Australian Government
Department of Health and Ageing

Communicable Diseases Intelligence

Volume 36 Number 4 Quarterly report December 2012

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ISSN 1445-4866 Online

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Communicable Diseases Intelligence contributes to the work of the Communicable Diseases Network Australia (http://www.health.gov.au/cdna)

Website

http://www.health.gov.au/cdi

Subscriptions and contacts

Communicable Diseases Intelligence is produced every quarter by:
Health Emergency Management Branch
Office of Health Protection
Australian Government Department of Health and Ageing
GPO Box 9848, (MDP 6)
CANBERRA ACT 2601;
Telephone: +61 2 6289 2717
Facsimile: +61 2 6289 2600
Email: cdi.editor@health.gov.au

This journal is indexed by *Index Medicus* and Medline.

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Annual reports

Annual report: surveillance of adverse events following immunisation in Australia, 2011

Deepika Mahajan, Jane Cook, Aditi Dey, Kristine Macartney, Rob I Menzies

Abstract

This report summarises Australian passive surveillance data for adverse events following immunisation (AEFI) reported to the Therapeutic Goods Administration (TGA) for 2011, and describes reporting trends over the 12-year period 2000 to 2011. There were 2,327 AEFI records for vaccines administered in 2011, a decrease of 40% from 3,894 in 2010. The decrease in 2011 was attributable to a decline in reporting following seasonal influenza (2,354 to 483) and pandemic H1N1 (pH1N1) influenza vaccines (514 to 2). However, reporting rates for some other vaccines were higher in 2011 compared with 2010. The 13-valent pneumococcal conjugate vaccine (13vPCV) replaced the 7-valent pneumococcal conjugate vaccine (7vPCV) and was suspected of involvement in 236 AEFI cases (48 per 100,000 doses). An increase in the number of reports following rotavirus (from 40 to 56 per 100,000 doses), and the hexavalent infant vaccine (from 27 to 40 per 100,000 doses), may have been due at least in part to co-administration with 13vPCV. Reports following DTPa-IPV also increased (from 94 to 139 per 100,000 doses), continuing a trend since 2009. AEFI reports following receipt of the 23-valent pneumococcal vaccine also increased markedly in those aged ≥65 years, from 155 to 288 records. In response to the increase in reports following 23vPPV, boosters are no longer recommended for those without medical risk factors. The most commonly reported reactions were injection site reactions, fever, allergic reactions and malaise. Only 7% of all the reported adverse events were categorised as serious, as per the database definitions, although some events classified as non-serious may have caused severe illness. Three deaths were temporally associated with vaccination; however, all were attributed to causes other than vaccination. The increase in 2011 was predominately due to reports of injection site reactions (49% increase in 2011). Increases in some instances may also be partly attributable to an increasing propensity to report AEFI. *Commun Dis Intell* 2012;36(4):E315–E332.

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

Introduction

This report summarises national passive surveillance data for adverse events following immunisation (AEFI) reported to the Therapeutic Goods Administration (TGA) to 28 February 2012. The report focuses on AEFI reported for vaccines administered during 2011 and trends in AEFI reporting over the 12-year period 1 January 2000 to 31 December 2011.

An adverse event following immunisation is defined as any untoward medical occurrence that follows immunisation and which does not necessarily have a causal relationship with the use of the vaccine.[1] The adverse event may be any unfavourable or unintended sign, abnormal laboratory finding, symptom or disease.[1]

Thus, AEFI may be caused by a vaccine(s) or may be coincidental. Adverse events may also include conditions that occur following the incorrect handling and/or administration of a vaccine(s). The post-marketing surveillance of AEFI is particularly important for detecting rare, late onset and unexpected events, which are difficult to detect in pre-registration vaccine trials.

Reports summarising national AEFI surveillance data have been published regularly since 2003. Trends in reported adverse events following immunisation are heavily influenced by changes to vaccines provided through the National Immunisation Program (NIP). Changes in previous years have been reported elsewhere.[2–10] Recent changes that impact on AEFI surveillance data presented in this report are:

i. From 1 July 2011, Prevenar 13® (13-valent pneumococcal conjugate vaccine, 13vPCV) replaced Prevenar® (7-valent pneumococcal conjugate vaccine, 7vPCV) on the NIP for children at 2, 4 and 6 months of age in all states and territories except the Northern Territory (which adopted 13vPCV from 1 October 2011).[11] In addition, children aged between 12 and 35 months, who had completed a primary pneumococcal vaccination course with 7vPCV were eligible to receive a free supplementary dose of Prevenar 13® from 1 October 2011 to 30 September 2012. The Northern Territory Gov-

ernment provided a free dose of Prevenar 13® at 18 months for children who previously received a primary course of Synflorix® (10vPCV) or a mixed primary pneumococcal course with Synflorix® and Prevenar®.[12]

ii. On 25 March 2011, TGA issued a recall of Batch N3336 of the 23 valent pneumococcal polysaccharide vaccine (23vPPV, Pneumovax® 23), as a precautionary measure following an increased number of reports of adverse reactions in patients who had received the vaccine.[13] Further advice to health professionals not to administer a second or subsequent dose of Pneumovax 23 vaccine was provided in April 2011.[14] Revised recommendations regarding which patients should be re-vaccinated under the NIP was provided in December 2011.[15]

A number of other important changes to vaccine funding and availability that impact on the interpretation of trend data have been described in detail in previous reports published regularly since 2003.[2–10] These are listed in Table 1 in chronological order. To assist readers, at the end of this report is a glossary of the abbreviations of the vaccines referred to in this report.

Methods

AEFI are notified to the TGA by state and territory health departments, health professionals, vaccine manufacturers and members of the public.[16,17] All reports are assessed using internationally consistent criteria[18] 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.

AEFI data

De-identified information on all AEFI reported to the TGA from 1 January 2000 to 28 February 2012 and stored in the ADRS database were released to the National Centre for Immunisation Research and Surveillance (NCIRS). Readers are referred to previous AEFI surveillance reports for a description of the surveillance system.[2,3]

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 2011, 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 2011.

Study definitions of AEFI 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[18] and the US Vaccine Adverse Events Reporting System (VAERS).[19] In this report, an event 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.

Causality ratings of 'certain', 'probable' and 'possible' are assigned to individual 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 that are considered in assigning causality ratings include the timing (minutes, hours), the spatial correlation of symptoms and signs in relation to vaccination (for injection site reactions), and whether one or more vaccines were administered, and are outlined in more detail elsewhere.[3] However, in many instances a causal association between vaccines administered to an individual and events that subsequently occurred cannot be clearly ruled in or out. In addition, children in particular often receive several vaccines at the same time. Therefore, all administered vaccines are usually listed as 'suspected' of involvement in a systemic adverse event as it is usually not possible to attribute the event to a single vaccine.

Typically, each record lists several symptoms, signs and/or diagnoses that have been coded by TGA staff from the reporter's description, into standardised terms using the Medical Dictionary for Regulatory Activities (MedDRA®).[20]

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 reactions listed and defined in *The Australian Immunisation Handbook* (9th edition).[17] 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 records (e.g. headache, dizziness, change in heart or respiratory rate or rhythm). Reaction terms listed in less than 1% of records were

* The term 'AEFI record' is used throughout this report because a single AEFI notification/report to the Medicine Safety Monitoring Unit can generate more than one record in the ADRS database. This may occur if there is a time sequence of separate adverse reactions in a single patient, such as systemic and local reactions.

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

Table 1: Changes to the Australian Standard Vaccination Schedule (2003–2010)[2–10]

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	From 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. From November 2005, universal funded immunisation against varicella at 18 months of age with a school-based catch-up program for children at 10–13 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	From 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. From 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. Pandemic H1N1 2009 influenza vaccine (Panvax®) was rolled out across Australia from 30 September 2009 for people aged ≥10 years. From December 2009, the pandemic vaccine was made available to children aged 6 months to 10 years.
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 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). 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. 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.
2011	From 1 July 2011, Prevenar 13® replaced Prevenar® on the NIP for children at 2, 4 and 6 months of age in all states and territories except the Northern Territory, which adopted 13vPCV from 1 October 2011. From 1 October 2011 to 30 September 2012 all children aged between 12–35 months who had completed a primary pneumococcal vaccination course with 7vPCV were eligible to receive a free supplementary dose of Prevenar 13® On 25 March 2011, TGA issued a recall of Batch N3336 of the 23 valent pneumococcal polysaccharide vaccine 23vPPV, Pneumovax® 23. In April 2011 health professionals were advised not to administer a second or subsequent dose of Pneumovax 23 vaccine.In December 2011 revised recommendations regarding which patients should be re-vaccinated under the National Immunisation Program were provided.

grouped into broader categories based on the organ system where the reaction was manifested (e.g. gastrointestinal, neurological).

Data analysis

All data analyses were performed using SAS software version 9.3.[21] 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.

Reporting rates per 100,000 administered doses were estimated where reliable information was available on the number of doses administered. This was done for 12 vaccines funded through the NIP for children aged <7 years, for influenza vaccine in adults aged ≥18 years, and for 23vPPV in adults aged ≥65 years.

Denominator data to estimate reporting rates for influenza and 23vPPV vaccines were obtained from a national adult coverage survey conducted in 2009.[22] For 23vPPV, the number of people vaccinated in 2011 was derived from the number of people who reported receipt of the vaccine within the previous 5 years, divided by five. 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.[23]

Notes on interpretation

Caution is required when interpreting the data presented in this report. Due to reporting delays and the late onset of some AEFI, the data are considered preliminary, particularly for the fourth quarter of 2011. Data published in previous reports for 2000–2010[2–10] may differ from that presented in this report for the same period because this report has been updated to include delayed notifications to the TGA that were not included in prior publications. Data can also differ because reports may be updated and recoded when follow-up information is received.

The information collated in the ADRS database is intended primarily for signal detection and hypothesis generation. While reporting rates can be estimated using appropriate denominators, they cannot be interpreted as incidence rates due to under-reporting and biased reporting of suspected events, and the variable quality and completeness of information provided in individual notifications.[2–10,24]

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 categories are created from available information and are similar, but not identical, to *The Australian Immunisation Handbook*[17] AEFI case definitions.

Comparison with online Database of Adverse Events Notifications

In August 2012, the TGA made a searchable database, the Database of Adverse Event Notifications (DAEN) publicly available on its web site. DAENS contains data of all adverse event reports for medicines (including vaccines).[25] This annual report includes data from the ADRS database sent to NCIRS by TGA in March 2012, and includes more detailed data than those provided by DAEN. The numbers published in this report may be different to the numbers in the DAEN database, due to different dates of data extraction. In addition, this report provides several features that are not available from the DAEN database, including long-term trends and population and dose-based reporting rates, put in the context of changes in vaccine policy and use, and reporting practices.

Results

The ADRS database included a total of 2,327 records where the date of vaccination (or onset of adverse event, if vaccination date was not reported) was between 1 January and 31 December 2011.

In 2011, 83% of AEFI (n=1,933) were reported to the TGA via states and territories, while the rest were reported directly to the TGA; 13% (n=291) by doctors or health care providers, 2% (n=42) by members of the public, 1% (n=29) by hospitals, and 1% (n=32) by drug companies. The proportion reported directly to the TGA by members of the public during 2011 (2%; n=42) was substantially lower than in 2009 (28%; n=664) and 2010 (13%; n=502) mainly because of the active promotion of the direct reporting of AEFI to TGA following the monovalent pandemic H1N1 influenza (pH1N1) vaccine in 2009, as well as a high level of public interest in both the pH1N1 and seasonal TIV vaccines during 2009 and 2010.

Reporting trends

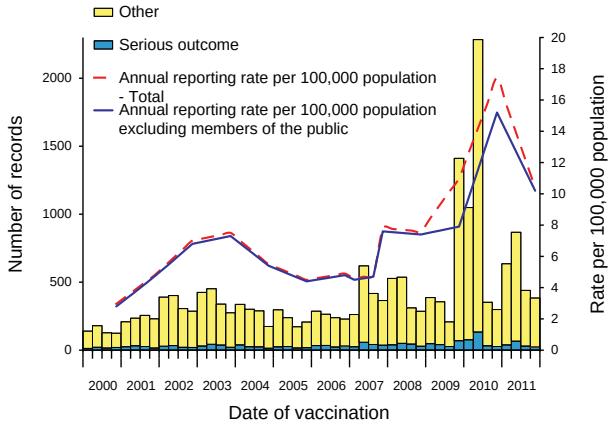
The overall AEFI reporting rate for 2011 was 10.4 per 100,000 population, compared with 17.4 in 2010. The AEFI reporting rate was the third highest for the period 2000 to 2011, after peaks in 2010 (17.4) predominantly due to reports in children following vaccination with the 2010 seasonal TIV, and in 2009 (11.0) following the commencement of the pandemic (pH1N1) influenza vaccine program.[9,10]

There was a substantial drop in reported events as well as reporting rate per 100,000 population during 2011, and the vast majority of reported events (from all reporter types) were of a non-serious nature (Figure 1). There were marked variations in reporting levels in association with previous changes to the NIP from 2000 onwards (Figures 2a, 2b and 2c). There was an increase in the number of in reports following the receipt of 7vPCV, 13vPCV, and DTPa-containing vaccines in children aged <7 years compared with previous years (Figures 2b and 2c). There was a spike in reports following 23vPPV vaccination in adults. However, this was consistent with the usual seasonal pattern of reporting from older Australians who typically receive 23vPPV and influenza vaccine during the autumn months (March–June) (Figure 2a).

Age distribution

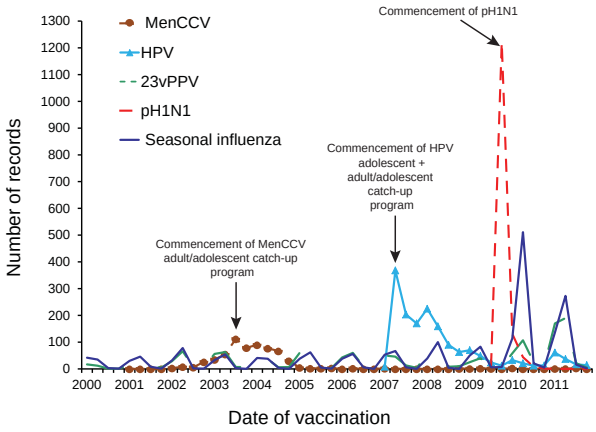
In 2011, the AEFI reporting rate per 100,000 population declined for all age groups <65 years com-

Figure 1: Adverse events following immunisation, ADRS database, 2000 to 2011, by date of vaccination



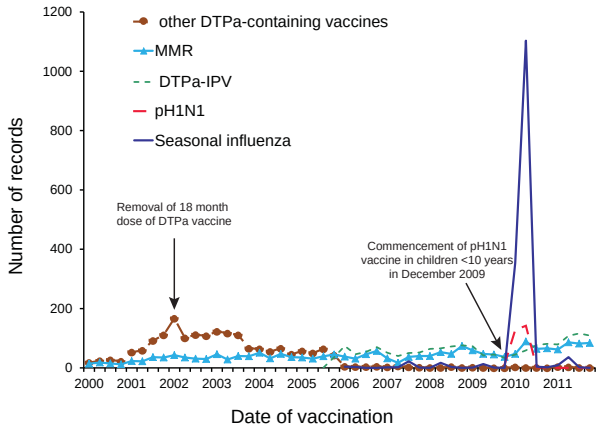
For reports where the date of vaccination was not recorded, the date of onset or the date the event was reported to the Therapeutic Goods Administration was used as a proxy for vaccination date.

Figure 2a: Adverse events following immunisation for people aged ≥7 years for frequently reported vaccines, ADRS database, 2000 to 2011, by date of vaccination



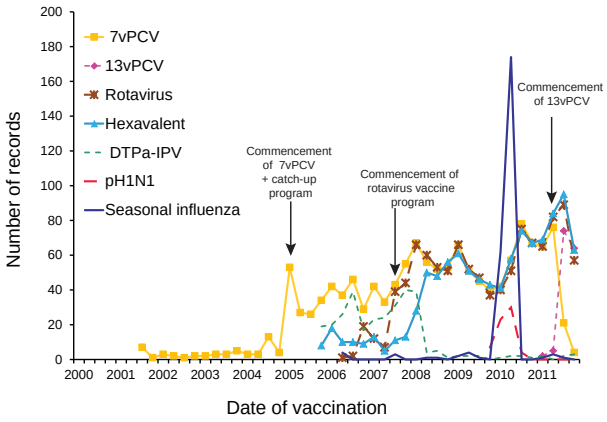
For reports where the date of vaccination was not recorded, the date of onset or the date the event was reported to the Therapeutic Goods Administration was used as a proxy for vaccination date.

Figure 2b: Adverse events following immunisation for children aged 1 to <7 years for frequently reported vaccines, ADRS database, 2000 to 2011, by date of vaccination



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

Figure 2c: Frequently suspected vaccines,* adverse events following immunisation for children aged <1 year, ADRS database, 2000 to 2011, by date of vaccination



* Meningococcal C conjugate vaccine (MenCCV) was introduced into the NIP 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; seasonal trivalent influenza vaccine in 2010; and the 13-valent pneumococcal conjugate vaccine (13vPCV) on 1 July 2011 (Table 1).

