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Australia's notifiable disease status, 2015: Annual report of the National Notifiable Diseases Surveillance System

NNDSS Annual Report Working Group

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Table of Contents

Annual report

Australia's notifiable disease status, 2015: Annual report of the National Notifiable Diseases Surveillance System

NNDSS Annual Report Working Group

Abstract

In 2015, 67 diseases and conditions were nationally notifiable in Australia. States and territories reported a total of 320,480 notifications of communicable diseases to the National Notifiable Diseases Surveillance System, an increase of 16% on the number of notifications in 2014. In 2015, the most frequently notified diseases were vaccine preventable diseases (147,569 notifications, 46% of total notifications), sexually transmissible infections (95,468 notifications, 30% of total notifications), and gastrointestinal diseases (45,326 notifications, 14% of total notifications). There were 17,337 notifications of bloodborne diseases; 12,253 notifications of vectorborne diseases; 1,815 notifications of other bacterial infections; 710 notifications of zoonoses and 2 notifications of quarantinable diseases.

Introduction

Australia's notifiable diseases status, 2015, is an annual surveillance report of nationally notifiable communicable diseases. Communicable disease surveillance in Australia operates at the national, jurisdictional and local levels. Primary responsibility for public health action lies with the state and territory health departments. The role of communicable disease surveillance at the national level includes:

- identifying national trends;
- providing guidance for policy development and resource allocation at the national level;
- monitoring the need for and impact of national disease control programs;
- informing the response to national or multi-jurisdictional outbreaks;
- describing the national epidemiology of communicable diseases;
- meeting international reporting requirements, such as providing disease statistics to the World Health Organization (WHO); and
- supporting quarantine activities, which are the responsibility of the Australian government.

Methods

Australia is a federation of 6 states (New South Wales, Queensland, South Australia, Tasmania, Victoria and Western Australia) and 2 territories (the Australian Capital Territory and the Northern Territory).

State and territory health departments collect notifications of communicable diseases under their respective public health legislations. In September 2007, the *National Health Security Act 2007*[1] (the "Act") received royal assent. This Act provides a legislative basis for and authorises the exchange of health information, including personal information, between jurisdictions and the Australian Government. The Act provides for the establishment of the National Notifiable Diseases List[2], which specifies the diseases about which personal information can be provided.

The *National Health Security Agreement* [3], (the "*Agreement*")which was signed by Health Ministers in April 2008, establishes the operational arrangements to formalise and enhance existing surveillance and reporting systems, an important objective of the Act. Under the Agreement, in 2015, states and territories forwarded de-identified notification data on 67 communicable diseases to the Australian Government Department of Health for the purposes of national communicable disease surveillance, although not all 67 diseases were notifiable in each jurisdiction. Data were electronically updated daily from states and territories. The system was complemented by other surveillance systems, which provided information on various diseases, including 4 that are not reported to the National Notifiable Diseases Surveillance System (NNDSS): human immunodeficiency virus (HIV), acquired immune deficiency syndrome (AIDS) and the classical and variant forms of Creutzfeldt-Jakob disease (CJD).

The NNDSS core dataset requires the following mandatory data fields: unique record reference number; notifying state or territory; disease code; confirmation status; and the date when the jurisdictional health department was notified (notification received date). In addition, the following data fields were supplied where available: date of birth; age at onset; sex; Indigenous status; postcode of residence; disease onset date; date when the pathology service authorised a report or a medical practitioner signed the notification form (notification date); death status; date of specimen collection; and outbreak reference number (to identify cases linked to an outbreak). Where relevant, information on the species, serogroups/subtypes and phage types of organisms isolated, and on the immunisation status of the case, were collected and reported to NNDSS. Data quality was monitored by the Office of Health Protection and the National Surveillance Committee (NSC), and there was a continual process of improving the national consistency of communicable disease surveillance through the daily, fortnightly and quarterly review of these data.

While not included in the core national dataset, enhanced surveillance information for some diseases (invasive pneumococcal disease, hepatitis B, hepatitis C, tuberculosis, donovanosis, gonococcal infection and syphilis <2 years duration) were reported from states and territories to NNDSS. With the exception of hepatitis B and hepatitis C these enhanced data are not included in this report. These data, along with influenza enhanced data, are reported in separate (disease-specific) annual reports. Additional information concerning mortality and specific health risk factors for some diseases were obtained from states and territories and included in this annual report.

Newly diagnosed HIV infection and AIDS were notifiable conditions in each state or territory health jurisdiction in 2015. These data are forwarded directly to the Kirby Institute for Infection and Immunity in Society (Kirby Institute) by states and territories. Further information can be found in the Kirby Institute's annual surveillance report.[4]

Surveillance for the classical and variant forms of CJD in Australia has been conducted through the Australian National Creutzfeldt-Jakob Disease Registry (ANCJDR) since its establishment in October 2003. CJD is a nationally notifiable disease, and by June 2006 CJD was notifiable in all states and territories. Further surveillance information on CJD can be found in surveillance reports from the ANCJDR.[5]

Information on communicable disease surveillance is communicated through several avenues. The most up-to-date information on topics of interest is provided at the fortnightly teleconferences of the Communicable Diseases Network Australia (CDNA). A summary of these reports is available online from the CDNA web site (http://www.health.gov.au/internet/main/publishing.nsf/Content/cdnareport.htm).[6]

The *Communicable Diseases Intelligence* (CDI) journal publishes surveillance data, annual surveillance reports, short reports, and articles on the epidemiology and control of communicable diseases in Australia.

Notification rates for each notifiable disease were calculated using the estimated 2015 December resident population supplied by the Australian Bureau of Statistics (ABS) (Appendix 1 and Appendix 2).[7] Where diseases were not notifiable in a state or territory, national rates were adjusted by excluding the population of that jurisdiction from the denominator. For some diseases, age adjusted rates were calculated using the direct method of standardisation, with 2011 census data as the standard population. All rates are represented as the rate per 100,000 population unless stated otherwise.

Direct age-standardised notification rates, using the method described by the Australian Institute of Health and Welfare[8], were calculated for Aboriginal and Torres Strait Islander and non-Indigenous notifications for relevant sexually transmissible infections (STIs) for jurisdictions that had Indigenous status data completed for more than 50% of notifications over the period from 2010 to 2015. Where the Indigenous status of a notification was not completed, these notifications were counted as non-Indigenous in the analyses. These data, however, should be interpreted with caution, as STI screening may occur predominantly in specific high risk groups, including in remote Aboriginal and Torres Strait Islander populations. Recent studies have suggested that higher rates in Aboriginal and Torres Strait Islander populations may be attributable to higher prevalence and reinfection rates, while others have suggested that they may be due to increased testing and contact tracing.[9]

In the national case definitions for chlamydial infection, gonococcal infection and syphilis, the mode of transmission cannot be inferred from the site of infection. Infections in children may be acquired prenatally (e.g. congenital chlamydia).[10] As such, notifications of chlamydial, gonococcal and non-congenital syphilis infections were excluded from analysis of age and sex distribution where the case was aged less than 13 years and the infection was determined by public health follow-up to be non-sexually acquired.

NOTES ON INTERPRETATION

This report is based on 2015 data from each state and territory, agreed upon in July 2016, and represents a snapshot of the year after duplicate records and incorrect or incomplete data were removed. Totals in this report may vary slightly from the totals reported in CDI quarterly publications and state and territory reports.

Analyses in this report were based on the date of disease diagnosis in an attempt to estimate disease activity within the reporting period. The date of diagnosis for most diseases is the onset date or, where the onset date was not known, the earliest of the following dates: the specimen collection date, the notification date, or the notification received date. However, for the chronic diseases hepatitis B (unspecified), hepatitis C (unspecified), leprosy, syphilis (unspecified) and tuberculosis, the diagnosis date is derived from the notification received date.

When referring to NNDSS notification data throughout the report, the terms 'cases' and 'notified cases' are used to identify individuals for whom 'notification' of a condition has been received by NNDSS. These notifications can only represent a proportion (the 'notified fraction') of the total incidence (Figure 1), and this has to be taken into account when interpreting NNDSS data. Moreover, the notified fraction varies by jurisdiction, over time and by disease. This caveat is particularly relevant to STIs, many or most of which are identified through screening programs (Figure 1, dashed line).

A survey of jurisdictional public health departments was conducted in 2015 to ascertain the source of each notification (Table 1). While most jurisdictions have data on laboratory notifications, the percentages of notifications attributed to doctor only and to both laboratory and doctor for each state and territory are based on estimates deduced from the data that are available, noting that fields for these data may be incomplete.

Methods of surveillance vary between states and territories, each having different requirements

Figure 1: Communicable diseases notifiable fraction

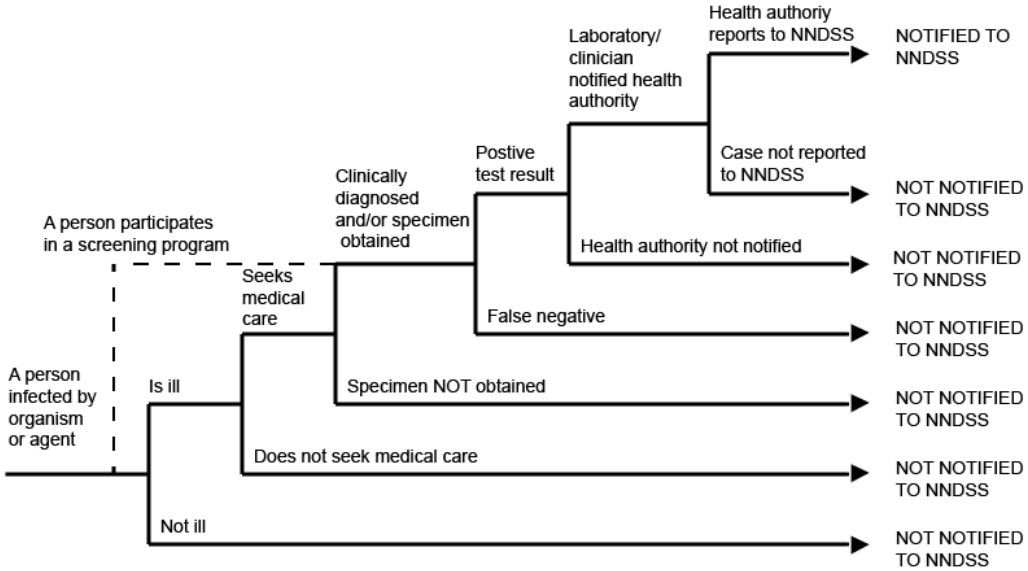

Table 1: Percentage of notified cases from different sources in each jurisdiction, 2015*

State or territory	Source of notifications		
	Laboratory only	Doctor only	Laboratory and doctor
ACT	97	<1	<1
NSW	99	<1	<1
NT	98	1	1
Qld	100	<1	<1
SA	9	2	89
Tas.	98	<1	1
Vic.	49	6	45
WA	34	2	64

*Not all percentages add up to 100% due to other sources of notifications and/or incomplete data for laboratory and medical notification fields.

for notification by medical practitioners, laboratories and hospitals. Although the National Notifiable Diseases List[2] was established, some diseases are not notifiable in all 8 jurisdictions (Table 2).

Changes in surveillance practices may have been introduced in some jurisdictions and not in others, and must be taken into consideration when comparing data between jurisdictions. In this report, some additional information was obtained from states and territories to assist in the interpretation of the 2015 data. These include changes in surveillance practices, screening practices, laboratory practices, and major disease control or prevention initiatives.

Postcode information reflects the residential location of the case, but this does not necessarily represent the place where the disease was acquired.

Data completeness was assessed for cases' Indigenous status and place of acquisition, and

Table 2: Diseases notified to the National Notifiable Diseases Surveillance System, Australia 2015

Disease	Data received from
Bloodborne diseases	
Hepatitis B (newly acquired)	All jurisdictions
Hepatitis B (unspecified)	All jurisdictions
Hepatitis C (newly acquired)	All jurisdictions, except Qld
Hepatitis C (unspecified)	All jurisdictions
Hepatitis D	All jurisdictions
Gastrointestinal diseases	
Botulism	All jurisdictions
Campylobacteriosis	All jurisdictions, except NSW
Cryptosporidiosis	All jurisdictions
Haemolytic uraemic syndrome	All jurisdictions
Hepatitis A	All jurisdictions
Hepatitis E	All jurisdictions
Listeriosis	All jurisdictions
Paratyphoid	All jurisdictions
Salmonellosis	All jurisdictions
Shigellosis	All jurisdictions
Shiga toxin producing *Escherichia coli*	All jurisdictions
Typhoid fever	All jurisdictions
Quarantinable diseases	
Cholera	All jurisdictions
Highly pathogenic avian influenza in humans	All jurisdictions
Middle East respiratory syndrome coronavirus	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 infections	All jurisdictions
Donovanosis	All jurisdictions
Gonococcal infection	All jurisdictions
Syphilis < 2 years duration	All jurisdictions
Syphilis > 2 years or unspecified duration	All jurisdictions
Syphilis – congenital	All jurisdictions
Vaccine preventable diseases	
Diphtheria	All jurisdictions

Disease	Data received from
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 NSW
Varicella zoster (shingles)	All jurisdictions, except NSW
Varicella zoster (unspecified)	All jurisdictions, except NSW
Vectorborne diseases	
Barmah Forest virus infection	All jurisdictions
Chikungunya virus infection	All jurisdictions, except ACT
Dengue virus infection	All jurisdictions
Flavivirus infection (unspecified)	All jurisdictions
Japanese encephalitis virus infection	All jurisdictions
Malaria	All jurisdictions
Murray Valley encephalitis virus infection	All jurisdictions
Ross River virus infection	All jurisdictions
West Nile / Kunjin 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 disease (invasive)	All jurisdictions
Tuberculosis	All jurisdictions

NEC Not elsewhere classified.

reported as the proportion of complete notifications. The completeness of data in this report is summarised in the 'Results' section.

The percentage of data completeness was defined as:

> Percentage of data completeness = (total notifications – missing or unknown) / total notifications x 100

> The Indigenous status was defined by the following nationally accepted criteria:[11]

> 1=Indigenous (Aboriginal but not Torres Strait Islander origin);

> 2=Indigenous (Torres Strait Islander but not Aboriginal origin);

> 3=Indigenous (Aboriginal and Torres Strait Islander origin);

> 4=Not Indigenous (not Aboriginal or Torres Strait Islander origin);

> 9=Not stated.

For the purposes of this report, an Indigenous person includes responses 1, 2 or 3, with non-Indigenous including response 4 only.

Place of acquisition is where the disease is believed to have been acquired, either locally or overseas. The country of acquisition is determined by the Standard Australian Classification of Countries (SACC) from the ABS.[12] A notification is complete if a valid value from the SACC is entered.

In interpreting STI notification data it is important to note that changes in notifications over time may not solely reflect changes in disease prevalence as changes in screening programs,[13,14] the use of less invasive and more sensitive diagnostic tests[15] and periodic public awareness campaigns[16] may influence the number of notifications that occur over time. Rates for STIs are particularly susceptible to overall rates of testing, with low testing rates resulting in an underestimation of disease and increased testing potentially causing an increase in notifications.[17]

The differences in rates between females and males for STIs should be interpreted with caution, as rates of testing, symptom status, health care-seeking behaviours, and partner notification differ between the sexes.[18] ■

NOTES ON CASE DEFINITIONS

Each notifiable disease is governed by a national surveillance case definition for reporting to the NNDSS. These case definitions were agreed by CDNA and implemented nationally in January 2004 and were used by all jurisdictions for the first time in 2005. These case definitions are reviewed by the Case Definitions Working Group (CDWG) as required. In 2015, the following case definitions were updated:

- hepatitis C (newly acquired)
- avian influenza in humans
- hepatitis B (newly acquired)
- hepatitis B (unspecified)
- hepatitis E
- syphilis
- congenital syphilis

In addition to the above, a change was made to the salmonella case definition and a paratyphoid case definition was created. From 1 January 2016, paratyphoid notifications were separated from salmonellosis notifications. Paratyphoid is reported for the first time in this annual report as all paratyphoid data in the NNDSS was retrospectively updated.

The national surveillance case definitions and their review status are available from the

Australian Government Department of Health web site (http://www.health.gov.au/casedefinitions). ■

RESULTS

There were 320,480 communicable disease notifications received by NNDSS in 2015 (Table 3).

Table 3: Notifications to the National Notifiable Diseases Surveillance System, Australia, 2015, by disease category rank order

Disease category	Number	%
Vaccine preventable diseases	147,569	46
Sexually transmitted infections	95,468	30
Gastrointestinal diseases	45,326	14
Bloodborne diseases	17,337	5
Vectorborne diseases	12,253	4
Other bacterial diseases	1,815	1
Zoonoses	710	<1
Quarantinable diseases	2	<1
Total	320,480	100

In 2015, the most frequently notified diseases were vaccine preventable diseases (147,569 notifications, 46% of total notifications), sexually transmissible infections (95,468 notifications, 30% of total notifications), and gastrointestinal diseases (45,326 notifications, 14% of total notifications).

There was an increase of 16% compared with the total number of notifications in 2014 (276,188) (Figure 2). The increase can largely be attributed to the seasonal increase in influenza notifications for 2015, which reached a higher peak than in previous seasons.

Number of notifications and notification rates per 100,000 for each disease by state or territory in 2015, are shown in Table 4 and Table 5 respectively. Notifications and rates per 100,000 for the period 2010 to 2015 are shown in Table 6. ■

Figure 2: Trends in notifications received by the National Notifiable Diseases Surveillance System, Australia, 1991 to 2015

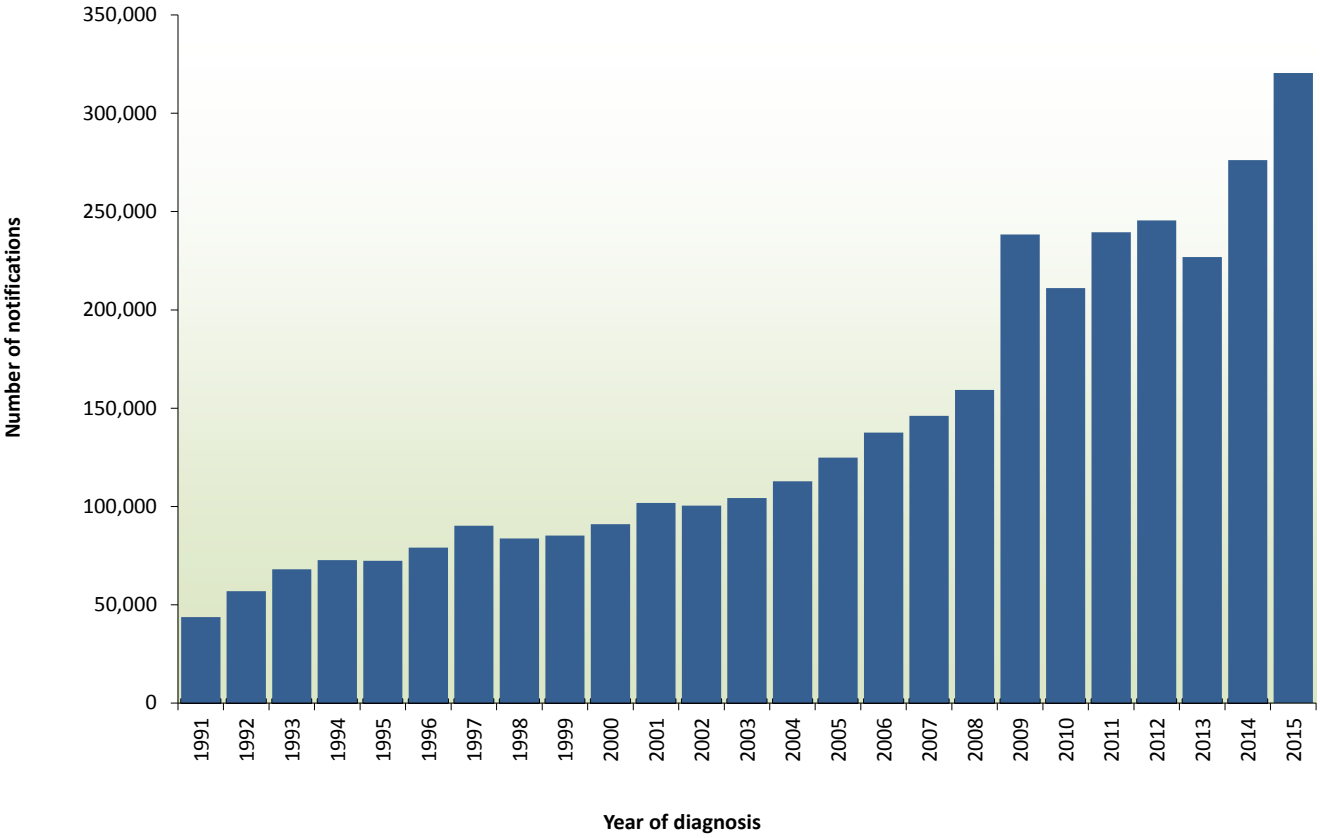

Table 4: Notified cases of communicable diseases, Australia, 2015, by state or territory

Disease	State or Territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Bloodborne diseases									
Hepatitis B (newly acquired)*	0	29	1	43	7	1	30	29	140
Hepatitis B (unspecified)†	81	2,356	159	998	337	41	1,817	576	6,365
Hepatitis C (newly acquired)*‡	13	24	4	NN	43	26	140	183	433
Hepatitis C (unspecified)†	175	3,556	196	2,577	458	234	2,202	962	10,360
Hepatitis D	0	9	0	15	9	0	6	0	39
Gastrointestinal diseases									
Botulism	0	1	0	0	0	0	1	1	3
Campylobacteriosis	608	NN	371	7,546	1,816	1,035	8,305	2,892	22,573
Cryptosporidiosis	26	1,051	122	1,314	420	19	857	255	4,064
Haemolytic uraemic syndrome	0	11	0	2	0	0	4	1	18
Hepatitis A	3	68	5	33	10	1	33	25	178
Hepatitis E	0	21	0	1	1	1	15	2	41
Listeriosis	1	28	2	8	4	0	21	6	70
Paratyphoid§	4	18	1	6	9	0	27	11	76
Salmonellosis	237	4,061	544	5,420	1,263	255	3,525	1,708	17,013
Shigellosis	7	175	136	148	18	6	451	97	1,038
Shiga toxin-producing *Escherichia coli*	0	31	0	32	45	0	29	0	137
Typhoid Fever	2	42	0	24	8	1	30	8	115
Quarantinable diseases									
Cholera	0	1	0	0	1	0	0	0	2
Highly pathogenic avian influenza in humans	0	0	0	0	0	0	0	0	0
Middle East respiratory syndrome coronavirus	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0
Rabies	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome	0	0	0	0	0	0	0	0	0
Smallpox	0	0	0	0	0	0	0	0	0
Viral haemorrhagic fever	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0

Disease	State or Territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Sexually transmitted infections									
Chlamydial infection[‖¶]	1,266	22,609	2,738	21,184	5,385	1,666	6,265	11,150	72,263
Donovanosis	0	0	0	0	0	0	0	0	0
Gonococcal infection[‖¶]	141	5,461	1,832	3,035	795	56	4,977	2,253	18,550
Syphilis – congenital[‖¶]	0	0	0	3	0	0	0	0	3
Syphilis < 2 years duration[*¶**]	14	743	202	570	70	15	935	164	2,713
Syphilis > 2 years or unspecified duration[†¶]	9	632	76	286	123	14	730	69	1,939
Vaccine preventable diseases									
Diphtheria	0	0	0	2	0	0	0	0	2
Haemophilus influenzae type b	0	5	2	5	0	0	2	2	16
Influenza (laboratory confirmed)	1,204	30,303	676	28,056	15,652	1,434	17,265	5,993	100,583
Measles	2	9	0	21	4	0	30	8	74
Mumps	5	63	15	46	33	8	18	456	644
Pertussis	486	12,244	59	1,861	1,333	31	4,664	1,868	22,546
Pneumococcal disease (invasive)	17	489	61	243	125	43	355	166	1,499
Poliomyelitis	0	0	0	0	0	0	0	0	0
Rubella	1	7	0	4	2	1	0	2	17
Rubella - congenital	0	0	0	1	0	0	0	0	1
Tetanus	0	1	0	0	0	0	1	0	2
Varicella zoster (chickenpox)	65	NN	118	331	446	68	967	484	2,479
Varicella zoster (shingles)	196	NN	363	54	2,325	248	1,740	1,417	6,343
Varicella zoster (unspecified)	125	NN	2	6,485	128	146	5,022	1,455	13,363
Vectorborne diseases									
Barmah Forest virus infection	2	181	26	360	1	1	11	46	628
Chikungunya virus infection	0	35	7	17	2	0	38	11	110
Dengue virus infection	19	344	55	263	74	19	386	554	1,714
Flavivirus infection (unspecified)[††]	0	2	0	5	1	0	2	2	12
Japanese encephalitis virus infection	0	1	0	1	0	0	1	0	3
Malaria	7	47	12	56	3	2	57	49	233
Murray Valley encephalitis virus infection	0	0	2	0	0	0	0	0	2

Disease	State or Territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust
Ross River virus infection	10	1,620	360	6,192	112	5	289	962	9,550
West Nile / Kunjin virus infection	0	1	0	0	0	0	0	0	1
Zoonoses									
Anthrax	0	0	0	0	0	0	0	0	0
Australia bat lyssavirus	0	0	0	0	0	0	0	0	0
Brucellosis	0	11	1	7	0	0	0	0	19
Leptospirosis	1	17	4	42	0	2	7	1	74
Lyssavirus (NEC)	0	0	0	0	0	0	0	0	0
Ornithosis	0	2	0	1	1	0	11	1	16
Q fever	0	262	1	255	13	0	58	12	601
Tularaemia	0	0	0	0	0	0	0	0	0
Other bacterial diseases									
Legionellosis	2	98	7	80	26	7	71	74	365
Leprosy	0	3	1	2	0	0	5	2	13
Meningococcal infection‡‡	2	45	1	30	29	2	56	17	182
Tuberculosis	16	445	27	183	87	13	352	132	1,255
Total	4,747	87,162	8,189	87,848	31,219	5,401	61,808	34,106	320,480

* Newly acquired hepatitis and syphilis < 2 years duration 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 or is greater than 24 months.

‡ In Queensland, includes newly acquired hepatitis C cases.

§ From 1 January 2016 a case definition for paratyphoid was created and for the first time is reported on as a separate condition from salmonella. Changes were made to paratyphoid notifications retrospectively to 1991.

|| Includes *Chlamydia trachomatis* identified from cervical, rectal, urine, urethral and throat samples, except for South Australia, which reports only cervical, urine and urethral specimens.

¶ The national case definitions for chlamydial, gonococcal and syphilis diagnoses include infections that may be acquired through a non-sexual mode (especially in children – e.g. perinatal infections, epidemic gonococcal conjunctivitis).

** Data for all states and territories are reported by diagnosis date, except Queensland, where data are reported by notification received date.

†† Arbovirus infection NEC changed to flavivirus infection (unspecified) in 2015.

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

NEC Not elsewhere classified.

NN Not notifiable.

Table 5: Notification rates per 100,000 of nationally notifiable communicable diseases, Australia, 2015, by state or territory

Disease	State or territory								
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Aust.
Bloodborne diseases									
Hepatitis B (newly acquired)*	–	0.4	0.4	0.9	0.4	0.2	0.5	1.1	0.6
Hepatitis B (unspecified)†	20.7	30.9	65.0	20.9	19.8	7.9	30.6	22.2	26.8
Hepatitis C (newly acquired)*‡	3.3	0.3	1.6	NN	2.5	5.0	2.4	7.1	2.3
Hepatitis C (unspecified)†	44.8	46.7	80.2	53.9	27.0	45.3	37.1	37.1	43.6
Hepatitis D	–	0.1	–	0.3	0.5	–	0.1	–	0.2
Gastrointestinal diseases									
Botulism	–	<0.1	–	–	–	–	<0.1	<0.1	<0.1
Campylobacteriosis	155.5	NN	151.7	157.8	106.9	200.3	139.8	111.6	139.6
Cryptosporidiosis	6.6	13.8	49.9	27.5	24.7	3.7	14.4	9.8	17.1
Haemolytic uraemic syndrome	–	0.1	–	<0.1	–	–	0.1	<0.1	0.1
Hepatitis A	0.8	0.9	2.0	0.7	0.6	0.2	0.6	1.0	0.7
Hepatitis E	–	0.3	–	<0.1	0.1	0.2	0.3	0.1	0.2
Listeriosis	0.3	0.4	0.8	0.2	0.2	–	0.4	0.2	0.3
Paratyphoid§	1.0	0.2	0.4	0.1	0.5	–	0.5	0.4	0.3
Salmonellosis	60.6	53.3	222.5	113.4	74.3	49.4	59.3	65.9	71.5
Shigellosis	1.8	2.3	55.6	3.1	1.1	1.2	7.6	3.7	4.4
Shiga toxin producing *Escherichia coli*	–	0.4	–	0.7	2.6	–	0.5	–	0.6
Typhoid fever	0.5	0.6	–	0.5	0.5	0.2	0.5	0.3	0.5

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Disease	State or territory								
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Aust.
Quarantinable diseases									
Cholera	–	<0.1	–	–	0.1	–	–	–	<0.1
Highly pathogenic avian influenza in humans	–	–	–	–	–	–	–	–	–
Middle East respiratory syndrome coronavirus	–	–	–	–	–	–	–	–	–
Plague	–	–	–	–	–	–	–	–	–
Rabies	–	–	–	–	–	–	–	–	–
Severe acute respiratory syndrome	–	–	–	–	–	–	–	–	–
Smallpox	–	–	–	–	–	–	–	–	–
Viral haemorrhagic fever	–	–	–	–	–	–	–	–	–
Yellow fever	–	–	–	–	–	–	–	–	–
Sexually transmitted infections									
Chlamydial infection[‖¶]	323.8	296.7	1119.8	443.1	316.9	322.4	105.5	430.4	303.8
Donovanosis	–	–	–	–	–	–	–	–	–
Gonococcal infection[‖¶]	36.1	71.7	749.3	63.5	46.8	10.8	83.8	87.0	78.0
Syphilis – congenital[¶]	–	–	–	0.1	–	–	–	–	<0.1
Syphilis < 2 years duration[*¶**]	3.6	9.8	82.6	11.9	4.1	2.9	15.7	6.3	11.4
Syphilis > 2 years or unspecified duration[†¶]	2.3	8.3	31.1	6.0	7.2	2.7	12.3	2.7	8.2
Vaccine preventable diseases									
Diphtheria	–	–	–	<0.1	–	–	–	–	<0.1
Haemophilus influenzae type b	–	0.1	0.8	0.1	–	–	<0.1	0.1	0.1

Commun Dis Intell (2018) 2019;43(https://doi.org/10.33321/cdi.2019.43.6) Epub 15/03/2019

Disease	State or territory								
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Aust.
Influenza (laboratory confirmed)	307.9	397.7	276.5	586.9	921.2	277.5	290.6	231.3	422.9
Measles	0.5	0.1	–	0.4	0.2	–	0.5	0.3	0.3
Mumps	1.3	0.8	6.1	1.0	1.9	1.5	0.3	17.6	2.7
Pertussis	124.3	160.7	24.1	38.9	78.5	6.0	78.5	72.1	94.8
Pneumococcal disease (invasive)	4.3	6.4	24.9	5.1	7.4	8.3	6.0	6.4	6.3
Poliomyelitis	–	–	–	–	–	–	–	–	–
Rubella	0.3	0.1	–	0.1	0.1	0.2	–	0.1	0.1
Rubella – congenital	–	–	–	<0.1	–	–	–	–	<0.1
Tetanus	–	<0.1	–	–	–	–	<0.1	–	<0.1
Varicella zoster (chickenpox)	16.6	NN	48.3	6.9	26.3	13.2	16.3	18.7	15.3
Varicella zoster (shingles)	50.1	NN	148.5	1.1	136.8	48.0	29.3	54.7	39.2
Varicella zoster (unspecified)	32.0	NN	0.8	135.6	7.5	28.3	84.5	56.2	82.7
Vectorborne diseases									
Barmah Forest virus infection	0.5	2.4	10.6	7.5	0.1	0.2	0.2	1.8	2.6
Chikungunya	–	0.5	2.9	0.4	0.1	–	0.6	0.4	0.5
Dengue virus infection	4.9	4.5	22.5	5.5	4.4	3.7	6.5	21.4	7.2
Flavivirus infection (unspecified)[††]	–	<0.1	–	0.1	0.1	–	<0.1	0.1	0.1
Japanese encephalitis virus infection	–	<0.1	–	<0.1	–	–	<0.1	–	<0.1
Malaria	1.8	0.6	4.9	1.2	0.2	0.4	1.0	1.9	1.0
Murray Valley encephalitis virus infection	–	–	0.8	–	–	–	–	–	<0.1

Disease	State or territory								
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Aust.
Ross River virus infection	2.6	21.3	147.2	129.5	6.6	1.0	4.9	37.1	40.1
West Nile / Kunjin virus infection	–	<0.1	–	–	–	–	–	–	<0.1
Zoonoses									
Anthrax	–	–	–	–	–	–	–	–	–
Australia bat lyssavirus	–	–	–	–	–	–	–	–	–
Brucellosis	–	0.1	0.4	0.1	–	–	–	–	0.1
Leptospirosis	0.3	0.2	1.6	0.9	–	0.4	0.1	<0.1	0.3
Lyssavirus (NEC)	–	–	–	–	–	–	–	–	–
Ornithosis	–	<0.1	–	<0.1	0.1	–	0.2	<0.1	0.1
Q fever	–	3.4	0.4	5.3	0.8	–	1.0	0.5	2.5
Tularaemia	–	–	–	–	–	–	–	–	–
Other bacterial diseases									
Legionellosis	0.5	1.3	2.9	1.7	1.5	1.4	1.2	2.9	1.5
Leprosy	–	<0.1	0.4	<0.1	–	–	0.1	0.1	0.1
Meningococcal infection‡‡	0.5	0.6	0.4	0.6	1.7	0.4	0.9	0.7	0.8
Tuberculosis	4.1	5.8	11.0	3.8	5.1	2.5	5.9	5.1	5.3

* Newly acquired hepatitis and syphilis < 2 years duration 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 or is greater than 24 months.

‡ In Queensland, includes newly acquired hepatitis C cases.

§ From 1 January 2016 a case definition for paratyphoid was created and for the first it became reportable as a separate condition from Salmonella. Changes were made to paratyphoid notifications retrospectively to 1991.

‖ Includes *Chlamydia trachomatis* identified from cervical, rectal, urine, urethral and throat samples, except for South Australia, which reports only cervical, urine and urethral specimens.

¶ The national case definitions for chlamydial, gonococcal and syphilis diagnoses include infections that may be acquired through a non-sexual mode (especially in children – e.g. perinatal infections, epidemic gonococcal conjunctivitis).

** Data for all states and territories are reported by diagnosis date, except Queensland, where data are reported by notification received date.

†† Arbovirus infection NEC changed to flavivirus infection (unspecified) in 2015

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

NEC Not elsewhere classified.

NN Not notifiable.

Table 6: Notified cases and notification rate for communicable diseases, Australia, 2010 to 2015

Disease	Number of notified cases						5 year mean	Ratio (2015: 5 year mean)	Notification rate per 100,000					
	2010	2011	2012	2013	2014	2015			2010	2011	2012	2013	2014	2015
Bloodborne diseases														
Hepatitis B (newly acquired)[*]	233	189	192	174	171	140	191.8	0.7	1.1	0.8	0.8	0.8	0.7	0.6
Hepatitis B (unspecified)[†]	6,763	6,328	6,384	6,864	6,399	6,365	6,547.6	1.0	30.7	28.3	28.1	29.7	27.3	26.8
Hepatitis C (newly acquired)[*‡]	383	410	471	399	448	433	422.2	1.0	2.2	2.3	2.6	2.2	2.4	2.3
Hepatitis C (unspecified)[†]	11,019	9,864	9,639	10,307	10,211	10,360	10,208.0	1.0	50.0	44.2	42.4	44.6	43.5	43.6
Hepatitis D	44	48	36	61	57	39	49.2	0.8	0.2	0.2	0.2	0.3	0.2	0.2
Gastrointestinal diseases														
Botulism	0	2	0	4	1	3	1.4	2.1	–	<0.1	–	<0.1	<0.1	<0.1
Campylobacteriosis	16,995	17,724	15,671	14,688	19,945	22,573	17,004.6	1.3	114.2	117.2	101.6	93.5	125.1	139.6
Cryptosporidiosis	1,482	1,812	3,143	3,851	2,408	4,064	2,539.2	1.6	6.7	8.1	13.8	16.7	10.3	17.1
Haemolytic uraemic syndrome	9	13	20	15	21	18	15.6	1.2	<0.1	0.1	0.1	0.1	0.1	0.1
Hepatitis A	267	145	166	190	231	178	199.8	0.9	1.2	0.6	0.7	0.8	1.0	0.7
Hepatitis E	37	41	32	34	57	41	40.2	1.0	0.2	0.2	0.1	0.1	0.2	0.2

Disease	Number of notified cases						5 year mean	Ratio (2015: 5 year mean)	Notification rate per 100,000					
	2010	2011	2012	2013	2014	2015			2010	2011	2012	2013	2014	2015
Listeriosis	71	70	93	76	80	70	78.0	0.9	0.3	0.3	0.4	0.3	0.3	0.3
Paratyphoid[§]	84	69	74	74	70	76	74.2	1.0	0.4	0.3	0.3	0.3	0.3	0.3
Salmonellosis	11,830	12,202	11,170	12,723	16,283	17,013	12,841.6	1.3	53.7	54.6	49.1	55.0	69.4	71.5
Shigellosis	552	493	547	538	1,034	1,038	632.8	1.6	2.5	2.2	2.4	2.3	4.4	4.4
Shiga toxin–producing *Escherichia coli*	80	95	112	180	115	137	116.4	1.2	0.4	0.4	0.5	0.8	0.5	0.6
Typhoid fever	96	135	123	152	119	115	125.0	0.9	0.4	0.6	0.5	0.7	0.5	0.5
Quarantinable diseases														
Cholera	3	6	5	3	2	2	3.8	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Highly pathogenic avian influenza in humans	0	0	0	0	0	0	0.0	–	–	–	–	–	–	–
Middle East respiratory syndrome coronavirus	0	0	0	0	0	0	0.0	–	–	–	–	–	–	–
Plague	0	0	0	0	0	0	0.0	–	–	–	–	–	–	–
Rabies	0	0	0	0	0	0	0.0	–	–	–	–	–	–	–
Severe acute respiratory syndrome	0	0	0	0	0	0	0.0	–	–	–	–	–	–	–

Commun Dis Intell (2018) 2019;43(https://doi.org/10.33321/cdi.2019.43.6) Epub 15/03/2019

Disease	Number of notified cases						5 year mean	Ratio (2015: 5 year mean)	Notification rate per 100,000					
	2010	2011	2012	2013	2014	2015			2010	2011	2012	2013	2014	2015
Smallpox	0	0	0	0	0	0	0.0	–	–	–	–	–	–	–
Viral haemorrhagic fever	0	0	0	0	0	0	0.0	–	–	–	–	–	–	–
Yellow fever	0	2	0	0	0	0	0.4	–	–	<0.1	–	–	–	–
Sexually transmissible infections														
Chlamydial infection[‖¶]	74,420	81,105	83,148	83,796	86,782	72,263	81,850.2	0.9	337.8	363.0	365.8	362.5	369.9	303.8
Donovanosis	1	0	1	0	1	0	0.6	<0.1	<0.1	–	<0.1	–	<0.1	–
Gonococcal infection[‖¶]	10,322	12,097	13,889	14,912	15,707	18,550	13,385.4	1.4	46.9	54.1	61.1	64.5	67.0	78.0
Syphilis – congenital[‖¶]	4	6	0	8	3	3	4.2	0.7	<0.1	<0.1	–	<0.1	<0.1	<0.1
Syphilis < 2 years duration[*¶**]	1,118	1,284	1,558	1,767	2,033	2,713	1,552.0	1.7	5.1	5.7	6.9	7.6	8.7	11.4
Syphilis > 2 years or unspecified duration[†¶]	1,360	1,353	1,391	1,747	1,872	1,939	1,544.6	1.3	6.7	6.5	6.1	7.6	8.0	8.2
Vaccine preventable diseases														
Diphtheria[††]	–	4	–	3	2	2	1.8	1.1	–	0.0	–	0.0	0.0	0.0
Haemophilus influenzae type b	23	13	16	20	21	16	18.6	0.9	0.1	0.1	0.1	0.1	0.1	0.1
Influenza (laboratory confirmed)	13,466	27,210	44,564	28,309	67,699	100,583	36,249.6	2.8	61.1	121.8	196.1	122.5	288.6	422.9

Disease	Number of notified cases						5 year mean	Ratio (2015: 5 year mean)	Notification rate per 100,000					
	2010	2011	2012	2013	2014	2015			2010	2011	2012	2013	2014	2015
Measles	70	194	199	158	339	74	192.0	0.4	0.3	0.9	0.9	0.7	1.4	0.3
Mumps	97	153	201	217	186	644	170.8	3.8	0.4	0.7	0.9	0.9	0.8	2.7
Pertussis	34,845	38,752	24,102	12,359	11,867	22,546	24,385.0	0.9	158.2	173.5	106.0	53.5	50.6	94.8
Pneumococcal disease (invasive)	1,640	1,884	1,822	1,549	1,563	1,499	1,691.6	0.9	7.4	8.4	8.0	6.7	6.7	6.3
Poliomyelitis	0	0	0	0	0	0	0.0	–	–	–	–	–	–	–
Rubella	44	58	36	25	17	17	36.0	0.5	0.2	0.3	0.2	0.1	0.1	0.1
Rubella – congenital	–	–	1	2	–	1	0.6	1.7	–	–	0.0	0.0	–	0.0
Tetanus	2	3	7	4	3	2	3.8	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Varicella zoster (chickenpox)	1,793	2,100	1,990	2,122	2,103	2,479	2,021.6	1.2	12.0	13.9	12.9	13.5	13.2	15.3
Varicella zoster (shingles)	3,046	4,022	4,507	5,005	5,520	6,343	4,420.0	1.4	20.5	26.6	29.2	31.9	34.6	39.2
Varicella zoster (unspecified)	8,150	8,605	9,414	11,008	12,017	13,363	9,838.8	1.4	54.7	56.9	61.0	70.1	75.4	82.7
Vectorborne diseases														
Barmah Forest virus infection	1,470	1,863	1,730	4,238	742	628	2,008.6	0.3	6.7	8.3	7.6	18.3	3.2	2.6
Chikungunya virus infection	62	39	19	134	110	110	72.8	1.5	0.3	0.2	0.1	0.6	0.5	0.5

Commun Dis Intell (2018) 2019;43(https://doi.org/10.33321/cdi.2019.43.6) Epub 15/03/2019

Disease	Number of notified cases						5 year mean	Ratio (2015: 5 year mean)	Notification rate per 100,000					
	2010	2011	2012	2013	2014	2015			2010	2011	2012	2013	2014	2015
Dengue virus infection	1,228	822	1,540	1,841	1,721	1,714	1,430.4	1.2	5.6	3.7	6.8	8.0	7.3	7.2
Flavivirus infection (unspecified)	14	10	6	16	20	12	13.2	0.9	0.1	0.0	0.0	0.1	0.1	0.1
Japanese encephalitis virus infection	–	–	1	4	1	3	1.2	2.5	–	–	0.0	0.0	0.0	0.0
Malaria	405	418	344	416	324	233	381.4	0.6	1.8	1.9	1.5	1.8	1.4	1.0
Murray Valley encephalitis virus infection	–	16	1	–	–	2	3.4	0.6	–	0.1	0.0	–	–	0.0
Ross River virus infection	5,128	5,136	4,681	4,317	5,316	9,550	4,915.6	1.9	23.3	23.0	20.6	18.7	22.7	40.1
West Nile/Kunjin virus infection	2	2	–	2	1	1	1.4	0.7	0.0	0.0	–	0.0	0.0	0.0
Zoonoses														
Anthrax	1	0	0	0	0	0	0.2	–	<0.1	–	–	–	–	–
Australian bat lyssavirus	0	0	0	1	0	0	0.2	–	–	–	–	<0.1	–	–
Brucellosis	21	37	31	14	17	19	24.0	0.8	0.1	0.2	0.1	0.1	0.1	0.1
Leptospirosis	131	215	114	87	86	74	126.6	0.6	0.6	1.0	0.5	0.4	0.4	0.3
Lyssavirus (NEC)	0	0	0	0	0	0	0.0	–	–	–	–	–	–	–

Disease	Number of notified cases 2010	2011	2012	2013	2014	2015	5 year mean	Ratio (2015: 5 year mean)	Notification rate per 100,000 2010	2011	2012	2013	2014	2015
Ornithosis	58	89	76	47	41	16	62.2	0.3	0.3	0.4	0.3	0.2	0.2	0.1
Q fever	338	359	369	486	475	601	405.4	1.5	1.5	1.6	1.6	2.1	2.0	2.5
Tularaemia	0	2	0	0	0	0	0.4	–	–	<0.1	–	–	–	–
Other bacterial infections														
Legionellosis	307	357	382	509	425	365	396.0	0.9	1.4	1.6	1.7	2.2	1.8	1.5
Leprosy	10	9	8	14	10	13	10.2	1.3	0.0	0.0	0.0	0.1	0.0	0.1
Meningococcal infection§§	228	242	223	149	169	182	202.2	0.9	1.0	1.1	1.0	0.6	0.7	0.8
Tuberculosis	1,363	1,388	1,316	1,261	1,343	1,255	1,334.2	0.9	6.2	6.2	5.8	5.5	5.7	5.3
Total	211,115	239,495	245,565	226,880	276,188	320,480								

* Newly acquired hepatitis and syphilis < 2 years duration 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 or is greater than 24 months.

‡ In Queensland, includes newly acquired hepatitis C cases.

§ From 1 January 2016 a case definition for paratyphoid was created and for the first time it became reportable on as a separate condition from salmonella. Changes were made to paratyphoid notifications retrospectively to 1991.

|| Includes *Chlamydia trachomatis* identified from cervical, rectal, urine, urethral and throat samples, except for South Australia, which reports only cervical, urine and urethral specimens. From 1 July 2013 the case definition changed to exclude all ocular infections.

¶ The national case definitions for chlamydial, gonococcal and syphilis diagnoses include infections that may be acquired through a non-sexual mode (especially in children – e.g. perinatal infections, epidemic gonococcal conjunctivitis).

** Data for all states and territories are reported by diagnosis date, except Queensland, where data are reported by notification receive date.

†† This number may underrepresent the number of diphtheria cases in Australia in 2015. For more details please see the summary of diphtheria in the Vaccine Preventable Diseases section of this report.

‡‡ Arbovirus infection NEC changed to flavivirus infection (unspecified) in 2015

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

NEC Not elsewhere classified.

NN Not notifiable.

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DATA COMPLETENESS

Indigenous status

Indigenous status is usually obtained from clinical notifications, and completeness varies by disease and by state and territory. This reflects differences in notification requirements (i.e. depending on the jurisdiction, some diseases are primarily or completely notified by pathology laboratories rather than clinicians) and the fact that it is not possible to follow up all cases for diseases that have a large volume of notifications and/or do not require specific case-based public health action.

Indigenous status was complete in 46% of all notifications reported to NNDSS in 2015. Indigenous status was complete in 94% of data reported in the Northern Territory and Western Australia, and 88% in South Australia. In the remaining jurisdictions, Indigenous status completeness ranged from 17% to 67% (Table 7).

Data completeness on Indigenous status also varied by disease as summarised in Appendix 3. In 2009, CDNA set target thresholds of 95% completeness for 18 priority diseases (17 notifiable to NNDSS and HIV, which are provided to the Kirby Institute) (Table 8), and 80% completeness for the remainder of the notifiable diseases, as part of its 'Closing the Gap' strategy. There were 53 diseases with cases notified to the NNDSS in 2015, of which 36 (68%) equalled or exceeded 80% completeness for Indigenous status and 13 (36%) were priority diseases.

In 2015, 16 of the 17 priority diseases were notified to NNDSS. Of the 16 notified, 11 had an Indigenous completeness that exceeded 95% (congenital syphilis, dengue virus (locally acquired), *Haemophilus influenzae* type b, hepatitis A, hepatitis C (newly acquired), leprosy, measles, meningococcal infection, pneumococcal disease < 5 years, pneumococcal disease ≥ 50 years, and tuberculosis). While pertussis < 5 years notifications are still below the 95% threshold there has been a notable improvement in the completeness of Indigenous identification. From 2004 to 2014 the average completeness was 83% with the highest completeness in this period 86%, in 2013. In 2015 the completeness was 91%.

Place of acquisition

The place of acquisition is where the disease is determined to have been acquired, either locally or overseas. This information is usually obtained through public health follow-up. Follow-up, and thus completeness, varies by disease and by jurisdiction. It is not possible to follow up all cases for diseases with a large volume of notifications. Place of acquisition is not usually completed for diseases unless overseas travel is known to be a risk factor. In this analysis a notification is considered to be complete where a valid SACC is used; this includes values for 'not stated'. This differs from where the aim of the analysis on place of acquisition is to determine whether a disease has been acquired either locally or overseas.

Through the NSC, jurisdictions have agreed that completeness for place of acquisition should be 100% for the following 32 priority diseases:

- anthrax
- brucellosis
- chikungunya virus infection
- cholera
- dengue virus infection
- diphtheria
- flavivirus infection (unspecified)
- hepatitis A
- hepatitis B (newly acquired)
- hepatitis E
- highly Pathogenic Avian influenza in humans (HPAIH)
- Japanese encephalitis virus infection
- Kunjin virus / West Nile virus infection
- legionellosis
- leprosy
- malaria
- measles
- Middle East respiratory syndrome coronavirus (MERS-CoV)
- mumps
- Murray Valley encephalitis virus infection

- plague
- poliovirus infection
- Q fever
- rabies
- Rubella
- severe acute respiratory syndrome (SARS)
- shigellosis
- smallpox
- tularaemia
- typhoid fever
- viral haemorrhagic fever (NEC)
- yellow fever

In 2015, 23 of the 32 priority diseases had cases notified to NNDSS. The overall completeness for place of acquisition for these diseases was 89%. The completeness was 100% in 2015 for 10 diseases: brucellosis, chikungunya virus infection, cholera, diphtheria, flavivirus infection (unspecified), Japanese encephalitis virus infection, Kunjin virus infection, leprosy, measles and Murray Valley encephalitis virus infection (Table 9). This is an improvement on 2014, when 5 priority diseases had 100% completeness for place of acquisition. ■

Table 7: Indigenous status completeness of National Notifiable Diseases Surveillance System data, Australia, 2015, by state or territory

	State or territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aust.
Total notifications	4,747	87,162	8,189	87,848	31,219	5,401	61,808	34,106	320,480
Indigenous status									
Unknown/missing	1,545	72,629	473	49,638	3,728	4,191	40,127	2,146	174,477
Per cent complete	67	17	94	43	88	22	35	94	46

Table 8: Percentage completeness of priority diseases for Indigenous status completeness of National Notifiable Diseases Surveillance System data, Australia, 2015, by state or territory

Priority disease	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Aust.
Congenital syphilis	No cases	No cases	No cases	100	No cases	No cases	No cases	No cases	100
Dengue virus (locally acquired)	No cases	100	No cases	100	No cases	No cases	No cases	No cases	100
Donovanosis	No cases	No cases	No cases	No cases	No cases	No cases	No cases	No cases	No cases
Gonococcal infection	100	42	98	63	97	80	53	100	64
Haemophilus influenzae type b	No cases	100	100	100	No cases	No cases	100	100	100
Hepatitis A	100	99	100	91	100	100	97	100	97
Hepatitis B (newly acquired)	No cases	97	100	84	100	100	93	100	93
Hepatitis C (newly acquired)	92	96	100	NN	100	96	86	100	95
Leprosy	No cases	100	100	100		No cases	100	100	100
Measles	100	100	No cases	100	100	No cases	100	100	100
Meningococcal disease (invasive)	100	98	100	100	100	100	96	100	98
Pertussis < 5 years	97	93	100	99	100	83	74	93	91
Pneumococcal disease < 5 years	100	100	100	100	100	100	89	100	98
Pneumococcal disease ≥ 50 years	100	99.7	100	96.5	100	100	92	100	97
Shigellosis	85.7	87.4	100	84.5	100	100	82	100	88
Syphilis < 2 years	100	85.9	100	97.5	100	100	86	100	91
Tuberculosis	100	98	100	100	100	100	100	100	99

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Table 9: Percentage completeness of place of acquisition data for priority diseases* in the National Notifiable Diseases Surveillance System, Australia, 2015

Disease	2011	2012	2013	2014	2015
Brucellosis	24	35	100	100	100
Chikungunya virus infection	100	95	100	100	100
Cholera	100	100	100	100	100
Dengue virus infection	98	100	>99	>99	>99
Diphtheria	75	No cases	67	100	100
Flavivirus infection (unspecified)	100	100	100	100	100
Hepatitis A	99	94	95	99	94
Hepatitis B (newly acquired)	65	50	40	35	59
Hepatitis E	95	97	94	88	90
Japanese encephalitis virus infection	0	100	100	100	100
Kunjin virus infection	100	No cases	100	100	100
Legionellosis	83	85	82	86	94
Leprosy	100	100	79	100	100
Malaria	100	100	100	100	>99
Measles	89	95	100	>99	100
Mumps	63	49	74	58	91
Murray Valley encephalitis virus infection	88	100	No cases	No cases	100
Q fever	57	79	88	90	86
Rubella	78	64	80	53	88
Shigellosis	58	57	64	50	64
Tularaemia	100	No cases	No cases	No cases	No cases
Typhoid Fever	97	94	98	97	97
Yellow fever	100	No cases	No cases	No cases	No cases
Total	**84**	**87**	**89**	**84**	**89**

*Only priority diseases notified to the National Notifiable Surveillance System in 2011 to 2015 are included.

BLOODBORNE DISEASES

In 2015, the bloodborne diseases reported to the NNDSS were hepatitis B, C, and D. Both hepatitis B and C infections were notified to the NNDSS as either 'newly acquired', where evidence was available that the infection was acquired in the 24 months prior to diagnosis; or 'greater than 2 years or unspecified' period of infection. These categories were reported from all states and territories except Queensland, where all cases of hepatitis C infection, including newly acquired, were reported as 'greater than 2 years or unspecified'. Determination of a case as 'newly acquired' is reliant on public health follow-up, with the method and intensity of follow-up varying by jurisdiction and over time.

In interpreting these data it is important to note that changes in numbers of notified cases over time may not solely reflect changes in disease prevalence or incidence. National testing policies developed by the Australasian Society for HIV and viral hepatitis and sexual health medicine and screening programs, including the preferential testing of high risk populations such as prisoners, injecting drug users and people from countries with a high prevalence of hepatitis B or C infection, may contribute to these changes.[19,20]

Information on exposure factors relating to the most likely source(s) of infection for hepatitis B and C was reported in a subset of newly acquired infections. The collection of enhanced data is dependent on the level of public health follow-up, which is variable by jurisdiction and over time.

Notifications of HIV diagnoses were reported directly to the Kirby Institute, which maintains the National HIV Registry. Information on national HIV surveillance can be obtained from the Kirby Institute web site (http://www.kirby.unsw.edu.au/). ■

Hepatitis B

- There were 6,505 cases of hepatitis B notified in 2015.
- Over the past 6 years, notifications of newly acquired hepatitis B have declined.

Hepatitis B is a potentially life-threatening liver infection caused by the hepatitis B virus. Major modes of transmission include unprotected sexual contact, needle sharing with an infected person, and perinatal transmission from mother to child. Symptoms of acute infection include abdominal pain, nausea and vomiting progressing to jaundice. Outcomes vary inversely with age; infected infants are more likely to progress to chronic infection, whereas people who are infected as adults often clear the virus. Chronic infection can lead to a number of liver complications, including cirrhosis, cancer and liver failure.[21]

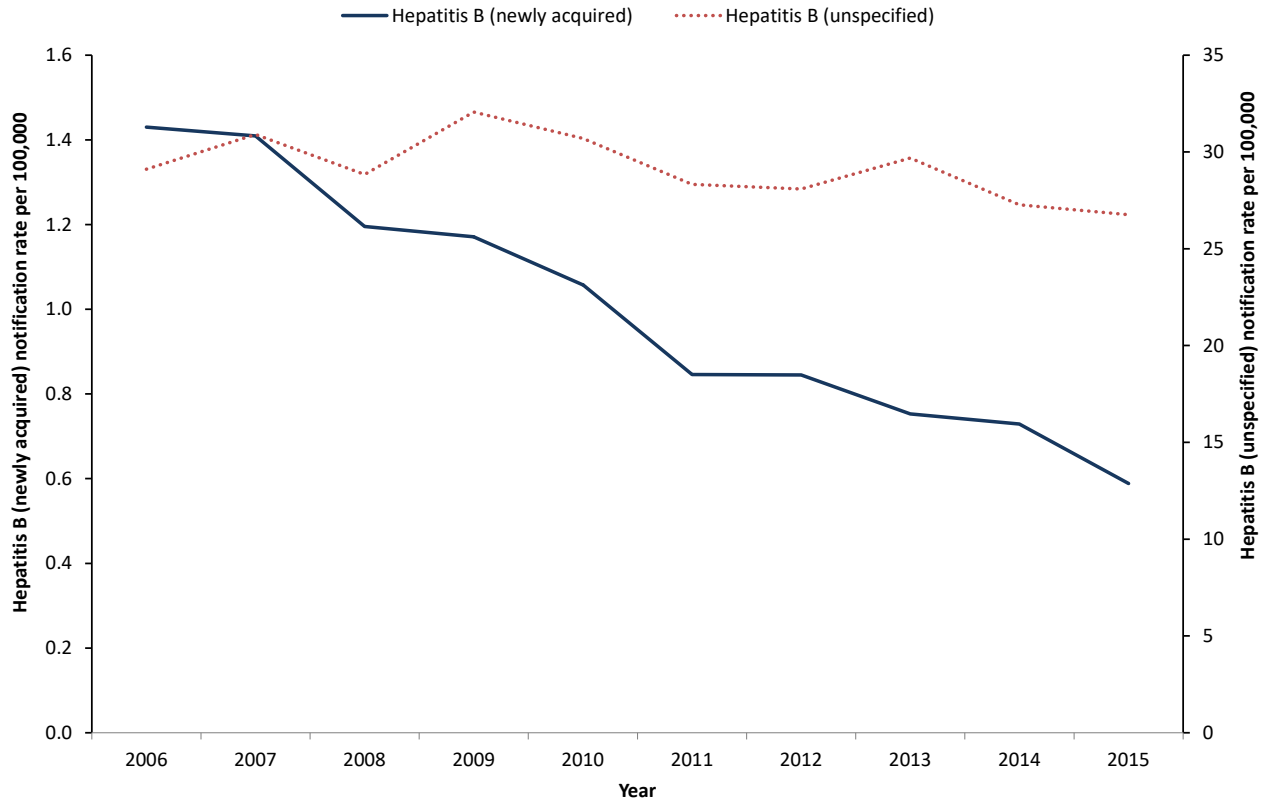
Hepatitis B notifications are classified as being either 'newly acquired' (evidence that infection was acquired within the 24 months prior to diagnosis) or 'unspecified' (infection acquired more than 24 months prior to diagnosis or at a time that could not be specified).

Epidemiological situation in 2015

In 2015, there were 6,505 notified cases of hepatitis B (both newly acquired and unspecified), representing an overall rate of 27.3 cases per 100,000 (Figure 3).

Between 2010 and 2015, rates of newly acquired hepatitis B decreased by 44% from 1.1 to 0.6 per 100,000 (Figure 3). The decline in newly acquired hepatitis B notifications may be attributed to the universal hepatitis B infant immunisation program, introduced in 2000, and the adolescent hepatitis immunisation programs, introduced from 1997 depending on the jurisdiction.[22] As at 30 September 2016, approximately 94%

Figure 3: Notification rate for newly acquired hepatitis B and unspecified hepatitis B, Australia, 2010 to 2015, by year



of children 12–15 months of age in Australia were assessed as being fully immunised for hepatitis B.[23]

A 2007 study, comparing 2 national serosurveys from 1996–99 and 2002, showed significant improvements in immunity to hepatitis B for the 12–17 years age group in jurisdictions with established school-based programs compared to those jurisdictions without such programs.[24]

From the 1980s, hepatitis B immunisation was also recommended for certain at-risk adults in Australia.[25] Some jurisdictions have implemented immunisation programs to target identified at-risk adults in a variety of settings and over different time periods.[22] The full impact of Australian immunisation programs should be reflected in trends in chronic infection and reductions in hepatitis B related complications in the future.

Between 2010 and 2015, rates of unspecified hepatitis B declined by 13% from 30.7 to 26.8 per 100,000. It is important to note the significant impact of immigration on rates of unspecified hepatitis B. For example, in 2015, Western Australia reported a decline in asylum seeker boat arrivals coinciding with a decline in unspecified hepatitis B notifications in the state, particularly in the Kimberley region (which includes the postcode for Christmas Island, where there was a detention centre). An Australian study estimated that in 2011 more than 95% of new cases of chronic hepatitis B virus infection were diagnosed in new migrants.[26] ■

Newly acquired hepatitis B

Epidemiological situation in 2015

- There were 140 cases of newly acquired hepatitis B notified in 2015.
- The highest rate of notification was among males aged 30–34 years.

In 2015, 140 cases of newly acquired hepatitis B infection were notified to the NNDSS, a rate of 0.6 per 100,000, declining from 171 cases (0.7 per 100,000) reported in 2014 (Figure 4).

Geographical distribution

The highest rates were reported from Western Australia (1.1 per 100,000) and Queensland (0.9 per 100,000) (Table 5). This may be due to population differences between the jurisdictions, with hepatitis B disproportionately affecting a number of marginalised groups in Australia including migrant communities with origins in Asia, the Pacific and Africa; and Aboriginal and Torres Strait Islander people.[26,27]

Age and sex distribution

In 2015, males accounted for 66% of newly acquired hepatitis B notifications. In 2015, the highest rate of newly acquired hepatitis B infection was observed among males aged 30–34 years (2.2 per 100,000). For females, the highest rate was in those aged 35–39 years (1.4 per 100,000) (Figure 4). Exposure to hepatitis B may be more common in certain high risk groups, including immigrants from endemic regions; people who inject drugs; prisoners; Aboriginal and Torres Strait Islander people; and men who have sex with men.[21,26] The greater representation of males in some of these groups may contribute to the higher notification rates among males.

