

The Flutracking FVE estimates have been qualitatively aligned with findings from other analyses of vaccine efficacy, which is reassuring, but being a symptom based case definition it cannot provide the same quantitative estimates that a laboratory confirmed outcome produces. The main benefit of Flutracking's FVE calculations are that they can provide a rapid qualitative indication of FVE, as occurred during the pandemic, if there was a significant vaccine failure.

Based on Flutracking data, the community attack rates in the 2010 influenza season were lower than 2009, and lower than most other Flutracking surveillance years. This suggests that a high rate of community immunity (either through vaccination or natural infection) led to low community ILI rates in 2010.

While there was a large reduction in laboratory notified cases of influenza from 2009 to 2010, a corresponding reduction was not seen in Flutracking data. We believe this indicates that much of the surge in laboratory notifications in 2009 was mediated by clinical and health seeking behaviour rather than community influenza rates. The enhanced laboratory testing of 2009 appears to have reverted back to more routine practice in 2010.

Based on the comparison with other surveillance systems, it appears that Flutracking data is not as biased by health seeking behaviour and clinician testing practices as emergency department and laboratory surveillance for ILI.[5] Flutracking will implement new questions for 2011 that identify the proportion of participants who seek health care and have swabs collected for influenza testing. These data will be important for further assessing health seeking and testing biases and understanding the

burden of influenza illness in Australia. Because influenza testing practices have changed since 2009, further work is required to understand how the year to year variation in laboratory confirmed influenza notifications should be interpreted.

Authors' contributions

Craig Dalton conceived and designed the project, oversaw the statistical analysis, and contributed to writing of the manuscript; Sandra Carlson contributed to the statistical analysis and writing of the manuscript; Michelle Butler contributed to the statistical analysis, John Fejsa; contributed to the design of the project and had primary responsibility for the online software and database development, as well as questionnaire design; Elissa Elvidge contributed to the daily operational running of the system; and David Durrheim contributed to the design of the project, statistical analysis, and writing of the manuscript.

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Short reports

Surveillance of adverse events following immunisation: the model of SAEFVIC, Victoria

Hazel J Clothier, Nigel W Crawford, Ann Kempe, Jim P Buttery

Abstract

State-based adverse events following immunisation (AEFI) reporting systems in Australia demonstrate marked regional differences in surveillance methodologies and reporting rates. To improve AEFI services in Victoria, Surveillance of Adverse Events Following Vaccination in the Community (SAEFVIC) was established in 2007. SAEFVIC comprises a central reporting enhanced passive surveillance system integrated with clinical services. AEFI may be reported by phone, fax or on-line. Immunisation nurse specialists follow up all reports, coupled with physician review as required. Supervised re-vaccination in a hospital environment, when appropriate, helps ensure clinical support for vaccinees, families and health-care providers. The *Brighton Collaboration*, the *Australian Immunisation Handbook* and in-house case definitions are used to categorise AEFI reports. In the first 3 years (2007–2010) of operation 3,265 reports were received, describing 4,293 AEFI. The number of reports received increased annually over the 3-year period. Seventy-six per cent of AEFI met one of 52 established case definitions and the remainder were recorded verbatim: 22% of reported AEFI were considered severe. Of 1,086 persons reporting an AEFI in 2009, 356 (36%) attended for a clinical consultation and 325 (83%) were revaccinated, of which 114 were day stay or overnight patients. Enhanced passive AEFI surveillance using integrated clinical services has been shown to improve adverse event reporting with reporting rates in Victoria increasing from 2.6 per 100,000 in 2003 to 13.5 per 100,000 per annum in 2009. This report describes the SAEFVIC service model and summarises outcomes and lessons learnt in the first 3 years of operation. *Commun Dis Intell* 2011;35(4):294–298.

Keywords: Surveillance, adverse event, immunisation, vaccine safety

Introduction

The international definition of an adverse event following immunisation (AEFI) is 'an unwanted or unexpected event following the administration of a vaccine(s). AEFI may be caused by a vaccine(s) or may occur by coincidence: that is, it would have occurred regardless of vaccination'. AEFIs also include conditions that may occur following the incorrect handling and/or administration of a vaccine.

In Victoria prior to 2007, AEFI surveillance was conducted as a passive system whereby reports were sent directly to the Adverse Drug Reaction Unit (ADRU) in the Therapeutic Goods Administration (TGA) and reviewed by the Adverse Drug Reactions Advisory Committee (ADRAC), now replaced by the Advisory Committee on the Safety of Medicines (ACSOM). This system was known to be insensitive and AEFI events appeared to be significantly under-reported: the overall reporting rate per 100,000 population in 2002 being 2.6 in Victoria, compared with the Australian Capital Territory (22.5 per 100,000) and South Australia (10.8 per 100,000) where enhanced surveillance systems were already in place.[1,2]

In May 2007, under contract with the Victorian Department of Health, an enhanced passive surveillance system known as Surveillance of Adverse Events Following Vaccination in the Community (SAEFVIC) was initiated. SAEFVIC comprised a partnership led by the Murdoch Childrens Research Institute, with the Royal Children's Hospital, the Victorian Infectious Diseases Service at the Royal Melbourne Hospital and Monash Medical Centre. The service continues to provide Victorian-wide enhanced passive surveillance integrated with a clinical support service. Patients and their families, and immunisation service providers can access advice and support from expert immunisation nurses and physicians. The objectives of the system were to: increase the number of AEFI reports, to maximise confidence in the immunisation program for those who have experienced AEFI, and importantly, to provide clinical feedback directly to vaccinees and the AEFI reporters. Effective clinical communication is paramount for SAEFVIC to function effectively.

Aims

SAEFVIC aims to provide increased early detection and appropriate rapid response to AEFI in adults and children, integrated with clinical support for reporting health care workers and patients/families.

The intention is to enhance the passive surveillance of all significant or rare AEFI, regardless of causality. The surveillance information is used to detect vaccine safety 'signals', prompt action and maintain confidence in immunisation programs. This collaboration aims to deliver a system with world-leading sensitivity for Victorian health authorities to rapidly detect and research vaccine safety concerns, whether they are new trends or just temporally associated events.

This report describes the Victorian SAEFVIC service model and summarises outcomes in the first 3 years of operation.

Methods

Reporting

AEFI may be reported by phone, fax or, as of 2010, on-line. SAEFVIC encourages reporting from health care professionals, including immunisation providers and accepts self or parent reports. Reports sent by the vaccine service-provider directly to the TGA are re-directed back to SAEFVIC. Once assessed by a SAEFVIC immunisation nurse all reports are forwarded to the TGA.

Follow-up

Accredited immunisation nurses follow up all reports of AEFI and discuss with reporters the nature of the AEFI, any ongoing concerns and strategies for future vaccinations. Informed consent to contact the vaccinee or their guardian is normally provided at the time of the report or at the time of follow-up. The initial contact is by telephone and a minimum of three attempts made, before a letter is sent to the reporter to advise SAEFVIC has been unable to follow-up with the case.

Clinical review

All persons reporting a serious AEFI (requiring hospitalisation or having ongoing sequelae) or those who have concerns about future vaccinations are offered the option to attend a clinical review with a medical specialist. Clinics are available on a weekly basis at the Royal Children's Hospital and on a fortnightly basis at Monash Children's Hospital. In addition, there are monthly adult vaccine safety clinics in two tertiary centres, the Royal Melbourne Hospital and the Monash Medical Centre. Clinic appointments are on average for 30 minutes and are organised so that revaccination, if indicated, is possible at the time of the appointment These may be provided in the hospital clinic under medical or nursing supervision if required. Supervised vaccination may be within the clinic, as a day patient or supported by an overnight admission depending on the severity and time of onset of previous AEFI. For rural areas, SAEFVIC clinicians can liaise with a local clinician to provide a more convenient consultation option.

Passive surveillance

AEFI are recorded using standard case definitions where available (currently n=52), in the following order: the *Brighton Collaboration* (n=23),[3] the *Australian Immunisation Handbook* (n=22)[4] and then the definitions derived by SAEFVIC from published literature (n=7). The remaining AEFI are recorded verbatim using standard medical terminology where possible for consistency. Regular analysis for quarterly reporting to the Victorian Department of Health is conducted and case reports of points of interest are published in the Immunisation newsletter.

Additional analysis is conducted as required in response to local, national or international concerns or in response to possible safety signals or unusual trends noticed in the AEFI data. AEFI rates are calculated by the type of vaccine delivered for those vaccines recorded on the Australian Childhood Immunisation Register (ACIR). This means the analysis is limited to children under 7 years of age and will be affected by any under-reporting to ACIR.[5] Additional calculations are possible if appropriate denominator data are available, for example the Department of Health records of vaccine doses distributed.

SAEFVIC contributes to national AEFI surveillance by forwarding reports to the TGA. As an additional vaccine safety review, SAEFVIC also reviews all TGA AEFI summaries forwarded to each state, in collaboration with the Immunisation Section of the Victorian Department of Health.

Data analysis

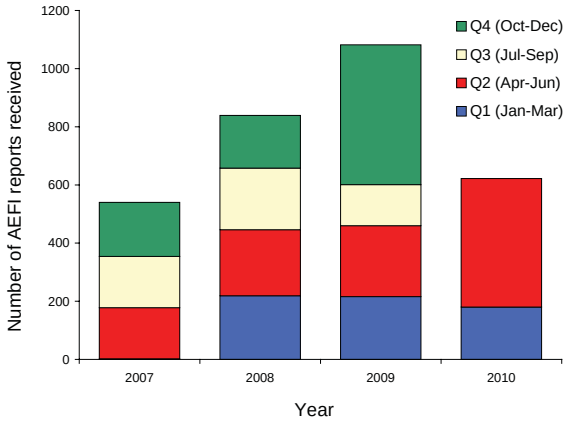
AEFI reported to SAEFVIC from 1 July 2007 to 30 June 2010 were analysed by number, AEFI symptoms reported and population-based reporting rate. Clinical review data were analysed for reports received for the calendar year 2009. Analyses were conducted using Microsoft Excel and STATA 11.0. Australian Bureau of statistics estimated resident population data were used to calculate AEFI rates.

Results

For the 3-year period July 2007 to June 2010, 3,265 reports describing 4,293 AEFI were received. Between 1 and 6 separate AEFI case definitions were extracted in relation to each report received. A total of 5,648 vaccines were administered to the subjects of AEFI reports in the 3 year period with between 1 and 5 vaccines included in each of the AEFI reports in this period. The number of reports

received increased in each 12-month period, from 804 in 2007–2008 to 1,336 in 2009–2010. There was a notable increase observed in the fourth quarter of 2009 and second quarter of 2010 (Figure 1). The first increase coincided with the release of the H1N1 2009 pandemic influenza vaccine (PANVAX®) and the second increase coincided with the release of the trivalent seasonal influenza vaccine when more febrile seizures in children were noted (Figure 1).[6]

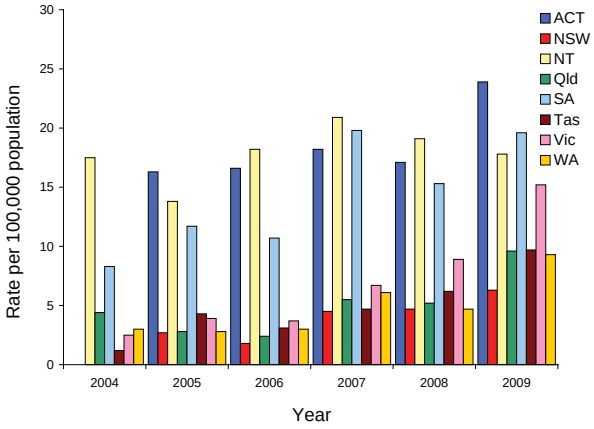
Figure 1: Number of adverse events following immunisation reports received, SAEFVIC, May 2007 to July 2010, by year and quarter



AEFI reporting rates per 100,000 population increased from baseline reporting rates of 2.6 per 100,000 in 2003, prior to SAEFVIC commencing operation, to 13.5 per 100,000 per annum in 2009 (Figure 2).[7,8]

Of all 4,293 AEFI reports, 3,262 (76%) were classified according to previously discussed case definitions. The most frequently reported AEFI were: injection site reactions (minor, common or expected) 987 (23%); fever (≥38°C) 472 (11%); rash 429 (10%); urticaria 300 (7%); and vasovagal episode 215 (5%). Of all 4,293 AEFI reports, 944 (22%) were considered serious (requiring hospitalisation or having ongoing sequelae). Of the serious AEFI reported there were 26 cases of anaphylaxis, 16 intussusception and 32 afebrile seizures. Three deaths were reported following vaccination. The deaths were due to ovarian cancer, sudden infant death syndrome and a car accident. Review by SAEFVIC clinicians of the 3 deaths did not support a likely aetiological association between vaccination and subsequent death.

Figure 2: Adverse events following immunisation reporting rates per 100,000 population, 2003 to 2009, by state or territory[7,8]



An increased proportion of reports received by SAEFVIC related to people who required advice prior to vaccination. These types of reports increased from one in 2008 to 75 or 10% of all reports received in the first 6 months of 2010. The main concern raised related to the influenza vaccine for individuals with a past history of egg allergy. These reports are recorded on the database as 'non-events' in order to provide clarity that no adverse event has occurred.

Of the 1,086 people for whom AEFI were reported in 2009, 356 (36%) attended for clinical review. Of the 41 people who presented in 2009 with concerns prior to receiving vaccine, 33 (80%) also attended for clinical review. Of 356 clinic attendees, 325 (83%) continued with vaccination, 95 (26%) were vaccinated in a hospital setting and 19 (6%) were admitted as day or overnight patients for additional monitoring.

In 2010, most of the AEFI reports were sent directly to SAEFVIC from across Victoria, with only 2 reports being redirected back from the TGA. This was a decrease compared with the 85 reports (19% of all reports received) in 2007, which was the first year of the program.

Discussion

In the 3 years following the establishment of SAEFVIC as a dedicated Victorian passive AEFI surveillance system, the number of AEFI reported increased. The Victorian AEFI reporting rate of 13.8 per 100,000 population, is now closer to that of similar sized states.[8]

Scheduled and ad hoc analyses of data have identified and permitted further investigation of potential immunisation concerns arising during the review period. In 2007, following introduction of the 4-valent human papillomavirus (4vHPV) vaccine, SAEFVIC investigated potential signals such as an event of mass psychogenic illness occurring in school-aged girls following administration of the 4vHPV vaccine[9] and later a review of all cases of syncope and seizures post the 4vHPV vaccine.[10] SAEFVIC has reported on rare AEFI cases such as 4vHPV vac-

cine associated lipoatrophy, measles-mumps-rubella vaccine associated orchitis, and prolonged rotavirus vaccine excretion in an infant diagnosed with severe combined immunodeficiency.[11–13] SAEFVIC has also been involved in supporting active surveillance of intussusception following rotavirus vaccine.[14]

Offering vaccination under an appropriate level of supervision permits adequate medical support in the event of a recurrence and appears to improve parental, adult vaccinee and community confidence, in the immunisation program. Stringent clinical review and monitoring for recurrence of AEFI has enabled SAEFVIC to provide evidence-based advice for administration of vaccine to infants experiencing apnoea as an AEFI.[15] Most importantly, it also allows us to document the risk of recurrence of AEFI; an area where current evidence is sparse.

In the absence of a more systematic, centralised, national AEFI surveillance system, we believe SAEFVIC presents a suitable model for enhanced passive surveillance of AEFI. The link between the reporting system and access to individualised clinical advice and possible vaccination or re-vaccination under medical supervision in those with a previous AEFI, provides an incentive for the initial reporting of AEFI. A vaccine safety service was established in Western Australia based on the SAEFVIC model.

SAEFVIC has an advisory board of stakeholders including local government, immunisation nurses, physicians and general practitioners. The board meets annually and assists us to improve the reporting system, the clinical service, and communication strategies. The introduction of new vaccines to the National Immunisation Program such as HPV, rotavirus and monovalent H1N1 vaccine, meant the service has had to adapt rapidly and has been greatly enhanced through the electronic reporting function introduced in 2010. Future enhancements being considered are to improve the compatibility with other state reporting systems, reporting AEFI rates by vaccines administered and maximising reporting from immunisation providers.

Conclusion

Enhanced passive AEFI surveillance linked to an integrated clinical immunisation service has been shown to improve AEFI reporting within Victoria and has contributed to the detection and investigation of both potential and actual AEFI signals.

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Conflict of interest

NWC and JPB have acted as chief investigators for epidemiological studies sponsored by vaccine manufacturers (CSL) and serological testing (Merck). Industry sourced honoraria for sitting on advisory boards (NWC), data safety monitoring boards (JPB), lecturing (NWC) and travel expenses for attendance at scientific meetings, are paid directly to an administrative fund held by Murdoch Childrens Research Institute.

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Campylobacter outbreaks associated with poultry liver dishes

Tony Merritt, Barry Combs, Nevada Pingault

Introduction

Campylobacter is a frequent contaminant of poultry liver. The bacteria can often be found throughout liver tissues and may survive brief frying. Two recent microbiological surveys of raw poultry liver in New Zealand identified *Campylobacter* on the surface of 98% and 100% of livers sampled, and isolated *Campylobacter* from within liver tissues in 76% and 90% of samples.[1,2] Cooking liver to achieve an internal temperature of between 70 and 80 degrees Celsius for at least 2 minutes was required to inactivate *Campylobacter*.[2]

The Health Protection Agency in the United Kingdom recently reported a significant increase in *Campylobacter* outbreaks associated with poultry liver dishes in the United Kingdom and attributed this to deliberate undercooking.[3,4] The United Kingdom Food Standards Agency issued advice to caterers on the safe handling and cooking of livers in 2010, recommending that livers be cooked thoroughly until steaming hot all the way through, to reach a core temperature of 70 degrees Celsius for 2 minutes or equivalent.[5,6] An update in December 2011 recommended that 'chefs thoroughly cook chicken livers fully to kill any bacteria, until there is no pinkness left in the centre'.[7]

Australian outbreaks

Campylobacter outbreaks associated with poultry liver dishes have not been commonly recognised in Australia but have increased in frequency in recent years.

A review of the OzFoodNet outbreak register identified seven such outbreaks in Australia since 2000, with six of these occurring since 2008 (Table).

Only outbreaks in which a poultry liver food item could be clearly identified are included in this report and it is possible that there were additional associated outbreaks. For example, poultry liver pate may be an ingredient in dishes such as Asian-style pork and chicken rolls. These items have been implicated in *Campylobacter* outbreaks during this period, but poultry liver pate was not specifically identified as the food vehicle for any of these.

The identification of *Campylobacter* outbreaks in general is also constrained by the lack of an effective typing system for this pathogen. In addition, *Campylobacter* is not notifiable in New South Wales.

Campylobacter outbreaks associated with poultry liver dishes have occurred in five Australian states since 2000. All outbreaks implicated commercial food venues with either chicken (5) or duck (2) liver dishes prepared on site. The 2 outbreaks reported in Tasmania involved functions at the same venue serving the same menu 2 days apart. A relative risk for the combined cohort is provided in the Table.

A poultry liver dish was implicated by an analytic epidemiological investigation for 5 outbreaks and the descriptive epidemiology was supportive for the other two. The liver dishes were often consumed or discarded prior to an investigation and *Campylobacter* was not identified in samples of the implicated food item for any outbreak. In the 2011 outbreak in Western Australia, *Campylobacter* was isolated from a subsequent batch of raw duck liver from the same supplier.

Inadequate cooking of poultry liver dishes was likely a significant contributing factor to these outbreaks. Temperature monitoring was only described for one venue (Western Australia 2011) and the cooking times and temperatures were inadequate to achieve a core temperature sufficient to inactivate *Campylobacter* reliably. Inadequate cooking was suspected by investigators for a further 4 outbreaks and cooking details were not available for the remaining two.

Conclusion

A recent increase in *Campylobacter* outbreaks associated with poultry liver dishes in Australia and the United Kingdom has highlighted potential foodborne illness risks if these dishes are undercooked.

There is a need to develop and promote Australian guidelines for the safe preparation of poultry liver dishes.

Acknowledgement

We thank the OzFoodNet Working Group for providing outbreak data.