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

pared with 2010 (Figure 3). These decreases were almost entirely related to the decline in the number of reports following the receipt of the influenza vaccine; primarily seasonal influenza vaccine. An increase was observed in reporting rates per 100,000 doses of certain vaccines and age groups as shown in Table 2. Reporting rates per 100,000 doses were higher in 2011 compared with 2010 for all age groups, but the increase was significant in children aged 2 to <7 years (80.2 vs 44.7) compared with children aged <1 years (17.6 vs 12.8) and 1 to <2 years (14.2 vs 9.2). The increase in reporting of AEFI in children aged 2 to <7 years in 2011 is primarily because of increased reporting of injection site reaction (ISR) following vaccination with DTPa-IPV

Table 2: Vaccine types recorded as 'suspected' of involvement in adverse events following immunisation, ADRS database, 2011, by selected age group

Vaccines*	AEFI records† (n)	Vaccine doses‡ (n)	Reporting rate per 100,000 doses§ (95% CI)	
			2011	2010
<7 years				
DTPa-containing vaccines	757	1,135,635	66.7 (62.0–71.6)	44.0 (40.2–48.1)
DTPa-IPV	419	301,607	138.9 (125.9–152.9)	94.1 (83.2–106.2)
Pentavalent (DTPa-IPV-HepB)	1	252	396.8 (11.9–2222.2)	1033.6 (281.7–2646.0)
Hexavalent (DTPa-IPV-HepB-Hib)	337	833,776	40.4 (36.2–45.0)	26.5 (23.2–30.3)
Haemophilus influenzae type b	72	282,350	25.5 (19.9–32.1)	31.9 (25.6–39.2)
Measles-mumps-rubella	324	591,059	54.8 (49–61.1)	48.2 (42.6–54.2)
Meningococcal C conjugate	78	296,320	16.9 (20.8–32.8)	28.6 (22.8–35.4)
Pneumococcal conjugate –7vPCV	176	460,353	33.7 (32.8–44.3)	26.3 (22.9–30.0)
Pneumococcal conjugate –13vPCV	236	488,896	48.3 (42.3–54.8)	na
Rotavirus vaccine	294	522,638	56.3 (50.0–63.1)	39.8 (34.6–45.6)
Varicella	61	280,837	21.7 (16.6–27.9)	35.2 (28.5–42.9)
Seasonal influenza	52	na	na	na
pH1N1	2	na	na	na
Total‖ (<7 years)¶	1,121	4,058,431	27.6 (26.0–29.3)	19.3 (18.0–20.8)
7–17 years				
HPV	128	na	na	na
Hepatitis B	96	na	na	na
dTpa	93	na	na	na
Varicella	31	na	na	na
Seasonal influenza	66	na	na	na
pH1N1	–	na	na	na
Total 7–17 years)	346	na	na	na
18–64 years				
Seasonal influenza**	226	3,170,300	7.1 (6.2–8.1)	10.8 (9.7–12.0)
pH1N1	–	na	na	na
dTpa	108	na	na	na
23vPPV¶	84	132,520	63.4 (50.6–78.4)	22.6 (15.3–32.3)
Total‖ (18–64 years)††	467	3,302,820	9.4 (8.4–10.5)	11.3 (10.2–12.5)
≥65 years				
23vPPV**	288	317,400	90.7 (80.6–101.8)	48.8 (41.4–57.2)
Seasonal influenza**	129	2,176,000	5.9 (4.9–7.0)	7.0 (6.0–8.2)
pH1N1	–	na	na	na
dTpa	27	na	na	na
Total‖ (≥65 years)††	363	2,493,400	16.7 (15.2–18.4)††	12.4 (11.0–13.8)††

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

† Number of 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 2011. 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 (ACIR) and administered between 1 January and 31 December 2011.

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

‖ 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.

¶ Number of AEFI records excluding influenza vaccines

** Number of administered doses of seasonal influenza vaccine estimated from the 2009 AIHW national adult vaccination survey.[24]

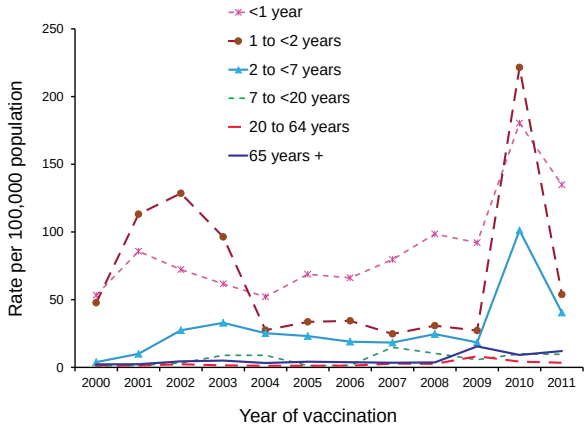
†† Seasonal influenza and 23vPPV only

Na Not applicable

containing vaccines and 13vPCV. The increase was largely seen in Victoria followed by Queensland and New South Wales.

There were reductions in population-based reporting rates in all age groups over the age of 7 years in 2011 compared with 2010, with the exception of the ≥65 year age group in which rates increased from 9.2 to 12.1 per 100,000. Also, reporting rates per 100,000 vaccine doses were higher overall in 2011 compared with 2010 for the ≥65 years age group (from 12.4 to 16.7) especially for 23vPPV (from 48.8 to 90.7) (Table 2).

Figure 3: Reporting rates of adverse events following immunisation per 100,000 population, ADRS database, 2000 to 2011, by age group and year of vaccination



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

Geographical distribution

Population-based reporting patterns varied between states and territories during 2011 (Table 3) as in previous years.[2–10] The highest rates were in the Northern Territory, the Australian Capital Territory and South Australia (27.7, 17.4, 15.1, respectively), while New South Wales had the lowest rate (6.2). Reporting rates dropped in most jurisdictions in 2011 compared with 2010. There was a 75% decline in Western Australia (from 42.1 to 10.5); 57% decline in South Australia (from 34.9 to 15.1) and a more than 45% decline in Tasmania (from 15.6 to 8.4) and the Australian Capital Territory (from 32.6 to 17.4).

Vaccines

Thirty-one different vaccines were included in the 2,327 records received in 2011 (Table 4). 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 records assigned causality ratings of 'certain' or 'probable' also varied, in accordance with the frequency of injection site reactions, for which

Table 3: Adverse events following immunisation, ADRS database, 1 January to 31 December 2011, by state or territory

State or territory	AEFI records		Annual reporting rate per 100,000 population*			
	n	%	Overall	'Certain'/'probable' causality rating†	'Serious' outcome‡	Aged <7 years
Australian Capital Territory	64	3	17.4 (13.4–22.2)	3.8	1.4	7.3
New South Wales	449	19	6.2 (5.7–6.8)	1.4	0.6	2.1
Northern Territory	64	3	27.7 (21.3–35.3)	7.8	3.5	14.7
Queensland	433	18	9.7 (8.8–10.6)	3.1	0.8	5.1
South Australia	248	11	15.1 (13.3–17.1)	2.7	0.5	7.4
Tasmania	43	2	8.4 (6.1–11.3)	2.2	0.0	3.3
Victoria	738	31	13.3 (12.4–14.3)	2.6	0.7	7.6
Western Australia	248	11	10.5 (9.3–11.9)	2.1	0.6	4.7
Other§	40	2	na	na	na	na
Total	2,327	100	10.4 (10.0–10.9)	2.3	0.7	5.0

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

† See previous reports[2,3] for criteria used to assign causality ratings.

‡ 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=32), members of the public (n=6), and health care providers (n=2).

Table 4: Vaccine types listed as 'suspected' in records of adverse events following immunisation, ADRS database, 2011

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	483	356	74	68	14	34	7	52	11	427	88
DTPa-IPV	426	198	46	161	38	16	4	419	98	4	1
23vPPV	405	281	69	106	26	17	4	16	4	386	95
MMR	348	34	10	14	4	20	6	324	93	22	6
DTPa-IPV-HepB-Hib	339	28	8	16	5	40	12	337	99	2	1
Rotavirus	296	31	10	7	2	36	12	294	99	1	0.3
13vPCV	236	78	33	43	18	20	8	235	99.6	1	0.4
dTpa	235	173	74	73	31	13	6	4	2	229	97
7vPCV	176	8	5	6	3	24	14	176	100	0	0
Hepatitis B	140	54	39	9	6	9	6	11	8	127	91
HPV	133	58	44	9	7	4	3	1	0.8	129	97
Varicella	96	55	57	10	10	8	8	61	64	35	36
MenCCV	83	3	4	0	0	9	11	78	94	5	6
Hib	73	2	3	0	0	9	12	72	99	1	1
Hepatitis A	25	3	12	1	4	3	12	6	24	19	76
DTPa	24	15	63	8	33	4	17	11	46	12	50
Typhoid	21	4	19	0	0	3	14	0	0	21	100
dT	19	13	68	6	32	1	5	0	0	19	100
Yellow fever	16	6	38	1	6	6	38	1	6	15	94
Hepatitis A + B	14	6	43	0	0	1	7	1	7	13	93
Rabies	13	6	46	0	0	4	31	2	15	11	85
10vPCV	11	2	18	0	0	1	9	9	82	2	18
Hepatitis A-Typhoid	9	2	22	0	0	2	22	2	22	7	78
Q fever	7	7	100	2	29	0	0	0	0	7	100
BCG	6	5	83	2	33	0	0	6	100	0	0
IPV	4	0	0	0	0	0	0	1	25	3	75
Japanese encephalitis	4	1	25	0	0	1	25	0	0	4	100
Men4PV	4	0	0	0	0	2	50	1	25	3	75
Cholera	2	2	100	0	0	2	100	0	0	2	100
dTpa-IPV	2	0	0	0	0	0	0	0	0	2	100
DTPa-IPV-HepB	1	0	0	0	0	0	0	1	100	0	0
Total**	2,327	1,421	61	523	22	158	7	1,121	48	1,189	51

* 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.

‡ Causality ratings were assigned to AEFI records using criteria described previously.[2,3]

§ 'Serious' outcomes are defined in the Methods section.

‖ 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 133 AEFI records; this was the only suspected vaccine in 44% of the 133 AEFI records, 7% had 'certain' or 'probable' causality ratings, 3% were defined as 'serious' and 97% 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.

the attribution of causality is more straightforward. There were also slight variations in the numbers with outcomes defined as 'serious', which have remained low as in previous years.

The individual vaccines most frequently suspected to have been related to AEFI events were seasonal influenza vaccine with 483 records (21%), followed by DTPa-IPV (n=426; 18%) and 23vPPV (n=405; 17%) (Table 4).

Reactions

The distribution and frequency of reactions listed in records for vaccines received in 2011 are shown in Tables 5a and 5b. In Table 5a, only the reaction categories analogous to those listed in *The Australian Immunisation Handbook*[17] are shown. In Table 5b, other reaction categories are listed in descending order of frequency.

The most frequently reported adverse events were ISR (46%), fever (24%), allergic reaction (18%), malaise (10%), rash, headache and pain (8% each) (Tables 5a and 5b; Figure 4).

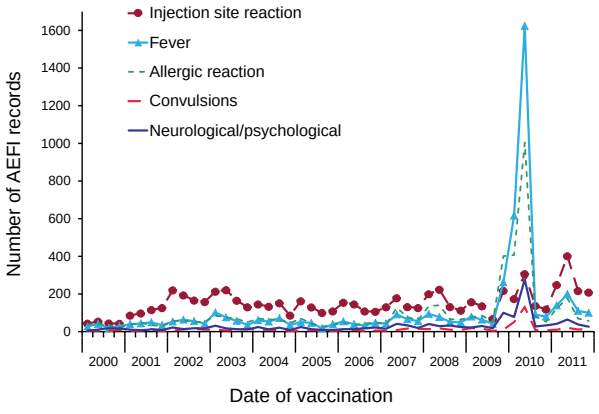
Of the 1,073 cases of ISR, 531 (49%) were children aged less than 7 years. The vaccines most commonly suspected to have been related to AEFI for the <7 years age group related to ISR were: DTPa-IPV (n=345); MMR (n=183); 13vPCV (n=77); hexavalent vaccine (n=61) and 7vPCV (n=24). For the ≥7 years age group (n=533), these were 23vPPV (n=269); seasonal influenza vaccine (n=163); and dTpa (n=116) either given alone or co-administered with other vaccines. As expected, reports for 23vPPV and seasonal influenza vaccine were predominantly in the ≥65 years age group (72% and 39% respectively), while dTpa was commonly reported in the 12–17 years (26%) and 18–64 years age groups (58%).

The number of reports in each reaction category has changed over time (Figure 4). In previous years, reports of allergic reactions peaked in 2003 and 2007, coinciding with the national school-based MenCCV immunisation program and the human papillomavirus school program. Much of the variation in reporting of ISR over time is 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.[2–10,26,27] Increases in reports of fever were largely associated with time periods when new vaccines were added to the NIP in the reporting period, such as 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. 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 the pH1N1 and seasonal influenza vaccines. Reports of convulsions peaked in 2010, mainly associated with the seasonal influenza vaccine but also to a lesser extent with pH1N1. The peaks in neurological/psychological conditions in both years were mainly related to the pH1N1 and seasonal influenza vaccine. In 2011, the increase in ISR was associated with non-influenza vaccines, particularly 23vPPV and DTPa-containing vaccines.

Severity of outcomes

Summary data on outcomes are presented in Table 6. Fifty-eight per cent of reported events in 2011 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) (Table 6). This is similar to the proportion of serious AEFI observed in previous years.[9,10] A further 22% were recorded as not fully recovered at the time of reporting; 41% of these reports came from Victoria, followed by Western Australia (20%) and Queensland (15%). Ninety-three per cent of cases recorded as 'not fully recovered' had missing information in various fields including hospitalisation; 77% were reported by states and territories, 17% by health care providers, 3% by members of the public, and 1% each by hospital, pharmacist and drug companies. Information on severity could not be determined for 14% (n=316) of records due to insufficient data and the majority of these reports came from states and territories (77%). Forty-four per cent of these reports were reported by Victoria. Of those without information describing severity,

Figure 4: Selected frequently reported adverse events following immunisation, ADRS database, 2000 to 2011, by date of vaccination



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

the most commonly reported adverse reactions were: ISR (49%); fever (23%); and allergic reactions (15%).

A total of 523 (22%) records were assigned causality ratings of either 'certain' (n=466; 20%) or 'probable' (n=57; 2%) and the rest (78%) were rated as 'possible'.

Table 5a: Reaction categories of interest* mentioned in records of adverse events following immunisation, ADRS database, 2011

Reaction category*	AEFI records	Only reaction reported†		'Certain'/'probable' causality rating‡		Age group§			
						<7 years		≥7 years	
	n	n	%‖	n	%‖	n	%‖	n	%‖
Injection site reaction	1,073	244	23	481	45	531	49	533	50
Fever	549	11	2	34	6	301	55	245	45
Allergic reaction¶	426	53	12	14	3	173	41	250	59
Rash**	190	66	35	1	1	134	71	54	28
Syncope	106	64	60	12	11	19	18	84	79
Abnormal crying	82	3	4	5	6	79	96	3	4
Convulsions	56	31	55	1	2	44	79	12	21
Lymphadenopathy/lymphadenitis††	42	4	10	13	31	7	17	35	83
Hypotonic-hyporesponsive episodes	38	29	76	1	3	38	100	0	0
Arthralgia	36	3	8	4	11	3	8	33	92
Abscess	16	5	31	6	38	4	25	12	75
Anaphylactic reaction	13	11	85	1	8	2	15	11	85
Arthritis	12	1	8	2	17	5	42	7	58
Intussusception	6	6	100	0	0	6	100	0	0
Guillain-Barré syndrome	3	2	67	1	33	0	0	3	100
Death	3	2	67	0	0	1	33	2	67
Brachial neuritis	1	1	100	0	0	0	0	1	100
Parotitis	1	0	0	0	0	0	0	1	100
Thrombocytopenia	1	1	100	0	0	1	100	0	0
Encephalitis	0	0	0	0	0	0	0	0	0
Encephalopathy	0	0	0	0	0	0	0	0	0
Orchitis	0	0	0	0	0	0	0	0	0
Osteitis	0	0	0	0	0	0	0	0	0
Sepsis	0	0	0	0	0	0	0	0	0
Total‡‡	2,327	1,421	61	523	22	1,121	48	1,189	51

* 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)[17] as described in the Methods section.

† AEFI records where only one reaction was reported.

‡ Causality ratings were assigned to AEFI records using criteria described previously.[2,3]

§ 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 1,073 AEFI records listing injection site reaction, 23% listed only one type of reaction while 45% had a causality rating of 'certain' or 'probable' and 49% 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, hematochezia etc. Does not include anaphylaxis.

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

†† Includes lymphadenitis following Bacille Calmette-Guérin vaccination and the more general term of 'lymphadenopathy'.

‡‡ 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 5b: 'Other'* reaction terms listed in records of adverse events following immunisation, ADRS database, 2011

Reaction term*	AEFI records	Only reaction reported†		'Certain'/'probable' causality rating‡		Age group§			
						<7 years		≥7 years	
	n	n	%‖	n	%‖	n	%‖	n	%‖
Malaise	240	0	0	16	7	80	33	160	67
Headache	180	4	2	6	3	19	11	59	88
Pain	176	6	3	2	1	16	9	159	90
Neurological/psychological	169	1	0.6	6	4	133	79	36	21
Oedema	146	9	6	2	1	35	24	110	75
Nausea	126	0	0	9	7	6	5	118	94
Myalgia	121	5	4	6	5	12	10	110	89
Erythema	118	16	14	2	2	41	35	77	65
Gastrointestinal – RVV¶	107	8	7	3	3	106	99	0	0
Abdominal pain	91	4	4	4	4	45	49	45	49
Respiratory	88	12	13	4	5	39	44	49	56
Dizziness	75	1	1	3	4	2	3	73	97
Reduced sensation	44	1	2	4	9	1	2	43	98
Increased sweating	39	0	0	0	0	7	18	32	82
Somnolence	39	0	0	3	8	28	72	11	28
Pallor	35	0	0	2	6	22	63	13	37
ENT**	32	1	3	4	13	5	16	27	84
Circulatory	25	2	8	1	4	7	28	18	72
Weakness	21	0	0	0	0	2	10	19	90
Flushing	17	1	6	2	12	2	12	15	88
Tremor	17	1	6	2	12	4	24	12	71
Vision impaired	16	0	0	1	6	5	31	11	69
Other	242	22	9	15	6	111	46	130	54
eye or ear	25	0	0	2	8	12	48	13	52
cardiovascular	14	0	0	1	7	5	6	9	64
general non-specific	38	10	26	3	8	16	42	22	58
infection	20	3	15	0	0	10	50	10	50
respiratory	10	0	0	0	0	5	50	5	50
psychological	15	0	0	3	20	8	53	7	47
neurological	14	4	29	1	7	7	50	7	50
skin††	17	2	12	2	12	9	53	8	47
renal/urogenital	11	0	0	0	0	1	9	10	91
gastrointestinal‡‡	15	0	0	1	7	8	53	6	40
musculoskeletal	11	2	18	0	0	2	18	9	82
metabolic/endocrine	15	0	0	1	7	9	60	6	40
pregnancy/congenital	5	1	20	1	20	1	20	4	80
miscellaneous	3	0	0	1	33	2	67	1	33
haematological	5	0	0	0	0	3	60	2	40

* Reaction terms not listed in *The Australian Immunisation Handbook*[17] but included in adverse events following immunisation (AEFI) records in the ADRS 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.

‡ Causality ratings were assigned to AEFI records using criteria described previously.[2,3]

§ 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 1,073 AEFI records listing injection site reaction, 23% listed only one type of reaction while 45% had a causality rating of 'certain' or 'probable' and 49% were for children aged <7 years.

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

** Includes all the conditions related to ear, nose and throat

†† Other, skin includes purpura, petechia, 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.