Between 2010 and 2015, most age-specific notification rates were low and remained stable or trended downwards. The most marked decreases occurred among those aged 15–29 years.

Figure 4: Notification rate for newly acquired hepatitis B, Australia, 2015, by age group and sex

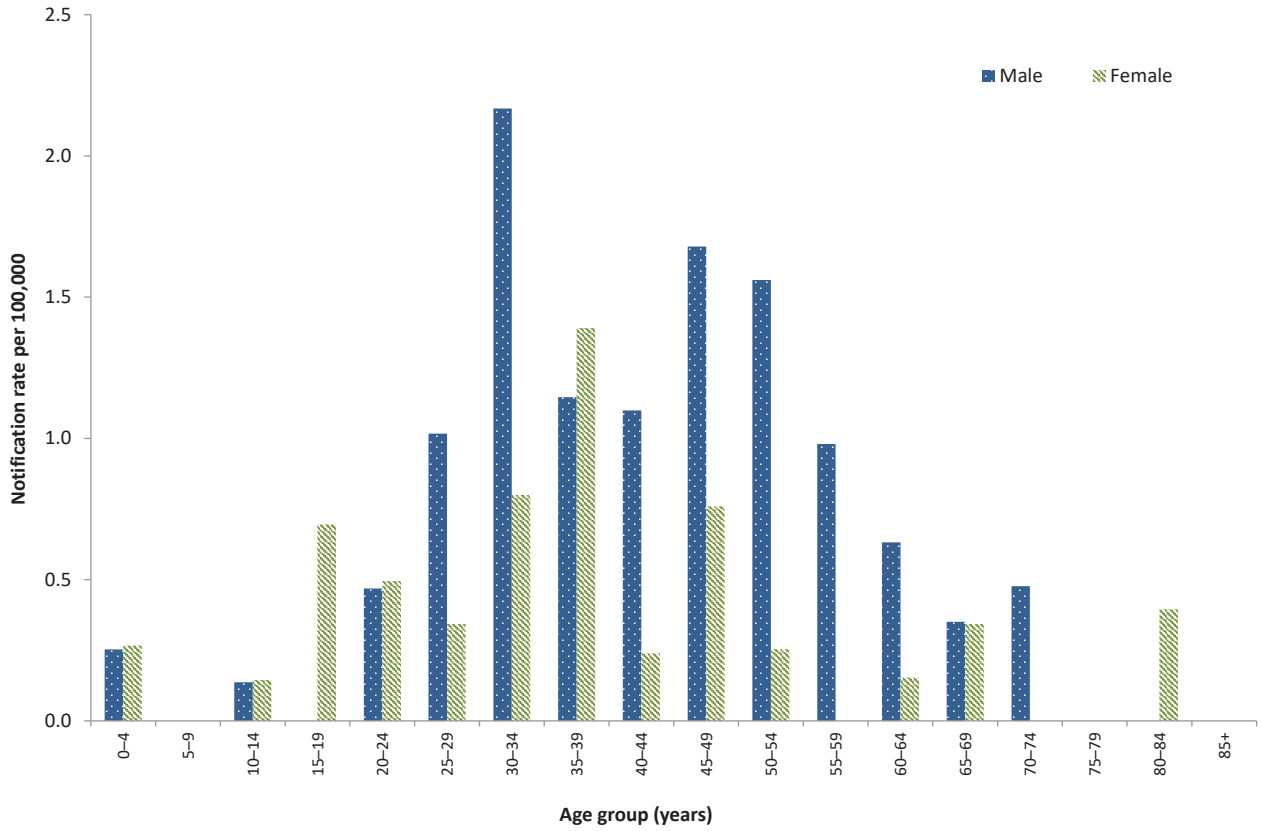


Figure 5. Notification rate for newly acquired hepatitis B, Australia, 2010 to 2015, by year and selected age groups

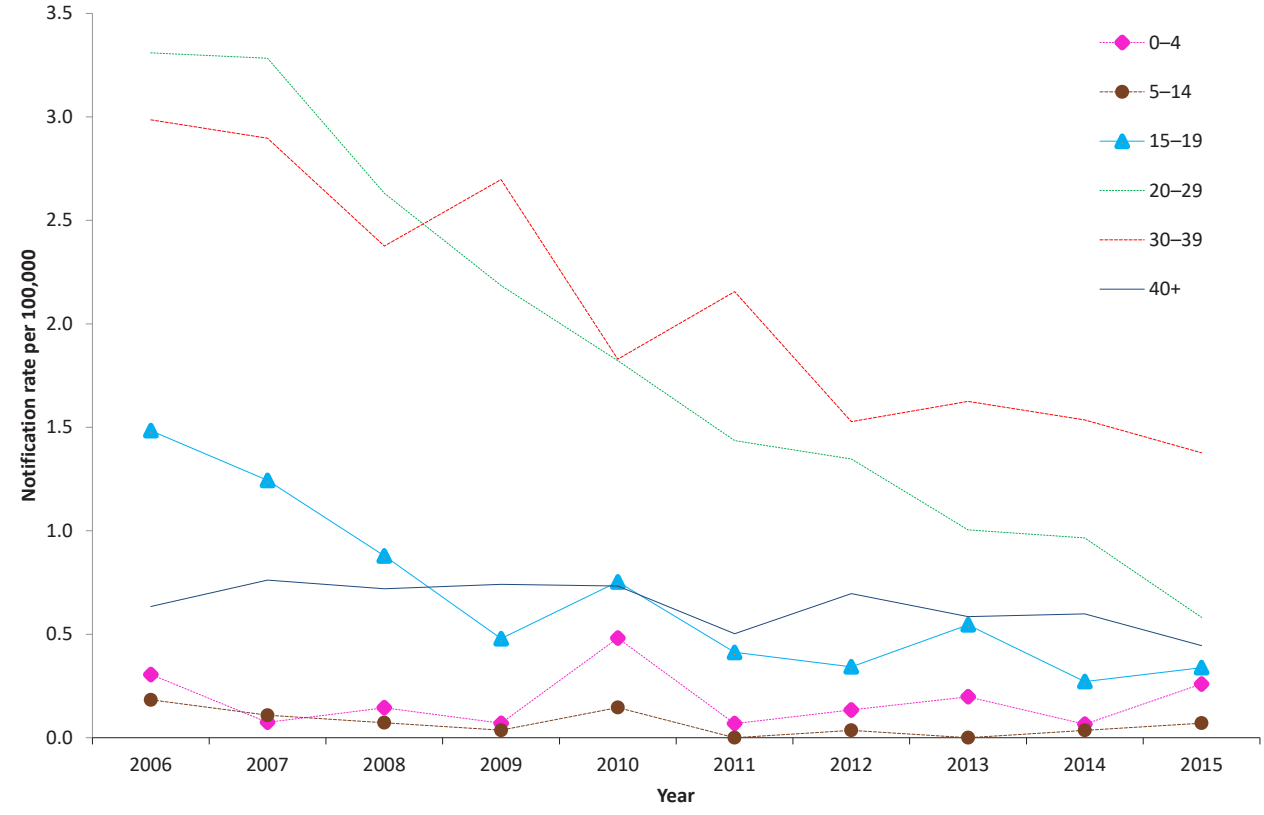


Table 10. Enhanced risk factor data on notifications of newly acquired hepatitis B cases in selected jurisdictions,* 2015, by sex and risk factors†‡

Exposure category	Number of exposure factors reported			Percentage§ of total cases* (n=97)
	Male	Female	Total	
Sexual exposure	28	7	35	36
Sexual contact (hepatitis B partner status unknown) – opposite sex	12	2	14	14
Sexual contact (hepatitis B positive partner) – opposite sex	5	4	9	9
Sexual contact – not further classified	5	0	5	5
Sexual contact (hepatitis B partner status unknown) – same sex	3	1	4	4
Sexual contact (hepatitis B positive partner) – same sex	3	0	3	3
Injecting drug use	22	8	30	31
Skin penetration procedure	10	3	13	13
Tattoos	5	1	6	6
Ear or body piercing	1	1	2	2
Acupuncture	4	1	5	5
Household contact	2	3	5	5
Major dental surgery work	3	1	4	4
Imprisonment	3	0	3	3
Surgical work	1	1	2	2
Needlestick/biohazardous injury	1	2	3	3
Perinatal transmission	1	0	1	1
Other	6	3	9	9
Undetermined	4	2	6	6
Unknown (not recorded)	9	6	15	15
Total exposure factors reported	77	28	105	
Total number of cases	67	30	97	

* Cases from New South Wales, South Australia, Tasmania, Victoria and Western Australia. While these 5 jurisdictions provided enhanced data on risk factors, not all cases had this information recorded.

† More than 1 exposure category for each case could be recorded.

‡ Analysis and categorisation of these exposures are subject to interpretation and may vary between reports.

§ The denominator used to calculate the percentage is based on the cases with recorded enhanced data from New South Wales, South Australia, Tasmania, Victoria and Western Australia. As more than 1 exposure category for each notification could be recorded, the total percentage does not equate to 100%.

During this period, notification rates declined by 67% for those aged 20–29 years (from 1.8 to 0.6 per 100,000) and 63% for those aged 15–19 years (from 0.8 to 0.3 per 100,000) (Figure 5). These declines are likely to be attributable to the hepatitis B immunisation program.[28]

Risk groups

Enhanced data on risk factors and country of birth were provided by New South Wales, South Australia, Tasmania, Victoria and Western Australia (Table 10). In 2015, 76 of the 97 cases (78%) from these jurisdictions had at least 1 risk factor recorded, with a potential source of exposure not recorded or not possible to determine for the remainder. Sexual exposure was the most frequently reported potential source of infection (35/97, 36%), followed by injecting drug use (30/97, 31%). Of the 88 cases for which country of birth was reported, 66 were Australian born (75%) and 22 were overseas born (11 from Europe, 6 from Asia, 2 from the Middle East, 2 from the Pacific, and 1 from North America). ■

Unspecified hepatitis B

- There were 6,365 cases of unspecified hepatitis B notified in 2015.
- Notification rates highest in females and males aged 30–34 years.

Epidemiological situation in 2015

In 2015, 6,365 cases of unspecified hepatitis B infection were notified to the NNDSS, representing a rate of 26.8 per 100,000, compared with 6,399 cases (27.3 per 100,000) reported in 2014 (Figure 3).

Geographical distribution

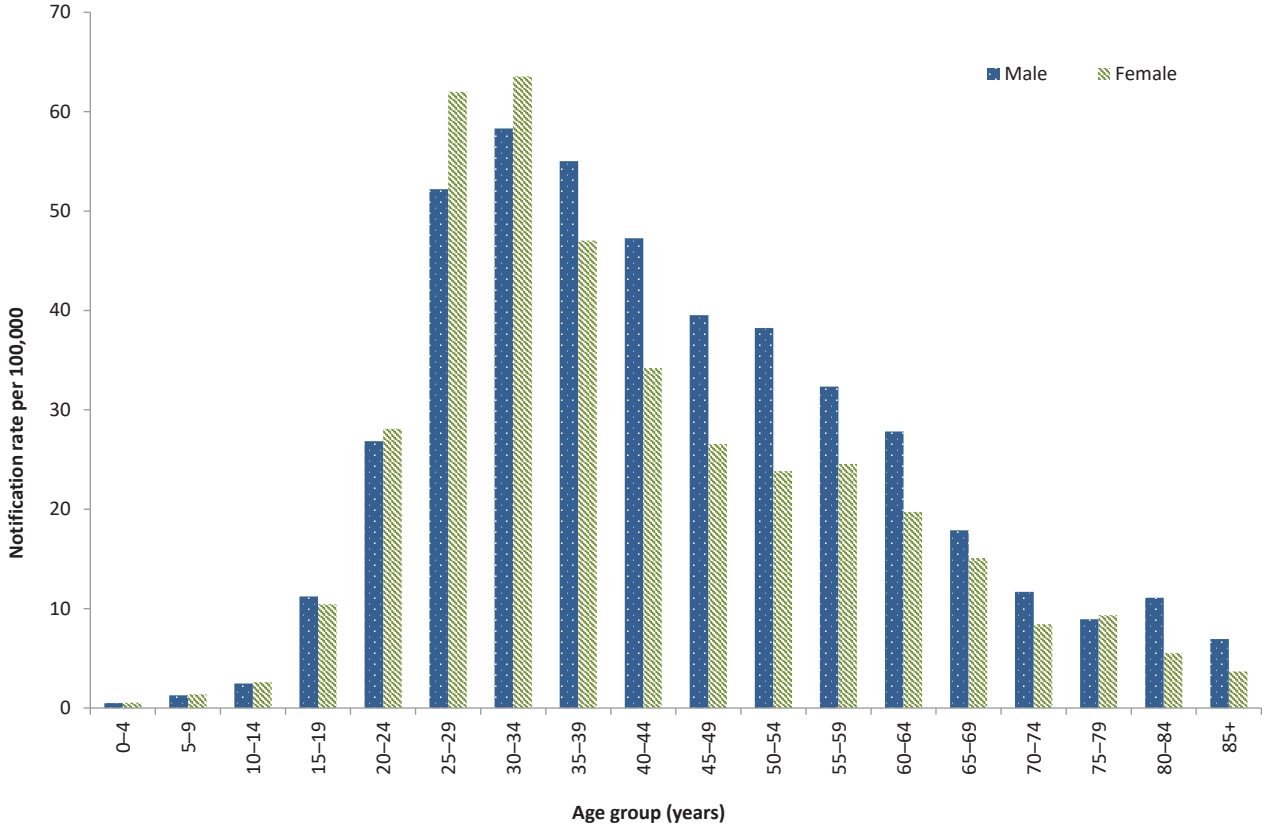
In 2015, the Northern Territory had the highest rate of unspecified hepatitis B infection (65.0 per 100,000) (Table 5).

Age and sex distribution

In 2015, males accounted for 51% (3,359/6,365) of unspecified hepatitis B notifications, with an overall rate of 28.4 per 100,000 for males and 24.9 per 100,000 for females. Notification rates were similar for males and females in most age groups. Notification rates in both males and females were highest in the 30–34 years age group (Figure 6).

Between 2010 and 2015, notification rates for unspecified hepatitis B decreased across all age groups (Figure 7). The decrease in rates for the younger age groups is likely explained by the introduction of the infant and adolescent hepatitis B immunisation programs.[28] The adolescent immunisation program commenced in some jurisdictions from 1997 and the infant immunisation program commenced nationally from 2000.[29] ■

Figure 6: Notification rate for unspecified hepatitis B, Australia, 2015, by age group and sex*



* Excludes 28 cases where age and/or sex were not reported.

Figure 7: Notification rate for unspecified hepatitis B, Australia, 2010 and 2015, by year and selected age groups*

* Excludes 5 cases where age was not reported.

Hepatitis C

- There were 10,793 cases of hepatitis C notified in 2015.
- Over the past 6 years, notifications of hepatitis C have declined by 5%.

Infection with hepatitis C virus causes inflammation of the liver. In more than 90% of cases, initial infection with hepatitis C virus is asymptomatic or mildly symptomatic. Approximately 50%–80% of cases will go on to develop a chronic infection. Of those who develop a chronic infection, half will eventually develop cirrhosis or cancer of the liver.[21] There is no vaccine to prevent hepatitis C infection.

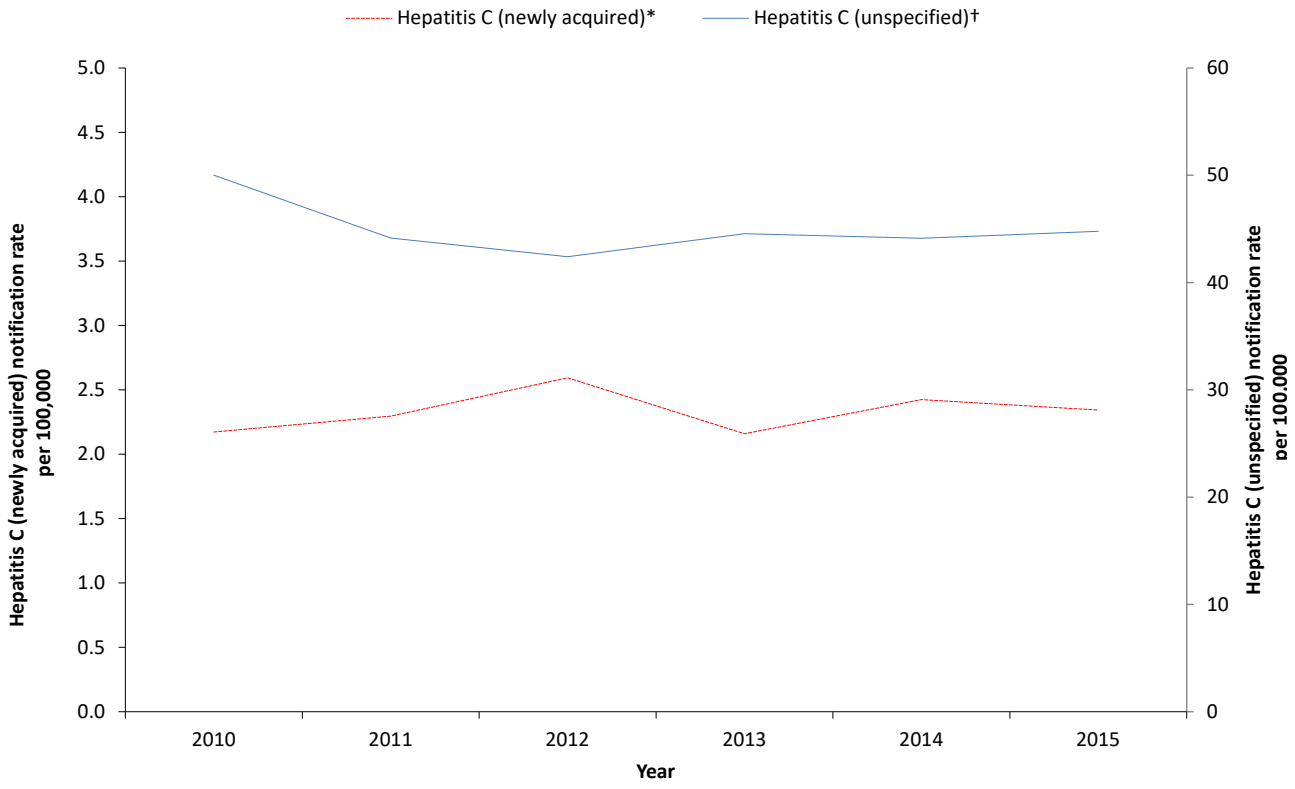
Hepatitis C notifications are classified as being either 'newly acquired' (evidence that infection was acquired within the 24 months prior to diagnosis) or 'unspecified' (infection acquired more than 24 months prior to diagnosis or at a time that could not be specified).

Epidemiological situation in 2015

Of the 10,793 cases of hepatitis C notified in 2015, 4% (433/10,793) were classified as newly acquired infections. The proportion of hepatitis C notifications classified as newly acquired has remained reasonably stable since 2010 (range: 3% to 5%).

Between 2010 and 2015, hepatitis C notifications (both newly acquired and unspecified) declined by 5% from 11,402 to 10,793 (Figure 8). ■

Figure 8: Notification rate for hepatitis C (newly acquired* and unspecified) infection, Australia, 2010 to 2015, by year



* Data from all states and territories except Queensland.

† Data provided from Queensland includes both newly acquired and unspecified hepatitis C cases.

Newly acquired hepatitis C

- There were 433 cases of newly acquired hepatitis C notified in 2015.
- The majority of newly acquired cases had a history of injecting drug use.
- The highest notification rate was among males in the 20–24 years age group.

Epidemiological situation in 2015

Cases of newly acquired hepatitis C infection were reported from all states and territories except Queensland, where all cases of hepatitis C infection are reported as unspecified. Nationally, the notification rate in 2015 was 2.3 per 100,000 (n=433) compared with 2.4 per 100,000 (n=448) in 2014 (Figure 8).

Geographical distribution

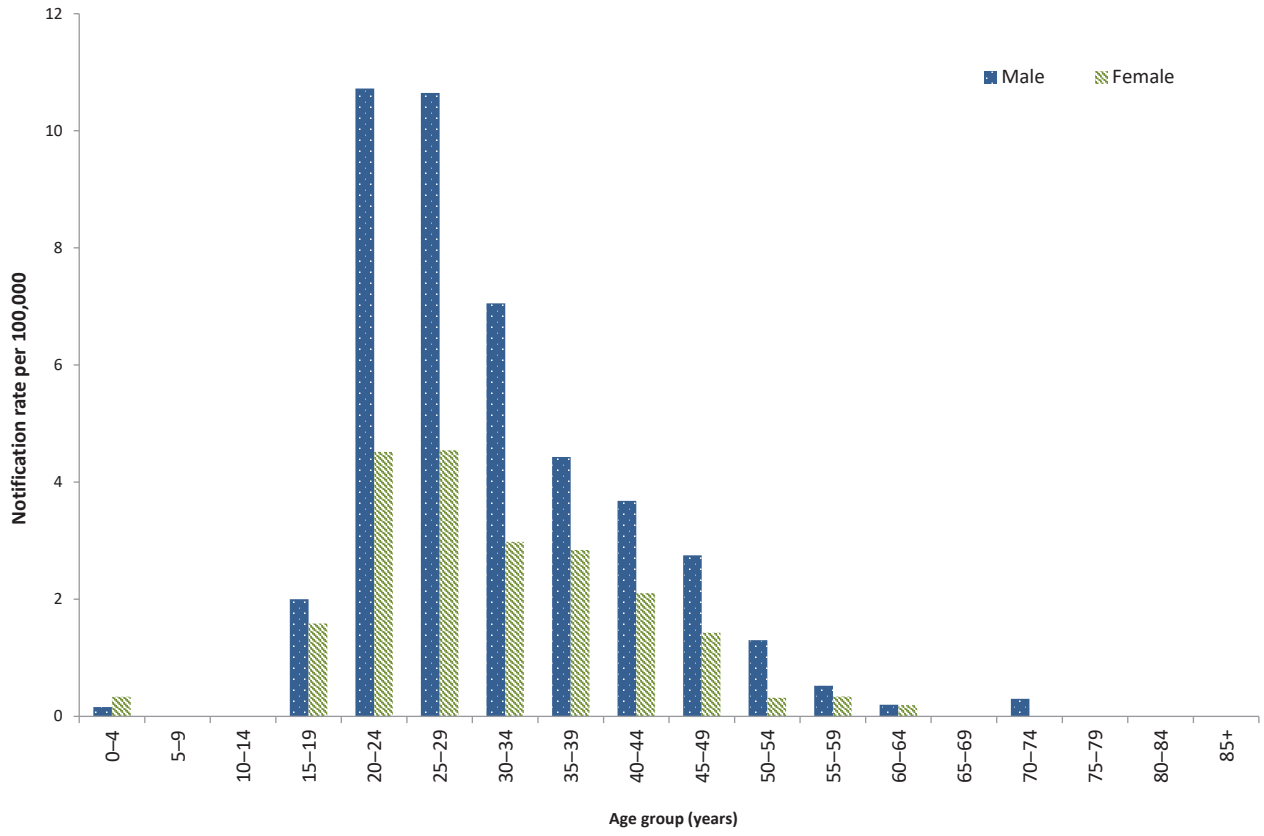
In 2015, Western Australia reported the highest jurisdiction-specific rate of newly acquired hepatitis C infection (7.1 per 100,000) (Table 5).

Age and sex distribution

In 2015, males accounted for 68% (294/433) of newly acquired hepatitis C notifications, and the highest notification rate was observed among males aged 20–29 years (10.7 per 100,000). This may be due to males in this age group having greater exposure to the hepatitis C virus through injecting drug use and imprisonment.[30,31] For females, the highest notification rate was in those aged 25–29 years (4.5 per 100,000) (Figure 9).

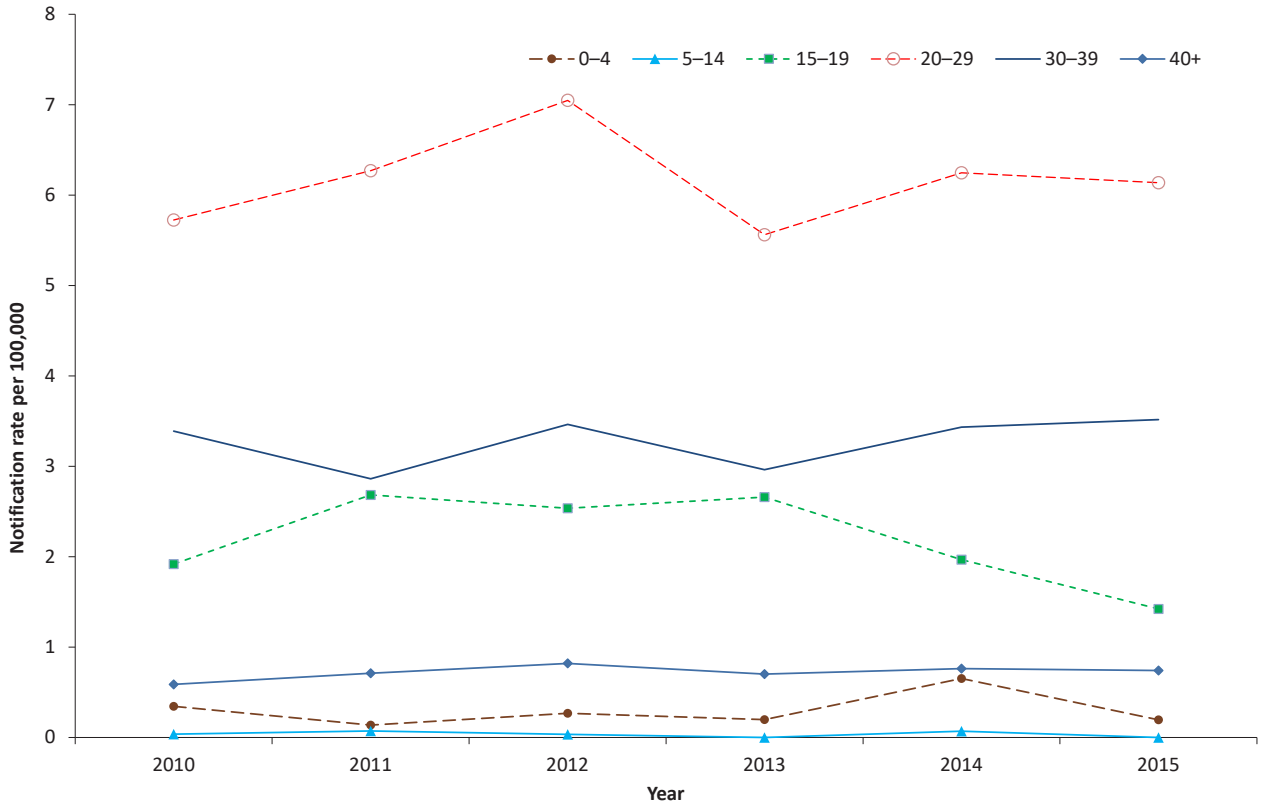
Between 2010 and 2015, age-specific notification rates for newly acquired hepatitis C infection remained stable or declined. The largest decrease

Figure 9: Notification rate for newly acquired hepatitis C* infection, Australia, 2015, by age group and sex



* Data from all states and territories except Queensland.

Figure 10: Notification rate for newly acquired hepatitis C* infection, Australia, 2010 to 2015, by year and selected age groups



* Data from all states and territories except Queensland.

from 2010 to 2015, occurred in the 15–19 years age group (from 1.9 to 1.4 per 100,000) (Figure 10).

Risk groups

Exposure histories for newly acquired hepatitis C cases reported in 2015 were analysed for all jurisdictions except Queensland (Table 11). In 2015, 81% (350/433) of cases with enhanced data had at least one risk factor recorded, with the potential source of exposure not recorded or not possible to determine for the remainder. Of the cases for which enhanced data were reported, 60% (258/433) had a history of injecting drug use and 15% (63/433) reported possible sexual exposure.

More than a third (38%, n=166) of cases with enhanced data reported being imprisoned in the 24 months prior to diagnosis. Of these cases, 66% (n=110) also reported a history of injecting drug use. However, it is important to note that screening rates are generally higher in the prison entry population than the general population. A screening survey of prison entrants conducted over a 2-week period found that the prevalence of hepatitis C infection, based on hepatitis C antibody detection, was 31% in 2013, an increase from 22% in 2010.[32]

Of the 402 cases for which country of birth was reported, 369 were in Australian born (92%) and 33 cases were born overseas (11 from Europe, 11 from the Pacific, 6 from Asia, 3 from Southern Africa, 1 from North America, and 1 from South America). ■

Table 11: Enhanced risk factor data on notifications of newly acquired hepatitis C infection in selected jurisdictions,* 2015, by sex and risk factors†‡

Exposure category	Number of exposure factors reported			Percentage§ of total cases*(n=433)
	Male	Female	Total	
Injecting drug use	172	86	258	60
Imprisonment	144	22	166	38
Sexual exposure	**29**	**34**	**63**	**15**
Sexual contact (hepatitis C positive partner) – opposite sex	13	26	39	9
Sexual contact (hepatitis C positive partner) – same sex	11	4	15	3
Sexual contact – not further classified	3	3	6	1
Sexual contact (hepatitis C partner status unknown) – same sex	2	0	2	0
Sexual contact (hepatitis C partner status unknown) – opposite sex	0	1	1	0
Skin penetration procedure	**41**	**20**	**61**	**14**
Tattoos	35	11	46	11
Ear or body piercing	5	9	14	3
Acupuncture	1	0	1	0
Perinatal transmission	28	13	41	9
Household contact	18	20	38	9
Non-IDU remote risk (>24 months prior to diagnosis)	11	0	11	3
Surgical work	11	9	20	5
Needlestick/biohazardous injury	3	4	7	2
Major dental surgery work	4	1	5	1
Other	10	5	15	3
Undetermined	7	4	11	3
Unknown (not recorded)	50	20	70	16
Total exposure factors reported	236	114	350	
Total number of cases	**294**	**139**	**433**	

* Cases from the Australian Capital Territory, New South Wales, the Northern Territory, South Australia, Tasmania, Victoria and Western Australia. While these 7 jurisdictions provided enhanced data on risk factors, not all cases had this information recorded.

† More than 1 exposure category for each case could be recorded.

‡ Analysis and categorisation of these exposures are subject to interpretation and may vary between reports.

§ The denominator used to calculate the percentage is based on the cases with recorded enhanced data from the Australian Capital Territory, New South Wales, Northern Territory, South Australia, Tasmania, Victoria and Western Australia. As more than 1 exposure category for each notification could be recorded, the total percentage does not equate to 100%.

Unspecified hepatitis C

- There were 10,360 cases of unspecified hepatitis C infection notified in 2015.
- The highest notification rates were among males in the 25–49 years age groups.

Epidemiological situation in 2015

In 2015, 10,360 cases of unspecified hepatitis C infections were notified to the NNDSS (44.8 per 100,000) compared with 10,211 cases in 2014 (44.1 per 100,000). Notification rates have decreased since 2010 and remained stable between 2013 and 2015. There was an overall decline of 10% between 2010 (50.0 per 100,000) and 2015 (44.8 per 100,000) (Figure 8).

Several factors may account for the decrease, including changes in surveillance practices, removal of duplicate notifications, and a gradual decline in the prevalent group of hepatitis C cases accumulated prior to the introduction of hepatitis C testing in the early 1990s.[33]

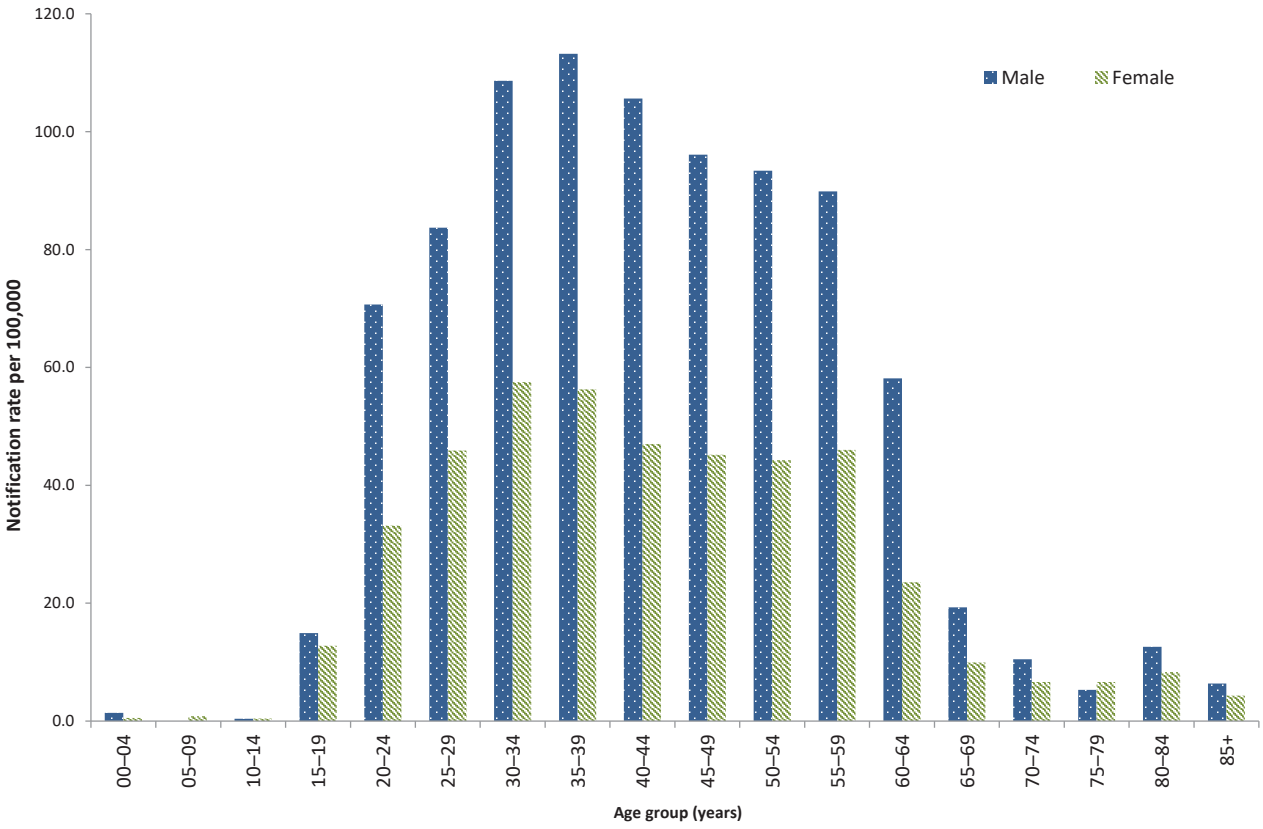
Geographical distribution

For the past 5 years, the Northern Territory has reported the highest jurisdiction-specific notification rate for unspecified hepatitis C. In 2015, the Northern Territory's notification rate was 80.2 per 100,000 (Table 5), which was 9% higher than the 2010 rate of 73.5 per 100,000.

Age and sex distribution

Nationally in 2015, 66% (6,855/10,360) of unspecified hepatitis C notifications were in males (for cases where the sex was reported). The notification rate in males was 58.0 per

Figure 11: Notification rate for unspecified hepatitis C* infection, Australia, 2015, by age group and sex†



* Data provided from Queensland includes both newly acquired and unspecified hepatitis C cases.

† Excludes 47 cases where age and/or sex were missing or unknown.

Figure 12: Notification rate for unspecified hepatitis C* infection, Australia, 2010 to 2015, by year and selected age groups†

* Data provided from Queensland (2010–2015) includes both newly acquired and unspecified hepatitis C cases.

† Excludes 63 cases where age was not reported.

100,000, and in females was 28.9 per 100,000; this equates to a male to female rate ratio of 2:1. Notification rates in males exceeded those in females across most age groups. The highest notification rates were among males aged 35–39 years (113.2 per 100,000) and 30–34 years (105.6 per 100,000). The highest notification rates among females were for those aged 30–34 years (57.5 per 100,000) and 35–39 years (56.3 per 100,000) (Figure 11).

Between 2010 and 2015, notification rates for unspecified hepatitis C infection remained stable or declined. The largest decreases have occurred in the 20–29 years (from 73.5 to 58.9 per 100,000) and the 30–39 years (102.2 to 84.4 per 100,000) age groups (Figure 12). ■

Hepatitis D

- There were 39 cases of hepatitis D notified in 2015.
- Hepatitis D is always associated with hepatitis B co-infection.

Hepatitis D is a defective single-stranded RNA virus that replicates in the presence of the hepatitis B virus. Hepatitis D infection can occur as either an acute co-infection with hepatitis B or as a super-infection with chronic hepatitis B infection. The modes of hepatitis D transmission are similar to those for hepatitis B.[21]

Epidemiological situation in 2015

In Australia, the notification rate for hepatitis D infection remains low. In 2015, there were 39 notified cases of hepatitis D, representing a rate of 0.2 per 100,000 (Table 5). Over the preceding 5 years, notifications of hepatitis D remained relatively low, with an average of 49 cases notified per year (range: 36 to 61).

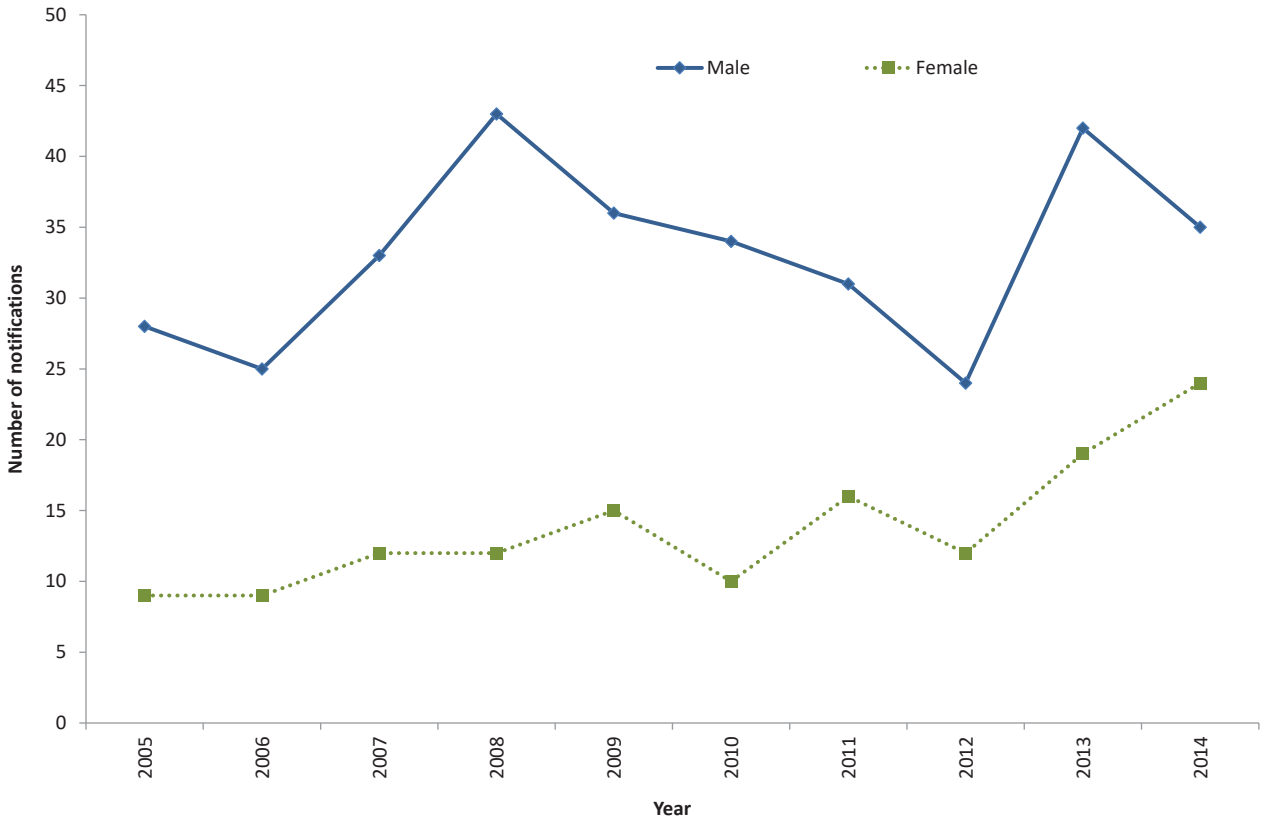
Geographical distribution

In 2015, Queensland reported the highest number of cases (n=15), followed by New South Wales (n=9), South Australia (n=9) and Victoria (n=6). No cases were reported from the Australian Capital Territory, the Northern Territory, Tasmania or Western Australia during this period.

Age and sex distribution

Hepatitis D notifications in males exceeded those in females each year from 2010 to 2015. In 2015, 67% (26/39) of notifications were in males. This represents a male to female notification ratio of 2.0:1. This is less than the average notification ratio of 2.2:1 over the preceding 5 years (Figure 13). ■

Figure 13: Notifications of hepatitis D infection, Australia, 2010 to 2015, by year and sex



GASTROINTESTINAL DISEASES

In 2015, gastrointestinal diseases notified to NNDSS were botulism; campylobacteriosis; cryptosporidiosis; haemolytic uraemic syndrome (HUS); hepatitis A; hepatitis E; listeriosis; paratyphoid; salmonellosis; shigellosis; Shiga toxin-producing *Escherichia coli* (STEC) infections; and typhoid. From January 2016, paratyphoid has been recorded in the NNDSS as a separate condition from salmonellosis. The separation of paratyphoid from salmonellosis was applied to data in the NNDSS retrospectively; therefore paratyphoid is included as a separate disease for this 2015 annual report. Please note that the NNDSS data reports at http://www9.health.gov.au/cda/source/cda-index.cfm for salmonellosis in past years will now not match previously published data, as paratyphoid has been separated out.

Overall, notified cases of gastrointestinal diseases increased by 12%, from 40,364 in 2014 to 45,326 in 2015. Notifications for campylobacteriosis (22,573), and salmonellosis (17,013) were at the highest levels since NNDSS records began in 1991. It should be noted that culture-independent nucleic acid-based testing methods were introduced by a number of diagnostic laboratories around the country from late 2013 onwards, which may partially explain this increase. These testing methods have increased sensitivity compared to traditional techniques, such as culture; however, the full effect on notifications has not been quantified.

Surveillance systems overview

The Australian Government established OzFoodNet – Australia's enhanced foodborne disease surveillance system – in 2000 as a collaborative network of epidemiologists and microbiologists who conduct enhanced surveillance, epidemiological outbreak investigations and applied research into foodborne diseases across Australia. OzFoodNet's mission is to apply concentrated effort at the national level to investigate and understand foodborne disease, to describe its epidemiology more effectively and to identify ways to minimise foodborne illness in Australia. The data and results summarised in the following sections will be reported in more detail in the OzFoodNet 2015 annual report.

Botulism

There were 3 cases of botulism notified in 2015.

Botulism is a rare, extremely serious intoxication resulting from accidental or intentional exposure to toxins produced by *Clostridium botulinum* (commonly toxin types A, B and E; rarely type F). All toxins can cause flaccid paralysis by blocking the neuromuscular junction. There are 4 recognised forms of botulism: infant; foodborne; wound; and adult intestinal toxaemia.[21]

Epidemiological situation in 2015

There were 3 cases of botulism (2 infants and one adult) notified in 2015. Of the 2 cases of infant botulism, one was in New South Wales and one was in Western Australia; no source of infection was identified. The remaining notification was of foodborne botulism in an adult male in Victoria. The suspected source was consumption of home-cured meat. *C. botulinum* toxin type A gene was detected in the stools of the New South Wales case by polymerase chain reaction (PCR), and *C. botulinum* neurotoxin gene B was detected by PCR in the Victorian case's specimen, and in the stools of the Western Australian case. ■

Campylobacteriosis

- Three were 22,573 cases of campylobacteriosis notified in 2015.
- Campylobacteriosis was the most frequently notified enteric infection in 2015.

The *Campylobacter* bacteria is a common cause of foodborne illness (campylobacteriosis) in humans. This illness varies in severity and is characterised by diarrhoea (often bloody), abdominal pain, fever, nausea and vomiting.[21] Campylobacteriosis is notifiable in all Australian states and territories except New South Wales.

Epidemiological situation in 2015

There were 22,573 notified cases of campylobacteriosis in 2015, making it the most frequently notified enteric infection (139.6 per 100,000). This is a 13% increase on the number of notifications received for 2014 (n=19,945) (Figure 14) and an increase of 33% on the 5-year mean for 2010 to 2014 (n=17,005) (Table 6). The number of notified cases for 2015 was the highest recorded in the NNDSS, with the highest number of cases notified in October 2015.

Geographical distribution

Notification rates for campylobacteriosis ranged from 106.9 per 100,000 in South Australia to 200.3 per 100,000 in Tasmania. The Tasmanian rate was approximately 1.4 times higher than the national rate (139.6 per 100,000) (Table 5).

Age and sex distribution

Campylobacteriosis was most frequently notified among the 0–4 years age group for both males (252.4 per 100,000) and females (181.6 per 100,000). The median age of notified cases was 37 years (range: 0 to 99 years). Of those where sex was reported, 54% (12,185/22,562) were male. Notification rates were highest among males in all age groups except for the 25–29 and 30–34 years age groups, where notifications for females were slightly higher (Figure 15). ■

Figure 14: Notifications and notification rate for campylobacteriosis, Australia, 2010 to 2015, by year

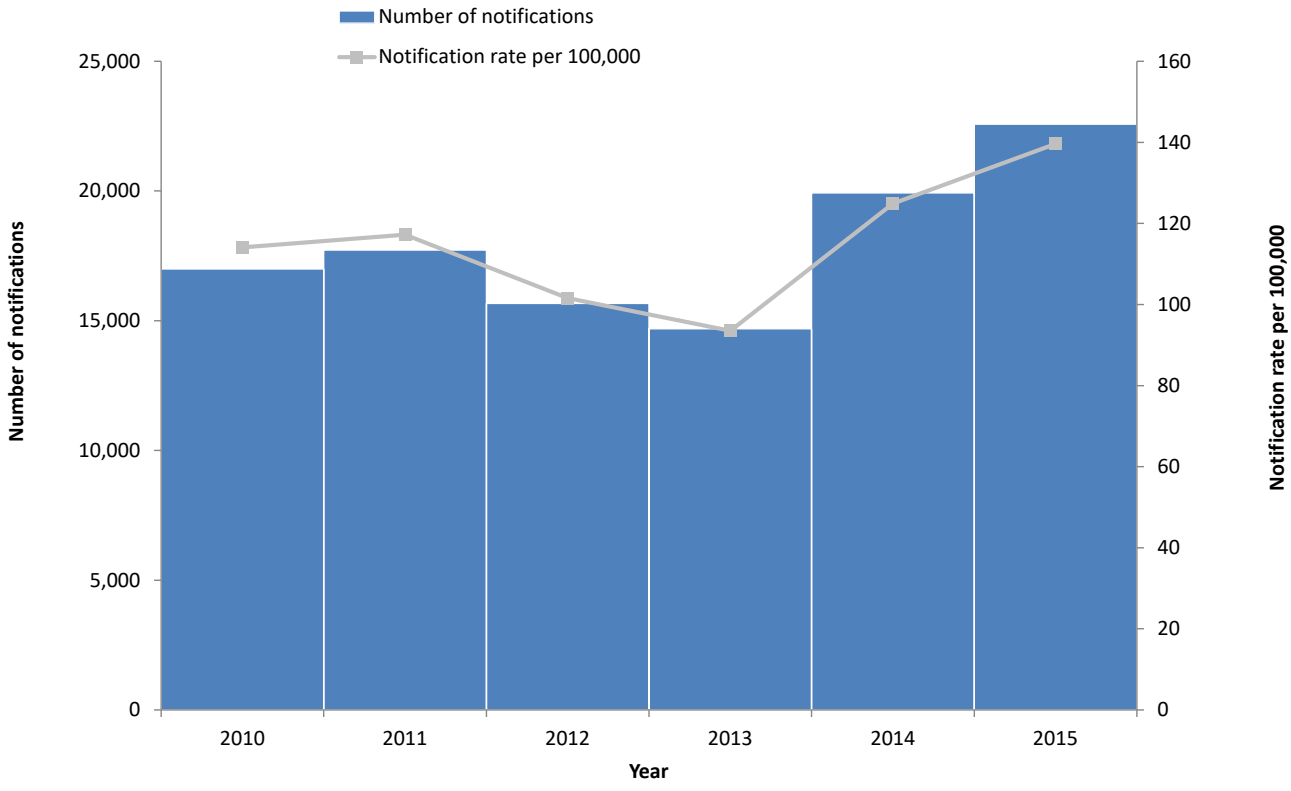
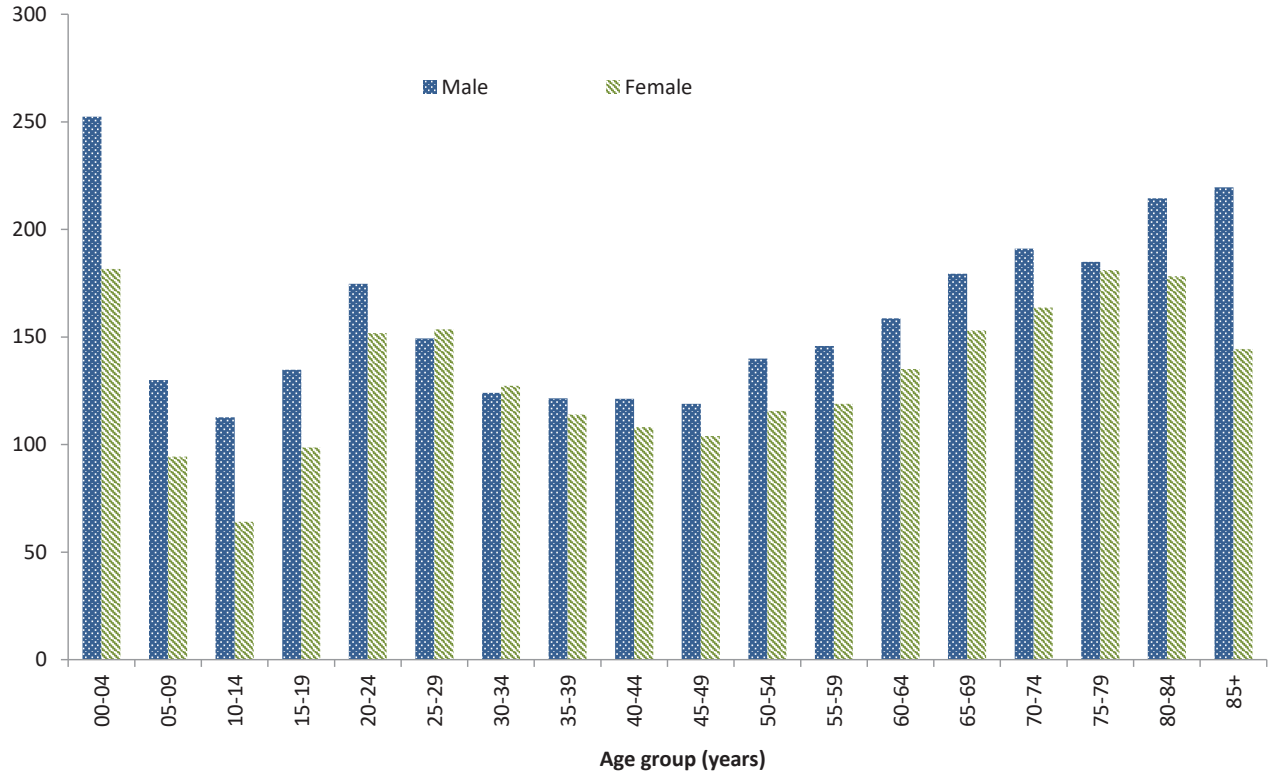
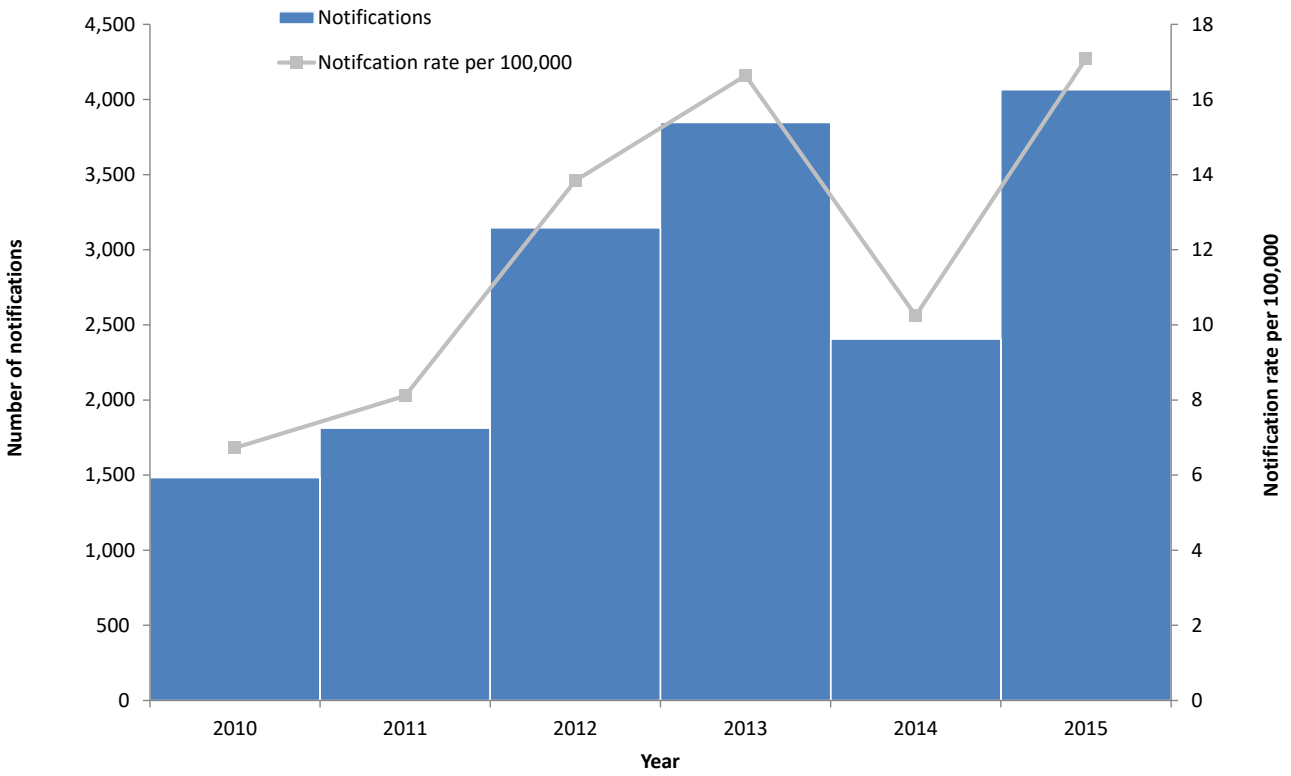


Figure 15: Notification rate for campylobacteriosis, Australia, 2015, by age group and sex*



* Excludes notifications where age (n=10), sex (n=11) or both (n=1) were not reported.

Figure 16: Notifications and notification rate for cryptosporidiosis, Australia, 2010 to 2015, by year



Cryptosporidiosis

There were 4,064 cases of cryptosporidiosis notified in 2015.

Cryptosporidiosis is a parasitic infection characterised by abdominal cramping and usually a large volume of watery diarrhoea. Ingesting contaminated water, typically from a recreational source such as a community swimming pool or lake, is a major risk factor for infection.[21]

Epidemiological situation in 2015

There were 4,064 notified cases of cryptosporidiosis in 2015 (17.1 per 100,000). This represents a 69% increase on the number of notifications received for 2014 (n=2,408) and a 60% increase on the 5-year historical mean (n=2,539.2) (Figure 16).

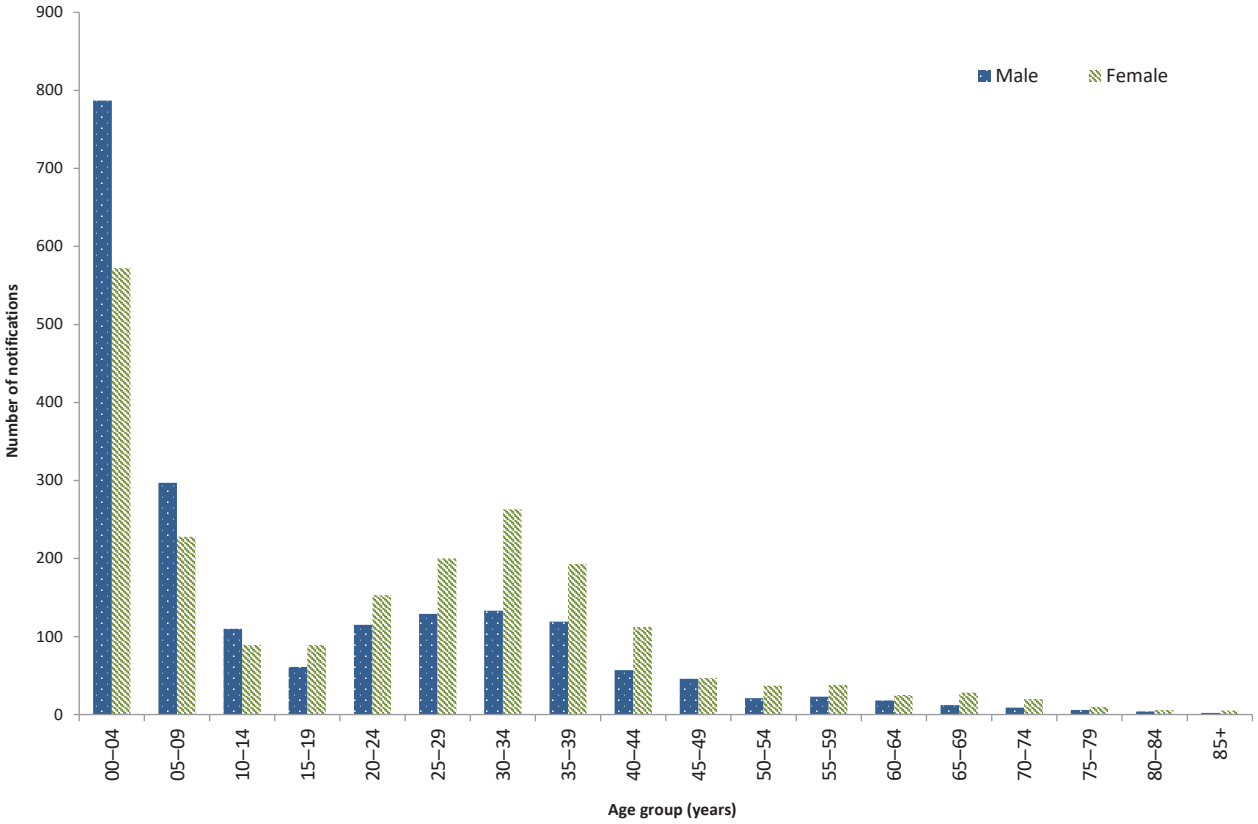
Geographical distribution

Notification rates for cryptosporidiosis ranged from 3.7 per 100,000 in Tasmania to 49.9 per 100,000 in the Northern Territory. The Northern Territory rate was 3 times higher than the national rate (17.1 per 100,000) (Table 5).

Age and sex distribution

In 2015, notified cases for cryptosporidiosis were most frequent among the 0–4 years age group (33%; 1,359/4,064). The median age of notified cases was 13 years (range: 0 to 89 years), and just over half (2,115/4,064) were females (Figure 17). ■

Figure 17: Notifications of cryptosporidiosis, Australia, 2015, by age group and sex



Haemolytic uraemic syndrome

- There were 18 cases of haemolytic uraemic syndrome notified in 2015.
- Cases were more frequently notified among the 0–4 years age group in 2015.

Haemolytic uraemic syndrome (HUS) is a rare and serious illness that is characterised by acute renal impairment, with 50% of patients requiring dialysis and approximately 5% dying.[21] Not all diagnoses of HUS are related to enteric pathogens; however, cases in Australia are commonly associated with Shiga toxin-producing *Escherichia coli* (STEC) infection.[34]

Epidemiological situation in 2015

There were 18 notified cases of HUS in 2015, comparable to the 21 cases reported in 2014 and the 5-year historical mean (15.6 cases per year). Overall, 44% (8/18) of notified HUS cases also had a notification for STEC and 63% (7/8) had a confirmed serogroup (2 cases each were O157:H- and O111, and one case each were O26, O28:H8 and OR[i]:H- respectively).