Table: *Campylobacter* outbreaks associated with poultry liver dishes, Australia, 2000 to 2011

Year	State	Cases		Setting	Suspected food vehicle	Epidemiological investigation	Environmental investigation
		Total	Confirmed*			RR/OR (95% CI)†	
2001	Qld	2	2	Restaurant	Pan-fried duck liver		Under-cooked duck liver reported
2008	Qld	4	2	Restaurant	Chicken liver pâté	4/6 diners ate pâté, all 4 developed gastroenteritis	No food samples collected
2009	Tas	35	7	Restaurant	Chicken liver parfait	Combined cohort RR 5.2 (2.4–11.3)	Inadequate cooking of livers suspected. Livers lightly pan-fried, leaving pink centres. Parfait samples negative for *Campylobacter.*
2009	Tas	9	0	Restaurant			
2010	SA	9	1	Restaurant	Chicken liver pâté/steak	RR 6.7 (1.7–26.3)	Cooking procedure not described in detail. Food samples negative, pâté not sampled.
2011	NSW	11	2	Restaurant	Chicken liver pâté	RR 6.9 (1.0–45.4)	Cooked whole until liver surface was brown, liver temperature not monitored. Pâté from a subsequent batch negative for *Campylobacter* and *Salmonella.*
2011	WA	67	6	Function centre	Duck liver parfait	OR 13.0 (1.9–91.5)	Parfait made from duck liver. Oven baked to core temperature of 60°C. Raw duck liver from a subsequent batch positive for *Campylobacter.*

* Confirmed *Campylobacter* infection.

† RR: Relative risk, OR: Odds ratio, 95% CI: 95% confidence interval.

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Quarterly reports

OzFoodNet quarterly report, 1 January to 31 March 2011

The OzFoodNet Working Group

Introduction

The Australian Government Department of Health and Ageing established the OzFoodNet network in 2000 to collaborate nationally to investigate foodborne disease. OzFoodNet conducts studies on the burden of illness and coordinates national investigations into outbreaks of foodborne disease. This quarterly report documents investigations of outbreaks of gastrointestinal illness and clusters of disease potentially related to food, occurring in Australia from 1 January to 31 March 2011.

Data were received from OzFoodNet epidemiologists in all Australian states and territories. The data in this report are provisional and subject to change, as the results of outbreak investigations can take months to finalise.

During the 1st quarter of 2011, OzFoodNet sites reported 364 outbreaks of enteric illness, including those transmitted by contaminated food. Outbreaks of gastroenteritis are often not reported to health agencies or the reports may be delayed, meaning that these figures under-represent the true burden of enteric disease outbreaks. In total, these outbreaks affected 5,220 people, of whom 247 were hospitalised. There were 13 deaths reported during these outbreaks. The majority of outbreaks (70%, n = 255) were due to person-to-person transmission (Table 1).

Table 1: Mode of transmission for outbreaks and clusters of gastrointestinal illness reported by OzFoodNet, 1 January to 31 March 2011

Transmission mode	Number of outbreaks and clusters	Per cent of total
Foodborne and suspected foodborne	45	12
Person-to-person	255	70
Unknown (*Salmonella* cluster)	18	5
Unknown (other pathogen cluster)	3	1
Unknown	41	11
Waterborne	2	1
Total	364	100

Foodborne and suspected foodborne disease outbreaks

There were 45 outbreaks during this quarter where consumption of contaminated food was suspected or confirmed as the primary mode of transmission (Table 2). These outbreaks affected 785 people and resulted in 119 hospitalisations. There was 1 death reported during these outbreaks. This compares with 37 outbreaks for the last quarter for 2010[1] and a 5-year mean of 37 outbreaks for the 1st quarter between 2006 and 2010.

Salmonella was the aetiological agent for 24 outbreaks during this quarter, with *S.* Typhimurium being the most common serotype (n = 22). Of the remaining 21 outbreaks, six were due to foodborne toxins, including 1 ciguatera fish poisoning, and 5 outbreaks of *Clostridium perfringens*. There were 2 outbreaks due to *Campylobacter* infection and one due to norovirus. Twelve outbreaks were of unknown aetiology.

Thirteen outbreaks (29% of foodborne outbreaks) reported in this quarter were associated with food prepared in restaurants, 9 outbreaks (20%) in aged care facilities, six each (13%) were associated with bakeries and takeaway food outlets, and two each (4%) with private residences, camps and grocery stores or delicatessens. Single outbreaks (2%) were associated with primary produce, a hospital, an institution, a school and an unknown setting.

To investigate these outbreaks, sites conducted three cohort studies, two case control studies and collected descriptive case series data for 39 investigations, while for 1 outbreak no individual patient data were collected. As evidence for the implicated food vehicle, investigators collected both microbiological and analytical evidence for 3 outbreaks, relied on microbiological evidence alone for 7 outbreaks and analytical evidence alone for 3 outbreaks. Descriptive evidence alone was obtained in 32 outbreak investigations.

Table 2: Outbreaks of foodborne disease reported by OzFoodNet sites,* 1 January to 31 March 2011 (n = 45)

State	Month of outbreak	Setting prepared	Agent responsible	Number affected	Hospitalised	Evidence	Responsible vehicles
ACT	March	Takeaway	*S.* Typhimurium PT 197	9	1	D	Chicken kebab, lamb kebab
NSW	January	Bakery	*S.* Typhimurium PT 135	9	0	D	Unknown
	January	Grocery store/ delicatessen	*S.* Singapore	10	0	AM	Roast chicken pieces served cold
	January	Grocery store/ delicatessen	*S.* Singapore	46	2	AM	Roast chicken pieces served cold
	January	Restaurant	Unknown	5	0	D	Unknown
	January	Restaurant	Unknown	7	0	D	Unknown
	January	Restaurant	*S.* Typhimurium	11	1	M	Caesar salad dressing – raw egg†
	January	School	*S.* Typhimurium PT 170	17	1	A	Apple turnover
	January	Takeaway	*S.* Typhimurium PT 44	85	17	M	Vietnamese pork/chicken/salad rolls containing raw egg butter†
	February	Institution	*C. perfringens*	6	0	D	Unknown
	February	Restaurant	*Campylobacter*	11	0	A	Chicken liver pate on toast
	February	Restaurant	Unknown	36	0	D	Suspected dessert
	February	Restaurant	Unknown	3	0	D	Unknown
	February	Restaurant	*S.* Typhimurium	10	0	D	Dessert containing raw egg custard†
	February	Restaurant	*S.* Typhimurium PT 170	6	2	M	Fried ice cream†
	March	Restaurant	Norovirus	49	Unknown	D	Suspected person-person
	March	Restaurant	Unknown	7	0	D	Unknown
NT	January	Camp	Unknown	3	0	D	Unknown
	February	Camp	Unknown	3	1	D	Unknown
Qld	January	Unknown	*S.* Typhimurium MLVA profile 1-5-5-2-3	49	6	M	Eggs†
	March	Primary produce	Ciguatera fish poisoning	3	0	D	Red Bass
SA	January	Bakery	*S.* Typhimurium PT 9	15	3	AM	Bakery product– cannoli
	January	Bakery	*S.* Typhimurium PT 9	43	19	A	Bakery product– custard berliner
	February	Bakery	*S.* Typhimurium PT 44	8	0	D	Unknown
	March	Bakery	*S.* Typhimurium PT 135	6	2	M	Egg wash†
	March	Private residence	Unknown	16	1	D	Unknown

Table 2 *continued*: Outbreaks of foodborne disease reported by OzFoodNet sites,* 1 January to 31 March 2011 (n = 45)

State	Month of outbreak	Setting prepared	Agent responsible	Number affected	Hospitalised	Evidence	Responsible vehicles
Vic	January	Aged care	Unknown	9	0	D	Unknown
	January	Aged care	*C. perfringens*	25	0	D	Unknown
	January	Takeaway	*S.* Typhimurium 9	3	1	D	Chicken sushi (hand rolls)
	February	Aged care	*C. perfringens*	7	0	D	Unknown
	February	Aged care	*C. perfringens*	22	0	D	Unknown
	February	Aged care	*C. jejuni*	15	2	D	Unknown
	February	Hospital	*S.* Typhimurium PT 135	7	0	D	Unknown
	February	Private residence	Unknown	5	0	D	Tiramisu made with raw eggs†
	February	Restaurant	*S.* Typhimurium PT 170	15	6	D	Salty fish, pork and eggs Vietnamese dish
	February	Takeaway	*S.* Typhimurium PT 170 and *S.* Typhimurium RDNC A066	26	6	D	Sushi made with raw egg mayonnaise†
	February	Takeaway	*S.* Typhimurium 9	84	19	M	Sushi made with raw egg mayonnaise†
	March	Aged care	Unknown	9	0	D	Unknown
	March	Aged care	*C. perfringens*	9	0	D	Unknown
	March	Aged care	*S.* Typhimurium PT 170	6	5	D	Unknown
	March	Bakery	*S.* Typhimurium PT 135	18	3	M	Chicken pate
WA	January	Restaurant	*S.* Typhimurium PT 170, PFGE 0011	4	1	D	Unknown
	January	Takeaway	*S.* Typhimurium PT 9, PFGE 0001	15	5	D	Vietnamese pork roll with raw egg butter†
	February	Restaurant	*S.* Typhimurium PT 135, PFGE 0003	24	15	D	Unknown

* No foodborne outbreaks were reported by Tasmania.

† Suspected/confirmed egg associated outbreaks

A Analytical epidemiological association between illness and one or more foods.

D Descriptive evidence implicating the suspected vehicle or suggesting foodborne transmission.

M Microbiological confirmation of agent in the suspected vehicle and cases.

MLVA Multi-locus variable number of tandem repeat analysis.

PFGE Pulsed-field gel electrophoresis.

PT Phage type

The following jurisdictional summaries describe key outbreaks and public health actions that occurred in this quarter.

Australian Capital Territory

There was 1 reported outbreak of foodborne or suspected foodborne disease reported during the quarter.

An investigation was commenced following an increase in notifications of *S.* Typhimurium phage type (PT) 197 multi-locus variable number of tandem repeats analysis (MLVA) profile 5-13-11-11-490.* Nine confirmed *S.* Typhimurium PT 197 infections were epidemiologically linked to the consumption of kebabs served at a Turkish takeaway, including 1 hospitalised case. Two further cases of *S.* Typhimurium PT 197 were identified, including an additional hospitalised case, but neither reported exposure to the implicated premises at initial interview. One *S.* Virchow PT 34 case was also linked to the premises. An environmental inspection identified issues with cleaning and sanitising and also a practice of allowing cut cooked meat to fall into the tray under the rotisserie where it could then be contaminated with juices collected during the thawing and heating processes. Food and environmental samples were negative for *Salmonella*.

New South Wales

There were 16 reported outbreaks of foodborne or suspected foodborne illness during the quarter.

An outbreak of *S.* Typhimurium PT 44 multi-locus variable number of tandem repeats analysis (MLVA) profile 3-10-8-9-523* was investigated in January following an increase in hospital emergency department presentations with gastrointestinal symptoms. Case data were suggestive of a point source of infection – pork/chicken/salad rolls with raw egg mayonnaise from a Vietnamese bakery in the area. Of 147 cases who presented to emergency departments and general practitioners, 58 were interviewed and provided information on a further 27 people who were ill. Forty-nine people submitted a stool sample and 47 were positive for *S.* Typhimurium PT 44 (MLVA profile 3-10-8-9-523). The bakery was inspected by the New South Wales Food Authority (NSWFA) and shut down for clean up and disinfection. Thirteen of 21 food samples including raw egg butter, pate, chicken, pork and salad items and 5 of 11 environmental swabs were positive for *S.* Typhimurium 44 (MLVA profile 3-10-8-9-523). Lack of records or supplier information prevented an egg trace back.

Five cases of salmonellosis were notified by a hospital emergency department. Two of the 5 cases had eaten fried ice cream at the same Chinese restaurant. Two additional clinical cases had also eaten fried ice cream, and the NSWFA received a complaint from two further cases (one hospitalised) who had both eaten fried ice cream at the same premises. Confirmed cases were infected with *S.* Typhimurium (MLVA profile 3-9-7-14-523). The NSWFA inspected the premises and issued a prohibition order on serving fried ice cream. Samples of uncooked and cooked fried ice cream balls and numerous environmental samples were positive for *S.* Typhimurium phage type 170 (MLVA profile 3-9-7-14-523). NSWFA traced the eggs back to a specific farm and collected approximately 30 samples. Chicken feed, faeces and environmental samples were positive for a mixture of *S.* Infantis, *S.* Havana and *S.* Saintpaul. One environmental sample from a walkway was positive for *S.* Typhimurium 170 (MLVA profile 3-9-7-13-523).

A geographic cluster of 23 cases of *S.* Typhimurium MLVA profile 3-12-9-10-550 (previously associated with PT 135) was identified and 19 were interviewed. Nine of the 19 cases had eaten a range of products from a bakery with common ingredients including cream, custard and icing. There were no reports of illness in staff. Two environmental samples taken by the NSWFA were positive for *S.* Typhimurium (MLVA profiles 3-12-9-10-550 and 3-12-9-9-550), but no food samples were positive for *Salmonella*. Environmental swabs were repeated following cleaning and *S.* Typhimurium (MLVA profiles 3-12-9-11-550) was again found on numerous pieces of kitchen equipment and surfaces. A prohibition order for full closure was issued. The bakery was re-opened following negative results on clearance swabs for *Salmonella* and a satisfactory assessment of food handling skills and knowledge.

Six cases of *S.* Typhimurium with a novel MLVA profile (3-11-11-10-523) and clustered in time were investigated. Cases were part of 5 groups who had eaten at the same restaurant over a 2-day period in late January, and 4 additional clinical cases were found through interviews. Nine of 10 cases had eaten a dessert containing berries (strawberries, raspberries and possibly others), meringue and sabayon containing raw egg. The final case ate a baked chocolate dessert. All food and environmental samples taken from the restaurant by the NSWFA were negative except for a swab from a hand wash basin, which was positive for *S.* Sofia.

Seventeen of 311 girls at a boarding school developed diarrhoea, vomiting, headache and fever in late

* Reported in the nomenclature used by the Institute for Clinical Pathology and Medical Research, New South Wales.

January. Five stool specimens were taken and three were positive for *S.* Typhimurium (MLVA profile 3-9-8-13-523). Web-based questionnaires were administered to 72 students (17 cases, 56 controls). The only food statistically significantly associated with illness was an apple turnover consumed one evening: odds ratio (OR) = 4.6 (95% confidence interval [CI]; 1.4–15.4) though this was consumed by only 11 cases and 18 controls. The apple turnover was not served with any high risk foods such as cream, custard or ice cream. The NSWFA inspected the premises and found no issues and took no samples. They received reports that 15 staff ate the same meals as the boarders and none were ill. It was also reported that approximately 50% of the boarders ate off-site one night, mostly with their own families before returning to school. Investigations could not determine a credible source of the infection.

Two separate outbreaks of gastroenteritis were investigated, each affecting four of five people who had eaten a meal at a local café on the same date in February. Investigations revealed a further 3 cases. In total, 11 people (6 with laboratory confirmed *Salmonella* infection) were symptomatic with a diarrhoeal illness after consuming a chicken Caesar salad from the café, over a 2-day period. All isolates were typed as *S.* Typhimurium with MLVA profiles 3-13-14-9-523 (5 cases) and 3-13-14-10-523 (1 case). NSWFA investigations revealed that raw egg was used in the chicken Caesar salad dressing, with the same batch of dressing used over a 2-day period. *S.* Typhimurium MLVA profile 3-13-14-9-523 (PT 3) was isolated from a sample of Caesar salad dressing 10 days after the exposure period. The NSWFA has issued an order prohibiting the use of raw egg in ready to eat foods.

Two outbreaks of *S.* Singapore were associated with buffet functions on a cruise boat in February. The first was an 80th birthday party, with 41 of 57 people reporting a *Salmonella*-like illness, *S.* Singapore was isolated from 5 stool specimens, and *Salmonella* spp detected from a 6th specimen. Roast chicken pieces (relative risk [RR] 5.70, 95% CI 0.93–35.19), silverside (RR 1.32, 95% CI 0.97–1.81) and potato salad (RR 1.60, 95% CI 1.08–2.36) were found to have an association with illness, but only roast chicken had a statistically significant association with illness (OR 26.4, 95% CI 2.85–244.43) in a multivariate analysis. The 2nd outbreak involved a function on the previous day, with 10 of 35 attendees becoming ill (one with laboratory confirmed *S.* Singapore infection). Similar foods were served at both functions. Five of 7 food handlers were also ill with a similar illness and all 5 cases reported consuming food at both functions. The chicken for both functions was purchased from a supermarket and then plated and stored for use. *S.* Virchow phage type 34 was isolated from a sample of chicken obtained from the supermarket; however other food samples and swabs taken from both the supermarket and the cruise owner's premises were negative for pathogens.

An outbreak of campylobacteriosis was investigated amongst guests who had attended an 80th birthday at a restaurant. Eleven of 34 people (2 laboratory confirmed *Campylobacter* spp) became unwell with a diarrhoeal illness after the meal. Chicken liver pate consumed as a canapé was the only food item that was found to have a statistically significant association with illness (RR 7, 95% CI 1.04–45.44 $P = 0.004$). NSWFA found that the chicken livers were undercooked. All food samples and environmental swabs were negative for pathogens. The NSWFA has advised the business to cease using raw eggs in aioli, and is currently reviewing the practice of pate preparation at the premises.

An outbreak in a long-term care facility for disabled men aged between 30 and 70 years was initially notified as a probable viral gastroenteritis outbreak, with 5 residents and 1 staff member reporting diarrhoea. Cases appeared in 3 clusters occurring 2 weeks apart. One stool specimen was positive for *C. perfringens* with a cell count of 6.5×10^7 (suggestive of food poisoning). The local council inspected the facility and reported that the kitchen was clean and well-organised. Residential facilities for developmentally disabled people are not covered by Food Safety Programs for Food Service to Vulnerable Persons. The NSWFA will discuss the inclusion of these facilities with the Food Standards Australia New Zealand.

Forty-nine of 82 people developed vomiting and diarrhoea after attending a christening. No-one from the venue was able to be interviewed regarding staff illness. The complainant's son was admitted to hospital. Three stool samples were submitted and all were positive for norovirus. There was not enough evidence available to indicate whether the norovirus outbreak was due to person-to-person spread or to food contamination.

In 5 suspected foodborne outbreaks, the aetiology remained unknown:

- All 7 people eating a range of dishes at a Thai restaurant, developed abdominal cramps, nausea, diarrhoea and vomiting 5–24 hours after eating. No stool specimens were submitted for testing. The NSWFA inspected the premises and took food samples but found no breaches and all samples were negative.
- Five of 6 members in one family became ill 12–15 hours after eating beef steaks and hamburgers from a restaurant. The adult who was not ill had a chicken Caesar salad. Analysis of the

menu items did not reveal any common foods to all 5 dishes and no stool samples were submitted for testing.

- Thirty-six of 100 attendees of an 80th birthday party developed diarrhoea and fever after eating at a Chinese restaurant. The people ate a set banquet menu and desserts that were brought in from a shop (coffee sponge cake) and homemade (sticky rice congee, biscuits and red bean balls). No illness was reported amongst a wedding party of 120 people who had the same banquet menu.
- All 3 of a group of people consuming chicken and salad wraps from a bistro became unwell with vomiting and diarrhoea 35–40 hours after eating. No illness was reported in the contacts of cases, and no specimens were obtained. It is suspected that this was a point source viral outbreak associated with the consumption of wraps.
- Seven people became unwell with vomiting 6 hours after attending a wedding reception. No contact details were available for attendees of the wedding. Although the epidemiology suggests a point source of infection associated with the wedding, there were a number of shared exposures between the cases prior to the reception.

Northern Territory

There were 2 reported outbreaks of foodborne or suspected foodborne illness during this quarter.

An investigation commenced after routine follow-up of a *S.* Typhimurium PT 9 notification revealed that 2 people with gastroenteritis symptoms had been on a camping trip together prior to and whilst ill. Almost all foods that were consumed were high risk (being mostly raw and prepared in a camping ground) and both gave a history of swimming in a remote creek. No food vehicle was identified and the investigation was closed.