The reactions recorded as 'serious' (n=158) were ISR (n=40; 25%); fever (n=37; 23%); allergic reactions (n=23; 15%); convulsions (n=18; 11%), including 11 febrile convulsions; diarrhoea/vomiting (n=11; 7%); hypotonic-hyporesponsive episode (HHE) (n=6; 4%); anaphylaxis (n=4; 3%); Guillain-Barré syndrome (GBS) (n=3; 2%); intussusception (n=3; 2%); 3 cases of syncope (2%); 3 reports of death (2%); and 1 case of idiopathic thrombocytopenic purpura. 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=38; 38/56=68%), including 20 febrile convulsions; HHE (n=32; 32/38=84%); anaphylaxis (n=9; 9/13=69%); and intussusception (n=3; 3/6=50%).

All the reported cases of HHE (38) were from children aged <7 years. Seventeen reports (45%) were following co-administration of hexavalent, 7vPCV and rotavirus vaccines while 11 reports were following hexavalent, 13vPCV and rotavirus vaccines. Another 10 cases were following vaccination with MenC, MMR, BCG and DTPa/IPV administered simultaneously or individually.

All the 3 cases of GBS were in people aged >60 years. All of the three reports were following receipt of the seasonal influenza vaccine (2 following vaccination with Fluvax®, and one with Vaxigrip®).The timing in relation to administration of vaccine and onset of symptoms varied between same day to 7 weeks.

Of the 6 reports of intussusception, 5 were from infants (<1 year of age): 3 were following hexavalent, 7vPCV and rotavirus vaccines and 2 were following hexavalent, 13vPCV and rotavirus vaccines administered together. One report of intussusception was from a 19-month-old child following varicella vaccine administered alone. Five of the 13 reports of anaphylaxis in 2011 occurred following receipt of one of the influenza vaccines administered alone or in combination with other vaccines, while another 5 reports were following adult dTpa vaccine administered alone or in combination with other vaccines. Other individual vaccines leading to anaphylaxis were rotavirus, 13vPCV, and typhoid vaccine.

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

- One was an infant who had received hexavalent, 13vPCV and rotavirus vaccine 3 days prior to death. The cause of death was recorded as sudden infant death syndrome.
- The second reported death was a middle-aged person, with motor neurone disease, who died 4 days after receiving the seasonal influenza vaccine. He developed flu-like-illness after vaccination and had a cardiac arrest. The cause of the death was documented as complications of motor neurone disease.
- The third death was of a very elderly person, who developed progressive neurological dysfunction and died 29 days after receiving sea-

Table 6: Outcomes of adverse events following immunisation, ADRS database, 2011

Outcome	AEFI records		'Certain'/ 'probable' causality rating†		Age group‡ <7 years		≥7 years	
	n	%*	n	%§	n	%§	n	%§
Non-serious:	1,341	58	290	22	611	46	720	54
Not recovered at time of report	512	22	119	23	248	48	258	50
Not known (missing data) – total	316	14	87	28	172	54	144	46
Serious:	158	7	27	17	90	57	67	42
recovered with sequelae	1		–		–		1	
hospital treatment – admission	148		25		89		58	
life-threatening event	6		2		–		6	
Death	3		–		1		2	
Total	2,327	100	523	22	1,121	48	1,189	51

* Percentages relate to the total number of adverse events following immunisation (AEFI) records (n=2,327).

† Causality ratings were assigned to AEFI records using criteria described previously.[2,3]

‡ AEFI records where both age and date of birth were not recorded are not shown (17 missing).

§ Percentages relate to the number of AEFI records with the specific outcome, e.g. of 1,341 AEFI records with a 'non-serious' outcome, 22% had causality ratings of 'certain' or 'probable' and 46% were for children aged <7 years.

sonal influenza vaccine. The cause of the death was documented as acute disseminated encephalomyelitis (ADEM).

All deaths were investigated by the TGA and no clear causal relation to vaccination was found.

Pneumococcal conjugate vaccine

In 2011, pneumococcal conjugate vaccines (7vPCV and 13vPCV) were suspected of involvement in 412 records (236 for 13vPCV and 176 for 7vPCV) for people aged <7 years with 44 cases being coded as serious (24 for 7vPCV and 20 for 13vPCV). Eighty-five per cent of the 7vPCV reports were from the first half of the year and 97% of 13vPCV in the second half, consistent with their usage, with 13vPCV replacing 7vPCV in July 2011. The AEFI reporting rates in people aged < 7 years were 48.3 per 100,000 doses for 13vPCV and 33.7 per 100,000 doses for 7vPCV (Table 2). The rate for 7vPCV was about 28% higher in 2011 than in 2010 (26.3) and 33% higher than in 2009 (25.4). The majority of the 7vPCV vaccines were co-administered with hexavalent and rotavirus vaccines and only 5% were administered alone while in the case of 13vPCV, 29% (n=68) cases were administered alone. Of the 68 cases, 95% (n=65) of children were between 12 months and <36 months, who received vaccine under the catch-up program offered to children between 12 months and 35 months.

The most frequently reported reactions for 7vPCV were vomiting/diarrhoea (n=46, 26% each); fever (n=39, 22%); rash (n=34, 19%); screaming (n=31, 18%); allergic reactions (n=26, 15% each); ISR (n=24, 14%) and 1 case of syncope (Figure 5a). All reports recorded the co-administration of other vaccines.

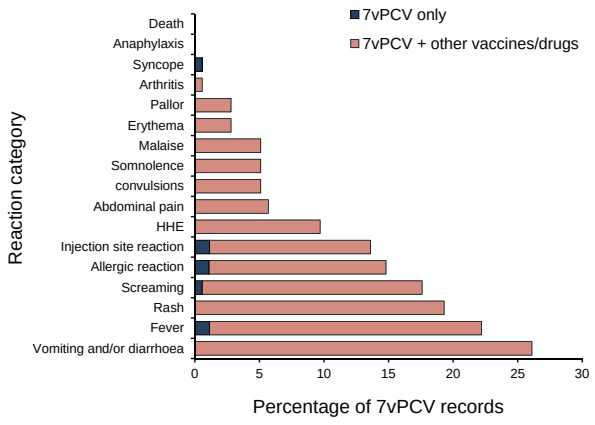
The spectrum of reactions for 13vPCV included 77 (33%) reports of ISR; 66 (28%) of fever; 43 (18%) of rash; 37 (16%) of vomiting/diarrhoea; 31 (13%) of allergic reactions; 2 case of syncope; 1 case of anaphylaxis and 1 reported death following co-administration of hexavalent, 13vPCV and rotavirus vaccine (Figure 5b).

Pneumococcal polysaccharide vaccine (23vPPV)

A single dose of 23vPPV is recommended for all non-Indigenous persons aged ≥65 years and all Indigenous persons aged ≥50 years. A second dose, 5 years later, should only be given to non-Indigenous persons aged ≥65 years with specified medical conditions that put them at increased risk of invasive pneumococcal disease, and to Indigenous persons who received their 1st dose at age ≥50 years.

There were a total of 405 records for 2011 where 23vPPV was listed as a suspected vaccine. Twenty-seven records were from those aged <18 year (16 in the 0–6 years and 11 in the 8–17 years age groups). There were 375 records for adults aged ≥18 years, with 13 cases coded as serious. There were 288 reports for older adults (≥65 years) including 194 (67%) reports of ISR, 76 (26%)

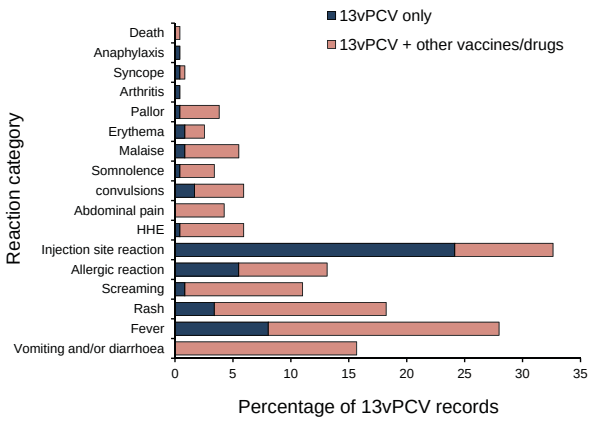
Figure 5a: Percentage of reported adverse events following immunisation with 7vPCV,* 2011, by reaction type and vaccine suspected of involvement in the reported event



* Per cent of 176 adverse events following immunisation records where 7vPCV was listed as suspected of involvement in the reported adverse event following immunisation.

Source: Adverse Drug Reactions Reporting System database, Therapeutic Goods Administration.

Figure 5b: Percentage of reported adverse events following immunisation with 13vPCV,* 2011, by reaction type and vaccine suspected of involvement in the reported event



* Per cent of 236 AEFI records (13vPCV) where 13vPCV was listed as suspected of involvement in the reported adverse event following immunisation.

Source: Adverse Drug Reactions Reporting System database, Therapeutic Goods Administration.

oedema, 60 (21%) fever, 43 (15%) erythema, 4 reports of syncope, and 1 report of anaphylaxis (Figure 6.). Using the 2009 estimate of the number of doses of 23vPPV administered to people aged ≥65 years (n=317,400), the reporting rate was 90.7 per 100,000 doses, with rates of 3.2 for events classified as serious and 61.0 for ISR. This is substantially higher than the overall rate reported for 2010 (from 48.8 to 90.7). Reporting rates for ISR also increased substantially (from 39.7 per 100,000 to 61.0 per 100,000).

An initial increase in reports of adverse events following vaccination with 23vPPV was noted in early 2011 up to 25 March 2011, which was much greater than the historical average (Figure 7). These initial reports triggered a national investigation, which led to a batch recall on 25 March and a subsequent increase in reporting.

Figure 7: Injection site reactions following 23vPPV immunisation for individuals aged ≥65 years, 2002 to 2011, by week of vaccination (2002–2010)* and week of report (2011)†

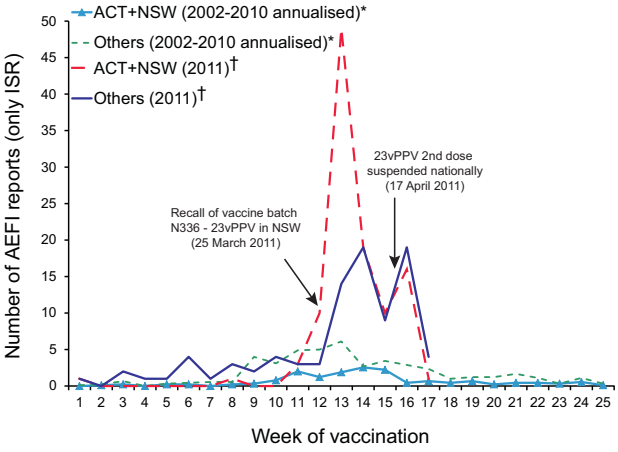
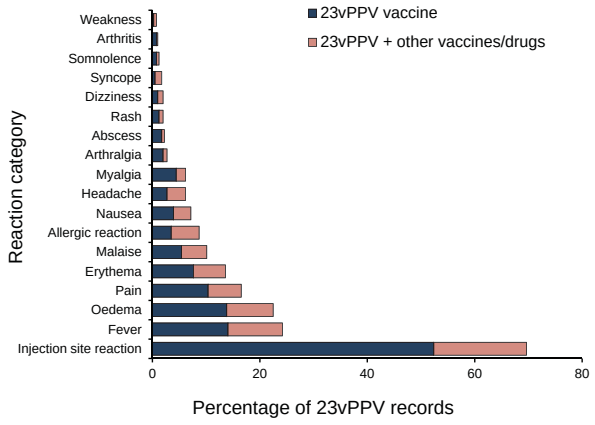


Figure 6: Percentage of reported adverse events following immunisation with pneumococcal polysaccharide (23vPPV),* 2011, by reaction type and vaccines suspected of involvement in the reported event



* Per cent of 405 adverse events following immunisation records where the pneumococcal polysaccharide vaccine (23vPPV) was listed as suspected of involvement in the reported adverse event following immunisation.

Source: Adverse Drug Reactions Reporting System database, Therapeutic Goods Administration

Discussion

In 2011 there was a substantial drop in the total number of reports of AEFI and population-based reporting rates compared with 2010, predominantly due to a large decline in reports following vaccination with seasonal influenza vaccine and pH1N1 influenza vaccines. The reduction in reports follows the temporary suspension of the Western Australia vaccination program for children under 5 years and the national vaccination program for at-risk children under age 5 years in 2010 and the subsequent recommendations against using the CSL vaccine (Fluvax®) in young children (<10 year),[28,29] which was associated with fever and febrile convulsions in children <5 years and has been discussed in detail elsewhere.[30]

However in 2011, reporting rates per 100,000 doses, which excluded influenza vaccine in children due to unreliable dose data, increased in all age groups except those aged 18–64 years, as shown in Table 2. The increase in reports for children aged 2 to <7 years is primarily due to ISR following vaccination with DTPa-IPV and 13vPCV. The increase was largely seen in Victoria, Queensland and New South Wales.

Data from the clinical studies of Prevenar 13® demonstrated an increase in ISR and systemic reactions following the 4th dose of 7vPCV or 13vPCV vaccine in the second year of life compared with earlier doses.[31] From October 2011 children aged between 12 and 35 months who had completed a primary pneumococcal vaccination course with 7vPCV have been eligible to receive a free supplementary dose of Prevenar 13®,[11] and the increased reporting rate of ISR for 13vPCV may be in part because it is being given as a fourth dose of a PCV vaccine. It may also be attributed to the 'Weber effect',[32] which describes increased reporting frequently observed following the introduction of new vaccines.

The reporting rate of ISR in children aged 2 to <7 years has declined in recent years, as was expected following the removal of the dose of DTPa-IPV due at 18 months of age from the NIP schedule in September 2003. However, an increase in ISR following DTPa-IPV was observed in 2011.

The reasons for the increase in 2011 are not entirely clear but are at least partly due to general changes in AEFI surveillance. One additional suggested hypothesis is that some ISR's are 'Arthus reactions' caused by the presence of high levels of prevaccination IgG antibody in the vaccinees, which have been associated with higher rates of ISR.[33,34] Possible causes of higher pre-vaccination antibody levels include immunity induced by natural infection during the pertussis epidemic from 2008, which was notable for high notification rates in pre-school aged children,[35] as well as the earlier age of administration of the pre-school DTPa-IPV booster since the change of eligibility rules for provider and parent incentive payments.[36]

The higher overall numbers of reports in 2011 (excluding influenza vaccines) is also suggestive of generally increased propensity to report by providers in 2011, and may also reflect changes in the proportion of reports that were sent to TGA from individual state or territory surveillance systems. For example, in 2011, Victoria changed to submitting all reports to TGA, irrespective of severity, whereas previously minor/expected AEFI reports had not been submitted [personal communication: Dr Nigel Crawford, Surveillance of Adverse Events Following Vaccination In the Community (SAEFVIC), Victoria].

Reports of adverse events following 23vPPV vaccination in those aged ≥65 years increased substantially in 2011 compared with 2010 in all AEFI (from 48.8 to 90.7 per 100,000 doses). This increase may have been due to a larger number of people receiving second doses (recommended 5 years after the second dose) following the commencement of nationally funded vaccine in 2005. However, the current method of estimating the number of doses administered does not allow the detection of changes in vaccinations by year and cannot distinguish between the first and subsequent doses. In response to the continued increase in reports of severe ISR reports, in April 2011, the TGA issued advice to health professionals not to administer a second or subsequent dose of Pneumovax 23 vaccine.[14] An expert multidisciplinary working group was convened to investigate all reports of ISR following 23vPPV. Revised recommendations regarding which patients should be re-vaccinated under the NIP was provided in December 2011, with revaccination no longer recommended for those in the ≥65 years age group without predisposing medical conditions.[15]

Conclusion

There was a decline of 40% in the number of AEFI reported in 2011 compared with 2010 when a large number of reports were submitted in association with influenza vaccination. However, reporting rates for selected vaccines were higher in various age groups in 2011, mainly due to reports of ISR. Increases in reports in infants were related to the introduction of 13vPCV onto the schedule from July 2011, particularly including the supplementary booster dose for children aged 12–35 months, which as a booster dose, is known to be associated with increased ISRs. Increases in the 2 to <7 year age group were related to the DTP-IPV vaccine, and continue the trend of increasing reports since 2009. There was also an increase in the 12–17 year age group associated with dTPa. Increases in reactions in the ≥65 years age group were mostly of ISR following 23vPPV, many of which may have been second doses. The increase in the reporting rate for most vaccines might also be due to the greater propensity by providers to report in 2011 due to the heightened awareness of adverse events following influenza vaccine safety issues in 2010.

The majority of AEFIs reported to the TGA were mild transient events and the data reported here are consistent with an overall high level of safety for vaccines included in the NIP schedule.

Acknowledgements

We thank Brynley Hull and Donna Armstrong, NCIRS, for assisting in the preparation of this report.

The National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases is supported by the Australian Government Department of Health and Ageing, the NSW Department of Health and The Children's Hospital at Westmead, Australia.

Author details

Deepika Mahajan[1]
Jane Cook[2]
Aditi Dey[1]
Kristine Macartney[1]
Rob Menzies[1]

1. National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, University of Sydney and The Children's Hospital at Westmead, Sydney, New South Wales
2. Office of Product Review, Therapeutic Goods Administration, Canberra, Australian Capital Territory

Corresponding author: Dr Deepika Mahajan, National Centre for Immunisation Research and Surveillance, Locked Bag 4001, WESTMEAD NSW 2145. Telephone: +61 2 9845 1433. Facsimile: +61 2 9845 1418. Email: Deepika.mahajan@ health.nsw.gov.au

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Abbreviations for 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
pH1N1	pandemic H1N1 influenza 2009
7vPCV	7-valent pneumococcal conjugate vaccine
10vPCV	10-valent pneumococcal conjugate vaccine
23vPPV	23-valent pneumococcal polysaccharide vaccine

Peer-reviewed articles

Changing epidemiology of bloodstream infection pathogens over time in adult non-specialty patients at an Australian tertiary hospital

Ar Kar Aung, Matthew J Skinner, Felicity J Lee, Allen C Cheng

Abstract

The epidemiology of bloodstream infections (BSI) has been changing over time in developed countries. However, overview reports of BSI trends are limited in Australia. This descriptive epidemiological study analysed general and age-group specific trends, and antimicrobial susceptibility patterns of blood culture isolates between 2001 and 2009 in non-specialty adult patients at an Australian tertiary referral centre. A total of 3,051 isolates from 2,172 patients (60% males) were analysed. Both community onset (1,790 isolates, 59%) and hospital onset (1,261 isolates, 41%) BSIs were included. The mean age of patients was 59 ± 20 years; 930 patients (43%) were 70 years of age or over. Overall, 1,493 (49%) gram positive bacteria, 1,389 (46%) gram negative bacteria and 169 (5.5%) fungi were isolated. The proportion of gram negative isolates increased over the 9 years, (44% to 53%, $P = 0.006$) whilst gram positives decreased (49% to 45%, $P = 0.045$). These trends were significant in community onset infections but not hospital onset infections, and also in adult patients (≥20 to <70 years) but not in the elderly (≥70 years). Gram negative pathogens were most prevalent amongst the elderly (53% in the ≥70 years age group, $P < 0.0001$ vs 41% in the ≥20 to <70 years age group), attributable to an age-dependent increase in *Escherichia coli* infections and a decrease in *Staphylococcus aureus* infections ($P < 0.0001$ for both). Most gram negative isolates remained susceptible to commonly prescribed antibiotics. By contrast, methicillin-resistant *S. aureus* rates decreased from 54% in 2001 to 28% in 2009 ($P = 0.007$). This study found that gram negative BSIs appeared to be re-emerging, particularly in community onset infections and also amongst the younger patients at the study institution. Such epidemiological trends have important implications for antimicrobial choices for the treatment of undifferentiated sepsis. *Commun Dis Intell* 2012;36(4):E333–E341.