Geographical distribution

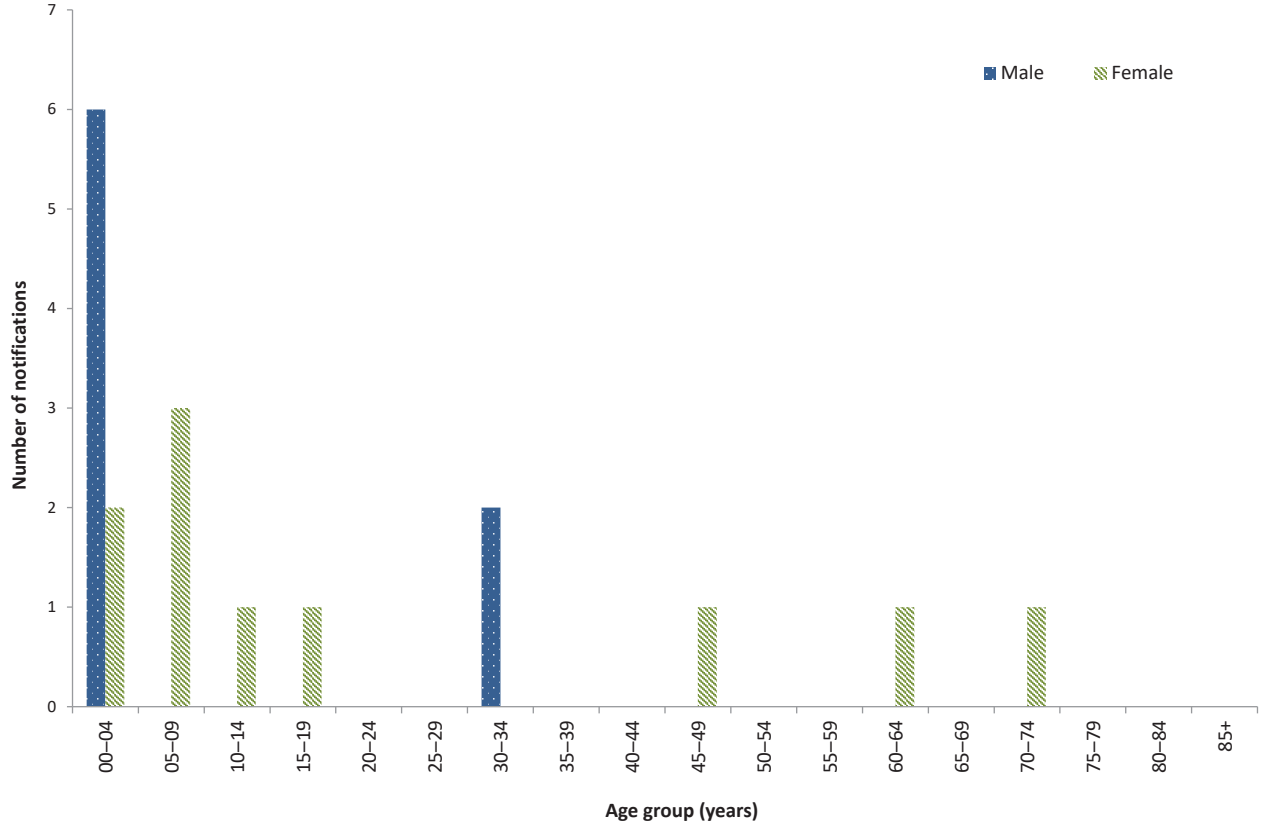
Nearly two-thirds (61%, 11/18) of notifications were residents of New South Wales (n=11), although there was a mix of urban and rural and no cases were associated by person, place or time.

Age and sex distribution

In 2015, HUS was most frequently notified among the 0–4 years age group (44%, 8/18) (Figure 18). Over half of the notified cases were in females (n=10). ■

i R = Rough

Figure 18: Notifications of HUS, Australia, 2015, by age group and sex



Hepatitis A

- There were 178 cases of hepatitis A infection notified in 2015.
- Overseas travel was the primary risk factor for notified cases.

Hepatitis A is an acute viral infection primarily affecting the liver. It is characterised by fever, malaise, anorexia, nausea and abdominal discomfort followed by jaundice. The disease is usually asymptomatic in young children and varies from a mild illness to a severely disabling disease that could last for several months in older children and adults. Infection is usually spread from person to person via the faecal–oral route but can also be foodborne or waterborne.[21]

Epidemiological situation in 2015

There were 178 notified cases of hepatitis A infection in 2015 (0.7 per 100,000). This is a 30% decrease on the number of notified cases in 2014 (n=231), and a 12% decrease on the 5-year historical mean (n=199.8) (Figure 19). The historical mean partially reflects the impact of a 2009–2010 outbreak of hepatitis A infection associated with the consumption of imported semi-dried tomatoes.[35]

Geographical distribution

New South Wales reported the highest number of hepatitis A notifications (68/178), with a population rate of 0.9 per 100,000, followed by Queensland (33/178, 0.7 per 100,000 population), and Victoria (33/178, 0.6 per 100,000 population).

Age and sex distribution

Hepatitis A infection was most frequently notified among the 20–24 years age group (12%,

Figure 19: Notifications and notification rate for hepatitis A infection, Australia, 2010 to 2015, by year and place of acquisition

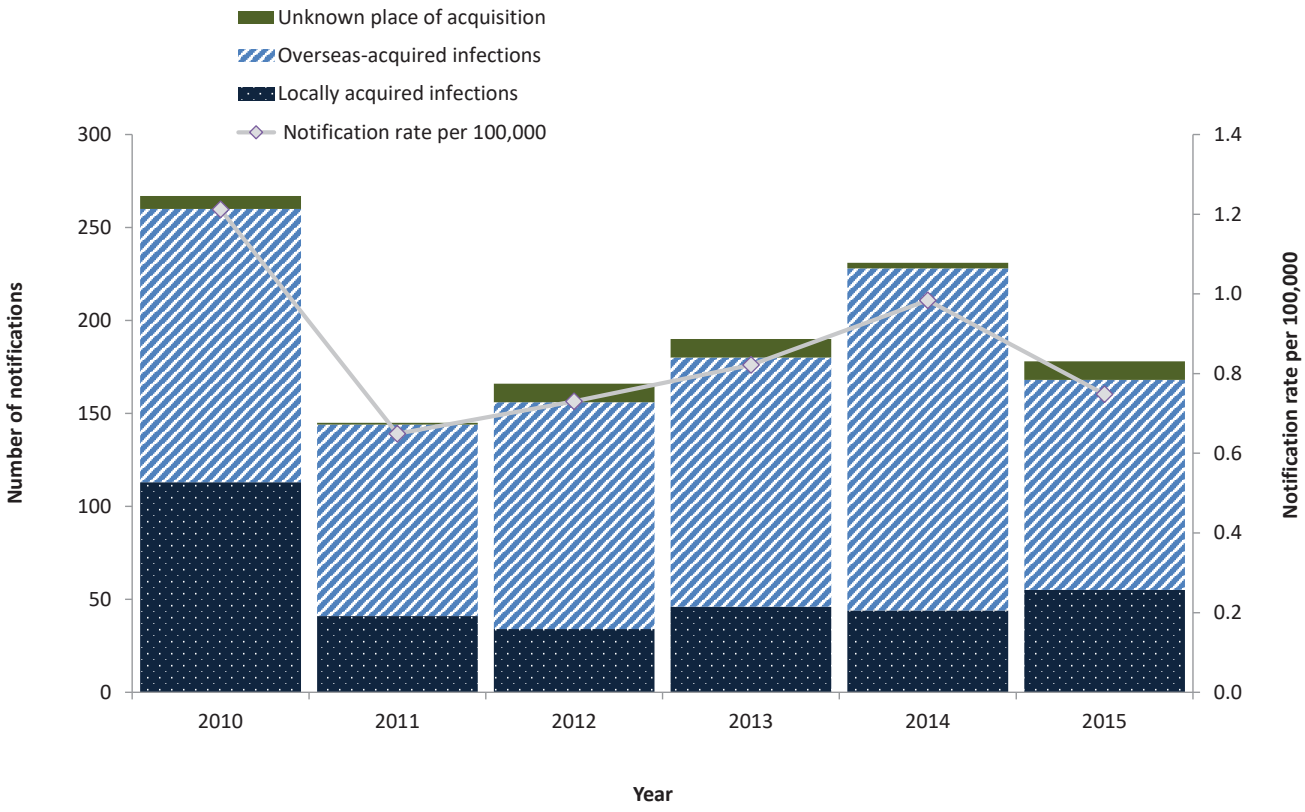
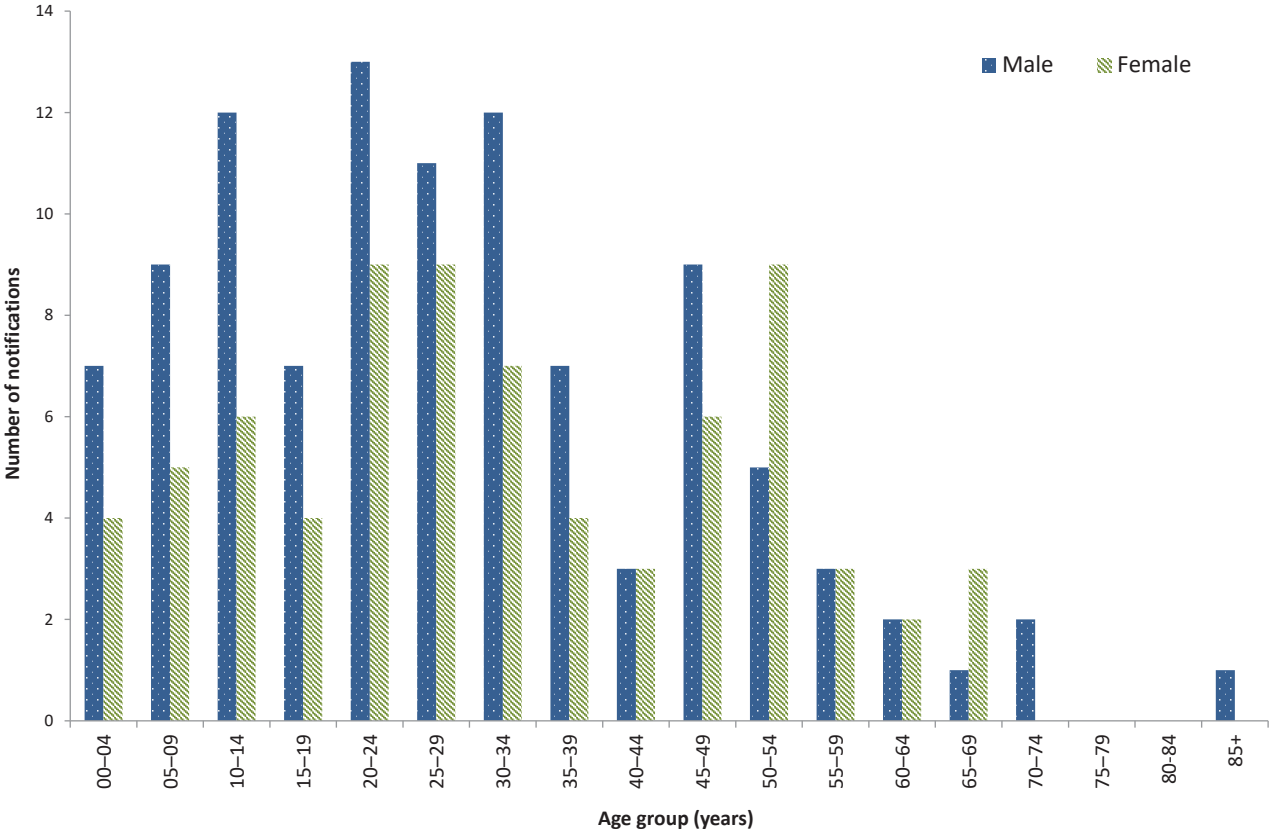


Figure 20: Notifications of hepatitis A infection, Australia, 2015, by age group and sex



22/178) in 2015 (Figure 20). The median age of notified cases was 27 years (range: 2 to 85 years), and 58% (103/178) of all cases were male.

Indigenous status

Indigenous status was known for 97% (173/178) of notified cases of hepatitis A. Of these 173 cases, 4 were identified as being Indigenous. Immunisation programs for Indigenous children were established initially in North Queensland in 1999 for Indigenous children aged 18 months. The hepatitis A immunisation program was expanded in 2005 to include all Indigenous children aged ≤2 years in the Northern Territory, Queensland, South Australia and Western Australia.[36] These programs led to a sharp decline in the number of cases of hepatitis A in Indigenous people,[37] and numbers have remained low in this population group.

Place of acquisition

Place of acquisition was known for 168 cases of hepatitis A in 2015. Of these, 67% (113/168) reported overseas travel during their period of acquisition and were considered to have been overseas acquired (Table 12). The top 5 countries of acquisition were India (n=23), Pakistan (n=11), Fiji (n=10), the Philippines (n=10) and Bangladesh (n=9).

Thirty-three per cent (55/168) of notified cases in 2015, where place of infection was known, were locally acquired. This is the second highest number of locally acquired cases in the last 5 years, with the highest recorded locally acquired cases occurring in 2010 (44%, n=113) (Table 12). Thirty-five of the 55 locally acquired cases notified in 2015 were attributed to a multi-jurisdictional outbreak of hepatitis A infection associated with the consumption of imported frozen mixed berries. A summary of this outbreak will be included in the 2015 OzFoodNet Annual Report. ■

Table 12: Notifications of hepatitis A, Australia, 2010 to 2015, by place of acquisition

Year	Locally acquired		Overseas acquired	Unknown	Total
	n	%*	n	n	
2010	113	44	145	9	267
2011	41	28	103	1	145
2012	32	20	128	6	166
2013	46	26	134	10	190
2014	44	19	184	3	231
2015	55	33	113	10	178

*Excludes cases where the place of acquisition was unknown or not supplied

Year	Locally acquired		Overseas acquired		Unknown		Total
	n	%*	n	%	n	%	
2010	113	44	145	54	9	3	267
2011	41	28	103	71	1	<1	145
2012	32	20	128	77	6	4	166
2013	46	26	134	71	10	5	190
2014	44	19	184	80	3	1	231
2015	55	33	113	63	10	6	178

Hepatitis E

There were 41 cases of hepatitis E infection notified in 2015.

Hepatitis E infection is an acute viral infection primarily affecting the liver. The virus is transmitted via the faecal–oral route, most often via food or water.[21] The infection is usually acquired overseas among travellers to endemic areas.

Epidemiological situation in 2015

There were 41 notified cases of hepatitis E infection in 2015 (0.2 per 100,000). This is a 28% decrease on the number of notified cases in 2014 (n=57), and a 2% increase on the 5-year historical mean (n=40).

Geographical distribution

The majority of notifications were in residents of New South Wales (n=21), followed by residents of Victoria (n=15).

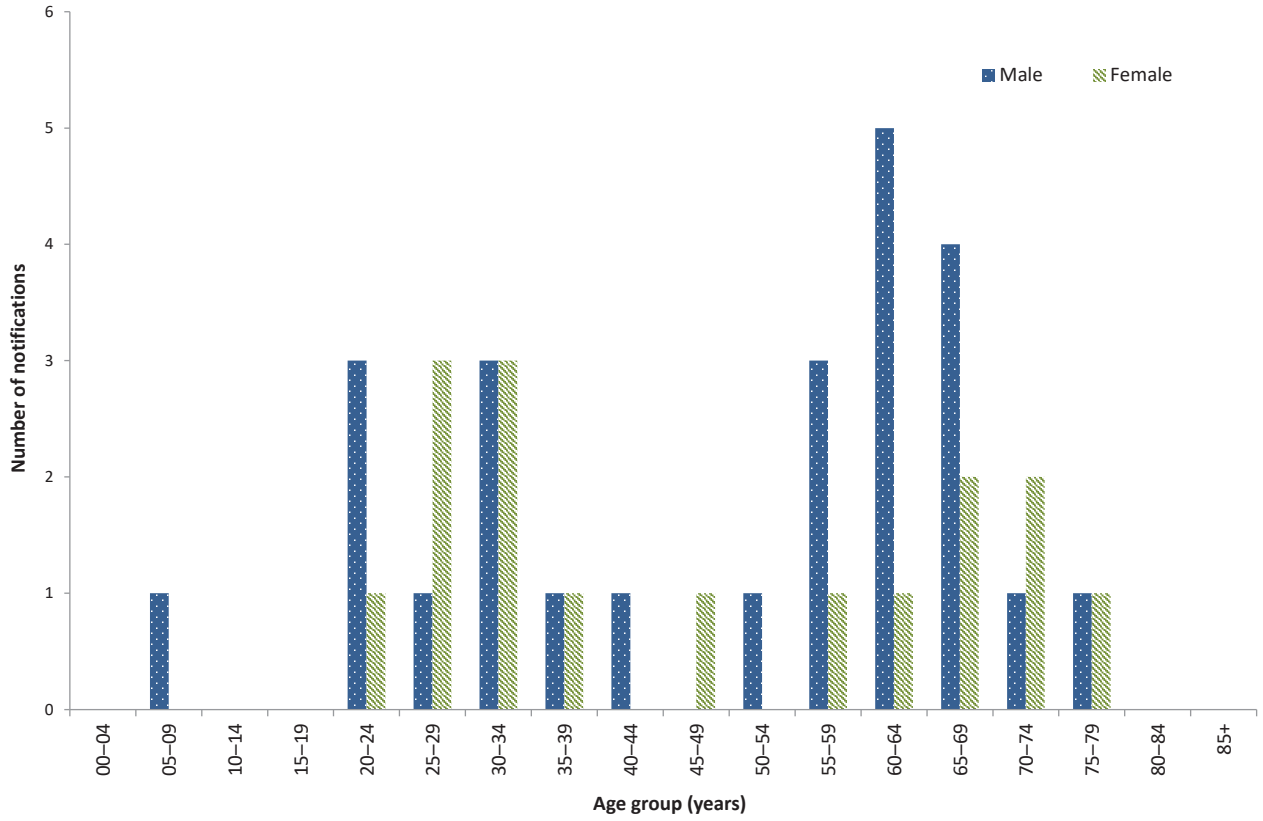
Age and sex distribution

Hepatitis E infection was most frequently notified among people aged 60–64 and 65–69 years (Figure 21). In 2015, the median age of notified cases was 55 years (range: 6 to 79 years), and 61% (25/41) were male.

Place of acquisition

Hepatitis E infection in Australia has traditionally been associated with overseas travel. In 2015, place of acquisition was recorded for 37 cases, of which 30 reported overseas travel during their period of acquisition and were considered to have acquired infection overseas. Of these, 57% (17/30) reported travel to India.

Figure 21: Notifications of Hepatitis E infection, Australia, 2015, by age group and sex.



In 2015, 19% (7/37) of cases were locally acquired. One case from Western Australia was associated with a liver transplant. The remaining 6 cases were from New South Wales (n=5) and South Australia (n=1) and there were no apparent links or common sources between these cases. ■

Listeriosis

- There were 70 cases of listeriosis notified in 2015.
- Notifications were highest in the 60–64 and 75–79 years age groups.

Invasive listeriosis is caused by a bacterial infection that commonly affects the elderly or immunocompromised, and typically occurs among people with serious underlying illnesses. Listeriosis can also affect pregnant women and infect their unborn baby.[38] Laboratory-confirmed infections in a mother and her unborn child or neonate are notified separately in the NNDSS.

Epidemiological situation in 2015

There were 70 notified cases of listeriosis in 2015 (0.3 per 100,000), which was a 13% decrease on the number of notified cases in 2014 (n=80) and a 10% decrease compared with the 5-year historical mean (n=78.0).

Geographical distribution

New South Wales had the highest number of notifications (28/70, 40%), followed by Victoria (21/70 30%).

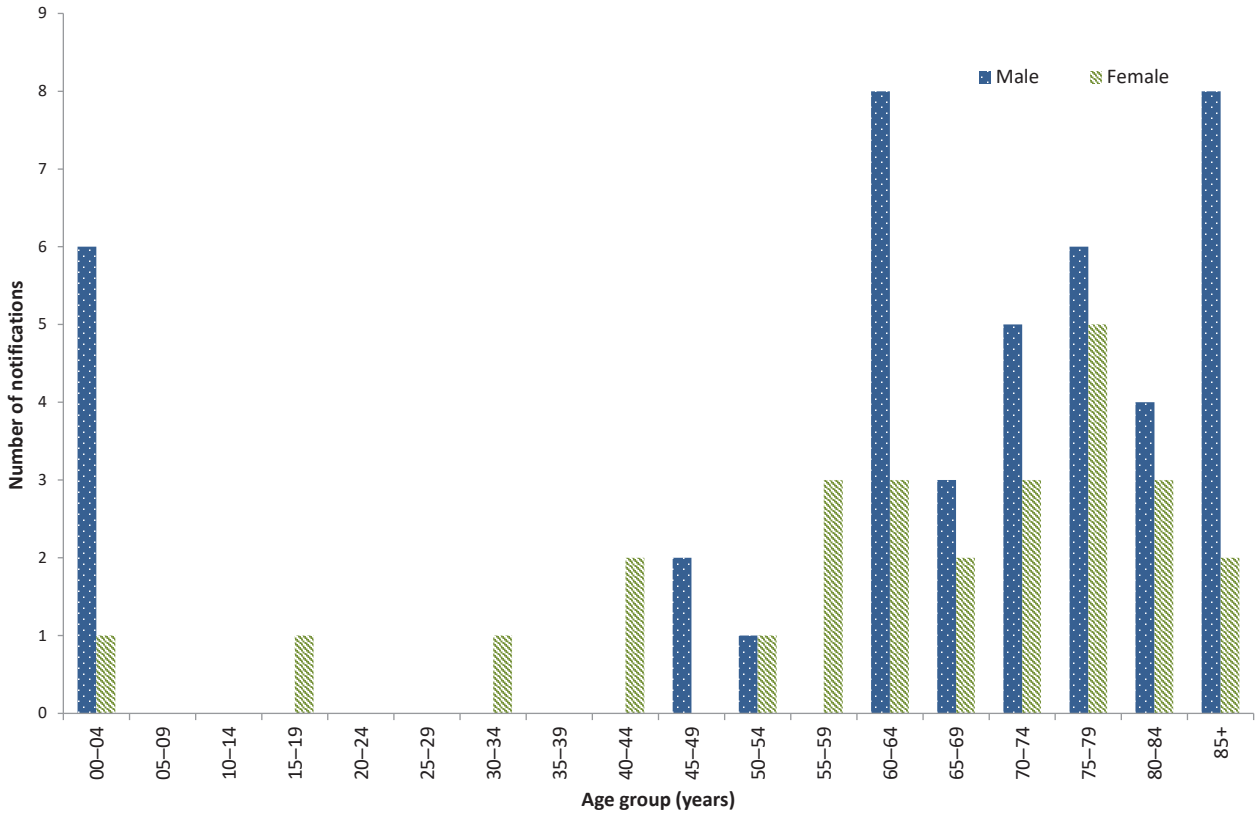
Age and sex distribution

Notifications of listeriosis were highest in the 60–64 and 75–79 years age groups (both 16%, 11/70,) (Figure 22), with over half (61%, 43/70) of all notified cases being male.

Enhanced surveillance datasets

In 2010, OzFoodNet implemented the National Enhanced Listeriosis Surveillance System (NELSS), which collects enhanced surveillance data on all notified cases of listeriosis in Australia. The enhanced information includes laboratory data collected from the characterisation of *Listeria monocytogenes* isolates by molec-

Figure 22: Notifications of listeriosis, Australia, 2015, by age group and sex



ular subtyping methods, and epidemiological data including food consumption histories and clinical data. The overall aim of this enhanced surveillance is to enable timely detection of outbreaks and subsequent public health response.[34] From 1 July 2015, OzFoodNet's NELSS began to utilise whole genome sequencing (WGS) in parallel with other molecular subtyping methods. More information on NELSS can be found in OzFoodNet Annual Reports (http://health.gov.au/internet/main/publishing.nsf/Content/cdna-ozfoodnet-reports.htm). ■

Paratyphoid

- There were 76 cases of paratyphoid notified in 2015.
- This was the second highest number of notifications recorded in NNDSS since 1991.

This is the first NNDSS Annual Report to include paratyphoid as a separate notifiable condition from salmonellosis, as paratyphoid was only made a separate condition from 1 January 2016. However, data have been updated retrospectively for all years, making annual comparisons possible. Paratyphoid is a bacterial disease caused by *S. enterica* serovars Paratyphi A, Paratyphi B, or Paratyphi C, which typically produce symptoms similar to typhoid, known commonly as 'enteric fever'. Please note: *S. enterica* Paratyphi B biovar Java does not cause an enteric fever and is included under salmonellosis.

Epidemiological situation in 2015

There were 76 notified cases of paratyphoid in 2015 (0.3 per 100,000). This is an increase of 9% compared with 2014 (n=70) (Figure 23), and a 3% increase on the 5-year historical mean (n=74.2).

Geographical distribution

The highest number of notifications (36%, 27/76) was in residents of Victoria, followed by New South Wales (24%, 18/76).

Age and sex distribution

Paratyphoid was most frequently notified among the 30–34 years age group (20%, 15/76) (Figure 24). The median age of notified cases was 27 years (range : 0 to 66 years), and there were more males (54%, 41/76) than females (46%, 35/76).

Figure 23: Notifications and notification rate for paratyphoid, Australia, 2010 to 2015, by year

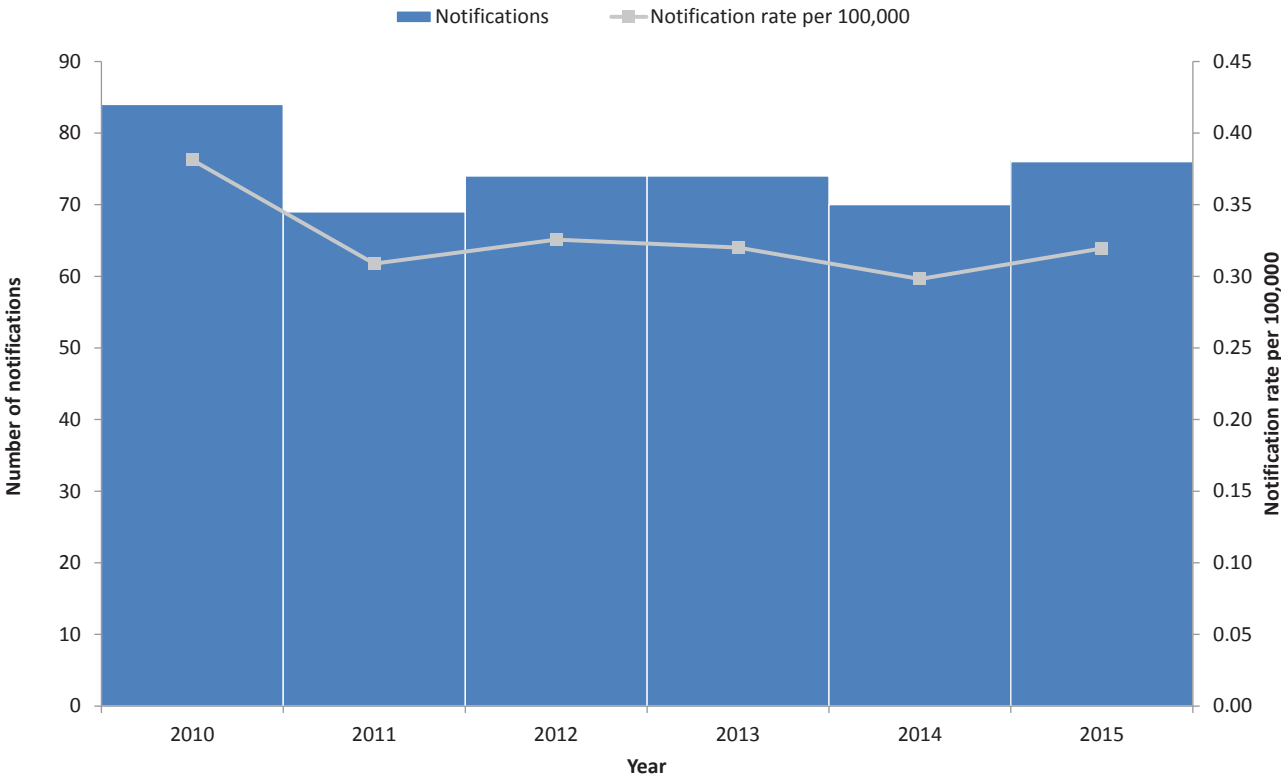


Figure 24: Notifications of paratyphoid, Australia, 2015, by age group and sex

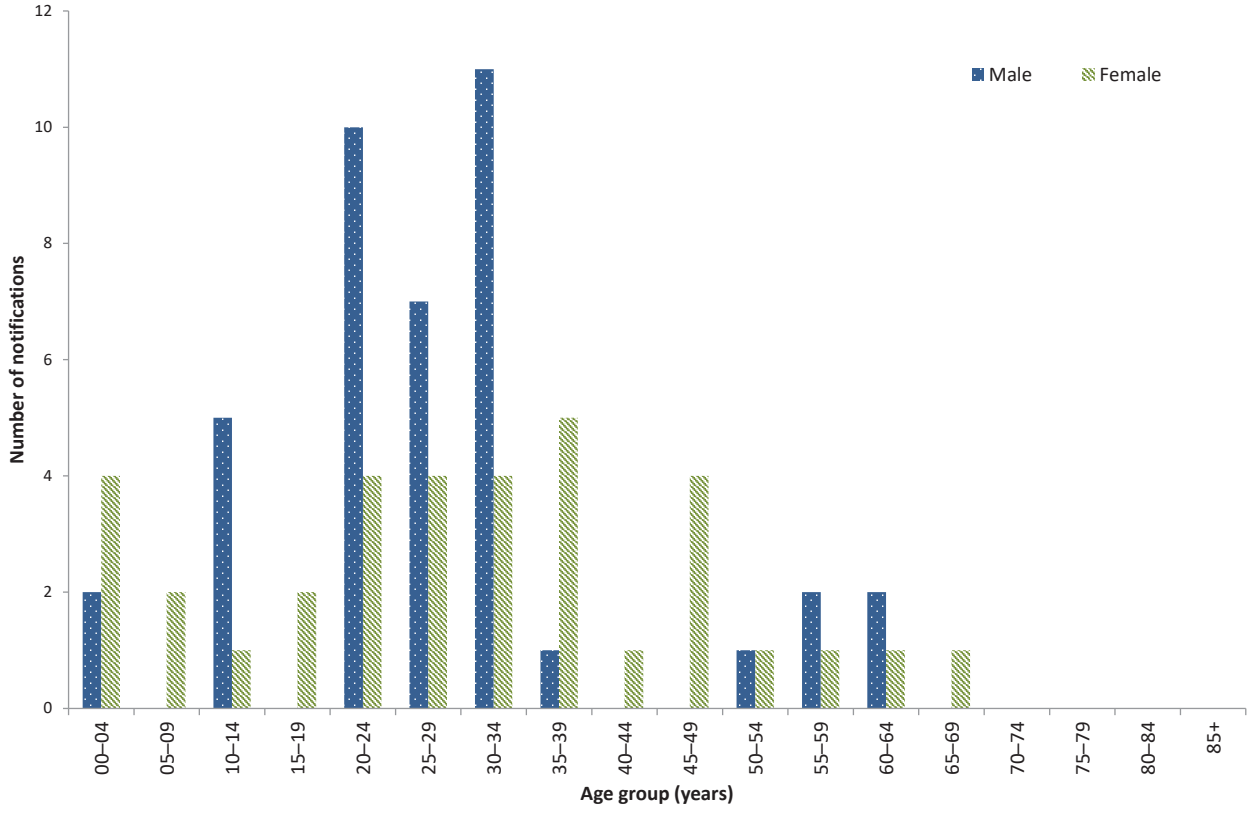


Table 13: Notifications of paratyphoid, Australia, 2010 to 2015, by place of acquisition

Year notified	Locally acquired		Overseas acquired		Unknown		Total
	n	%*	n	%	n	%	
2010	6	7	75	89	3	4	84
2011	4	6	65	94	0	0	69
2012	2	3	63	85	9	12	74
2013	1	1	66	89	7	90	74
2014	2	3	57	81	11	16	70
2015	4	5	62	82	10	13	76

* Excludes cases where the place of acquisition was not supplied or unknown.

Place of acquisition

Overseas travel is the primary risk factor for notified cases of paratyphoid. In 2015, place of acquisition was reported for 87% (66/76) of notified cases of paratyphoid. Of these, 94% (62/66) reported overseas travel during their exposure period and were considered overseas acquired. The most frequently reported country of acquisition was India, accounting for 34% (21/62) of overseas-acquired cases in 2015. Four cases were reported as locally acquired, and the place of acquisition was unknown or not stated for 10 cases (Table 13). Four locally acquired cases were residents of South Australia, 3 of which were a family cluster in 1 household; *S. enterica* serovar Paratyphi B was detected in all 4 cases. Two cases in residents of Victoria with an unknown place of acquisition were suspected to have been locally acquired, but a source could not be determined despite screening of household contacts of both cases. ■

Salmonellosis (non-typhoidal)

- There were 17,013 cases of salmonellosis notified in 2015.
- Salmonellosis was the second most frequently notified enteric infection in 2015.
- This was the highest number of salmonellosis notifications recorded in the NNDSS since 1991.

Salmonellosis is a bacterial disease characterised by the rapid development of symptoms including abdominal pain, fever, diarrhoea, muscle pain, nausea and/or vomiting. The predominant mode of transmission is contaminated food, mainly of animal origin;[21] however, people can also become infected via faecal–oral transmission, through animal contact and from environmental exposures.

Epidemiological situation in 2015

There were 17,013 notified cases of salmonellosis in 2015 (71.5 per 100,000). This is the highest annual number of notifications ever recorded in the NNDSS since salmonellosis became nationally notifiable in 1991. This represents a 4% increase on the number of cases reported in 2014 (n=16,283) (Figure 25), and a 32% increase on the 5-year historical mean (n=12,841.6), which is greater than 2 standard deviations.

Geographical distribution

Rates ranged from 49.3 per 100,000 in Tasmania to 222.5 per 100,000 in the Northern Territory (Table 5).

Age and sex distribution

Salmonellosis was most frequently notified among the 0–4 years age group (23%; 3,846/17,013) (Figure 26), where age was recorded, with an age-specific rate of 249.6 per 100,000 population. The median age of notified cases was 27 years (range: 0 to 104 years), and over half (53%, 8,960/17,013) of cases where sex was recorded were female. ■

Figure 25: Notifications and notification rate for salmonellosis, Australia, 2010 to 2015, by year

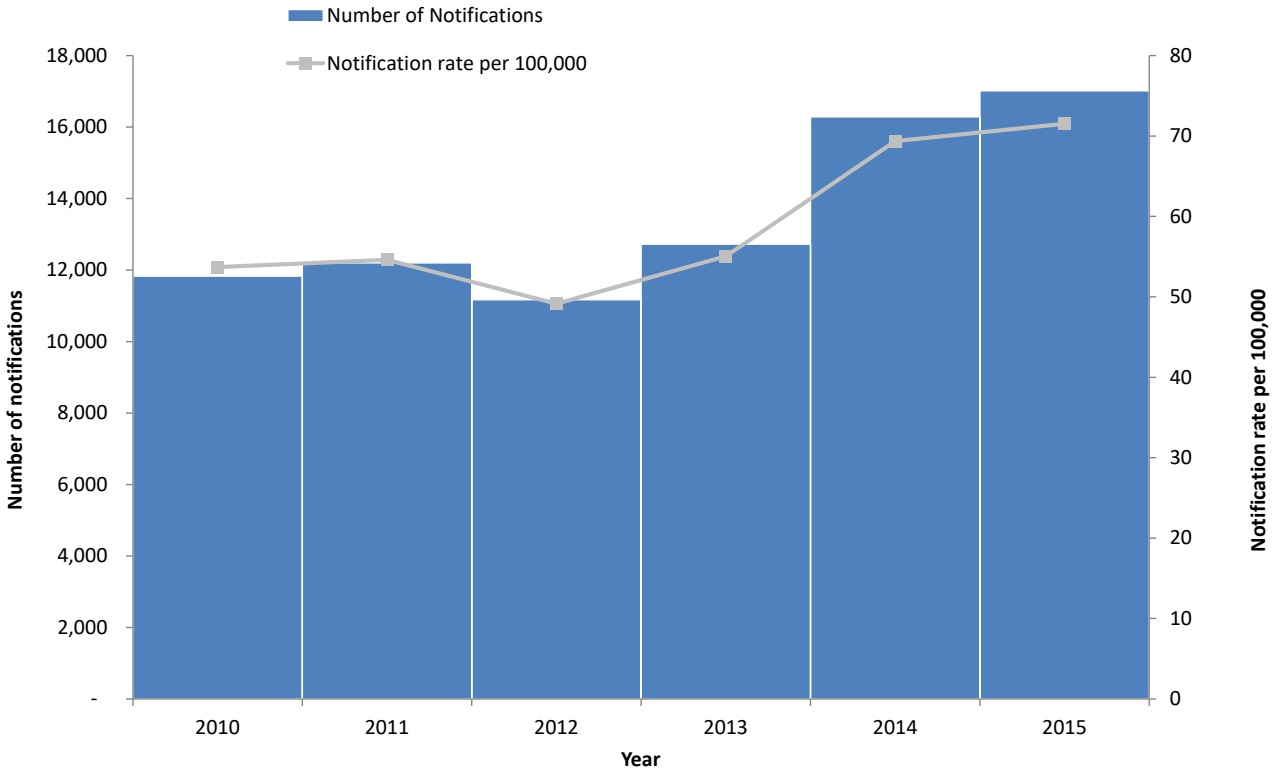
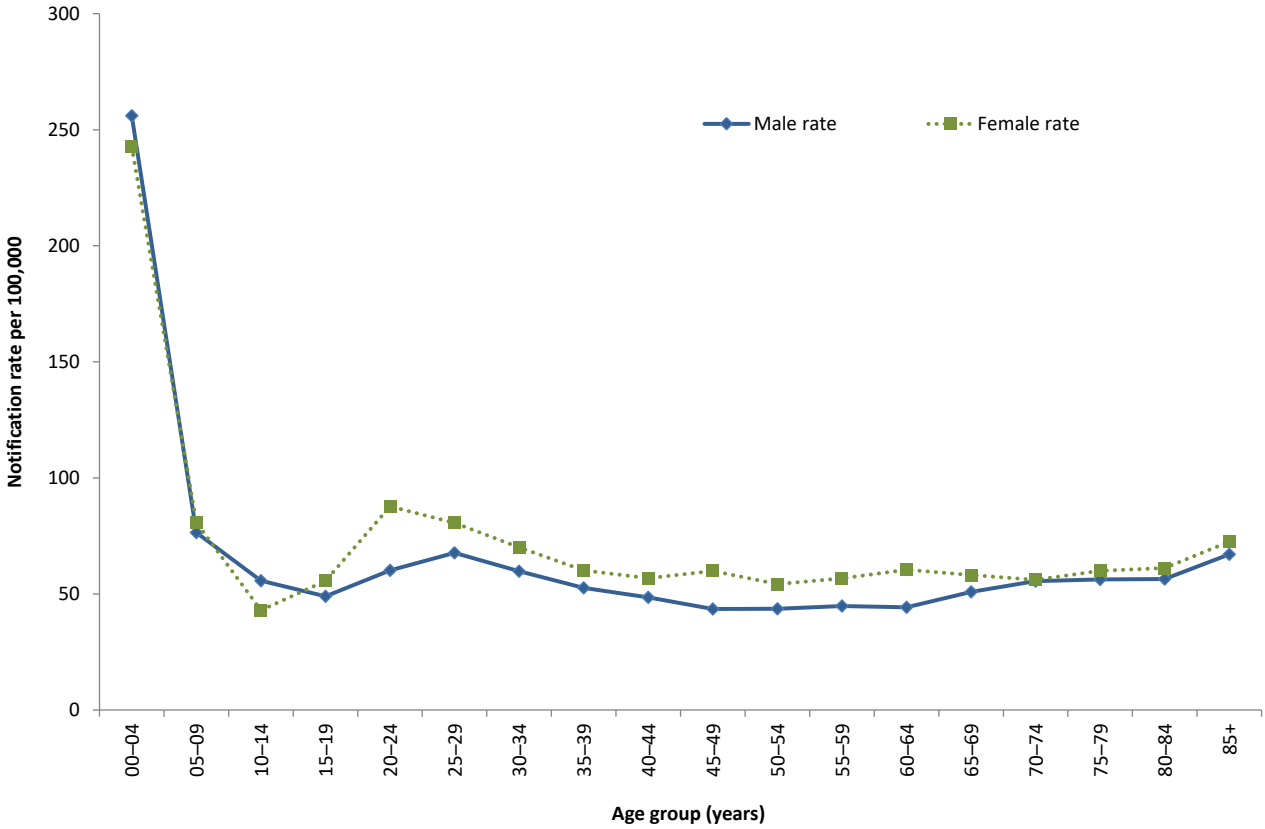


Figure 26: Notification rate for salmonellosis, Australia, 2015, by age group and sex (n=16,999)*



* Excludes notifications where age (n=1), sex (n=12) or both (n=1) were not reported.

Shigellosis

- There were 1,038 cases of shigellosis notified in 2015.
- This rise in notifications is possibly associated with the increase in culture-independent diagnostic testing since late 2013.

Shigellosis is a bacterial disease characterised by acute abdominal pain and fever, small-volume loose stools, vomiting and tenesmus. *Shigella* is transmitted via the faecal–oral route, either directly (such as male-to-male sexual contact) or indirectly through contaminated food or water.[21]

Epidemiological situation in 2015

There were 1,038 notified cases of shigellosis in 2015 (4.4 per 100,000). This is a slight decrease of 1% compared with 2014 (n=1,034) (Figure 27), and a 64% increase on the 5-year historical mean (n=632.8). This rise may be associated with the increased use of culture-independent diagnostic testing (CIDT). The current CIDT methods are unable to differentiate between infection caused by the notifiable *Shigella* and the non-notifiable entero-invasive *Escherichia coli*.[39]

Geographical distribution

Notification rates ranged from 1.1 per 100,000 in South Australia to 55.6 per 100,000 in the Northern Territory. State and territory rates for 2015 should be interpreted with caution as some jurisdictions require CIDT-positive samples to be confirmed by culture while others do not.

Age and sex distribution

Notifications of shigellosis were highest in the 0–4 years age group (17%, 174/1,038) (Figure 28). In 2015, the median age of notified cases was 31 years (range: 0 to 89 years), and just over half (54%, 561/1,038) were male.

Indigenous status

Information on Indigenous status was available for 88% (909/1,038) of shigellosis cases. This proportion varied by state or territory: 86% for the

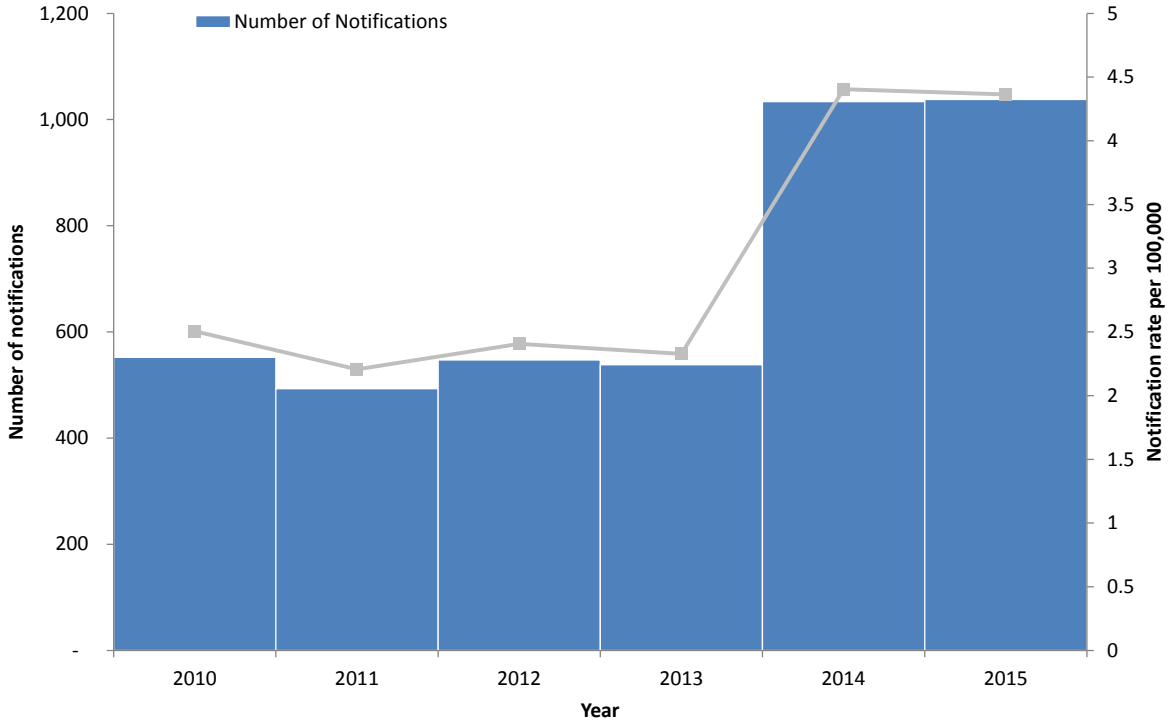


Figure 28: Notifications of shigellosis, Australia, 2015, by age group and sex

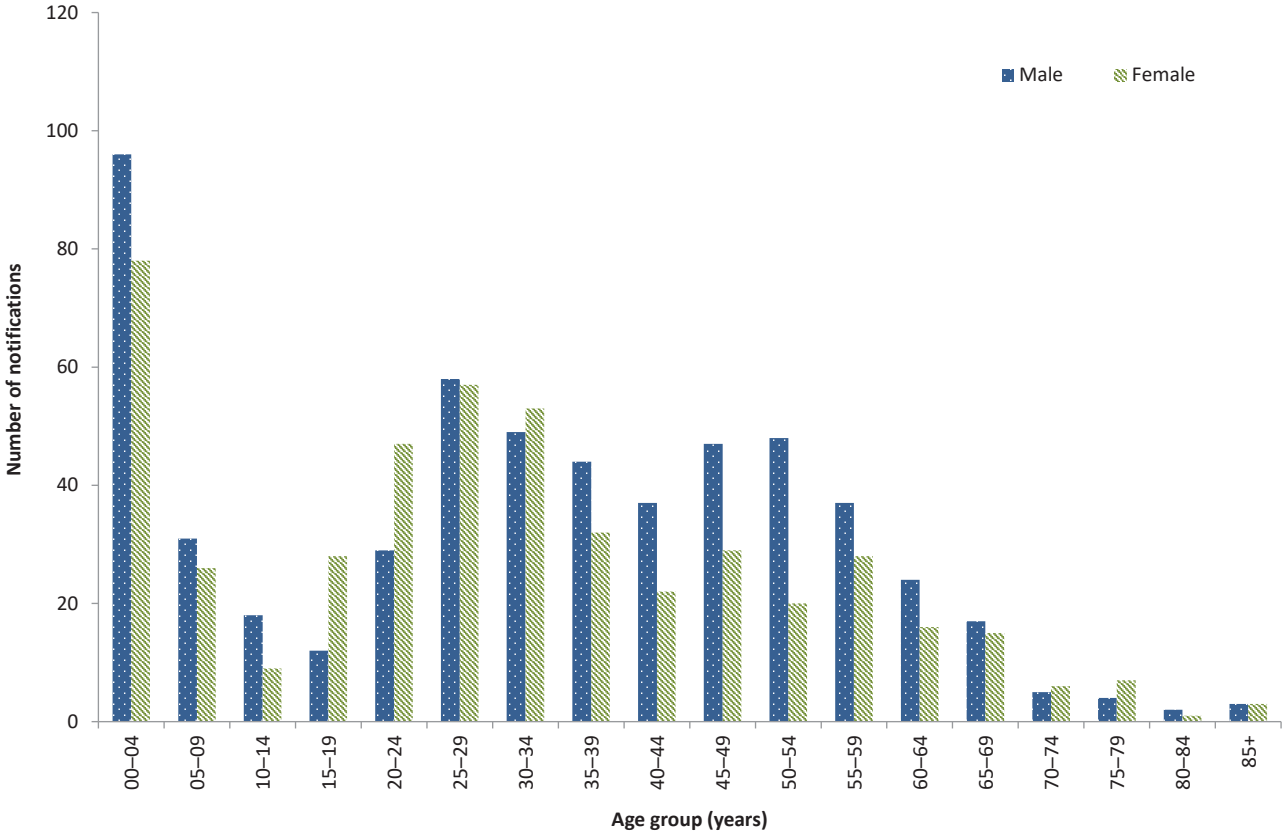


Table 14: Notifications of shigellosis, Australia, 2010 to 2015, by place of acquisition

Year notified	Locally acquired		Overseas acquired	Unknown	Total
	n	%*	n	n	n
2010	179	47	201	172	552
2011	169	53	148	176	493
2012	170	45	204	173	547
2013	137	39	210	191	538
2014	184	36	334	516	1,034
2015	243	36	435	360	1,038

*Excludes cases with unknown place of acquisition

Australian Capital Territory (86%); 87% for New South Wales; 82% for Victoria; and 100% for the Northern Territory, Tasmania, South Australia and Western Australia. The proportion of notified cases who identified as being of Aboriginal and/or Torres Strait Islander origin was 24% (214/909).

Place of acquisition

Place of acquisition was reported in 65% (678/1.038) of notified cases of shigellosis, Of these, 64% (435/678) were reported as being acquired overseas (Table 14). The top 5 countries of acquisition were India (n=98), Indonesia (n=95), Philippines (n=19), Thailand (n=19) and Vietnam (n=18). ■

Shiga toxin-producing Escherichia coli

- There were 137 cases of Shiga toxin-producing *Escherichia coli* infection notified in 2015.
- In 2015, the median age of notified cases was 37 years (range: 0 to 91 years).

Shiga toxin-producing *Escherichia coli* (STEC) is a common cause of diarrhoeal illness in humans. People can become infected via faecal–oral transmission, ingesting contaminated food, through animal contact and from environmental exposures. Severe illness can progress to HUS. Children under 5 years of age are most frequently diagnosed with infection and are at greatest risk of developing HUS.[21]

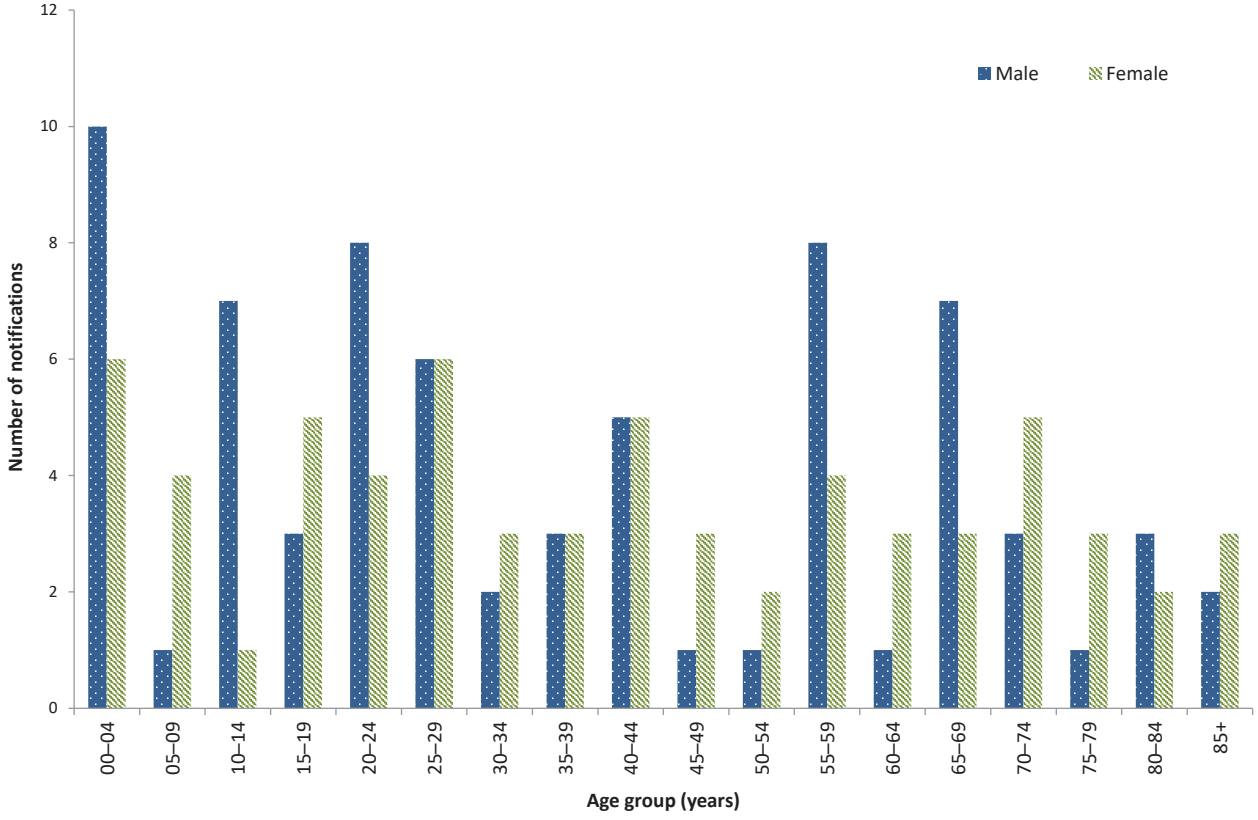
Epidemiological situation in 2015

There were 137 notified cases of STEC in 2015 (0.6 per 100,000). This was a 19% decrease from the number of cases in 2014 (n=115) and an 18% increase compared to the 5-year historical mean (n=116.4).

Geographical distribution

Detection of STEC infection is strongly influenced by jurisdictional practices regarding the screening of stool specimens.[34] South Australia continues to test all bloody stools for STEC using PCR and has the most comprehensive screening practices across all jurisdictions. As a result of these testing practices, it has the highest notification rate in the country; 2.6 cases per 100,000 compared with between 0.4 and 0.7 cases per 100,000 in other states and territories reporting cases. The differences in testing practices among states and territories render comparison of notification data by jurisdiction and over time invalid.

Figure 29: Number of notifications of Shiga toxin-producing *Escherichia coli* infection, Australia, 2015, by age group and sex



Age and sex distribution

Notifications of STEC were highest in the 0–4 years age group (12%, 16/137) (Figure 29). In 2015, the median age of notified cases was 37 years (range: 0 to 91 years) and 53% (72/137) of notified cases were male.

Microbiological trends

A partial or complete serotype was available for 61% (84/137) of STEC notifications in 2015, while a further 2 were reported as being not typable (Table 15). ■

Table 15: Notifications of Shiga toxin-producing *E.coli* (STEC) in 2015 by serotype or partial serotype

Serotype / partial serotype	n
O111	4
O111:H	6
O113	4
O128:H2	3
O146:H-	1
O157	15
O157:H	16
O163:H19	1
O181:H16	1
O26	16
O26:H	2
O26:H11	4
O5/O7:H	1
O59:H19	1
Ont:H19	2
Ont:H2	1
Ont:H8	1
Or:H41	1
Or:H7	1
Untypable	2
Serogroup Unknown	54
Total	**137**

Ont=O antigen not typable

Or=Rough O antigen

Typhoid

- There were 115 cases of typhoid notified in 2015. Of these, 98% were acquired overseas.

Typhoid is a bacterial disease caused by *S. enterica* serovar Typhi. Symptoms include sustained fever, marked headache, malaise, and constipation more often than diarrhoea in adults. The transmission mode is the same as for salmonellosis; however, typhoid differs in that humans are the reservoir for the bacterium.[21]

Epidemiological situation in 2015

There were 115 notified cases of typhoid in 2015 (0.5 per 100,000). This was a slight decrease of 3% from the number of cases in 2014 (n=119) (Figure 30) and 8% fewer than the 5-year historical mean (n=125).

Geographical distribution

Almost two-thirds (63%, 74/115) of notifications were in residents of New South Wales (n=42) and Victoria (n=30).

Age and sex distribution

Typhoid was most frequently notified among the 25–29 years age group (26%, 30/115) (Figure 31). The median age of notified cases was 26 years (range: 0 to 77 years), with similar proportions of males 50% (57/115) and females 50% (58/115).

Place of acquisition

As in previous years, overseas travel was the primary risk factor for notified cases. In 2015, 93% (107/115) of notifications reported overseas travel during their period of acquisition and were considered overseas acquired. India continues to be the most frequently reported country of acquisition, accounting for 59% (63/107) of overseas-acquired cases in 2015. Two cases were listed as locally acquired (2%), and the place of acquisi-

Figure 30: Notifications and notification rate for typhoid, Australia, 2010 to 2015, by year

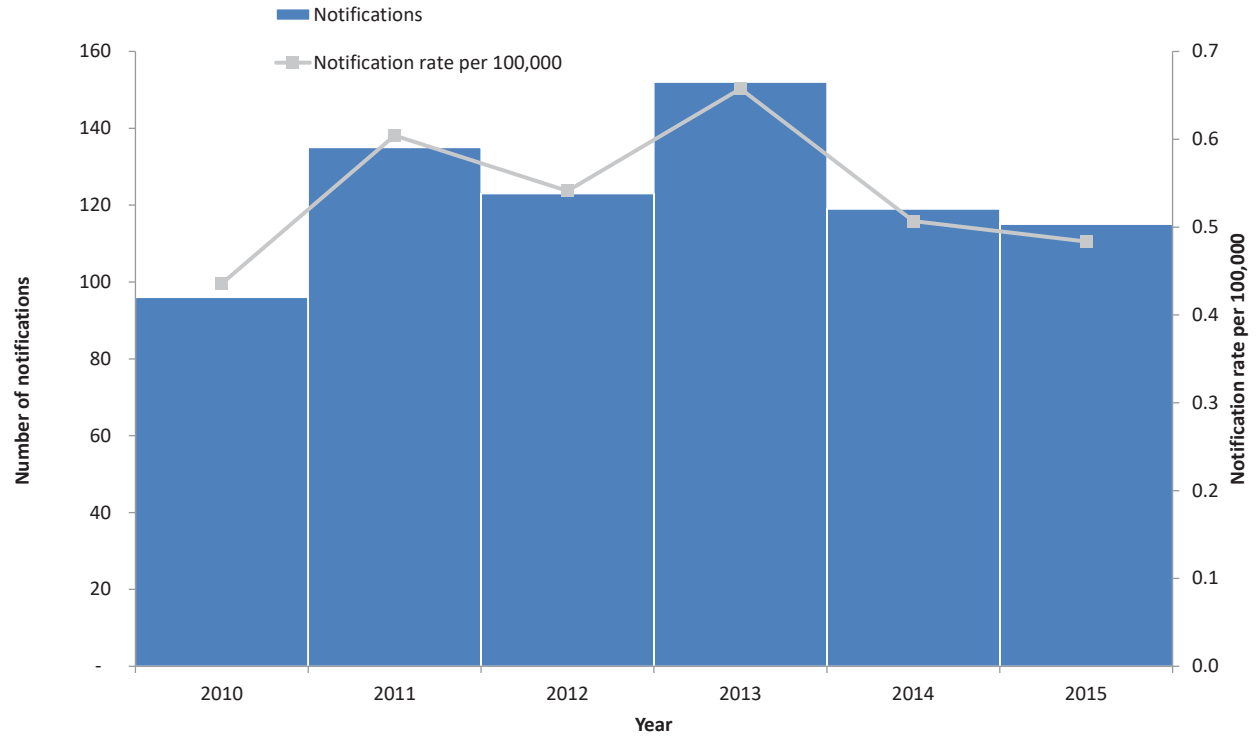


Figure 31: Notifications of typhoid, Australia, 2015, by age group and sex

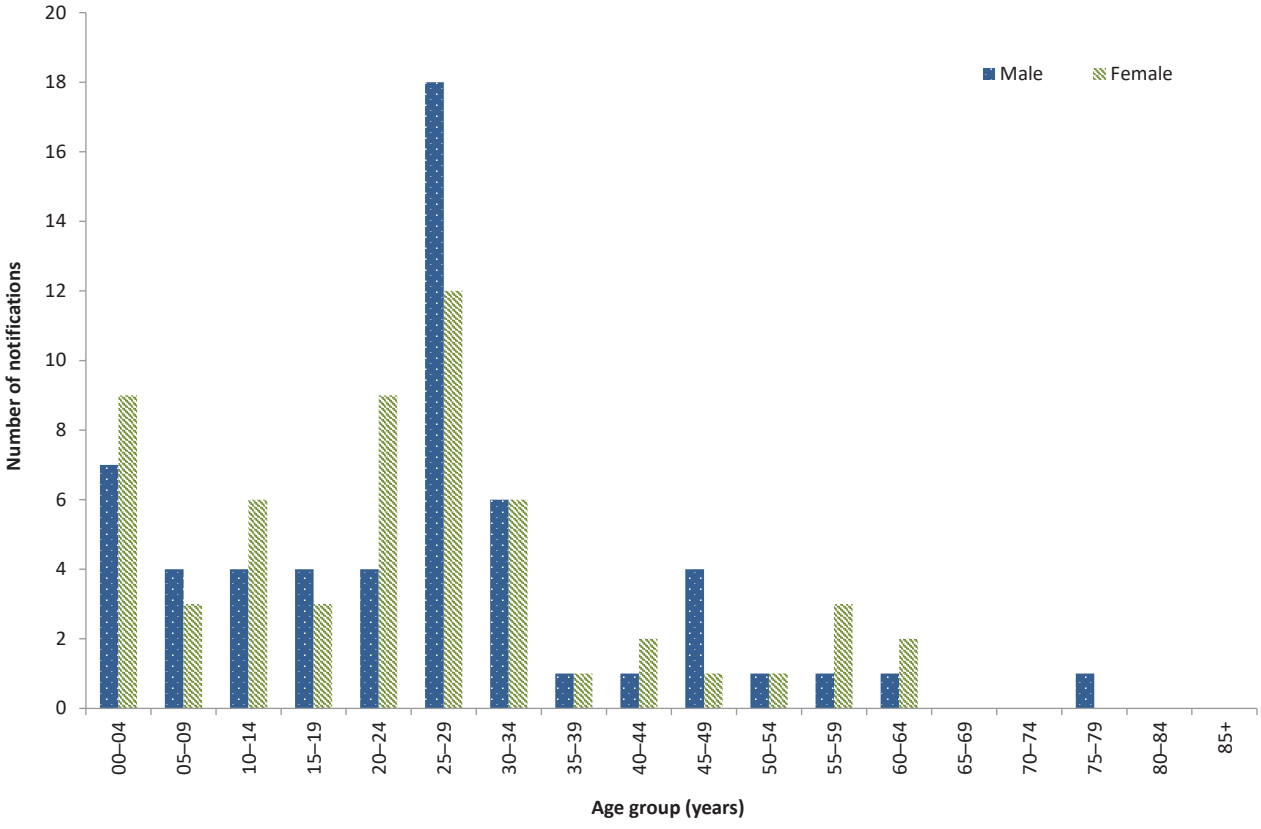


Table 16: Notifications of typhoid, Australia, 2010 to 2015, by place of acquisition

Year notified	Locally acquired		Overseas acquired	Unknown	Total
	n	%*	n	n	n
2010	2	2	92	2	96
2011	6	5	125	4	135
2012	3	8	118	2	123
2013	8	5	141	3	152
2014	6	5	109	4	119
2015	2	2	107	6	115

*Excludes cases where the place of acquisition was unknown or not supplied

tion was unknown for 6 cases (5%) (Table 16). Of the 2 locally acquired cases, one case from Queensland was a resident of the Torres Strait and their source of infection was unknown. The second case was from South Australia had not travelled during their incubation period but had migrated from Afghanistan and was thought to have been a chronic carrier of typhoid. Two of the cases notified by Victoria in 2015 as having an unknown place of acquisition were suspected to have been locally acquired, but the source of infection could not be determined despite extensive screening of contacts. ■

QUARANTINABLE DISEASES

Human diseases covered by the *Quarantine Act 1908*, and notifiable in Australia and to the WHO in 2015 were cholera, plague, rabies, yellow fever, smallpox, highly pathogenic avian influenza in humans (HPAIH), severe acute respiratory syndrome (SARS) and 4 viral haemorrhagic fevers (Ebola, Marburg, Lassa and Crimean–Congo). These diseases are of international public health significance.