Three of 21 tourists became ill on the same day whilst travelling on a commercial tour bus. Food histories were obtained for 2 of the 3 cases. No stool samples were obtained but the illness was suspected to be of a viral nature. The investigation was closed with no pathogens or source identified.

Queensland

There were 2 reported outbreaks of foodborne or suspected foodborne illness during this quarter.

Forty-nine cases of *S.* Typhimurium with MLVA profile 1-5-5-2-3† were notified and 34 of the 49 cases were interviewed. Six cases were hospitalised. A single sushi outlet located in a suburban shopping precinct was associated with 7 cases and several other retail outlets were common amongst some cases. Each of the premises was using eggs sourced from the same egg layer farm. No other common links were identified among the food establishments. Food preparation, handling and storage procedures in each of these premises were investigated and environmental sampling conducted. An extensive audit of the egg layer farm was undertaken by environmental health officers from Queensland Health in conjunction with regulatory officers from Queensland Primary Industries and Fisheries (Safe Food Queensland). Environmental swabs, drag swabs and eggs were collected at different sections of the production line. Eggs were also inspected and sampled from several retail outlets in South East Queensland that were supplied by the egg layer farm. *S.* Typhimurium with MLVA profile 1-5-5-2-3 (outbreak strain) was cultured from drag swabs collected at the farm and from cage eggs sampled at retail level. Other *Salmonella* serotypes identified from drag swabs collected from the farm included *S.* Montevideo, *S.* Anatum, *S.* Kottbus and *S.* Subsp 1. *S.* Montevideo was also detected in eggs sampled at the retail level. No *Salmonella* were detected in environmental samples taken from the sushi outlet that was epidemiologically linked to 7 cases.

Three family members became ill with suspected ciguatera fish poisoning following the consumption of Red Bass fish. The cases experienced symptoms including reversed temperature sensation, numbness and tingling of the mouth and muscle pain. The fish was approximately 6–7 kg and was taken as part of a private catch at a reef off Lucinda in North Queensland.

South Australia

There were 5 reported outbreaks of foodborne or suspected foodborne illness during this quarter.

Two outbreaks of *S.* Typhimurium PT 9 were investigated following a sharp increase in notifications in January. Through hypothesis-generating questionnaires, it was found that bakery products were frequently consumed food items. A case control study identified that 2 items were significantly associated with illness in a multi-variate analysis: custard berliners (OR 55.9; 95% CI 11.1–282.1) and cannoli (OR 16.8; 95% CI 1.8–157.2). Products were from 2 different bakeries. Bakery A made the custard berliners eaten by 43 cases (19 of them hospitalised). Samples of product, raw materials and environmental swabs collected from bakery A were all negative for *Salmonella*. Bakery B made the cannolis that were eaten by 15 cases (3 hospital-

† Reported in the European nomenclature used by Queensland Health Scientific Services.

ised). Products, raw materials and environmental swabs were collected from bakery B and product samples tested positive for *S*. Typhimurium PT 9. There appeared to be no common ingredients, processes, distribution chains or suppliers to either bakery, and no staff worked at both bakeries.

In March, 8 cases of *S.* Typhimurium PT 135 were reported in a 1-week period. Interviews identified 6 people who reported eating products from the same bakery. An egg wash that was used to brush pies tested positive for *S.* Typhimurium phage type 135. The brush used to glaze the pies was old and not adequately sanitised, cross contamination of cooked products appeared to have been occurring. No further traceback on the eggs was conducted.

In February, an increase in the number of notifications of *S.* Typhimurium phage type 44 was detected. Eight cases reported eating sweet and savoury items from the same bakery franchise. The sweet and savoury products were made at different locations. None of the food or environmental samples collected tested positive for *Salmonella*. An improvement notice was issued at one of the bakery locations.

An outbreak of gastrointestinal illness was investigated amongst an extended family group in March. Cases had attended a family party at which pork, chicken and noodles were served. Leftover food was taken on a bus tour by some family members on the following day and eaten without adequate reheating. A total of 16 people were ill and seven provided faecal specimens. All specimens were negative for bacterial and viral pathogens.

Tasmania

There were no reported outbreaks of foodborne or suspected foodborne illness during this quarter.

Victoria

There were 16 reported outbreaks of foodborne or suspected foodborne illness during this quarter.

In January, an outbreak of *C. perfringens* occurred in an aged care facility. Twenty-one residents and 4 staff members developed diarrhoea and 2 residents had a 2nd episode of diarrhoea a few days later. Seven faecal specimens were collected and five were positive for *C. perfringens* enterotoxin. This outbreak was atypical for a *C. perfringens* outbreak as onsets were spread out over a 10-day period. However, the predominance of diarrhoea and a median duration of 1 day were consistent with the aetiology.

In January, an outbreak of *C. perfringens* affecting 9 residents of an aged care facility was investigated. Onsets for cases ranged over an 18-hour period and symptoms and duration of illness were consistent with *C. perfringens*. One faecal specimen was collected, which was negative for bacterial and viral pathogens. A food source was unable to be identified in this outbreak.

During routine surveillance in January, a cluster of 7 cases of *S.* Typhimurium PT 9 was detected in residents of a regional Victorian town. Five cases were interviewed and three of these cases, who had onsets of illness in December, had recalled eating chicken sushi hand rolls from the same premises. It is possible that one batch of chicken was cross-contaminated after cooking as an investigation at the premises by the local environmental health officer revealed that cooking procedures for the chicken appeared to be adequate.

In February, an outbreak of salmonellosis was detected through routine surveillance. A number of cases were notified from the same pathology service located at a metropolitan hospital and 4 inpatients with salmonellosis at the hospital, mentioned eating sushi from the same premises prior to becoming ill. Further cases linked to the same premises were found through council food poisoning complaints. Environmental health officers from council and the Department's regional office conducted an on-site investigation at the takeaway premises, which was temporarily closed by the council. A total of 84 cases (59 confirmed with *S.* Typhimurium PT 9) were found to have eaten sushi from these premises between 27 January and 7 February and 19 cases were hospitalised with their illness. Two of the confirmed cases were food handlers at the premises. Twenty-five of 59 food samples and five of 17 environmental swabs taken at the premises were positive for *S.* Typhimurium PT 9, including a mayonnaise used in the sushi hand rolls and environmental swabs of the blender used to make the mayonnaise. The mayonnaise was made using raw eggs. The eggs were traced back to farm level but samples (both eggs and environmental samples) taken on the farm were negative.

Salmonella surveillance in early February identified a family of 4 cases who had reported consuming a Vietnamese dish containing salty fish, eggs and pork mince from a restaurant/ takeaway food premises. Further cases were identified through active surveillance of notified *Salmonella* cases living in the same geographical area. A further 3 groups who had eaten the same food item from this premises were identified. In total, 15 cases (9 confirmed with *S.* Typhimurium phage type 170) who had consumed the food in a 2-day period were associated with the outbreak. A review of the preparation and cooking methods for this food item revealed that it is probable that the batch eaten by the cases was undercooked.

Two outbreaks of *C. perfringens* in aged care facilities in February were investigated:

- Seven residents were ill with diarrhoea. Onsets for cases ranged over a 9-hour period and symptoms and duration of illness were consistent with *C. perfringens*. Three faecal specimens were collected and two were positive for *C. perfringens* enterotoxin. A food source could not be identified.
- Sixteen residents and 6 staff members were ill. Onsets for cases ranged over a 4-day period and the duration of illness was consistent with *C. perfringens*. Atypically, vomiting was experienced by 74% of cases. Three faecal specimens were collected and two were positive for *C. perfringens* enterotoxin. Staff also ate food at the facility. A food source could not be identified.

In February, an outbreak of *Salmonella* affecting 4 residents and 1 staff member of an aged care facility located in a rural Victorian town, was investigated. Three residents were subsequently notified with *S.* Typhimurium PT 135. Food for the aged care facility and a community meals-on-wheels service was prepared by the local hospital. Active surveillance for cases in the hospital and community found a further 2 confirmed *Salmonella* cases linked to the outbreak, one was a patient in the hospital and the other was a health care worker at the hospital. No cases were identified in community residents who received meals-on-wheels. Onsets for the 7 cases ranged over a 9-day period. A food source for this outbreak could not be identified.

A small family outbreak of gastroenteritis, suspected to have been caused by *S.* Typhimurium PT 44 (1 confirmed case), was identified during the follow-up of a *Salmonella* case thought to be associated with the point source outbreak linked to the Vietnamese restaurant. The case attended a family barbeque with 5 others. Foods served included roasted meat, salads and a Tiramisu for dessert. Five family members became unwell with diarrhoea and a further case (a child) had abdominal pain but no diarrhoea. The outbreak was suspected to have been caused by consumption of Tiramisu, which contained raw eggs.

An outbreak of *C. jejuni* affecting 15 residents of an aged care facility was investigated in February. Onsets ranged over a 4-day period. Three of 6 faecal specimens were positive for *C. jejuni*. No particular food source could be identified, but it is possible that cross contamination of some foods may have caused the outbreak.

In early March, 3 cases of salmonellosis were notified in cases who had eaten sushi from the same food premises. The premises closed voluntarily for cleaning, and sampling and disposal of foods was undertaken. Active surveillance was conducted for notified cases of *Salmonella* residing in the geographical area surrounding the food premises. In total, 26 cases were found to have consumed sushi hand rolls from this premises and subsequently developed diarrhoea within a median incubation period of 24 hours. Cases had a median duration of illness of 8 days and 6 cases were admitted to hospital. There were 25 cases confirmed with either *S.* Typhimurium PT 170 or *S.* Typhimurium RDNC A066. The Microbiological Diagnostic Unit, University of Melbourne reported that *S.* Typhimurium RDNC A066 does not exhibit the full characteristics of *S.* Typhimurium PT 170, but in those characteristics expressed, they resemble *S.* Typhimurium PT 170. It is suspected that the raw egg mayonnaise (an ingredient of the hand rolls) was the source of this outbreak.

In March, an outbreak affecting 9 residents of an aged care facility was investigated. Onsets for cases ranged over a 24-hour period and symptoms and duration of illness were consistent with *C. perfringens*. Three faecal specimens were collected, which were negative for bacterial and viral pathogens. A food source could not be identified.

In March, an outbreak of *C. perfringens* affecting 7 residents and 2 staff members of an aged care facility was notified. Onsets for cases ranged over a 10-day period but the majority of cases had onsets over a 3-day period. Four cases also had a second episode but were not counted twice in the case numbers. Three faecal specimens were collected and two were positive for *C. perfringens* enterotoxin. Symptoms and duration of illness were consistent with this aetiology. Staff also ate food at the facility. A food source was unable to be identified in this outbreak.

In March, an outbreak of *C. perfringens* affecting 9 residents of an aged care facility was investigated. Five faecal specimens were collected and one was positive for *C. perfringens* enterotoxin. Symptoms, duration of illness and clustered onsets over a 24-hour period were consistent with this aetiology. A food source was unable to be identified in this outbreak.

An outbreak of *S.* Typhimurium PT 135 was investigated in which 5 family members developed acute gastroenteritis symptoms approximately 24 hours after consuming Vietnamese chicken rolls from a bakery. Faecal specimens collected from two of these cases were confirmed positive for *Salmonella* and subsequently typed as *S.* Typhimurium 135. Active case finding amongst confirmed *Salmonella* cases residing in this geographical area was commenced and a total of 17 cases (13 confirmed *S.* Typhimurium PT 135) had eaten either chicken or pork rolls from this premises during their incubation period.

An additional case, an asymptomatic food handler working at the premises, also had a faecal specimen positive for *S.* Typhimurium PT 135. Council environmental health officers undertook an investigation at the implicated premises, which included supervised cleaning and sanitising, and sampling and disposal of high risk foods. Of the 21 food samples submitted for analysis, 2 samples of chicken liver pate were positive for *S.* Typhimurium PT 135. The rolls also contained raw egg butter but samples taken for analysis were negative for *Salmonella*. A review of the process for making the chicken liver pate was unable to determine any food safety issues.

In late March, an outbreak of gastroenteritis affecting 5 residents and 1 staff member of an aged care facility was investigated. *S.* Typhimurium PT 170 was subsequently identified as the aetiology of this outbreak with all 5 residents having positive faecal specimens. Onsets for cases ranged over an 11-day period and symptoms lasted for a median of 12 days. A review of the menus and food process information revealed that the likely cause of this outbreak was low dose sporadic contamination of a ready-to-eat food such as cream, which had been processed (beaten) in a blender that had not been adequately cleaned and sanitised after being used to process raw foods.

Western Australia

There were 3 reported outbreaks of foodborne or suspected foodborne illness during this quarter, all due to *S.* Typhimurium.

In January, 4 cases of *S.* Typhimurium pulsed-field gel electrophoresis (PFGE) type 0011 (PT 170) were notified. These cases had separately eaten at an Asian restaurant on one of two consecutive days. Cases ate different meals, but all meals consumed contained chicken. An environmental investigation was conducted. Swabs and food samples were not collected during the initial investigation. Deficiencies were found with food handling practices, particularly temperature control. The source of contamination was not found.

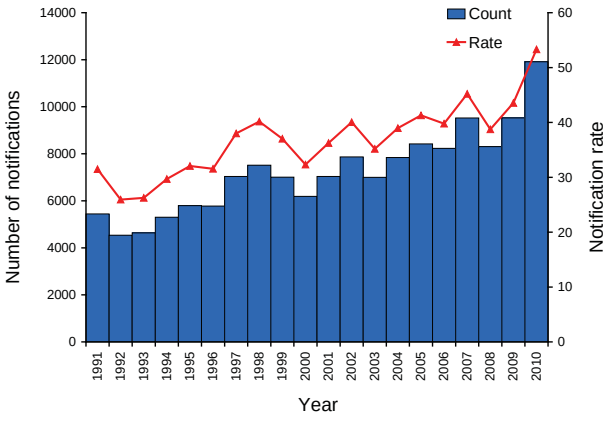
An outbreak of *S.* Typhimurium infection PFGE type 0001 (PT 9) was investigated in January. Fifteen cases (10 laboratory-confirmed) reported eating Vietnamese pork rolls over a 9-day period, with a median incubation period of 20 hours. The pork rolls were produced at one food business and distributed to at least 3 retail food premises. No product or swabs tested positive. The roll ingredients included cooked pork, pickled vegetables, a chicken liver pate, and a raw egg 'butter' spread. The rolls were not refrigerated during transport to retail shops, or during storage at these shops, which is likely to have contributed to proliferation of bacteria.

Between January and March, 24 cases of *S.* Typhimurium PFGE type 0003 were associated with an Asian restaurant. Six isolates tested were confirmed as *S.* Typhimurium PT 135. The median incubation period was 5 days. This strain appeared to be associated with unusually severe illness, with 15 of the 24 cases hospitalised. A variety of foods were eaten by cases. Investigation of the premises identified deficiencies that may have resulted in cross-contamination. A variety of food samples and swabs were collected, all were negative for *Salmonella*. Stool samples collected from 10 staff were negative for *Salmonella*. The Asian restaurant associated with this outbreak and the Asian restaurant associated with the outbreak due to *S.* Typhimurium PFGE type 0011 (PT 170) are part of the same restaurant franchise. *Salmonella* outbreaks associated with restaurants from this franchise were also investigated in 2007 and 2009.

Multi-jurisdictional outbreak investigations

In Australia in 2010, the number of notified cases of salmonellosis was the highest on record, with 11,900 notifications (54.4 notifications per 100,000 population) nationally, compared with an average of 8,807 cases per year (41.8 notifications per 100,000 population) between 2005 and 2009 (Figure 1). Notifications continued to increase in 2011. On 17 March 2011, OzFoodNet commenced 2 multi-jurisdictional outbreak investigations: into *S.* Virchow PT 34 and *S.* Typhimurium PT 170/108. The *S.* Virchow PT 34 multi-jurisdictional outbreak investigation was commenced after Victoria was notified of 13 cases in 2011 (Victorian 5-year average for the same time period was 2 cases). Cases were also notified in South Australia, Tasmania, Queensland, New South Wales and the Australian Capital Territory. The *S.* Typhimurium PT 170/108 investigation was commenced because this phage

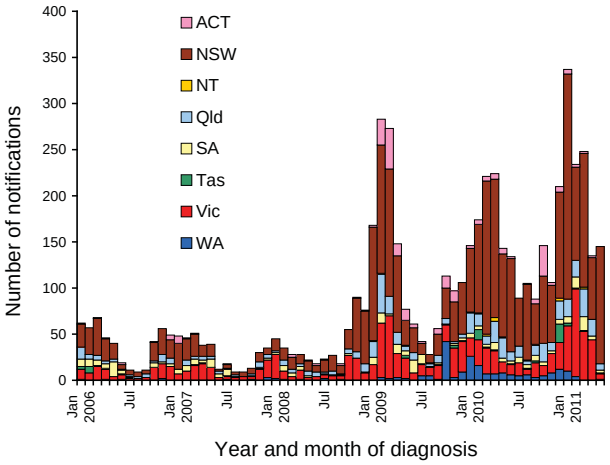
Figure 1: Notifications of salmonellosis, Australia, 1991 to 2010*



Source: National Notifiable Diseases Surveillance System, 1 February 2011.

type was the largest single contributor to the increase in *Salmonella* notifications nationally. Notifications peaked in January 2011, which is consistent with the historical seasonal peak for salmonellosis in Australia (Figure 2).

Figure 2: Notifications of *Salmonella* Typhimurium 170/108, Australia, 1 January 2006 to 31 May 2011, by state or territory



Jurisdictions conducted hypothesis-generating questionnaires with notified cases of *S.* Virchow PT 34 using a standardised *Salmonella* questionnaire developed in Victoria. Data from questionnaires completed during interviews were entered onto a national database and analysed for common exposures, and for food frequencies. Victoria also undertook to conduct sampling from possible food sources identified through interviews with cases. Forty-nine cases of *S.* Virchow PT 34 were interviewed by jurisdictions during the investigation (26 from Victoria); two of these were considered to have been secondary cases. The median age of cases was 11 years (range 4 months to 90 years). While a range of foods such as eggs were consumed by the majority of cases, the products were from a range of retailers and were different brands, and no source of infection could be identified. For 1 case from Victoria, investigators were able to collect a sample of eggs from the place of purchase, and to trace back these eggs to a particular farm where an on-farm investigation was conducted by the Victorian Department of Primary Industries. While S. Virchow PT 34 was isolated from a wash of the eggs from the retail outlet, no on-farm samples were positive for the organism.

From January 2009 to May 2011, there were 1,099 notifications of S. Typhimurium PT 170/108 nationally. Whilst no single point source could be identified, associations with eggs and egg-based foods were frequently identified amongst smaller outbreaks within the larger increase, with 25 of 36 outbreaks during the time period with a known food vehicle suspected to have been due to eggs.

From January to May 2011, OzFoodNet epidemiologists investigated 13 *S.* Typhimurium 170/108 outbreaks that affected at least 124 people (accounting for only 12% of notified cases), with 35 hospitalisations (hospitalisation rate 28.2%) and 1 death (case fatality rate, CFR 0.8%). A food vehicle was identified for nine of the 13 foodborne outbreaks. In the other 4 outbreaks the food vehicle remained unknown. Seven of the 9 (77%) outbreaks with a known food vehicle were suspected to be due to eggs, or a food containing raw or lightly cooked eggs. Investigations into the increase in notified cases of STm 170/108 during this period did not provide any additional evidence of the source/s of infection. In the absence of a sufficient number of point source outbreaks, epidemiologists relied on interviews with sporadic cases. These interviews were hampered by poor recall of food histories by the cases. Associations between illness and the consumption of specific food items were difficult to establish, particularly because food items such as egg and chicken are commonly consumed. With the exception of the identified outbreaks there were no further associations found with specific food items.

Both investigations were stood down on 1 June 2011 with declining notifications.

Cluster investigations

During the 1st quarter of 2011, OzFoodNet sites investigated a number of clusters with 12 due to *S.* Typhimurium, six to other *Salmonella* serotypes, and one each due to *Campylobacter*, *Shigella* and non-toxigenic *Vibrio cholerae*. In the clusters, no particular source or transmission mode could be identified.