Keywords: bloodstream infections, gram positive organisms, gram negative organisms, epidemiology, antimicrobial susceptibility

Introduction

Bloodstream infections (BSIs) are a major cause of morbidity and mortality worldwide. They contribute significantly to the healthcare burden and their management remains a constant challenge for physicians.[1,2] The epidemiology of BSIs is continually changing. Since the early 1980s there has been a gradual shift towards gram positive organisms being the predominant pathogens for BSIs in developed countries, in both community and healthcare-associated settings.[2,3] By contrast, gram negative organisms remain the more prevalent BSI pathogens in developing countries.[4,5] However, there has been a recent re-emergence of gram negative organisms, particularly in developed countries, contributing up to 55% of community-associated BSIs.[6–9] The prevalence of gram negative infections is also known to increase with age, and elderly patients are most vulnerable to high morbidity and mortality from these BSIs.[1,10–13]

Among the BSI pathogens in developed countries, *Staphylococcus aureus* is the most frequently isolated gram positive pathogen, whilst *Escherichia coli* is the most frequently isolated gram negative pathogen.[6,7,10,14,15] The antimicrobial susceptibility patterns of common BSI isolates have also been changing over time.[3,14,16,17] A concerning increase in infections with methicillin-resistant *S. aureus* (MRSA) worldwide as well as resistant gram negative isolates to commonly used antimicrobials has been described.[17,18]

Despite regular reporting of epidemiologic data in other developed parts of the world, such overview reports on BSI trends are limited in Australia.[19,20] Moreover, current Therapeutic Guidelines recommend the use of intravenous flucloxacillin and gentamicin as empiric treatment for all patients presenting with undifferentiated sepsis.[21] However, recent epidemiological studies to support or refute these recommendations are lacking. In addition, these recommendations do not take into account the age-specific distribution of BSI organisms and that elderly patients are more prone to unwanted side effects of

antibiotic treatment. All these factors pose significant challenges for the management of undifferentiated sepsis for the hospital inpatient population, which comprises both community and hospital onset infections. This descriptive epidemiological study was conducted with the aim of reviewing the changing trends in the epidemiology of BSI pathogens, and the antimicrobial susceptibility patterns for the most commonly isolated organisms over a 9-year period, among non-specialty inpatients at a single Australian tertiary institution. The study further stratified the overall trends into community and hospital onset infections and two age groups: adults (≥20 years to <70 years) and the elderly (>70 years) to determine any strata-specific trends.

Methods

This study was conducted at The Alfred; a 380 bed adult tertiary referral centre and university teaching hospital, in Melbourne, Australia. Approval to conduct the study was obtained from the hospital ethics committee prior to commencement.

BSI isolates collected between 1 January 2001 and 31 December 2009 from patients aged 20 years or over were identified. Both community and hospital onset infections were included. Community onset infections were defined as the time from hospital admission to the first positive blood culture of 48 hours or less, and hospital onset infections as occurring more than 48 hours post-admission. Information on patient demographics, positive blood culture isolates and antimicrobial susceptibilities were extracted from computerised admission and routine laboratory databases.

Study population

Organ transplant recipients, haematology, oncology, respiratory (including cystic fibrosis) and burns patients were excluded as they represented heterogenous populations. Patients included in the study were from 'non-specialty' populations, defined as any patient from an inpatient unit who did not meet the above exclusion criteria. They included all patients from general medicine, subspecialty medicine units (including patients on haemodialysis), psychiatry, radiation oncology, general surgery and surgical specialties (including trauma but not the burns unit). These patients were chosen as they represented a more homogenous group who were not heavily immunocompromised nor were they likely to have bloodstream infections with distinct pathogens, thereby closely representing the general patient population.

Coagulase negative staphylococci isolates were excluded as it was not possible to retrospectively differentiate between true infection and contamination. Duplicate isolates, defined as the growth of the same organism within 14 days of the primary blood culture with the same antibiograms, were counted as a single BSI episode.

During the period of this study, *in vitro* antimicrobial susceptibility data for BSI isolates and minimum inhibitory concentration (MIC) breakpoints were reported by the laboratory in accordance with the British Society of Antimicrobial Chemotherapy guidelines using the disc diffusion method.[22]

Statistical analysis

All statistical analyses were performed using GraphPad Prism 4.0 (GraphPad Software, San Diego, CA). Continuous numerical data were expressed as mean ± standard deviation and categorical data were expressed as count and proportions. Dichotomous age groups of adult and elderly were pre-defined for statistical analysis. These age groups were chosen to reflect the published epidemiology of BSIs and associated mortality in the elderly, and are also in accordance with recent studies of the elderly populations.[23–25]

Simple linear regression analyses were performed using years as independent variables and proportions of gram positive and gram negative organisms in a given year as dependent variables to detect significant trends over time. These trends were further stratified according to community and hospital onset BSIs and pre-defined age groups of adult and elderly to further detect category specific trends. Similar linear regression analyses were performed on antimicrobial susceptibility data, with per cent susceptibility as dependent variables, for key isolates to antimicrobials of interest. With all linear regression analyses, normality of distribution was assumed and a two sided *P*-value of less than 0.05 was considered significant, provided the coefficient of determination, $R^2 \geq 0.3$.

Pearson's chi-square tests were used to measure the differences in the proportions of gram positive and gram negative BSIs and the proportions of individual BSI organisms between the pre-defined age categories. In these analyses, the proportions over the 9-year period were collapsed into overall proportions in each age group. A two sided *P* - value of less than 0.05 was considered statistically significant for chi-square tests.

Results

A total of 5,821 blood culture isolates were identified over a 9-year period. After exclusions (Figure 1), 3,051 isolates were included for further analysis. These isolates represented a total of 2,172 patients (60% males). Of the excluded blood cultures,

coagulase negative staphylococci were isolated from 2,467 samples (42% of all positive blood cultures). Other excluded samples were 72 from patients aged less than 20 years and 231 duplicates. The mean age of patients was 59 ± 20 years and 930 (43%) patients were in the elderly age group.

Table 1 details BSI isolates over the 9-year period, with figures for the lead pathogen in each group. Overall, there were 1,493 (49%) gram positive isolates, 1,389 (46%) gram negative isolates and 169 (5.5%) fungal isolates. Of the isolates analysed, 1,790 (59%) were community onset whilst 1,261 (41%) were hospital onset BSIs. Community onset BSIs comprised 861 (48%) gram positive, 904 (51%) gram negative and 25 (1.4%) fungal isolates while hospital onset BSIs, comprised 632 (50%) gram positive, 485 (39%) gram negative and 144 (11%) fungal isolates.

A statistically significant increase in the proportion of gram negative pathogens was evident over time (44% in 2001 to 53% in 2009, $P = 0.006$) with a concomitant decrease in the proportion of gram positive pathogens (49% in 2001 to 45% in 2009, $P = 0.045$) (Figure 2). Community onset BSIs showed similar statistically significant trends in increasing proportions of gram negative pathogens and decreasing proportions of gram positive pathogens over time (Figure 3). By contrast, no statistically significant changes in trends over time were detected for hospital onset BSIs (Figure 4). When stratified according to age groups, statistically significant trends in increasing gram negative infections and decreasing gram positive infections were observed over time in the adult age group (Figure 5). However, these trends were not evident

Figure 1: A flow diagram outlining the selection process for isolates

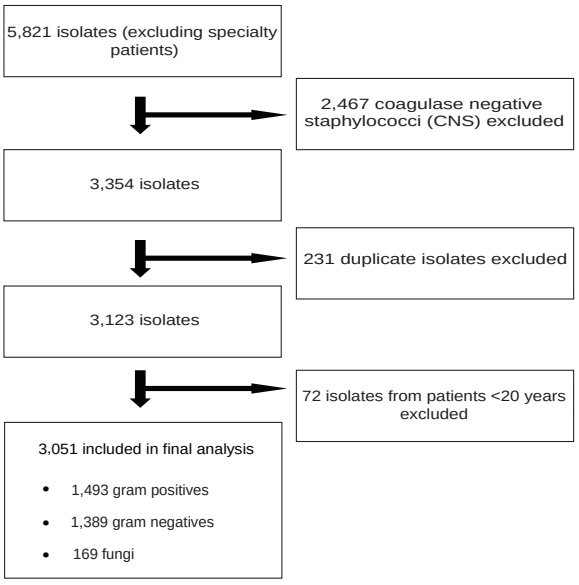

Table 1: Bloodstream infection isolates, 2001 to 2009, by organism

Year	2001		2002		2003		2004		2005		2006		2007		2008		2009		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Gram positives	**189**	**48.7**	**250**	**61.0**	**216**	**51.3**	**175**	**47.9**	**145**	**44.3**	**142**	**48.0**	**137**	**45.5**	**127**	**43.2**	**112**	**45.0**	**1,493**	**48.9**
S. aureus	100	25.8	138	33.7	107	25.4	87	23.8	78	23.9	72	24.3	57	18.9	47	16.0	45	18.1	731	24.0
Gram negatives	**169**	**43.6**	**137**	**33.4**	**177**	**42.0**	**168**	**46.0**	**162**	**49.5**	**142**	**48.0**	**151**	**50.2**	**152**	**51.7**	**131**	**52.6**	**1,389**	**45.5**
E. coli	55	14.2	54	13.2	70	16.6	63	17.3	73	22.3	81	27.4	80	26.6	74	25.2	68	27.3	618	20.3
Fungi	**30**	**7.7**	**23**	**5.6**	**28**	**6.7**	**22**	**6.0**	**20**	**6.1**	**12**	**4.1**	**13**	**4.3**	**15**	**5.1**	**6**	**2.4**	**169**	**5.5**
C. albicans	13	3.4	13	3.2	13	3.1	12	3.3	10	3.1	6	2.0	8	2.7	9	3.1	2	0.8	86	2.8
Total BSI episodes	**388**	**100.0**	**410**	**100.0**	**421**	**100.0**	**365**	**100.0**	**327**	**100.0**	**296**	**100.0**	**301**	**100.0**	**294**	**100.0**	**249**	**100.0**	**3,051**	**100.0**

BSI Bloodstream infections.

in the elderly age group (Figure 6). Results of linear regression analyses were further summarised in Table 2.

S. aureus (731 isolates, 24%) remained the most common BSI pathogen followed by *E. coli* (618 isolates, 20%); *Klebsiella pneumoniae* (160 isolates, 5.2%); *Enterococcus faecalis* (156 isolates, 5.1%) and *Pseudomonas aeruginosa* (112 isolates, 3.7%). The proportion of fungal BSIs was low (169 isolates, 5.5%), with *Candida albicans* being most frequently isolated (86 isolates, 2.8%).

Gram negative BSIs were significantly more common in the elderly patients (41% in the adult age group vs 53% in the elderly age group, $P < 0.0001$) whilst gram positive infections were more common in the younger patients (54% in the adult age group vs 42% in the elderly age group, $P < 0.0001$). This finding was mainly mediated by an increase in prevalence of *E. coli* BSIs (15% in the adult age group vs 28% in the elderly age group, $P < 0.0001$) with a concurrent decrease in prevalence of *S. aureus* BSIs with age (27% in the adult age group vs 19% in the elderly age group, $P < 0.0001$). No other statistically significant age group specific differences in proportions were observed for other pathogens in the top rank order.

In terms of antimicrobial sensitivity (Table 3), the percentage of methicillin-resistant *S. aureus* (MRSA) BSI episodes decreased from 54% in 2001 to 28% in 2009 ($P = 0.007$). Most *Ent. faecalis* isolates remained susceptible to amoxicillin, and this trend did not change over time ($P = 0.13$); although an increase in vancomycin resistance was noted over this 9-year period ($P = 0.035$). A similar trend in vancomycin resistance was also observed for *Ent. faecium* isolates ($P = 0.012$); however, their overall numbers remained relatively small.

Most *E. coli* isolates remained susceptible to gentamicin and carbapenems but an increase in resistance to third-generation cephalosporins and ciprofloxacin was observed ($P = 0.027$ and 0.019 respectively). There was a significant increase in ceftazidime resistance in *E. coli* ($P = 0.013$), indicating an increase in the number of extended spectrum beta-lactamase inhibitor producing organisms, but the overall proportions remained low (<5%). Other key gram negative isolates remained susceptible to the commonly used antibiotics. Interestingly, gentamicin resistance decreased over time in *Klebsiella spp*. ($P = 0.044$) (Table 1).

Discussion

In certain developed regions of the world, such as North America and Europe, the epidemiological data on BSI pathogens and their antimicrobial susceptibilities have been published at regular intervals.[14,16,17] Likewise, in the Australasian region, the Australian Group on Antimicrobial Resistance has taken the lead in reporting the epidemiology of specific BSI pathogens such as *S. aureus*.[26–28] Although state-based surveillance programs are in place throughout Australia to monitor the epidemiology of bloodstream infections, reports from such programs are limited.[29] This study is one of the few Australian studies that has analysed trends for a range of pathogens to describe trends in the epidemiology of BSIs at a single referral centre.[19,20,30,31] One aim of this study was to encourage other Australian tertiary institutions to report epidemiological data of a similar nature, thus allowing for the collation of more generalisable regional and national data on the epidemiology of BSIs.

At the study institution, gram positive BSIs remained prevalent overall in the non-specialty patient population over the last 9 years. However, there was a significant increase in the prevalence of gram negative BSIs with a concomitant decrease in gram positive BSIs over time. This trend appears to have been mediated by the changing epidemiology in community onset but not hospital onset infections and, also in the younger adult age group. Gram negative pathogens remained the predominant cause of BSI in the elderly. Whilst *E. coli* resistance to third-generation cephalosporins and ciprofloxacin increased over time, antimicrobial susceptibilities for other gram negative organisms remained relatively stable. Vancomycin-resistant enterococci (VRE) infection rates had increased but MRSA rates had decreased.

In the last decade, gram negative pathogens have re-emerged as dominant contributors of BSIs in some developed countries, both in the healthcare-associated and community-acquired settings.[6,7] The study results appear to be consistent with these trends, although the trends for hospital onset BSIs failed to reach statistical significance. The reasons for this are unclear. However a change in the hospital patient population, local antimicrobial prescribing preferences and differing methods of clinical practice may play important roles.[7] Another possible contributing factor to this trend is the ageing population in developed countries, since gram negative infections are more common in the elderly and nursing home residents.[11,13] The study results challenged such assumptions. It was surprising to find that the changing epidemiology at the study institution was not mediated by the elderly age group, but rather by the adult age group. As with previous studies, it was found that in the elderly age group the likelihood of gram negative infections increased significantly. This demonstrates that there is a gradual shift towards infections involving enteric organisms with increasing age.

Figure 2: The proportion of gram positive and gram negative pathogens, 2001 to 2009

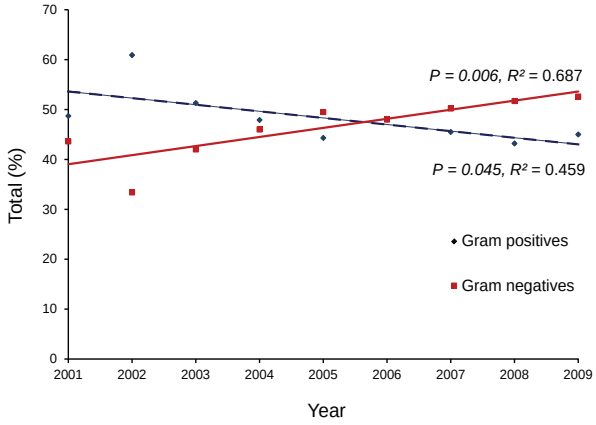

Figure 3: The proportion of gram positive and gram negative pathogens in community onset bloodstream infections, 2001 to 2009

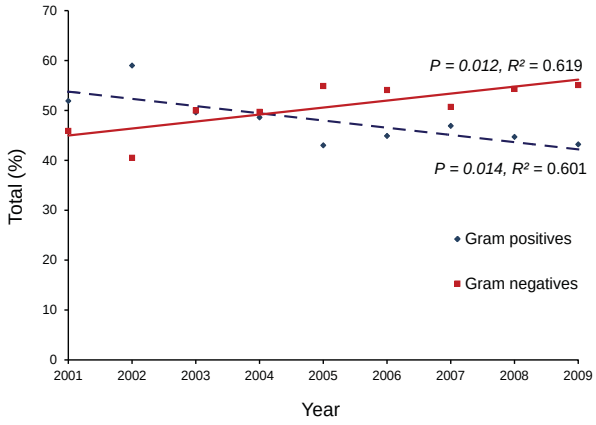

Figure 4: The proportion of gram positive and gram negative pathogens in hospital onset bloodstream infections, 2001 to 2009

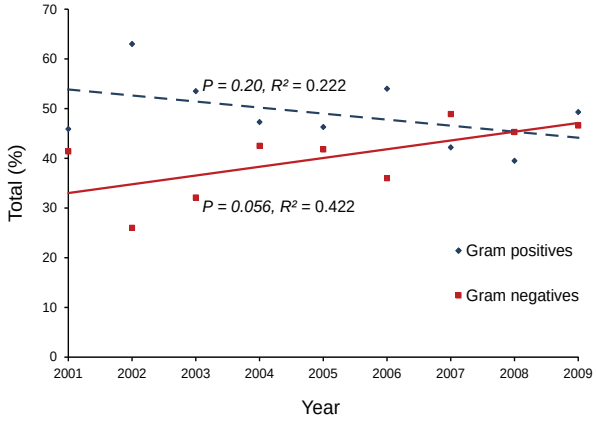

Figure 5: The proportion of gram positive and gram negative pathogens in the ≥20 to <70 years age group, 2001 to 2009