There were no cases of plague, rabies, yellow fever, smallpox, SARS, HPAIH or viral haemorrhagic fevers reported in Australia in 2015. While there were 2 cases of overseas-acquired cholera in 2015, Australia remains free of all the listed quarantinable diseases (Table 17).

Table 17: Australia's status for human quarantinable diseases, 2015

Disease	Status	Date of last record and notes
Cholera	Free	Small number of cases reported annually related to overseas travel. Very rare instances of local acquisition as described under the section 'Cholera'.
Plague	Free	Last case recorded in Australia in 1923[40]
Rabies	Free	Last case (overseas acquired) recorded in Australia in 1990[41]
Smallpox	Free	Last case recorded in Australia in 1938, last case world-wide in 1977, declared eradicated by the World Health Organization 1980[42, 43]
Yellow fever	Free	Two cases in 2011 were the first recorded, related to overseas travel[44]
SARS	Free	Last case recorded in Australia in 2003[45]
HPAIH	Free	No cases recorded[46]
Viral haemorrhagic fevers		
Ebola	Free	No cases recorded
Marburg	Free	No cases recorded
Lassa	Free	No cases recorded
Crimean–Congo	Free	No cases recorded

Cholera

- There were two cases of cholera notified in 2015.
- Between 2010 and 2015, there have been a total of 19 cases of cholera were notified in Australia.

Cholera is an infection of the digestive tract caused by certain strains of the bacterium *Vibrio cholerae* that produce toxins. It is most commonly acquired in parts of Africa, Asia, South America, the Middle East and the Pacific islands. *V. cholerae* is found in the faeces of infected people, and is spread by drinking contaminated water, eating food washed with contaminated water or prepared with soiled hands, or eating fish or shellfish caught in contaminated water. Person to person spread of cholera is less common. Most people do not develop symptoms or have only mild illness but a small proportion of people will develop severe symptoms. Symptoms typically start between 2 hours and 5 days (usually 2 to 3 days) after ingesting the bacteria. Symptoms can include characteristic 'rice water' faeces (profuse, watery diarrhoea), nausea and vomiting and signs of dehydration, such as weakness, lethargy and muscle cramps. Only toxigenic *V. cholerae* O1 and O139 are notifiable in Australia.

Epidemiological situation in 2015

In 2015, there were 2 notifications of cholera in Australia. The following details are available about the relevant exposures and place of acquisition for these cases:

- Case 1, notified by South Australia, was a 78-year-old male who acquired the infection while travelling in Indonesia; and
- Case 2, notified by New South Wales, was a 47-year-old female who acquired the infection while travelling in Thailand.

There were a total of 19 cases of cholera notified in Australia between 2010 and 2015. All cases of cholera reported from the commencement of the NNDSS in 1991 to 2015 were acquired outside Australia, except for 1 case of laboratory-acquired cholera in 1996,[47] 3 cases in 2006 linked to imported whitebait[48] and 1 laboratory-acquired case in 2013.[44] ■

SEXUALLY TRANSMISSIBLE INFECTIONS

In 2015, the STIs notified to the NNDSS were chlamydial infection, donovanosis, gonococcal infection, and congenital and non-congenital syphilis. Other national surveillance systems that monitor STIs in Australia include the Australian Gonococcal Surveillance Programme (AGSP), which is a network of specialist laboratories monitoring antimicrobial susceptibility patterns of gonococcal infection; and the National HIV Registry maintained by the Kirby Institute at the University of New South Wales.

Chlamydial infection

- There were 65,998 cases of chlamydial infection notified in 2015.
- Chlamydia notifications from Victoria in 2015 were incomplete and have been excluded from the report. Victorian notifications normally account for approximately 23% of notifications nationally.
- Thirty-seven per cent of notifications in 2015 were among females aged 15–24 years.

Genital chlamydial infection is caused by the bacterium *Chlamydia trachomatis* serogroups D to K. Screening is important in detecting chlamydial infections, as a large proportion of infections are asymptomatic. Chlamydial infection is highly treatable, although reinfection is common.[49] If it is left untreated, complications such as epididymitis in males and infertility and pelvic inflammatory disease in females can arise.[21]

Chlamydia notifications in 2015 are incomplete for Victoria, but will be available for future reporting. Victoria is excluded for every year in the analyses and figures presented below.

Epidemiological situation in 2015

In 2015, there were 65,998 cases of chlamydial infection, representing 21% of all notifications reported to the NNDSS. From 2011 to 2014, notification rates remained relatively stable, increasing marginally from 368.0 per 100,000 in 2011 to 379.4 per 100,000 in 2014, and declining in 2015 to 369.9 per 100,000 (Figure 32).

Geographical distribution

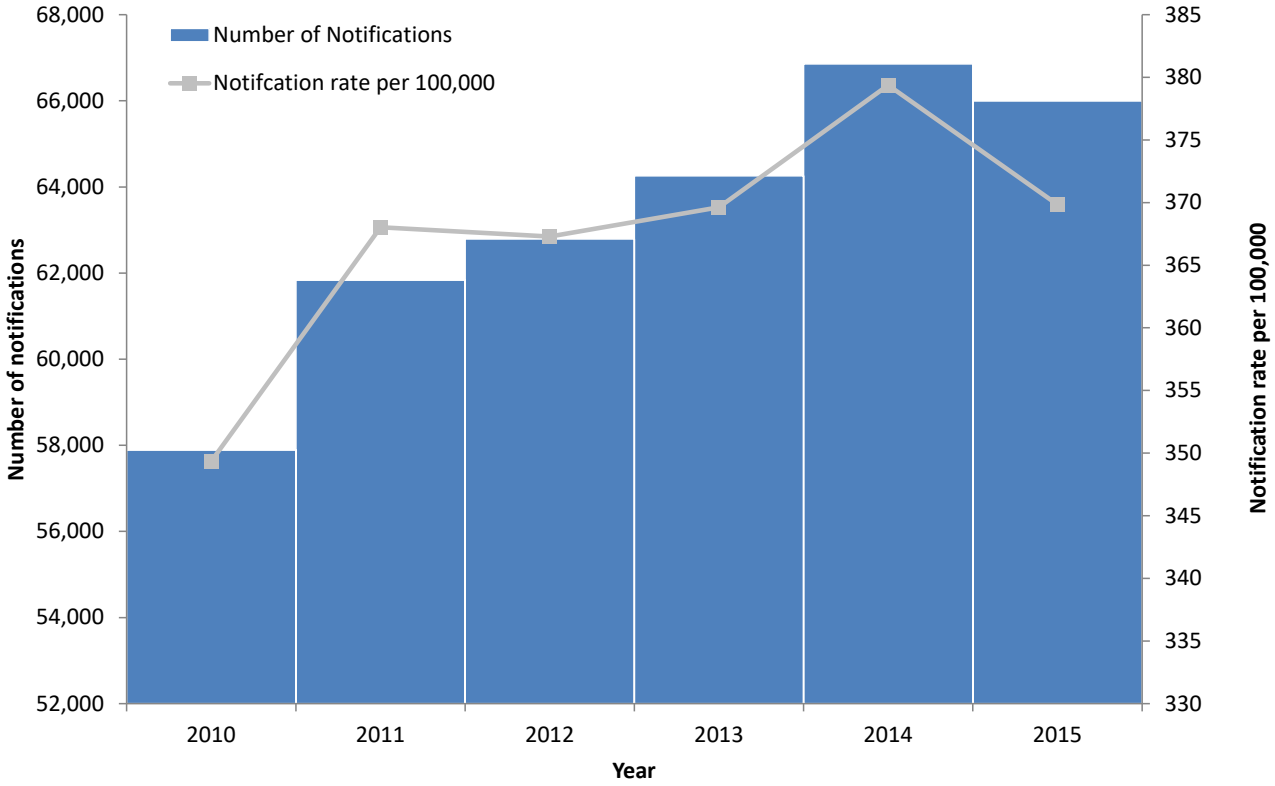
In 2015, the notification rate for chlamydia was 3 times higher in the Northern Territory (1,119.8 per 100,000) compared to the national rate (369.8 per 100,000) (Figure 33). This is probably due to the disproportionate representation of Aboriginal and Torres Strait Islander women, particularly in regional and remote areas, in the chlamydia notification data (Figure 36).[9]

Age and sex distribution

In 2015, chlamydial infection occurred predominately in females aged 15–24 years, accounting for 37% of all chlamydial infections (Figure 34). The national notification rate for chlamydial infection in 2015 was 368.4 per 100,000 in males and 479.9 per 100,000 in females. The overall higher rate among females may be partly attributable to preferential testing of women attending health services compared with men.[9,50] Notification rates for males and females, aged 20–39 years, increased between 2010 and 2015: in males by 17% (706.6 in 2010 to 823.4 in 2015) and in females by 16% (872.6 in 2010 to 1,016.0). Notification rates for both males and females aged 15–19 years decreased between 2011 and 2015, declining by 19% (784.5 in 2011 to 635.3 in 2015) in males and 20% (2,421.6 in 2011 to 1,944.6 in 2015) in females (Figure 35).

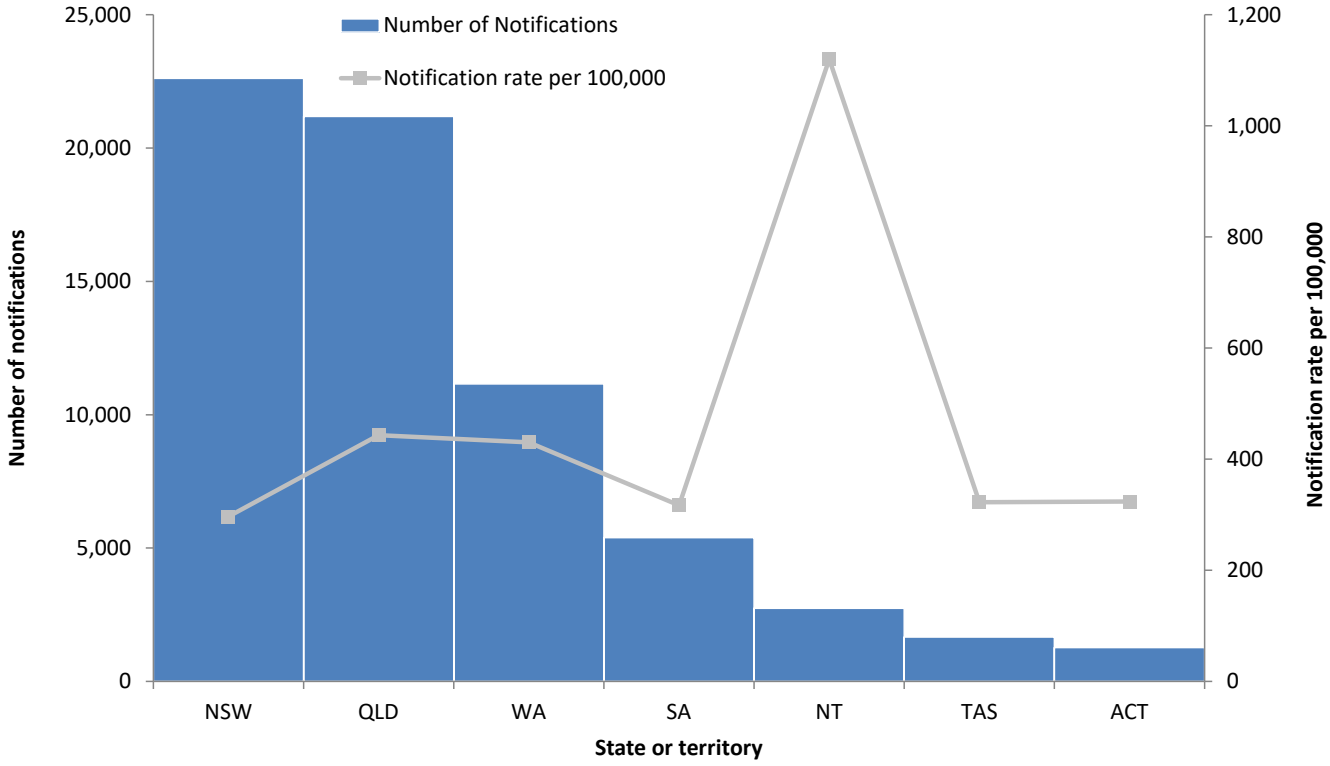
Indigenous status

The completeness of Indigenous status identification for chlamydial infection notification data varies by year and jurisdiction. Nationally in 2015, data on Indigenous status were complete for 49% (32,047) of chlamydial infection notifications, which is lower than the preceding



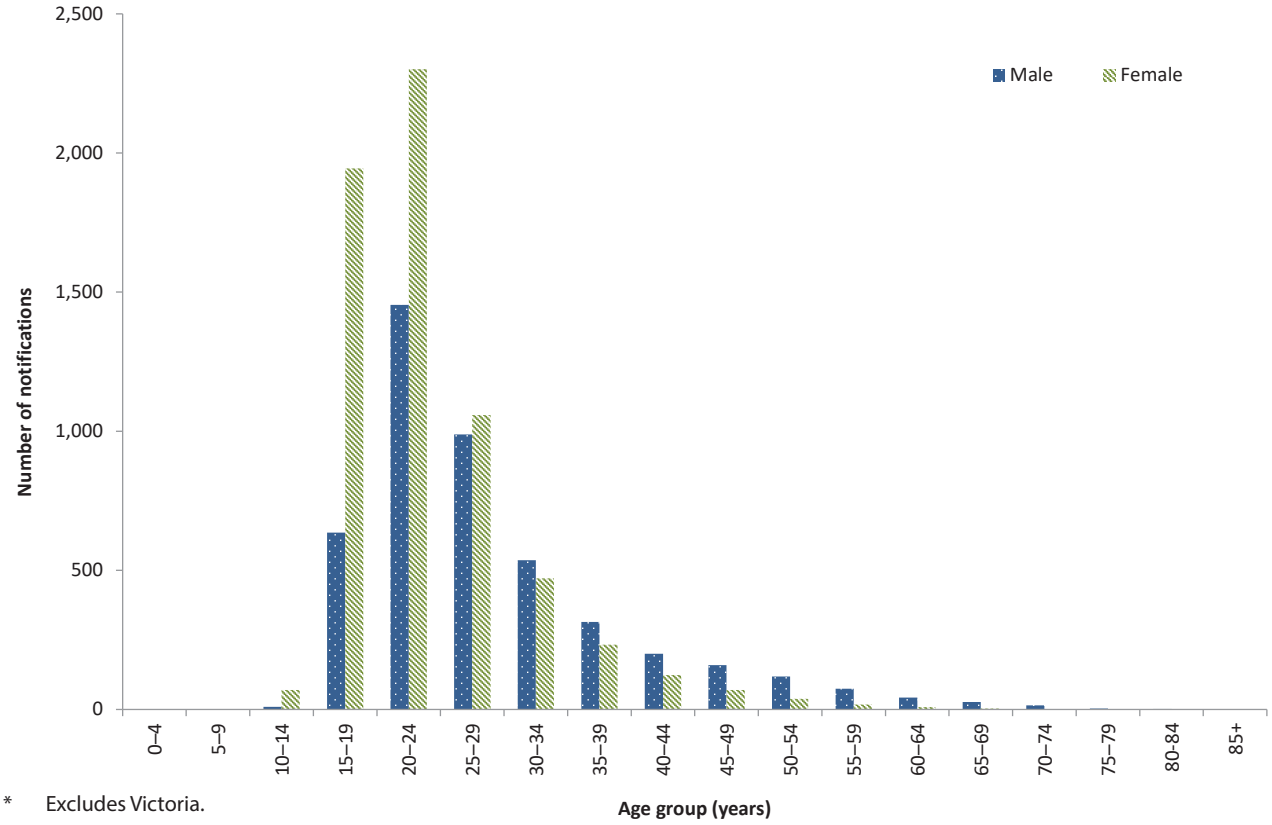
*Excludes Victoria.

Figure 33: Notifications and notification rate for chlamydial infection, Australia, 2015, by state or territory*



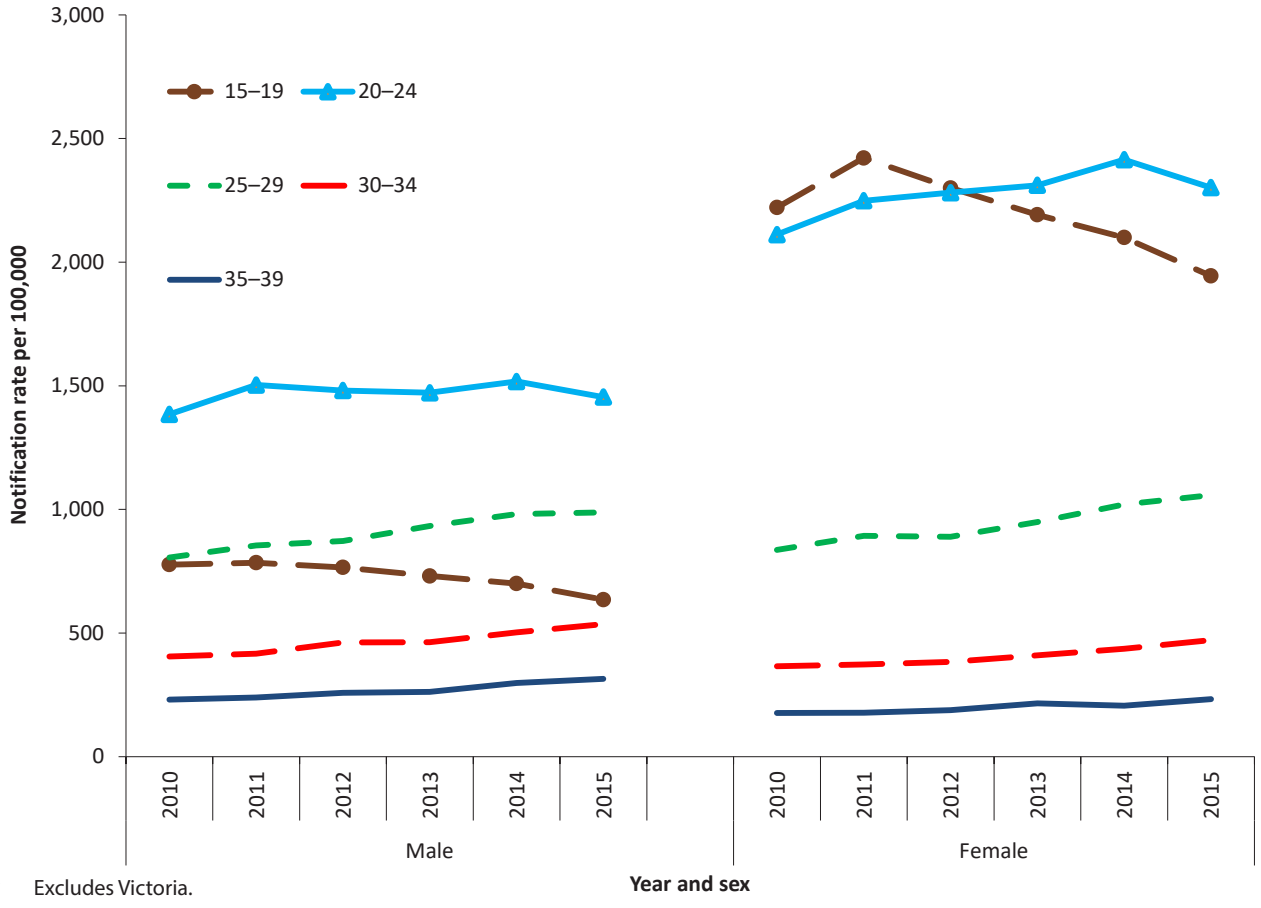
*Excludes Victoria.

Figure 34: Notification rate* for chlamydial infection, Australia, 2015, by age group and sex



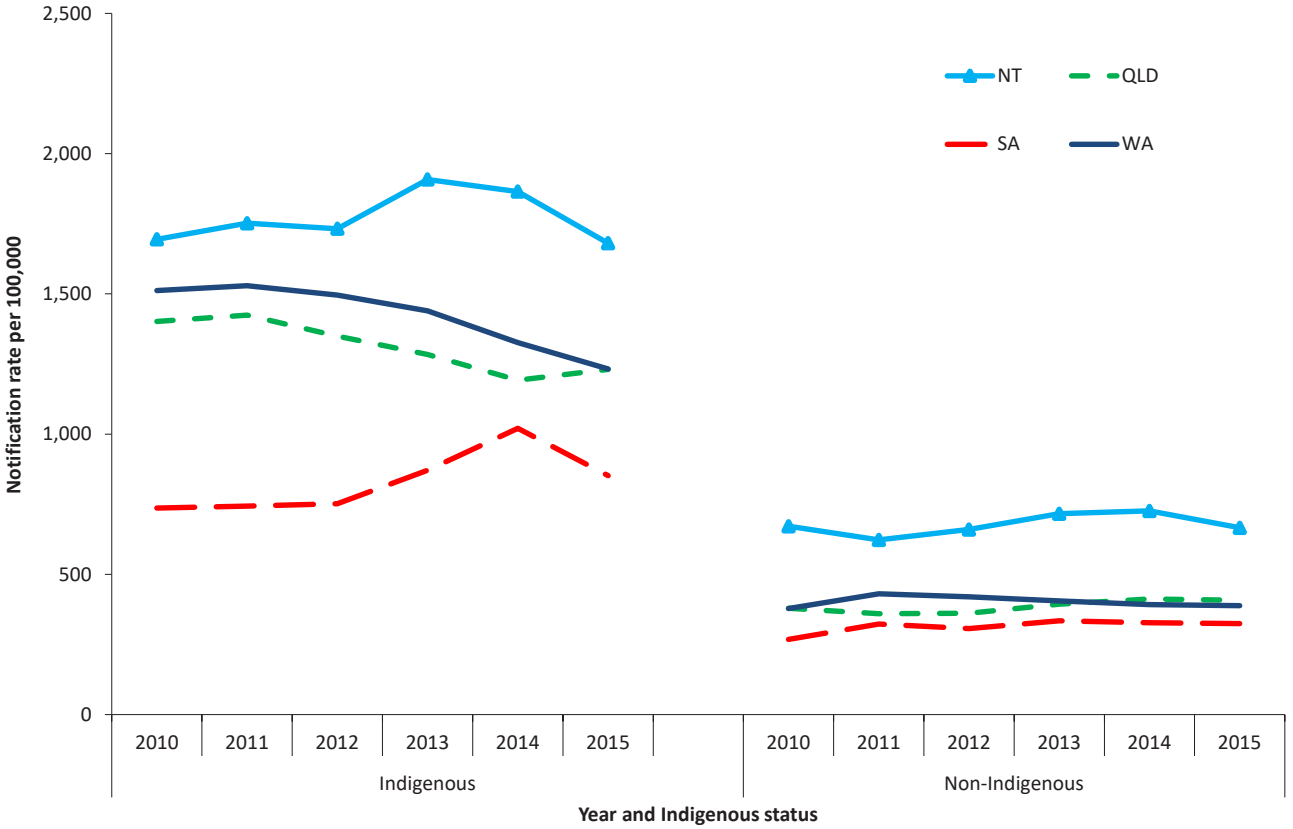
* Excludes Victoria.

Figure 35: Notification rate* for chlamydial infection, Australia, 2010 to 2015, by year, sex and selected age groups



* Excludes Victoria.

Figure 36. Age-standardised notification rates for chlamydial infection, selected states and territories,* 2010 to 2015, by year and Indigenous status



* Includes the states and territories where Indigenous status was reported for more than 50% of cases between 2010 and 2015: the Northern Territory, Queensland, South Australia and Western Australia.

five-year average of 46% (range: 37% to 51%). Four jurisdictions had greater than 50% completeness of the Indigenous status field in each year during the 2010–2015 period: the Northern Territory, Queensland, South Australia, and Western Australia. Among these jurisdictions, the combined age-standardised notification rate ratio between Indigenous and non-Indigenous populations in 2015 was 2.8:1, which is slightly lower compared to the previous 5 years (range: 2.9 to 3.2).

Among the Indigenous population, the age-standardised notification rate for the 4 states and territories with more than 50% Indigenous status completeness declined from 1,455.8 per 100,000 in 2011 to 1,288.6 per 100,000 in 2015. This followed a slight increase from 1,430.3 per 100,000 in 2010 to 1,455.8 per 100,000 in 2011.

Age-standardised notification rates among the non-Indigenous population increased overall from 364.2 per 100,000 in 2010 to 392.5 per 100,000 in 2015.

Between 2014 and 2015, age-standardised notification rates for chlamydial infection in the Indigenous population decreased by 17% in South Australia (1,020.6 to 852.0 per 100,000), by 7% in Western Australia (1,326.3 to 1,232.5 per 100,000), and by 10% (1,864.8 to 1,680.5 per 100,000) in the Northern Territory. Conversely, rates increased in Queensland by 3% (1,192.1 to 1,230.9 per 100,000).

Between 2014 and 2015, age-standardised notification rates for chlamydial infection in the non-Indigenous population decreased by 1% (327.4 to 324.3 per 100,000) in South Australia, Western Australia (392.5 to 388.5) and Queensland (412.1 to 407.5 per 100,000), and by 8% in the Northern Territory (726.2 to 655.9 per 100,000) (Figure 36). ■

Donovanosis

- There were no cases of donovanosis notified in 2015.
- Donovanosis remains rare in Australia.

Donovanosis, caused by the bacterium *Klebsiella granulomatis*, is a chronic, progressively destructive infection that is primarily transmitted through sexual exposure. It affects the skin and mucous membranes of the external genitalia, inguinal and anal regions.[51] Once diagnosed, donovanosis is treated with a series of antibiotics.[52]

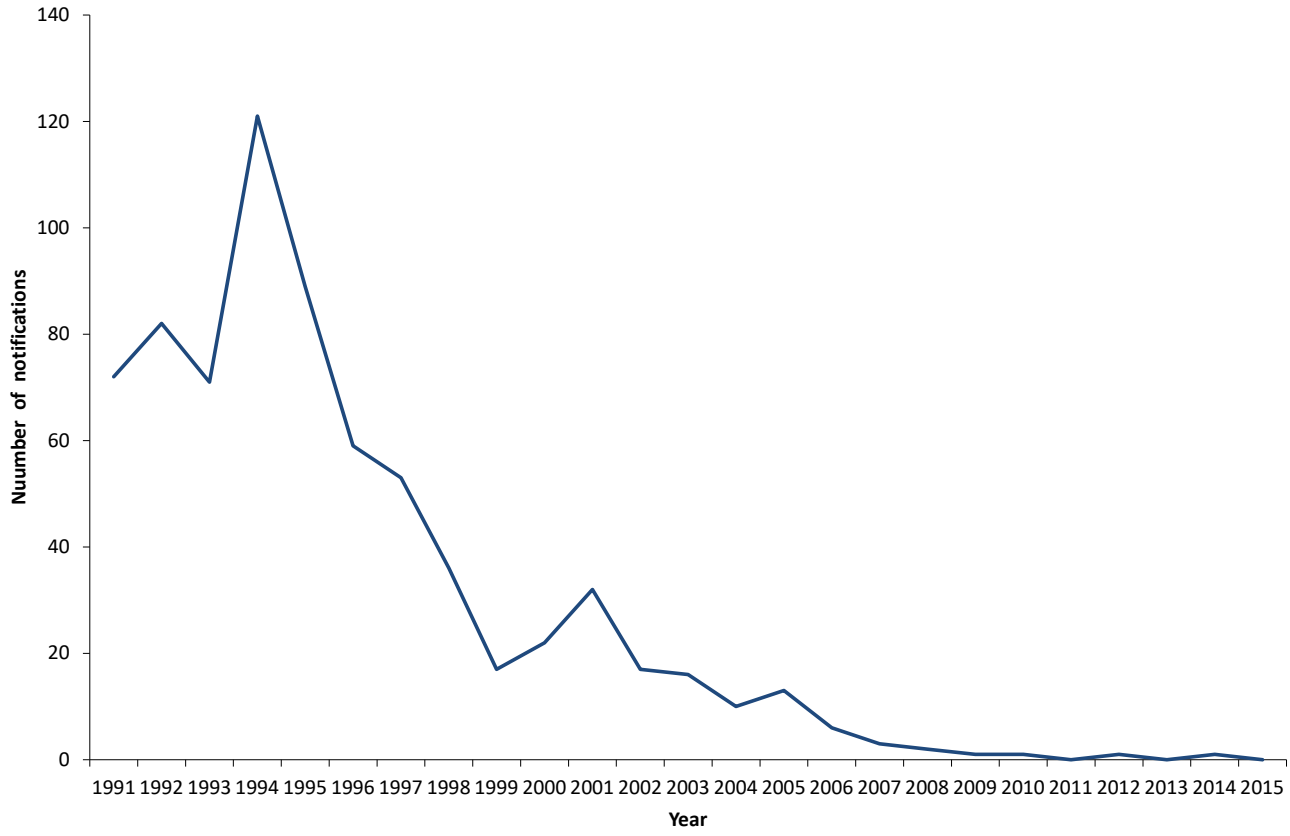
All donovanosis notifications in Australia since 1991 have been reported the Northern Territory, Western Australia or Queensland and have predominately occurred in Aboriginal and Torres Strait Islander people living in remote areas in northern and central Australia.

Donovanosis was targeted for elimination in Australia through the National Donovanosis Elimination Project 2001–2004.[53] It is now rare, with fewer than 17 cases notified each year since 2002, and fewer than 5 cases notified each year since 2007 (Figure 37).

Epidemiological situation in 2015

In 2015, no cases of donovanosis were notified in Australia (Figure 37). ■

Figure 37: Notified cases of donovanosis, Australia, 1991 to 2015, by year



Gonococcal infection

- There were 18,550 cases of gonococcal infection notified in 2015.
- Notification rates for gonococcal infection have continued to increase.
- Notifications occurred predominately in males aged 20–39 years.

Gonococcal infection is caused by the bacterium *Neisseria gonorrhoeae*, which affects the mucous membranes causing symptomatic and asymptomatic genital and extra-genital tract infections. The most common source of transmission is via unprotected sexual intercourse with an infected person.[21] If left untreated, it can lead to pelvic inflammatory disease in women and infertility in both men and women. Gonococcal infection also increases the risk of both acquisition and transmission of HIV.[51]

Epidemiological situation in 2015

In 2015, there were 18,550 notified cases of gonococcal infection, a notification rate of 78.0 per 100,000. This was a 16% increase compared with the rate reported in 2014 (67.0 per 100,000). In the past 6 years, gonococcal infection notification rates increased, on average, 11% each year since 2010 (range: 4% to 16%). Overall, gonococcal infection notification rates have increased by 66% from 2010 (46.9 per 100,000) to 2015 (78.0 per 100,000) (Figure 38). The increases in gonorrhoea notifications, particularly in females from 2012, is most likely due to the increased practice of dual testing for both chlamydia and gonorrhoea.[54]

Geographical distribution

In 2015, the notification rate for gonococcal infection was almost 10 times higher in the Northern Territory (749.3 per 100,000) compared to the national rate (78.0 per 100,000) (Figure 39).

Figure 38: Notifications and notification rate for gonococcal infection, Australia, 2010 to 2015, by year

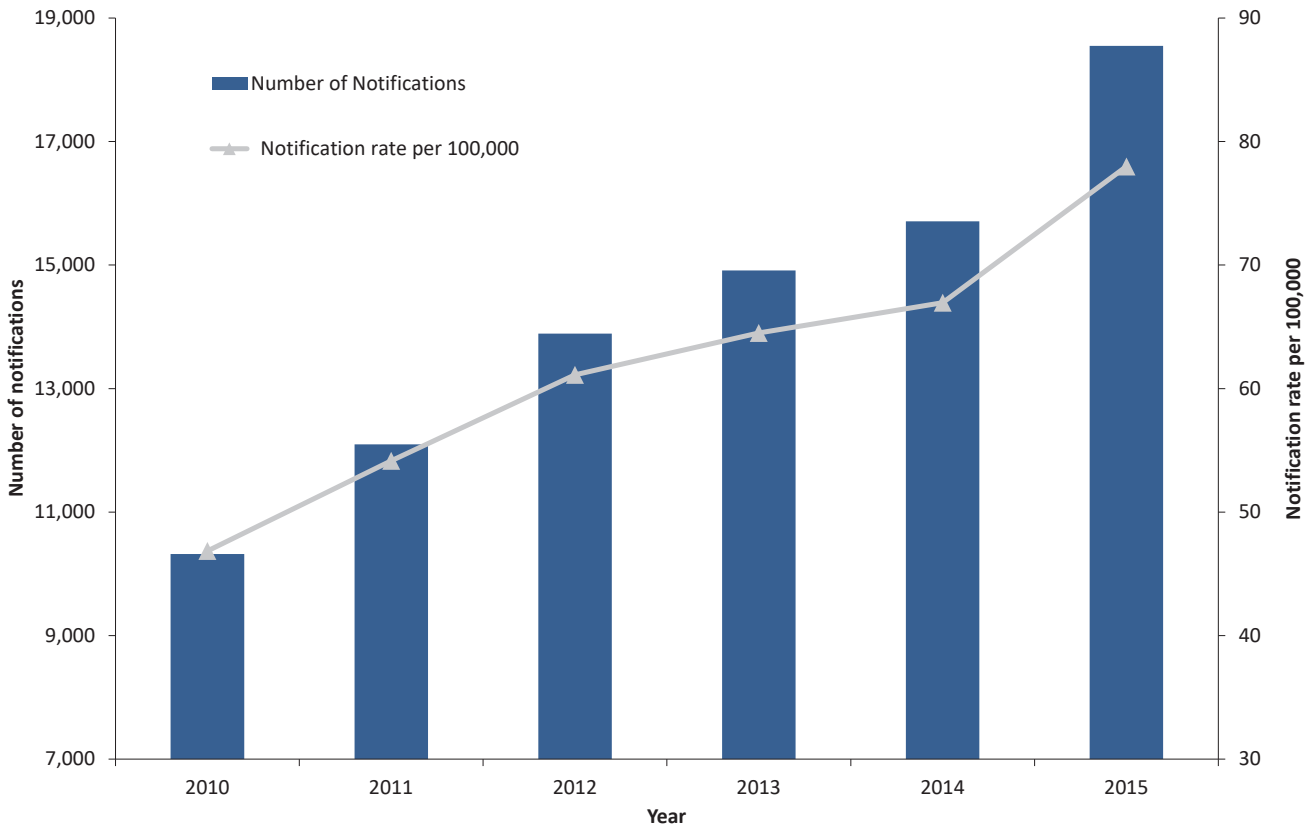
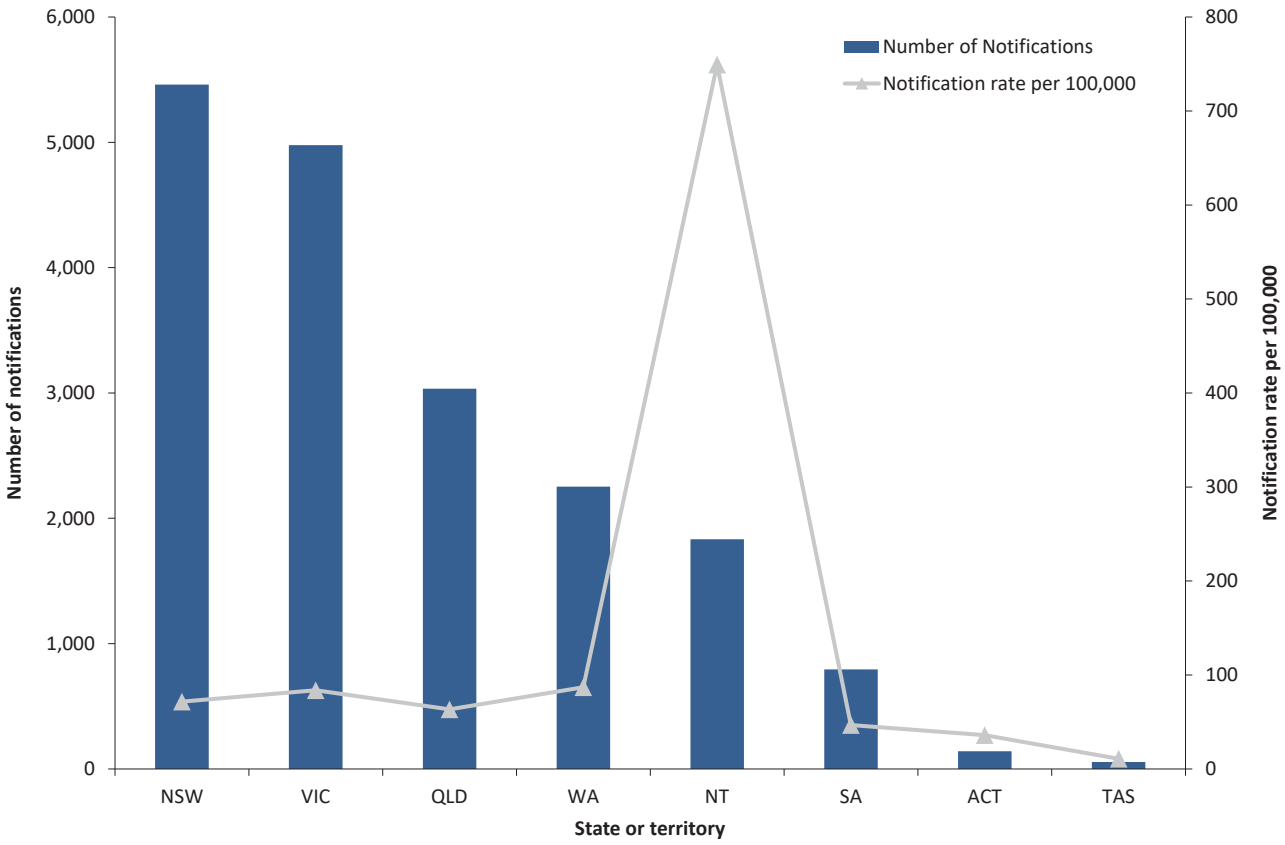


Figure 39: Notifications and notification rate for gonococcal infection, Australia, 2015, by state or territory



Age and sex distribution

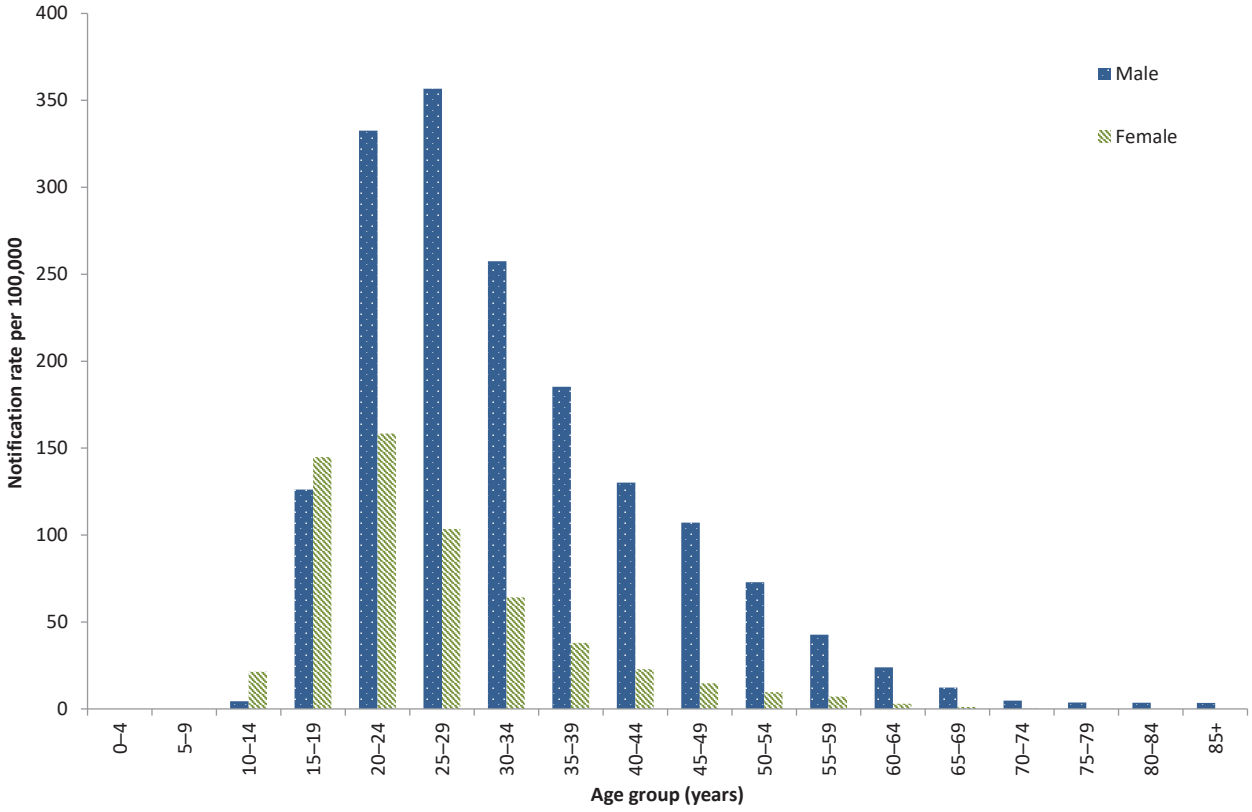
Nationally, the notification rate for gonococcal infection was 116.0 per 100,000 in males and 39.3 per 100,000 in females in 2015. Notification rates increased by 18% in males and 11% in females compared with 2014 (98.1 and 35.3 per 100,000 respectively). In 2015, 53% of all notifications occurred in males in the 20–39 years age group. Notification rates in males exceeded those in females across all age groups above 20 years (Figure 40). This was consistent with previous years when, with the exception of Indigenous people, notifications were largely reported in men who have sex with men (MSM).[55]

From 2010 to 2015, notification rates of gonococcal infection increased annually for males aged 20–49. The biggest overall increase was seen in the 30–34 years age group, with notification rates increasing by 121% (from 116.7 to 257.5 per 100,000), followed by the 45–49 years age group, with notification rates increasing by 119% (from 48.9 to 107.2 per 100,000). As with males, 2015 marked the highest notification rate reported for females, since gonococcal infection first became nationally notifiable in 1991. Females aged 15–19 years consistently had the highest rate between 2010 and 2014, however in 2015 females aged 20–24 years surpassed this age group (Figure 41).

Indigenous

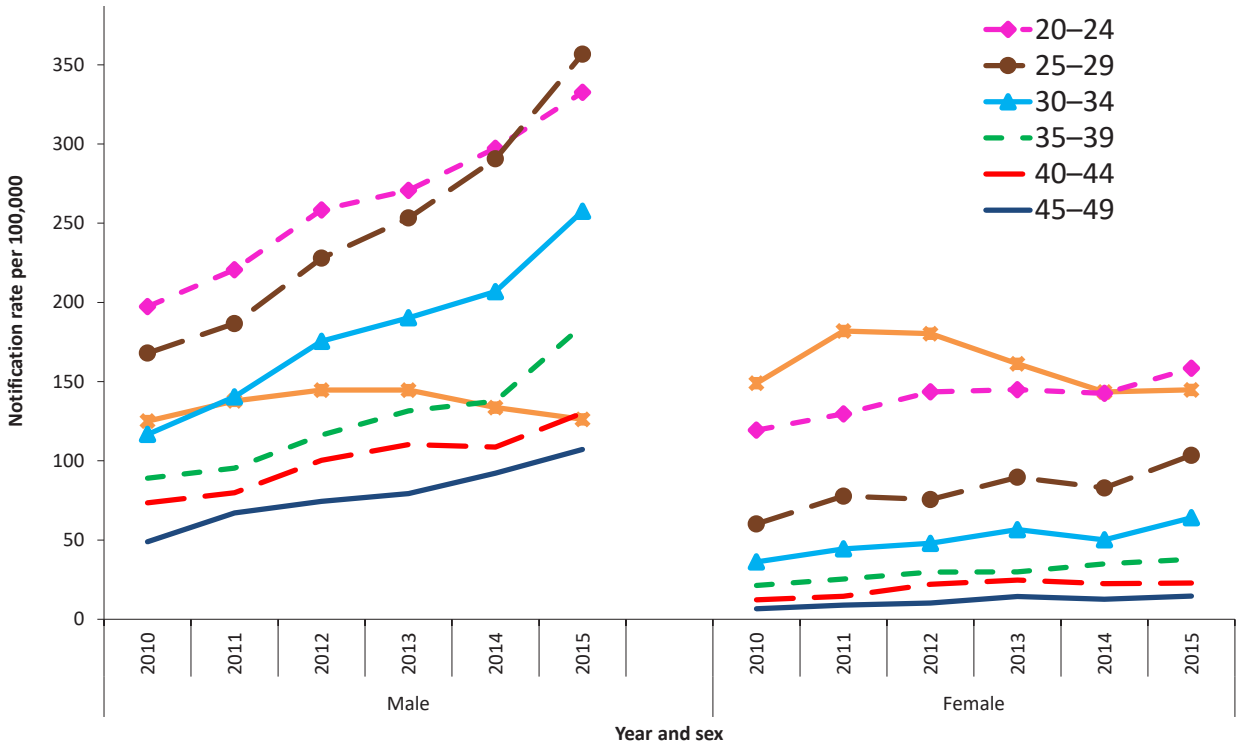
The completeness of Indigenous status identification in the notification data varies by year and by jurisdiction. Nationally in 2015, data on Indigenous status were complete for 64% of notifications, which was slightly lower than the preceding 5-year mean of 68% (range: 65% to 71%). All states and territories except New South Wales had greater than 50% completeness of the Indigenous status field across the 2010 to 2015 period. Among the states and territories with

Figure 40: Notification rate for gonococcal infection, Australia, 2015, by age group and sex



* Excludes notifications where age and/or sex were not reported and those less than 13 years of age.

Figure 41: Notification rate for gonococcal infection, Australia, 2010 to 2015, by year, sex and selected age groups*



* Excludes notifications where age and/or sex were not reported.

Figure 42: Age-standardised notification rates for gonococcal infection, selected states and territories,* 2010 to 2015, by Indigenous status and year

* Includes the states and territories where Indigenous status was reported for more than 50% of cases between 2010 and 2015: the Australian Capital Territory, the Northern Territory, Queensland, South Australia, Tasmania, Victoria and Western Australia.

greater than 50% completeness, the combined age-standardised notification rate ratio between Indigenous and non-Indigenous populations in 2015 was 10.0:1.0, decreasing from 13.1:1.0 in 2014. Overall, the rate ratio has declined by 63% from 2010 to 2015 (from 26.6:1.0 to 10.0:1.0).

Among the Indigenous population, the age-standardised notification rate decreased by 2% from 2014 to 2015 (from 630.5 to 617.4 per 100,000 respectively). From 2010 to 2015, the age-standardised Indigenous rate declined by 19% from 762.0 per 100,000 to 617.4 per 100,000.

Among the non-Indigenous population, the age-standardised notification rate increased by 116% from 2010 to 2015 (28.6 and 61.9 per 100,000 respectively).

Among the states and territories in which Indigenous status was more than 50% complete, age-standardised notification rates for gonococcal infection in the Indigenous population between 2014 and 2015 decreased in South Australia by 11% (from 543.7 to 485.1 per 100,000), in Victoria by 22% (from 87.6 to 68.1 per 100,000) in Western Australia by 17% (from 850.5 to 709.0 per 100,000); and increased in the Northern Territory by 4% (from 1,722.6 to 1,790.0 per 100,000) in Queensland by 8% (from 301.3 to 325.9 per 100,000) and in the Australian Capital Territory by 232% (from 13.1 to 43.6 per 100,000) (Figure 42).

Microbiological trends

The Australian Gonococcal Surveillance Program (AGSP) is the national surveillance system for monitoring the antimicrobial resist-

ance of *N. gonorrhoeae* isolates. These results are published in more detail in the AGSP annual report in CDI. At the time of writing, the 2015 AGSP annual report was in-press. Earlier AGSP annual and quarterly reports are available in the various editions of the CDI.

In 2015, the AGSP reported that a total of 5,411 gonococcal isolates were referred for antibiotic susceptibility testing, representing 28%* of gonococcal infections notified to the NNDSS. This was slightly lower than the proportion of NNDSS cases tested in 2014 (31%*, 4,804/15,728).

Eighty-three per cent of the isolates (n=4,505) were from males and 17% (n=900) were from females (M:F=5:1). There were 6 isolates for which gender was unknown. The proportion of gonococcal isolates from males and females tested by the AGSP has remained stable over recent years (2010–2015).

Current treatment recommendations for the majority of gonococcal infections in Australia are for a dual therapeutic strategy of ceftriaxone and azithromycin.[56] Decreased susceptibility to ceftriaxone (minimum inhibitory concentration (MIC) value 0.06–0.125 mg/L) was found nationally in 1.8% of isolates, lower than that reported in the AGSP Annual Report 2014 (5.4%). The highest proportions were reported from South Australia and New South Wales (3.6% and 2.7% respectively). High-level resistance to azithromycin (MIC value ≥256 mg/L) was again reported in 2015, one strain in New South Wales and one in urban Western Australia. There was no reported azithromycin resistance in the Australian Capital Territory, the Northern Territory, or remote Western Australia. ■

*The denominator (gonorrhoea notifications reported to NNDSS) used to calculate proportions of isolates tested may differ from reported notifications in this report due to data being extracted at different points in time.

Syphilis (non-congenital categories)

- There were 4,652 cases of syphilis (non-congenital categories) notified in 2015, a notification rate of 19.6 per 100,000.
- Cases of non-congenital syphilis were more frequently reported in MSM.

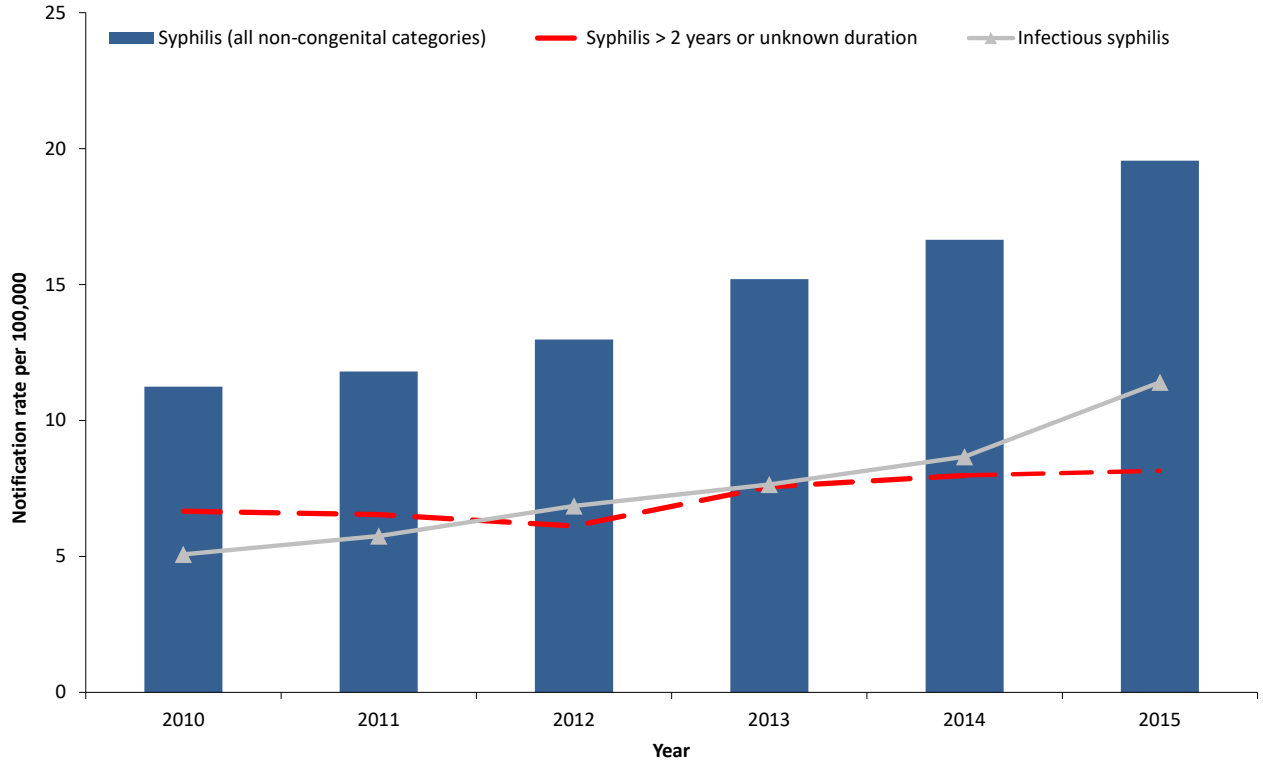
Syphilis is a sexually transmitted infection caused by the bacterium *Treponema palladium*. Infection is characterised by a primary lesion, a secondary eruption involving skin and mucous membranes, long periods of latency and late lesions of skin, bone, viscera, cardiovascular and nervous systems.[21]

In 2004, all jurisdictions except South Australia began reporting non-congenital syphilis infections to the NNDSS separately categorised as: infectious syphilis (primary, secondary or early latent) of less than 2 years duration; and syphilis of more than 2 years or unknown duration. From 2004 to 2011, South Australia reported only cases of infectious syphilis; it then commenced reporting syphilis of more than 2 years or unknown duration in 2012.

Epidemiological situation in 2015

In 2015, a total of 4,652 cases of syphilis (non-congenital) were reported to the NNDSS. This represented a rate of 19.6 per 100,000, a 17% increase compared with 2014 (16.6 per 100,000) (Figure 43). In 2015, 42% of syphilis notifications were categorised as greater than 2 years or unknown duration, and 58% of cases were categorised as infectious syphilis. ■

Figure 43: Notification rate for non-congenital syphilis infection (all categories),† Australia, 2010 to 2015, by category and year



† For syphilis of more than 2 years or unknown duration, excludes South Australia from 2010–2011.

Syphilis – infectious (primary, secondary and early latent), less than 2 years duration

- There were 2,713 cases of infectious syphilis notified in 2015.
- Of all notifications, 79% occurred in males aged 20–54 years, indicating transmission through male-to-male sex.
- Notifications continued to increase in Aboriginal and Torres Strait Islander people due to the ongoing outbreak in northern Australia.

Epidemiological situation in 2015

In 2015, 2,713 notified cases of infectious syphilis of less than 2 years duration were reported to the NNDSS, representing a rate of 11.4 per 100,000. This was a 17% increase compared with the rate reported in 2014 (8.7 per 100,000), and a 74% increase from 2010 (5.1 per 100,000) to 2015 (Table 5).

In 2015, the infectious syphilis case definition was changed to include both probable and confirmed infectious syphilis cases.[57] Of the cases notified in 2015, 9% (n=245) were reported as probable.

Geographical distribution

In 2015, notification rates for infectious syphilis were highest in the Northern Territory (82.6 per 100,000), followed by Victoria (15.7 per 100,000) and Queensland (11.9 per 100,000) (Table 5). This probably reflects the on-going outbreaks in Indigenous people in the Northern Territory and Queensland, and MSM in Victoria.[58,59]

Age and sex distribution

Nationally, the notification rate for infectious syphilis was 20.5 per 100,000 in males and 2.4 per 100,000 in females in 2015, a male to female rate ratio of 8.5:1, which was consistent with previous years. In males, rates increased by 30% compared with 2014 (16.0 per 100,000). The notification rate for females in 2015 increased by 71% compared with 2014 (1.0 per 100,000). In 2015, 79% (2,137/2,713) of all notifications occurred in males aged 20–54 years (Figure 44).

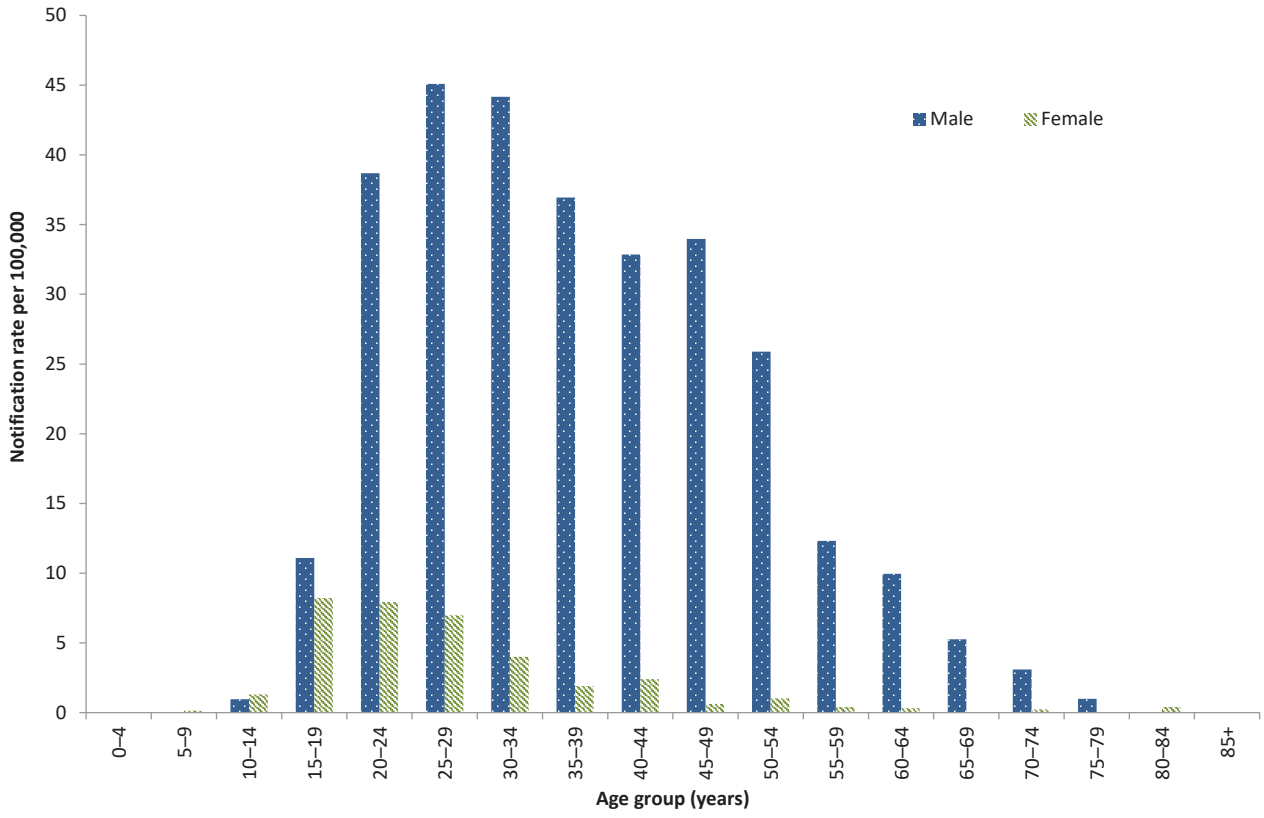
Notification rates for males aged 15 years or over increased overall from 2010 to 2015 for all age groups. For the majority of age groups, rates were at their lowest in 2010, after which rates steadily increased and reached maximum values for the period in 2015 (Figure 45). The greatest increases among females aged 15 years or over were within the 15–34 years age groups (Figure 14).

Indigenous

The completeness of Indigenous status identification in the notification data varies by year and jurisdiction. Nationally in 2015, data on Indigenous status were complete for 91% of notifications of infectious syphilis, decreasing by 1% since 2014, compared to the preceding 5-year mean of 94% (range: 91% to 96%). All states and territories had greater than 50% completeness of the Indigenous status field across the 2010 to 2015 period.