Comments

The number of foodborne outbreaks reported during the quarter (n = 45) was the same as the number reported in the 1st quarter 2010 (n = 45)[2] but exceeded the average number during the same quarter over the past 5 years (n = 37) and the number reported during the previous quarter (n = 37).[1] This increase in the number of foodborne outbreaks coincided with a increase in notifications of salmonellosis to the National Notifiable Diseases Surveillance System (NNDSS), with 4,756 notifications of salmonellosis during the quarter compared with a mean of 3,383 notifications for the same period over the past 5 years.‡

‡ National Notifiable Diseases Surveillance System, 12 January 2012.

During the quarter, 9 of 45 outbreaks investigated were confirmed or suspected to have been due to the consumption of foods containing raw or undercooked eggs (Table 1). This highlights the continued importance of eggs as a source of salmonellosis in Australia. Analyses of outbreak data during the multi-jurisdictional outbreak investigation into *S.* Typhimurium 170/108 also showed that a high proportion of smaller outbreaks within the larger increase were related to the consumption of eggs. Egg associated outbreaks can be difficult to investigate for a number of reasons. Eggs are a commonly consumed food and consumers often do not know if they have eaten foods containing raw eggs such as chocolate mousse. Trace back of eggs is often hampered by poor documentation of batch details and a complex supply chain. Even where eggs are traced back to a particular brand or farm, the outbreaks strain(s) are often not isolated from environmental swabs, drag swabs or samples of eggs. Health departments and food safety regulators in Australia need to work with the egg industry to decrease the incidence of salmonellosis associated with the consumption of eggs. A recent investigation in Queensland (see foodborne outbreaks investigated) provides a good example of what might be achieved. Following the investigation, a consumer level recall of cage eggs laid on a single day was undertaken in March 2011. Based on the microbiological test results, the egg farm also conducted a voluntary trade level recall of a different batch of eggs considered to be a potential risk to the public. Longer-term sustainable control measures were also introduced as a result of this investigation. In conjunction with Safe Food Queensland and Queensland Health, a veterinary consultancy group was engaged to review and update egg washing procedures and on-farm biosecurity and control measures. The consultancy group will also assist the egg farm to develop an ongoing monitoring and prevention program aimed at minimising the level of *Salmonella* found in layers and the layer environment. The prevention program includes adding specific feed additives and vaccination of flocks to reduce the levels of *Salmonella* in the birds and in the environment. The rearing and production sheds will also be cleaned and sanitised on a regular basis. *Salmonella* levels will be monitored by ongoing environmental sampling.

The outbreak of *C. perfringens* amongst developmentally disabled men highlights the need to ensure that food standards are adequate in this setting. Residential facilities for developmentally disabled people are not currently covered by *Food Safety Programs for Food Service to Vulnerable Persons.*

Since 2008, OzFoodNet investigated 6 outbreaks of *Campylobacter* associated with liver pate or liver parfait containing undercooked poultry livers, including one during this quarter.[2] This analysis did not include mixed foods such as Vietnamese rolls, which may include a pate (as in the outbreaks this quarter in Victoria and Western Australia).

A limitation of the outbreak data provided by OzFoodNet sites for this report is the potential for variation in categorisation of the features of outbreaks depending on investigator interpretation and circumstances. OzFoodNet continues to standardise and improve practices through its Outbreak Register Working Group. Changes in the incidence of foodborne outbreaks should be interpreted with caution due to the small numbers each quarter.

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OzFoodNet quarterly report, 1 April to 30 June 2011

The OzFoodNet Working Group

Introduction

The Australian Government Department of Health and Ageing established the OzFoodNet network in 2000 to collaborate nationally to investigate foodborne disease. In each Australian state and territory, OzFoodNet epidemiologists investigate outbreaks of enteric infection. OzFoodNet conducts studies on the burden of illness and coordinates national investigations into outbreaks of foodborne disease. This quarterly report documents investigations of outbreaks of gastrointestinal illness and clusters of disease potentially related to food, occurring in Australia from 1 April to 30 June 2011.

Data were received from OzFoodNet epidemiologists in all Australian states and territories. The data in this report are provisional and subject to change, as the results of outbreak investigations can take months to finalise.

During the 2nd quarter of 2011, OzFoodNet sites reported 553 outbreaks of enteric illness, including those transmitted by contaminated food. Outbreaks of gastroenteritis are often not reported to health agencies or the reports may be delayed, meaning that these figures under-represent the true burden of enteric disease outbreaks. In total, these outbreaks affected 10,085 people, of whom 242 were hospitalised. There were 23 deaths reported during these outbreaks. The majority of outbreaks (83%, n = 457) were due to person-to-person transmission (Table 1).

Table 1: Outbreaks and clusters of gastrointestinal illness reported by OzFoodNet, 1 April to 30 June 2011, by mode of transmission

Transmission mode	Number of outbreaks and clusters	Per cent of total
Foodborne and suspected foodborne	35	6
Person-to-person	457	83
Unknown (*Salmonella* cluster)	10	2
Unknown (other pathogen cluster)	4	1
Unknown	47	8
Waterborne	0	0
Total	553	100

Foodborne and suspected foodborne disease outbreaks

There were 35 outbreaks during this quarter where consumption of contaminated food was suspected or confirmed as the primary mode of transmission (Table 2). These outbreaks affected 493 people and resulted in 42 hospitalisations. There was 1 death reported during these outbreaks. This compares with 35 outbreaks for the second quarter of 2010[1] and a 5-year mean of 29 outbreaks for the 2nd quarter between 2006 and 2010.

Salmonella enterica was the aetiological agent for 13 outbreaks during this quarter, all of them due to *S. enterica* ser Typhimurium. Of the remaining outbreaks, 4 (11%) were due to *Clostridium perfringens* and 4 (11%) due to norovirus. There was 1 outbreak (3%) of *Campylobacter jejuni*. In 13 outbreaks (37%), the aetiological agent remained unknown.

Ten outbreaks (29% of foodborne outbreaks) reported in this quarter were associated with food prepared in restaurants, 9 outbreaks (26%) in aged care facilities, 8 outbreaks (24%) in private residences and 3 outbreaks (9%) with food prepared by a commercial caterer. Five single outbreaks (3%) were reported from a range of other settings.

To investigate these outbreaks, sites conducted 9 cohort studies, 1 case control study and collected descriptive case series data for 24 investigations, while for 1 outbreak no individual patient data were collected. As evidence for the implicated food vehicle, investigators collected both microbiological and analytical evidence for 1 outbreak, relied on microbiological evidence alone for 3 outbreaks and analytical evidence alone for 4 outbreaks. Descriptive evidence alone was obtained for 27 outbreak investigations.

The following jurisdictional summaries describe key outbreaks and public health actions that occurred in this quarter.

Australian Capital Territory

There were 2 reported outbreaks of foodborne or suspected foodborne disease during the quarter.

Five persons with a non-English speaking background became unwell with symptoms of diarrhoea, abdominal pain and fever following a privately prepared pig on a spit meal. One case was hospital-

ised with gastroenteritis and acute renal failure that required dialysis. A faecal culture for this case was positive for *S.* Typhimurium phage type (PT) 135. No others who ate the implicated meal were tested. A likely secondary case of *S.* Typhimurium PT 135 was also identified in a family member of the hospitalised case. Details on the preparation of the pig was limited, but it would seem there was opportunity for cross contamination and bacterial growth as the pig was cooked 2 days prior to it being eaten. Storage and transportation conditions were inappropriate.

Six of 7 people who had shared a pub lunch became unwell with gastroenteritis. Meals included burgers and schnitzels with chips and salads. No samples were collected. An inspection of the kitchen identified no apparent issues and there were no reports of recent or ongoing illness among kitchen staff. Anecdotally, a number of co-workers of those affected also reported illness after eating lunch at the same venue on the same day. However, they could not be contacted to verify this. No other complaints were received from other patrons. The cause remains unknown.

New South Wales

There were 10 reported outbreaks of foodborne or suspected foodborne illness during the quarter.

Two complaints were received from the New South Wales Food Authority (NSWFA) about 4 people who consulted a general practitioner (GP) after becoming ill with diarrhoea 19–34 hours after eating prawn dumplings at a café over a 2-day period. Two people were hospitalised. Three of the 4 submitted stool specimens were positive for *S.* Typhimurium PT 135, multi-locus variable number of tandem repeats analysis (MLVA) profile 3-13-11-9-523.* A NSWFA inspection found that the premises was clean and food handling practices were appropriate. The staff at the premises stated that prawn dumplings were made fresh each day using frozen prawns, coriander and egg to bind. Prawn dumplings were served with a tomato relish. A number of food specimens (prawn dumplings – cooked and raw but a different batch from that eaten by the cases, eggs, coriander and raw green prawns) were taken, as well as environmental samples. All samples were negative for pathogens. The small number of cases specific to the batch of prawn dumplings served over the 2 days suggests that this food was most likely the source, but the cause remains unknown.

A small outbreak of *S.* Typhimurium MLVA profile 3-13-12-10-523 (no phage type available but historically associated with PT 135a and PT 170) was identified through routine surveillance. All 3 cases had consumed a home-made semifreddo and hollandaise sauce in a private household 22–48 hours prior to the onset of symptoms. It was estimated that there were 8–10 eggs used to make both dishes, with minimal heat treatment used. Education about safe egg handling and preparation was given.

An outbreak of salmonellosis was reported by a hospital clinician when 3 of 4 family members became unwell with gastroenteritis after eating at an Asian restaurant in May. *Salmonella* spp. was isolated from the stool specimen of a hospitalised case. A second report of illness affecting 2 persons from a group of 3 people, was received by the NSWFA. All additional notified cases of salmonellosis were interviewed as part of active case finding, and the local GP was requested to review case histories of people presenting to the practice with symptoms of diarrhoea. A booking list was not available for further case identification. In total, 8 of 21 people who ate at the restaurant on the same night reported symptoms of gastroenteritis. All cases consumed a chicken and corn soup or other dishes containing chicken. Five people (from 5 separate groups) who had submitted stool specimens were positive for *S.* Typhimurium (MLVA profile 3-10-8-9-523, historically associated with PT 44). No food hygiene or food safety issues were identified on inspection, however a sample of raw chicken strips, which was used for both the chicken and corn soup, and other chicken dishes, were positive for *S.* Typhimurium with a MLVA profile matching the cases and with the PT confirmed as PT 44. Other food items and swabs taken as part of the environmental investigation were negative for pathogens.

Two separate complaints were received from the NSWFA about several groups of people who developed vomiting and diarrhoea 24 hours after eating at a bowling club. The venue only served food on weekends. On a single weekend, 415 people ate at the bowling club, 110 of these were interviewed and 79 (70%) reported being unwell with gastroenteritis. Twelve people were hospitalised and 2 stool specimens were positive for norovirus. A cohort study could not identify any particular food associated with illness. There were reports of the chef working while ill. The NSWFA issued a prohibition order to stop the venue from preparing food until kitchen and staff management knowledge and practices met required standards. A stool sample submitted by the chef was negative for norovirus and bacterial pathogens. There were 4 positive norovirus results from environmental samples (the metal handle of a ladle from the kitchen, a swab from a tap in the ladies toilet, a microwave metal door release and an oven handle). The outbreak was most likely caused by norovirus transmitted from person-to-food-to-person via an infected food handler.

* Reported in the nomenclature used by the Institute of Clinical Pathology and Medical Research (ICPMR).

Table 2: Outbreaks of foodborne disease reported by OzFoodNet sites,* 1 April to 30 June 2011 (n=35)

State	Month	Setting prepared	Agent responsible	Number affected	Hospitalised	Evidence	Responsible vehicles
ACT	Jun	Private residence	*S.* Typhimurium PT 135	5	1	D	Spit roast pig
	Jun	Restaurant	Unknown	6	0	D	Burgers, schnitzels and chips
NSW	Apr	Other	Unknown	80	0	D	Unknown
	Apr	Private residence	*S.* Typhimurium (MLVA profile 3-13-12-10-523)	3	0	D	Eggs in home-made hollandaise sauce and a homemade semifreddo†
	Apr	Restaurant	Unknown	3	0	D	Unknown. Suspect prawn and pesto pizza
	Apr	Restaurant	Unknown	6	0	D	Unknown
	May	Commercial caterer	Norovirus G II-6	23	0	D	Suspect chocolate and mandarin pie
	May	Restaurant	Norovirus	79	12	M	Person to food to person transmission via infected food handler
	May	Restaurant	*S.* Typhimurium PT 135 (MLVA profile 3-13-11-9-523)	4	2	A	Suspect prawn dumplings prepared with minced prawn, coriander and egg to bind
	May	Takeaway	Unknown	4	0	D	Unknown
	Jun	Commercial caterer	Unknown	13	Unknown	D	Unknown
	May	Restaurant	*S.* Typhimurium (MLVA profile 3-10-9-8-523)	8	0	D	Chicken; eggs†
NT	May	Private residence	*S.* Typhimurium PT 141	5	0	D	Unknown
Qld	Jun	Picnic	*C. jejuni*	4	0	D	Chicken kebabs
SA	Apr	Community	*S.* Typhimurium PT 9	48	11	M	Eggs†
Vic	Apr	Aged care	*C. perfringens*	5	0	D	Unknown
	Apr	Private residence	*S.* Typhimurium PT 141	2	0	D	Chocolate mousse (raw eggs)†
	Apr	Private residence	*S.* Typhimurium PT 135a	9	5	A	Potato salad with raw egg mayonnaise†
	Apr	Private residence	*S.* Typhimurium PT 170	2	0	D	Raw muffin batter†
	Apr	Private residence	*S.* Typhimurium PT 170	2	2	M	Raw pancake batter†
	Apr	Restaurant	*S.* Typhimurium PT 170	15	2	AM	Fried ice cream†
	May	Aged care	Unknown	6	0	D	Unknown
	May	Aged care	Unknown	10	0	D	Unknown
	May	Aged care	Unknown	12	0	D	Unknown
	May	Aged care	*C. perfringens*	8	0	D	Unknown
	May	Aged care	*C. perfringens*	13	0	D	Unknown
	May	Private residence	*S.* Typhimurium PT 9	9	1	D	Unknown
	May	Restaurant	Norovirus	26	4	A	Chicken parmagiana

Table 2 *continued*: Outbreaks of foodborne disease reported by OzFoodNet sites,* 1 April to 30 June 2011 (n=35)

State	Month	Setting prepared	Agent responsible	Number affected	Hospitalised	Evidence	Responsible vehicles
Vic, *cont'd*	Jun	Aged care	Unknown	5	0	D	Unknown
	Jun	Aged care	Unknown	8	0	D	Vitamised food suspected
	Jun	Hospital	*C. perfringens*	11	0	D	Unknown
	Jun	Restaurant	Norovirus	15	0	A	Fruit platter
	Jun	Restaurant	Unknown	9	0	D	Curries suspected
WA	Apr	Commercial caterer	*S.* Typhimurium PT 193 (PFGE type 0386)	30	2	D	Unknown

* No foodborne outbreaks were reported by Tasmania.

† Suspected/confirmed egg associated outbreaks.

A Analytical epidemiological association between illness and one or more foods.

D Descriptive evidence implicating the suspected vehicle or suggesting foodborne transmission.

M Microbiological confirmation of agent in the suspected vehicle and cases.

MLVA Multi-locus variable number of tandem repeat analysis.

PFGE Pulsed-field gel electrophoresis.

An outbreak of norovirus was investigated amongst guests at a wedding. Twenty-three of 61 people became unwell with diarrhoea and/or vomiting a median of 34 hours (range 18–39 hours) after consuming the meal. There was no illness identified in wedding attendees prior to or at the wedding ceremony or reception. Seven people visited a medical practitioner, and 3 faecal specimens were positive for norovirus (genotype GII-6) by polymerase chain reaction. A cohort study was conducted, and the consumption of a chocolate and mandarin pie had a statistically significant association with illness (relative risk [RR]: 2.94, 95% confidence interval [CI] 1.28–6.72, $P = 0.0003$). There were no reports of illness in food handlers or waiting staff, and there had been no reports of illness in groups using the function room prior to or after the implicated function. An environmental investigation was conducted by the NSWFA, who as a result issued a warning letter prohibiting the use of minimally heat treated eggs for ready-to-eat products.

For the other 6 suspected foodborne outbreaks, the aetiology and source of infection could not be established:

- The NSWFA received a complaint about 17 of 50 people who developed nausea, vomiting and diarrhoea approximately 24 hours after eating assorted sandwiches, rolls and pastries at a wake at a reception centre. A point source cohort study was conducted, with 9 of 31 interviewed people reporting being unwell before attending the function. There was some indication that there were secondary cases after the function. No specific foods were epidemiologically associated with the illness. A NSWFA inspection revealed that the chef had returned to work following gastrointestinal illness on the same day as symptoms ceased, and prepared foods for the function. This outbreak was likely to have been caused by a viral pathogen, transmitted from person-to-person. There was insufficient evidence to say that the outbreak was caused by person-to-food-to-person transmission (by the chef). No human, food or environmental specimens were available for testing. The NSWFA issued an improvement notice to the function centre.
- A complainant reported to the NSWFA that 80 of 90 people developed abdominal cramps and diarrhoea between 9 and 15 hours after eating assorted Indian dishes and salad at a family gathering at a community centre in April. Hot food was brought in by a caterer and the complainant prepared some salads, dry snacks and rice. The public health unit conducted a cohort study and received information about 28 people of which 25 had developed illness. No stool samples were collected. The caterer who prepared the foods was not planning to cater for any functions in the near future.
- A complainant reported to the NSWFA that all senior citizens from a group of 6 developed diarrhoea and vomiting a median of 10 hours after eating at a lunch buffet in April. Foods served included cooked meats, vegetables, prawns, fish and salad with egg. Five cases were interviewed and 2 cases reported prolonged symptoms (up to 28 days). One person had a stool sample taken shortly after illness onset. The sample was negative for bacterial pathogens and was not tested for viral pathogens.
- All work colleagues from a group of four developed vomiting and diarrhoea, fever and abdominal cramps 1 to 7 hours after eating beef kebab with tomato, lettuce, cheese, onion, BBQ sauce and chilli sauce. Six of their colleagues, who remained at the workplace (and did not eat the kebabs), did not report illness. This was the only common meal between the four. No stool specimens were submitted. Due to the short incubation period it was thought unlikely that the implicated food was the cause of illness.
- Organisers of a training workshop in June reported an outbreak of gastroenteritis affecting 13 of 30 attendees who became unwell 1–2 days after the workshop. An online survey tool was used to collect risk factor information from the cohort. No illness was identified in attendees either prior to or at the workshop, nor was there any illness reported in family members of attendees prior to the workshop. The workshop was the only exposure common to all cases in the 7 days preceding the outbreak. The clinical profile and the occurrence of secondary cases in family members is suggestive of a viral illness, possibly norovirus, but no stool samples were submitted so the illness could not be confirmed. None of the foods consumed were found to have a statistical association with illness, and none of the food handlers reported having symptoms of gastroenteritis on the day the workshop was catered. There was no illness amongst another group who were provided the same foods from the caterer on the same day.
- In May, an outbreak of gastroenteritis was investigated, affecting 3 of 6 people. All cases consumed a prawn and pesto pizza from a restaurant. Incubation time and symptoms were indicative of an illness caused by a preformed toxin, but this could not be confirmed. No booking list was available. A local council inspection did not find any significant issues.

Northern Territory

There was 1 reported outbreak of foodborne or suspected foodborne illness during this quarter.

Two confirmed and 3 probable cases of *S.* Typhimurium PT 141 were associated with foods prepared by a commercial caterer and served at a sports event with several hundred people in attendance. Foods were prepared by the commercial caterer at a private residence, and there were issues with inexperienced and untrained food handlers (including children). Cleaning practices and hand washing facilities were inadequate in the food preparation area. Whilst most cases reported eating a curry/rice dish, which is the suspected vehicle, this dish was not on the menu provided by the caterers and it is unclear whether the caterer provided meals on both of the days that cases were exposed.

Queensland

There was 1 reported outbreak of foodborne or suspected foodborne illness during this quarter.