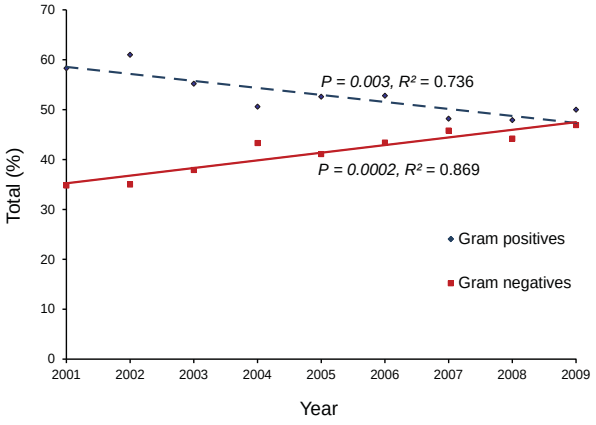

Figure 6: The proportion of gram positive and gram negative pathogens in the ≥70 years age group, 2001 to 2009

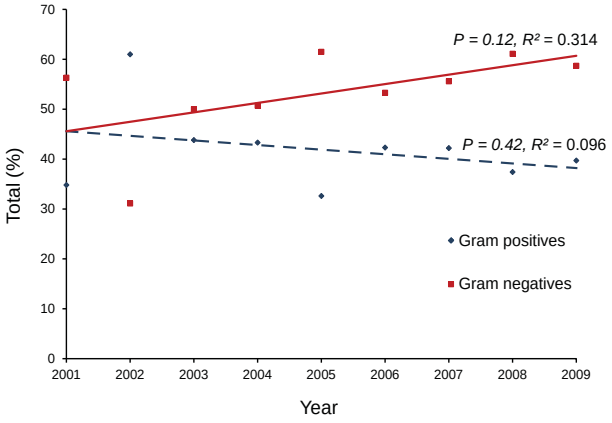

Table 2: Linear regression analyses for proportions of gram positive and gram negative organisms

Dependent variables	Gradient estimate	Intercept estimate	*P*-value	R^2
Figure 2 (overall)				
Gram positives	-1.32	2,701.6	0.045	0.459
Gram negatives	1.82	-3,606.1	0.006	0.688
Figure 3 (community onset)				
Gram positives	-1.45	2,948.5	0.014	0.601
Gram negatives	1.40	-2,756.4	0.012	0.619
Figure 4 (hospital onset)				
Gram positives	-1.20	2,481.7	0.20	0.222
Gram negatives	1.76	-3,495.4	0.056	0.427
Figure 5 (age ≥20-<70 years)				
Gram positives	-1.41	2,870.0	0.003	0.736
Gram negatives	1.53	-3,029.6	0.0002	0.869
Figure 6 (age ≥70 years)				
Gram positives	-0.92	1,893.2	0.42	0.096
Gram negatives	1.89	-3,736.3	0.12	0.314

Independent variable = Years (2001 – 2009)

Table 3: Antimicrobial sensitivity for selected bloodstream pathogens, 2001 to 2009 (Number susceptible/Total, % susceptible)

Organisms and antimicrobials tested	2001		2002		2003		2004		2005		2006		2007		2008		2009		Total	
	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%	n/N	%
Staphylococcus aureus																				
Flucloxacillin	46/100	46.0	61/138	44.2	65/105	61.9	48/84	57.1	35/74	47.3	41/72	56.9	42/55	76.3	33/40	82.5	29/40	72.5	400/708	56.5
Erythromycin* (for MRSA only)	4/54	7.4	2/77	2.6	0/40	0.0	2/36	5.6	4/39	10.3	4/31	12.9	1/13	7.7	2/7	28.6	2/11	18.2	21/308	6.8
Enterococcus faecalis																				
Vancomycin	11/11	100.0	30/30	100.0	23/23	100.0	20/20	100.0	11/11	100.0	10/10	100.0	11/11	100.0	6/7	85.7	14/16	87.5	136/139	97.8
Amoxicillin	10/11	90.9	29/29	100.0	23/23	100.0	22/22	100.0	13/13	100.0	13/13	100.0	16/16	100.0	10/10	100.0	15/15	100.0	151/152	99.3
Enterococcus faecium																				
Vancomycin	3/3	100.0	7/8	87.5	6/7	85.7	5/6	83.3	4/6	66.7	4/5	80.0	7/10	70.0	7/9	77.8	1/4	25.0	44/58	75.9
Amoxicillin	2/3	66.7	2.8	25.0	3/7	42.9	1/6	16.7	1/6	16.7	0/5	0/0	2/10	20.0	0/10	0.0	0/4	0.0	11/59	18.6
Escherichia coli																				
Gentamicin	54/54	100.0	51/54	94.4	68/69	98.6	61/63	96.8	70/70	100.0	77/81	95.1	75/77	97.4	69/73	94.5	55/60	91.7	580/601	96.5
Third generation cephalosporin†	53/54	98.1	54/54	100.0	69/70	98.6	63/63	100.0	69/71	97.2	79/81	97.5	73/77	94.8	69/74	93.2	60/62	96.8	589/606	97.2
Ceftazidime‡	53/54	98.1	54/54	100.0	67/69	97.1	62/62	100.0	69/71	97.2	79/81	97.5	73/77	94.8	68/73	93.2	58/61	95.1	583/602	96.8
Meropenem	54/54	100.0	53/54	98.1	68/69	98.6	63/63	100.0	71/71	100.0	80/81	98.8	76/77	98.7	73/73	100.0	61/61	100.0§	599/603	99.3
Ciprofloxacin	54/54	100.0	51/54	94.4	67/69	97.1	61/63	96.8	67/71	94.4	79/81	97.5	72/77	93.5	68/73	93.2	56/61	91.8	576/603	95.4
***Klebsiella* spp.**																				
Gentamicin	39/41	95.1	22/25	88.0	18/20	90.0	25/29	86.2	16/16	100.0	16/17	94.1	21/21	100.0	20/20	100.0	19/19	100.0	196/208	94.2
Third generation cephalosporin†	38/41	92.7	23/25	92.0	20/20	100.0	26/29	89.7	16/16	100.0	14/17	82.4	22/22	100.0	19/20	95.0	19/19	100.0	197/209	94.3
Ceftazidime‡	38/41	92.7	22/25	88.0	18/20	90.0	26/29	89.7	16/16	100.0	14/17	82.4	21/21	100.0	19/20	95.0	19/19	100.0	193/208	92.8
Meropenem	41/41	100.0	25/25	100.0	20/20	100.0	28/29	96.6	16/16	100.0	17/17	100.0	21/21	100.0	20/20	100.0	19/19	100.0	207/208	99.5
Ciprofloxacin	41/41	100.0	22/25	88.0	20/20	100.0	29/29	100.0	16/16	100.0	16/17	94.1	19/21	90.5	20/20	100.0	18/19	94.7	201/208	96.6
***Pseudomonas* spp.**																				
Ciprofloxacin	11/11	100.0	11/12	91.7	16/18	88.9	11/15	73.3	13/18	72.2	10/11	90.9	8/8	100.0	11/11	100.0	5/6	83.3	96/110	87.3
Tobramycin	12/12	100.0	10/12	83.3	18/18	100.0	11/15	73.3	16/18	88.9	11/11	100.0	7/8	87.5	11/11	100.0	6/6	100.0	102/111	91.9
Meropenem	10/10	100.0	7/8	87.5	16/18	88.9	10/15	66.7	16/18	88.9	10/11	90.9	8/8	100.0	9/11	81.8	4/6	66.7	90/105	85.7

* Erythromycin sensitivity was used as a surrogate marker for community-associated methicillin-resistant *Staphylococcus aureus* infections.

† Third generation cephalosporin susceptibility was determined by sensitivity to ceftriaxone or cefotaxime.

‡ Ceftazidime susceptibility was used as a surrogate marker for determination of extended spectrum beta-lactamase inhibitor production.

§ Susceptibility data based on 61 out of 68 isolates. Data was not known for 7 isolates.

N = total number of isolates tested, n = number of isolates susceptible.

Current Australian antibiotic guidelines recommend the use of intravenous flucloxacillin and gentamicin as empiric therapy for the treatment of undifferentiated sepsis regardless of a patient's age.[21] However, the appropriateness of this recommendation needs to be carefully considered in the elderly, who are more likely to have gram negative sepsis, and are more prone to the side effects of antimicrobial drugs. Although in principle, gentamicin would achieve broad cover for the gram negative pathogens, the use of aminoglycosides may be problematic in the elderly due to the risks of developing sensorineural hearing loss, vestibular toxicity and nephrotoxicity. These risks are known to increase with age-related hearing and renal impairment, concurrent ototoxic and nephrotoxic medication use, and the development of sepsis-associated multi-organ dysfunction. Hence, empiric treatment with alternative antimicrobial agents may be more suitable for elderly patients. Given the favourable susceptibility patterns of major gram negative isolates and decreasing MRSA rates in the study population, piperacillin/tazobactam or ticarcillin/clavulanate may be more appropriate first-line antimicrobials for the treatment of undifferentiated sepsis, for both community and hospital-onset bacteraemia.

At the start of the study period, the MRSA rates at The Alfred were high (>50% of total *S. aureus* isolates for a particular year) but towards the end of the study period, they decreased to the national average of around 25%.[32] It was unclear why there were such high MRSA rates, but lack of structured infection control programs in the early years may have contributed. Recent Australian studies have shown that the implementation of basic infection control measures, such as reinforcement of hand-hygiene and antimicrobial stewardship, significantly contributed to an overall decline in MRSA rates.[33,34] A subsequent decline in rates at this institution was likely attributable to the introduction of similar practices halfway through the study period. Further work is needed to elucidate causal relationships. It remains unclear as to why such infection control measures did not confer similar trends in VRE rates.

Limitations

This study was conducted at a single institution and the results may not be generalisable to the whole Australian population. In addition, a selection bias may have occurred in excluding certain specialty patient populations such as solid organ and haematological transplant patients, oncology, cystic fibrosis and burns patients, thereby resulting in a more homogenous general patient population with more favourable antimicrobial susceptibility profiles. Nonetheless, the main aim of this study was to evaluate the BSI trends in a general patient population who were not heavily immunosuppressed. Accordingly, this study has provided useful results and recommendations for the non-specialised patient population, which may be of some value to other tertiary centres. It is hoped that other centres will collate and publish their local data to provide further comparisons.

Secondly, in this study it was not possible to determine the exact number of hospital admissions and days of bed-separation per year in the study population, and therefore it was not possible to calculate the incident rates of BSIs.

Thirdly, although this study separated the BSI episodes into community onset and hospital onset infections according to time from admission to the first culture positivity (≤48 hours vs >48 hours), without accompanying clinical data, misclassification could have occurred. Examples include those who had peripherally inserted central venous catheter associated infections or those who re-presented within 48 hours of discharge from a previous episode of care. This is an inherent limitation of a retrospective study. However, these results provided relatively close estimations of true community and hospital onset BSI episodes.

Lastly, due to the retrospective design, it was not possible to determine the relative contribution of coagulase negative staphylococci to the BSI epidemiology. Although this should be included in the analysis, BSIs with coagulase negative staphylococci are known to cause less significant mortality and morbidity when compared with other pathogens.[7]

Conclusions

This study provides some insight into the local epidemiology of BSI pathogens. It was concluded that over the last decade, there has been a changing epidemiology of BSI pathogens at this institution with gram negative organisms becoming the key contributors. Community onset infections, particularly in younger patients, appeared to drive this trend. Exact contributing factors within these groups need to be further elucidated. Closer surveillance of these trends is needed at The Alfred, as well as nation-wide, for provision of appropriate antimicrobial therapy for undifferentiated sepsis.

Author details

Dr Ar Kar Aung, Registrar in Infectious Diseases and General Medicine[1,2]
Dr Matthew J Skinner, General Medicine and Infectious Diseases Physician[1,2]
Dr Felicity J Lee, Resident Medical Officer[1]
A/Prof Allen C Cheng, Infectious Diseases and General Medicine Physician[2,3]

1. Department of Infectious Diseases and Microbiology, Sir Charles Gairdner Hospital, Nedlands, Western Australia
2. General Medical Unit, The Alfred, Prahran, Victoria
3. Department of Epidemiology and Preventive Medicine, Monash University, Melbourne, Victoria

Corresponding author: Dr Ar Kar Aung, General Medical Unit, The Alfred, Level 5, The Alfred Centre, Commercial Road, PRAHAN VIC 3181. Telephone: +61 3 9076 2000. Email: arkaraung@yahoo.com

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Short reports

A DECISION SUPPORT TOOL FOR VECTORBORNE DISEASE IN QUEENSLAND, AUSTRALIA

Anita M Pelecanos, Archie DeGuzman, Ben Cull, Peter A Ryan, Michelle L Gatton

Keywords: decision support tool, mosquito-borne disease, outbreak detection

Ross River virus (RRV) and Barmah Forest virus (BFV) infections are the two most prevalent mosquito-borne diseases in Australia. Prevention through vector control and public awareness is important to lessen their burden on public health, as there are no treatments or vaccines currently available. In many geographical areas there are clear relationships between climatic variables and RRV or BFV disease incidence,[1–5] creating the potential for climate-based early warning systems. Such systems could be used to guide mosquito control activities. However, early warning system accuracy and adequate intervention is unlikely to entirely counteract increased disease activity. For this reason, early detection of increased RRV and BFV activity is important.

RRV and BFV cases are reported to the National Notifiable Diseases Surveillance System (NNDSS) via Australian state and territory health departments,[6] while mosquito control activities are typically the responsibility of local government. However there is currently no routine mechanism for disease data to be transferred from the NNDSS, or the state managed notification databases, to local government. To address this deficiency the Queensland Institute of Medical Research developed the Vector-borne disease Early Detection and Surveillance (VEDS) system, a web-based disease monitoring system that currently operates in Queensland.[7]

The VEDS System uses de-identified data collected by the Queensland Health Notifiable Conditions System (NOCS); data are extracted weekly and imported into VEDS. Current and historical notification data are categorised by Local Government Area (LGA) of residence, age (5-year groups), gender and week of disease onset. Outbreak alert thresholds are calculated using the 95th percentile of the Poisson distribution centred around the expected number of notifications within each week and LGA.[8,9] The main focal point of the software is a plot displaying the current number of notifications compared with the usual number for each LGA. Notifications are colour-coded depending on whether disease levels are categorised as normal or outbreak (Figure 1). To complement the graphical representation, a map displays LGAs currently or recently experiencing outbreaks and allows for the easy identification of geographically widespread disease activity (Figure 2). As the VEDS system is a passive system requiring users to log-on to monitor disease trends, the system includes an option for users to receive

Figure 1: Reports page screen capture of the VEDS2 System

Each bar represents the number of notifications within the current 3 week moving window (3-week moving window finishes at end of the indicated week) and is colour coded according to whether it is above (red) or below (blue) the alert threshold. The green line is the expected number of notifications and the red line is the alert threshold.

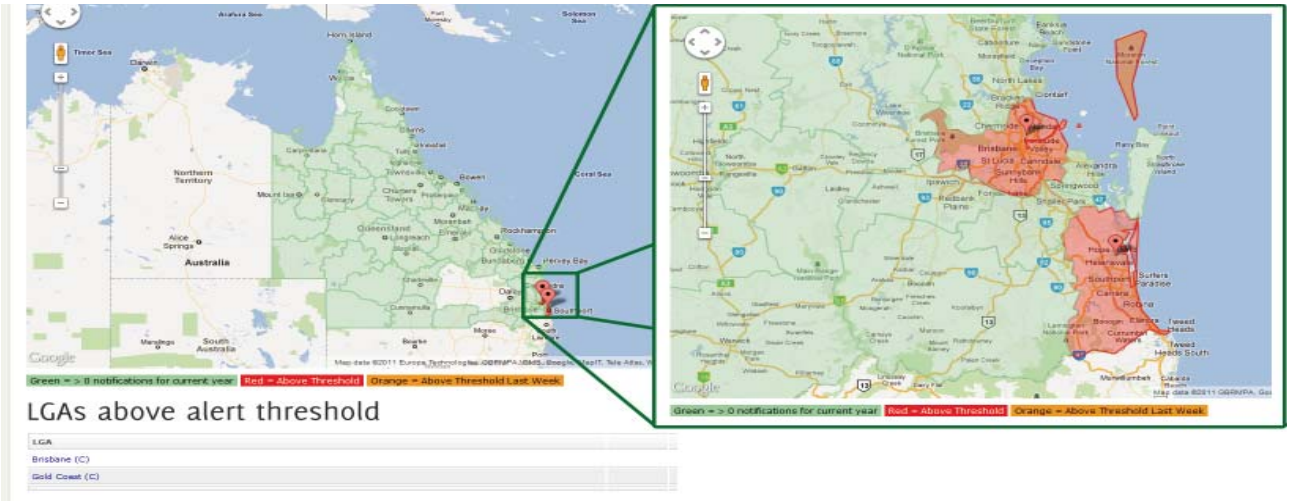
an automatic email message when notifications in their nominated LGA exceed the alert threshold. This is a technically simple but effective way of ensuring that users are informed of potentially significant events.

The VEDS System was released to all local governments in Queensland in August 2010. An updated version of the site (VEDS2) was released in April 2012; at that time there were 74 registered users from Queensland Health, Queensland local government and federal health authorities. In October 2012 an online survey of VEDS2 users from local and state government was conducted to gauge patterns of usage and the impact on decision making practices. Although the individual response rate was low (19%), feedback was obtained from approximately half of the organisations registered to use VEDS2. Most respondents indicated that they logged into VEDS2 as part of their normal duties (54%), while a smaller proportion (38%) did so when there was suspected virus activity; when they received an email alert; or when climate conditions seemed favourable to transmission. Twenty-three per cent of survey respondents indicated that they had altered their activities in some way after receiving a VEDS alert. The most frequent action reported was a more concentrated inspection of known breeding sites. State government users indicated that following an alert they often engaged with the relevant local governments about the problem, assisting, when needed, in coordinating additional vector control activities and the release of public health advisories. Those users who had not altered their plans stated that they may if a large significant outbreak event occurred. Thirty-one per cent of the respondents used VEDS in conjunction with other tools such as mosquito surveillance data, climate conditions and larval sampling.

As with all surveillance systems VEDS is limited by the delay between the onset of illness and data availability. A retrospective analysis indicated that 92.3% and 89% of notifications for BFV and RRV infections, respectively, were accessible on VEDS within 2 weeks of illness onset. These rates were consistent across Queensland LGAs and are satisfactory for the target diseases since outbreaks typically develop over several weeks and tend to last for several months.[4,7]

We believe that the VEDS System improves the utilisation of routinely collected notification data by ensuring that disease specific data are available promptly in a user-friendly format with increased interpretability. This is the crucial link when those who hold the responsibility for vector control are from a different authority to those who record the disease data. Developing a set of decision-support tools including early warning and detection systems, as well as other complementary surveillance data, can assist with curtailing mosquito-borne disease through scheduled vector control, emergency vector control and carefully timed public health warnings and campaigns.