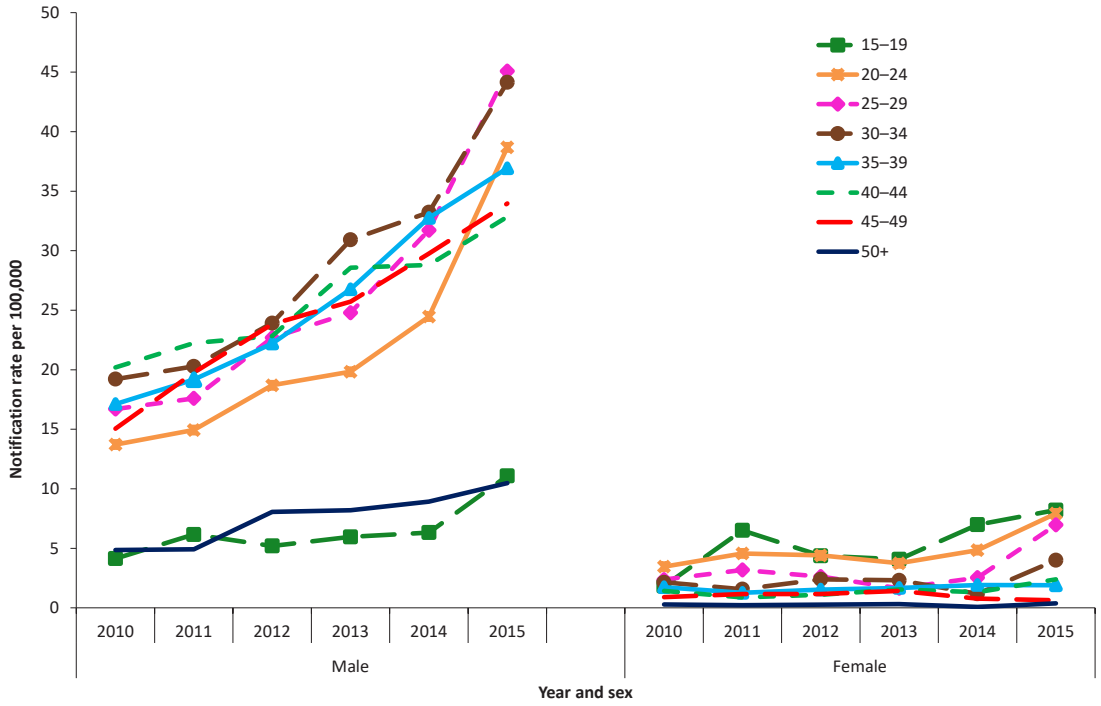
In 2015, where rates were calculated for Indigenous and non-Indigenous people, the age-standardised rates were higher for Indigenous people than non-Indigenous people in all jurisdictions, with the exception of New South Wales (Figure 46). For all states and territories, the combined age-standardised notification rate ratio between the Indigenous and non-Indigenous populations in 2015 was 6.2:1, which was higher than the preceding 5-year mean

Figure 44: Notification rate for infectious syphilis (primary, secondary and early latent), less than 2 years duration, Australia, 2015, by age group and sex*



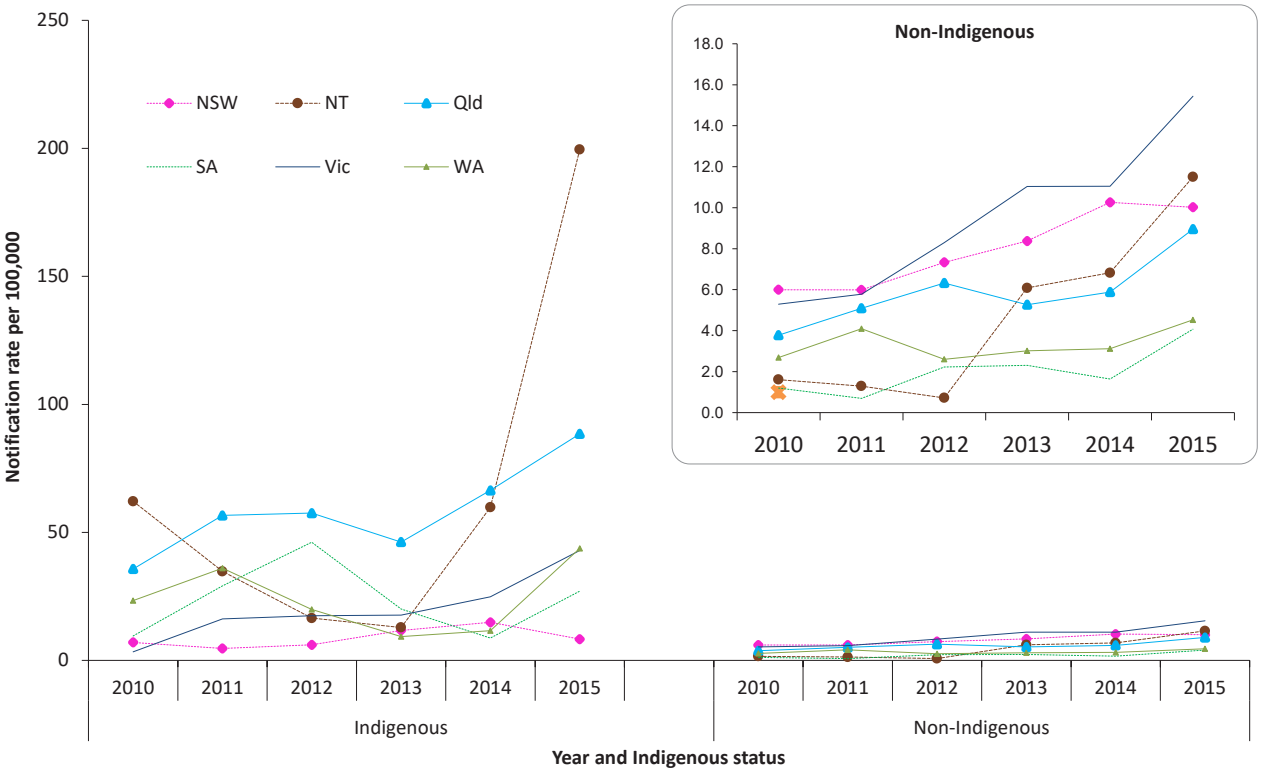
* Excludes notifications where age and/or sex were not reported and those less than 13 years of age.

Figure 45: Notification rate for infectious syphilis (primary, secondary and early latent), less than 2 years duration, Australia, 2010 to 2015, by year, sex and selected age groups*



* Excludes notifications where age and/or sex were not reported and those less than 13 years of age.

Figure 46: Age-standardised notification rate for infectious syphilis (primary, secondary and early latent), less than 2 years duration, selected states and territories,* 2010 to 2015, by Indigenous status and year



* All states and territories reported Indigenous status for more than 50% of notifications between 2010 and 2015. The Australian Capital Territory and Tasmania were excluded due to low numbers of notifications.

(4.6:1; range: 3.1 to 5.9). In 2015, for jurisdictions where cases were notified in both Indigenous and non-Indigenous people, the age-standardised notification rate ratio between Indigenous and non-Indigenous populations ranged from 0.8:1 in New South Wales to 17.3:1 in the Northern Territory. Between 2014 and 2015, the largest increase in the difference between Indigenous and non-Indigenous age-standardised notification rates was 161% in Western Australia (3.7 to 9.7 per 100,000). The only 2 jurisdictions where the difference between Indigenous and non-Indigenous age-standardised notification rates decreased from 2014 to 2015 were New South Wales (a decrease of 43%) and Queensland (a decrease of 12%).

An outbreak of infectious syphilis affecting largely young heterosexual Indigenous people in remote areas of Australia[5,12] was first reported in January 2011 in northern Queensland, followed by the Northern Territory in July 2013[13,14], and the Kimberley region of Western Australia in June 2014. Increased transmission along with targeted and opportunistic syphilis screening in each of these jurisdictions is likely to have contributed to an increase in Indigenous age-standardised rates for Queensland, the Northern Territory, and Western Australia between 2011–2015.[60] Further information about the outbreak of infectious syphilis is available at: http://www.health.gov.au/internet/main/publishing.nsf/Content/ohp-infectious-syphilis-outbreak.htm ■

Syphilis of more than 2 years or unspecified duration

- There were 1,939 cases of syphilis of more than 2 years or unknown duration notified in 2015.
- In 2015, males aged 20 years and older accounted for 72% of all notifications, indicating transmission through male-to-male sex.

Epidemiological situation in 2015

In 2015, 1,939 cases of syphilis of more than 2 years or unknown duration were reported to the NNDSS. Notification rates increased by 22% between 2010 (6.7 per 100,000) and 2015 (8.2 per 100,000), and increased by 2% between 2014 (8.0 per 100,000) and 2015 (Table 5). It is unknown whether this increase is due to increased testing in people or populations with no previous testing history or an actual increase in the number of people with non-infectious syphilis.

Geographical distribution

In 2015, notification rates for syphilis of more than 2 years or unknown duration were highest in the Northern Territory (31.1 per 100,000), followed by Victoria (12.3 per 100,000) (Table 5). Similar to infectious syphilis, this geographical distribution likely reflects the large proportions of at-risk individuals living in these jurisdictions (Indigenous people in the Northern Territory and MSM in Victoria).[58, 59]

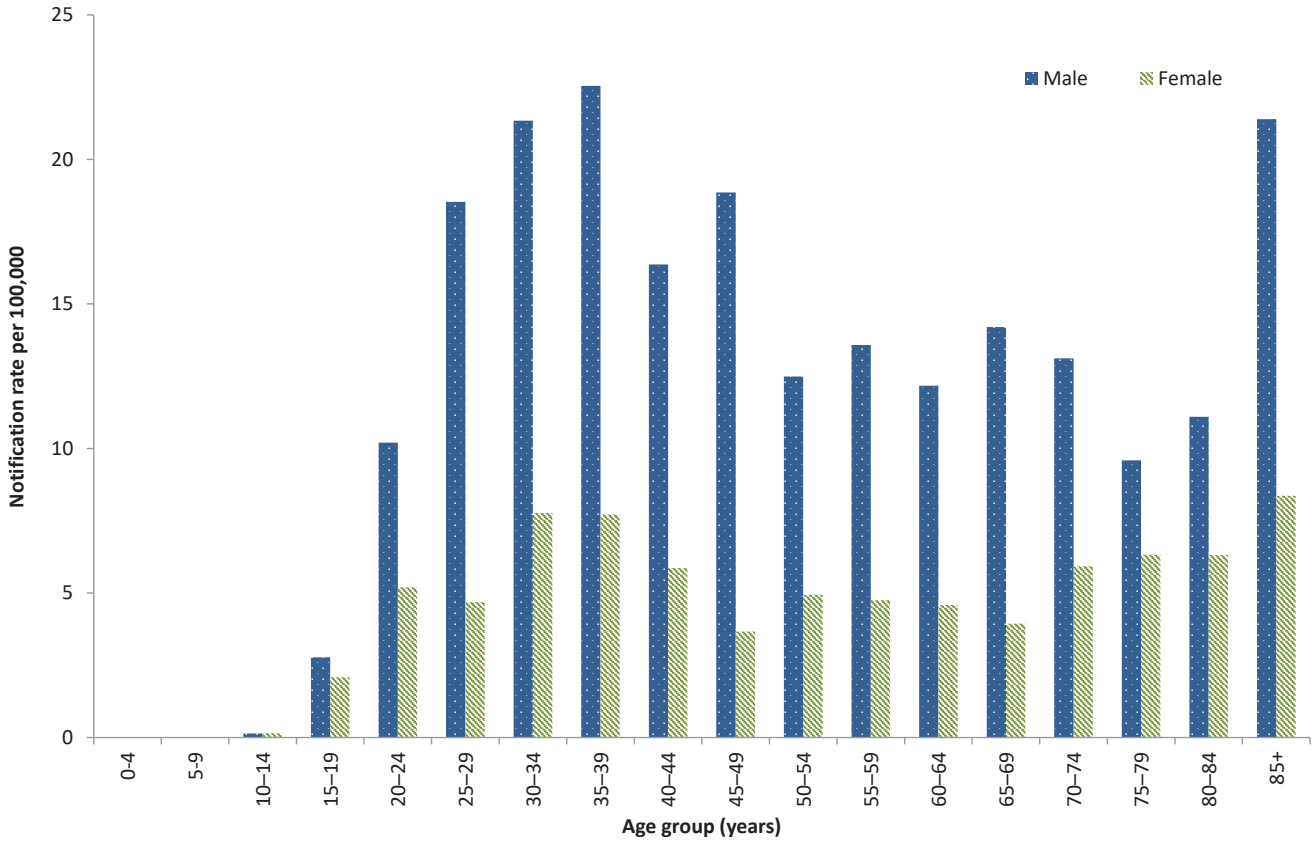
Age and sex distribution

Nationally, the notification rate for syphilis of more than 2 years or unknown duration was 11.9 per 100,000 in males and 4.4 per 100,000 in females in 2015, a male to female rate ratio of 2.7:1. Between 2014 and 2015, the notification rate in males decreased by 2% (12.2 to 11.9 per 100,000) but increased by 3% (4.2 to 4.4 per

100,000) in females. In 2015, approximately 72% (1,389/1,932) of all notifications for which sex was reported, occurred in males aged 20 years or over (Figure 47).

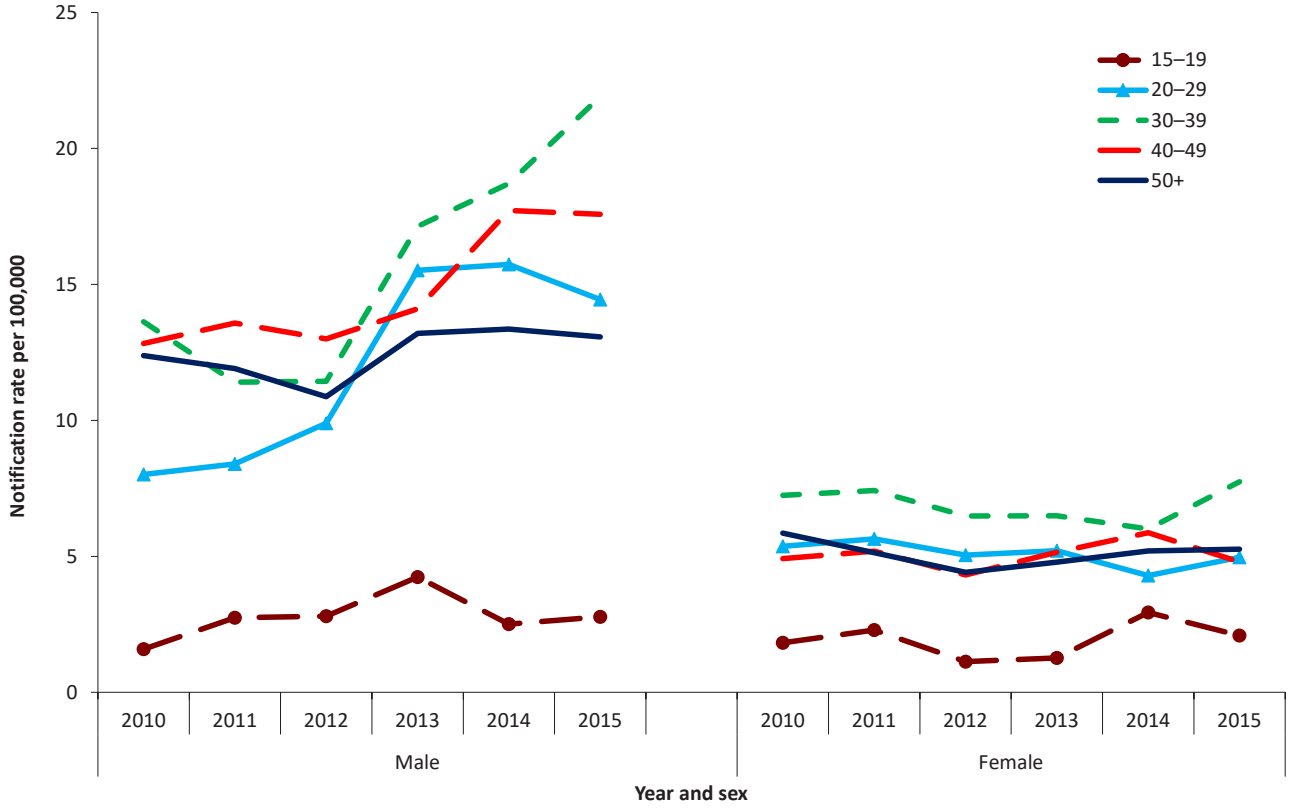
Notification rates in males for all age groups except the 15–19 years age group increased overall from 2010 to 2015 (Figure 48). This increase is particularly prominent from 2012 to 2015 in the 30–39 years age group. Notification rates in females for all age groups except the 15–19 years age group and the 30–39 years age group declined overall from 2010 to 2015 (Figure 48). Notification rates in males in the 15–19 years age group were lower than those of the other age groups and fluctuated across the time period. Notification rates in females in the 15–19 years age group were also lower than those of the other age groups with an increasing trend from 2012 to 2014 (Figure 48). ■

Figure 47: Notification rate for syphilis of more than 2 years or unknown duration,* Australia, 2015, by age group and sex



* Excludes notifications where age and/or sex were not reported and notifications where the case was aged less than 13 years.

Figure 48: Notification rate for syphilis of more than 2 years or unknown duration, Australia,* 2010 to 2015, by year, sex and selected age groups†



* Data from all states and territories except South Australia in 2010–2011.

† Excludes notifications where age and/or sex were not reported and those aged less than 15 years (51 notifications).

Congenital syphilis

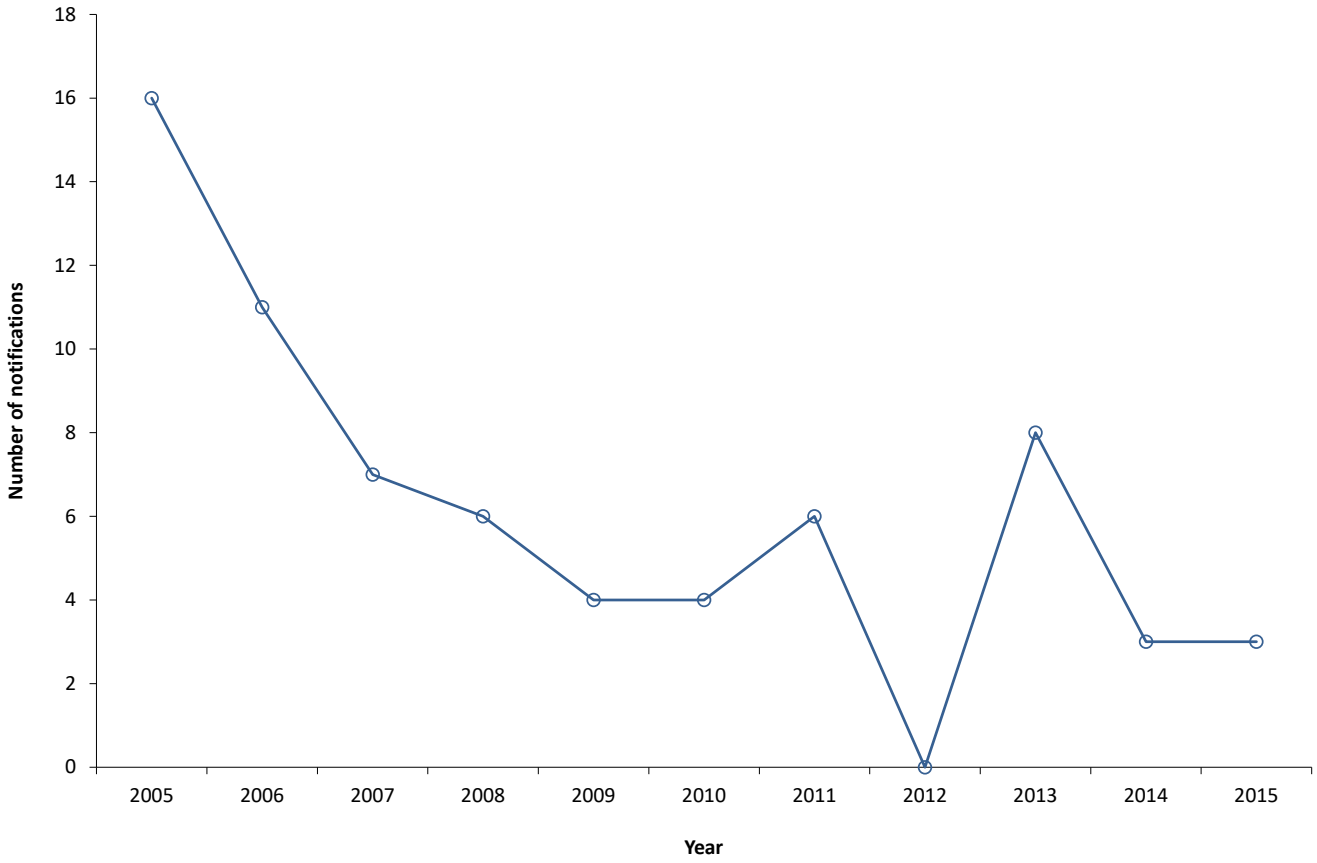
- In 2015, 3 cases of congenital syphilis were notified to the NNDSS.
- Congenital syphilis remains rare in Australia.

Congenital syphilis is caused by fetal infection with the bacterium *T. pallidum*. Syphilis is acquired by infants either in utero or at birth from women with untreated early infection. Infection commonly results in abortion or stillbirth and may cause the death of a new-born infant. Congenital syphilis can be asymptomatic, especially in the first weeks of life.[21]

Epidemiological situation in 2015

Three notifications of congenital syphilis were reported in 2015: 2 cases were reported in Indigenous people and were associated with the infectious syphilis outbreak in northern Australia, and; 1 case was reported in a non-Indigenous person. Eight of the 20 congenital syphilis cases reported since 1 January 2011 were associated with the infectious syphilis outbreak in northern Australia. This reflects the increased risk to neonates and mothers that outbreak situations pose.[15,16] Despite recent increases, the overall case numbers remain low (Figure 49). Routine antenatal screening for syphilis with follow-up and adequate treatment is considered to be a contributor to historical declines and sustained low case numbers.[61] Congenital syphilis, particularly in Indigenous people, is targeted for elimination. This target is stated in the 4th National Aboriginal and Torres Strait Islander Blood-borne Viruses and Sexually Transmissible Infections Strategy and the third National Sexually Transmissible Infections Strategy, both for 2014–2017.[62,63] ■

Figure 49: Notifications of congenital syphilis, Australia, 2005 to 2015



VACCINE PREVENTABLE DISEASES

This section summarises the national surveillance data for notifiable diseases targeted by the National Immunisation Program (NIP) in 2015. These include diphtheria, invasive *Haemophilus influenzae* type b infection, laboratory confirmed influenza, measles, mumps, pertussis, invasive pneumococcal disease, poliomyelitis, rubella, congenital rubella, tetanus and varicella zoster infections (unspecified, chickenpox and shingles). Data on hepatitis B and invasive meningococcal disease, which are also targeted by the NIP, can be found in this report under 'Bloodborne diseases' and 'Other bacterial infections' respectively. Other vaccine preventable diseases (VPDs) presented in this report include hepatitis A and Q fever, which can be found in the 'Gastrointestinal' and 'Zoonoses' sections respectively. For more detailed reports on historical data including notifications, hospitalisations and deaths, readers are referred to the journal supplements 'Vaccine Preventable Diseases in Australia' and the 'Australian Vaccine Preventable Diseases Epidemiological Review Series' for additional analysis of individual diseases, which are published in CDI.

In 2015, there were 147,569 VPD notifications reported to the NNDSS, representing 46% of all disease notifications and a 46% increase compared with 2014 (n=101,337). Influenza was the most commonly notified VPD, with 100,583 cases (68%) of total VPD notifications, followed by pertussis (15%, n=22,546). The number of notifications and notification rates for VPDs in Australia are shown in Table 4, Table 5 and Table 6.

Immunisation coverage is an important factor influencing the incidence of VPDs. Since the commencement of the Australian Childhood Immunisation Register in 1996, immunisation coverage of children has been high by international standards, although geographical pockets of lower coverage in which there is an increased potential for VPD cases still remain. As no vaccine is 100% effective, infections with these diseases sometimes do occur in fully vaccinated people. However, evidence shows vaccines do provide a substantially lower chance of developing infection or can reduce the severity of disease.[64,65,66,67,68]

Information on a case's immunisation history was previously recorded in the NNDSS using the 'immunisation status' field (fully or partially vaccinated for age, or unvaccinated), plus fields capturing the number of doses, the last immunisation date and how the immunisation information was validated. In January 2008, new more detailed fields were incorporated for recording 'vaccine type' and 'immunisation date' for each dose of vaccine given. The new fields were intended to replace the old fields, with a transition period allowing either field to be utilised. In this report the immunisation status of a case is interpreted according to the data provided by the states and territories from 2 different formats. A case is described as fully vaccinated if the person has received all doses of the relevant vaccine according to the most recent edition of *The Australian Immunisation Handbook* and at least 14 days prior to disease onset.

Diphtheria

- There were 2 cases of diphtheria notified in 2015, of which 1 was acquired in Australia and the other in the Solomon Islands.
- Diphtheria is rare in Australia.
- Immunisation against diphtheria provides prolonged but not lifelong protection against infection.

Diphtheria is an acute pharyngeal or cutaneous infection caused mainly by toxigenic strains of *Corynebacterium diphtheriae*. The exotoxin acts locally on the mucous membranes of the respiratory tract, and on damaged skin, although this is not as common. Disease is mainly due to local membranous inflammation, which for pharyngeal diphtheria can cause airway

obstruction. Occasionally systemic infections occur and cause damage to the myocardium, nervous system and kidneys. Diphtheria is spread by respiratory droplets or direct contact with nasopharyngeal secretions or skin lesions. While there are non-toxigenic strains of *C. diphtheriae*, they usually only cause mild throat or skin infection and are not nationally notifiable.[21]

Epidemiological situation in 2015

In 2015, there were 2 notifications[ii] of diphtheria reported. Both cases were reported in Queensland 1 case was a cutaneous infection from *C. diphtheria*, partially vaccinated and imported from the Solomon Islands; and the other was a pharyngeal infection from *C. ulcerans*, of unknown immunisation status and locally acquired in Australia.

Diphtheria is rare in Australia, with most cases associated with sporadic importations from countries in which the disease remains endemic. From 2001 to 2014, there were 10 cases of diphtheria reported to the NNDSS, including one case in 2001, a cluster of 3 cases and a sporadic case in 2011, 3 cases in 2013 and 2 cases in 2014. Of these, 7 were imported, 2 were linked to an imported case and the place of acquisition for one was unknown. ■

ii This number may underrepresent the number of diphtheria cases in Australia due to a change in the national case definition for this disease. In mid-2013, the national case definition for diphtheria was revised, requiring clinical and laboratory evidence for confirmed cases. This change may have inadvertently excluded the notification of some cases of cutaneous toxigenic diphtheria, as cutaneous presentations were not listed as clinical evidence in the revised definition.

Haemophilus influenzae type b (invasive)

- There were 16 cases of invasive *Haemophilus influenzae* type b (Hib) reported in 2015.
- Of the cases reported, 63% were male and 8 were under the age of 15 years (50%).

Haemophilus influenza type b (Hib) is a gram negative bacterium that causes disease, with symptoms dependent on which part of the body is affected. Clinical categories of invasive disease caused by Hib include septicaemia (infection of the blood stream), meningitis (infection of the membranes around the brain and spinal cord), epiglottitis (severe swelling of the epiglottis at the back of the throat) and a range of other infections. Hib is mostly carried as a commensal organism (present without causing symptoms) in the nasopharynx of healthy individuals and is spread by respiratory secretions, including aerosol transmission or contact with articles soiled with discharges from the nose or throat.[69] The case fatality rate of Hib meningitis is at least 3% in developed countries, even with treatment. Approximately 15% to 30% of survivors have permanent neurological sequelae.[70]

Epidemiological situation in 2015

In 2015, there were 16 notifications of invasive Hib infection in Australia. This was a 23% decrease in the number of cases notified compared with 2014 (n=21), and represented a ratio of 0.9 compared with the mean of the previous 5 years. The notification rate in 2015 was 0.1 per 100,000, consistent with the very low rates seen since the introduction of the vaccine on the NIP in July 1993 (Figure 50). Cases occurred in 5 states or territories, with 5 cases each reported in Queensland and New South Wales, and 2 cases each in Victoria, the Northern Territory and Western Australia. Notification rates between states and territories ranged from

Figure 50: Notifications and notification rate for invasive *Haemophilus influenzae* type b, Australia, 1994 to 2015, by year

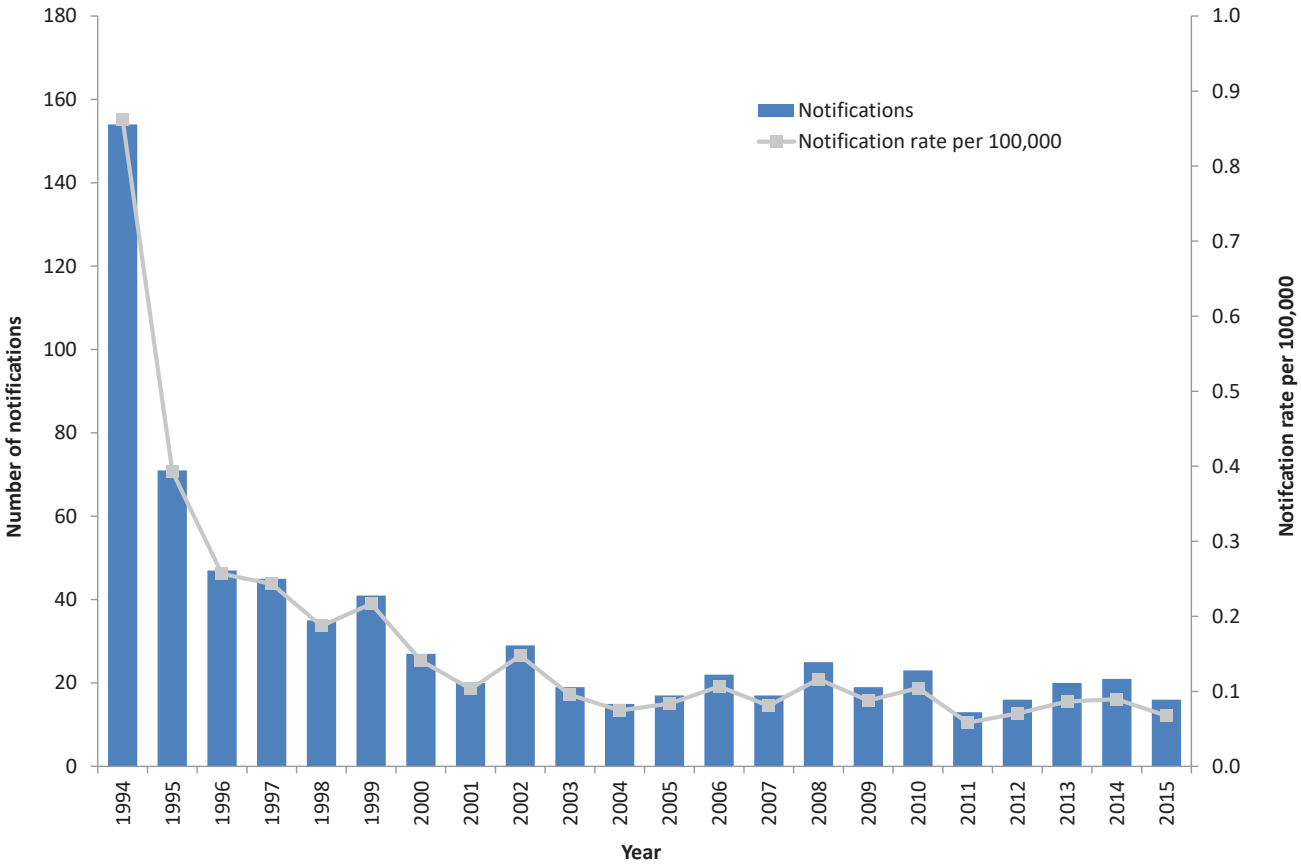
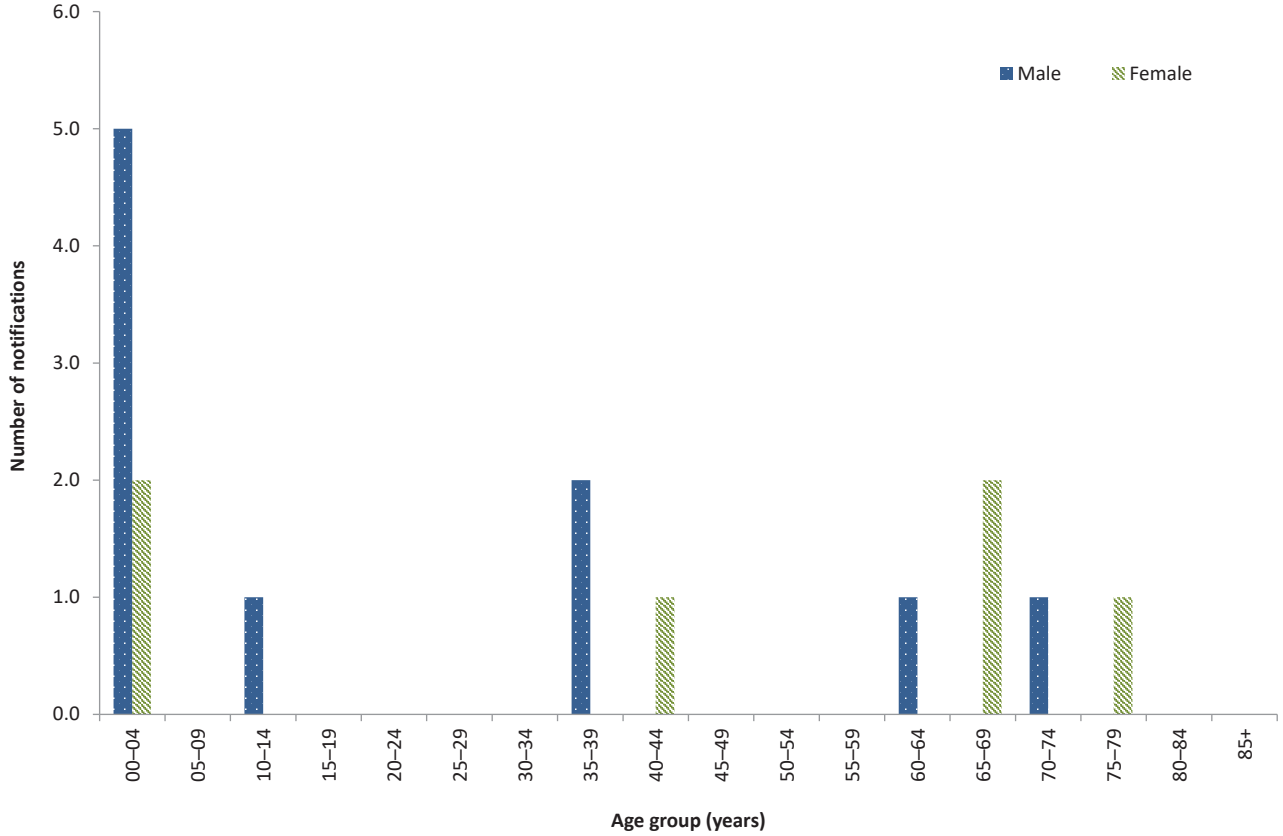


Figure 51: Notifications for invasive *Haemophilus influenzae* type b infection, Australia, 2015, by age group and sex



0.03 per 100,000 in Victoria to 0.8 per 100,000 in the Northern Territory. There were no Hib associated deaths reported in 2015.

Age and sex distribution

Over half of notified invasive Hib cases in 2015 were male (63%, n=10). Fifty per cent of cases (n=8) were in children aged less than 15 years, of which 63% (n=5) were among infants less than 1 year of age (Figure 51). Consistent with previous years, the 0–4 years age group had the highest notification rate at 0.5 per 100,000.

Indigenous Status

Indigenous status was reported for all notified invasive Hib cases in 2015. Three cases were reported as Indigenous Australians, representing a notification rate of 0.5 per 100,000. This rate is lower than in 2014 (0.8 per 100,000) but the same as in 2013 and 2012 (0.5 per 100,000).

Immunisation status

In 2015, people less than 23 years of age were eligible for Hib immunisation under the NIP during their infancy. Of the 16 Hib cases reported in 2015, eight were eligible for immunisation. Three of these cases were 12 months of age or older, and therefore eligible for the full primary vaccine course and the booster. Of these, one case received the full primary course and 2 were reported as unvaccinated. The remaining 5 cases eligible for immunisation were less than 12 months of age, of whom 4 were reported as fully vaccinated for age and 1 was partially vaccinated for age. ■

Influenza (laboratory confirmed)

- The seasonal peak, as well as the total number of notifications of laboratory confirmed influenza reported for 2015 was higher than in previous years, including notifications reported during the 2009 influenza pandemic.
- Influenza notifications during the 2014–15 inter-seasonal period (December to March) were also the highest on record.
- Nationally, influenza B was the predominant influenza virus type in circulation, with distribution relatively similar across jurisdictions.
- Where subtype information was available, influenza A(H3N2) was the predominant influenza A subtype; however, the proportion of notifications attributed to influenza A(H3N2) and influenza A(H1N1)pdm09 varied across jurisdictions.

Influenza is a common, highly infectious acute respiratory disease caused by infection with influenza viruses. The virus is transmitted from person to person by airborne droplets of exhaled respiratory secretions, especially by coughing or sneezing.[71] The disease ranges from asymptomatic[72] through to mild upper respiratory tract illness, to severe complications including pneumonia. The severity of disease is determined by features intrinsic to the virus including its similarity to previous circulating and vaccine strains and by host factors including the age, level of immunity and presence of chronic medical conditions.[73,74]

Annual influenza immunisation is the primary means of preventing or attenuating influenza and its complications and is included in the NIP for individuals who are at increased risk of complications from influenza infection. In 2015, the NIP funded influenza immunisation for people

aged 6 months and over with medical conditions placing them at risk of serious complications due to influenza, Aboriginal and Torres Strait Islander people aged 6 months to 5 years and 15 years and over, pregnant women, and people aged 65 years and over.[29]

Epidemiological situation in 2015

In 2015, there were 100,583 notifications of laboratory confirmed influenza, almost 1.5 times the number of notified cases reported in 2014 (n=67,699) (Figure 52). The number of notifications recorded in 2015 is the highest on record and is 70% higher than in 2009 (n=59,023), the year of the last influenza pandemic.

Geographical distribution

Notification rates were highest in South Australia (921 per 100,000), and Queensland (587 per 100,000). Notifications rates in all other jurisdictions were lower than the national notification rate of 423 per 100,000. Jurisdictional-specific notification rates increased from 2014 to 2015, notably in Tasmania (112% increase), Victoria (72% increase) and New South Wales (43%).

New South Wales reported the highest number of influenza cases of any jurisdiction (n=30,303), comprising 30% of notifications nationally (Figure 53). The number of influenza cases in Queensland (n=28,056) accounted for almost 28% of notifications nationally.

Age and sex distribution

The highest number of influenza notifications occurred in the 0–4 years and 5–9 years age groups (n=10,987 and n=13,770, respectively), which together accounted for 25% of all notifications with ages attributed (Figure 54). This differed from 2014 notifications, in that fewer notifications were reported in the 5–9 years age group (n=4,291) than in the 0–4 years age group (n=5,715) during that year.

Notification rates were highest in the 5–9 years and over 85 years age groups (909 and

Figure 52: Notifications of laboratory confirmed influenza, Australia, 1 January 2010 to 31 December 2015, by week.

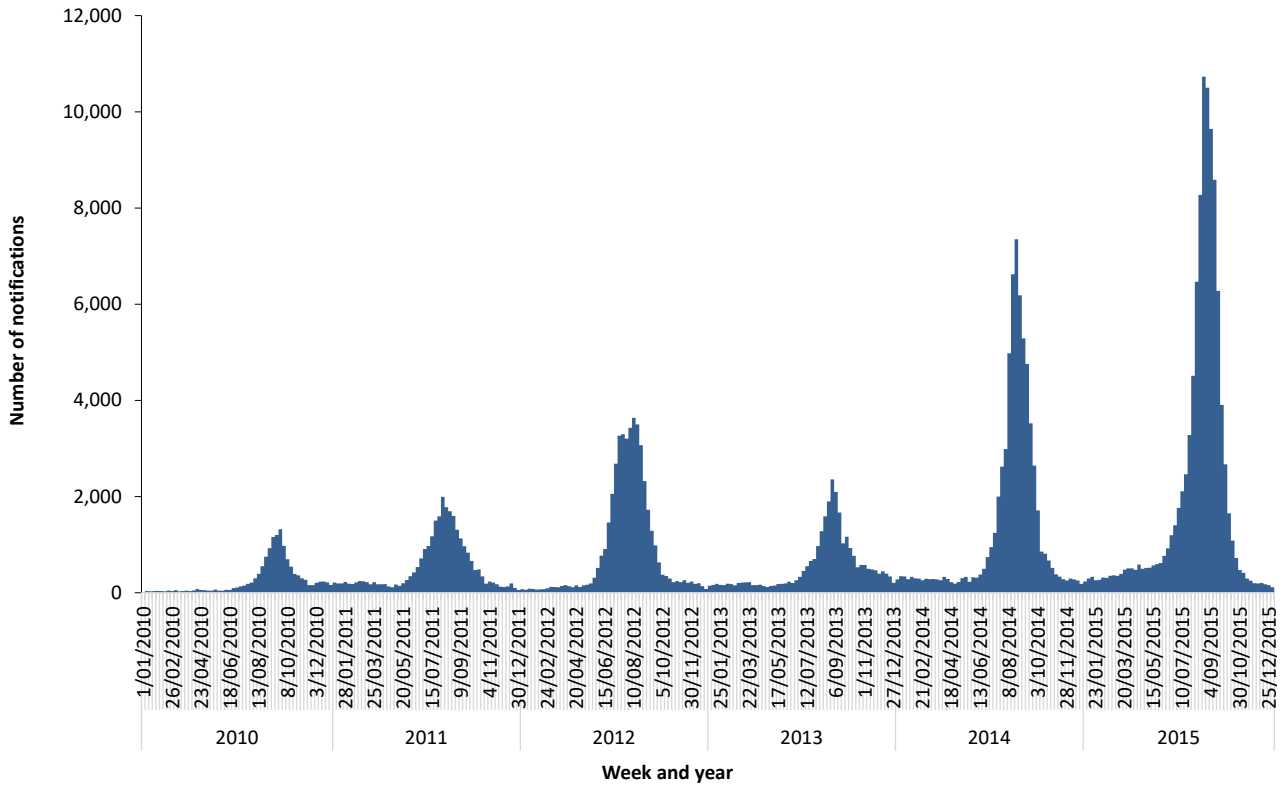


Figure 53: Notifications of laboratory confirmed influenza, Australia, 2015, by week and state or territory

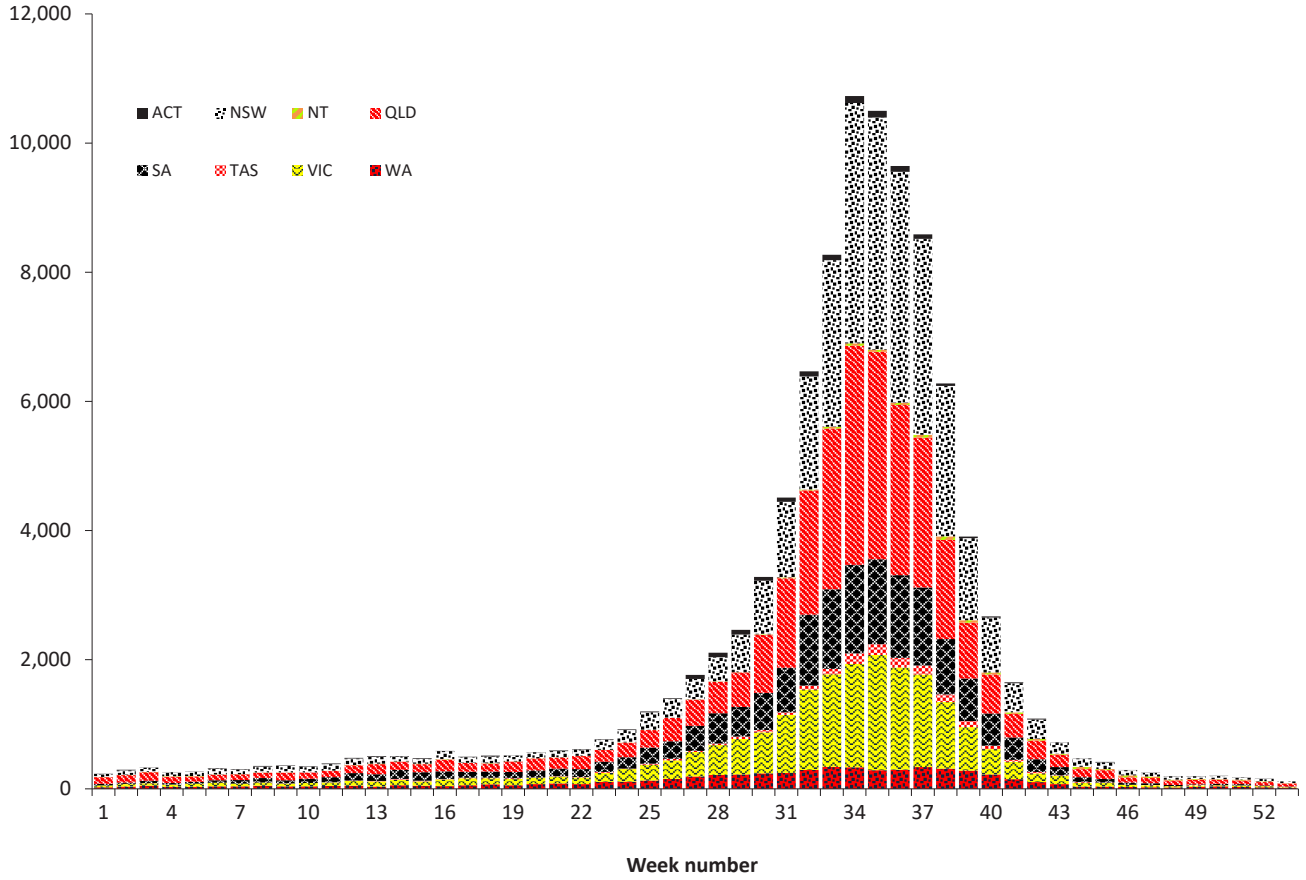
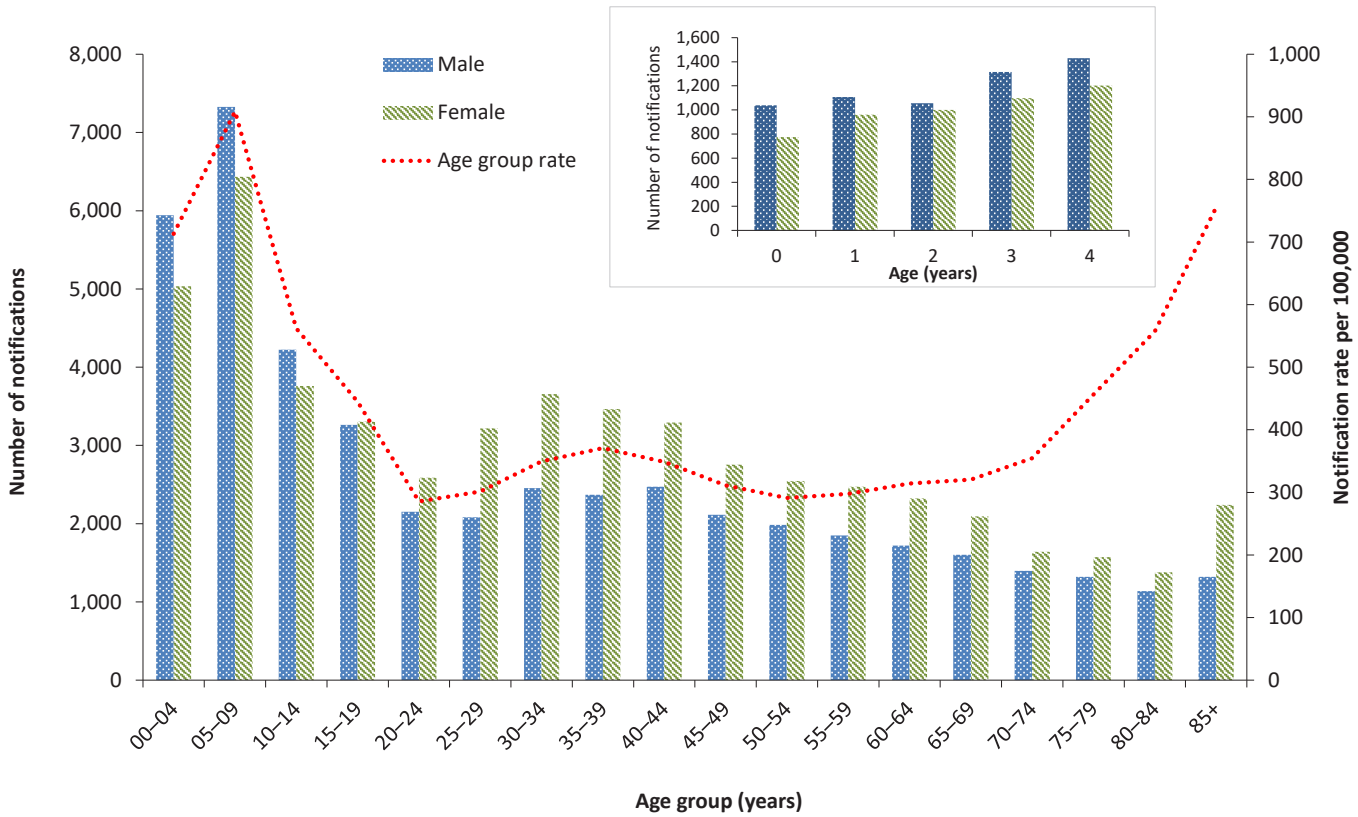


Figure 54: Notifications and notification rate for laboratory confirmed influenza, Australia, 2015, by age group and sex



755 notifications per 100,000, respectively (Figure 54), followed by the 0–4 years age group (713 notifications per 100,000).

In 2015, females accounted for 54% (n=53,778) of the influenza notifications for which sex was reported. The age-group-specific rate of influenza in males exceeded that in females in age groups less than 15 years and 80 years and over, while the rates in females in all other age groups exceeded those in males.

Influenza types and subtypes affect different age profiles, with the predominant virus in circulation influencing the age distribution of influenza notification rates. For example, in seasons dominated by the influenza A(H1N1) pdm09 virus, such as 2010 and 2011, the age distribution of influenza notification rates showed a downward trend with increasing age (Figure 55). For comparison, in 2012, which was dominated by influenza A(H3N2), the age distribution of influenza notifications was bimodal, with peaks in those aged under 10 years and in those aged 70 years and over. In 2015, the influenza season was bimodal in distribution, with peaks in the 5–9 years and 85 years and over age groups.

Seasonality

Influenza notifications during the 2014–15 inter-seasonal period (December to March) were the highest on record, with an average of 1,423 notifications per month, slightly higher than in the same period in 2013–14 (n=1,333). Queensland reported the largest number of inter-seasonal influenza notifications (n=1,777), followed by New South Wales (n=1,326). It is unclear whether this is a reflection of a higher prevalence of influenza circulating in the community at this time, an increased rate of testing or another factor.

The seasonal increase of influenza notifications in 2015 started in June, rose sharply and peaked in August, similar in pattern to the 2014 influenza season (Figure 56). The 2015 peak was higher than in previous years. The majority of activity in the jurisdictions peaked around late

Figure 55: Notification rate for laboratory confirmed influenza, Australia, 2010 to 2015, by age

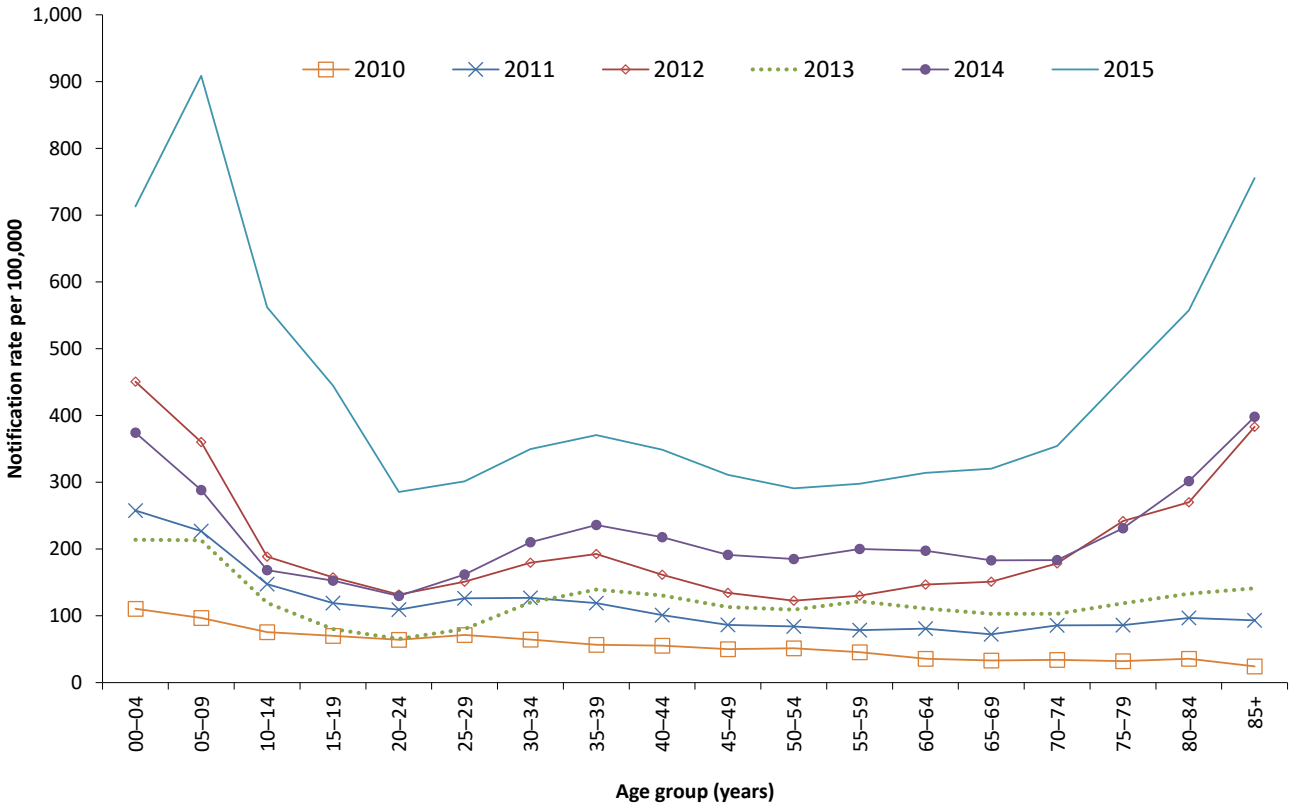
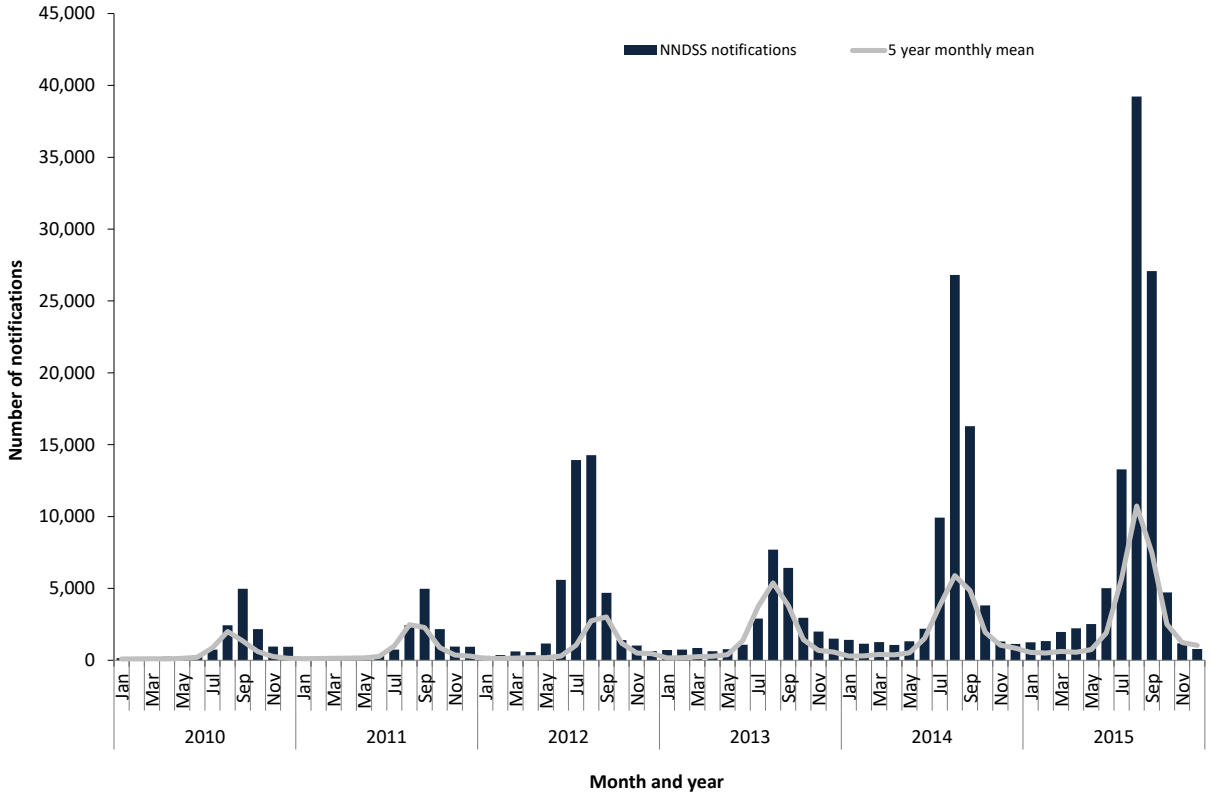


Figure 56: Notifications of laboratory confirmed influenza, Australia, 2010 to 2015, by month and year



August, followed by a steady decline back to interseasonal levels by November. The exceptions were the Northern Territory and Western Australia, with heightened activity continuing a month later than the other jurisdictions.

Indigenous status

Nationally in 2015, Indigenous status was reported in 36% (n=35,941) of laboratory confirmed notifications of influenza. Indigenous status completeness was greater than 50% in 4 jurisdictions: the Northern Territory (98%), Western Australia (94%), South Australia (83%) and the Australian Capital Territory (71%). The combined notification rates for influenza in these jurisdictions were 428 per 100,000 and 480 per 100,000 for non-Indigenous Australians, and representing a notification rate ratio of 0.9.

Mortality

Nationally, there were 137 influenza-associated deaths notified to the NNDSS, with a median age of 84 years (range: 1 to 102 years). The majority of deaths were associated with influenza A infections (n=102, 74%). Of these, 73 were associated with A (unsubtyped) infections, 1 was associated with A(H1N1)pdm09 and 28 were associated with A(H3N2). Indigenous status was reported for 85% (n=117) of the influenza-associated deaths; and Indigenous Australians accounted for <1% (n=1) of these deaths. The number of influenza-associated deaths reported to the NNDSS is reliant on the follow-up of cases to determine the outcome of their infection and most likely underestimates the true mortality associated with this disease. Of the 100,752 notifications to the NNDSS, only 41% (n=41,266) were provided with data relating to the association of influenza with individual deaths.

Microbiological trends

NNDSS

In 2015, typing data were reported for all but one laboratory confirmed influenza notification. The season was characterised by the predominant circulation of influenza B viruses

(Figure 57). Influenza B viruses accounted for 60% (n=60,865) of all notifications reported in 2015, and influenza A viruses accounted for 39% (n=39,510) of all notifications. While the majority of notifications of influenza A were reported as unsubtyped (30%, n=30,671), influenza A(H3N2) was detected at higher levels than influenza A(H1N1)pdm09 (6%, n=6,505; and 2%, n=2,334 respectively). Mixed influenza type A and B infections accounted for <1% of notifications (n=206). There was 1 notification of influenza type C.

The predominance of influenza B in the 2015 season was in contrast to recent years, where influenza A viruses have historically dominated the season (Figure 58). The ratio of reported influenza A(H1N1)pdm09 viruses to influenza A(H3N2) viruses was 1:2.8 in 2015, as opposed to 4 of the 5 past years, when influenza A(H1N1)pdm09 was the predominant influenza A subtype notified. The notable exception was in 2012, when, for every notification of influenza A(H1N1)pdm09, 28 notifications of influenza A(H3N2) were reported to the NNDSS.

The predominance of influenza B viruses was consistent across jurisdictions and ranged from 45% of notifications in Tasmania, up to 65% in Queensland. Influenza A(H3N2) was the predominant influenza A virus notified in each jurisdiction, where subtype information was available. The ratio of reported influenza A(H1N1)pdm09 viruses influenza A(H3N2) viruses varied, ranging from 1:1.2 in the Australian Capital Territory to 1:11.9 in Tasmania.