Four people amongst 16 became ill after attending a barbecue meal on consecutive nights in June. The cases were all males aged 26–56 years with onsets of illness over a 2-day period. Three of 4 stool specimens submitted by cases were positive for *Campylobacter*. Chicken kebabs was the suspected vehicle of transmission, however no food samples were collected. No other chicken meat was reportedly consumed by these cases during their exposure period and no other potential risk factors were identified.

South Australia

There was 1 reported outbreak of foodborne or suspected foodborne illness during this quarter.

During the investigations of *S.* Typhimurium PT 9 in January 2011,[2] a particular MLVA profile was predominant. After the point source outbreaks had ended, sporadic cases of the outbreak MLVA profile were still being reported from the community in the 2nd quarter of 2011. Whilst investigations during the January outbreaks did not reveal any common ingredients or suppliers to the 2 bakeries involved, further traceback of ingredients conducted subsequently found a common supplier of eggs. An investigation was conducted at the egg farm and specimens were collected. Of the 26 samples collected, three were positive for *S.* Typhimurium PT 9 with the outbreak MLVA profile. Further investigations are being conducted to determine whether this particular MLVA profile of *S.* Typhimurium PT 9 is present on other farms.

Tasmania

There were no reported outbreaks of foodborne or suspected foodborne illness during this quarter.

Victoria

There were 19 reported outbreaks of foodborne or suspected foodborne illness during this quarter.

In April, the registrar from a metropolitan hospital notified the Communicable Disease Prevention and Control Unit (CDPCU) of 3 children from the same family admitted with gastroenteritis. These cases were subsequently confirmed with salmonellosis and 3-day food histories implicated home cooked meals and a restaurant. Local council investigations included inspection and food sampling at the restaurant and sampling of leftover eggs from the family home. An outbreak investigation was initiated when 2 further notified cases of salmonellosis were linked to the same restaurant. Further cases were identified through interviews with patrons from the booking list and active surveillance for notified cases of salmonellosis living in the same geographical area. In total, 9 confirmed cases of *S.* Typhimurium PT 170 and a further 6 suspected cases had eaten at the restaurant in early April. All cases had consumed fried ice cream and fried ice cream sampled from the restaurant was positive for *S.* Typhimurium PT 170. It is suspected that raw eggs used in the production of the fried ice cream were responsible for this outbreak.

In April, a cluster of *Salmonella* cases from the same rural town was detected through routine surveillance. One of these cases had also been notified by a doctor who reported that several family members had become unwell after eating at a family barbeque. Through an outbreak investigation it was determined that 12 people attended a lunchtime barbeque at a family home. Nine people became ill and 4 cases were confirmed with *S.* Typhimurium PT 135a including one who had a positive blood culture. Five cases were hospitalised. Foods served at the barbeque included commercially made dips, lamb chops, a variety of different sausages, hamburgers, duck, salads (green, potato and noodle), chocolate cake, tea cake and commercial ice cream. The potato salad was made with a raw egg mayonnaise and seven of the cases definitely ate this food. In addition, the person who prepared the potato salad was the case with the first onset and she had eaten some of the potato salad the night before the barbeque. The eggs used in the mayonnaise were purchased from a large supermarket chain store in the rural town. Eggs were suspected as the source of this outbreak.

Three small outbreaks of *Salmonella* associated with the consumption of raw egg foods prepared in private residences were investigated in April as follows:

- 2 cases of *S.* Typhimurium PT 170 who consumed raw pancake batter. Leftover eggs from the cases' home were sampled and *S.* Typhimurium PT 170 was isolated from the outside of the eggs;

- 2 cases of *S*. Typhimurium PT 170 who consumed raw muffin batter; and
- 2 cases of *S*. Typhimurium PT 141 who consumed chocolate mousse made with raw eggs.

Nine of 13 family members became ill after eating a home-prepared meal in early April. The meal consisted of a variety of foods, including a lasagne. Three of the cases were confirmed with *S*. Typhimurium PT 9 infection. Analysis of foods consumed by guests indicated that the lasagne may have been the source of the outbreak but information provided about how the lasagne was prepared failed to identify any issues. There were no leftover foods available for testing.

CDPCU was notified of vomiting and diarrhoea amongst a group of 10 people who attended a local hotel for dinner in May. The Council also received a complaint from a group of 30 who had visited the hotel on the same night for a birthday function and subsequently developed gastroenteritis. A total of 24 cases were identified from interviews with 39 attendees. Three cases were confirmed with norovirus. Two cases were considered to have been secondary cases. Analysis of foods consumed by the cohort identified chicken parmigiana as a possible source (RR:1.9; 95% CI 1.06–3.29) with 13 cases (59%) having consumed this food. However, foodborne norovirus outbreaks often have multiple food vehicles contributing to infections. The means by which the food was contaminated with norovirus could not be identified.

In early June, an outbreak of *C. perfringens* was reported to CDPCU in 2 groups of people who attended an Indian restaurant on the same night. Eleven people were interviewed and nine developed diarrhoea and abdominal pain between 5 and 16 hours after eating various curries. Two faecal specimens collected 5 days after the onset of symptoms, were negative for bacterial and viral pathogens. A specific food source was not identified but *C. perfringens* enterotoxin was suspected as the outbreak aetiology.

An outbreak with symptoms of vomiting and diarrhoea occurred in a group of 28 people who attended a catered workshop at a hotel in June. Investigations determined that 13 workshop attendees and 2 staff were ill. Five faecal specimens were collected and four were positive for norovirus. The ill food handlers had an onset of symptoms at the same time as the workshop attendees. Analysis of food histories of the function attendees found a statistically significant association with people who consumed fruit from a platter and illness (RR 3.7; 95% CI 1.02 – 13.14).

There were 9 outbreaks in aged care facilities and one in a hospital where the aetiology was either confirmed or suspected as being caused by *C. perfringens* enterotoxin as follows:

- An outbreak of *C. perfringens* affecting 5 residents of an aged care facility was notified to CDPCU in April. Onsets for cases ranged over a 48-hour period and median duration of diarrhoea was 12 hours. Four faecal specimens were collected and *C. perfringens* enterotoxin was detected in three of these. A food source for this outbreak was not identified.
- An outbreak of *C. perfringens* affecting 10 residents and 3 staff members of an aged care facility was notified to CDPCU in May. The majority of cases (11) had onsets over a 5-day period and one case had a second onset 5 days after the initial symptoms had resolved and was counted as a case twice. Faecal specimens were taken from 6 cases and four were confirmed with *C. perfringens* enterotoxin. A food source for this outbreak was not identified.
- An outbreak of *C. perfringens* affecting 7 residents and 3 staff members of an aged care facility was notified to CDPCU in May. Onsets ranged over a 4-day period (50 % in the first 24 hours). There was only 1 faecal specimen collected and this was positive for *C. perfringens* enterotoxin. A food source for this outbreak was not identified.
- An outbreak of *C. perfringens* affecting 8 residents from an aged care facility was notified to CDPCU in May. Onsets occurred in 2 discrete time periods. One of the cases had an episode of diarrhoea in both clusters and was counted as a case twice. Duration of diarrhoea was a median of 1.5 days. Four faecal specimens were collected and all were positive for *C. perfringens* enterotoxin. A food source for this outbreak was not definitively identified but vegetable soups served on a number of occasions during this period were identified as a possible source.
- An outbreak of *C. perfringens* affecting 11 residents and 1 staff member from an aged care facility was notified to CDPCU in May. Onsets ranged over a 6-day period (7 cases within the first 24 hours). Three faecal specimens were collected and one was positive for *C. perfringens* enterotoxin. A food source for this outbreak was not identified.
- An outbreak affecting 6 residents from an aged care facility was notified to CDPCU in May. Onsets were all on the same day. No faecal specimens were collected but the clustered onsets, duration and symptoms were consistent with *C. perfringens*. A food source for this outbreak was not identified.

- An outbreak affecting 8 residents from one section of an aged care facility was notified to CDPCU in June. Onsets were over a 3-day period. One faecal specimen was collected, which was negative for bacterial and viral pathogens but the clustered onsets, duration and symptoms were consistent with *C. perfringens*. A cohort analysis of whether residents ate texture modified foods showed an association with consumption of vitamised food and illness (RR 4.9: 95% CI 1.4–16.7; $P = 0.03$).
- An outbreak affecting 5 residents from an aged care facility was notified to CDPCU in June. Onsets were in a 24-hour period. One faecal specimen was collected, which was negative for bacterial and viral pathogens but the clustered onsets, duration and symptoms were consistent with *C. perfringens*. A food source for this outbreak was not identified.
- An outbreak of *C. perfringens* affecting 5 residents from an aged care facility was notified to CDPCU in June. Onsets were in a 24-hour period. One faecal specimen was collected, which was positive for *C. perfringens* enterotoxin. A food source for this outbreak was not identified.
- An outbreak of *C. perfringens* affecting 11 patients and one staff member from a hospital was notified to CDPCU in June. Onsets ranged over a 5-day period (8 were over the first 24 hours). Six faecal specimens were collected and three were positive for *C. perfringens* enterotoxin. A food source for this outbreak was not identified.

Western Australia

There was 1 reported outbreak of foodborne or suspected foodborne illness during this quarter

Following a birthday party in April with 120 guests, approximately 30 were reported to have become ill with gastroenteritis. Seven cases were confirmed as *S.* Typhimurium pulsed-field gel electrophoresis profile 0386† and 2 isolates were further characterised as *S.* Typhimurium PT 193, both fully susceptible to the antibiotics tested. Interviews were conducted with 31 attendees, and of these 12 reported illness. Two cases were hospitalised. Food eaten at the party included roast beef, bread rolls, gravy, a cake purchased from a bakery and 5 salads prepared by a caterer. The roast beef was whole blade roast, cooked offsite on the morning of the birthday party, then sliced, kept warm in a bain-marie and delivered to the party. The gravy was prepared at the party using a commercial gravy powder and water, and the person who prepared this subsequently became ill. A case control study showed that gravy (odds ratio [OR] 10.0, CI 1.8–53.7), Waldorf salad (OR 7.0, CI 1.1–42.2) and bread rolls (OR 17.2, CI 2.2–not defined) were associated with illness. Samples of coleslaw, potato salad, macaroni salad, Waldorf salad, Greek salad and commercial mayonnaise were all negative for *Salmonella,* although the salads were from batches different from those served at the party. The source of the *Salmonella* contamination could not be identified.

† Tested by PathWest Laboratory Medicine using the PulseNet *Salmonella* protocol.

Multi-jurisdictional outbreak investigations

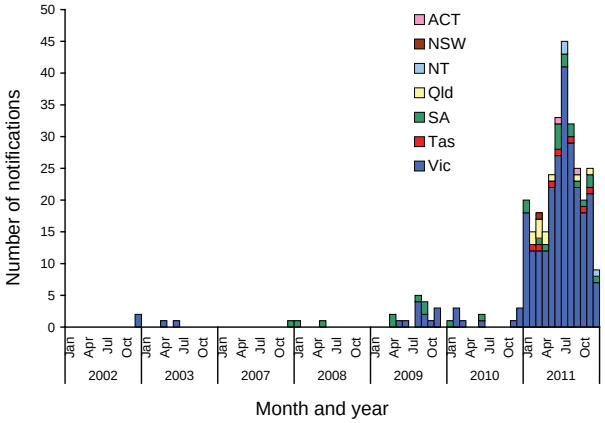
Multi-jurisdictional outbreak investigations into *S.* Typhimurium 170/108 and *S.* Virchow 34 were stood down on 1 June 2011. Outcomes of these investigations were reported in the 1st quarter.[2]

Cluster investigations

During the quarter, OzFoodNet sites investigated a number of clusters, with four due to *S.* Typhimurium, 1 cluster each of *S.* Infantis, *S.* Wangata, *S.* Lansing, *S.* Montevideo and *S.* Saintpaul infections. Sites also investigated 2 clusters of *Campylobacter* infection, a cluster of Shiga-toxin producing *Escherichia coli* and one of *Vibrio parahaemolyticus*. In these clusters, no particular source or transmission mode could be identified.

South Australia and Victoria both investigated increases in cases of *S.* Typhimurium PT 60 during the quarter. The first report of this phage type in the National Notifiable Diseases Surveillance System (NNDSS) was in 2002, and cases were rare until the recent increases in 2011 (Figure). In Victoria, 44 interviews with cases were completed, and raw chicken was sampled from butchers in three regional towns. *S.* Typhimurium 60 was isolated from each of these samples, and investigations revealed that all

Figure: Notifications of *Salmonella* Typhimurium PT 60, National Notifiable Diseases Surveillance System, Australia, 2002 to 2011, 9 February 2012, by month and year and state or territory



three butchers received their chicken from the same processor. In South Australia, two of the 4 cases in the cluster were from the same rural town.

Comments

The majority of reported outbreaks of gastrointestinal illness in Australia are due to person-to-person transmission, and in this quarter, 83% of outbreaks (n = 457) were transmitted via this route. The number of foodborne outbreaks this quarter (n = 35) exceeded the 5-year average of 29 outbreaks for the same quarter during the past 5 years. *S.* Typhimurium continues to be a leading cause of foodborne outbreaks in Australia, with 59% (13 of 22) of outbreaks with a known aetiology due to this *Salmonella* serotype. Notifications of campylobacteriosis nationally were elevated during the quarter (*Campylobacter* infection is not notifiable in New South Wales), with particular increases noted in Queensland, the Australian Capital Territory, Western Australia and Victoria. Only 1 reported foodborne outbreak and 2 clusters were due to this pathogen.

Foodborne disease outbreak investigations this quarter have highlighted a range of high-risk practices, many occurring in food service settings. Ten foodborne disease outbreaks this quarter were associated with foods prepared in a restaurant, while a further three were associated with foods prepared by caterers (one of them a home-based business). Catering for large groups presents particular challenges in the adequate temperature control of stored foods and in preventing cross contamination between raw and cooked foods. There may often be inadequate facilities for the safe storage and handling of large quantities of food at the location where it is to be served. The proper education of food handlers and function hosts is essential in preventing foodborne outbreaks of gastrointestinal illness in this setting. Food Standards Australia New Zealand has begun the development of a national standard for catering operations (Proposal P290 – Food Safety Programs for Catering Operations to the General Public), but the development of the standard is currently on hold pending outcomes of a review of the Ministerial Policy Guidelines for Food Safety Management in Australia.[4]

The consumption of dishes containing raw or undercooked eggs continues to account for a large proportion of outbreaks of foodborne disease in Australia. Of the 19 outbreaks in which any food vehicle could be identified, 8 (42%) were associated with the consumption of eggs, and raw or undercooked egg-based dishes, including chocolate mousse, raw pancake batter and hollandaise sauce. In only one of these outbreaks was the aetiological agent isolated from the food vehicle, in one other the organism was isolated from a wash of leftover eggs, and from one other the infecting organism was isolated from swabs taken on farm following trace back.

A limitation of the outbreak data provided by OzFoodNet sites for this report was the potential for variation in categorisation of the features of outbreaks depending on circumstances and investigator interpretation. Changes in the number of foodborne outbreaks should be interpreted with caution due to the small number each quarter.

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Communicable diseases surveillance

Tables

National Notifiable Diseases Surveillance System

A summary of diseases currently being reported by each jurisdiction is provided in Table 1. There were 68,032 notifications to the National Notifiable Diseases Surveillance System (NNDSS) with a notification received date between 1 July and 30 September 2011 (Table 2). The notification rate of diseases per 100,000 population for each state or territory is presented in Table 3.

Table 1: Reporting of notifiable diseases by jurisdiction

Disease	Data received from:
Bloodborne diseases	
Hepatitis (NEC)	All jurisdictions
Hepatitis B (newly acquired)	All jurisdictions
Hepatitis B (unspecified)	All jurisdictions
Hepatitis C (newly acquired)	All jurisdictions except Queensland
Hepatitis C (unspecified)	All jurisdictions
Hepatitis D	All jurisdictions
Gastrointestinal diseases	
Botulism	All jurisdictions
Campylobacteriosis	All jurisdictions except New South Wales
Cryptosporidiosis	All jurisdictions
Haemolytic uraemic syndrome	All jurisdictions
Hepatitis A	All jurisdictions
Hepatitis E	All jurisdictions
Listeriosis	All jurisdictions
STEC, VTEC*	All jurisdictions
Salmonellosis	All jurisdictions
Shigellosis	All jurisdictions
Typhoid	All jurisdictions
Quarantinable diseases	
Cholera	All jurisdictions
Highly pathogenic avian influenza in humans	All jurisdictions
Plague	All jurisdictions
Rabies	All jurisdictions
Severe acute respiratory syndrome	All jurisdictions
Smallpox	All jurisdictions
Viral haemorrhagic fever	All jurisdictions
Yellow fever	All jurisdictions
Sexually transmissible infections	
Chlamydial infection	All jurisdictions
Donovanosis	All jurisdictions
Gonococcal infection	All jurisdictions
Syphilis < 2 years duration	All jurisdictions
Syphilis > 2 years or unspecified duration	All jurisdictions except South Australia
Syphilis - congenital	All jurisdictions

Table 1: Reporting of notifiable diseases by jurisdiction, *continued*

Disease	Data received from:
Vaccine preventable diseases	
Diphtheria	All jurisdictions
Haemophilus influenzae type b	All jurisdictions
Influenza (laboratory confirmed)	All jurisdictions
Measles	All jurisdictions
Mumps	All jurisdictions
Pertussis	All jurisdictions
Pneumococcal disease (invasive)	All jurisdictions
Poliomyelitis	All jurisdictions
Rubella	All jurisdictions
Rubella - congenital	All jurisdictions
Tetanus	All jurisdictions
Varicella zoster (chickenpox)	All jurisdictions except New South Wales
Varicella zoster (shingles)	All jurisdictions except New South Wales
Varicella zoster (unspecified)	All jurisdictions except New South Wales
Vectorborne diseases	
Arbovirus infection (NEC)	All jurisdictions
Barmah Forest virus infection	All jurisdictions
Dengue virus infection	All jurisdictions
Japanese encephalitis virus infection	All jurisdictions
Kunjin virus infection	All jurisdictions
Malaria	All jurisdictions
Murray Valley encephalitis virus infection	All jurisdictions
Ross River virus infection	All jurisdictions
Zoonoses	
Anthrax	All jurisdictions
Australian bat lyssavirus	All jurisdictions
Brucellosis	All jurisdictions
Leptospirosis	All jurisdictions
Lyssavirus (NEC)	All jurisdictions
Ornithosis	All jurisdictions
Q fever	All jurisdictions
Tularaemia	All jurisdictions
Other bacterial infections	
Legionellosis	All jurisdictions
Leprosy	All jurisdictions
Meningococcal infection	All jurisdictions
Tuberculosis	All jurisdictions

* Infections with Shiga-like toxin (verotoxin) producing *Escherichia coli* (STEC/VTEC).

NEC Not elsewhere classified.