Figure 2: Modified screen capture of Map page of the VEDS2 System highlighting the region with higher than expected RRV notifications



Author details

Miss Anita M Pelecanos[1]
Mr Archie DeGuzman[2]
Mr Ben Cull[2]
Dr Peter A. Ryan[3]
Dr Michelle L Gatton[1]

1 Malaria Drug Resistance and Chemotherapy Laboratory, Queensland Institute of Medical Research, Brisbane, Queensland
2 Corporate and Financial Services – Information Technology, Queensland Institute of Medical Research, Brisbane, Queensland
3 Mosquito Control Laboratory, Queensland Institute of Medical Research, Brisbane, Queensland

Corresponding author: Dr Michelle Gatton, Malaria Drug Resistance and Chemotherapy Laboratory, Queensland Institute of Medical Research, 300 Herston Road, HERSTON QLD 4006. Telephone: +61 7 3362 0416. Facsimile: +61 7 3362 0104. Email: michelle.gatton@qimr.edu.au

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Policy and guidelines

REVISED SURVEILLANCE CASE DEFINITIONS

The Case Definitions Working Group (CDWG) is a subcommittee of the Communicable Diseases Network Australia (CDNA). Membership is comprised of representatives from all states and territories, the Australian Government Department of Health and Ageing, the Public Health Laboratory Network, OzFoodNet, the Kirby Institute, the National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases and other communicable disease experts. CDWG develops and revises surveillance case definitions for all diseases reported to the National Notifiable Diseases Surveillance System. Surveillance case definitions incorporate laboratory, clinical and epidemiological elements as appropriate.

The following case definitions have been reviewed by CDWG and endorsed by CDNA.

These case definitions will be implemented from 1 January 2013 and supersede any previous versions.

Hepatitis A

(Effective 1 January 2013)

Reporting

Both confirmed cases and probable cases should be notified.

Confirmed case

A confirmed case requires either laboratory definitive evidence OR laboratory suggestive evidence AND clinical evidence OR laboratory suggestive evidence AND epidemiological evidence

Probable case

A probable case requires clinical evidence AND epidemiological evidence.

Laboratory definitive evidence

Detection of hepatitis A virus by nucleic acid testing.

Laboratory suggestive evidence

Detection of hepatitis A-specific IgM, in the absence of recent vaccination.

Clinical evidence

Child less than 5 years of age

OR

Acute illness with discrete onset of at least two of the following signs and symptoms: fever; malaise; abdominal discomfort; loss of appetite; nausea

AND

Jaundice or dark urine or abnormal liver function tests that reflect viral hepatitis.

Epidemiological evidence

Contact between two people involving a plausible mode of transmission at a time when:

a one of them is likely to be infectious (from two weeks before the onset of jaundice to a week after onset of jaundice)

AND

b the other has an illness that started within 15 to 50 days (average 28–30) after this contact

AND

at least one case in the chain of epidemiologically linked cases (which may involve many cases) is laboratory confirmed.

Hepatitis A

(Effective 1 January 2013)

Hepatitis A changes	**Confirmed case** Added 'either' and 'OR Laboratory suggestive evidence AND clinical evidence OR laboratory suggestive evidence AND epidemiological evidence.' **Laboratory definitive evidence** Removed 'Detection of anti-hepatitis A IgM, in the absence of recent vaccination.' **Laboratory definitive evidence** Added 'Detection of hepatitis A virus by nucleic acid testing.' **Laboratory suggestive evidence** Added 'Detection of hepatitis A-specific IgM, in the absence of recent vaccination.' **Clinical evidence** Changed to 'Child less than 5 years of age OR Acute illness with discrete onset of at least two of the following signs and symptoms: fever; malaise; abdominal discomfort; loss of appetite; nausea AND jaundice or dark urine or abnormal liver function tests that reflect viral hepatitis'.

Barmah Forest virus infection

(Effective 1 January 2013)

Reporting

Only confirmed cases should be notified.

Confirmed case

A confirmed case requires laboratory definitive evidence only.

Laboratory definitive evidence

Isolation of Barmah Forest virus

OR

Detection of Barmah Forest virus by nucleic acid testing

OR

IgG seroconversion or a significant increase in antibody level or a fourfold or greater rise in titre to Barmah Forest virus

OR

Detection of Barmah Forest virus-specific IgM in the absence of Ross River virus IgM unless Barmah Forest virus IgG is also detected.

OR

Detection of Barmah Forest virus-specific IgM in the presence of Barmah Forest virus IgG.

Barmah Forest virus infection changes	An assessment of notifications of Ross River virus and Barmah Forest virus infection found significant numbers of dual notifications in both jurisdictional and national data sets. It was agreed that the case definitions for Ross River virus and Barmah Forest virus infection should be made more specific. Add to the end of point 4 under Laboratory definitive evidence 'in the absence of IgM to Ross River virus unless Barmah Forest virus IgG is also detected'. Add point 5 under Laboratory definitive evidence 'Detection of Barmah Forest virus IgM in the presence of Barmah Forest virus IgG'. Classifying cases with IgM to both RRV and BFV but IgG to neither as RRV cases was considered, as the cross-reactivity problem is thought to be mainly due to false positive BFV IgM in patients with genuine RRV IgM, rather than vice versa. However it was decided that this would complicate the case definitions too much for little gain as there are likely to be relatively few such situations.

Yellow fever

(Effective 1 January 2013)

Reporting

Only a confirmed case should be notified.

Confirmed case

A confirmed case requires either laboratory definitive evidence AND clinical evidence OR laboratory suggestive evidence AND clinical evidence AND epidemiological evidence.

Laboratory definitive evidence

Isolation of yellow fever virus

OR

Detection of yellow fever virus by nucleic acid testing

OR

Seroconversion or a four-fold or greater rise in yellow fever virus-specific serum IgM or IgG levels between acute and convalescent serum samples in the absence of vaccination in the preceding 3 weeks

OR

Detection of yellow fever virus antigen in tissues by immunohistochemistry.

Laboratory suggestive evidence

Yellow fever virus-specific IgM detected in the absence of IgM to other relevant flaviviruses, in the absence of vaccination in the preceding 3 months

Confirmation of laboratory results by a second arbovirus reference laboratory is required in the absence of travel history to areas with known endemic or epidemic activity.

Clinical evidence

A clinically compatible illness.

Epidemiological evidence

History of travel to a yellow fever endemic country in the week preceding onset of illness.

Yellow fever changes	The yellow fever case definition was changed to exclude vaccine-related cases from being reported. At the end of laboratory definitive evidence, point 3 'in the absence of vaccination in the preceding 3 weeks' was added. At the end of laboratory suggestive evidence 'in the absence of vaccination in the preceding 3 months' was added. A note 'Confirmation of laboratory results by a second arbovirus reference laboratory is required in the absence of travel history to areas with known endemic or epidemic activity' was also added.

Dengue virus infection

(Effective 1 January 2013)

Reporting

Both confirmed cases and probable cases should be notified.

Confirmed case

A confirmed case requires laboratory definitive evidence AND clinical evidence.

Laboratory definitive evidence

Isolation of dengue virus

OR

Detection of dengue virus by nucleic acid testing

OR

Detection of dengue non-structural protein 1 (NS1) antigen in blood

OR

IgG seroconversion or a significant increase in antibody level or a fourfold or greater rise in titre to dengue virus, proven by neutralisation or another specific test

OR

Detection of dengue virus-specific IgM in cerebrospinal fluid, in the absence of IgM to Murray Valley encephalitis, West Nile virus /Kunjin, or Japanese encephalitis viruses

Confirmation of the laboratory result by a second arbovirus reference laboratory is required if the infection was locally acquired and occurred in an area of Australia without known local transmission of dengue fever since 1990 (i.e. anywhere outside north Queensland).

Clinical evidence

A clinically compatible illness (e.g. fever, headache, arthralgia, myalgia, rash, nausea, and vomiting, with possible progression to severe plasma leakage, severe haemorrhage, or severe organ impairment – CNS, liver, heart or other).

Probable case

A probable case requires laboratory suggestive evidence AND clinical evidence AND epidemiological evidence

Laboratory suggestive evidence

Detection of dengue virus-specific IgM in blood.

Clinical evidence

As for a confirmed case

Epidemiological evidence

A plausible explanation, e.g. travel to a country with known dengue activity OR exposure in Australia where local transmission has been documented within the previous month.

Dengue virus infection

(Effective 1 January 2013)

Dengue changes	A probable case category was added. IgM in blood was changed from definitive to suggestive evidence requiring clinical evidence and epidemiological evidence to become a probable case. This is more consistent with the PHLN case definition and resolves the issue of false positive serum IgM 'locally acquired' cases in Queensland, both in north Queensland when there is no known outbreak and in other areas of Queensland where *Aedes aegypti* is present. New criterion added under definitive evidence 'Detection of dengue non-structural protein 1 (NS1) antigen in blood' point 3. Point 4 under laboratory definitive evidence has been re-worded to 'IgG seroconversion or a significant increase in antibody level or a fourfold or greater rise in titre to dengue virus, proven by neutralisation or another specific test.' Point 5 under laboratory definitive evidence has been re-worded to 'Detection of dengue virus-specific IgM in cerebrospinal fluid, in the absence of IgM to Murray Valley encephalitis, West Nile /Kunjin, or Japanese encephalitis viruses' Note requiring second reference laboratory testing in area 'without known previous local transmission' amended to make clear that this relates to transmission since 1990. Clinical evidence amended to be consistent with the new WHO classification (p11). http://whqlibdoc.who.int/publications/2009/9789241547871_eng.pdf Epidemiological evidence criterion added: 'A plausible explanation, e.g. travel to a country with known dengue activity OR exposure in Australia where local transmission has been documented within the previous month.'

Ross River virus infection

(Effective 1 January 2013)

Reporting

Only confirmed cases should be notified.

Confirmed case

A confirmed case requires laboratory definitive evidence only.

Laboratory definitive evidence

Isolation of Ross River virus

OR

Detection of Ross River virus by nucleic acid testing

OR

IgG seroconversion or a significant increase in antibody level or a fourfold or greater rise in titre to Ross River virus

OR

Detection of Ross River virus-specific IgM in the absence of IgM to Barmah Forest virus unless Ross River virus IgG is also detected.

OR

Detection of Ross River virus-specific IgM in the presence of Ross River virus IgG.

Ross River virus infection changes	An assessment of notifications of Ross River virus and Barmah Forest virus infection found significant numbers of dual notifications in both jurisdictional and national data sets. It was agreed that the case definitions for Ross River virus and Barmah Forest virus infection should be made more specific. Add to the end of point 4 under Laboratory definitive evidence 'in the absence of IgM to Barmah Forest virus, unless Ross River virus IgG is also detected'. Add point 5, 'Detection of Ross River virus-specific IgM in the presence of Ross River virus IgG'. Classifying cases with IgM to both RRV and BFV but IgG to neither as RRV cases was considered, as the cross-reactivity problem is thought to be mainly due to false positive BFV IgM in patients with genuine RRV IgM, rather than vice versa. However it was decided that this would complicate the case definitions too much for little gain as there are likely to be relatively few such situations.

Leprosy

(Effective 1 January 2013)

Reporting

Only a confirmed case should be notified.

Confirmed case

A confirmed case requires either laboratory definitive evidence OR laboratory suggestive evidence AND clinical evidence.

Laboratory definitive evidence

Detection of *Mycobacterium leprae* by nucleic acid testing from the ear lobe or other relevant specimens.

Laboratory suggestive evidence

Demonstration of characteristic acid fast bacilli in slit skin smears and biopsies prepared from the ear lobe or other relevant sites

OR

Histopathological report from skin or nerve biopsy compatible with leprosy (Hansen's disease) examined by an anatomical pathologist or specialist microbiologist experienced in leprosy diagnosis.

Clinical evidence

Compatible nerve conduction studies

OR

Peripheral nerve enlargement

OR

Loss of neurological function not attributable to trauma or other disease process

OR

Hypopigmented or reddish skin lesions with definite loss of sensation.

Leprosy changes	In Reporting, changed 'only' confirmed cases to 'a' confirmed case. • Changed Confirmed case to 'either laboratory definitive evidence OR laboratory suggestive evidence AND clinical evidence'. • Changed 'Laboratory definitive evidence to Laboratory suggestive evidence'. • Redefined 'Laboratory definitive evidence – Detection of *Mycobacterium leprae* by nucleic acid testing from the ear lobe or other relevant specimens'.

Note

International reporting to the World Health Organization (WHO) is based on the WHO working definition: A person showing one or more of the following features, and who as yet has to complete a full course of treatment:

- hypopigmented or reddish skin lesions with definite loss of sensation
- involvement of the peripheral nerves, as demonstrated by definite thickening with loss of sensation
- skin smear positive for acid-fast bacilli definition.

The difference in surveillance case definitions should be noted when reporting to the WHO.

Legionellosis

(Effective 1 January 2013)

Reporting

Both confirmed cases and probable cases should be notified.

Confirmed case

A confirmed case requires laboratory definitive evidence AND clinical evidence.

Laboratory definitive evidence

Isolation of *Legionella*

OR

Detection of *Legionella* urinary antigen

OR

Seroconversion or a significant increase in antibody level or a fourfold or greater rise in titre to *Legionella*.

Clinical evidence for confirmed cases

Fever

OR

Cough

OR

Pneumonia

Probable case

A probable case requires laboratory suggestive evidence AND clinical evidence.

Laboratory suggestive evidence

Single high antibody titre to *Legionella*

OR

Detection of *Legionella* by nucleic acid testing

OR

Detection of *Legionella* by direct fluorescence assay.

Clinical evidence for probable cases

Fever AND Cough

OR

Pneumonia

Legionellosis changes	
	Confirmed case Under Laboratory definitive evidence, Point 12, 'Presence of *Legionella* urinary antigen' has changed to 'Detection of *Legionella* urinary antigen'. Under Clinical evidence, 'Fever AND Cough AND Pneumonia' has changed to 'Fever OR Cough OR Pneumonia'. **Probable case** Under Clinical evidence for probable cases, 'Radiological evidence of pneumonia' has changed to 'Fever AND Cough OR Pneumonia.'

Quarterly reports

OzFoodNet quarterly report, 1 January to 31 March 2012

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, which occurred in Australia between 1 January and 31 March 2012.

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. Public Health laboratories across Australia have recently introduced standardised testing procedures and methods for coding and reporting of MLVA genotypes

During the 1st quarter of 2012, OzFoodNet sites reported 441 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 7,027 people, of whom 242 were hospitalised. There were 18 deaths reported during these outbreaks. The majority of outbreaks (72%, n=319) were due to person-to-person transmission (Foodborne and suspected foodborne disease outbreaks), with 48% (152/319) of these occurring in residential aged care facilities.

Foodborne and suspected foodborne disease outbreaks

There were 51 outbreaks during this quarter where consumption of contaminated food was suspected or confirmed as the primary mode of transmission (Appendix). These outbreaks affected 571 people, resulted in 44 hospitalisations and 2 deaths. This compares with 36 outbreaks in the 4th quarter of 2011[1] and a 5-year mean of 40 outbreaks for the 1st quarter between 2007 and 2011.

Salmonella enterica serotypes were identified as the aetiological agent in 28 outbreaks (55%) during this quarter (the majority of them due to *S.* Typhimurium, refer to the Appendix for more detail). Of the remaining outbreaks, 3 (6%) were due to norovirus, and 1 each due to *Campylobacter, Amanita phalloides* poisoning and a suspected viral agent. The aetiological agent remained unknown for 17 outbreaks (33%).

Twenty-three outbreaks (45% of foodborne or suspected foodborne outbreaks) reported in this quarter were associated with food prepared in restaurants. Other food preparation settings associated with foodborne or suspected foodborne outbreaks are listed in Table 2.

To investigate these outbreaks, sites conducted 11 cohort studies, 5 case control studies and col-

Table 1: Outbreaks and clusters of gastrointestinal illness reported by OzFoodNet, 1 January to 31 March 2012 by mode of transmission

Transmission mode	Number of outbreaks and clusters	Per cent of total
Foodborne and suspected foodborne	51	12%
Person-to-person	319	72%
Unknown (*Salmonella* cluster)	15	3%
Unknown (other pathogen cluster)	6	1%
Waterborne (recreational water)	1	<1%
Unknown	49	11%
Total	441	100%

lected descriptive case series data for 26 investigations, while for 9 outbreaks no individual patient data were collected. The evidence used to implicate food vehicles included analytical evidence in 4 outbreaks and microbiological evidence in 1 outbreak. Descriptive evidence alone was obtained in 46 outbreak investigations.

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

Multi-jurisdictional

There was 1 reported multi-jurisdictional outbreak of suspected foodborne illness during the quarter, which was due to *S. enterica* serotype Typhimurium (or *S.* Typhimurium).

Investigators detected an outbreak of *S.* Typhimurium phage type (PT) 135 associated with a catered sporting event in South Australia, with cases from 2 jurisdictions (South Australia and Tasmania). A cohort study was conducted, and 36 of 41 players and associated staff were interviewed, with 18 meeting the case definition (diarrhoea and/or stool sample positive for *S.* Typhimurium PT 135). Eleven cases (2 hospitalised) had faecal samples positive for *S.* Typhimurium PT 135 or *S.* Typhimurium multi-locus variable number tandem repeat analysis (MLVA) profile 03-14-13-13-524. The illness was suspected to be associated with the consumption of food provided by a private caterer at the sporting venue; however, analytical evidence did not identify a single food item associated with illness. An environmental inspection was conducted where the food was prepared: however, no pathogens were detected from environmental swabs or food samples.

Australian Capital Territory

There were 7 reported outbreaks of foodborne or suspected foodborne illness during the quarter, of which four were due to *S.* Typhimurium, and one each due to *Amanita phalloides* poisoning, a suspected viral cause and an unknown pathogen.

Description of key outbreaks

Routine interviewing of *Salmonella* cases identified an outbreak of 10 cases (1 hospitalised) of *S.* Typhimurium PT 170 infection (MLVA profile 03-10-07-12-523) that had eaten a variety of foods at the same café. An inspection of the café identified numerous food safety breaches, resulting in a prohibition order being served. Four cases had eaten a toasted chicken sandwich that contained a raw egg mayonnaise. Traceback of eggs identified that they had been produced at a New South Wales farm, with the New South Wales Food Authority (NSWFA) subsequently undertaking an inspection and testing of the implicated farm. Whilst the outbreak strain was not detected on the farm, a number of other *Salmonella* serotypes (including *S.* Singapore) were recovered from the environment, on equipment and in feed.