WHO Collaborating Centre for Reference and Research on Influenza

For 2015, the WHO Collaborating Centre for Reference and Research on Influenza (WHOCC) analysed 2,005 specimens from influenza cases identified in Australia. Specimens are submitted to the WHOCC from laboratories according to guidelines that aim for successful isolation of viruses and likelihood of obtaining a vaccine candidate. WHOCC specimens therefore do not constitute a representative sample of influenza

Figure 57: Notifications of laboratory confirmed influenza, Australia, 2015, by week and subtype

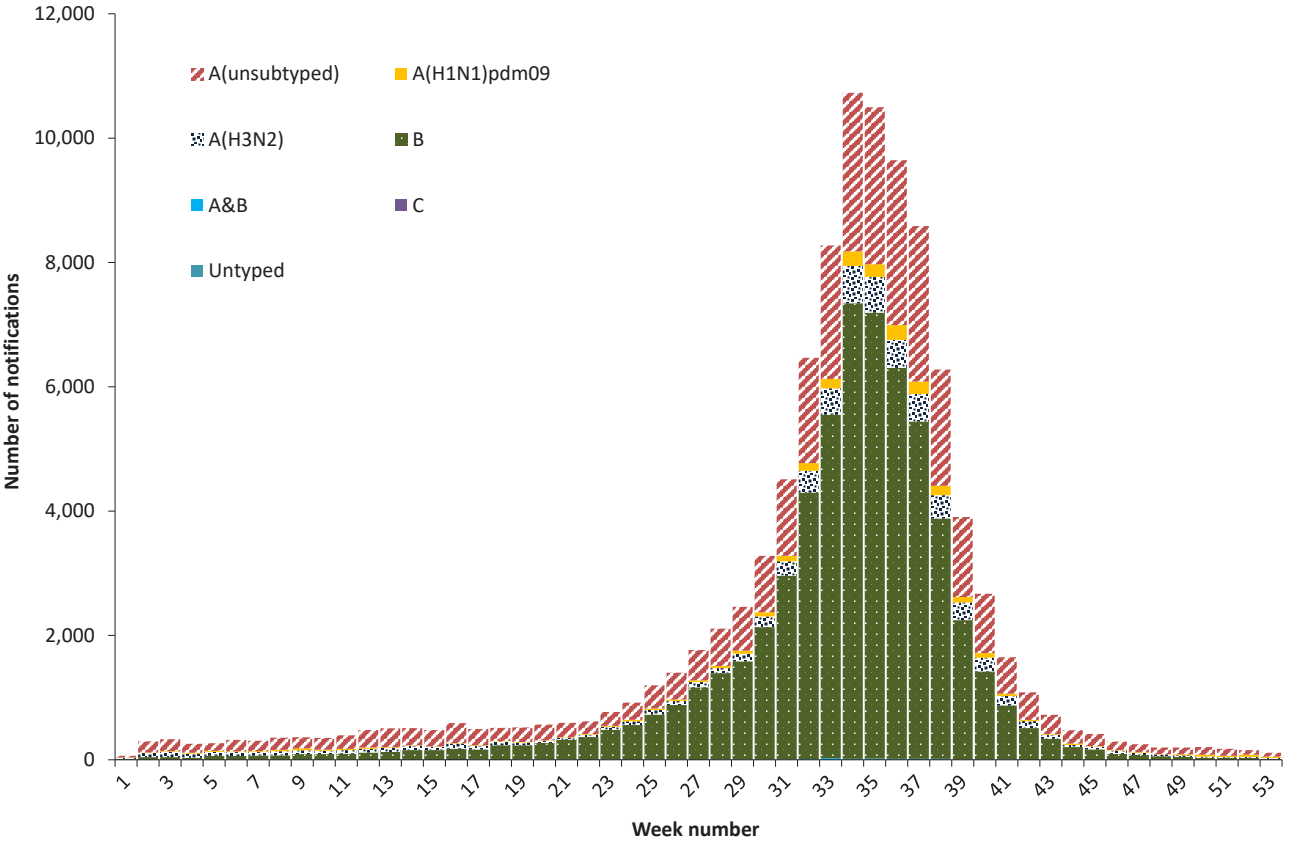
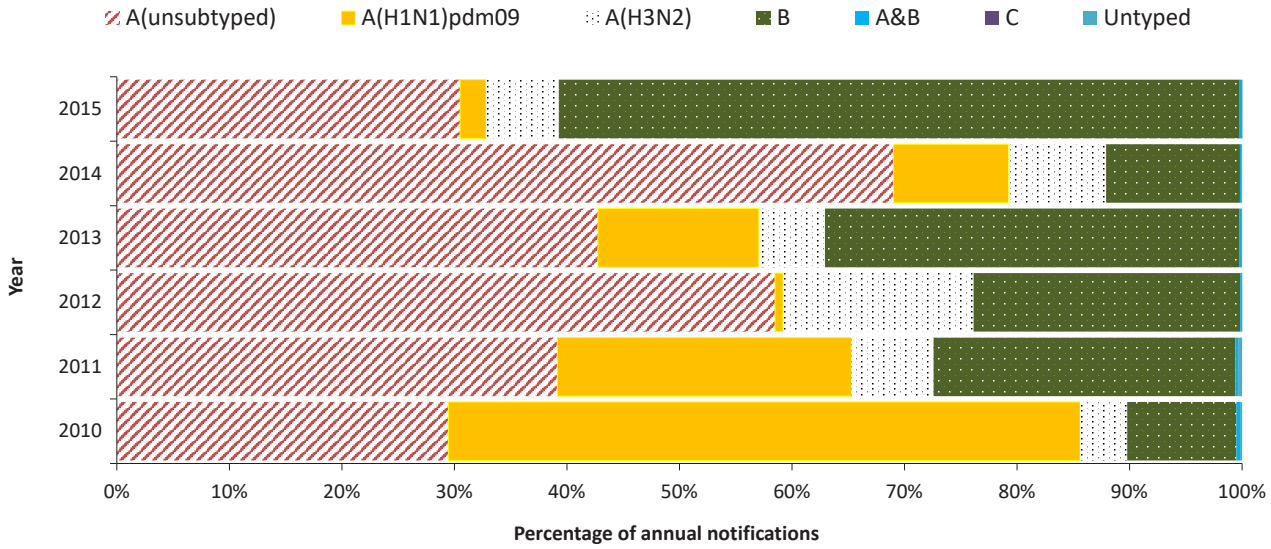


Figure 58: Percentage of annual notifications of laboratory confirmed influenza, Australia, 2010 to 2015, by subtype



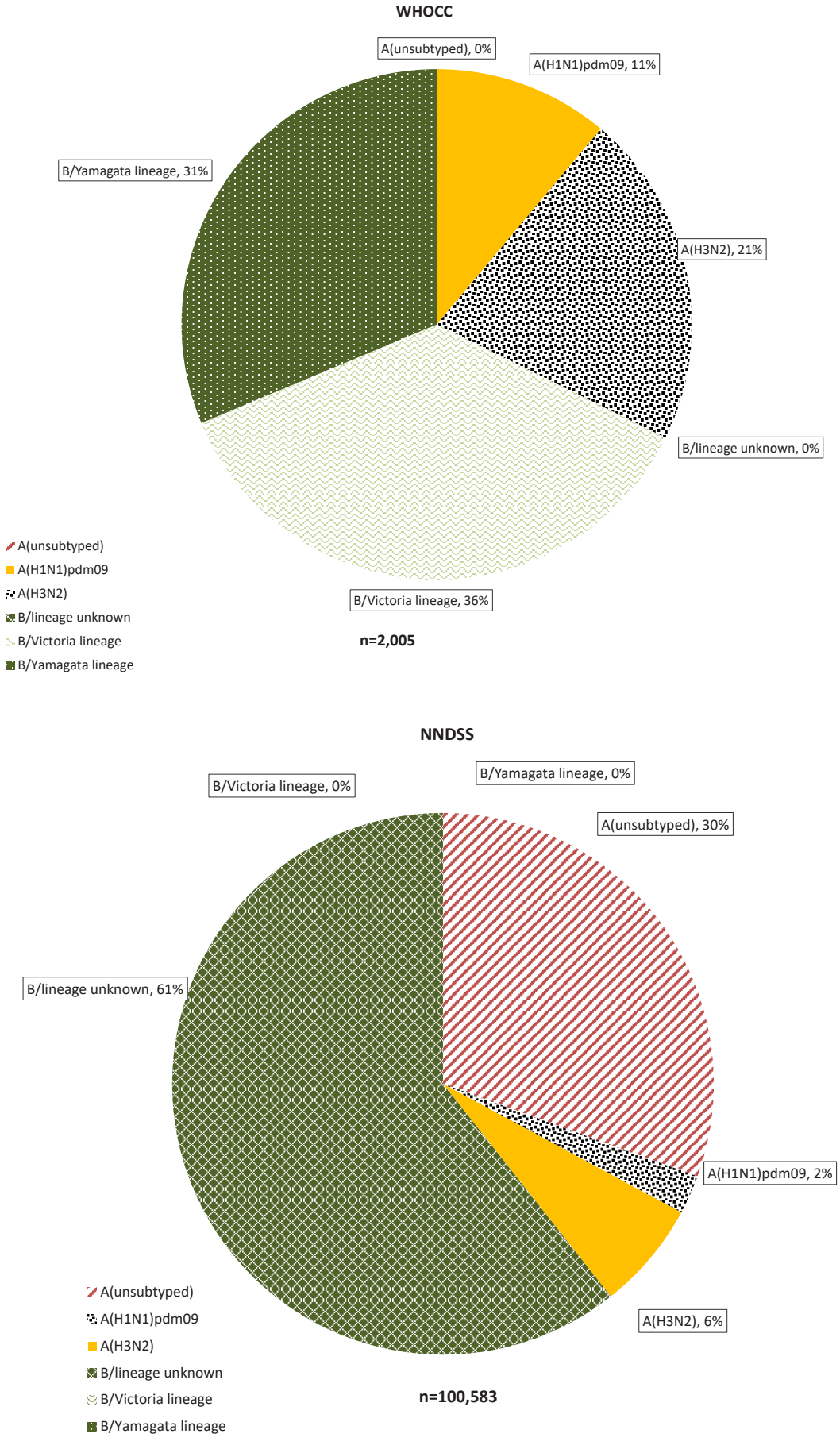
infections, which most likely accounts for differences in virus subtype distribution between NNDSS and WHOCC.

The number of specimens analysed by the WHOCC represents approximately 2% of the 100,583 laboratory confirmed cases reported to the NNDSS, compared with 2,072 specimens in 2014 representing 3% of notifications. The majority of specimens were influenza B (67%, n=1,355) with 36% identified as influenza B Victoria lineage (n=724) and 31% identified as influenza B Yamagata lineage (n=631) (Figure 59). The proportion of WHOCC specimens typed as influenza B was similar to that reported in laboratory confirmed notifications. The remainder of specimens were identified as influenza A(H1N1)pdm09 (n=221) and influenza A(H3N2) (n=429), accounting for 11% and 21% of samples respectively. Changes in the dominance of the two B lineages were seen over the season. During the 2015 pre-season period (January–April) and the early part of the influenza season (May–June), B/Yamagata lineage viruses predominated. However, from July to November, B/Victoria lineage viruses increased rapidly and were dominant from August.[75]

The WHOCC assessed the antigenic similarity of circulating influenza virus isolates to reference strains included in seasonal influenza vaccines using the haemagglutination inhibition assay. The 2015 seasonal trivalent influenza vaccines (TIVs) contained 2 changes from 2014 and included an A/California/7/2009 (H1N1)pdm09-like virus, an A/Switzerland/9715293/2013 (H3N2)-like virus and a B/Phuket/3073/2013-like virus (B/Yamagata lineage). The 2015 seasonal quadrivalent influenza vaccines (QIVs) contained a B/Brisbane/60/2008-like virus (B/Victoria lineage) in addition to the viruses contained within TIVs. TIVs were available through the NIP in 2015. As opposed to analyses in 2014, which found high proportions of low reactors to the B component of the TIV, analyses in 2015 found that a very small proportion of B/Yamagata lineage (2/631) viruses were low reactors to the influenza B component of the 2015 TIV. This demonstrates that the TIVs were an appropriate match to the circulating B lineages. Similarly, a small proportion of B/Victoria linage viruses (3/724) were low reactors to the additional influenza B component of the 2015 QIV.

The majority of the A(H1N1)pdm09 isolates (218 of 221) were antigenically similar to the A(H1N1) component of the influenza vaccine (A/California/7/2009-like) which has been used each year since 2010. The remaining 3 (1.4%) isolates were characterised as 'low reactors'. This

Figure 59: Subtyped influenza virus samples, WHOCC versus NNDSS, Australia, 2015



suggests that the A(H1N1) viruses which have been circulating since the 2009 pandemic continue to be genetically and antigenically stable. Similarly, approximately 1.9% (8/429) of A(H3N2) isolates with sufficient titre for haemagglutination inhibition assay were antigenically drifted from the A/Switzerland/9715293/2013-like vaccine strain and characterised as 'low reactors'.

Viruses submitted to the WHOCC in 2015 were also tested for sensitivity to the neuraminidase inhibitor class of antiviral drugs. Neuraminidase inhibition (NAI) assays were performed on 2,428 virus isolates, consisting of 1,269 influenza B, 210 influenza A(H1N1)pdm09 and 949 influenza A(H3N2) viruses. Reduced inhibition by oseltamivir was detected in a single A(H1N1)pdm09 isolate.

The WHO recommended changes to the influenza A(H3N2) and influenza B strains in TIVs for use in the 2016 influenza season. This included incorporating an A/Hong Kong/4801/2014 (H3N2)-like virus and B/Brisbane/60/2008-like virus (B/Victoria lineage) to the existing A/California/7/2009 (H1N1)pdm09-like virus. The WHO also recommended that 2016 QIVs include a B/Phuket/3073/2013-like virus (B/Yamagata lineage) in addition to the viruses contained with TIVs.

Enhanced surveillance data sets

In addition to NNDSS data, a series of targeted influenza surveillance systems operated during 2015. Together these systems collected data which were used to describe the season with respect to epidemiology, morbidity, mortality and virology and supported the conclusions drawn from analyses of NNDSS notification data. Enhanced influenza surveillance was based on the following additional sources of data:

- the number and proportion of calls to a national health call centre network for influenza or influenza-like illness (ILI);
- rates of ILI from a community survey;
- consultation rates for ILI identified by sentinel general practitioners;
- consultation rates for ILI identified by hospital emergency departments in Western Australia, New South Wales and the Northern Territory;
- hospitalised cases of influenza from 17 sentinel hospitals (adult and paediatric) across Australia;
- mortality data from the New South Wales Registry of Births, Deaths and Marriages; and
- typing and subtyping for influenza from sentinel laboratories in New South Wales, Victoria, Western Australia and Tasmania.

These data sources were used to inform the overall picture of influenza activity in Australia. Comprehensive analysis of these data was provided in the fortnightly Australian Influenza Surveillance Report, which was published during the season, and in the annual National Influenza Surveillance Scheme report published in CDI.

Discussion

The 2015 influenza season in Australia was characterised by the predominant circulation of influenza B viruses throughout the season, accounting for 60% of notified cases of laboratory confirmed influenza. Rates of influenza were highest among children aged less than 10 years and the elderly (aged 85 years and older), resulting in a bimodal age distribution.

The seasonal increase in notifications of laboratory confirmed influenza began in early June and reached a peak in mid-August. Notifications reported in the peak week, as well as total notifications reported in 2015, exceeded all previous years. Record numbers of notifications were also reported in the 2014–15 inter-seasonal period, suggesting a change in testing practices. This is further supported by data from the national sentinel general practice surveillance system,

which shows that rates of ILI among people visiting general practitioners were similar to recent years.[76]

Taking into account additional data from other targeted influenza surveillance systems monitored throughout the season, the severity of the 2015 influenza season was moderate across most jurisdictions. While there was a marked increase in the rates of notifications, presentations to emergency departments remained within the range experienced in recent years; however, some jurisdictions reported elevated presentations either widespread or regionally at the peak of the season. There were similar numbers of admissions to sentinel hospitals reported as in 2014; however, the overall proportion of patients admitted directly to intensive care units (ICUs) was less. Admissions to ICUs due to influenza A and influenza B were reported at similar proportions, suggesting that, at a type level, clinical severity was similar. Influenza-associated deaths remained fairly static, and were mostly attributable to association with influenza A. This may suggest the predilection for influenza A, particularly influenza A (H3N2), to affect people in older, more vulnerable age groups, leading to heightened mortality associated with influenza A in comparison to influenza B. ■

Measles

- Australia was certified by the World Health Organization (WHO) as achieving endemic measles elimination in 2014.
- There were 74 cases of measles notified in 2015, representing a national notification rate of 0.3 per 100,000 population.
- Eighty-four per cent of cases were either imported or import related.
- There were 11 outbreaks of measles in Australia in 2015. The median duration of these outbreaks was 23 days, and the median number of cases was 4 (range 2: to 11 cases).
- The largest outbreak of measles in 2015 consisted of 11 cases and lasted 60 days.

Measles is a highly infectious acute viral illness, caused by the measles virus, that is spread by respiratory secretions, including aerosol transmission.[77] Initial symptoms last 2 to 4 days and are characterised by fever and malaise, followed by a cough, coryza and conjunctivitis. It is usually followed by a red blotchy rash, which typically begins on the face, and then becomes generalised. Measles is often a severe disease with complications more common in the chronically ill, including otitis media, pneumonia, diarrhoea and acute encephalitis.[78] Subacute sclerosing panencephalitis is a late and rare (approximately 1 in 100,000 cases) complication of measles caused by persistent infection and is always fatal.[29] Complications are more common in children under 5 years of age and in adults over 20 years of age.[79]

Epidemiological situation in 2015

In 2015, there were 74 notifications of measles, representing a notification rate of 0.3 per 100,000,

the lowest rate since 2010. Compared with 2014 (n=339), measles notifications decreased by 78% (n=74) in 2015 (Figure 60) and were below the 5-year mean of 192 cases. Measles cases occurred in all states and territories in 2015, except for the Northern Territory and Tasmania, with 41% of cases occurring in Victoria (n=30) (Figure 60).

In temperate climates and where measles transmission remains endemic, the majority of cases usually occur in late winter to early spring.[80] In Australia, this seasonal pattern is no longer evident (Figure 61).

Age and sex distribution

In the 2015, the majority of measles cases were male (55%, n=41). There was a wide variation in the male to female rate ratio across the age groups (Figure 62).

In 2015, age at diagnosis ranged from 0 to 54 years, with a median of 21 years. Compared with 2014, notifications decreased in all age groups. Consistent with recent years, infants less than 1 year of age had the highest age-specific rate (3.0 per 100,000, n=9) in 2015. Overall, rates have remained below 2.5 per 100,000 in all age groups from 2010 to 2015, with the exception of the less than 1 year age group from 2011 to 2015 and the 10–19 years age group in 2014 (Figure 63).

Sixteen per cent of cases (n=12) occurred in those born between 1974 and 1980 (35 to 41 years old in 2015), a cohort previously identified as susceptible to measles infection.[81] In 2015, there was only one case that was born before 1966, a cohort that is considered to have high levels of natural immunity.[82]

Immunisation status

In 2015, the measles vaccine was provided in the combined measles-mumps-rubella (MMR) or measles-mumps-rubella-varicella (MMRV) vaccines. The MMR and MMRV vaccine induces long term measles immunity in 95% of recipients after a single dose and 99% of recipients after the second dose.[29] Two doses of measles-containing vaccine are recommended for all people born during or after 1966.[83]

Of the 74 cases notified in 2015, 86% (n=64) were born after 1965 or were 12 months of age or older, and therefore were eligible for at least 1 funded dose of a measles containing vaccine. Seventy-three per cent (n=47) of eligible cases were reported as either unvaccinated (39%, 25/64) or of unknown immunisation status (34%, 22/64). The remaining 27% (n=17) were reported as vaccinated, of whom 4 were fully vaccinated with 2 doses of a measles-containing vaccine and 13 were partially vaccinated with 1 dose (Figure 64). In 2015, all cases aged less than 15 years (n=26) were reported with an immunisation status. In contrast, 47% (22/47) of cases aged 15 years and older were reported with an unknown immunisation status (Figure 64).

Indigenous status

In 2015, Indigenous status was completed for all measles cases, an increase in completeness compared with 96% of cases in 2014 (228/339). Of the cases reported in 2015, 3% (n=2) were reported as Indigenous, representing a notification rate of 0.3 per 100,000.

Sources of infection and outbreaks

Eighty-four per cent of cases in 2015 were either imported (n=32) or import related (n=30), with the remaining 16% (n=12) of unknown source (Figure 65). Of the imported cases, 28% (9/32) were from the WHO Western Pacific Region (WPR), with 2 cases imported from Malaysia and one case imported from each of the following: China, Hong Kong, Papua New Guinea, Philippines, Singapore, Vanuatu and Vietnam. Of the remaining imported cases, 17 were imported from the WHO South East Asia Region (57%), 4 from the WHO European Region (13%), 1 from the WHO African Region (3%) and one from the WHO Eastern Mediterranean Region (3%).

Figure 60: Notifications and notification rate for measles, Australia, 1998 to 2015, by year

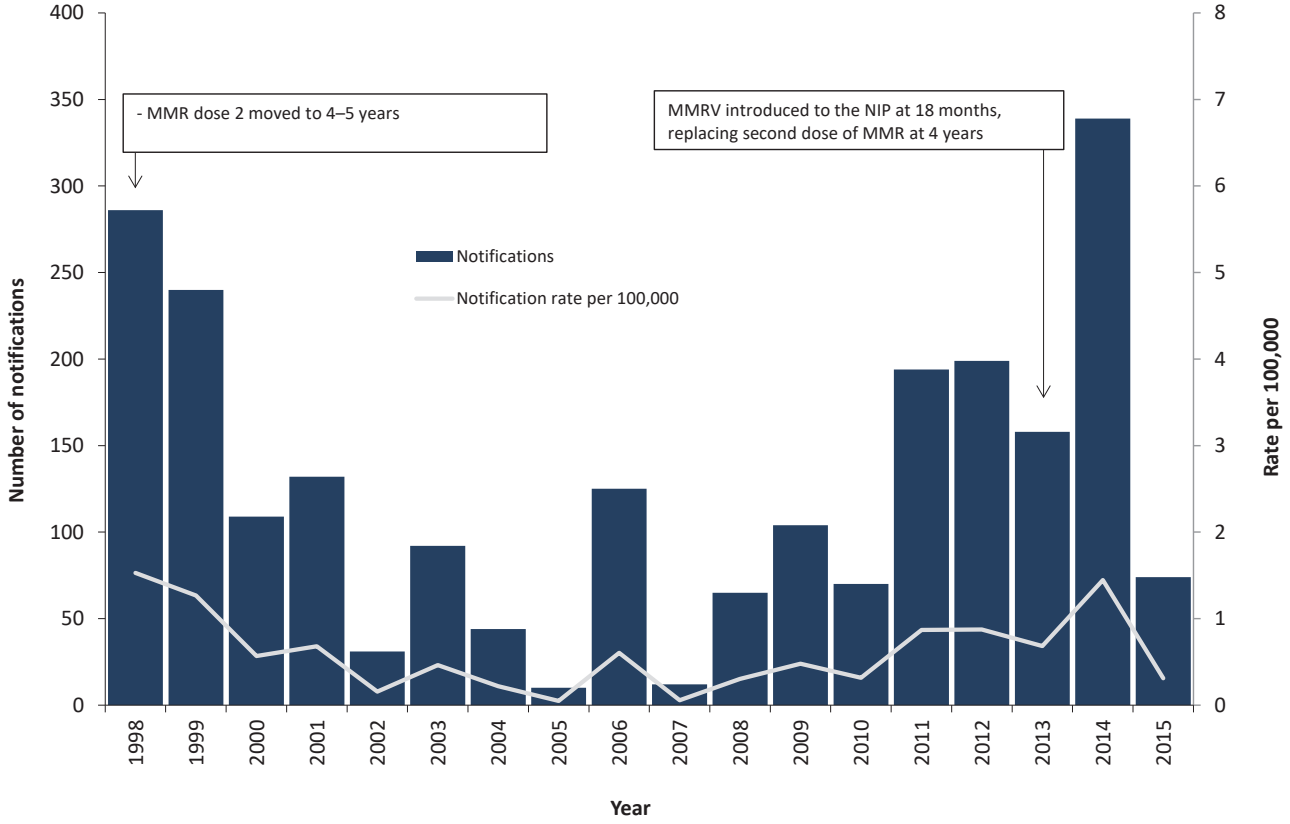


Figure 61: Notifications of measles, Australia, 2010 to 2015, by month, year and state or territory

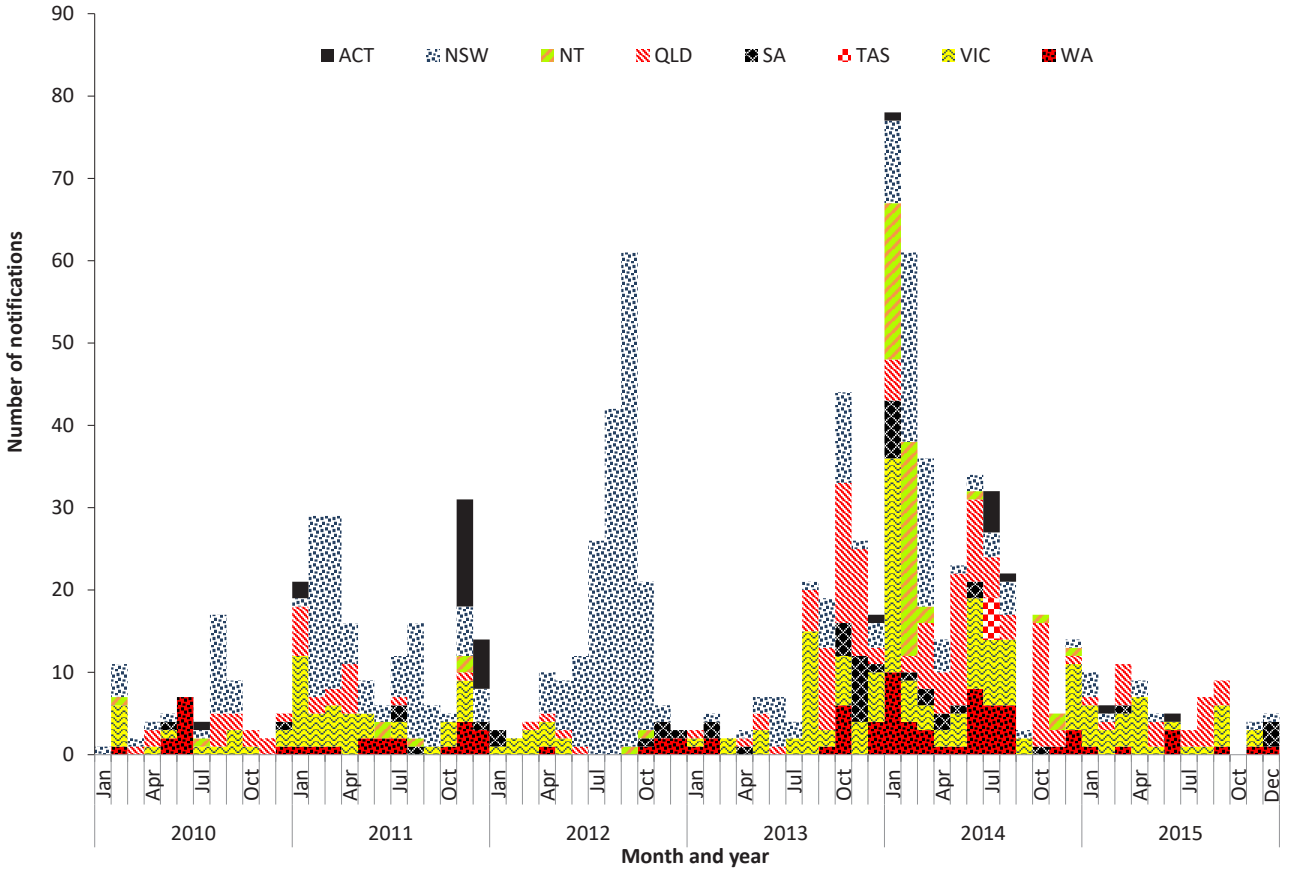


Figure 62: Notification rate for measles, Australia, 2015 by age group and sex

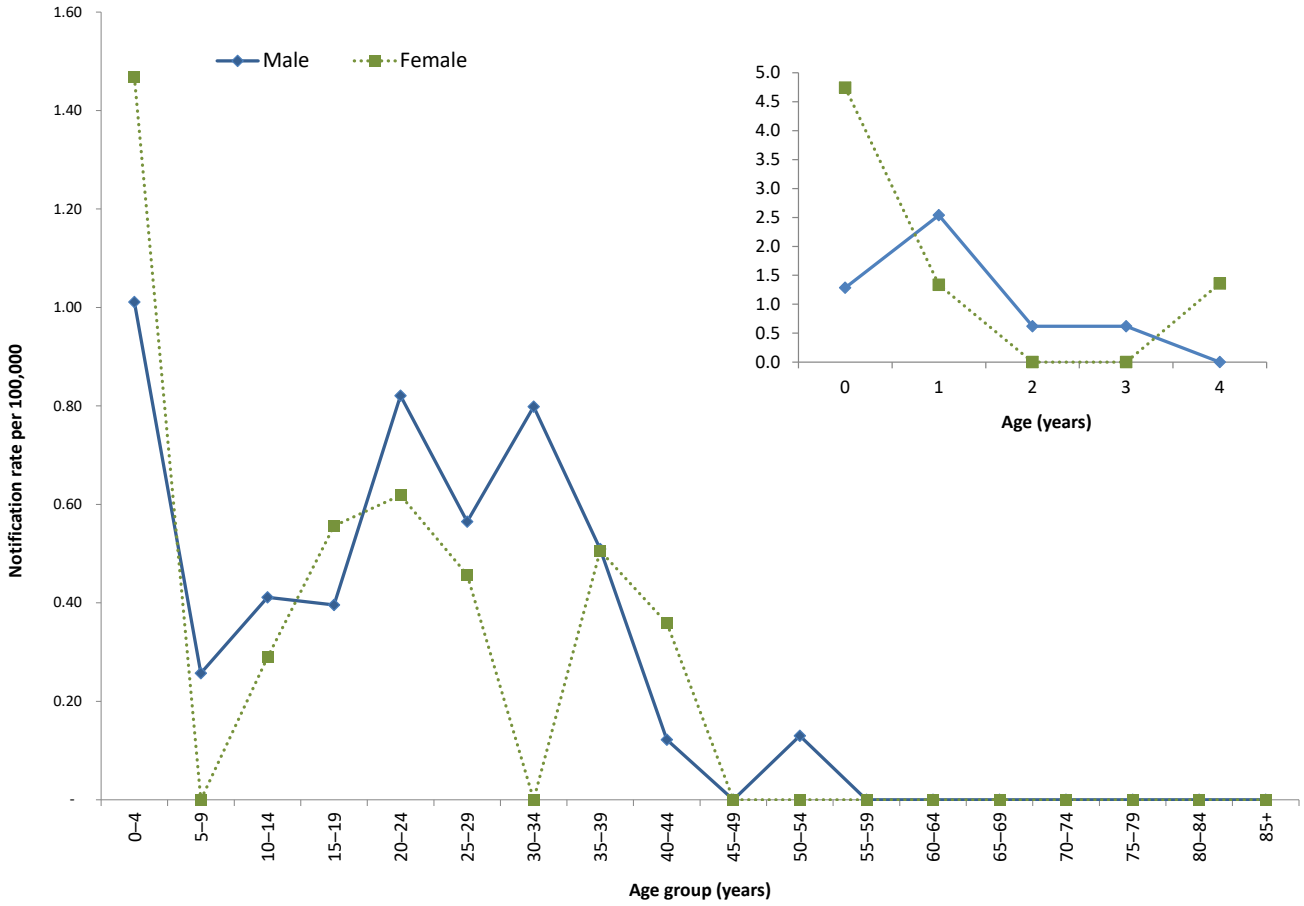


Figure 63: Notification rate for measles, Australia, 2010 to 2015, by year and selected age groups

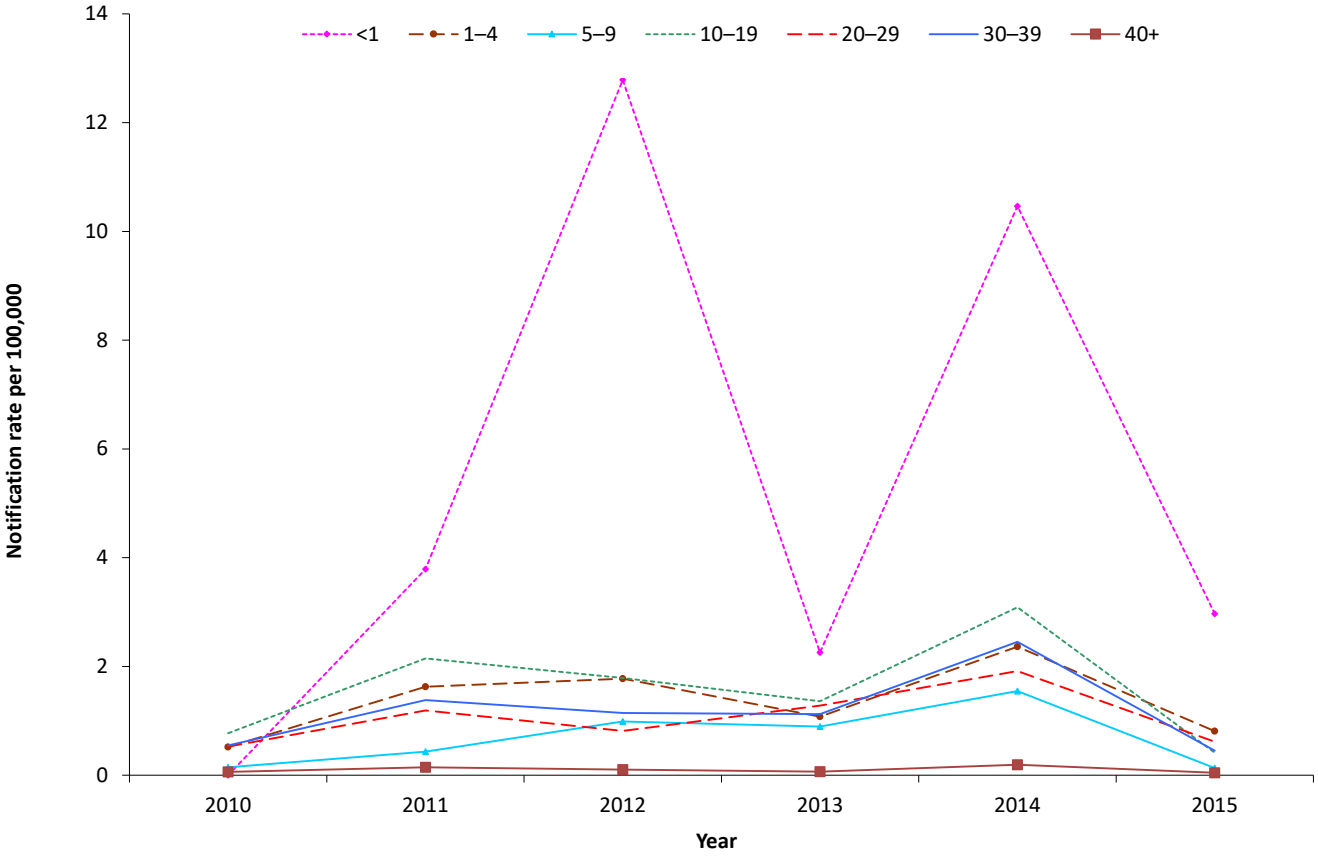


Figure 64: Notifications of measles, Australia, 2015, by immunisation status and age groups

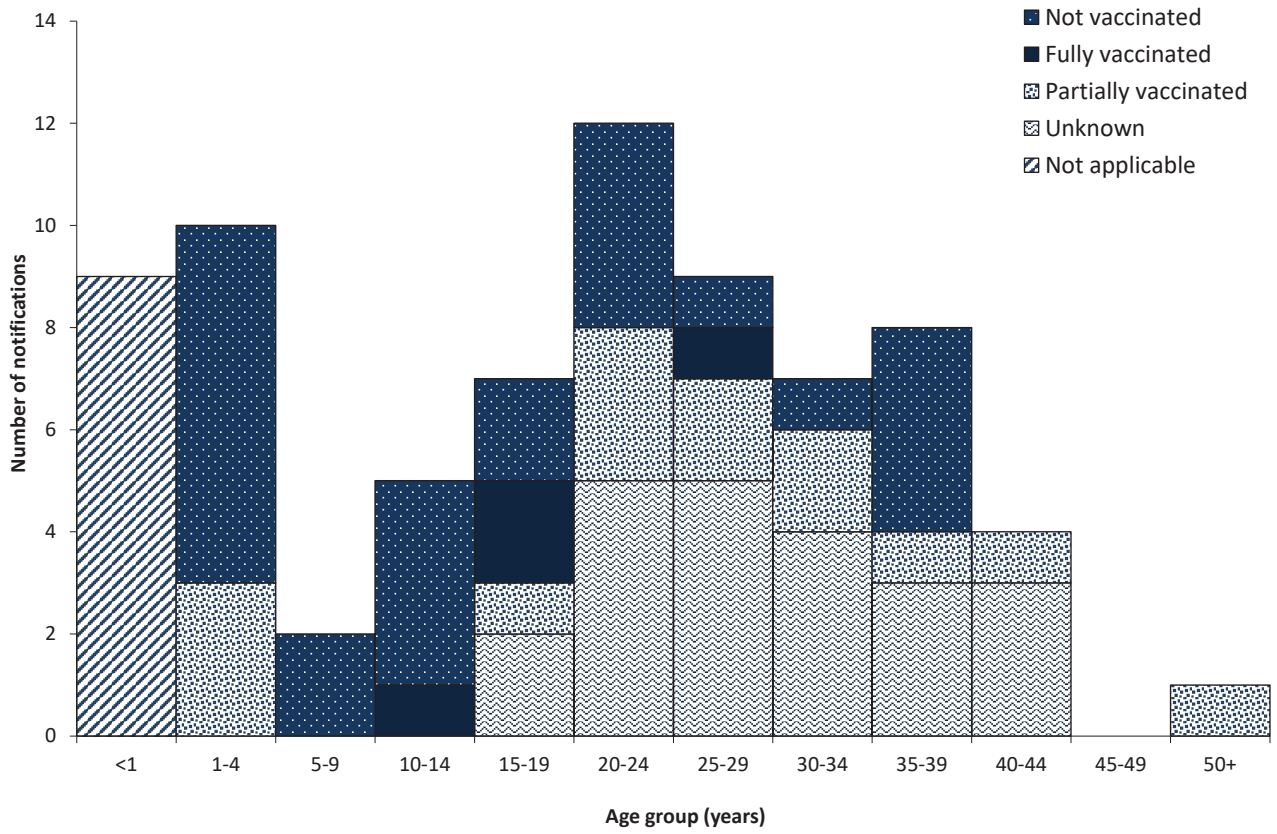
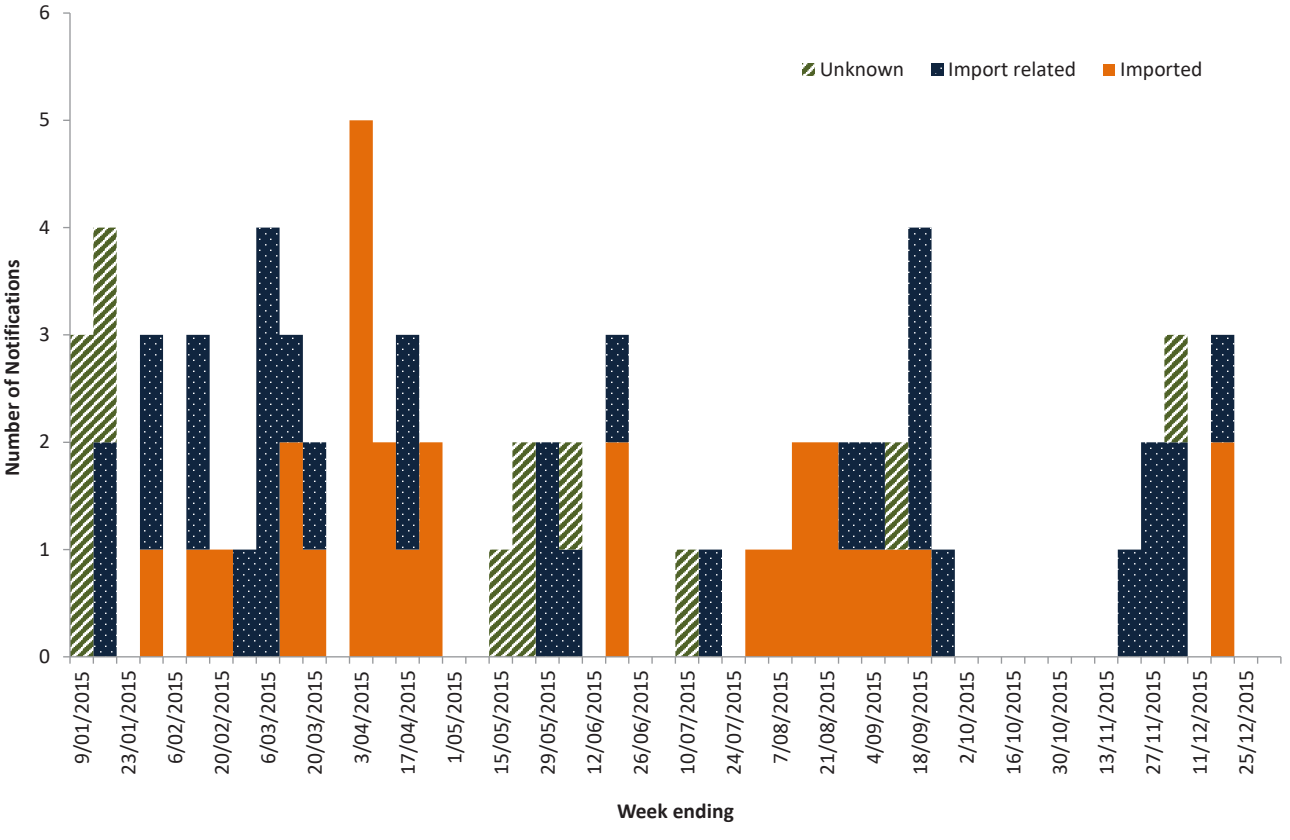


Figure 65: Notifications of measles, Australia, 2015, by source of infection and diagnosis week ending



There were 11 outbreaks of 2 or more epidemiologically linked cases in 2015, accounting for 64% (n=47) of all cases. The remaining cases comprised sporadic imported cases (n=24) and sporadic cases acquired in Australia from an unknown source (n=3). Seventy-three per cent of the outbreaks were related to imported cases (8/11). There were 3 outbreaks of locally acquired cases from an unknown source in 2015, and 2 of these outbreaks occurred in Victoria. The first was an outbreak of 5 cases, which included 1 case who resided in Queensland and was associated with an outbreak of 11 cases reported in 2014, and the second was an outbreak of 2 cases. The third outbreak was reported in Queensland and consisted of 2 cases.

Transmission was interrupted quickly in all outbreaks in 2015. The median outbreak duration was 23 days (range: 7 to 60 days) between the onset of symptoms in the index case and the last case. The median generations of transmission[84] was 3 (range: 1 to 6). Ten of the 11 clusters had fewer than 10 cases, with a median of 4 cases (range: 2 to 9). There was only 1 outbreak in 2015 that comprised 10 or more cases. This outbreak commenced in mid-July and lasted 60 days. It included 6 generations of transmission and was genotyped as D8. The source of infection for this outbreak was identified as a case who acquired their infection from Indonesia.

Microbiological trends

Genotyping data were available for 11 clusters, with 2 or more linked cases in 2015 (n=47) and 21 sporadic cases. Genotype D8 was the most common, being linked to 8 separate clusters (n=38) and 12 sporadic cases, followed by H1 with 2 clusters (n=7) and 6 sporadic cases; B3 with 1 cluster (n=2) and 6 sporadic cases; and D4 with 1 sporadic case.

Imported genotypes varied by WHO region. In 2015, there was one B3 importation from the Eastern Mediterranean Region, and there were three D8 and two B3 importations from the Western Pacific Region. Multiple genotypes were imported from the South East Asia Region (B3, D8 and D4) and the European Region (B3, D8 and H1).

Discussion

Evidence suggests endemic measles has been eliminated in Australia since at least 2005,[80] with this being verified by the WHO in 2014.[85,86] However, the increasing prevalence of measles in some parts of the world, and the continued circulation of the virus in countries of close geographical proximity to Australia, provide a continual source of imported virus in Australia. This was evident in 2015, with 84% of all measles linked to 32 separate importations.

Compared to 2014, the number of reported measles cases decreased substantially in 2015 (from 339 cases to 74 cases) and more cases were linked to an imported virus. None of the 11 outbreaks persisted for more than 12 months (the longest was 3 weeks) and there was no evidence of the continuous circulation of a single genotype. Over 50% of cases reported with an immunisation status in 2015 were either unvaccinated (39%) or not eligible for immunisation (12%). Due to the highly infectious nature of measles, importation with local transmission and clusters will continue to occur in Australia, mostly among contacts who have either not been vaccinated or only received 1 dose of measles-containing vaccine. ■

Mumps

- There were 644 cases of mumps notified in 2015, a rate of 2.7 per 100,000 and the highest rate since 2007.
- Seventy-one per cent of these (456/644) were notified from Western Australia.
- In 2015, 404 cases were Indigenous Australians, with the majority (n=391) notified from Western Australia.

Mumps is an acute viral illness caused by the mumps virus. Transmission is usually by respiratory secretions, including aerosol transmission, or by direct contact with saliva. Asymptomatic infections occur in one-third of cases. Symptomatic disease ranges from mild upper respiratory tract infections to systemic involvement. The characteristic bilateral, or occasionally unilateral, parotid swelling occurs in 60% to 70% of clinical cases; however, a high proportion have non-specific symptoms including fever, headache, malaise, myalgia and anorexia.[87] Mumps encephalitis has been estimated to occur in 1 to 2 per 10,000 cases, with a case fatality rate of around 1%.[21]

Epidemiological situation in 2015

In 2015, there were 644 notifications of mumps, a 246% increase compared with the 186 cases reported in 2014 and a ratio of 3.8 compared to the 5-year mean (n=171) (Figure 66). Since 2010, the national notification rate of mumps has remained below 1.0 per 100,000, ranging from 0.4 per 100,000 in 2010 to 0.9 per 100,000 in 2012 and 2013, and 0.8 per 100,000 in 2014. In 2015, the national notification rate of mumps was 2.7 per 100,000.

Geographical distribution

Cases of mumps were reported from all states and territories in 2015, with the highest rates occurring in Western Australia (17.6 per 100,000) and the Northern Territory (6.1 per 100,000).

Place of acquisition was complete for 91% (n=583) of cases in 2015, of which 3% (18/583) were imported from overseas. Of these, 4 cases acquired infection from India, 3 from Thailand, 2 each from Vietnam, Ireland, Papua New Guinea and New Zealand, and 1 each from Ghana, South Africa and Vanuatu. The remaining 565 cases were reported as locally acquired in Australia.

Age and sex distribution

In 2015, over half of all notified mumps cases were reported in males (57%, n=369), and 82% (n=528) were in people under the age of 40 years (Figure 67). The highest number of cases for males occurred in the 15–19 years age group (n=70), and for females in the 20–24 years age group (n=37), and followed closely by the 15–19 years age group (n=36). In contrast to previous years, where adults aged 30–39 years had the highest rates (3.3 per 100,000 in 2014), in 2015, adolescents aged 10–19 years age had the highest rates (6.5 per 100,000), followed by adults aged 20–29 years (4.7 per 100,000) (Figure 68). Since 2010, there has been a steady increase in age-specific rates across all age groups; this was particularly evident in 2015.

Immunisation status

In 2015, the mumps vaccine was provided in the combined MMR or MMRV vaccines. The mumps vaccine was first funded on the NIP schedule in 1982 for infants at 12 months of age, with people born after 1980 eligible for at least one dose of a mumps-containing vaccine. Of the 644 cases notified in 2015, 75% (n=483) were eligible for at least 1 dose of a publically funded mumps-containing vaccine. Of these, 60% (291/483) were fully vaccinated, having received 2 doses of a mumps-containing vaccine; 12% (56/483) were

Figure 66: Notifications of mumps, Australia, 2010 to 2015, by month, and year and state or territory

Figure 67: Notifications of mumps, Australia, 2015, by age group and sex

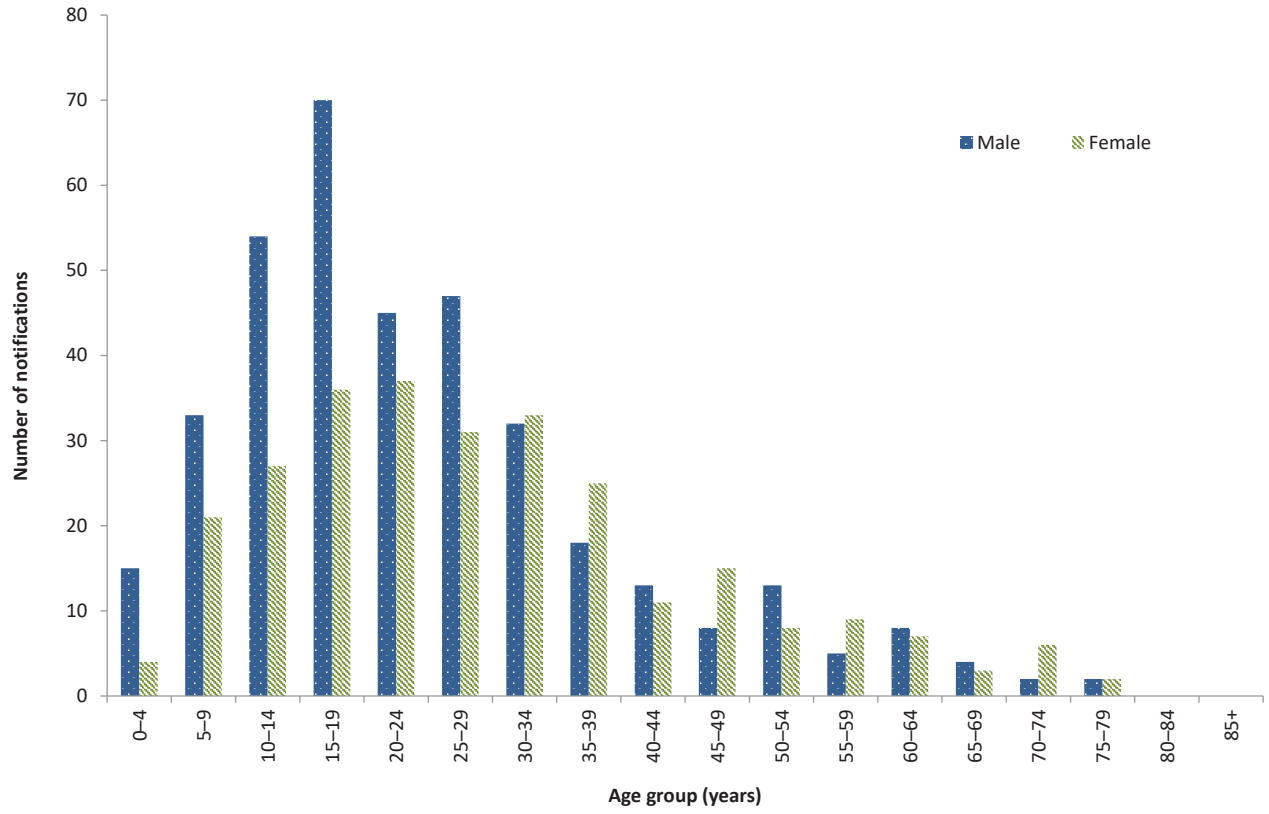
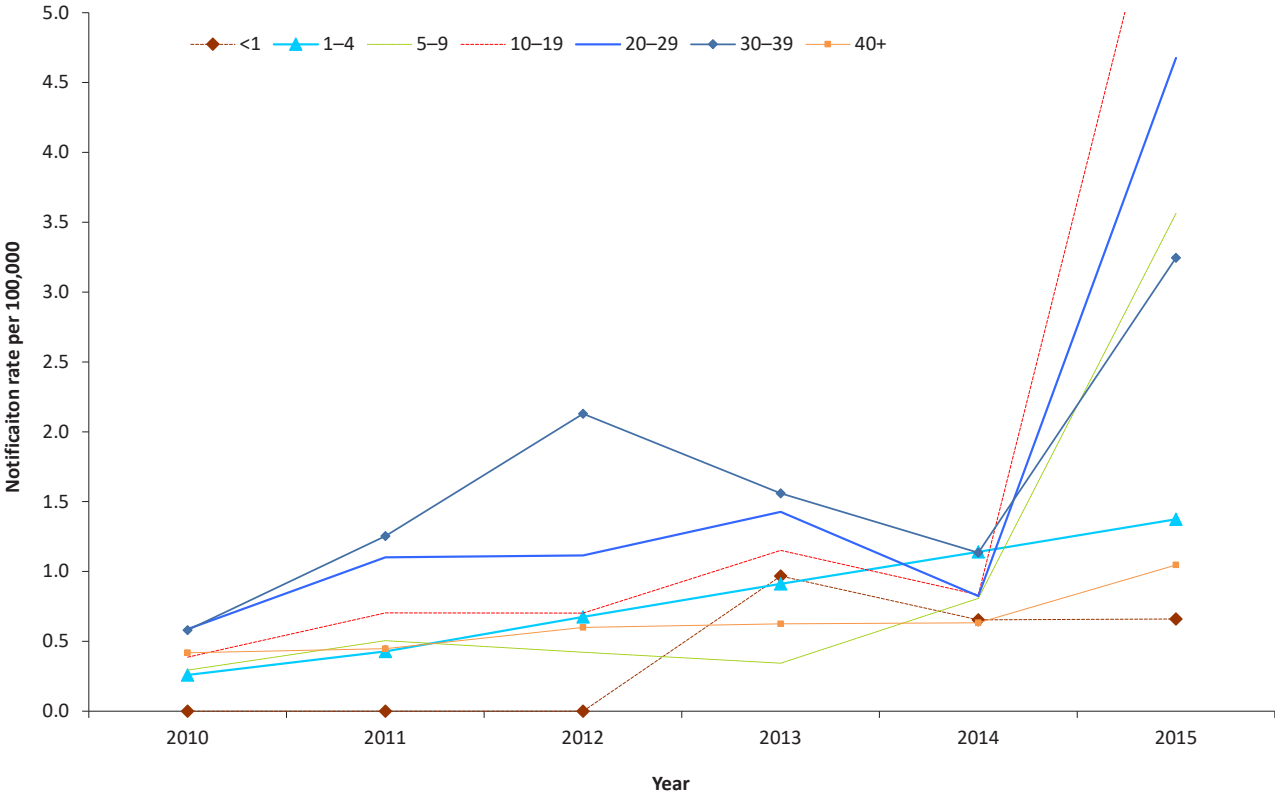


Figure 68: Notifications of mumps, Australia, 2010 to 2015, by year and selected age groups



partially vaccinated, having received 1 dose; 6% (31/483) were unvaccinated; and 20% (99/483) were of unknown immunisation status.

Indigenous status

Indigenous status was reported for 95% (n=609) of notified mumps cases in 2015. This is higher than the mean completeness of the previous 5-year period (69%; range: 51% to 88%). Of the cases with a known Indigenous status in 2015, 66% (404/609) were reported as Indigenous, with the majority of these cases linked to a large outbreak that occurred in Western Australia (see outbreak section for more information).

Outbreaks

The outbreak reference field was completed for 69% (n=447) of cases in 2015. There were 4 outbreaks of 2 or more epidemiologically linked cases reported, accounting for 69% of all cases. One outbreak was reported in South Australia, which was linked to an imported case from Vietnam. This outbreak consisted of 11 cases with a median age of 22 years (range: 18 to 64 years) and lasted 3 weeks.

The remaining 3 outbreaks were reported in Western Australia, of which all were locally acquired and genotyped to mumps virus G. Two of these outbreaks were small, consisting of 2 cases each; both had a short duration (less than 3 weeks) and had cases aged between 15 and 36 years.

The third outbreak reported in Western Australia was the largest outbreak to occur in 2015. This outbreak consisted of 432 cases and accounted for 94% of mumps cases reported in Western Australia. The outbreak commenced in the Kimberley region in mid-March, with subsequent spread to the Pilbara, Goldfields and Midwest region and limited spread to the Perth metro area.[88] The majority of cases reported in this outbreak were Indigenous Australians (90%, n=389) and the median age of cases was 20 years (range: 0 to 64 years). Seventy-five per cent (n=323) of cases were vaccinated, with 83% (267/323) of these reporting that they had received 2 or more doses of a mumps-containing vaccine, and 17% (56/323) reporting 1 dose. Of the remaining 25% of cases, 4% (17/323) were unvaccinated and 21% (92/323) were of unknown immunisation status.

Discussion

The large rise in mumps notifications seen in 2015 was associated with an ongoing large outbreak identified in Western Australia. Of the 644 cases of mumps reported nationally in 2015, 67% were linked to this outbreak. This is the second largest outbreak of mumps reported in Western Australia, with a localised outbreak occurring in the Kimberly region in 2007–08 that was genotyped as mumps virus J, which consisted of 183 cases.[89] At the end of 2015, this outbreak was still progressing, and it was anticipated that the number of mumps notifications would continue to be high in 2016. It is unclear why this outbreak disproportionately affected Indigenous Australians in Western Australia. Factors that may have contributed to widespread transmission of the virus within this population include differences in household density and mobility patterns, waning vaccine immunity, and potential immune escape due to the mismatch between the wild type and the vaccine virus genotypes.[90]

The mumps component of the MMR vaccine is considered to be the least effective of the 3 components with the reported 1 dose vaccine effectiveness varying between 60% and 90%.[91,92,93] While protection is greater in 2-dose vaccine recipients, recent outbreaks have been reported in 2-dose recipients, particularly young adults who received their vaccines more than 10 years previously.[94,95] Reduced effectiveness of the mumps vaccine over time may partially account for the proportion of vaccinated cases notified and also contribute to mumps outbreaks in older vaccinated populations.[96] ■

Pertussis

- Pertussis remains highly prevalent in Australia.
- An increasing trend in notifications of pertussis continued into 2015, with a total of 22,546 cases reported.
- In 2015, children under 15 years of age had a notification rate 4.6 times higher than those 15 years or older.

Pertussis, commonly known as whooping cough, is a highly infectious acute respiratory disease caused by the bacterium *Bordetella pertussis*. Spread by respiratory droplets, infection is often characterised by paroxysmal cough with inspiratory whoop, which is frequently seen among unvaccinated children but uncommon in individuals who have acquired some immunity through immunisation or infection.[97] The highest risk of infection and severe morbidity from pertussis occurs in infants who are too young to have received at least 2 doses of a pertussis-containing vaccine.[29] Complications include pneumonia, atelectasis, seizures, encephalopathy, and hernias, with pneumonia as the most common cause of death.[21]

Epidemiological situation in 2015

In 2015, there were 22,546 notifications of pertussis. This was an increase of 90% compared with 2014 (n=11,867) and 82% with 2013 (n=12,362), but 42% lower than 2011 (n=38,752) at the peak of the last epidemic period (2008–2012) (Figure 69). There was one pertussis-related death reported in 2015. The death was in an infant less than 6 weeks of age and therefore not eligible for immunisation.

Geographical distribution

Compared with 2014, notification rates increased in all jurisdictions except the Northern Territory, Tasmania and Victoria (Figure 70). The largest increases in rates were in New South Wales from 42 per 100,000 in 2014 to 161 per 100,000 in 2015, South Australia from 30 per 100,000 in 2014 to 78 per 100,000 in 2015 and in the Australian Capital Territory from 60 per 100,000 in 2014 to 124 per 100,000 in 2015. The national notification rate of pertussis in 2015 increased by 87% (95 per 100,000) compared with 2014 (51 per 100,000).

Age and sex distribution

Females accounted for 55% (n=12,297) of cases in 2015 and had higher rates across all age groups except 85 years or older (Figure 71). The highest age-specific notification rates for both males and females occurred in the 10–14 years age group at 296 and 309 per 100,000 respectively.

After reaching a peak in 2011, rates in children less than 15 years of age declined steeply, with the ratio of cases under 15 years compared with those over 15 years falling from 3.7 in 2011 to 2.7 in 2014. In 2015, this ratio increased, with rates for children less than 15 years (260 per 100,000) 4.6 times higher compared with those aged 15 years and older (56 per 100,000). This is almost double the ratio seen in 2014. The highest age-specific rates in 2015 occurred in the 10–14 years age group (305 per 100,000), which was higher than the rates reported in 2013 (111 per 100,000) and 2014 (112 per 100,000) (Figure 72).