Table 2: Notifications of diseases received by state and territory health authorities, 1 July to 30 September 2011, by date of diagnosis

Disease	State or territory								Total 3rd quarter 2011	Total 2nd quarter 2011	Total 3rd quarter 2010	Last 5 years mean 3rd quarter	Ratio	Year to date 2011	Last 5 years YTD mean
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA							
Bloodborne diseases															
Hepatitis (NEC)	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.2
Hepatitis B (newly acquired)*	0	10	2	9	1	2	15	6	45	42	61	65.4	0.7	136	201.2
Hepatitis B (unspecified)†	34	642	34	200	129	10	526	166	1,741	1,665	1,840	1,746.4	1.0	5,076	5,088.8
Hepatitis C (newly acquired)*,‡	3	12	0	NN	8	5	0	28	56	72	79	94.4	0.6	234	290.4
Hepatitis C (unspecified)†	50	864	47	670	102	54	552	252	2,591	2,518	2,901	2,884.6	0.9	7,632	8,609.2
Hepatitis D	0	3	0	2	0	0	5	0	10	11	14	9.2	1.1	31	28.0
Gastrointestinal diseases															
Botulism	0	1	0	0	0	0	0	0	1	1	0	0.0	0.0	2	0.4
Campylobacteriosis§	126	NN	43	1,314	611	177	1,661	513	4,445	4,070	3,995	3,734.8	1.2	13,353	11,633.6
Cryptosporidiosis	1	62	10	71	13	21	76	33	287	479	249	279.0	1.0	1,394	2,352.4
Haemolytic uraemic syndrome	0	1	0	0	2	0	1	0	4	1	3	2.2	1.8	9	11.0
Hepatitis A	0	7	3	8	2	1	6	1	28	32	65	61.8	0.5	104	224.6
Hepatitis E	0	3	0	0	0	0	2	1	6	10	9	7.0	0.9	31	26.4
Listeriosis	1	3	0	1	1	0	2	2	10	19	7	14.4	0.7	48	53.0
STEC, VTEC‖	0	3	0	5	18	0	0	1	27	18	18	16.2	1.7	62	66.8
Salmonellosis	18	489	82	405	168	33	540	285	2,020	2,638	2,076	1,532.2	1.3	9,379	7,173.4
Shigellosis	0	19	5	19	7	2	30	13	95	103	132	143.2	0.7	356	483.0
Typhoid	0	9	1	4	2	0	3	3	22	23	19	19.8	1.1	102	74.8
Quarantinable diseases															
Cholera	0	0	0	0	0	0	0	1	1	4	3	0.8	1.3	6	2.0
Highly pathogenic avian influenza in humans	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Plague	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Rabies	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Severe acute respiratory syndrome	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Smallpox	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Viral haemorrhagic fever	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Yellow fever	0	0	0	0	0	0	0	0	0	2	0	0.0	0.0	2	0.0

Table 2 *continued*: Notifications of diseases received by state and territory health authorities, 1 July to 30 September 2011, by date of diagnosis

Disease	State or territory								Total 3rd quarter 2011	Total 2nd quarter 2011	Total 3rd quarter 2010	Last 5 years mean 3rd quarter	Ratio	Year to date 2011	Last 5 years YTD mean
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA							
Sexually transmissible infections															
Chlamydial infection¶,**	295	5,090	705	4,538	1,299	474	4,828	3,012	20,241	20,495	18,415	14,481.4	1.4	61,198	44,548.8
Donovanosis	0	0	0	0	0	0	0	0	0	0	1	0.6	0.0	0	2.4
Gonococcal infection**	28	721	465	727	65	4	423	438	2,871	3,134	2,507	1,915.0	1.5	8,907	6,388.8
Syphilis < 2 years duration**	3	103	5	49	5	3	93	25	286	304	246	296.2	1.0	950	925.4
Syphilis > 2 years or unspecified duration**	6	75	10	59	-	5	140	22	317	303	336	350.4	0.9	939	1,017.8
Syphilis – congenital**	0	1	0	1	0	0	0	0	2	0	1	1.0	2.0	6	4.6
Vaccine preventable diseases															
Diphtheria	0	0	0	0	0	0	0	0	0	4	0	0.0	0.0	4	0.0
Haemophilus influenzae type b	0	0	1	2	0	0	0	0	3	5	7	5.8	0.5	11	16.0
Influenza (laboratory confirmed)	179	3,738	197	6,852	3,142	241	1,940	1,113	17,402	4,136	8,181	13,706.4	1.3	24,159	17,624.6
Measles	0	24	1	1	3	0	3	2	34	30	30	9.8	3.5	143	68.8
Mumps	1	11	0	9	1	2	3	5	32	39	21	70.2	0.5	109	193.6
Pertussis	174	3,247	97	2,131	533	42	2,195	1,150	9,569	8,135	9,150	4,930.6	1.9	28,249	12,379.0
Pneumococcal disease (invasive)	10	194	46	144	49	18	167	97	725	552	616	600.0	1.2	1,497	1,218.0
Poliomyelitis	0	0	0	0	0	0	0	0	0	0	0	0.3	0.0	0	0.3
Rubella	0	2	0	2	0	0	3	7	14	14	13	12.6	1.1	50	33.4
Rubella – congenital	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.4
Tetanus	0	0	0	0	0	0	0	0	0	2	1	0.6	0.0	3	2.4
Varicella zoster (chickenpox)††	2	NN	72	119	121	9	195	139	657	406	550	496.2	1.3	1,436	1,108.8
Varicella zoster (shingles)††	9	NN	46	21	402	40	252	235	1,005	907	678	497.8	2.0	2,914	1,535.4
Varicella zoster (unspecified)††	28	NN	3	1,007	27	25	650	267	2,007	1,797	1,820	1,321.6	1.5	5,562	3,819.2
Vectorborne diseases															
Arbovirus infection (NEC)	0	0	0	1	0	0	5	0	6	6	5	3.6	1.7	16	13.8
Barmah Forest virus infection	0	65	11	163	15	0	12	23	289	399	221	307.6	0.9	1,521	1,399.4
Dengue virus infection	4	21	2	21	4	1	25	36	114	123	314	120.2	0.9	591	554.2
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0	0.2	0.0	0	0.2
Kunjin virus infection‡‡	0	0	0	0	0	0	0	0	0	1	0	0.2	0.0	1	1.6
Malaria	1	22	1	30	0	2	26	12	94	92	107	145.8	0.6	302	431.2
Murray Valley encephalitis virus infection‡‡	0	0	0	0	0	0	0	0	0	7	0	0.0	0.0	15	1.4
Ross River virus infection	0	58	17	162	44	0	38	57	376	1,019	567	647.6	0.6	4,409	4,163.6

Table 2 *continued*: Notifications of diseases received by state and territory health authorities, 1 July to 30 September 2011, by date of diagnosis

Disease	State or territory								Total 3rd quarter 2011	Total 2nd quarter 2011	Total 3rd quarter 2010	Last 5 years mean 3rd quarter	Ratio	Year to date 2011	Last 5 years YTD mean
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA							
Zoonoses															
Anthrax	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.6
Australian bat lyssavirus	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Brucellosis	0	1	0	7	0	0	0	0	8	11	7	10.6	0.8	31	28.0
Leptospirosis	1	5	0	10	1	0	2	0	19	53	32	18.2	1.0	195	105.4
Lyssavirus (NEC)	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Ornithosis	0	4	0	0	0	1	15	0	20	16	9	22.6	0.9	59	71.2
Q fever	0	32	0	33	3	0	9	1	78	74	73	92.8	0.8	232	282.4
Tularaemia	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	1	0.0
Other bacterial infections															
Legionellosis	3	15	1	5	10	2	9	14	59	102	69	66.6	0.9	240	223.4
Leprosy	0	0	0	0	0	0	1	1	2	2	3	2.0	1.0	4	6.8
Meningococcal infection§§	0	21	0	27	6	5	14	4	77	57	72	101.6	0.8	191	214.2
Tuberculosis	2	87	12	60	14	5	120	36	336	267	357	317.0	1.1	891	869.2
Total	979	15,665	1,919	18,889	6,808	1,184	14,587	8,001	68,032	54,200	55,880			182,793	

* Newly acquired hepatitis includes cases where the infection was determined to be acquired within 24 months prior to diagnosis.

† Unspecified hepatitis and syphilis includes cases where the duration of infection could not be determined.

‡ In Queensland, includes incident hepatitis cases.

§ Not notifiable in New South Wales.

‖ Infections with Shiga-like toxin (verotoxin) producing *Escherichia coli* (STEC/VTEC).

¶ Includes *Chlamydia trachomatis* identified from cervical, rectal, urine, urethral, throat and eye samples, except for South Australia, which reports only genital tract specimens. The Northern Territory and Western Australia, exclude ocular infections.

** In the national case definitions for chlamydial, gonococcal and syphilis infections the mode of transmission cannot be inferred from the site of infection. Transmission (especially in children) may be by a non-sexual mode (e.g. perinatal infections, epidemic gonococcal conjunctivitis).

†† Ratio of current quarter total to the mean of last 5 years for the same quarter. Ratios for varicella zoster (chickenpox), varicella zoster (shingles) and varicella zoster (unspecified) are based on 4 years of data.

‡‡ In the Australian Capital Territory, Murray Valley encephalitis virus infection and Kunjin virus infection are combined under Murray Valley encephalitis virus infection.

§§ Only invasive meningococcal disease is nationally notifiable. However, New South Wales, the Australian Capital Territory and South Australia also report conjunctival cases.

NN Not notifiable.

NEC Not elsewhere classified.

NDP No data provided.

Table 3: Notification rates of diseases, 1 July to 30 September 2011, by state or territory. (Annualised rate per 100,000 population)

Disease	State or territory								Aust
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	
Bloodborne diseases									
Hepatitis (NEC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hepatitis B (newly acquired)*	0.0	0.6	3.5	0.8	0.2	1.6	1.1	1.0	0.8
Hepatitis B (unspecified)†	37.9	35.5	59.2	17.7	31.4	7.9	37.9	28.9	31.2
Hepatitis C (newly acquired)*	3.3	0.7	0.0	NN	1.9	3.9	0.0	4.9	1.3
Hepatitis C (unspecified)†,‡	55.7	47.7	81.9	59.3	24.8	42.6	39.8	43.9	46.4
Hepatitis D	0.0	0.2	0.0	0.2	0.0	0.0	0.4	0.0	0.2
Gastrointestinal diseases									
Botulism	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Campylobacteriosis§	140.4	NN	74.9	116.4	148.6	139.5	119.8	89.4	117.7
Cryptosporidiosis	1.1	3.4	17.4	6.3	3.2	16.5	5.5	5.7	5.1
Haemolytic uraemic syndrome	0.0	0.1	0.0	0.0	0.5	0.0	0.1	0.0	0.1
Hepatitis A	0.0	0.4	5.2	0.7	0.5	0.8	0.4	0.2	0.5
Hepatitis E	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.2	0.1
Listeriosis	1.1	0.2	0.0	0.1	0.2	0.0	0.1	0.3	0.2
STEC,VTEC‖	0.0	0.2	0.0	0.4	4.4	0.0	0.0	0.2	0.5
Salmonellosis	20.1	27.0	142.8	35.9	40.9	26.0	38.9	49.6	36.2
Shigellosis	0.0	1.0	8.7	1.7	1.7	1.6	2.2	2.3	1.7
Typhoid fever	0.0	0.5	1.7	0.4	0.5	0.0	0.2	0.5	0.4
Quarantinable diseases									
Cholera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Human pathogenic avian influenza in humans	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plague	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rabies	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Severe acute respiratory syndrome	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Smallpox	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Viral haemorrhagic fever	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow fever	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sexually transmitted infections									
Chlamydial infection¶,**	328.8	281.3	1,227.8	401.9	315.9	373.5	348.1	524.6	362.4
Donovanosis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonococcal infection**	31.2	39.8	809.8	64.4	15.8	3.2	30.5	76.3	51.4
Syphilis < 2 years duration**	3.3	5.7	8.7	4.3	1.2	2.4	6.7	4.4	5.1
Syphilis > 2 years or unspecified duration†,**	6.7	4.1	17.4	5.2	-	3.9	10.1	3.8	6.1
Syphilis – congenital**	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Vaccine preventable diseases									
Diphtheria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haemophilus influenzae type b	0.0	0.0	1.7	0.2	0.0	0.0	0.0	0.0	0.1
Influenza (laboratory confirmed)	199.5	206.6	343.1	606.9	764.2	189.9	139.9	193.9	311.6
Measles	0.0	1.3	1.7	0.1	0.7	0.0	0.2	0.3	0.6
Mumps	1.1	0.6	0.0	0.8	0.2	1.6	0.2	0.9	0.6
Pertussis	193.9	179.4	168.9	188.7	129.6	33.1	158.3	200.3	171.3
Pneumococcal disease (invasive)	11.1	10.7	80.1	12.8	11.9	14.2	12.0	16.9	13.0
Poliomyelitis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rubella	0.0	0.1	0.0	0.2	0.0	0.0	0.2	1.2	0.3
Rubella – congenital	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tetanus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3 *continued*: Notification rates of diseases, 1 July to 30 September 2011, by state or territory. (Annualised rate per 100,000 population)

Disease	State or territory								Aust
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	
Vaccine preventable diseases, *cont'd*									
Varicella zoster (chickenpox)	2.2	NN	125.4	10.5	29.4	7.1	14.1	24.2	17.4
Varicella zoster (shingles)	10.0	NN	80.1	1.9	97.8	31.5	18.2	40.9	26.6
Varicella zoster (unspecified)	31.2	NN	5.2	89.2	6.6	19.7	46.9	46.5	53.2
Vectorborne diseases									
Arbovirus infection (NEC)	0.0	0.0	0.0	0.1	0.0	0.0	0.4	0.0	0.1
Barmah Forest virus infection	0.0	3.6	19.2	14.4	3.6	0.0	0.9	4.0	5.2
Dengue virus infection	4.5	1.2	3.5	1.9	1.0	0.8	1.8	6.3	2.0
Japanese encephalitis virus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kunjin virus infection††	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Malaria	1.1	1.2	1.7	2.7	0.0	1.6	1.9	2.1	1.7
Murray Valley encephalitis virus infection††	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ross River virus infection	0.0	3.2	29.6	14.3	10.7	0.0	2.7	9.9	6.7
Zoonoses									
Anthrax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Australia bat lyssavirus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brucellosis	0.0	0.1	0.0	0.6	0.0	0.0	0.0	0.0	0.1
Leptospirosis	1.1	0.3	0.0	0.9	0.2	0.0	0.1	0.0	0.3
Lyssavirus (NEC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ornithosis	0.0	0.2	0.0	0.0	0.0	0.8	1.1	0.0	0.4
Q fever	0.0	1.8	0.0	2.9	0.7	0.0	0.6	0.2	1.4
Tularaemia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other bacterial diseases									
Legionellosis	3.3	0.8	1.7	0.4	2.4	1.6	0.6	2.4	1.1
Leprosy	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0
Meningococcal infection‡‡	0.0	1.2	0.0	2.4	1.5	3.9	1.0	0.7	1.4
Tuberculosis	2.2	4.8	20.9	5.3	3.4	3.9	8.7	6.3	6.0

* Newly acquired hepatitis includes cases where the infection was determined to be acquired within 24 months prior to diagnosis.

† Unspecified hepatitis and syphilis includes cases where the duration of infection could not be determined.

‡ In Queensland, includes incident hepatitis C cases.

§ Not notifiable in New South Wales.

|| Infection with Shiga toxin/verotoxin-producing *Escherichia coli* (STEC/VTEC).

¶ Includes *Chlamydia trachomatis* identified from cervical, rectal, urine, urethral, throat and eye samples, except for South Australia, which reports only genital tract specimens; the Northern Territory and Western Australia exclude ocular infections.

** In the national case definitions for chlamydial, gonococcal and syphilis infections the mode of transmission cannot be inferred from the site of infection. Transmission (especially in children) may be by a non-sexual mode (e.g. perinatal infections, epidemic gonococcal conjunctivitis).

†† In the Australian Capital Territory, Murray Valley encephalitis virus infection and Kunjin virus infection are combined under Murray Valley encephalitis virus infection.

‡‡ Only invasive meningococcal disease is nationally notifiable. However, New South Wales, the Australian Capital Territory and South Australia also report conjunctival cases.

NEC Not elsewhere classified.

NN Not notifiable.

NDP No data provided.

Additional reports

Australian childhood immunisation coverage

Tables 1, 2 and 3 provide the latest quarterly report on childhood immunisation coverage from the Australian Childhood Immunisation Register (ACIR).

The data show the percentage of children 'fully immunised' at 12 months, 24 months and 5 years of age, for 3-month birth cohorts of children at the stated ages between 1 October and 31 December 2010. 'Fully immunised' refers to vaccines on the National Immunisation Program Schedule, but excludes rotavirus, pneumococcal conjugate, varicella, or meningococcal C conjugate vaccines, and is outlined in more detail below.

A full description of the basic methodology used can be found in Commun Dis Intell *1998;22:36–37.*

The percentage of children 'fully immunised' at 12 months of age for Australia increased slightly by 0.4 percentage points to 91.8% (Table 1). There were no important changes in coverage for any individual vaccines due at 12 months of age or by jurisdiction.

The percentage of children 'fully immunised' at 24 months of age for Australia increased by 0.1 percentage points to 92.3 (Table 2). There were no important changes in coverage for any individual vaccines due at 24 months of age or by jurisdiction.

The percentage of children 'fully immunised' at 5 years of age for Australia decreased slightly by 0.2 percentage points, to sit currently at 89.2% (Table 3). There were no important changes in coverage for any individual vaccines due at 5 years of age or by jurisdiction.

Table 1. Percentage of children immunised at 1 year of age, preliminary results by disease and state or territory for the birth cohort 1 October to 31 December 2009; assessment date 31 March 2011

	State or territory								
Vaccine	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Total number of children	1,298	24,621	961	15,091	4,876	1,628	18,334	7,764	74,573
Diphtheria, tetanus, pertussis (%)	94.7	92.0	90.5	92.4	92.6	92.0	92.9	90.9	92.3
Poliomyelitis (%)	94.5	91.9	90.5	92.4	92.6	91.9	92.9	90.9	92.2
Haemophilus influenzae type b (%)	94.5	91.8	90.4	92.3	92.4	91.9	92.7	90.7	92.1
Hepatitis B (%)	93.8	91.6	90.4	92.2	92.2	91.9	92.5	90.4	91.9
Fully immunised (%)	93.5	91.5	90.4	92.1	92.1	91.8	92.3	90.3	91.8
Change in fully immunised since last quarter (%)	-0.4	+0.1	+0.8	+0.6	+0.6	+0.5	+0.5	+0.5	+0.4

Table 2. Percentage of children immunised at 2 years of age, preliminary results by disease and state or territory for the birth cohort 1 October to 31 December 2008; assessment date 31 March 2011*

	State or territory								
Vaccine	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Total number of children	1,259	24,941	857	15,368	4,890	1,723	18,100	7,552	74,690
Diphtheria, tetanus, pertussis (%)	95.7	94.9	95.5	94.7	94.6	96.2	95.8	93.3	95.0
Poliomyelitis (%)	95.6	94.9	95.5	94.7	94.6	96.2	95.7	93.3	94.9
Haemophilus influenzae type b (%)	95.5	95.1	95.3	94.6	94.5	95.9	95.7	93.3	95.2
Measles, mumps, rubella (%)	93.7	93.9	95.9	94.1	93.9	95.2	94.8	92.0	94.5
Hepatitis B (%)	95.0	94.5	95.3	94.2	94.3	96.0	95.3	92.8	94.5
Fully immunised (%)	92.2	92.5	94.4	92.4	92.2	94.1	93.5	89.9	92.7
Change in fully immunised since last quarter (%)	-1.3	+0.1	+0.5	-0.5	-0.5	-0.2	-0.0	-0.8	-0.0

* The 12 months age data for this cohort were published in *Commun Dis Intell* 2010;34(2):148.

Table 3. Percentage of children immunised at 5 years of age, preliminary results by disease and state or territory for the birth cohort 1 October to 31 December 2005; assessment date 31 March 2011

Vaccine	State or territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Total number of children	1,226	23,390	860	14,761	4,584	1,632	17,458	7,252	71,163
Diphtheria, tetanus, pertussis (%)	91.5	89.5	88.3	90.2	87.7	90.7	91.5	86.5	89.8
Poliomyelitis (%)	91.7	89.4	88.1	90.1	87.7	90.6	91.5	86.4	89.7
Measles, mumps, rubella (%)	91.2	89.3	87.9	90.1	87.4	90.6	91.3	86.4	89.6
Fully immunised (%)	91.0	88.9	87.4	89.7	87.1	90.2	91.0	85.7	89.2
Change in fully immunised since last quarter (%)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Figure 1: Trends in vaccination coverage, Australia, 1997 to 31 December 2010, by age cohorts

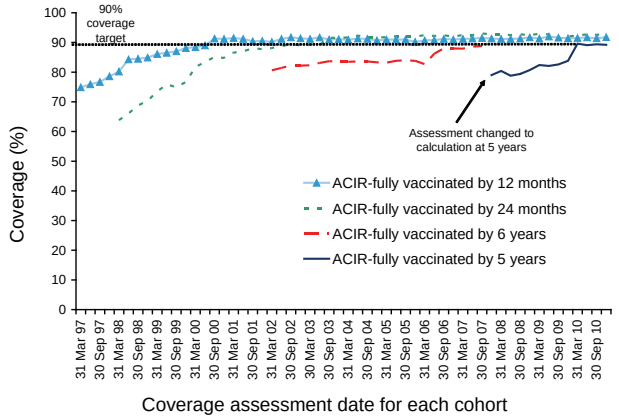


Figure 1 shows the trends in vaccination coverage from the first ACIR-derived published coverage estimates in 1997 to the current estimates. There is a clear trend of increasing vaccination coverage over time for children aged 12 months, 24 months and 6 years (till December 2007). This trend continued when the age of coverage calculation was changed from 6 to 5 years in March 2008, and then increased further in the previous quarter as outlined in the previous report.