Routine interviewing of *Salmonella* cases also identified an outbreak of 7 cases (3 hospitalised) of *S.* Typhimurium PT 135a infection at café (a different café to that involved above). Five of the 7 cases reported eating eggs as part of breakfast or brunch meals. An inspection of the café identified numerous food safety breaches and a prohibition order was served.

Investigators identified an outbreak of 22 cases (7 confirmed) of *S.* Typhimurium PT 170 infection (MLVA profile 03-09-08-13-524) when a number of general practitioners from the same practice became unwell after a dinner meeting at a function

Table 2: Outbreaks of foodborne or suspected foodborne disease reported by OzFoodNet, 1 January to 31 March 2012, by food preparation setting

Food preparation setting	Outbreaks
Restaurant	23
Commercial caterer	6
Takeaway venues	6
Aged care	4
Private residence	4
Unknown	3
Other	3
National franchised fast food	1
Fair, festival, other temporary/mobile service	1
Total	51

centre. The outbreak cases were linked to 5 separate functions, which included several interstate and international visitors. Analysis of a retrospective cohort study conducted with two separate cohorts identified an association between illness and the consumption of a fish dish (RR 7, 95% CI 0.9–51.1, $P = 0.04$) for cohort 1 and a lamb dish (RR 3.9, 95% CI 1–14.5, $P = 0.02$) for cohort 2. Interviews with the chef revealed that a raw egg emulsion was used to garnish both the lamb and the fish dish. This cold egg emulsion was prepared by mixing egg whites, oil and flavouring (specific to the dish) and 4–5 drops of this emulsion was added as a garnish to the dishes prior to being served. It was also found that after a batch of eggs were separated, that they were refrigerated for up to a week and batches of these were used to prepare the garnishes. An inspection of the premises did not identify any food safety breaches.

An outbreak of *Amanita phalloides* (death cap mushroom) poisoning was identified after 3 of 4 restaurant workers became ill after sharing a post-service staff meal. This meal contained mushrooms that had been recently picked in the Australian Capital Territory by one of the cases. All cases were hospitalised and two died. An inspection of the premises was undertaken and a large volume of fresh produce was destroyed (no mushrooms were found); any risk to the dining public was considered to be minimal. Additional public health actions taken included an urgent media alert, and targeted communication aimed at members of the Chinese community, overseas-born students and tourists. A further hospitalised case (unrelated to the previous cluster) was identified in a New South Wales resident who had picked mushrooms whilst visiting the Australian Capital Territory.

New South Wales

There were 20 reported outbreaks of foodborne or suspected foodborne illness during the quarter, of which 11 were due to *S.* Typhimurium; one each due to *S.* Give, *S.* Muenchen and *S.* Wangata. No pathogen could be identified for the remaining outbreaks.

Description of key outbreaks

Investigators were notified of an outbreak of *S.* Typhimurium MLVA profile 03-09-07-12-523 infection (historically associated with PT 170) involving 14 cases from 6 separate groups who had eaten at the same restaurant. All cases had consumed deep fried ice cream, but an investigation by the NSWFA did not identify any positive food samples. The restaurant was issued a warning letter advising of the risks involved in serving raw egg-based menu items and minimally cooked egg-based foods; deep fried ice cream has since been removed from the menu.

New South Wales Health investigated 9 cases of *S.* Typhimurium MLVA profile 03-09-08-13-523 infection (previously associated with PT 170) after receiving complaints via the NSWFA from 2 separate groups that ate deep fried ice cream at the same restaurant. The restaurant was issued a warning letter advising of the risks involved in serving raw and minimally cooked egg-based foods. Deep fried ice cream has since been removed from the menu. Samples taken of ice cream balls and component ingredients taken at the time were negative for pathogens. An egg-rinse was found to be positive for *S.* Bareilly.

Investigators were notified of 4 cases of *S.* Typhimurium MLVA profile 03-09-07-13-523 (previously associated with PT 170) who had eaten at the same café. Illness was associated with eating scrambled eggs, omelettes and a tortilla dish made from potato and egg. The chef advised that scrambled eggs and omelettes were lightly cooked, and that eggs were pooled and stored on the bench. A number of food safety breaches were identified during the investigations and an Improvement Notice was issued. The café no longer pools eggs; eggs are now kept under refrigeration and used only when an order is placed.

A public health unit investigated 11 cases of *S.* Typhimurium MLVA profile 03-10-08-09-523 infection (previously associated with PT 44) associated with Vietnamese rolls purchased from a bakery. A NSWFA inspection identified the use of raw egg butter in the rolls, but all samples taken during the inspection were negative. The bakery was advised of the dangers of using raw egg butter and recommended to use a commercial mayonnaise product.

Investigators were notified of 18 cases of gastrointestinal illness among a group that had eaten at a restaurant. Three of 4 stool samples were positive for *S.* Typhimurium MLVA profile 03-09-09-12-523. High risk foods eaten by the group were a Bombe Alaska dessert (coated in raw egg meringue) and raw vegetable ingredients in the Peking duck pancakes. The restaurant was issued with a warning letter advising of the risk involved in serving raw egg-based menu items and minimally cooked egg-based foods; they agreed to stop serving Bombe Alaska. A sample of egg rinse taken during an inspection was positive for *S.* Chester. Traceback to the supplying egg farm identified multiple *Salmonella* serotypes in the environment and the egg grading area, with the outbreak strain detected in faeces from a laying shed.

Investigation of a cluster of 34 *S.* Typhimurium MLVA profile 03-10-07-15-523 cases identified 15 that were linked to a takeaway shop. The NSWFA inspected the premises and collected numerous food and environmental samples, with a sample of hummus (made

with the same stick blender as the raw egg crepe batter) positive for the outbreak strain. The traceback to the supplying egg farm found *S.* Singapore on boot swabs from the egg grading area.

Investigations into an increase in *Salmonella* cases identified an outbreak linked to 2 cafés situated along a freeway. Twenty cases of *S.* Typhimurium MLVA profile 03-09-07-13-523 infection reported eating a variety of foods from both cafés. All foods consumed contained raw egg mayonnaise/dressing. Samples of aioli and mayonnaise collected during a NSWFA inspection of the manufacturing premises that supplied the cafés were positive for the same MLVA profile as the outbreak cases; the eggs used were supplied by a farm in Queensland. A prohibition order was issued to the manufacturing premises to cease the use of raw eggs in the preparation of foods that are not further cooked.

Northern Territory

There were 4 reported outbreaks of foodborne or suspected foodborne illness during the quarter, of which two were due to norovirus. No pathogen could be identified for the remaining outbreaks.

Description of key outbreaks

Investigators identified an outbreak of norovirus among 22 diners who all ate items from high tea platters served on one particular day at the same restaurant. A cohort study was conducted and high risk items were egg sandwiches, chicken sandwiches and cocktails. An environmental health inspection did not identify any food safety issues. Nevertheless, the restaurant was required to implement a food safety plan as part of their registration as a food business. Contamination via a food or beverage handler was suspected to have occurred, but no staff reported illness at the time.

Queensland

There were 7 reported outbreaks of foodborne or suspected foodborne illness during the quarter, of which four were due to *S.* Typhimurium and one due to *S.* Infantis. No pathogen could be identified for the remaining 2 outbreaks.

Description of key outbreaks

Investigators identified a restaurant-associated outbreak after 2 cases of *S.* Infantis infection were notified from the same hospital. A case series investigation identified that both cases had consumed prawn and pork rice paper rolls from the same restaurant on separate dates. *S.* Infantis was detected on kitchen towels, a cleaning cloth and raw chicken samples from the restaurant kitchen. This outbreak was likely to have been caused by cross contamination from staff handling raw chicken and subsequently preparing food that did not undergo a further cooking step.

Three cases of *S.* Typhimurium MLVA profile 03-13-10-10-524 infection and 1 epidemiologically linked case were identified as part of an outbreak associated with a church lunch. Food items served at the event were prepared by attendees. A case series investigation identified that all cases had consumed a chocolate cake with a raw egg meringue topping. Egg samples collected subsequent to the outbreak were negative for *Salmonella*.

A case series investigation of 5 geographically clustered cases of *S.* Typhimurium MLVA profile 03-09-07-13-524 infection (previously associated with PT 170) and 1 epidemiologically linked case found that all cases had attended the same café. Cases had consumed a variety of foods with salad being the common item. Food samples and environmental swabs taken at the café tested negative for *Salmonella*. An Environmental Health investigation of the café identified various hygiene issues. This Queensland cluster was investigated following the previously described New South Wales outbreak of the same strain of *S.* Typhimurium associated with food containing raw egg (supplied from Queensland), served at 2 cafés situated along a freeway.

Three cases of *S.* Typhimurium MLVA profile 03-12-13-09-524 infection (previously associated with PT 135a) and 2 epidemiologically linked cases were associated with an outbreak at a restaurant. A case series investigation identified that the only common food item consumed by all cases was deep fried ice cream. Egg samples and environmental swabs from the restaurant were all negative for *Salmonella*. A number of hygiene issues were identified at the restaurant and a compliance notice was issued by the local council. No confirmed source of infection was identified.

South Australia

There was 1 outbreak of suspected foodborne illness investigated during the quarter due to *S.* Typhimurium.

Investigators detected an outbreak of *S.* Typhimurium PT 9 infection that involved 80 people who had attended a private catered function at a restaurant. A cohort study was conducted with 25 of 73 respondents developing gastrointestinal illness, eight of whom were confirmed *S.* Typhimurium PT 9 cases. The study did not identify any significant associations between illness and any food item served at the function.

Tasmania

There was 1 reported outbreak of foodborne illness during the quarter, which was due to *S.* Typhimurium.

Investigators identified an outbreak of salmonellosis associated with a takeaway restaurant. There were 8 positive *Salmonella* cases (3 hospitalised), 6 *S.* Typhimurium PT 141, 1 *S.* subsp I ser 4,5,12:- :- (i.e. 'Typhimurium-like') PT 141 and 1 *S.* Mississippi. Five cases had eaten a chilli-coriander mayonnaise, with 2 of 3 remaining cases eating a tartare sauce; both sauces contained raw eggs. An inspection of the premises was conducted with samples of 4 egg-based sauces testing negative for *Salmonella*. A thorough cleaning of the restaurant was requested, and raw egg-based sauces were removed from the menu.

Victoria

There were 7 reported outbreaks of foodborne or suspected foodborne illness during the quarter, of which one was due to *S.* Typhimurium and one each due to *Campylobacter* and norovirus. No pathogen could be identified for the remaining outbreaks.

Description of key outbreaks

Investigators were notified of an outbreak of gastroenteritis affecting 2 separate groups who ate food (sandwiches, fruit platters, cakes) prepared by the same caterer. Illness was reported by 25 (and 1 secondary case) of 45 function attendees, with 3 faecal samples testing positive for norovirus. The chef had been ill with gastroenteritis 4 days prior to assisting with the preparation of the sandwiches.

Western Australia

There were 3 reported outbreaks of foodborne or suspected foodborne illness during the quarter, of which 1 was due to *S.* Anatum. No pathogen could be identified for the remaining outbreaks.

Description of key outbreaks

Investigators identified an outbreak of *S.* Anatum associated with a salad bar. Four cases with the same pulse-field gel electrophoresis type consumed a variety of foods from the salad bar. No major deficiencies in food safety practice were identified during the environmental inspection of the premises, although a sample of Caesar salad (without chicken) was positive for *S.* Anatum, closely related to outbreak strain.

Comments

The majority of reported outbreaks of gastrointestinal illness in Australia are due to person-to-person transmission, and in this quarter, 72% of outbreaks (n=319) were transmitted via this route. The number of foodborne outbreaks this quarter (n=51) had increased compared with the same quarter for 2011 and the 5-year mean (2007–2011). *S.* Typhimurium continues to be a leading cause of foodborne outbreaks in Australia, with 68% (23/34) of outbreaks during the quarter with a known *Salmonella* aetiology being due to this serotype.

Foodborne disease outbreak investigations this quarter have highlighted a range of high risk practices, many occurring in food service settings. Twenty-three foodborne or suspected foodborne disease outbreaks this quarter were associated with foods prepared in a restaurant, while a further 6 outbreaks were associated with foods prepared by caterers. Catering for large groups presents particular challenges in adequately controlling the temperature 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.

Outbreaks associated with raw or undercooked egg products (raw egg dressings, raw egg desserts, omelettes) continued to be reported this quarter (n=14). To address this continuing issue, OzFoodNet established an 'Egg Working Group' to describe the national epidemiology of egg-associated outbreaks. Jurisdictional food safety authorities are focussing on communication and education in relation to the use of raw egg products in commercial settings.

A limitation of the outbreak data provided by OzFoodNet sites for this report was the potential for variation in the 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.

Acknowledgements

OzFoodNet thanks the investigators in the public health units and state and territory departments of health, as well as public health laboratories, local government environmental health officers and food safety agencies who provided data used in this report. We would particularly like to thank reference laboratories for conducting sub-typing of *Salmonella, Listeria monocytogenes* and other enteric pathogens and for their continuing work and advice during the quarter.

OzFoodNet contributors to this report include (in alphabetical order): Robert Bell (Qld), Barry Combs (WA), Emily Fearnley (SA), Gerard Fitzsimmons (DoHA), Neil Franklin (NSW),

Robyn Gibbs (WA), Joy Gregory (Vic.), Michelle Harlock (NT), Karin Lalor (Vic.), Robyn Leader (DoHA), Megge Miller (SA), Cameron Moffatt (ACT), Sally Munnoch (Hunter New England), Jennie Musto (NSW), Nevada Pingault (WA), Timothy Sloan-Gardner (DoHA), Russell Stafford (Qld), Mark Veitch (Tas.) and Kate Ward (NSW).

Correspondence

Mr Timothy Sloan-Gardner, OzFoodNet, Office of Health Protection, Australian Government Department of Health and Ageing, GPO Box 9848, MDP 14, Canberra, ACT 2601. Telephone: +61 2 6289 2377. Facsimile: +61 2 6289 2600. Email: ozfoodnet@health.gov.au

Reference

1. The OzFoodNet Working Group. OzFoodNet quarterly report, 1 October to 31 December 2011. *Commun Dis Intell* 2012;36(3):E294–E300.

Appendix: Outbreaks of foodborne or suspected foodborne disease reported by OzFoodNet sites, 1 January to 31 March 2012 (n=51)

State	Month	Setting Prepared	Agent responsible	Number affected	Hospitalised	Evidence	Responsible vehicles
MJOI	March	Commercial caterer	*S.* Typhimurium PT 135	18	2	D	Unknown
ACT	January	Restaurant	Amanita phalloides poisoning	3	3	D	Stir fry – mushrooms
ACT	February	Restaurant	*S.* Typhimurium PT 135a	7	3	D	Eggs
ACT	February	Restaurant	Unknown	5	0	D	Oysters
ACT	February	Restaurant	Suspected viral	25	0	D	Unknown
ACT	February	Restaurant	*S.* Typhimurium PT 170 / MLVA profile 03-10-07-12-523	10	1	D	Raw egg mayonnaise suspected
ACT	February	Fair, festival, other temporary/mobile service	*S.* Typhimurium PT 9 / MLVA profile 03-12-16-13-526	10	3	D	Chicken doner kebab
ACT	March	Restaurant	*S.* Typhimurium PT 170 / MLVA profile 03-09-08-13-524	22	0	A	Raw egg white emulsions
NSW	January	Private residence	*S.* Give	10	1	D	Cold pasta salad suspected
NSW	January	Restaurant	Unknown	12	0	D	Unknown
NSW	January	Restaurant	*S.* Typhimurium MLVA profile 03-09-07-12-523 (historically PT 170)	14	2	D	Deep fried ice cream
NSW	January	Restaurant	*S.* Typhimurium MLVA profile 03-09-07-13-523 (historically PT 170)	5	0	D	Eggs and omelettes
NSW	January	Restaurant	*S.* Typhimurium MLVA profile 03-09-09-12-523	10	3	D	Unknown
NSW	January	Unknown	Unknown	12	0	D	Unknown
NSW	January	Other	*S.* Muenchen	16	1	D	Leg of ham
NSW	January	Other	*S.* Wangata	3	0	D	Unknown
NSW	February	Restaurant	Unknown	3	0	D	Unknown
NSW	February	Restaurant	Unknown	4	1	D	Unknown
NSW	February	Restaurant	*S.* Typhimurium MLVA profile 03-09-07-13-523 (historically PT 170)	20	3	M	Raw egg mayonnaise
NSW	February	Restaurant	*S.* Typhimurium MLVA profile 03-09-09-12-523	9	0	D	Deep fried ice cream
NSW	February	Takeaway	*S.* Typhimurium MLVA profile 03-09-08-13-523 (historically PT 170)	3	0	D	Unknown
NSW	March	Commercial caterer	Unknown	16	1	D	Lamb salad
NSW	March	Commercial caterer	*S.* Typhimurium MLVA profile 03-15/16-11-10/11-523	8	0	D	Unknown
NSW	March	Restaurant	Unknown	10	0	D	Unknown
NSW	March	Restaurant	*S.* Typhimurium PT 170 MLVA profile 03-09-09-12-523	18	1	D	Raw egg products suspected
NSW	March	Restaurant	*S.* Typhimurium MLVA profile 03-13-09-11-550 (historically PT 135)	4	2	D	Burger with egg and bacon
NSW	March	Restaurant	*S.* Typhimurium PT 170 MLVA profile 03-10-07-15-523	15	Unknown	D	Unknown
NSW	March	Takeaway	*S.* Typhimurium PT 44 MLVA profile 03-10-08-09-523	11	0	D	Vietnamese rolls with raw egg butter

Appendix *continued*: Outbreaks of foodborne or suspected foodborne disease reported by OzFoodNet sites, 1 January to 31 March 2012 (n=51)

State	Month	Setting Prepared	Agent responsible	Number affected	Hospitalised	Evidence	Responsible vehicles
NT	January	Private residence	Unknown	8	0	D	Unknown
NT	January	Private residence	Norovirus	6	0	D	Salad sandwiches suspected
NT	January	Restaurant	Norovirus	22	0	A	Chicken and/or egg sandwiches or cocktails
NT	March	Takeaway	Unknown	4	0	D	Unknown
Qld	January	Private residence	*S.* Typhimurium MLVA profile 03-13-10-10-524	4	0	D	Chocolate cake with raw egg meringue
Qld	January	Restaurant	*S.* Infantis	2	2	D	Prawn salad rolls
Qld	February	National franchised fast food	Unknown	4	0	D	Potato and gravy
Qld	February	Restaurant	*S.* Typhimurium MLVA profile 03-09-07-13-524	6	1	D	Unknown
Qld	February	Unknown	*S.* Typhimurium MLVA profile 03-14-09-13-524	30	Unknown	D	Unknown
Qld	March	Restaurant	*S.* Typhimurium MLVA profile 03-12-13-09-524	5	1	D	Deep fried ice cream suspected
Qld	March	Other	Unknown	35	0	D	Unknown
SA	February	Commercial caterer	*S.* Typhimurium PT 9	25	4	D	Unknown
Tas.	February	Takeaway	*S.* Typhimurium PT 141	8	3	D	Egg-based sauces (consumed with seafood)
Vic.	January	Takeaway	Unknown	9	1	D	Fish and chips
Vic.	January	Aged care	Unknown	8	0	D	Unknown
Vic.	January	Commercial caterer	Norovirus	27	0	D	Sandwiches suspected
Vic.	January	Aged care	Unknown	10	0	A	Vitamised food
Vic.	January	Aged care	Unknown	5	0	D	Unknown
Vic.	March	Restaurant	*S.* Typhimurium PT 170	13	3	D	Multiple foods
Vic.	March	Unknown	Campylobacter	3	2	D	Unknown
WA	February	Commercial caterer	Unknown	21	0	A	Grapes and caramel slice
WA	February	Takeaway	*S.* Anatum	4	0	D	Multiple salads
WA	March	Aged care	Unknown	9	0	D	Unknown

A Analytical epidemiological association between illness and 1 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 tandem repeat analysis.