Immunisation status

The NIP schedule in 2015 included a primary course of 3 doses of vaccine at 2, 4, and 6 months of age, with additional booster doses provided at 4 years of age and between 10 and 15 years of age.[29]

In order to determine the immunisation status of cases, public health follow up is required. As per the pertussis national guidelines for public health units,[98] jurisdictions prioritise case follow up to those less than 5 years of age. During 2015, those aged less than 5 years accounted for

Figure 69: Notifications of pertussis, Australia, 2010 to 2015, by month, year and state or territory

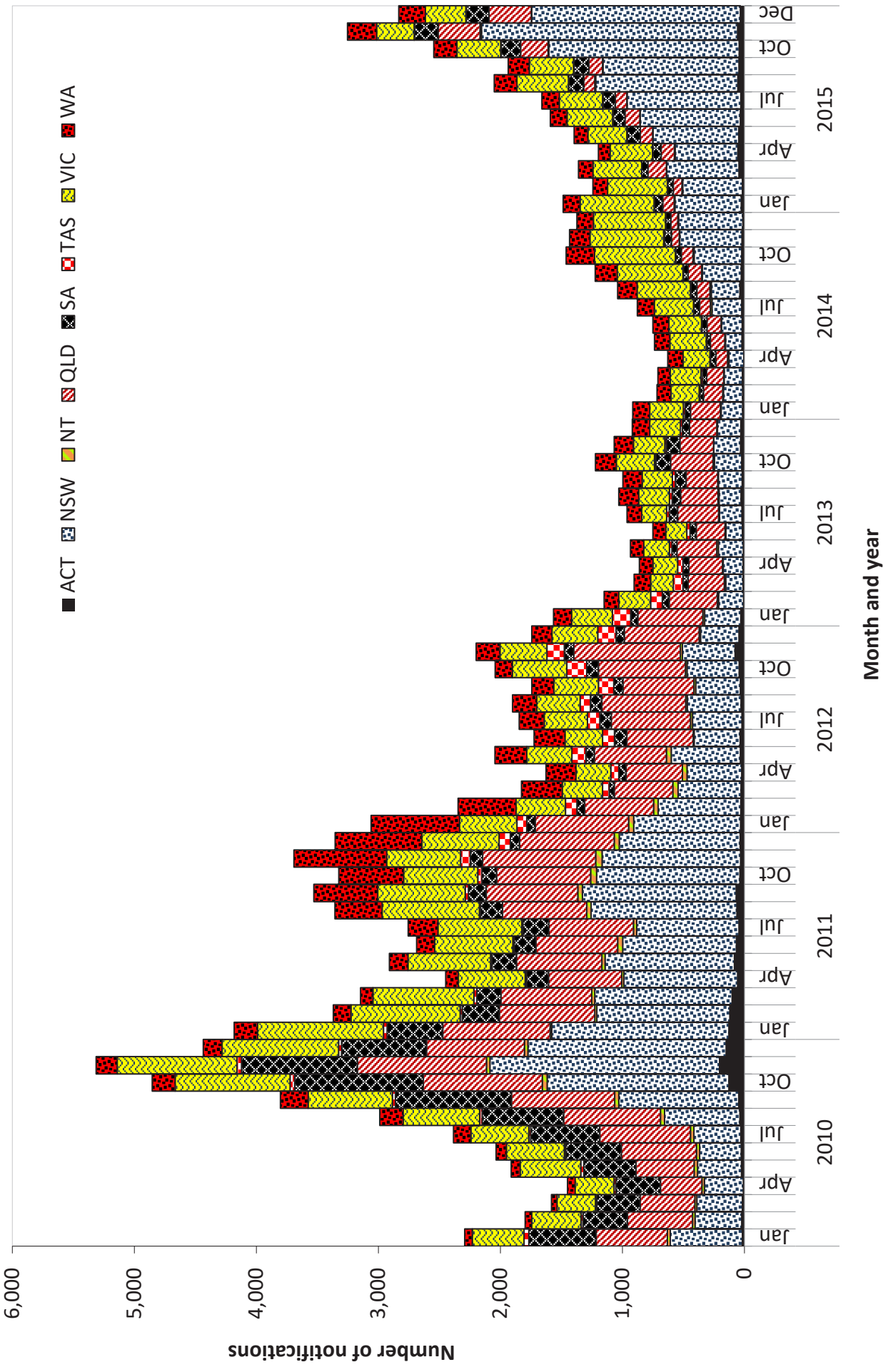


Figure 70: Notification rates for pertussis, Australia, 2010 to 2015, by year and state or territory

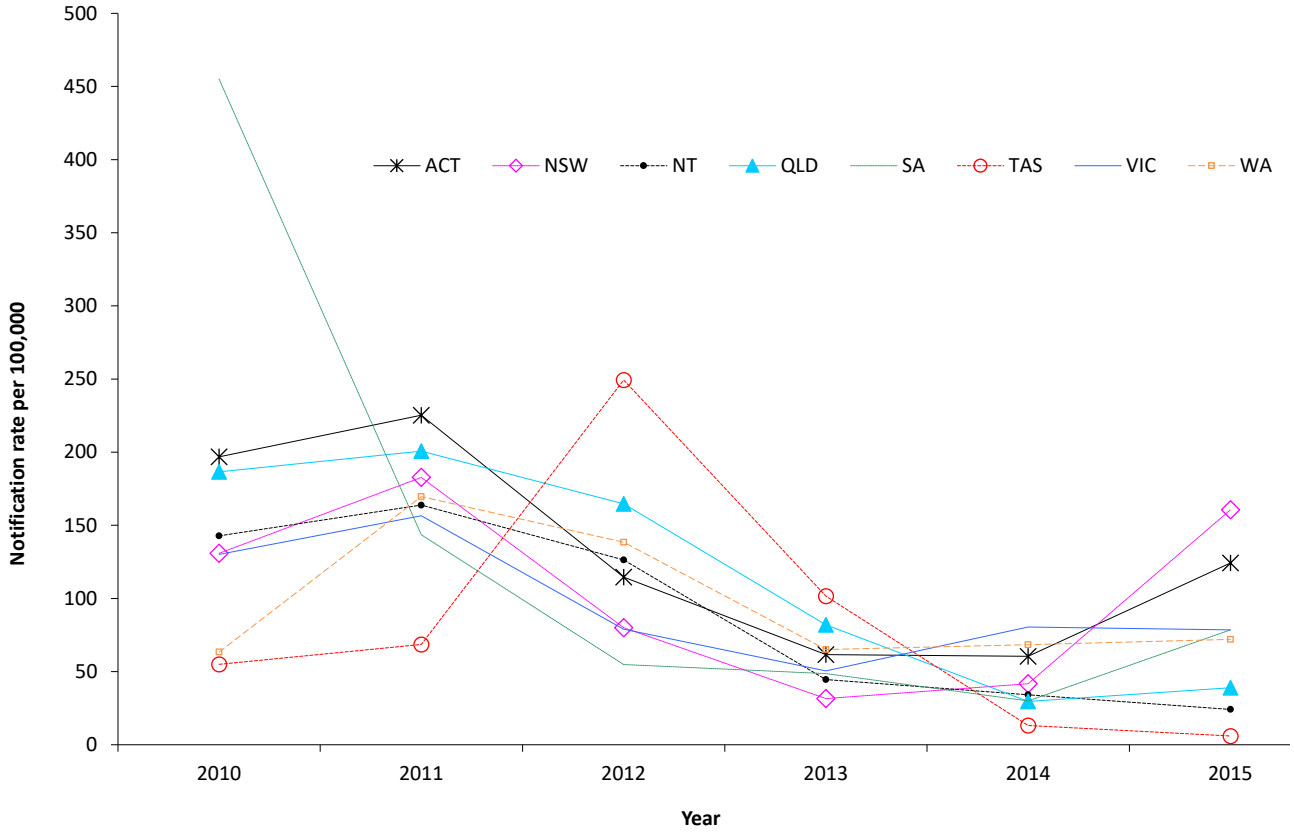
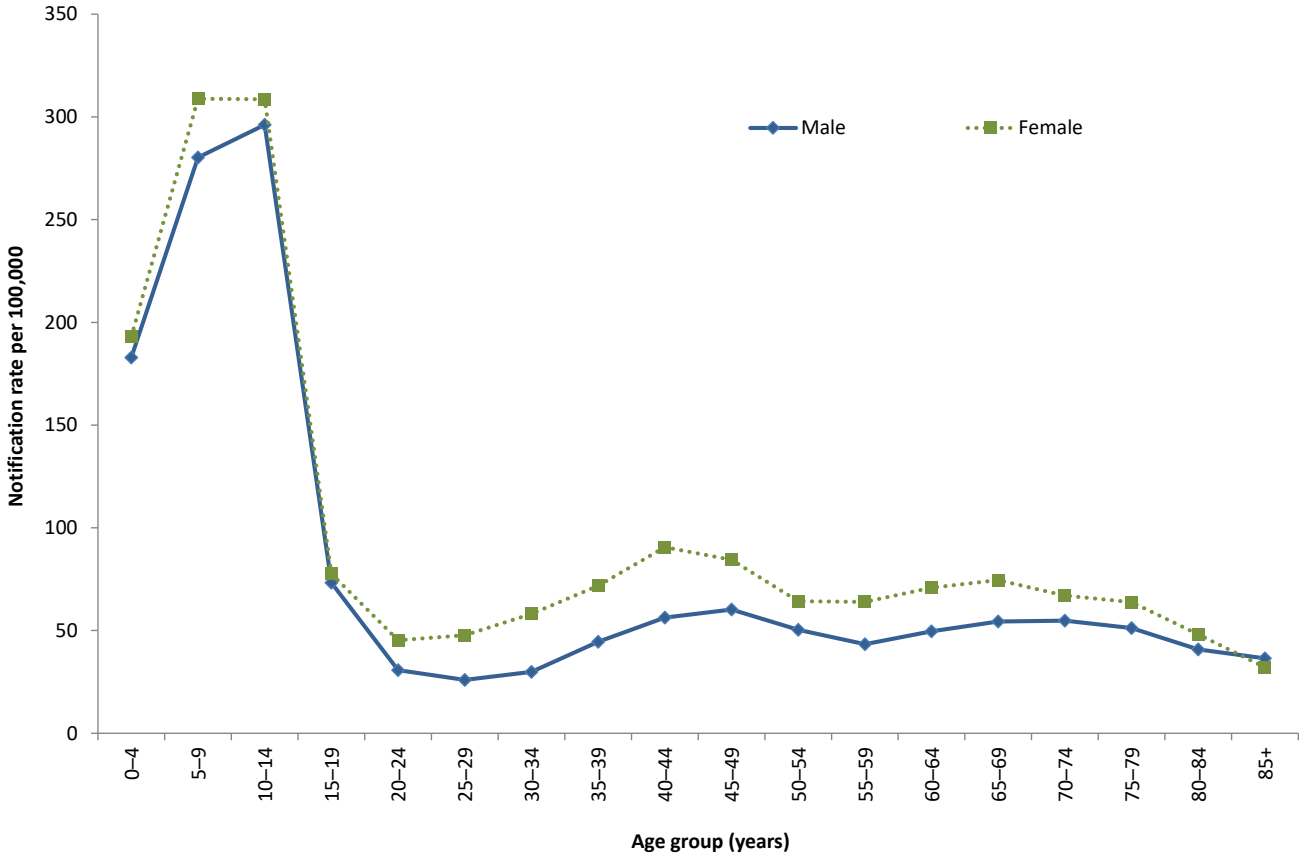


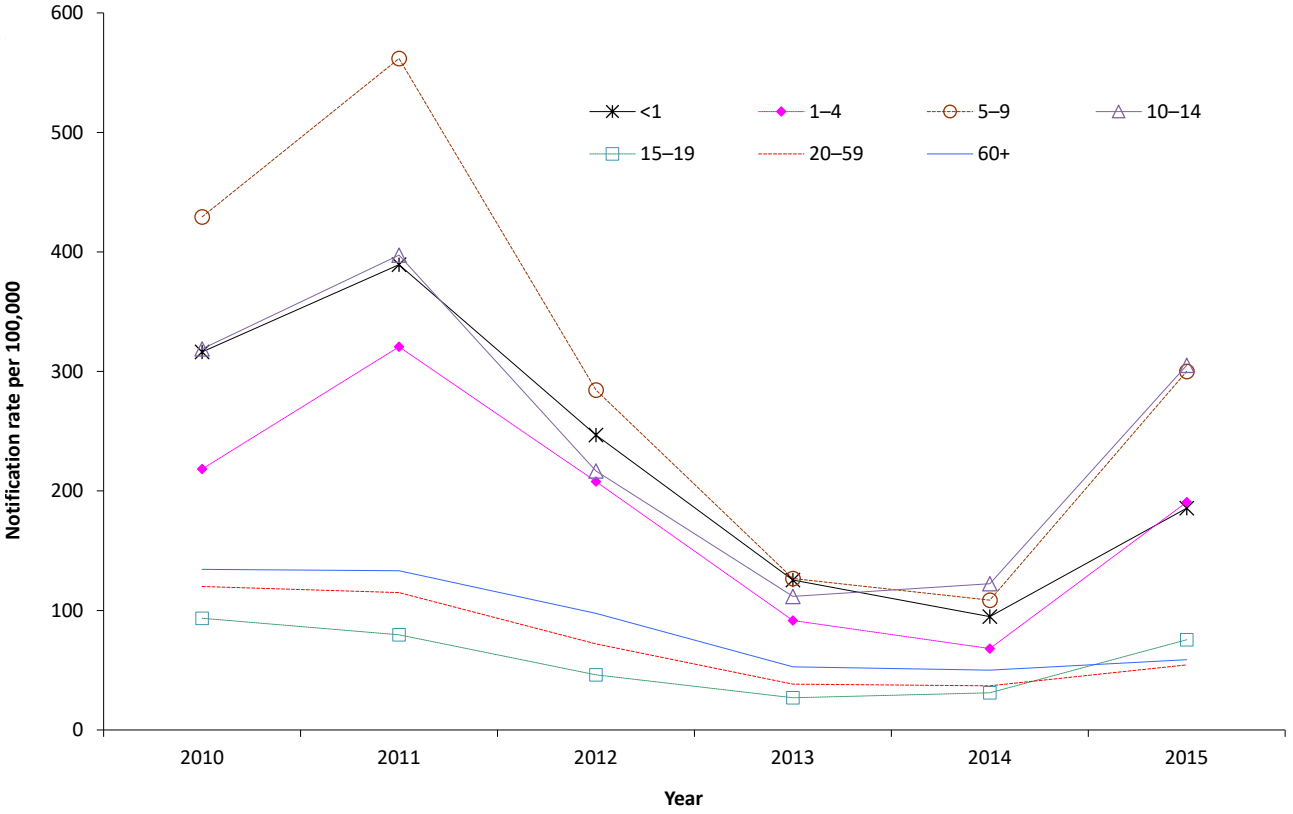
Figure 71: Notification rate for pertussis, Australia, by age group and sex



* Seven cases were reported without age

18 cases were reported without sex

Figure 72: Notification rates for pertussis, Australia, 2010 to 2015, by selected age groups*



13% (n=2,896) of all notified cases, Information about immunisation status was available for 94% of these (2,717/2,896).

Of the children eligible to receive pertussis-containing vaccines in 2015, 81% (1,729/2,145) of cases aged 6 months to 4 years received the full primary course of 3 doses, and 61% (273/449) of cases aged 4 to 5 years had received the full scheduled course of 4 doses (Table 18). Seventy-seven per cent (2,278/2,896) of eligible cases less than 5 years of age had received at least 2 doses of a pertussis-containing vaccine in 2015.

Pertussis vaccine effectiveness among Australian children has been estimated to range from 82% to 89%, with the lower figure representing the cohort of children who would not have been eligible for the 18-month booster dose, which was removed from the NIP in 2003.[99] Immunity to disease decreases over time post-immunisation, with estimates that protection remains for 4 to 12 years.[100,101,102] While pertussis can affect people of any age, infants are at highest risk of more severe disease, as adequate immunity is not achieved through infant immunisation until at least the second vaccine dose at 4 months of age.[103]

Discussion

Epidemics of pertussis have historically occurred at regular intervals of approximately 4 years on a background of endemic circulation in Australia, with the most recent epidemic peaking in 2011. In 2015, the national rate of pertussis increased, with jurisdictions reporting varying pertussis activity. The Northern Territory, Tasmania and Victoria displayed activity that is consistent at pre-epidemic levels, while the remaining jurisdictions exhibited increased activity compared with previous years, particularly New South Wales.

Increases in pertussis activity in New South Wales were evident from mid-2014, and were driven by an outbreak of pertussis which continued into 2015 and peaked in November.

Table 18: Notifications of pertussis in children aged 0 to 5 years, Australia, 2015, by age group

	Number of vaccine doses						
Age group	**0**	**1**	**2**	**3**	**4**	**Unknown**	**Total**
Less than 6 weeks of age (not eligible for immunisation)	35	4	0	0	0	9	48
6 weeks to <4 months (eligible for 1 dose of vaccine)	22	112	3	0	0	6	143
4 to <6 months (eligible for two doses of vaccine)	15	12	74	0	0	10	111
6 months to <4 years (eligible for 3 doses of vaccine)	177	17	64	1,729	47	111	2,145
4 to 5 years (eligible for 4 doses of vaccine)	44	1	5	83	273	43	449
Total	**293**	**146**	**146**	**1,812**	**320**	**179**	**2,896**

Pertussis activity in New South Wales displayed a decline in December 2015, but was still higher compared with activity in 2013 and early 2014.

All jurisdictions in 2015 introduced funded immunisation programs offering free pertussis immunisation to pregnant women in their third trimester (from 28 weeks gestation). In 2012, all jurisdictions, except for the Northern Territory, ceased their respective cocooning programs, which included various combinations of providing free booster immunisations to carers of infants. In 2015, Victoria funded a cocooning program as part of the maternal immunisation program. This program offers pertussis immunisations to parents and guardians of infants up to 6 months of age and born on or after 1 June 2015, and partners of women who are at least 28 weeks pregnant, if they have not received a pertussis booster in the last 10 years.[104] ■

Pneumococcal disease (invasive)

There were 1,499 cases of invasive pneumococcal disease notified in 2015, a small decrease on the total compared with 2014 (n=1,563).

Invasive pneumococcal disease (IPD) is a condition where *Streptococcus pneumoniae* is isolated from a normally sterile site such as blood, cerebrospinal fluid, or pleural fluid. Transmission of the bacterium from person to person is usually via the inhalation of respiratory droplets from an infected person. Many of the signs and symptoms of IPD are non-specific including fever, chills, headache, neck stiffness and general malaise. Severe symptoms can include seizures and occasionally coma.

Epidemiological situation in 2015

In 2015, there were 1,499 notifications of IPD, representing a notification rate of 6.3 per 100,000. Compared to 2011 (8.4 per 100,000), there has been a 25% reduction in the overall notification rate of IPD. This reduction was associated with the July 2011 replacement of the 7-valent pneumococcal conjugate vaccine (7vPCV) in the childhood immunisation program with

the 13-valent pneumococcal conjugate vaccine (13vPCV), where the declines were greatest among children aged less than 2 years targeted by the new vaccine and for those IPD cases caused by the 6 additional vaccine serotypes.[29]

Geographic distribution

Nationally in 2015, notification rates varied by jurisdiction, and ranged from 4.3 per 100,000 in the Australian Capital Territory to 24.9 per 100,000 in the Northern Territory. The Australian Capital Territory, the Northern Territory, Queensland and Tasmania all reported an increase in their rates of IPD notification compared to 2014. The Northern Territory reported the greatest increase on the previous year (41%, 17.7 to 24.9 per 100,000), noting that this increase had followed a decline from a previous peak in 2011 (55.8 per 100,000). In comparison, the other 3 jurisdictions reported only small increases (range: 4 to 12%). New South Wales, South Australia, Victoria and Western Australia all reported a decline in their notifications rates compared to 2014, with Western Australia reporting the greatest decrease (21%, 8.1 to 6.4 per 100,000).

Age and sex distribution

In 2015, males (55%, n=827) continued to account for a higher proportion of cases compared to females (45%, n=672). The rates of disease in males exceeded those in females across almost all age groups, especially among those aged 0–4 years and 75 years and over (Figure 73). Overall, the notification rate was highest in older Australians and young children, with an age distribution of cases similar to that observed in 2014. In adult Australians, the highest notification rate was among those aged 85 years and over (25.2 per 100,000), while in children it was among those aged less than 5 years (12.9 per 100,000). The notification rate among those aged less than 2 years was 17.9 per 100,000.

Seasonality

Many respiratory transmitted diseases, including IPD, are known to show a distinct seasonal trend, with incidence generally peaking during the winter months. In 2015, notifications of IPD peaked over the months of July and August (n=204 and 229 respectively), which was consistent with the seasonal peak observed in previous years.

Indigenous status

In 2015, 89% (1,340/1,499) of IPD cases were reported with a known Indigenous status. Of those with a known Indigenous status, 16% (208/1,340) were Indigenous. The age-specific notification rates for the Indigenous population were higher than for the non-Indigenous population in each age group. As Indigenous and non-Indigenous populations differ in age structure, age-standardised notification rates are reported to provide a more appropriate comparison of these 2 populations to a standard population, the Australian population in 30 June 2001. In 2015, the age-standardised notification rate in the Indigenous population was approximately 8 times that of the non-Indigenous population. The Indigenous age-standardised notification rate increased from 34.0 in 2006 to a peak of 58.6 in 2011 and then decreased to 42.2 per 100,000 population in 2015. In comparison, the non-Indigenous age-standardised notification rate increased from 6.3 in 2006 to 6.9 in 2011, followed by a decrease to 5.2 per 100,000 population in 2015 (Figure 25). The declines observed since 2011 are probably due to the replacement in mid-2011 of 7vPCV with 13vPCV as the pneumococcal vaccine offered to infants through the NIP.

Immunisation status

In 2015, publically funded pneumococcal immunisation was available for infants (at 2, 4 and 6 months of age), Aboriginal and Torres Strait Islander peoples aged 50 years and over, other Australians aged 65 years and over, and individuals with certain at-risk conditions.

Figure 73: Notification rate for invasive pneumococcal disease, Australia, 2015, by age group and sex

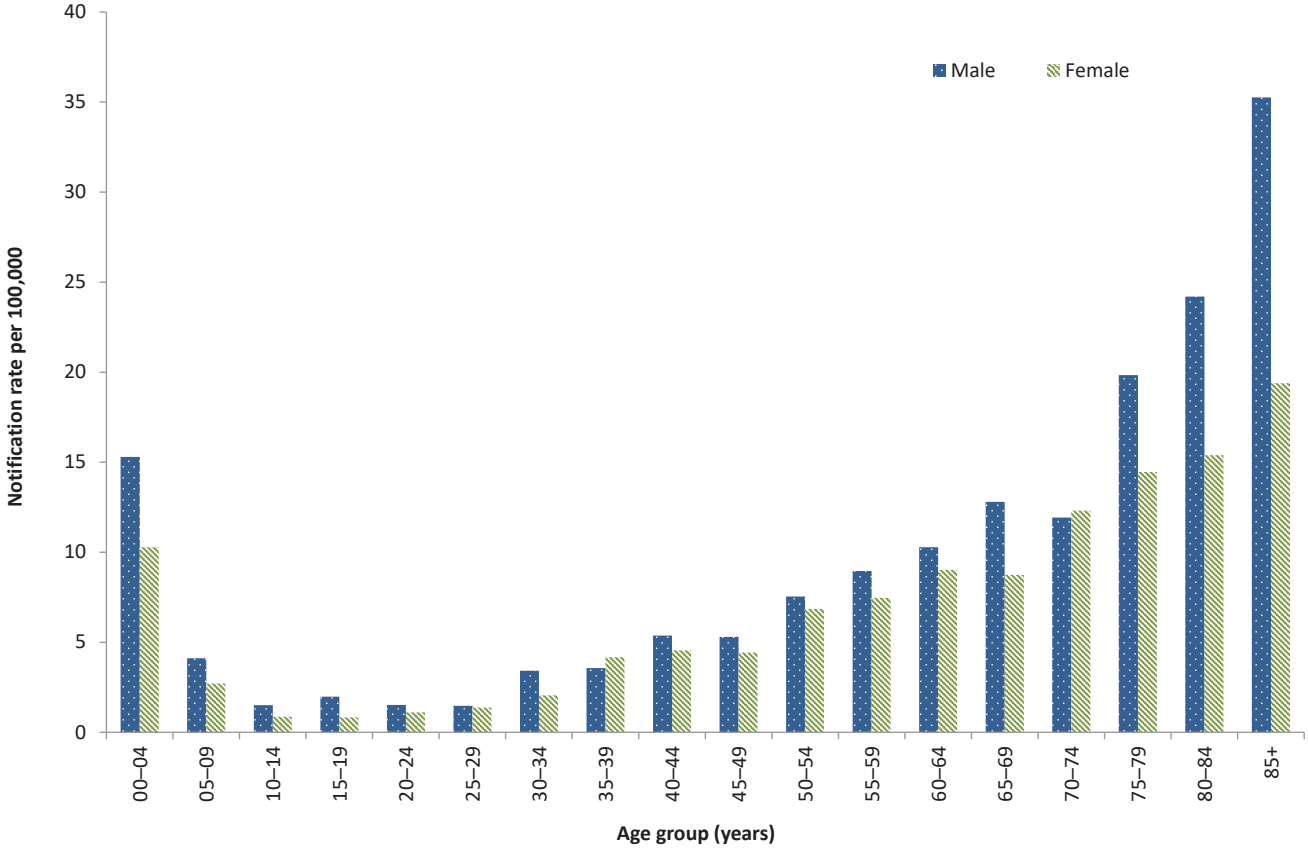
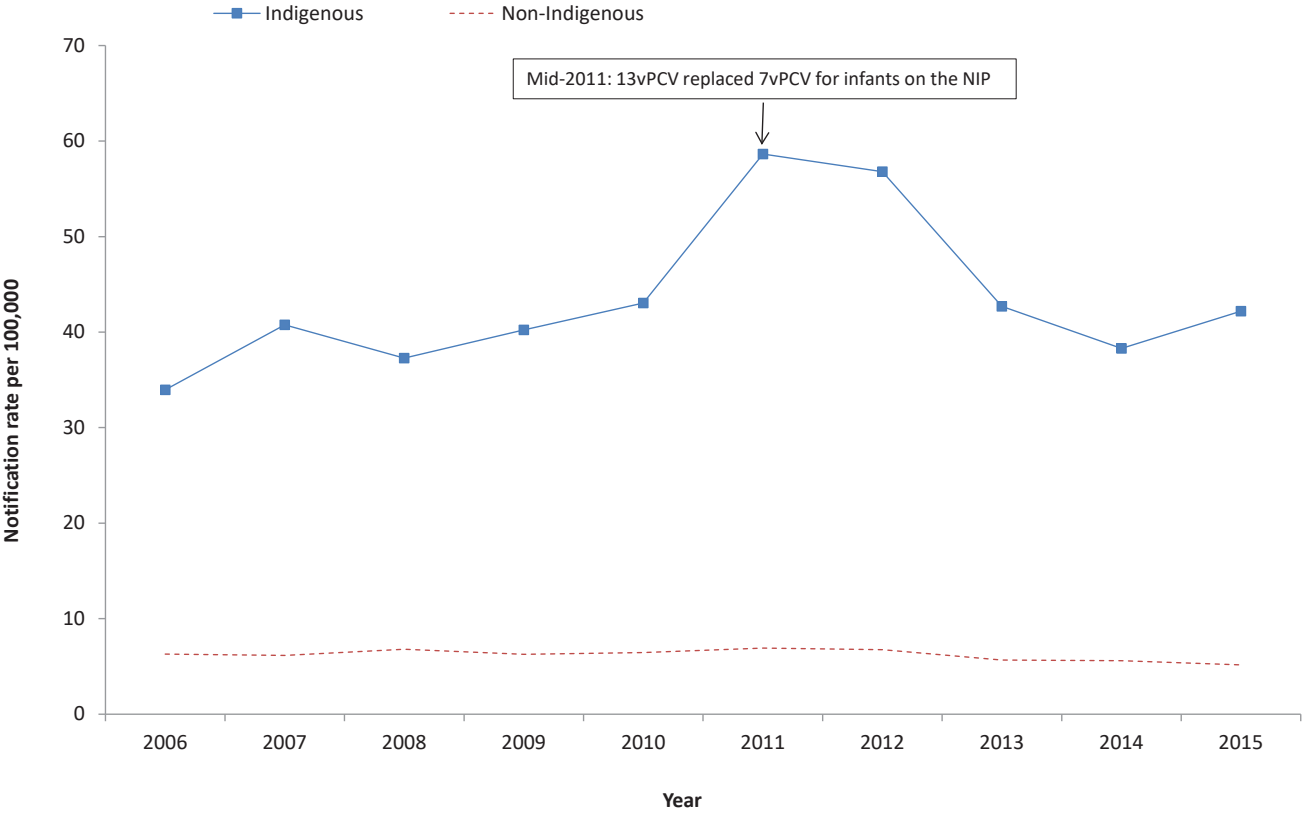


Figure 74: Age-standardised notification rates for invasive pneumococcal disease, Australia, 2006 to 2015, by Indigenous status*



* Where the Indigenous status of a notification was not completed, these notifications were counted as non-Indigenous in this analysis.

More information on the scheduling of the pneumococcal immunisation can be found in *The Australian Immunisation Handbook,* 10th edition.[105]

Based on the reported IPD serotype and relevant vaccine serotype coverage, there were 29 cases reported in fully vaccinated children aged less than 5 years who were considered to be 13vPCV failures and 3 cases who were considered 7vPCV failures, based on their vaccine type eligibility. Serotypes responsible for these vaccine failures were 19A (38%), 19F (38%) and 3 (25%). 'Fully vaccinated' describes cases that have completed the primary course of the relevant vaccine(s) required for their age according to the most recent edition of *The Australian Immunisation Handbook,*[105] at least 2 weeks prior to disease onset with at least 28 days between doses of vaccine.[iii]

Microbiological trends

Although there are more than 90 *S. pneumoniae* serotypes, a relatively limited number cause the majority of IPD. However, the predominant serotypes vary by age group and geographic area. Monitoring the profile of *S. pneumoniae* serotypes causing disease in the community is critical for evaluating the impact of the NIP funded vaccines as well as for the early detection of emerging serotypes and serotype-specific outbreaks. The serotypes causing IPD were reported in 94% (n=1,406) of notified cases in 2015 (Figure 75).

In 2015, 65% (n=917) of all notifications with a known serotype were caused by a serotype included in 23-valent pneumococcal polysaccharide vaccine (23vPPV) and 34% (n=484) were those included in 13vPCV. Overall after 13vPCV replaced 7vPCV in the childhood immunisation program in mid-2011, the proportion of IPD cases due to 13vPCV non-7vPCV disease declined from 51% in 2011 to 25% in 2015. Across all ages, the most frequently reported serotypes were 19A (10%, n=137), 3 (9%, n=132), 22F (8%, n=108), 19F (6%, n=78), 9N (5%, n=75) and 7F (5%, n=73). These 6 serotypes accounted for 43% (n=603) of all notifications with serotype information. All of these serotypes, except 9N and 22F, are included both in 13vPCV and 23vPPV. Serotypes 9N and 22F are only included in 23vPPV. Of the serotypes that are not covered by 13vPCV and 23vPPV (35%; n=489), these were distributed across 36 other serotypes, with serotypes 23B (5%; n=72), 23A (4%; n=60), 15A (4%; n=53) and 6C (3%; n=48) were the most common.

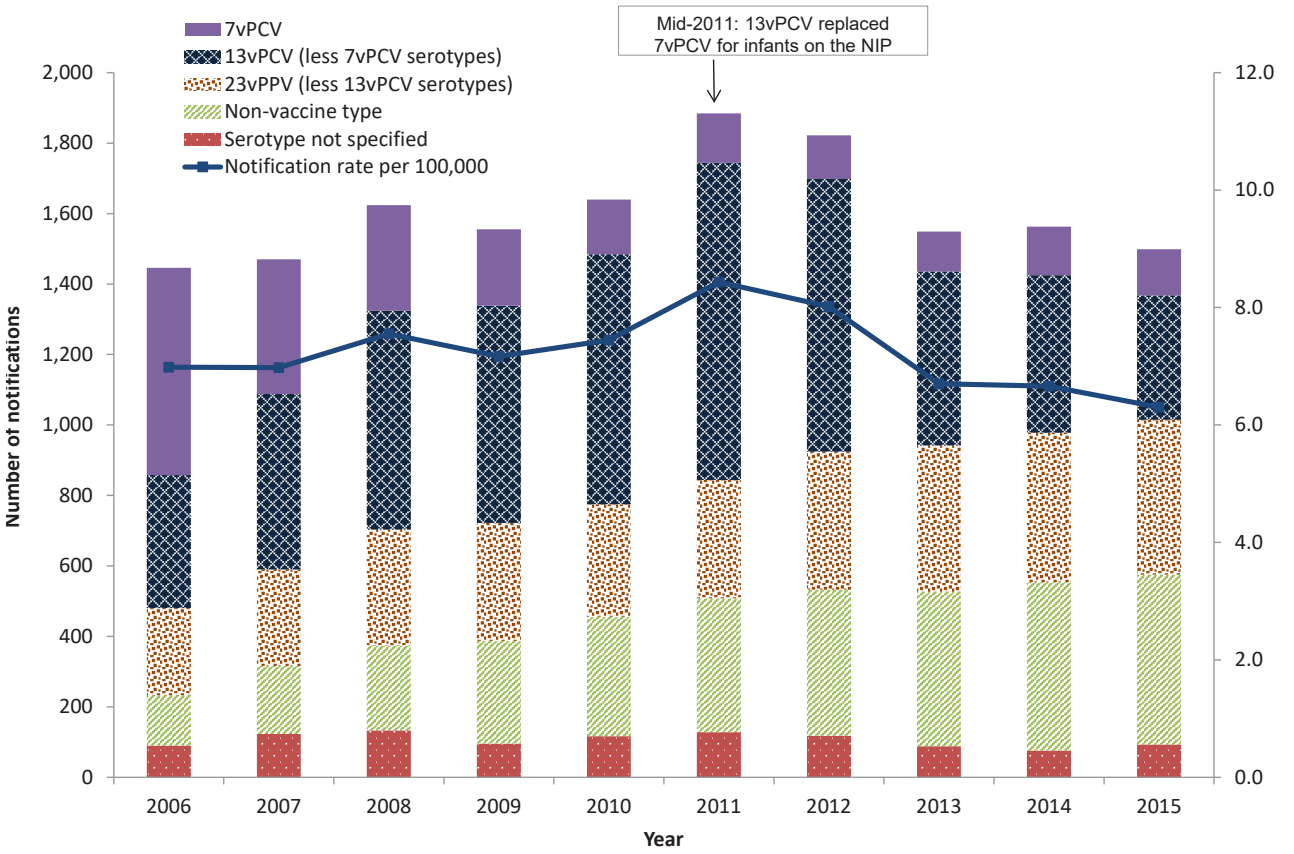
In 2015, 198 notifications of IPD were reported in children aged less than 5 years, with IPD serotype information reported in 85% (n=168) of these notifications. Just over 40% (n=70) of notifications in children aged under 5 years with a known serotype were a result of a serotype included in the 13vPCV. Since the 13vPCV replaced the 7vPCV in the childhood immunisation program in mid-2011, the proportion of cases due to 13vPCV non-7vPCV disease in this age group has declined from 69% in 2011 to 30% in 2015.

There were 37 notifications of IPD in Indigenous children aged less than 5 years in 2015, with a known serotype result reported for 31 (85%) of these cases. Seven notifications were associated with serotypes included in 13vPCV. Serotypes 19A (10%; n=3), 12F (10%; n=3), 23B (10%; n=3) were the most frequent serotypes reported. Of those, only serotype 19A is included in 13vPCV. In non-Indigenous children aged under 5 years there were 161 notifications, with a known serotype result reported for 137 (85%) of these cases. Serotypes 19A (23%, n=31) and 19F (12%, n=17) were the most frequently reported serotypes. Of those serotypes, only 19A is included in 13vPCV.

In Indigenous Australian adults aged 50 years and over, there were 72 notifications, with a known serotype result reported for 94% (n=68) of these cases. The most common serotypes

iii A young child who has had all the required doses for their age but is not old enough to have completed the primary course would not be classified as fully vaccinated.

Figure 75: Notifications and rates of invasive pneumococcal disease, Australia, 2006 to 2015, by vaccine serotype group and year



among this population group were serotypes 8 (12%, n=8) and 22F (10%, n=7), both of which are included in 23vPPV.

Among non-Indigenous adults aged 65 years or over, there were 525 notifications, with a known serotype reported for 97% (n=508) of these cases. The most common serotypes among this population group were serotypes 19A (9%, n=46), 3 (9%, n=44) and 22F (9%, n=43), which are all included in 23vPPV.

In 2015, 62% (n=42) of notifications with a reported serotype in Indigenous Australians aged 50 years or over and 56% (n=285) of notifications in non-Indigenous Australians aged 65 years or over, were a result of a serotype included in 23vPPV. While the overall number of IPD notifications in these 2 population groups has remained relatively stable, the proportion attributable to 23vPPV serotypes has continued to have a downward trend. A lot of this downward trend has been associated with the serotypes included in the 13vPCV, of which 12 are also included in the 23vPPV, and likely to be a result of the herd immunity effect on these 2 population groups afforded by the immunisation of infants with 13vPCV.

Enhanced surveillance

Enhanced data are available for IPD notifications. Further analyses, including risk factors and antibiotic susceptibilities, can be found in annual and quarterly IPD surveillance report series published regularly in CDI. In addition, a subset of IPD notification data, including serotype, age, sex, Indigenous status, clinical categories and immunisation history are publically available in the NNDSS IPD Public Dataset (http://www.health.gov.au/internet/main/publishing.nsf/Content/cds-surveillance-ipd-reports.htm) ■

Poliomyelitis

- There were no notifications of poliomyelitis in Australia in 2015.
- Australia, along with the Western Pacific Region, remains poliomyelitis free.

Poliomyelitis is an acute illness following gastrointestinal infection by one of the 3 types of poliovirus. Transmission occurs primarily person to person via the faecal–oral route. In most cases poliovirus infection is not symptomatic; however, in less than 1% of cases the virus may invade the nervous system and cause acute flaccid paralysis (AFP).[21]

Epidemiological situation in 2015

In 2015, there were no cases of poliomyelitis reported in Australia. Australia, along with the Western Pacific Region, remains poliomyelitis free.

Poliovirus infection, both paralytic (poliomyelitis) and non-paralytic, is a notifiable disease in Australia. Clinical and laboratory investigation is conducted for cases involving patients of any age with a clinical suspicion of poliomyelitis, following the WHO protocol which focuses on investigating cases of AFP in children under 15 years of age. The WHO target for AFP surveillance in a polio-free country is 1 case of AFP per 100,000 children less than 15 years of age.[106] Australia has achieved this surveillance target since 2008. However, the virological surveillance indicator of adequate stool specimen collection in 80% of AFP cases has never been met. More details can be found in the annual report series published in the CDI by the Australian Enterovirus Reference Laboratory, which coordinates poliovirus surveillance activities in Australia.[107]

Globally, strong progress continues to be made towards objectives of the Polio Eradication and Endgame Strategic Plan 2013–2018. In 2015, transmission of wild poliovirus was at the lowest levels in history, with the fewest ever reported cases. In 2015, there were only 35 cases of wild poliovirus reported from 3 countries: Afghanistan (19), Nigeria (4) and Pakistan (12). All were wild poliovirus type 1. On 20 September 2015, the Global Commission for the Certification of Poliomyelitis Eradication declared that wild poliovirus type 2 has been eradicated.[108] In October 2015, the Strategic Advisory Group of Experts on Immunization recommended that all countries still using trivalent oral polio vaccine (OPV) switch to a bivalent OPV. This committee encouraged countries to undertake the switch during the global synchronised withdrawal of the type 2 component of OPV, scheduled to occur between 17 April and 1 May 2016.[109] ■

Rubella and congenital rubella

- Rubella is a rare disease in Australia.
- Since 2003, the rubella notification rates have been less than 0.3 per 100,000.
- There were 17 cases of rubella and one case of congenital rubella syndrome notified in 2015.

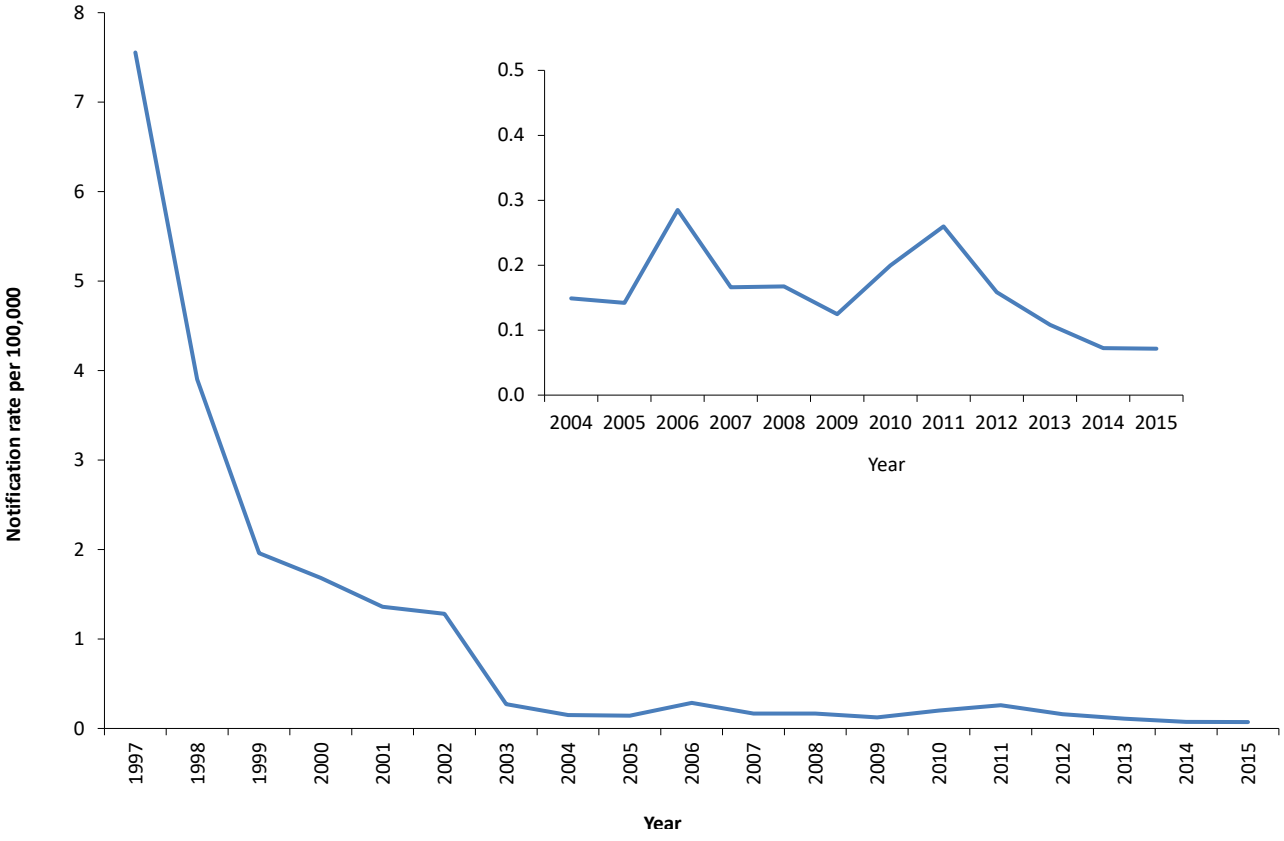
Rubella is generally a mild and self-limiting infectious disease caused by a rubella virus. It is spread from person to person through contact with respiratory secretions, including aerosol transmission. A rash, usually starting on the face before spreading across the body, may appear around 2 weeks after exposure to the virus and usually lasts for 3 days. Children usually show few or no constitutional symptoms of infection, but adults may experience 1 to 5 days of early low-grade symptoms, such as fever, malaise, headaches and mild head colds.[21] Clinically, rubella can be difficult to distinguish from other diseases which also cause febrile rash, such as measles, and is asymptomatic in up to 50% of cases.

Rubella infection in the first trimester of pregnancy can result in miscarriages, foetal deaths/stillbirths, and a collection of birth defects known as congenital rubella syndrome (CRS) in over 90% of cases.[21,110] CRS can result in single or combined defects such as hearing impairment, eye abnormalities (including retinopathy, cataract and microphthalmia) congenital glaucoma, microcephaly, meningoencephalitis, development delay, purpura, jaundice, radiolucent bone disease and congenital heart disease.

Epidemiological situation in 2015

In 2015, there were 17 cases of rubella reported, representing a rate of 0.1 per 100,000. While this is consistent with the low rates of this disease experienced since 2003, it is a marked decline from the peak rate of more than 7.5 per 100,000 in 1997 (Figure 76).

Figure 76: Notification rate for rubella, Australia, 1997 to 2015, by year



Age and sex distribution

Of the 17 cases of rubella reported in 2015, 10 cases were male and 7 were female. Of the 7 female cases, 6 were of child-bearing age (15–44 years) (Figure 77). The median age of cases was 28 years, with a range of 15 to 74 years. Consistent with previous years, the majority of cases (88%, 15/17) occurred among adults aged 20 years and older (Figure 77), and age-specific rates remained below 0.7 per 100,000 across all age groups (Figure 78).

There was one case of CRS reported in 2015. This case was an infant born in Australia to a non-immune mother who acquired her infection While in Indonesia.

Immunisation status

Rubella vaccine is provided in the combined MMR or measles-mumps-rubella-varicella (MMRV) vaccine. In 2015, rubella vaccines were provided under the NIP schedule at 12 months and 18 months of age. A dose at 4 years of age was also recommended for those who did not receive the second dose at 18 months of age.[29]

Of the 17 cases notified in 2015, 8 were reported as unvaccinated and the remaining 9 were of unknown immunisation status.

The primary aim of immunisation against rubella is to prevent cases of CRS.[111] Two doses of a rubella–containing vaccine are recommended for all non-immune people born during or since 1966 who are greater than 18 months of age.

Discussion

Evidence suggests that endemic rubella is well controlled in Australia. A marked decline in rubella notifications since 2002 has seen rates in Australia remain well below the 1.0 per 100,000 WHO goal indicative of rubella control.[112] The increasing trend in age of cases probably reflects the declining rates of rubella among children since routine MMR immunisation was imple-

Figure 77: Notifications of rubella, Australia, 2015, by age group and sex

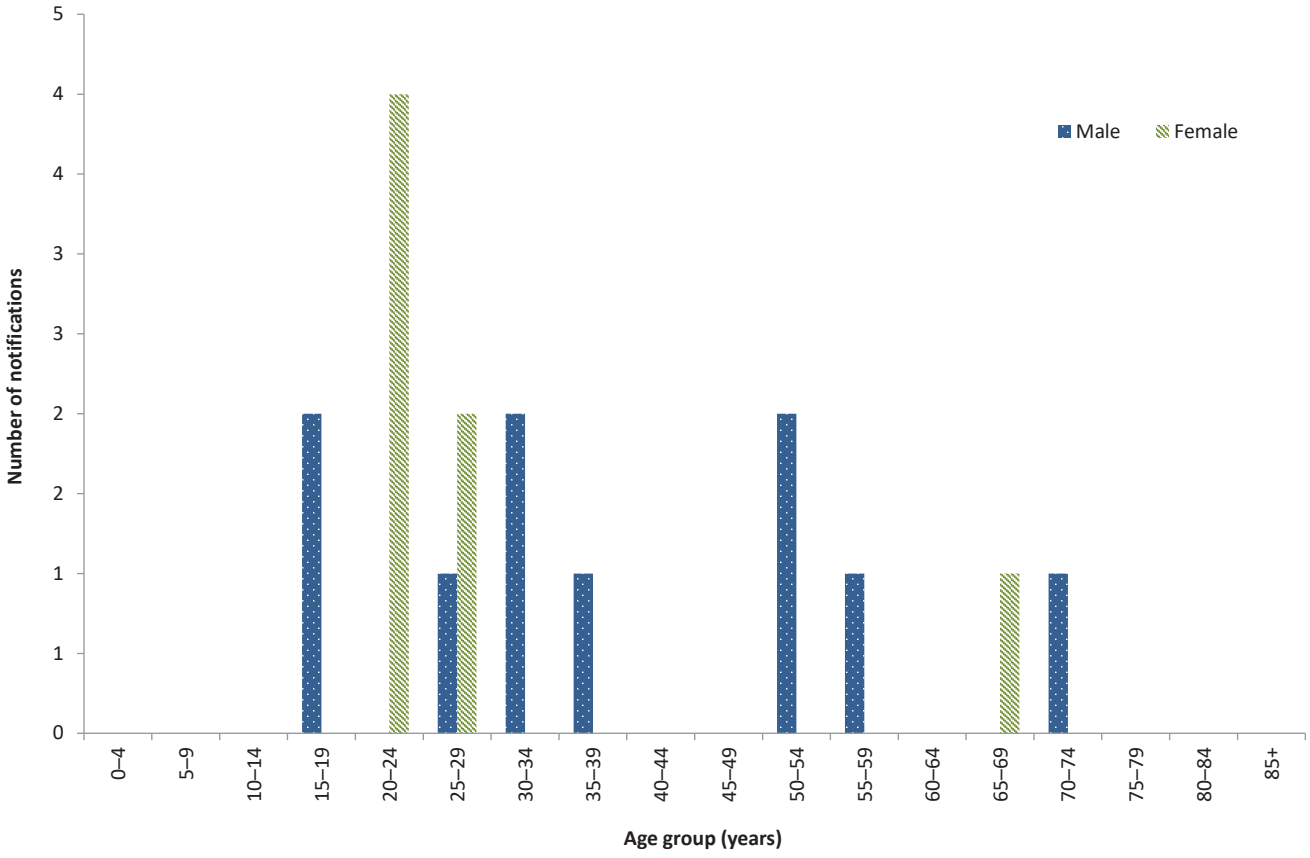
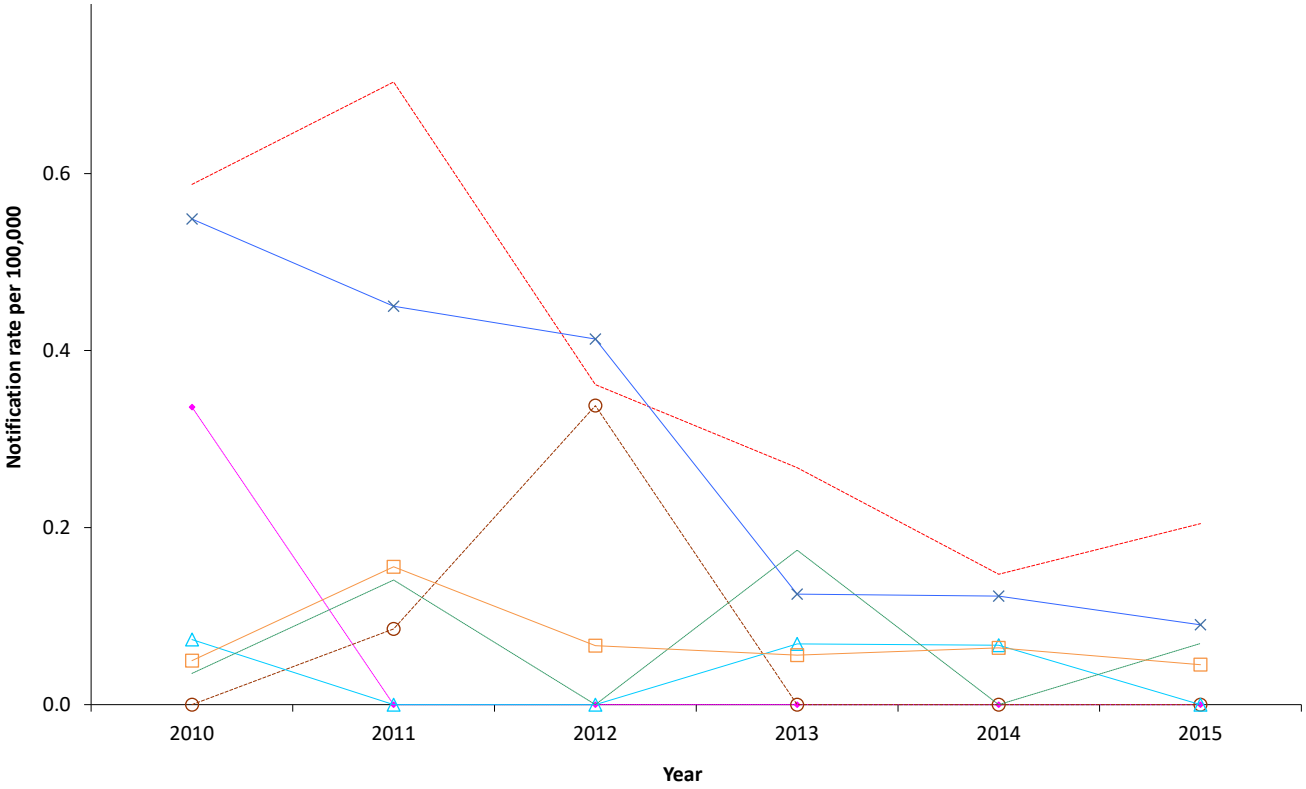


Figure 78: Notification rates for rubella, Australia, 2010 to 2015, by year and selected age groups



mented and the subsequent achievement of high 2-dose coverage. Males, historically were more susceptible as universal immunisation was not introduced until 1989, however now they no longer appear to be at greater risk of infection compared with females.

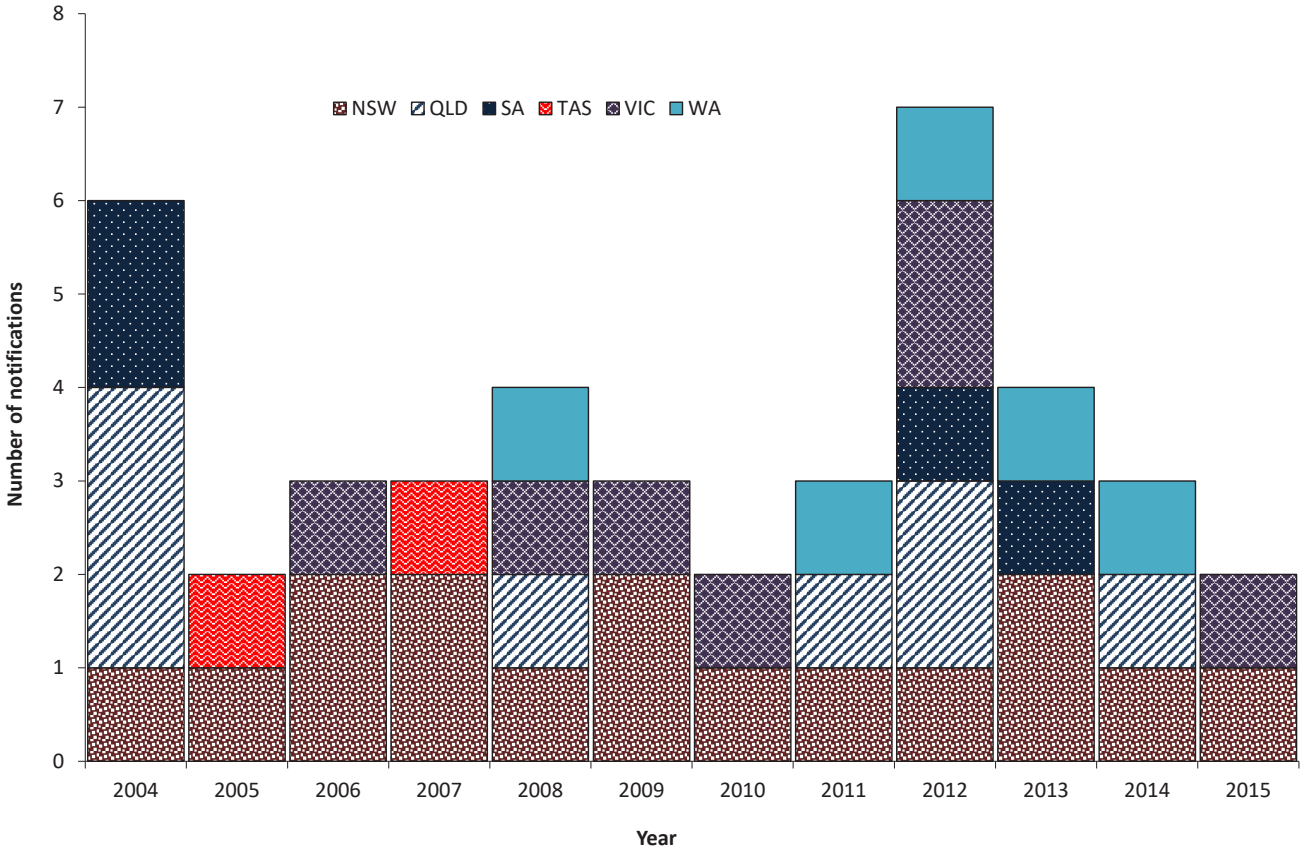
CRS is rare in Australia and in recent years has mainly occurred among infants of women who were born overseas.[113] ■

Tetanus

- Cases of tetanus are uncommon in Australia.
- Cases generally occur in older, unvaccinated people or in those who have not received a booster immunisation in the last 10 years.
- There were two cases of tetanus notified and no deaths reported in 2015.

Tetanus is an acute, often fatal, disease caused by the toxin produced by the bacterium *Clostridium tetani*. *C. tetani* spores usually enter the body through contamination of a wound with manured soil.[21] The neurotoxin acts on the central nervous system to cause muscle rigidity with painful spasms. Generalised tetanus, the most common form of the disease, is characterised by increased muscle tone and generalised spasms. The disease usually occurs after an

Figure 79: Notifications of tetanus, Australia, 2004 to 2015, by year and state or territory



incubation period of 3 to 21 days (ranging from 1 day to several months), with a median time of onset at 10 days post injury. In Australia, tetanus is rare, occurring primarily in older adults who have never been vaccinated or have not received a booster dose in the past 10 years. A high level of diagnostic awareness of tetanus is important in the elderly, as most deaths occur in people over 70 years of age, especially females, and may be associated with an apparently minor injury.[114]

Epidemiological situation in 2015

In 2015, there were 2 notifications of tetanus (Figure 79). This is consistent with the low numbers of this disease notified in recent years. Both cases were adult females aged between 75 and 79 years. There were no deaths due to tetanus reported in 2015.

Immunisation status

The NIP schedule in 2015, recommended a primary course of tetanus immunisation including 3 doses provided at 2, 4, and 6 months of age. Two booster doses are provided at 4 years and between 10 and 15 years, delivered through school-based programs. Booster doses are additionally recommended for all adults at the age of 50 years who have not received one in the previous 10 years.[29]

Of the 2 cases notified in 2015, both were reported as unvaccinated.

Complete immunisation induces protection which lasts throughout childhood, but by middle age 50% of vaccine recipients have low or undetectable levels of antibodies. Tetanus is, however, uncommon in people who have received 4 or more doses of a tetanus containing vaccine, and in those who received their last dose within 10 years.[113]

Varicella zoster virus

- There were 22,185 cases of varicella zoster infection notified in 2015.
- Of these, 2,479 (11%) were chickenpox, 6,343 (28%) were shingles and 13,363 (61%) were unspecified varicella zoster virus infection.
- Data were collected from all jurisdictions except New South Wales.

The varicella zoster virus (VZV) is a highly contagious member of the herpesvirus family and causes 2 distinct illnesses: chickenpox as the primary infection; and shingles (herpes zoster), which occurs following reactivation, often many years later, of latent virus in approximately 20% to 30% of all chickenpox cases. Shingles occurs more frequently among older adults (most commonly after 50 years of age) and in immunocompromised people.[21]

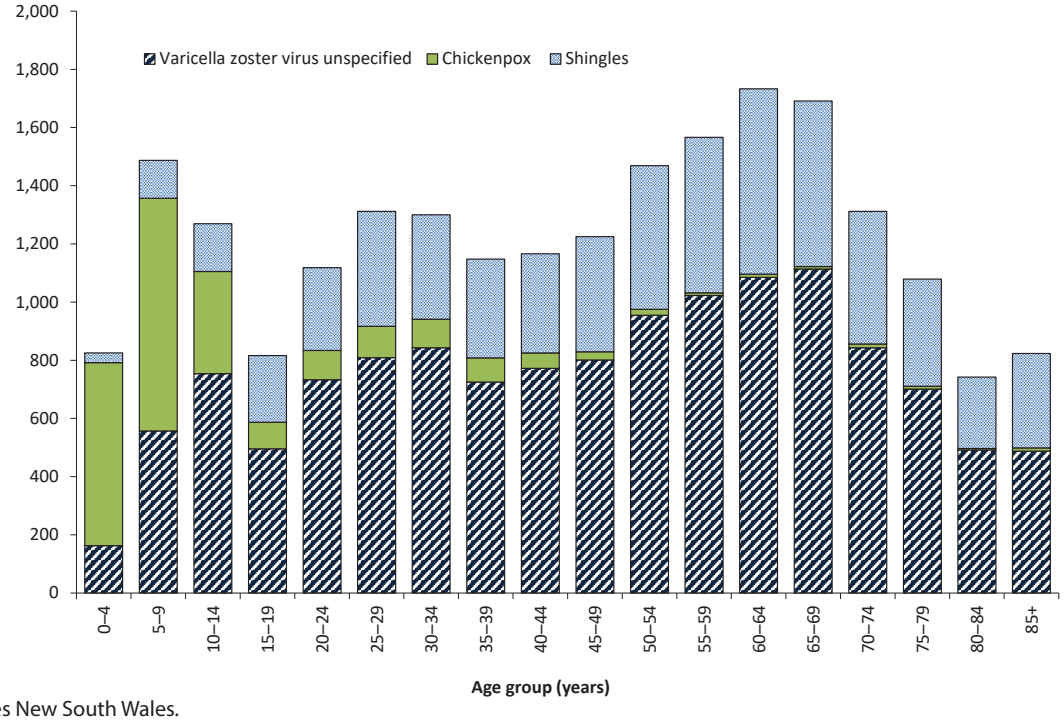
In 2006, the CDNA agreed 3 categories of VZV infection were nationally notifiable: 'chickenpox', 'shingles' and 'varicella zoster virus unspecified'. By 2009, all jurisdictions were notifying VZV infections to the NNDSS against these 3 categories, except New South Wales, where VZV is not a notifiable disease.

The ability to categorise a VZV infection as chickenpox or shingles depends on follow-up to determine the clinical presentation of the case. The majority of VZV infections are reported as unspecified, as follow-up does not occur (Table 5). Notification rates for chickenpox, shingles and VZV unspecified, including any comparisons made between jurisdictions and age groups, should be interpreted with caution as they are affected by the varying levels of follow-up undertaken in each jurisdiction.

Epidemiological situation in 2015

In 2015, there were 22,185 VZV notifications from the 7 reporting jurisdictions. This was 13% more than the total cases notified in 2014 (n=19,640). Of the total VZV notifications in 2015, 60% (n=13,354) were reported as unspecified VZV infection, 29% (n=6,298) as shingles and 11% (n=2,429) as chickenpox (Figure 80). ■

Figure 80: Notifications of varicella zoster virus infection, 2015, Australia*, by age group#



* Excludes New South Wales.

\# Age of onset missing for 104 notifications.

Varicella zoster virus (unspecified)

- There were 13,363 cases of VZV unspecified notified in 2015, a 10% increase from 2014.
- Fifty-four per cent of cases were female and rates were highest in those aged 55 years and over.

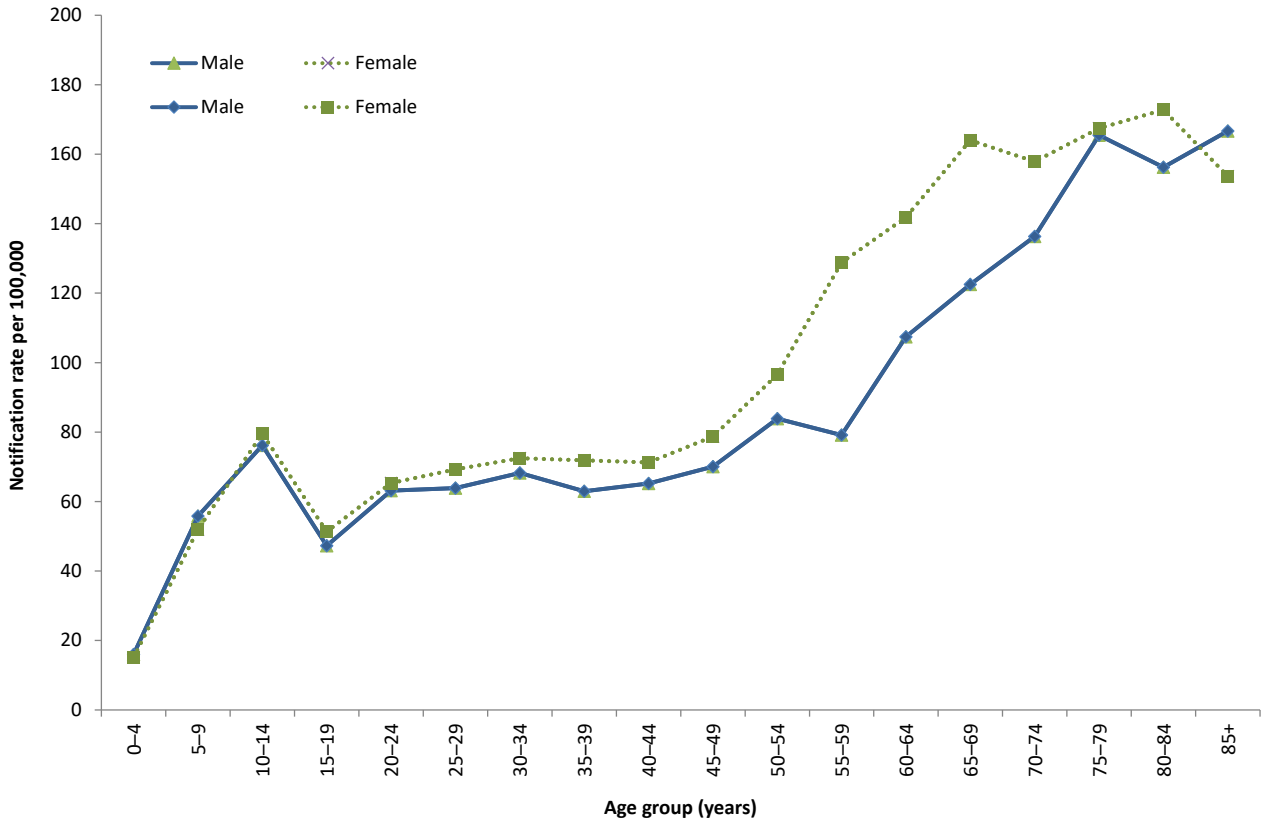
Epidemiological situation in 2015

In 2015, there were 13,363 cases of VZV unspecified infections reported, representing a notification rate of 83 per 100,000, and a 10% increase in notifications compared with 2014 (n=12,017). The highest notification rate for VZV unspecified was reported from Queensland (135.6 per 100,000) and the lowest from the Northern Territory (0.8 per 100,000) (Table 5).