Birth cohort 1 January to 31 March

Tables 4, 5 and 6 provide the latest quarterly report on childhood immunisation coverage from the Australian Childhood Immunisation Register (ACIR).

The data show the percentage of children 'fully immunised' at 12 months, 24 months and 5 years of age, for 3-month birth cohorts of children at the stated ages between 1 January to 31 March 2011.

The percentage of children 'fully immunised' at 12 months of age for Australia increased by 1.5 percentage points to 90.3% (Table 4). There were no important changes in coverage for any individual vaccines due at 12 months of age or by jurisdiction.

The percentage of children 'fully immunised' at 24 months of age for Australia increased by 0.1 percentage point to 92.8 (Table 5). There were no important changes in coverage for any individual vaccines due at 24 months of age or by jurisdiction.

The percentage of children 'fully immunised' at 5 years of age for Australia increased slightly by 0.4 percentage points to 89.6% (Table 6). There were no important changes in coverage for any individual vaccines due at 5 years of age or by jurisdiction.

Figure 2 shows the trends in vaccination coverage from the first ACIR-derived published coverage estimates in 1997 to the current estimates. There is a clear trend of increasing vaccination coverage over time for children aged 12 months, 24 months and 6 years (till December 2007). This trend continued when the age of coverage calculation was changed from 6 to 5 years in March 2008, and then increased further in the previous quarter as outlined in the previous report.

Figure 2: Trends in vaccination coverage, Australia, 1997 to 31 March 2011, by age cohorts

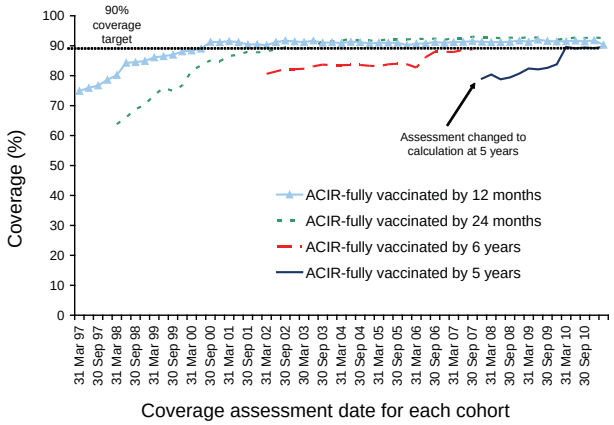


Table 4. Percentage of children immunised at 1 year of age, preliminary results by disease and state or territory for the birth cohort 1 January to 31 March 2010; assessment date 30 June 2011

Vaccine	State or territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Total number of children	1,314	24,366	976	16,030	4,957	1,533	17,997	8,049	75,222
Diphtheria, tetanus, pertussis (%)	93.2	90.2	92.0	91.4	90.9	90.7	92.1	88.2	90.8
Poliomyelitis (%)	93.2	90.1	91.9	91.3	90.9	90.6	92.1	88.1	90.7
Haemophilus influenzae type b (%)	93.0	90.0	91.8	91.2	90.8	90.5	91.9	88.1	90.6
Hepatitis B (%)	92.6	89.8	91.9	91.0	90.7	90.4	91.8	87.8	90.5
Fully immunised (%)	92.5	89.7	91.8	91.0	90.5	90.4	91.6	87.6	90.3
Change in fully immunised since last quarter (%)	-1.0	-1.8	+1.4	-1.1	-1.6	-1.4	-0.8	-2.6	-1.4

Table 5. Percentage of children immunised at 2 years of age, preliminary results by disease and state or territory for the birth cohort 1 January to 31 March 2009; assessment date 30 June 2011*

Vaccine	State or territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Total number of children	1,146	24,033	971	15,660	4,956	1,569	17,519	7,813	73,667
Diphtheria, tetanus, pertussis (%)	95.3	94.6	96.0	94.9	94.7	95.8	95.6	94.1	94.9
Poliomyelitis (%)	95.3	94.6	96.0	94.8	94.7	95.8	95.6	94.1	94.9
Haemophilus influenzae type b (%)	95.1	94.9	95.5	94.8	94.5	96.2	95.5	94.1	95.1
Measles, mumps, rubella (%)	94.5	93.5	95.6	94.3	93.8	95.5	94.7	93.4	94.0
Hepatitis B (%)	94.9	94.2	95.8	94.5	94.1	95.7	95.1	93.6	94.5
Fully immunised (%)	93.1	92.1	94.0	92.9	92.4	94.5	93.4	91.8	92.8
Change in fully immunised since last quarter (%)	+0.9	-0.4	-0.4	+0.5	+0.2	+0.4	-0.2	+1.9	+0.1

* The 12 months age data for this cohort were published in *Commun Dis Intell* 2010;34(3):365.

Table 6. Percentage of children immunised at 5 years of age, preliminary results by disease and state or territory for the birth cohort 1 January to 31 March 2006; assessment date 30 June 2011

Vaccine	State or territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Total number of children	1,228	23,532	902	15,480	4,755	1,630	17,305	7,735	72,567
Diphtheria, tetanus, pertussis (%)	91.5	90.1	88.8	90.8	87.4	91.2	91.6	86.6	90.1
Poliomyelitis (%)	91.4	90.1	88.8	90.7	87.4	91.2	91.5	86.6	90.0
Measles, mumps, rubella (%)	91.0	90.0	88.8	90.6	87.3	90.4	91.4	86.5	89.9
Fully immunised (%)	90.6	89.7	88.1	90.3	87.0	90.3	91.1	86.0	89.6
Change in fully immunised since last quarter (%)	-0.4	+0.8	+0.7	+0.6	-0.2	+0.1	+0.1	+0.3	+0.4

Birth cohort 1 April to 30 June

Tables 7, 8 and 9 provide the latest quarterly report on childhood immunisation coverage from the Australian Childhood Immunisation Register (ACIR).

The data show the percentage of children 'fully immunised' at 12 months, 24 months and 5 years of age, for 3-month birth cohorts of children at the stated ages between 1 April and 30 June 2011.

The percentage of children 'fully immunised' at 12 months of age for Australia increased by 1.8 percentage points to 92.1%, the highest level ever attained (Table 7). Important changes in coverage were seen for both Western Australia and South Australia with coverage for 'fully immunised', polio and DTP vaccines reaching the highest levels ever attained for these two jurisdictions.

The percentage of children 'fully immunised' at 24 months of age for Australia did not change and remained at 92.8% (Table 8). There were no important changes in coverage for any individual vaccines due at 24 months of age or by jurisdiction.

The percentage of children 'fully immunised' at 5 years of age for Australia decreased slightly by 0.3 percentage points to 89.3% (Table 9). There were no important changes in coverage for any individual vaccines due at 5 years of age or by jurisdiction.

Figure 3 shows the trends in vaccination coverage from the first ACIR-derived published coverage estimates in 1997 to the current estimates. There is a clear trend of increasing vaccination coverage over time for children aged 12 months, 24 months and 6 years (till December 2007). This trend continued when the age of coverage calculation was changed from 6 to 5 years in March 2008, and then increased further in the previous quarter as outlined in the previous report.

Table 7. Percentage of children immunised at 1 year of age, preliminary results by disease and state or territory for the birth cohort 1 April to 30 June 2010; assessment date 30 September 2011

	State or territory								
Vaccine	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Total number of children	1,299	24,659	957	15,797	4,900	1,517	17,940	7,859	74,928
Diphtheria, tetanus, pertussis (%)	94.2	92.3	93.4	92.2	93.2	91.5	93.2	91.4	92.5
Poliomyelitis (%)	94.2	92.3	93.5	92.2	93.2	91.5	93.2	91.3	92.5
Haemophilus influenzae type b (%)	94.1	92.2	93.4	92.1	93.1	91.4	93.1	91.2	92.4
Hepatitis B (%)	94.0	92.0	93.4	92.0	93.1	91.4	92.8	90.8	92.2
Fully immunised (%)	93.6	91.9	93.3	91.8	93.0	91.3	92.7	90.8	92.1
Change in fully immunised since last quarter (%)	+1.1	+2.2	+1.5	+0.9	+2.5	+1.0	+1.1	+3.1	+1.7

Table 8. Percentage of children immunised at 2 years of age, preliminary results by disease and state or territory for the birth cohort 1 April to 30 June 2009; assessment date 30 September 2011*

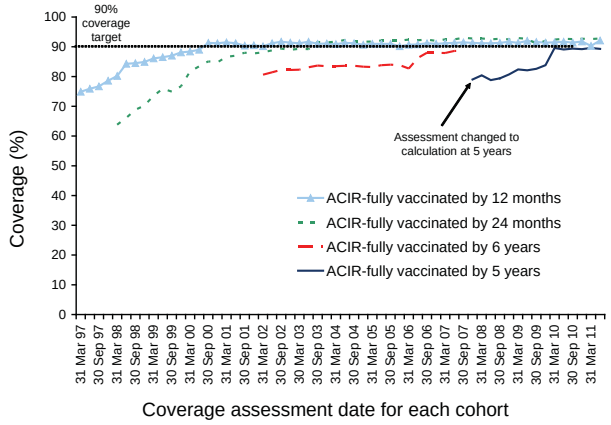
	State or territory								
Vaccine	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Total number of children	1,256	24,138	1,023	15,872	4,881	1,642	17,752	7,996	74,560
Diphtheria, tetanus, pertussis (%)	96.0	94.7	96.2	95.0	95.3	95.5	95.7	94.3	95.0
Poliomyelitis (%)	95.9	94.6	96.2	94.9	95.3	95.5	95.6	94.2	95.0
Haemophilus influenzae type b (%)	96.7	95.1	96.6	95.1	95.2	96.0	95.7	94.7	95.3
Measles, mumps, rubella (%)	95.6	93.5	95.1	94.2	94.2	95.2	94.7	93.3	94.1
Hepatitis B (%)	95.7	94.3	95.8	94.5	94.8	95.3	95.1	93.7	94.6
Fully immunised (%)	94.5	92.3	93.7	93.0	93.2	94.3	93.6	91.7	92.8
Change in fully immunised since last quarter (%)	+1.4	+0.1	-0.3	+0.1	+0.8	-0.2	+0.2	-0.2	+0.0

* The 12 months age data for this cohort were published in *Commun Dis Intell* 2010;34(4):469.

Table 9. Percentage of children immunised at 5 years of age, preliminary results by disease and state or territory for the birth cohort 1 April to 30 June 2006; assessment date 30 September 2011

Vaccine	State or territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Total number of children	1,178	23,446	897	15,464	4,687	1,446	17,323	7,673	72,114
Diphtheria, tetanus, pertussis (%)	91.9	90.0	88.7	89.8	87.1	90.4	91.5	86.3	89.8
Poliomyelitis (%)	91.9	90.0	88.7	89.6	87.0	90.4	91.5	86.2	89.7
Measles, mumps, rubella (%)	91.6	89.9	88.6	89.5	87.0	90.5	91.5	86.2	89.6
Fully immunised (%)	91.3	89.5	88.4	89.2	86.6	90.2	91.1	85.6	89.3
Change in fully immunised since last quarter (%)	+0.7	-0.1	+0.3	-1.1	-0.3	-0.1	+0.0	-0.4	-0.3

Figure 3: Trends in vaccination coverage, Australia, 1997 to 30 June 2011, by age cohorts



'Fully immunised' at 12 months of age is defined as a child having a record on the ACIR of 3 doses of a diphtheria (D), tetanus (T) and pertussis-containing (P) vaccine, 3 doses of polio vaccine, 2 or 3 doses of PRP-OMP containing Haemophilus influenzae *type b (Hib) vaccine or 3 doses of any other Hib vaccine, and 2 or 3 doses of Comvax hepatitis B vaccine or 3 doses of all other hepatitis B vaccines. 'Fully immunised' at 24 months of age is defined as a child having a record on the ACIR of 3 or 4 doses of a DTP-containing vaccine, 3 doses of polio vaccine, 3 or 4 doses of PRP-OMP containing Hib vaccine or 4 doses of any other Hib vaccine, 3 or 4 doses of Comvax hepatitis B vaccine or 4 doses of all other hepatitis B vaccines, and 1 dose of a measles, mumps and rubella (MMR)-containing vaccine. 'Fully immunised' at 5 years of age is defined as a child having a record on the ACIR of 4 or 5 doses of a DTP-containing vaccine, 4 doses of polio vaccine, and 2 doses of an MMR-containing vaccine.*

The National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases (NCIRS) provides commentary on the trends in ACIR data. For further information please contact NCIRS at: telephone +61 2 9845 1435, E-mail: brynleyh@chw.edu.au

Australian Sentinel Practices Research Network

The Australian Sentinel Practices Research Network (ASPREN) is a national surveillance system that is funded by the Australian Government Department of Health and Ageing, owned and operated by the Royal Australian College of General Practitioners and directed through the Discipline of General Practice at the University of Adelaide.

The network consists of general practitioners who report presentations on a number of defined medical conditions each week. ASPREN was established in 1991 to provide a rapid monitoring scheme for infectious diseases that can alert public health officials of epidemics in their early stages as well as play a role in the evaluation of public health campaigns and research of conditions commonly seen in general practice. Electronic, web-based data collection was established in 2006.

In June 2010, ASPREN's laboratory ILI testing was implemented, allowing for viral testing of 25% of ILI patients for a range of respiratory viruses including influenza A, influenza B and influenza A H1N1(2009).

The list of conditions is reviewed annually by the ASPREN management committee. In 2011, 4 conditions are being monitored. They include influenza-like illness (ILI), gastroenteritis and varicella infections (chickenpox and shingles). Definitions of these conditions are described in Surveillance systems reported in CDI, *published in* Commun Dis Intell *2011;35(1):57–58.*

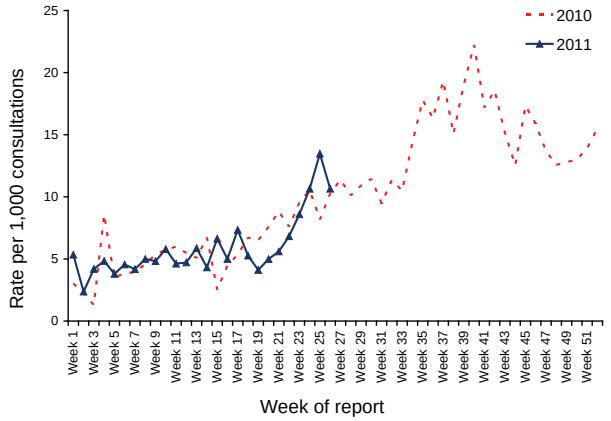
Reporting period 1 April to 30 June 2011

Sentinel practices contributing to ASPREN were located in all 8 jurisdictions in Australia. A total of 121 general practitioners contributed data to ASPREN in the second quarter of 2011. Each week an average of 94 general practitioners provided information to

ASPREN at an average of 9,792 (range 7,412–11,608) consultations per week and an average of 122 (range 70–184) notifications per week.

ILI rates reported from 1 April to 30 June 2011 averaged 7 cases per 1,000 consultations (range 4–13 cases per 1,000 consultations). The reported rates in April, May and June 2011 (4–7 cases per 1,000 consultations; 4–7 cases per 1,000 consultations and 9–13 cases per 1,000 consultations respectively) were relatively consistent compared with rates in the same reporting period in 2010 (3–7 cases per 1,000 consultations, 7–9 cases per 1,000 consultations and 8–11 cases per 1,000 consultations respectively) (Figure 1).

Figure 1: Consultation rates for influenza-like illness, ASPREN, 1 January 2010 to 30 June 2011, by week of report



ILI swab testing has continued through 2011. The most commonly reported virus during this reporting period was rhinovirus (21% of all swabs performed), with the second most common virus being influenza A H1N1(2009) (9% of all swabs performed) (Figure 2).

From the beginning of 2011 to the end of week 26, 55 cases of influenza have been detected, the majority of these being H1N1(2009) (9% of all swabs performed) and the remainder influenza A untyped / other (3% of all swabs performed) and influenza B (5% of all swabs performed).

During this reporting period, consultation rates for gastroenteritis averaged 5 cases per 1,000 consultations (range 3–6 cases per 1,000, Figure 3). This was lower compared with rates in the same reporting period in 2010 where the average was 6 cases per 1,000 consultations (range 5–9 cases per 1,000).

Varicella infections were reported at a slightly lower rate for the second quarter of 2011 compared with the same period in 2010. From 1 April to 30 June 2011, recorded rates for chickenpox averaged 0.21 cases per 1,000 consultations (range 0–0.71 cases per 1,000 consultations, Figure 4).

Figure 2: Influenza-like illness swab testing results, ASPREN, 1 January 2010 to 30 June 2011, by week of report

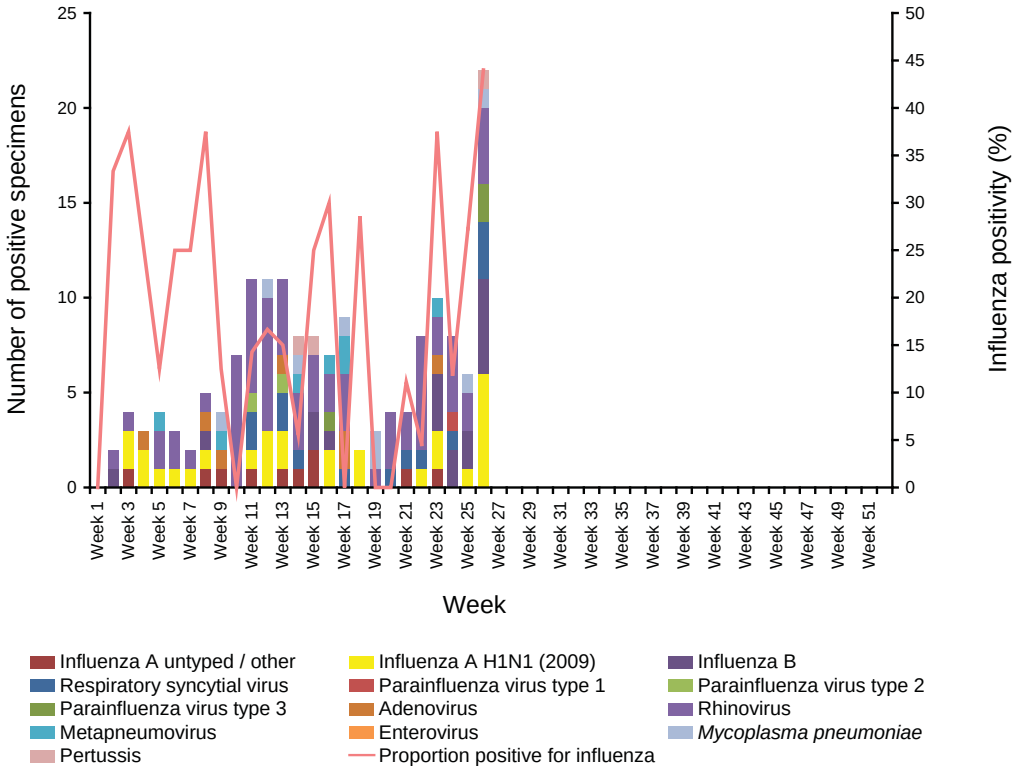


Figure 3: Consultation rates for gastroenteritis, ASPREN, 1 January 2010 to 30 June 2011, by week of report

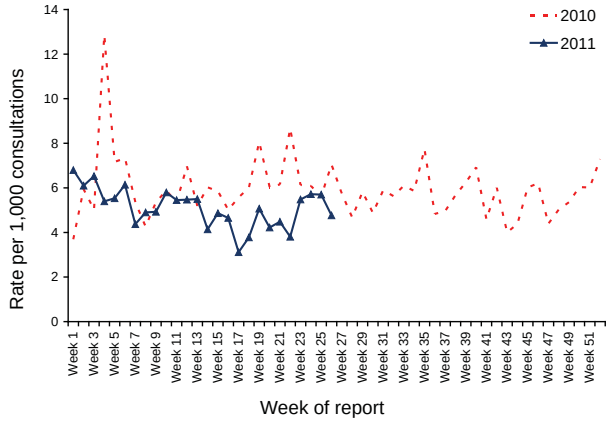
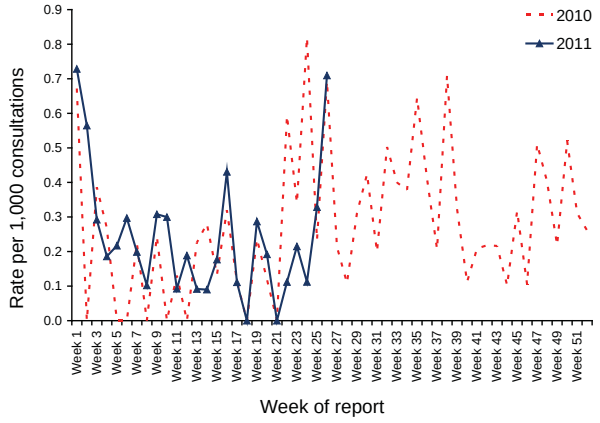


Figure 4: Consultation rates for chickenpox, ASPREN, 1 January 2010 to 30 June 2011, by week of report

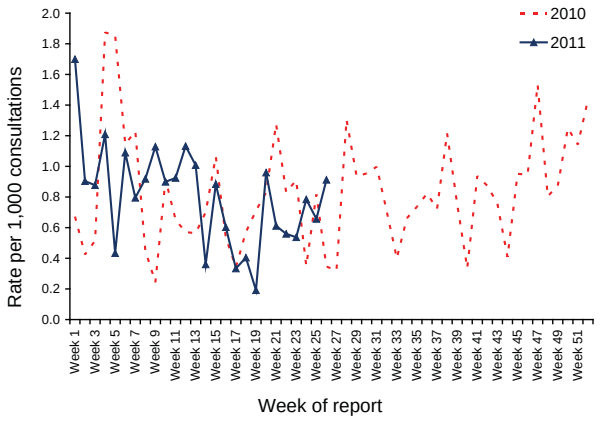


In the second quarter of 2011, reported rates for shingles averaged 0.6 cases per 1,000 consultations (range 0.2–1 cases per 1,000 consultations, Figure 5), slightly lower than the same reporting period in 2010 where the average shingles rate was 0.7 cases per 1,000 consultations (0.3–1.3 cases per 1,000 consultations).