PT Phage type.

MJOI Multijurisdictional outbreak investigation

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 78,598 notifications to the National Notifiable Diseases Surveillance System (NNDSS) with a notification received date between 1 July and 30 September 2012 (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 - congenital	All jurisdictions
Syphilis <2 years duration	All jurisdictions
Syphilis >2 years or unspecified duration	All jurisdictions except South Australia

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 2012, by date of diagnosis

Disease	State or territory								Total 3rd quarter 2012	Total 2nd quarter 2012	Total 3rd quarter 2011	Last 5 years mean 3rd quarter	Ratio	Year to date 2012	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	0.0
Hepatitis B (newly acquired)*	2	5	2	12	2	4	12	6	45	35	46	60.8	0.7	131	186.2
Hepatitis B (unspecified)†	21	610	45	222	93	17	505	235	1,748	1,605	1,735	1,746.6	1.0	5,008	5,132.2
Hepatitis C (newly acquired)*‡	3	8	0	NN	13	5	24	35	88	97	96	97.6	0.9	292	293.6
Hepatitis C (unspecified)†	37	855	57	625	90	54	505	280	2,503	2,315	2,549	2,757.2	0.9	7,394	8,244.8
Hepatitis D	0	0	0	1	1	0	2	1	5	8	9	9.2	0.5	20	29.0
Gastrointestinal diseases															
Botulism	0	0	0	0	0	0	0	0	0	0	1	0.2	0.0	0	0.8
Campylobacteriosis§	109	NN	42	851	586	214	1,469	409	3,680	3,297	4,444	3,842.0	1.0	11,746	12,096.4
Cryptosporidiosis	2	87	18	67	21	23	94	18	330	927	290	275.0	1.2	2,696	2,078.2
Haemolytic uraemic syndrome	0	2	0	0	0	0	1	0	3	5	4	3.0	1.0	14	11.8
Hepatitis A	1	7	2	11	2	1	11	2	37	37	28	56.2	0.7	119	200.0
Hepatitis E	1	2	0	1	0	0	0	1	5	8	6	6.8	0.7	28	28.8
Listeriosis	0	6	0	1	1	1	8	1	18	21	10	13.4	1.3	65	53.2
STEC, VTEC‖	1	2	2	3	8	0	3	0	19	24	26	17.8	1.1	78	67.0
Salmonellosis	30	539	60	477	162	45	498	203	2,014	2,489	2,013	1,680.0	1.2	8,430	7,781.4
Shigellosis	0	25	12	20	9	2	27	10	105	119	94	141.2	0.7	414	467.0
Typhoid	0	4	1	1	0	1	7	1	15	20	22	21.2	0.7	91	84.2
Quarantinable diseases															
Cholera	0	1	0	0	0	0	0	0	1	4	1	1.0	1.0	5	3.2
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	0	0	0.0	0.0	0	0.0

Table 2 *continued*: Notifications of diseases received by state and territory health authorities, 1 July to 30 September 2012, by date of diagnosis

Disease	State or territory								Total 3rd quarter 2012	Total 2nd quarter 2012	Total 3rd quarter 2011	Last 5 years mean 3rd quarter	Ratio	Year to date 2012	Last 5 years YTD mean
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA							
Sexually transmissible infections															
Chlamydial infection[¶]**	307	4,976	605	4,634	1,076	456	4,874	2,933	19,861	20,464	20,259	16,214.2	1.2	62,712	49,683.8
Donovanosis	0	0	0	0	0	0	0	1	1	0	0	0.4	2.5	1	1.4
Gonococcal infection**	31	958	323	596	103	8	516	479	3,014	3,468	2,862	2,127.0	1.4	10,078	6,862.4
Syphilis – congenital**	0	0	0	0	0	0	0	0	0	1	2	1.0	0.0	1	3.8
Syphilis < 2 years duration**	3	104	3	60	39	6	107	23	345	397	309	321.0	1.1	1,107	1,004.4
Syphilis > 2 years or unspecified duration**	2	51	15	59	NN	3	131	37	298	288	319	347.8	0.9	899	1,009.8
Vaccine preventable diseases															
Diphtheria	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.8
Haemophilus influenzae type b	0	2	0	1	0	0	2	0	5	4	3	4.2	1.2	12	15.2
Influenza (laboratory confirmed)	482	4,850	206	13,962	3,865	980	4,443	4,055	32,843	7,357	17,457	16,722.0	2.0	41,451	21,869.2
Measles	0	127	1	0	0	0	0	0	128	31	34	16.2	7.9	168	74.4
Mumps	5	21	0	9	1	0	5	7	48	68	36	58.8	0.8	155	170.2
Pertussis	83	1,185	42	1,909	241	310	1,042	571	5,383	5,376	9,594	6,041.2	0.9	17,948	16,325.2
Pneumococcal disease (invasive)	5	207	19	162	53	18	150	103	717	508	726	641.2	1.1	1,452	1,287.4
Poliomyelitis	0	0	0	0	0	0	0	0	0	0	0	0.2	0.0	0	0.2
Rubella	0	4	0	2	0	0	2	0	8	8	14	10.4	0.8	29	33.8
Rubella – congenital	0	0	1	0	0	0	0	0	1	1	0	0.0	0.0	2	0.4
Tetanus	0	0	0	1	0	0	1	0	2	0	0	0.6	3.3	3	2.8
Varicella zoster (chickenpox)[††]	1	NN	63	84	118	8	207	116	597	458	657	526.8	1.1	1,453	1,225.8
Varicella zoster (shingles)[††]	13	NN	45	19	372	61	272	264	1,046	1,122	1,016	633.8	1.7	3,236	1,984.6
Varicella zoster (unspecified)[††]	35	NN	2	1,097	46	31	585	266	2,062	2,046	1,995	1,519.4	1.4	6,173	4,376.4
Vectorborne diseases															
Arbovirus infection (NEC)	0	0	0	2	0	0	0	0	2	3	6	4.0	0.5	8	11.6
Barmah Forest virus infection	0	58	15	165	5	0	6	26	275	336	289	291.8	0.9	1,057	1,350.6
Dengue virus infection	6	47	6	28	9	0	35	51	182	412	117	137.4	1.3	1,283	647.4
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0	0.2	0.0	1	0.2
Kunjin virus infection[‡‡]	0	0	0	0	0	0	0	0	0	0	0	0.2	0.0	0	1.2
Malaria	0	24	7	17	4	1	27	19	99	70	95	123.2	0.8	241	366.4
Murray Valley encephalitis virus infection[‡‡]	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	1	4.2
Ross River virus infection	0	66	25	264	30	0	41	60	486	1,222	375	634.4	0.8	3,976	4,029.4

Table 2 *continued*: Notifications of diseases received by state and territory health authorities, 1 July to 30 September 2012, by date of diagnosis

Disease	State or territory								Total 3rd quarter 2012	Total 2nd quarter 2012	Total 3rd quarter 2011	Last 5 years mean 3rd quarter	Ratio	Year to date 2012	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	0.4
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	8	0	0	0	0	9	1	7	9.0	1.0	17	26.8
Leptospirosis	0	1	0	5	0	0	4	1	11	46	19	18.0	0.6	102	119.0
Lyssavirus (NEC)	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	0.0
Ornithosis	0	2	0	0	0	0	9	3	14	13	20	18.0	0.8	38	58.2
Q fever	0	19	0	48	3	0	4	2	76	78	83	85.4	0.9	257	269.2
Tularaemia	0	0	0	0	0	0	0	0	0	0	0	0.0	0.0	0	1.0
Other bacterial infections															
Legionellosis	1	15	1	34	11	6	15	23	106	86	61	62.6	1.7	284	220.8
Leprosy	0	0	0	0	0	0	1	0	1	1	2	2.0	0.5	2	6.8
Meningococcal infection§§	0	28	0	26	9	3	12	6	84	67	77	94.6	0.9	183	201.8
Tuberculosis	7	55	4	48	9	1	99	55	278	248	400	335.6	0.8	815	898.6
Total	1,188	14,954	1,624	25,532	6,982	2,259	15,756	10,303	78,598	55,191	68,208			191,676	

* 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 2012, 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)*	2.2	0.3	3.5	1.0	0.5	3.1	0.9	1.0	0.8
Hepatitis B (unspecified)†	23.0	33.4	78.1	19.4	22.5	13.3	35.9	40.0	30.9
Hepatitis C (newly acquired)*	3.3	0.4	0.0	NN	3.1	3.9	1.7	6.0	2.0
Hepatitis C (unspecified)†‡	40.5	46.8	99.0	54.6	21.7	42.3	35.9	47.7	44.3
Hepatitis D	0.0	0.0	0.0	0.1	0.2	0.0	0.1	0.2	0.1
Gastrointestinal diseases									
Botulism	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Campylobacteriosis§	119.2	NN	72.9	74.3	141.5	167.7	104.5	69.6	96.1
Cryptosporidiosis	2.2	4.8	31.3	5.9	5.1	18.0	6.7	3.1	5.8
Haemolytic uraemic syndrome	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.1
Hepatitis A	1.1	0.4	3.5	1.0	0.5	0.8	0.8	0.3	0.7
Hepatitis E	1.1	0.1	0.0	0.1	0.0	0.0	0.0	0.2	0.1
Listeriosis	0.0	0.3	0.0	0.1	0.2	0.8	0.6	0.2	0.3
STEC,VTEC‖	0.0	1.4	20.8	1.7	2.2	1.6	1.9	1.7	1.9
Salmonellosis	1.1	0.1	3.5	0.3	1.9	0.0	0.2	0.0	0.3
Shigellosis	32.8	29.5	104.2	41.7	39.1	35.3	35.4	34.6	35.6
Typhoid fever	0.0	0.2	1.7	0.1	0.0	0.8	0.5	0.2	0.3
Quarantinable diseases									
Cholera	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	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¶**	335.9	272.6	1,050.5	404.7	259.9	357.3	346.8	499.4	351.2
Donovanosis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0
Gonococcal infection**	33.9	52.5	560.8	52.0	24.9	6.3	36.7	81.6	53.3
Syphilis – congenital**	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Syphilis < 2 years duration**	3.3	5.7	5.2	5.2	9.4	4.7	7.6	3.9	6.1
Syphilis > 2 years or unspecified duration†**	2.2	2.8	26.0	5.2	NN	2.4	9.3	6.3	5.7
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	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.1
Influenza (laboratory confirmed)	527.3	265.7	357.7	1,219.3	933.4	767.8	316.2	690.4	580.8
Measles	0.0	7.0	1.7	0.0	0.0	0.0	0.0	0.0	2.3
Mumps	5.5	1.2	0.0	0.8	0.2	0.0	0.4	1.2	0.8
Pertussis	90.8	64.9	72.9	166.7	58.2	242.9	74.1	97.2	95.2
Pneumococcal disease (invasive)	5.5	11.3	33.0	14.1	12.8	14.1	10.7	17.5	12.7
Poliomyelitis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rubella	0.0	0.2	0.0	0.2	0.0	0.0	0.1	0.0	0.1
Rubella – congenital	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0
Tetanus	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.0

Table 3 *continued*: Notification rates of diseases, 1 July to 30 September 2012, by state or territory. (Annualised rate per 100,000 population)

Disease	State or territory								Aust
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	
Varicella zoster (chickenpox)	1.1	NN	109.4	7.3	28.5	6.3	14.7	19.8	15.6
Varicella zoster (shingles)	14.2	NN	78.1	1.7	89.8	47.8	19.4	44.9	27.3
Varicella zoster (unspecified)	38.3	NN	3.5	95.8	11.1	24.3	41.6	45.3	53.9
Vectorborne diseases									
Arbovirus infection (NEC)	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0
Barmah Forest virus infection	0.0	3.2	26.0	14.4	1.2	0.0	0.4	4.4	4.9
Dengue virus infection	6.6	2.6	10.4	2.4	2.2	0.0	2.5	8.7	3.2
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	0.0	1.3	12.2	1.5	1.0	0.8	1.9	3.2	1.8
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	3.6	43.4	23.1	7.2	0.0	2.9	10.2	8.6
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	0.7	0.0	0.0	0.0	0.0	0.2
Leptospirosis	0.0	0.1	0.0	0.4	0.0	0.0	0.3	0.2	0.2
Lyssavirus (NEC)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ornithosis	0.0	0.1	0.0	0.0	0.0	0.0	0.6	0.5	0.2
Q fever	0.0	1.0	0.0	4.2	0.7	0.0	0.3	0.3	1.3
Tularaemia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other bacterial diseases									
Legionellosis	1.1	0.8	1.7	3.0	2.7	4.7	1.1	3.9	1.9
Leprosy	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Meningococcal infection‡‡	0.0	1.5	0.0	2.3	2.2	2.4	0.9	1.0	1.5
Tuberculosis	7.7	3.0	6.9	4.2	2.2	0.8	7.0	9.4	4.9

* 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

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 *2012;36(1):123.*

HIV and AIDS diagnoses and deaths following AIDS reported for 1 October to 31 December 2011, are included in this issue of Communicable Diseases Intelligence *(Tables 1 and 2).*

Table 1: Number of new diagnoses of HIV infection, new diagnoses of AIDS and deaths following AIDS occurring in the period 1 October to 31 December 2011, 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 2011	This period 2010	YTD 2011	YTD 2010
HIV diagnoses	Female	0	6	0	9	3	1	7	10	36	36	142	150
	Male	3	79	1	40	7	1	74	24	229	196	994	896
	Not reported	0	0	0	0	0	0	0	0	0	0	0	0
	Total*	3	85	1	49	10	2	82	34	266	232	1,137	1,051
AIDS diagnoses	Female	0	1	0	1	0	0	2	1	5	2	17	12
	Male	0	2	0	1	0	2	12	3	20	34	98	112
	Total*	0	3	0	2	0	2	14	4	25	36	115	124
AIDS deaths	Female	0	0	0	0	0	0	0	0	0	0	3	1
	Male	0	0	0	0	0	0	0	0	0	7	21	22
	Total*	0	0	0	0	0	0	0	0	0	7	24	23

* 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 in 1985, and number of new diagnoses of AIDS and deaths following AIDS since 1981, cumulative to 31 December 2011, by sex and state or territory

		State or territory								
	Sex	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
HIV diagnoses	Female	40	1,075	32	425	147	26	533	333	2,611
	Male	302	15,191	171	3,642	1,153	152	6,551	1,546	28,708
	Not reported	0	227	0	0	0	0	22	0	249
	Total*	342	16,528	203	4,076	1,301	178	7,131	1,886	31,645
AIDS diagnoses	Female	10	289	6	81	33	4	136	51	610
	Male	95	5,672	53	1,116	428	58	2,252	475	10,149
	Total*	105	5,980	59	1,199	462	62	2,401	528	10,796
AIDS deaths	Female	7	144	1	44	20	2	67	30	315
	Male	73	3,624	33	687	281	34	1,472	301	6,505
	Total*	80	3,779	34	733	301	36	1,548	332	6,843

* Totals include people whose sex was reported as transgender.

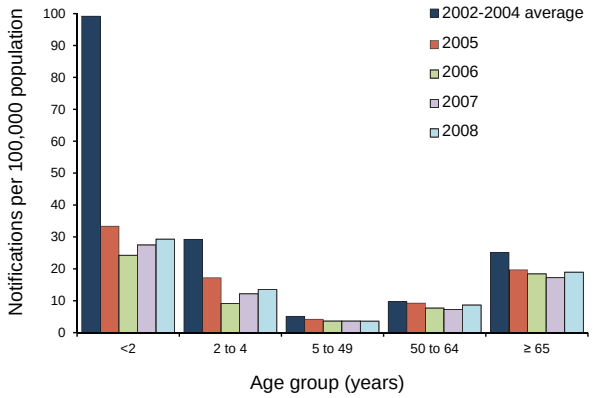
Administration

Errata

Invasive pneumococcal disease in Australia annual report, 2007 and 2008

There was an error in the recent Invasive pneumococcal disease in Australia annual report, 2007 and 2008 published in the June issue of CDI. The data in Figure 4 was a repeat of that in Figure 5, and the correct data for Figure 4 was not published (*Commun Dis Intell* 2012;36(2):E155). The correct Figure is displayed below.

Figure 4: Notification rate for invasive pneumococcal disease, Australia, 2002 to 2008, by age group



Communicable disease surveillance – Tables

For the issues of CDI published between June 2011 and September 2012 the data for salmonellosis; shigellosis and STEC/VTEC was incorrect in Table 3: Notification rates of diseases, by state or territory.

Please refer to the published issues on the *Communicable Diseases Intelligence* web site for the corrected data.

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Reviewers for *Communicable Diseases Intelligence* 2012

The *CDI* staff wish to thank the following reviewers for their valued assistance throughout the year.

Peter Collignon, Geoffrey Coombs, Scott Crerar, Bart Currie, Michael Good, Robert Hall, Alan Hampson, David Harley, Anthony Keil, Ann Kempe, Stephen Lambert, Rogan Lee, Rosemary Lester, Cameron Moffatt, Jennie Musto, Sally Partridge, Jane Raupach, Rick Stapeldon, Mary Valcanis, Mark Veitch, Justin Waring