Reporting period 1 July to 30 September 2011

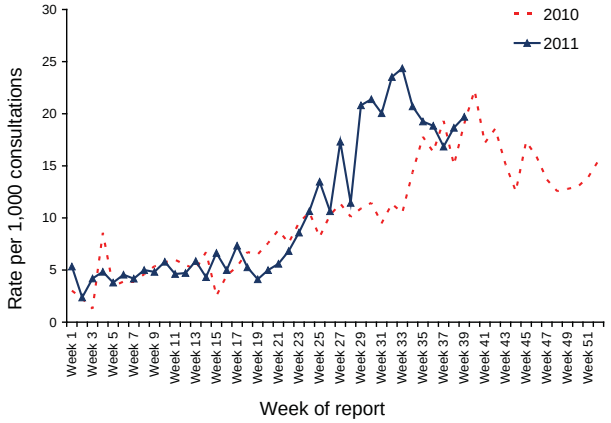
Sentinel practices contributing to ASPREN were located in all 8 jurisdictions in Australia. A total of 134 general practitioners contributed data to ASPREN in the third quarter of 2011. Each week an average of 111 general practitioners provided information to ASPREN at an average of 9,980 (range 9,229–10,031) consultations per week and an average of 259 (range 186–322) notifications per week.

Figure 5: Consultation rates for shingles, ASPREN, 1 January 2010 to 30 June 2011, by week of report



ILI rates reported from 1 July to 30 September 2011 averaged 19 cases per 1,000 consultations (range 11–24 cases per 1,000 consultations). The reported rates in July, August and September 2011 (11–21 cases per 1,000 consultations, 19–24 cases per 1,000 consultations and 17–20 cases per 1,000 consultations respectively) were higher compared with rates in the same reporting period in 2010 (10–11 cases per 1,000 consultations, 9–18 cases per 1,000 consultations and 15–19 cases per 1,000 consultations respectively) (Figure 6).

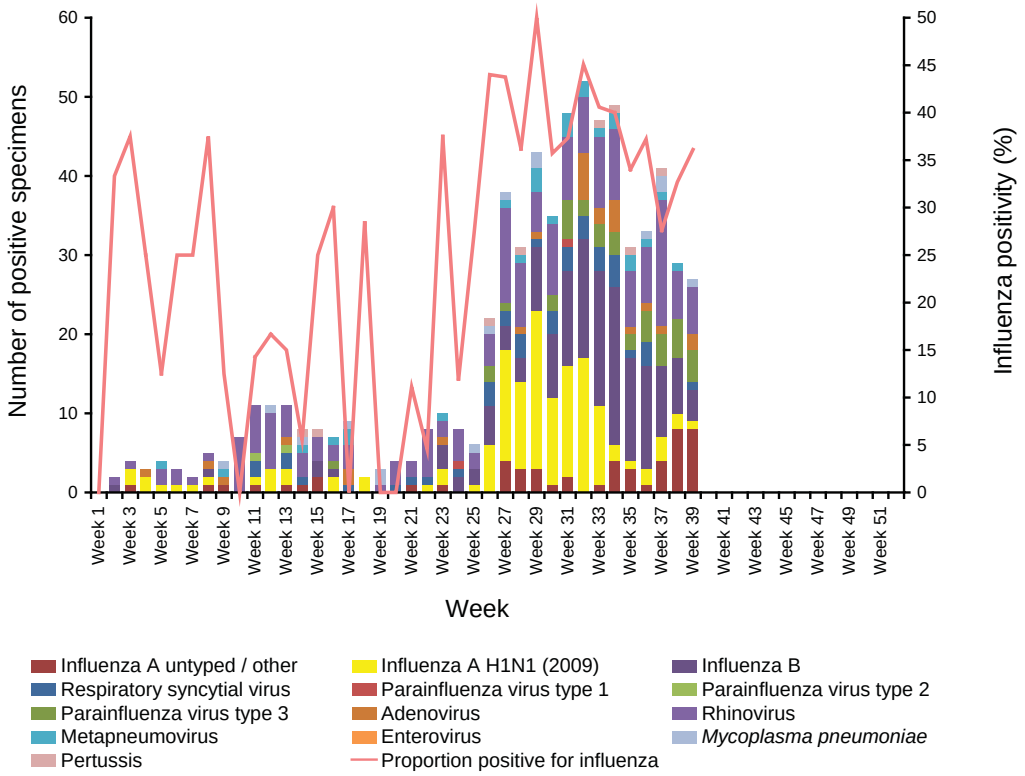
Figure 6: Consultation rates for influenza-like illness, ASPREN, 1 January 2010 to 30 September 2011, by week of report



ILI swab testing has continued through 2011. The most commonly reported virus during this reporting period was rhinovirus (17% of all swabs performed), with the second most common virus being influenza B (14% of all swabs performed) (Figure 7).

From the beginning of 2011 to the end of week 39, 337 cases of influenza have been detected, the major-

Figure 7: Influenza-like illness swab testing results, ASPREN, 1 January 2010 to 30 September 2011, by week of report



ity of these being influenza B (14% of all swabs performed), influenza A H1N1(2009) (13% of all swabs performed) and the remainder influenza A untyped/other (5% of all swabs performed).

During this reporting period, consultation rates for gastroenteritis averaged 5 cases per 1,000 consultations (range 4–7 cases per 1,000, Figure 8). This was lower compared to rates in the same reporting period in 2010 where the average was 6 cases per 1,000 consultations (range 5–8 cases per 1,000).

Varicella infections were reported at a slightly higher rate for the second quarter of 2011 compared with the same period in 2010. From 1 July to 30 September 2011, recorded rates for chickenpox averaged 0.4 cases per 1,000 consultations (range 0.2–0.61 cases per 1,000 consultations, Figure 9).

In the second quarter of 2011, reported rates for shingles averaged 0.8 cases per 1,000 consultations (range 0.5 to 1.3 cases per 1,000 consultations, Figure 10), which was relatively consistent compared with the

Figure 8: Consultation rates for gastroenteritis, ASPREN, 1 January 2010 to 30 September 2011, by week of report

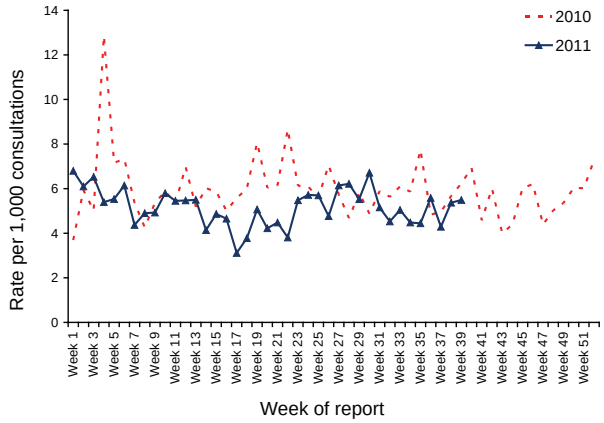
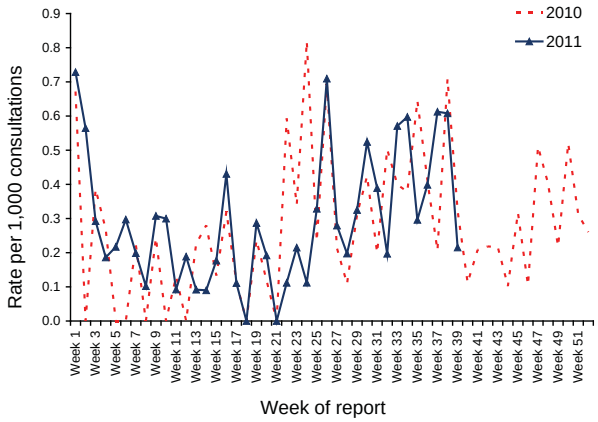
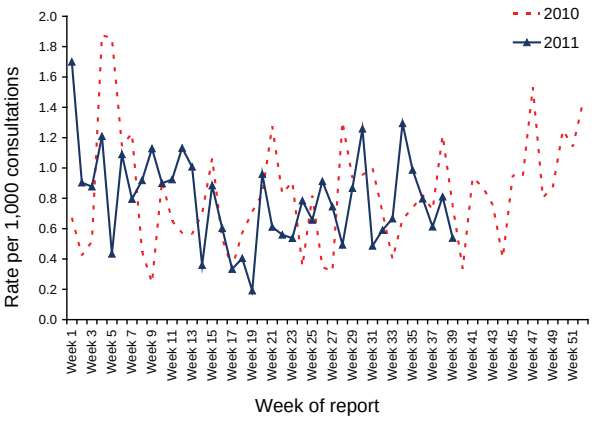


Figure 9: Consultation rates for chickenpox, ASPREN, 1 January 2010 to 30 September 2011, by week of report



same reporting period in 2010 where the average shingles rate was 0.8 cases per 1,000 consultations (0.3 to 1.3 cases per 1,000 consultations).

Figure 10: Consultation rates for shingles, ASPREN, 1 January 2010 to 30 September 2011, by week of report



HIV and AIDS surveillance

National surveillance for HIV disease is coordinated by the Kirby Institute, in collaboration with state and territory health authorities and the Australian Government Department of Health and Ageing. Cases of HIV infection are notified to the National HIV Registry on the first occasion of diagnosis in Australia, by either the diagnosing laboratory (Australian Capital Territory, New South Wales, Tasmania, Victoria) or by a combination of laboratory and doctor sources (Northern Territory, Queensland, South Australia, Western Australia). Cases of AIDS are notified through the state and territory health authorities to the National AIDS Registry. Diagnoses of both HIV infection and AIDS are notified with the person's date of birth and name code, to minimise duplicate notifications while maintaining confidentiality.

Tabulations of diagnoses of HIV infection and AIDS are based on data available 3 months after the end of the reporting interval indicated, to allow for reporting delay and to incorporate newly available information. More detailed information on diagnoses of HIV infection and AIDS is published in the quarterly Australian HIV Surveillance Report, and annually in 'HIV/AIDS, viral hepatitis and sexually transmissible infections in Australia, annual surveillance report'. The reports are available from the Kirby Institute, CFI Building, Cnr Boundary and West Streets, Darlinghurst NSW 2010. Internet: http://hiv.cms.med.unsw.edu.au/ Telephone: +61 2 9385 0900. Facsimile: +61 2 9385 0920. For more information see Commun Dis Intell *2011;35(1):58.*

HIV and AIDS diagnoses and deaths following AIDS reported for 1 July to 31 December 2010, are included in this issue of Communicable Diseases Intelligence *(Tables 1, 2, 3 and 4).*

Table 1: Number of new diagnoses of HIV infection, new diagnoses of AIDS and deaths following AIDS occurring in the period 1 July to 30 September 2010, by sex and state or territory of diagnosis

		State or territory								Totals for Australia			
	Sex	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	This period 2010	This period 2009	YTD 2010	YTD 2009
HIV diagnoses	Female	0	10	1	10	1	1	4	10	37	32	112	108
	Male	3	80	1	46	12	4	63	13	222	241	698	691
	Not reported	0	0	0	0	0	0	0	0	0	0	1	2
	Total*	3	91	2	56	13	5	67	23	260	274	816	801
AIDS diagnoses	Female	0	1	0	0	0	0	0	0	1	1	9	14
	Male	0	6	0	3	0	0	13	4	26	38	80	103
	Total*	0	7	0	3	0	0	13	4	27	39	89	117
AIDS deaths	Female	0	0	0	0	0	0	0	0	0	1	1	2
	Male	0	1	0	1	0	0	2	0	4	2	15	9
	Total*	0	1	0	1	0	0	2	0	4	3	16	11

* Totals include people whose sex was reported as transgender.

Table 2: Number of new diagnoses of HIV infection since the introduction of HIV antibody testing 1985, and number of new diagnoses of AIDS and deaths following AIDS since 1981, cumulative to 30 September 2010, by sex and state or territory

		State or territory								
	Sex	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
HIV diagnoses	Female	38	1,039	31	390	130	22	485	291	2,426
	Male	290	14,764	163	3,393	1,100	139	6,200	1,458	27,507
	Not reported	0	228	0	0	0	0	22	0	250
	Total*	328	16,066	194	3,792	1,231	161	6,731	1,756	30,259
AIDS diagnoses	Female	10	282	6	79	32	4	127	49	589
	Male	95	5,623	50	1,108	427	55	2,190	466	10,014
	Total*	105	5,924	56	1,189	460	59	2,330	517	10,640
AIDS deaths	Female	7	142	1	44	20	2	66	30	312
	Male	73	3,610	33	684	281	34	1,461	301	6,477
	Total*	80	3,763	34	730	301	36	1,536	332	6,812

* Totals include people whose sex was reported as transgender.

Table 3: Number of new diagnoses of HIV infection, new diagnoses of AIDS and deaths following AIDS occurring in the period 1 October to 31 December 2010, by sex and state or territory of diagnosis

		State or territory								Totals for Australia			
	Sex	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	This period 2010	This period 2009	YTD 2010	YTD 2009
HIV diagnoses	Female	1	4	0	7	0	0	14	7	33	35	145	143
	Male	3	58	0	55	2	2	57	17	194	226	892	917
	Not reported	0	0	0	0	0	0	0	0	0	0	1	2
	Total*	4	62	0	62	2	2	71	24	227	261	1043	1062
AIDS diagnoses	Female	0	0	0	1	0	0	0	0	1	5	10	19
	Male	0	11	1	4	0	0	13	3	32	20	112	123
	Total*	0	11	1	5	0	0	13	3	33	25	122	142
AIDS deaths	Female	0	0	0	0	0	0	0	0	0	0	1	2
	Male	0	2	0	3	0	0	2	0	7	3	22	12
	Total*	0	2	0	3	0	0	2	0	7	3	23	14

* Totals include people whose sex was reported as transgender.

Table 4: Number of new diagnoses of HIV infection since the introduction of HIV antibody testing 1985, and number of new diagnoses of AIDS and deaths following AIDS since 1981, cumulative to 31 December 2010, by sex and state or territory

		State or territory								
	Sex	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
HIV diagnoses	Female	39	1,043	31	397	130	22	499	298	2,459
	Male	293	14,822	163	3,448	1,102	141	6,257	1,475	27,701
	Not reported	0	228	0	0	0	0	22	0	250
	Total*	332	16,128	194	3,854	1,233	163	6,802	1,780	30,486
AIDS diagnoses	Female	10	282	6	80	32	4	127	49	590
	Male	95	5,634	51	1,112	427	55	2,203	469	10,046
	Total*	105	5,935	57	1,194	460	59	2,343	520	10,673
AIDS deaths	Female	7	142	1	44	20	2	66	30	312
	Male	73	3,612	33	687	281	34	1,463	301	6,484
	Total*	80	3,765	34	733	301	36	1,538	332	6,819

* Totals include people whose sex was reported as transgender.

Meningococcal surveillance

(Dr Monica M Lahra, The Prince of Wales Hospital, Randwick, NSW, 2031 for the Australian Gonococcal Surveillance Programme)

The reference laboratories of the Australian Meningococcal Surveillance Programme report data on the number of cases confirmed by laboratory testing using culture and by non-culture based techniques. Culture positive cases, where Neisseria meningitidis *is grown from a normally sterile site or skin lesions, and non-culture based diagnoses, derived from results of nucleic acid amplification assays (NAA) and serological techniques, are defined as invasive meningococcal disease (IMD) according to Public Health Laboratory Network definitions. Data contained in quarterly reports are restricted to a description of the numbers of cases by jurisdiction and serogroup, where known. Some minor corrections to data in the Table may be made in subsequent reports if additional data are received. A full analysis of laboratory confirmed cases of IMD in each calendar year is contained in the annual reports of the Programme is published in Communicable Diseases Intelligence. For more information see* Commun Dis Intell *2011;35(1):57.*

Laboratory confirmed cases of invasive meningococcal disease for the period 1 July to 30 September 2011 are included in this issue of Communicable Diseases Intelligence (Table).

Table: Number of laboratory confirmed cases of invasive meningococcal disease, Australia, 1 July to 30 September 2011, by serogroup and state or territory

State or territory	Year	Serogroup													
		A		B		C		Y		W135		ND		All	
		Q3	YTD	Q3	YTD	Q3	YTD	Q3	YTD	Q3	YTD	Q3	YTD	Q3	YTD
Australian Capital Territory	2011	0	0	0	5	0	0	0	0	0	0	0	0	0	5
	2010	0	0	1	2	0	0	0	0	0	0	0	0	1	2
New South Wales	2011	0	0	11	26	0	0	1	6	2	4	4	15	18	51
	2010	0	0	14	35	2	4	2	2	0	2	2	4	20	47
Northern Territory	2011	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2010	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Queensland	2011	0	0	26	46	0	3	1	3	0	0	0	2	27	54
	2010	0	0	31	48	4	5	0	0	1	2	0	0	36	55
South Australia	2011	0	0	6	10	0	1	0	0	0	2	0	1	6	14
	2010	0	0	6	16	0	0	0	1	0	0	0	0	6	17
Tasmania	2011	0	0	4	6	0	1	0	0	1	3	0	0	5	10
	2010	0	0	0	1	0	0	0	0	0	0	0	1	0	2
Victoria	2011	0	0	10	34	0	0	1	1	2	2	0	3	13	40
	2010	0	0	12	32	0	0	0	2	0	3	0	0	12	37
Western Australia	2011	0	0	4	12	0	0	0	1	0	0	0	0	4	13
	2010	0	0	8	13	0	1	0	1	1	1	0	0	9	16
Total	2011	0	0	61	139	0	5	3	12	5	11	4	21	73	188
	2010	0	0	73	147	6	10	3	6	3	8	2	5	86	176

Please Note: 2011 YTD totals have been amended to include diagnostic serology notifications.