Age and sex distribution

In 2015, the majority of VZV unspecified cases were reported in females (54%, n=7,242). Overall, females have a higher notification rate (82 per 100,000) compared with males (76 per 100,000) which predominated across all ages except young children (under 10 years of age) and adults aged 85 years or over (Figure 81). The highest age-specific rates for females occurred in the 80–84 years age group (173 per 100,000) and for males in the 85 years or over age group (167 per 100,000). ■

Figure 81: Notification rate for varicella zoster virus unspecified, Australia,* 2015, by age group and sex#



* Excludes New South Wales.

\# Age of onset and sex missing for 9 notifications.

Chickenpox

- There were 2,479 cases of chickenpox notified in 2015, a 15% increase from 2014 (n=2,103).
- Fifty-four per cent of cases were male and 72% were in children less than 15 years of age.

Chickenpox is a highly contagious infection spread by respiratory secretions, including aerosol transmission, or from the vesicle fluid of skin lesions from a patient with chickenpox or shingles infection. Chickenpox is usually a mild disease of childhood; however, complications occur in approximately 1% of cases. It is more severe in adults, and in people of any age who are immunocompromised.[29]

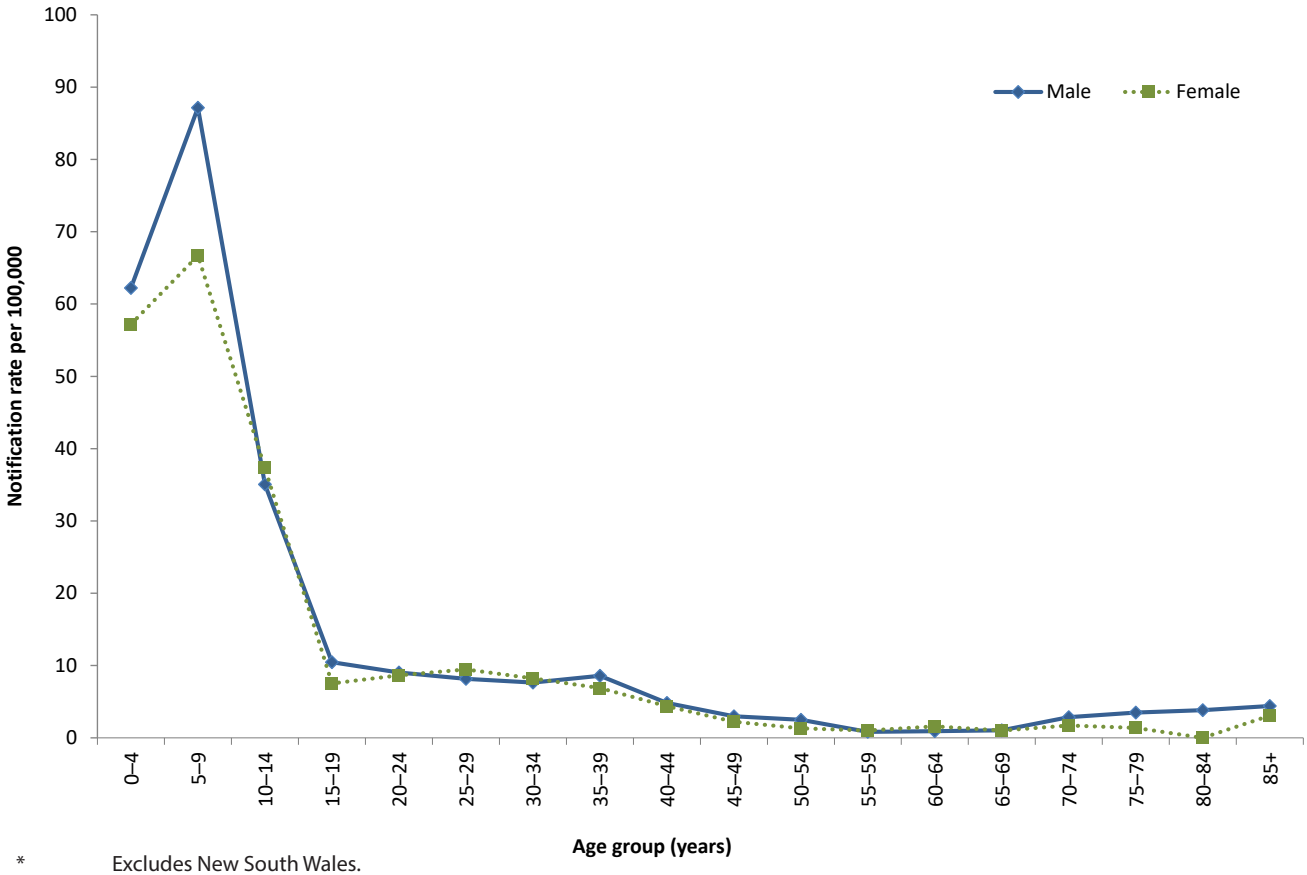
Epidemiological situation in 2015

In 2015, there were 2,479 cases of chickenpox reported, representing a notification rate of 15.3 per 100,000 and a 15% increase in the number of notifications compared with 2014 (n=2,103). The national notification rate of chickenpox has remained stable between 12.0 and 15.3 per 100,000 since 2010. The highest notification rate of chickenpox was in the Northern Territory (48.3 per 100,000), followed by South Australia (26.3 per 100,000), reflecting the higher case-ascertainment in these jurisdictions.

Age and sex distribution

In 2015, 54% (n=1,339) of notified cases were male and 72% (n=1,780) occurred in children less than 15 years of age. Consistent with recent years, children under the age of 10 years had the highest notification rates in 2015. Rates were highest in the 5–9 years age group (77 per 100,000) (Figure 82). Compared with 2014,

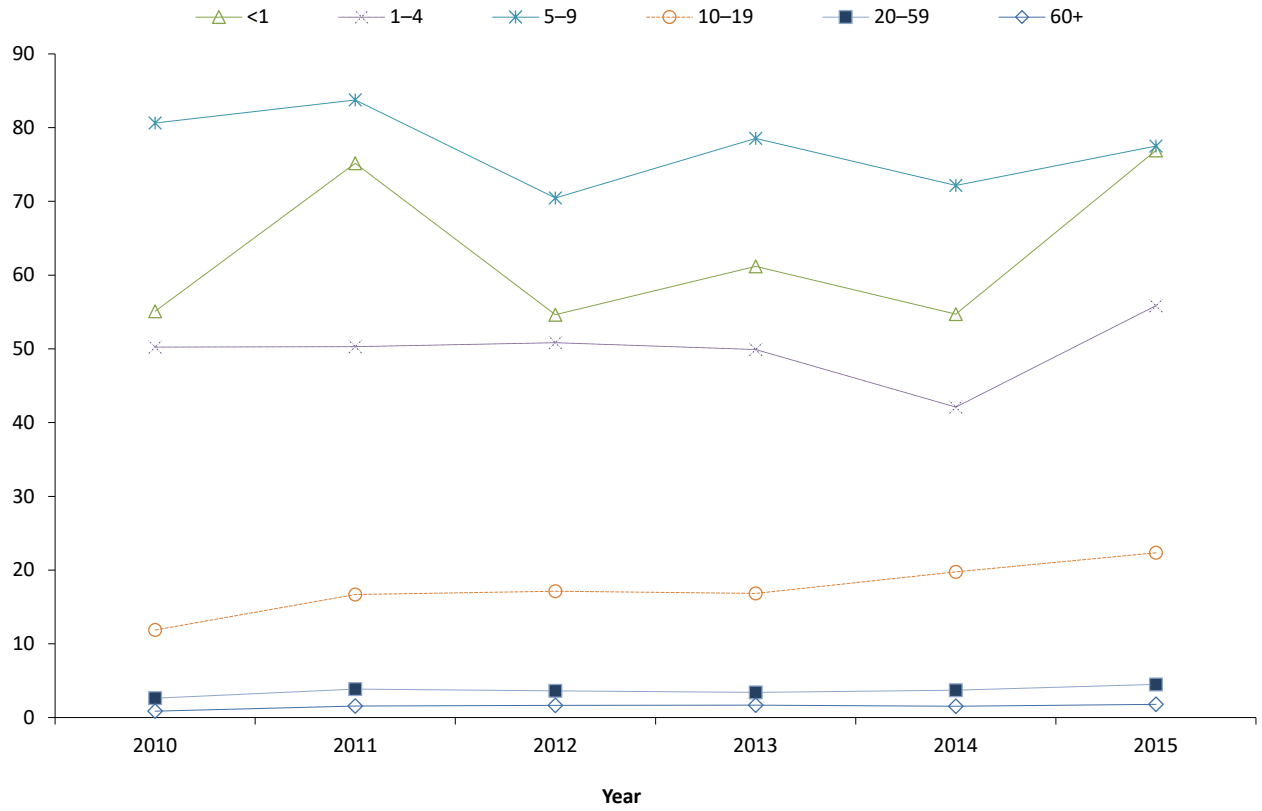
Figure 82: Notification rate of chickenpox, Australia,* 2015, by age group and sex#



* Excludes New South Wales.

\# Age of onset missing for 50 and sex missing for 13 notifications.

Figure 83: Notifications of chickenpox, Australia,* 2010 to 2015, by year and selected age groups#



* Excludes New South Wales # Age of onset missing for 9 notifications in 2010, 7 notifications in 2011, 21 notifications in 2012, 38 notifications in 2013, 54 notifications in 2014 and 50 notifications in 2015

all age-group-specific rates increased, with the largest increase occurring in infants under 1 year of age, from 55 per 100,000 in 2014 to 77 per 100,000 in 2015 (Figure 83).

Immunisation

Routine use of a varicella-containing vaccine in children was first recommended in Australia in 2003. In November 2005, the vaccine was funded under the NIP for all children at 18 months of age, with a school-based catch-up program included for children 10 to 13 years of age with no history of disease or previous immunisation.

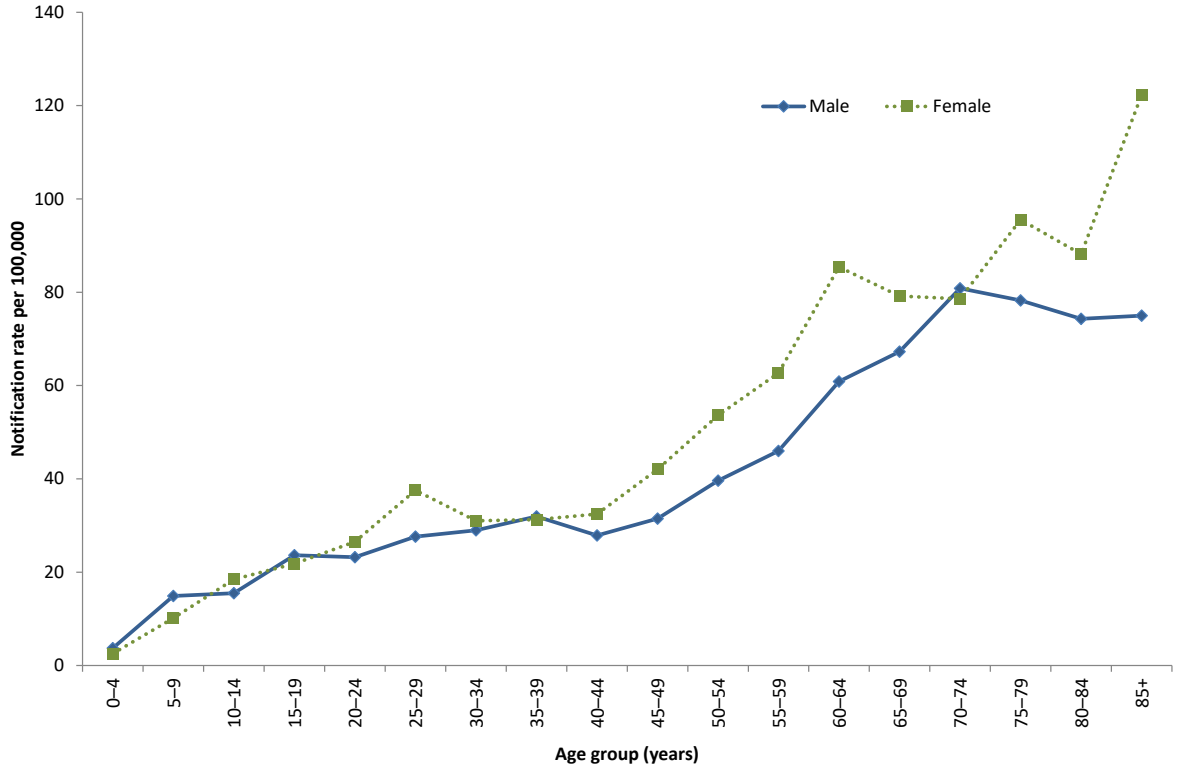
In 2015, the oldest cohort of children eligible for varicella immunisation at 18 months of age were 11 years of age. Of those eligible for immunisation (n=1,649), 35% (577/1,649) were vaccinated and 17% (283/1,649) were unvaccinated. The remaining 48% (789/1,649) were of unknown immunisation status. ■

Shingles

- There were 6,343 cases of shingles notified in 2015, a 15% increase compared with 2014.
- Fifty-six per cent of notified shingles cases were female, and rates were highest in the older age groups.

Shingles occurs most commonly with increasing age, impaired immunity, and a history of chickenpox in the first year of life.[29] Reactivation of VZV that causes shingles is thought to be due to a decline in cellular immunity to the virus. Shingles typically presents as a unilateral vesicular rash localised in a dermatomal distribution. Associated symptoms may include headache, photophobia, malaise, itching, tingling, or severe pain in the affected dermatome. In the majority of patients, shingles is an acute and self-limiting

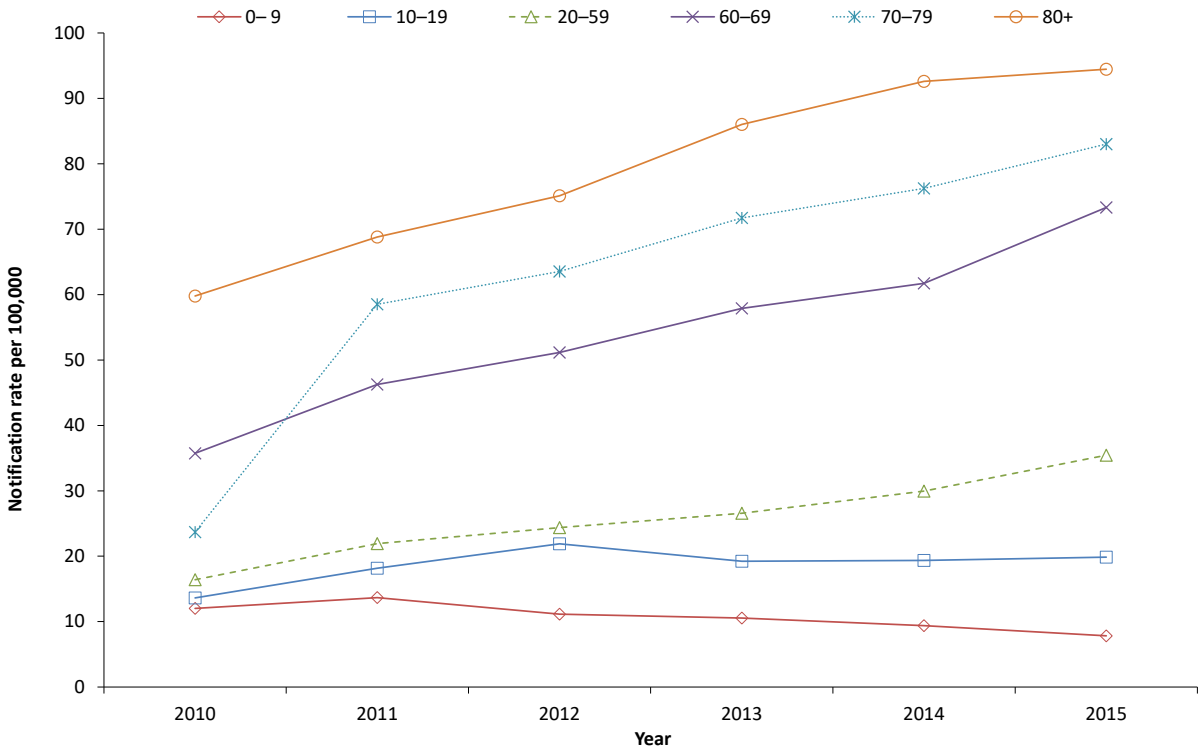
Figure 84: Notification rate for shingles, Australia,* 2015, by age group and sex#



* Excludes New South Wales

\# Age of onset missing for 45 notifications and sex missing for 5 notifications.

Figure 85: Notification rate for shingles, Australia,* 2010 to 2015, by year and selected age groups#



* Excludes New South Wales.

\# Age of onset missing for 13 notifications in 2010, 14 notifications in 2011, 23 notifications in 2012, 57 notifications in 2013, 57 notifications in 2014 and 45 notifications in 2015.

disease; however, complications develop in approximately 30% of cases, the most common of which is chronic severe neuropathic pain or post herpetic neuralgia.[21]

A single dose of zoster vaccine is recommended for adults aged 60 years and over who have not previously received a dose of zoster vaccine. However, in 2015 this immunisation was not funded through the NIP. [29]

Epidemiological situation in 2015

In 2015, there were 6,343 cases of shingles reported, representing a notification rate of 40 per 100,000 and a 15% increase compared with 2014 (n=5,520). The highest rates of shingles occurred in the Northern Territory (148.9 per 100,000) and in South Australia (136.8 per 100,000) (Table 5). The high rates in these jurisdictions most likely reflect their higher levels of case-ascertainment compared with other jurisdictions.

Age and sex distribution

In 2015, 56% (n=3,534) of notified shingles cases were female. As expected, the notification rate increased with age, with the highest rates occurring in those 80 years and over in 2015 (Figure 84). Since 2010, rates in the adult age groups (older than 20 years) have been rising, the largest increase occurring in the 70–79 years age group with a 250% increase in rates between 2010 and 2015 (Figure 85). Rates among children and adolescents have been more stable, remaining at or below 20 per 100,000 since 2010. ■

VECTORBORNE DISEASES

Vectorborne diseases are infections transmitted by arthropods such as mosquitoes and ticks. A vectorborne disease may involve a simple transfer via the arthropod, or, may involve replication of the disease-causing organism in the vector.[21] Vectorborne diseases of public health importance in Australia listed in this chapter are in the genera *Alphavirus* and *Flavivirus*. Viruses in the genus *Alphavirus* that are notifiable in Australia are Barmah Forest virus (BFV), Ross River virus (RRV) and Chikungunya virus (CHIKV).

Viruses in the genus *Flavivirus* that are included in the vectorborne diseases category are dengue virus (DENV) infection; Japanese encephalitis virus (JEV) infection; infections with the Kunjin lineage of West Nile virus (KUNV), which is probably limited to the Australian mainland or possibly Papua New Guinea, and other lineages of West Nile virus (WNV); malaria; Murray Valley encephalitis virus (MVEV) infection; and *Flavivirus* unspecified, which includes Zika virus infection (ZIKV).

Some other vectorborne diseases, including yellow fever virus infection, plague and certain viral haemorrhagic fevers, are listed under quarantinable diseases. The National Arbovirus and Malaria Advisory Committee (NAMAC) provides expert technical advice on vectorborne diseases to the Australian Health Principal Protection Committee through CDNA.

Barmah Forest virus

- The low number of notifications and rates observed in 2014 continued in 2015.
- BFV is most commonly reported in middle-aged to older age groups.
- Notifications peaked between January and April of 2015.

BFV occurs exclusively in the Australasian region.[115] Infection can cause a clinical illness, which is characterised by fever, rash and poly arthritis. The virus is transmitted by numerous species of mosquitos that breed in diverse environments.[116] False positive IgM diagnoses for BFV in particular are a known issue; thus it is unclear what proportion of notifications represent true cases. In 2015, the national case definition for BFV required only a single IgM positive test to BFV, in the absence of IgM to RRV.[117] A revised case definition was implemented on 1 January 2016, in which a single IgM is no longer considered sufficient evidence for a confirmed case.

Epidemiological situation in 2015

In 2015, there were 628 notifications of BFV, representing a rate of 2.6 per 100,000. This is much lower than the 5-year mean of 2,008.6 notifications and a 5-year mean rate of 8.8 per 100,000, but similar to 2014 (3.2 per 100,000; n=742) (Figure 86). A marked increase in notifications in 2013 was considered likely to have been due to a high rate of false positive IgM test results produced by a commercial test kit in private laboratories, which resulted in a recall of the affected kits in September 2013.[112]

Geographical distribution

The largest number of notifications was in Queensland (n=360), but the highest rate was in the Northern Territory (10.6 per 100,000) (Table 5). It is important to note that seasonal

Figure 86: Notifications of Barmah Forest virus infection, Australia, 2010 to 2015, by month and year and state or territory

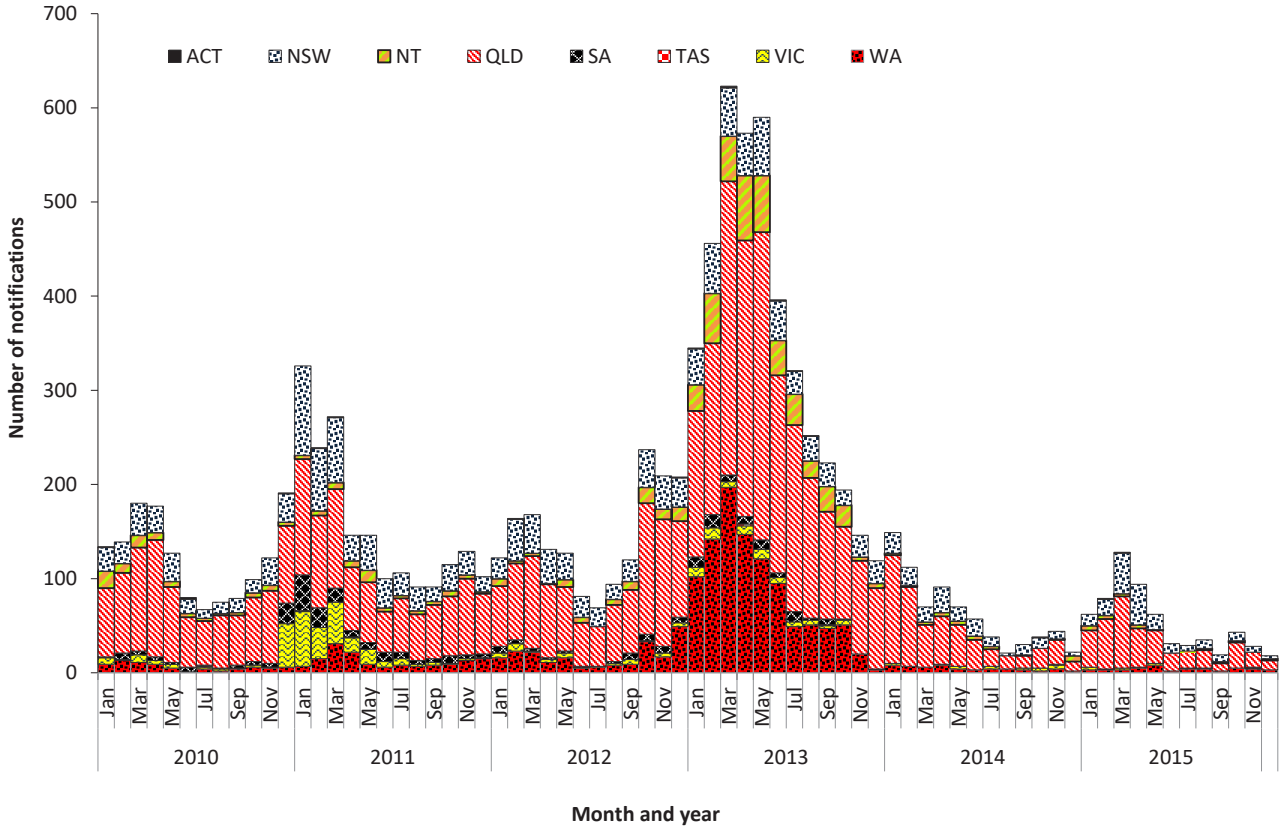


Figure 87: Rates of Barmah Forest virus infection, Australia, 2010 to 2015, by state or territory

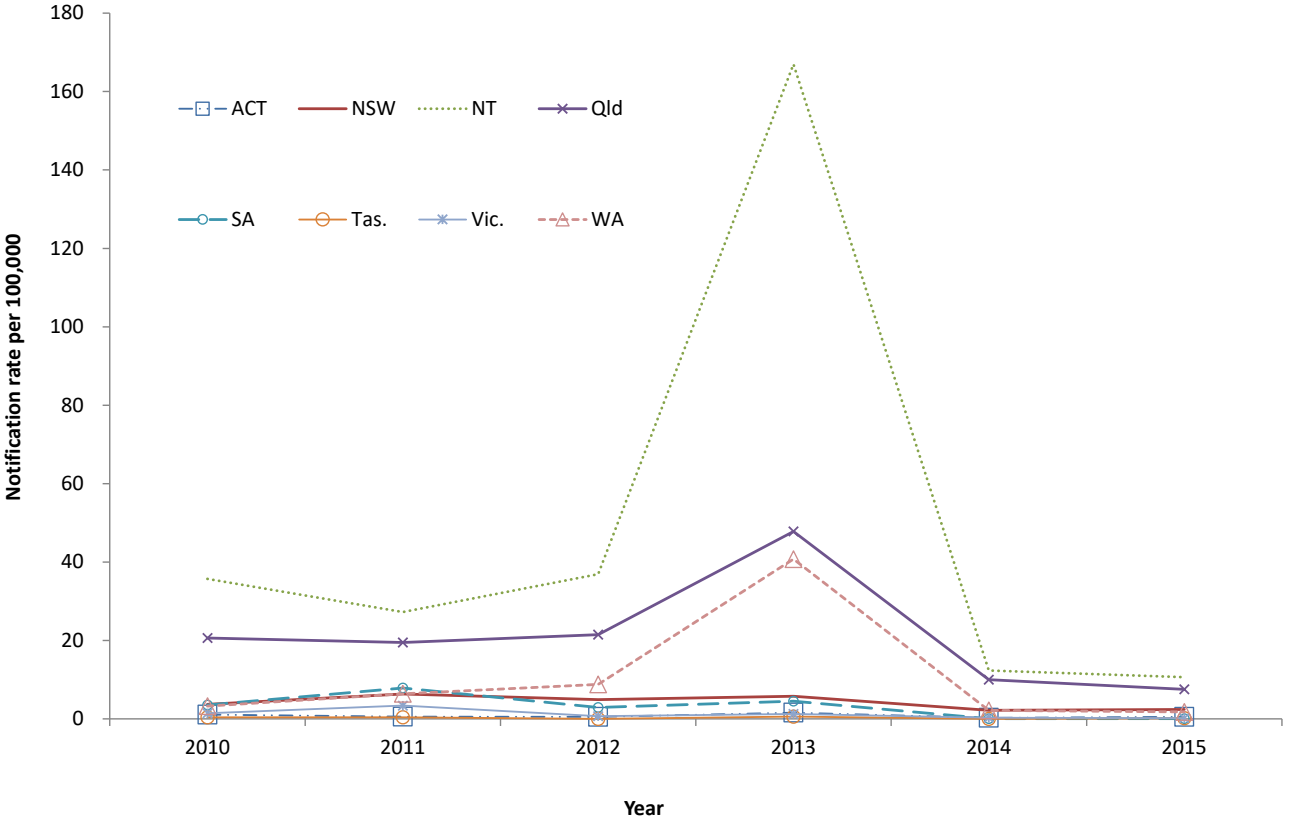
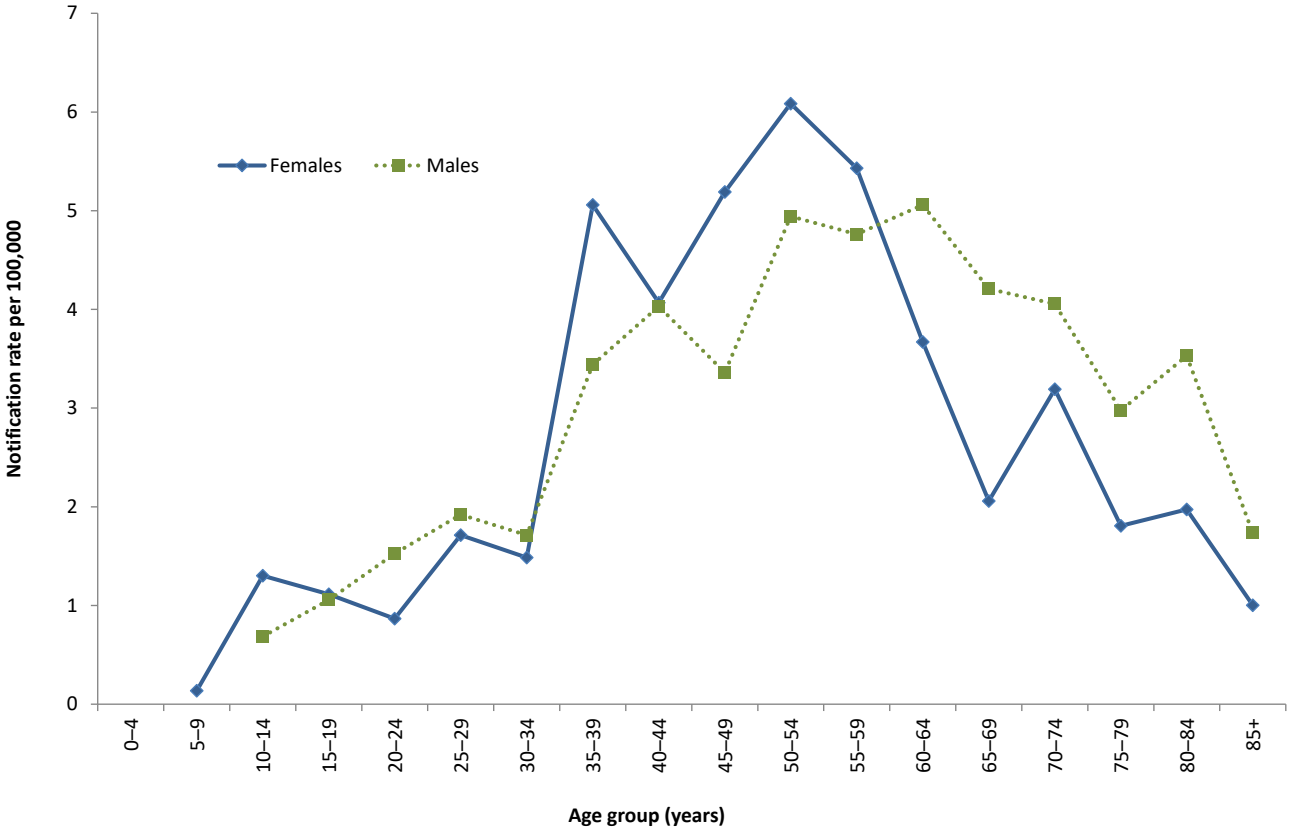


Figure 88: Notification rates for Barmah Forest virus, 2015, by age group and sex



trends vary between and within states and territories according to differences in mosquito vectors, hosts and climate. In addition, comparisons between regions are likely to be influenced by accuracy of case-ascertainment, which may vary between jurisdictions because of some differences in reporting criteria and the quality of diagnostic tests used.

Age and sex distribution

BFV is most commonly reported in middle-aged and older adults. The median age of notifications in 2015 was 50 years (range: 7 to 96 years), and 49% of cases were male. Notification rates of BFV peaked in females aged 50–54 years (6.1 per 100,000) and males aged 60–64 years (5.1 per 100,000) (Figure 88).

Seasonality

In 2015, BFV was most commonly reported between January and May, with 68% (425/628) of cases notified during these months. This is a more pronounced seasonality than that observed between 2010 and 2014, when 57% of cases were reported during these months. ■

Chikungunya virus

- Notifications of CHIKV in 2015 are lower than the 5-year mean but similar to 2013 and 2014.
- In 2015, place of acquisition information was completed for all but 1 case, and all of cases were acquired overseas.

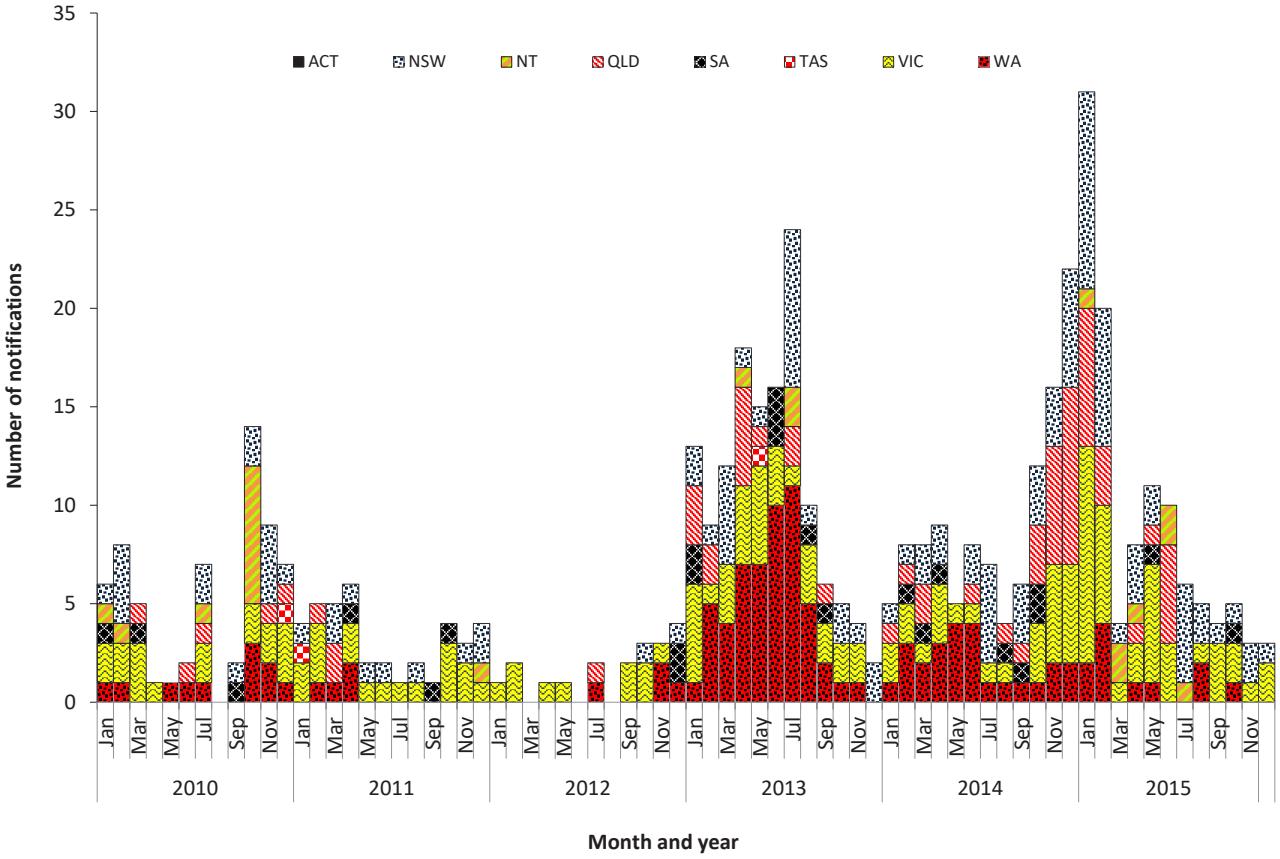
CHIKV can cause an illness which is characterised by an abrupt onset of fever, rash and severe joint pain. The acute disease lasts 1 to 10 days, but convalescence may include prolonged joint swelling and pain lasting months. Haemorrhagic manifestations may occur occasionally.[118] Humans are amplification hosts for CHIKV, and other vertebrates are not required for transmission to occur. Local transmission of CHIKV has not been reported in Australia, but it is regularly reported in travellers returning from overseas. There is the potential for transmission of CHIKV in areas where a suitable mosquito vector exists.

Internationally, CHIKV is most commonly transmitted by *Aedes aegypti* and *Aedes albopictus*. In Australia, *Ae. aegypti* is present in parts of Northern, Central and South-west Queensland and *Ae. albopictus* is found on Cocos Island, on Christmas Island and in some areas of the Torres Strait Islands.[119] CHIKV was made nationally notifiable in January 2015; however, notifications have been sent to the Commonwealth from all jurisdictions since 2010, when a national case definition was implemented.

Epidemiological situation in 2015

In 2015, there were 110 notifications of CHIKV. This is an increase compared with the 5-year

Figure 89: Notifications of chikungunya virus infection, Australia, 2010 to 2015, by month and year and state or territory



mean of 72.8 notifications, but similar to 2013 and 2014 (134 and 110 notifications respectively) (Figure 89).

Geographical distribution

The largest number of notifications was in Victoria (n=38), followed by New South Wales (n=35 and Queensland (n=11). Complete information on the place of acquisition was supplied for 99% (109/110). All notifications with complete information were overseas acquired, most frequently in Indonesia (21%, n=23) or Samoa (18%, n=20) (Table 19).

Age and sex distribution

In Australia, CHIKV is most commonly reported in younger and middle-aged adults, which may be a reflection of the peak travelling age groups. The median age of notifications in 2015 was 44.5 years (range: 11–76 years) and 39% of cases were male (Figure 90).

Seasonality

No clear seasonality for CHIKV is evident in Australia, although there can be increases in notifications during peak periods of travel by Australians overseas or during large outbreaks in a particular country or region. The first known outbreak of CHIKV in Samoa occurred in late 2014 and early 2015 with more than 4,500 cases.[120] This outbreak resulted in 20 imported cases in Australia in the first quarter of 2015 (Table 19). There had been a further 25 cases in the 4th quarter of 2014. ■

Table 19: Notifications of chikungunya virus infection 2015, by place of acquisition and quarter

Country or region of acquisition	Number of notifications				
	Jan–Mar	Apr–Jun	Jul–Sept	Oct–Dec	Total
Indonesia	16	4	2	1	23
Samoa	20	0	0	0	20
India	1	0	6	5	12
East Timor	2	7	1	0	10
Colombia	5	3	1	0	9
Nauru	0	5	0	0	5
Cook Islands	0	4	1	0	5
Kiribati	5	0	0	0	5
Mexico	0	0	2	1	3
French Polynesia	3	0	0	0	3
Philippines	0	2	0	0	2
El Salvador	0	1	0	0	1
Kenya	0	0	0	1	1
Taiwan	0	1	0	0	1
Malaysia	1	0	0	0	1
Central America, NFD	0	0	0	1	1
Not stated	0	1	0	0	1
Jamaica	1	0	0	0	1
South America, NEC	0	0	0	1	1
Honduras	0	0	1	0	1
Thailand	0	0	1	0	1
Tonga	1	0	0	0	1
Nigeria	0	0	0	1	1
Nicaragua	0	1	0	0	1
Total	**55**	**29**	**15**	**11**	**110**

Figure 90: Notifications of Chikungunya Virus infection, 2015, by age group and sex

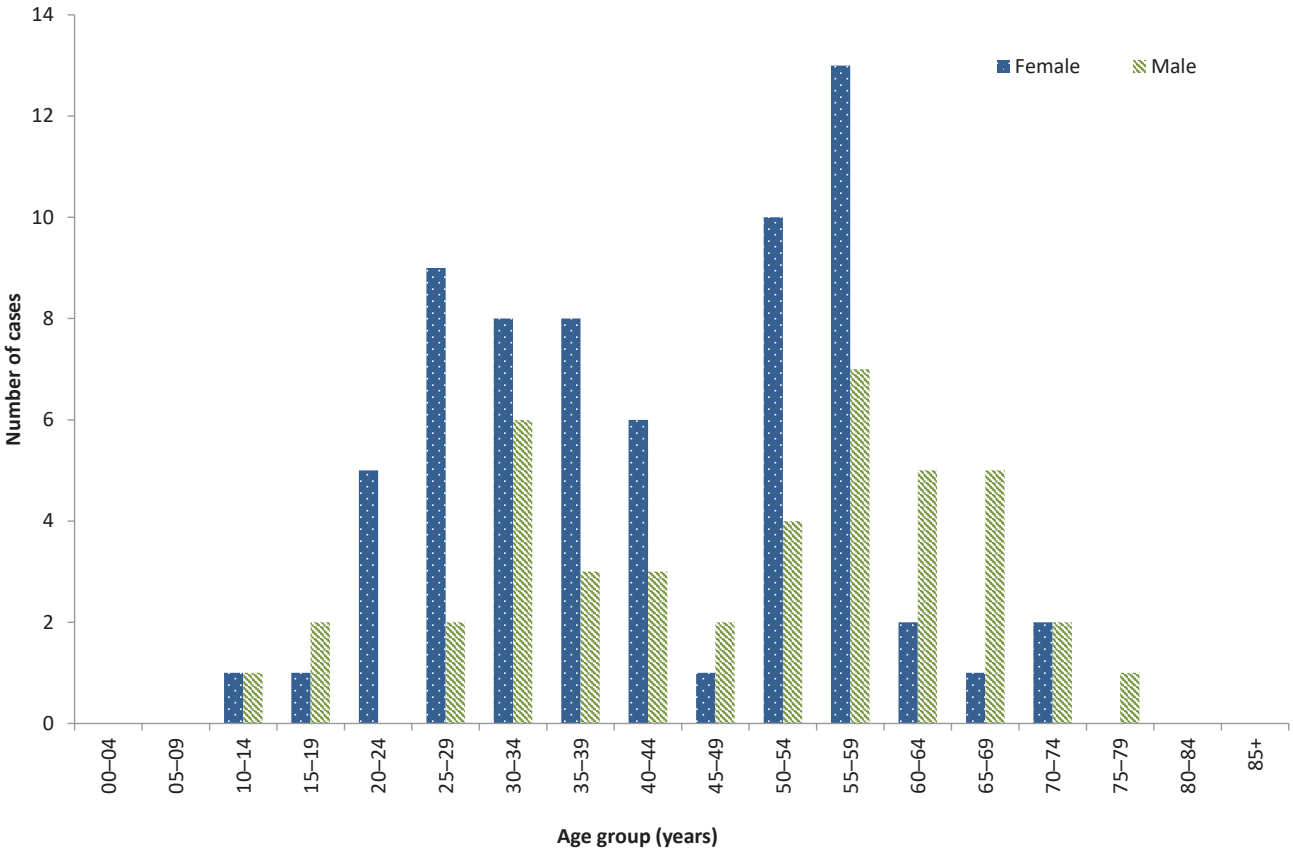
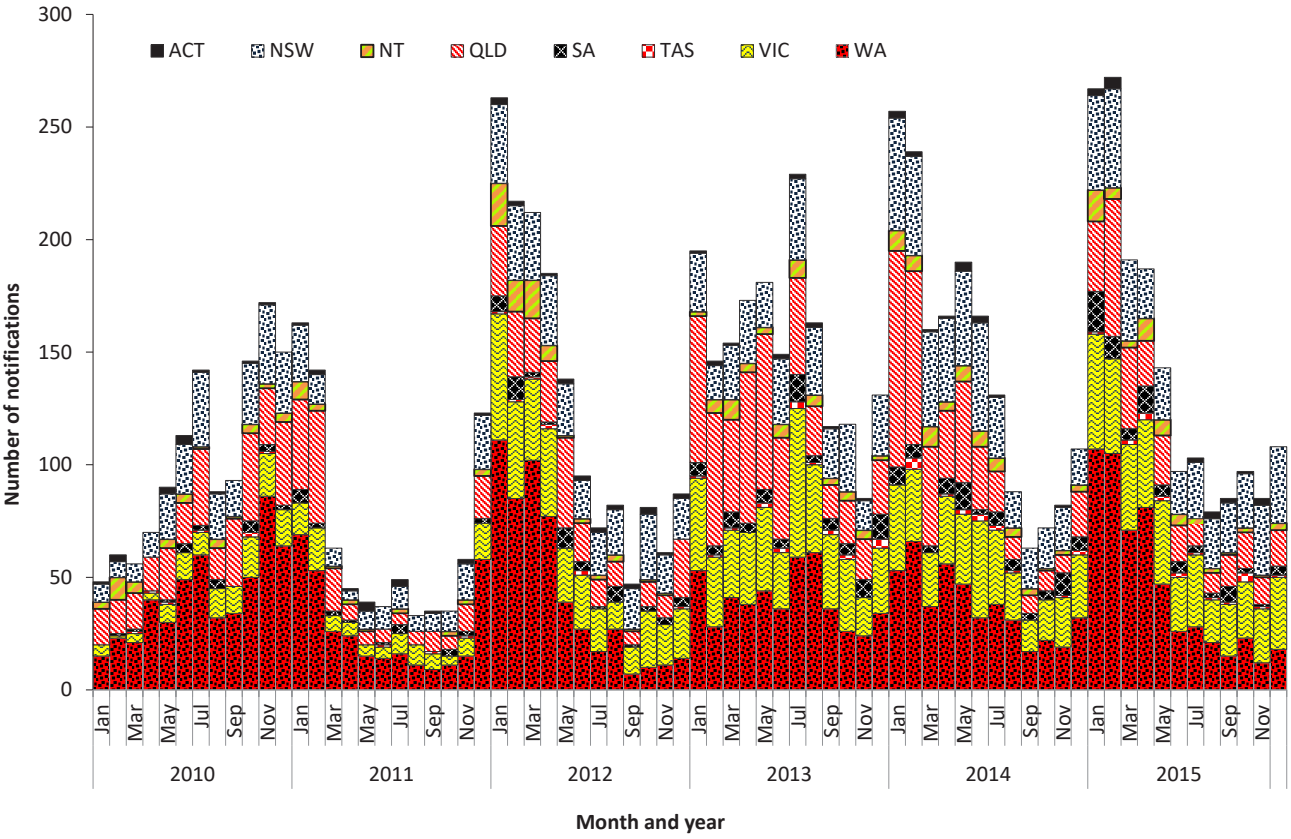


Figure 91: Notifications of dengue virus infection, Australia, 2010 to 2015, by month and year and state or territory



Dengue virus

- Notifications of DENV were 1.2 times the 5-year mean in 2015.
- For overseas-acquired DENV, the most common place of acquisition was Indonesia.
- There were 66 locally acquired cases reported in 2015.

The clinical illness for DENV infection is characterised by mild to severe febrile illness with fever, headache, muscle/joint pain and sometimes a rash. A minority of cases progress to severe dengue, with plasma leakage and possibly respiratory distress, haemorrhagic manifestations and shock. Mortality rates are 1% to 20%, depending on the level of supportive care given.[121] DENV has 4 serotypes, each containing numerous genotypes. No specific treatment is available and there is no vaccine currently available in Australia. The serotypes detected in returning travellers (and thus involved in any local outbreaks in Queensland) vary by year and geographical region. Infection with 1 serotype probably confers lifelong immunity to that serotype,[21] but subsequent infection with a different serotype is thought to increase the risk of severe outcomes, along with other factors including the infecting serotype and genotype, and host factors.[21,122,123,124]

DENV is not endemic anywhere in Australia, but local transmission can occur in dengue-receptive areas following importation by a viraemic tourist or a resident returning from a dengue-affected area overseas.[125] Outbreaks of dengue are considered a high risk in areas of Queensland where at least one vector species (*Ae. aegypti* or *Ae. albopictus*) is endemic and, where there is a regular influx of international travellers or residents who have returned from dengue-endemic

areas, and where there is a recent history of dengue transmission (e.g. Cairns, Townsville, Torres Strait). DENV transmission is considered a moderate risk where the vector is present but where there is no recent history of outbreaks and where few viraemic travellers arrive from endemic areas.[125] There is a low risk of outbreaks in other areas of Queensland (and elsewhere in Australia) where there are currently no populations of *Ae. aegypti* or *Ae. albopictus* present. Isolated cases of laboratory-acquired infection and infections with an unknown source (possibly related to mosquito importations on air cargo or luggage) have been reported.[126,127,128]

Epidemiological situation in 2015

In 2015, there were 1,714 notifications of DENV, representing a rate of 7.2 per 100,000. This is 1.2 times the 5-year mean of 1,430.4 notifications. Of these notifications, 1,534 were confirmed and 180 were probable.

Geographical distribution

The largest number of notifications was in Western Australia (Figure 91) (n=554), followed by Victoria (n=386). A high number of DENV notifications in Western Australia has previously been noted as reflecting the predilection of Western Australians to holiday in Bali, Indonesia where most of these infections are acquired.[129]

Complete information on the place of acquisition was supplied for 98% (1,680/1,714) of notifications (Table 19). There were 1,614 notifications of dengue acquired overseas. Of these, the majority were acquired in Indonesia, (60%, 970/1,614), with the next largest proportion being acquired in Thailand (8%, 133/1,614).

Age and sex distribution

In Australia, DENV is most commonly reported in younger, middle-aged and older adults, which may be a reflection of the peak travelling age groups. The median age of notifications in 2015 was 39.5 years (range: 1 to 83 years), and 50% of cases were male. Case numbers peaked in females aged 20–24 and 25–29 years and males aged 30–34 years (Figure 92).

Seasonality

For overseas-acquired cases of DENV, no clear seasonality is evident. However, there can be increases in notifications during peak periods of travel by Australians overseas or during large outbreaks in a particular country or region. In February 2015, the Ministry of Health in Tonga reported an outbreak of DENV serotype 3 that began in January 2015.[130] There were 36 cases imported from Tonga in 2015 (Table 20). There had been no cases imported from Tonga between 2011 and 2013, and 15 cases in 2014, with all reported from April 2014 onwards.

Outbreaks of locally acquired DENV in North Queensland are more likely to begin during the warmer, wetter months in North Queensland, and rarely continue into the cooler months. In 2015, 77% of locally acquired cases were reported between January and May.

Locally acquired cases and outbreaks

In 2015, almost all locally acquired cases of DENV (97%, 64/66) were associated with outbreaks in North Queensland. A further 2 cases had travelled to or within Queensland during their incubation period, but were not reported as being associated with a specific outbreak. ■

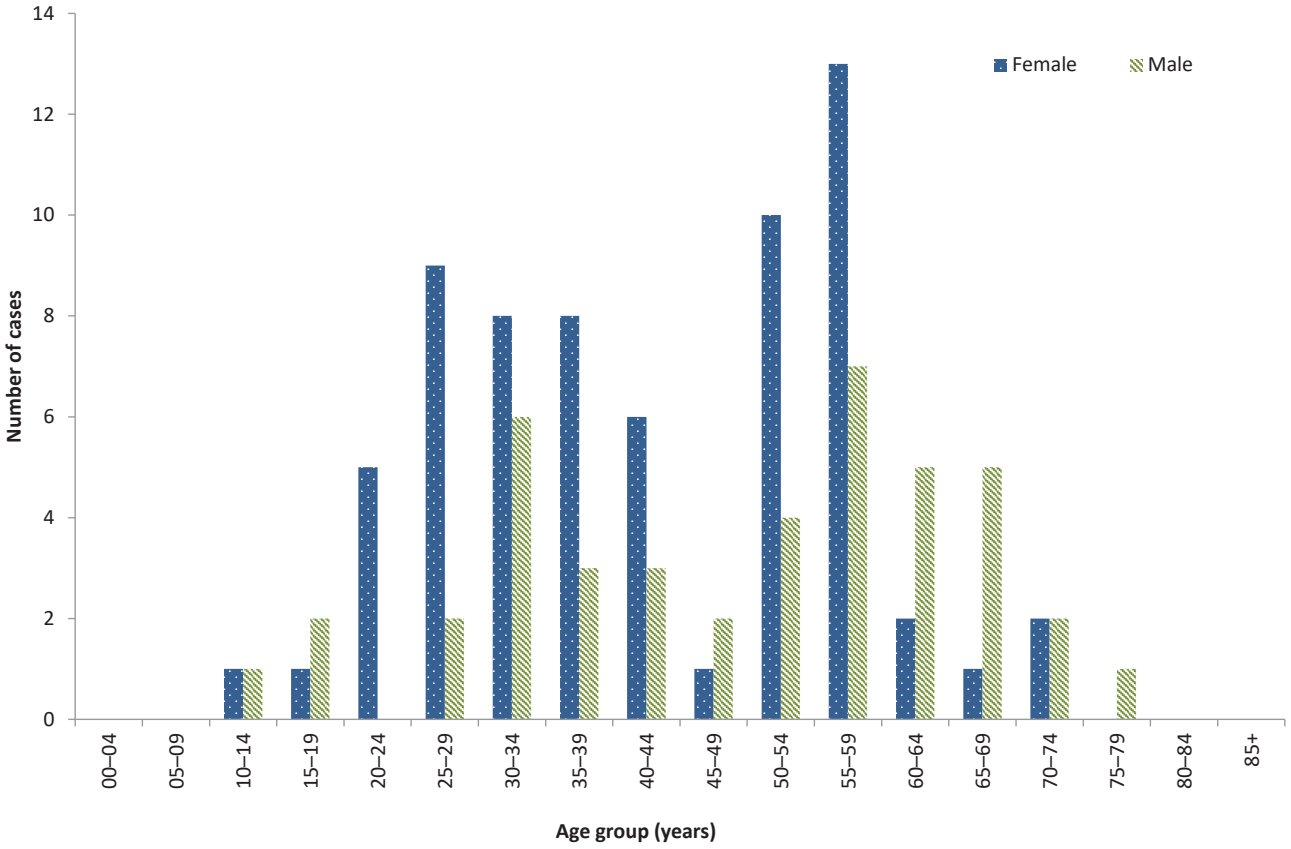
Table 20: Notifications of Dengue Virus infection 2015, by place of acquisition and quarter

Category	Country/region	Jan–Mar	Apr–Jun	Jul–Sept	Oct–Dec	Total
Overseas acquired	Indonesia	490	314	84	82	970
	Thailand	27	20	44	42	133
	Malaysia	36	16	19	9	80
	Philippines	19	5	17	32	73
	India	9	2	17	23	51
	Sri Lanka	14	4	10	11	39
	Tonga	34	2	0	0	36
	Papua New Guinea	0	16	6	6	28
	Vietnam	2	1	8	14	25
	Cambodia	0	2	7	11	20
	South-East Asia, NFD	2	3	4	8	17
	Bangladesh	0	1	13	2	16
	East Timor	6	6	3	0	15
	Singapore	2	2	3	7	14
	Burma (Myanmar)	2	1	2	6	11
	Samoa	0	0	6	4	10
	Fiji	2	4	0	4	10
	Brazil	2	3	1	2	8
	Solomon Islands	4	0	0	3	7
	Mainland South-East Asia, NFD	0	0	1	4	5
	Maldives	0	2	3	0	5
	South America, NFD	0	1	3	0	4
	Pakistan	1	0	2	1	4
	Cuba	0	0	0	3	3
	Other countries*	2	4	6	15	27
	Overseas–country unknown	1	0	2	0	3
Total		**655**	**409**	**261**	**289**	**1,614**
Locally acquired Australia		**58**	**8**	**0**	**0**	**66**
Unknown		**17**	**10**	**6**	**1**	**34**
Grand Total		**730**	**427**	**267**	**290**	**1,714**

NFD Not further defined.

* Each country with fewer than 3 cases in 2015.

Figure 92: Notifications of dengue virus infection, 2015, by age group and sex



Flavivirus unspecified (including Zika Virus)

There were 12 notifications reported in 2015, 10 of which were for ZIKV.

This disease category enables the capture and epidemiological analysis of emerging infections within this broad disease group. Emerging diseases can be made nationally notifiable if required, according to the protocol for making a change to the National Notifiable Diseases List in Australia, which is available on the Department of Health website. An unspecified category is particularly important for the flaviviruses, because it is recognised that some infections cannot be attributed to a single flavivirus.

Flavivirus unspecified includes notifications of ZIKV, for which a specific case definition was implemented from 1 January 2016. Prior to November 2015, ZIKV was not thought to be cause for serious public health concern, due to the high rate of asymptomatic infection and the fact that symptomatic cases were generally mild, notwithstanding the reports of a possible association with Guillain Barré syndrome.[131] However, ZIKV spread rapidly through the many countries in the Americas after being first confirmed in Brazil in May 2015.[132,133] An increase in microcephaly in Brazil with geographical and temporal links to ZIKV was reported in November 2015, and the WHO declared the clusters of microcephaly and neurological disorders a public health event of international concern on 1 February 2016.[134] There is now strong scientific consensus that the virus can be transmitted in utero and can cause severe birth defects such as microcephaly and foetal death,[135] and that it can cause Guillain Barré syndrome.[136,137] While vectorborne transmission remains the main mode of transmission, multiple instances of probable or confirmed sexual transmission have now been reported.[131,138,139,140, 141,142]

Epidemiological situation in 2015

In 2015, there were 12 notified cases of flavivirus unspecified, similar to the 5-year mean of 13.2 notifications. Most of these notifications (10/12) were for ZIKV, while there was 1 case of Sindbis. No single flavivirus species was identified for 1 notification.

Geographical distribution

There were 5 notifications from Queensland, 2 each from New South Wales, Victoria and Western Australia and 1 from South Australia. There were no notifications from the Australian Capital Territory, the Northern Territory or Tasmania.

Age and sex distribution

Notifications under Flavivirus unspecified were most commonly in younger and middle-aged adults (Figure 94), with all but one case acquired overseas. This may be a reflection of the peak travelling age groups. The median age of notifications in 2015 was 35 years (range: 22 to 69 years).

Seasonality

Notifications of overseas-acquired Flavivirus unspecified can increase during peak periods of travel by Australians overseas, or during large outbreaks in a particular country or region. Many of the notifications in 2015 were for ZIKV acquired in Pacific Island nations (7/12). The first outbreak of ZIKV in a Pacific Island nation was first reported in Yap, Federated States of Micronesia in 2007.[202] Following this ZIKV outbreaks were reported in French Polynesia in late 2013, and in the Cook Islands and New Caledonia in 2014.[203] ZIKV was first confirmed in the Solomon Islands in March 2015 (PacNet updates 16 March to 21 May 2015).[143] There were two ZIKV cases imported to Australia in 2015 from the Solomon Islands, both with dates of diagnosis in March (Table 21). ■

Figure 93: Notifications of flavivirus unspecified, Australia, 2010 to 2015, by month and virus species

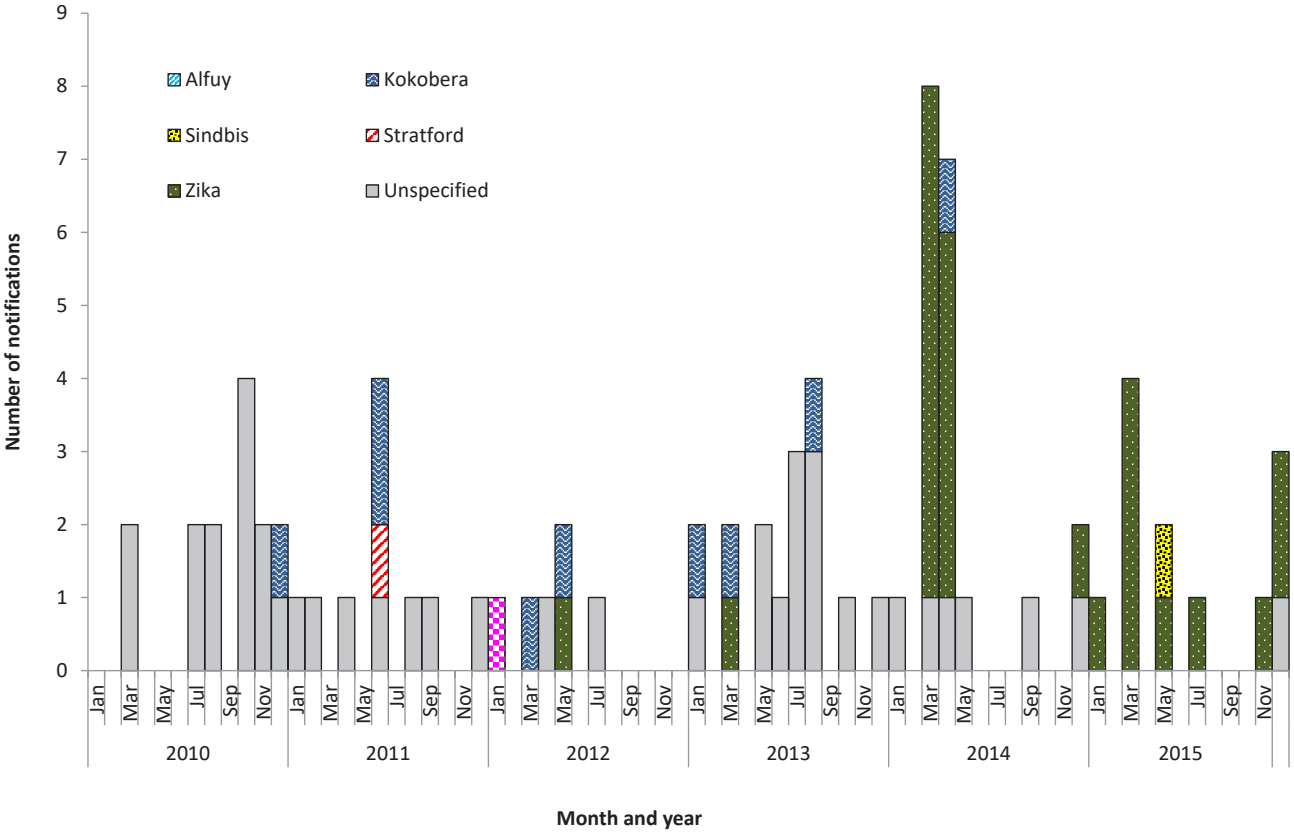


Figure 94: Notifications of flavivirus unspecified, 2015, by age-group and sex

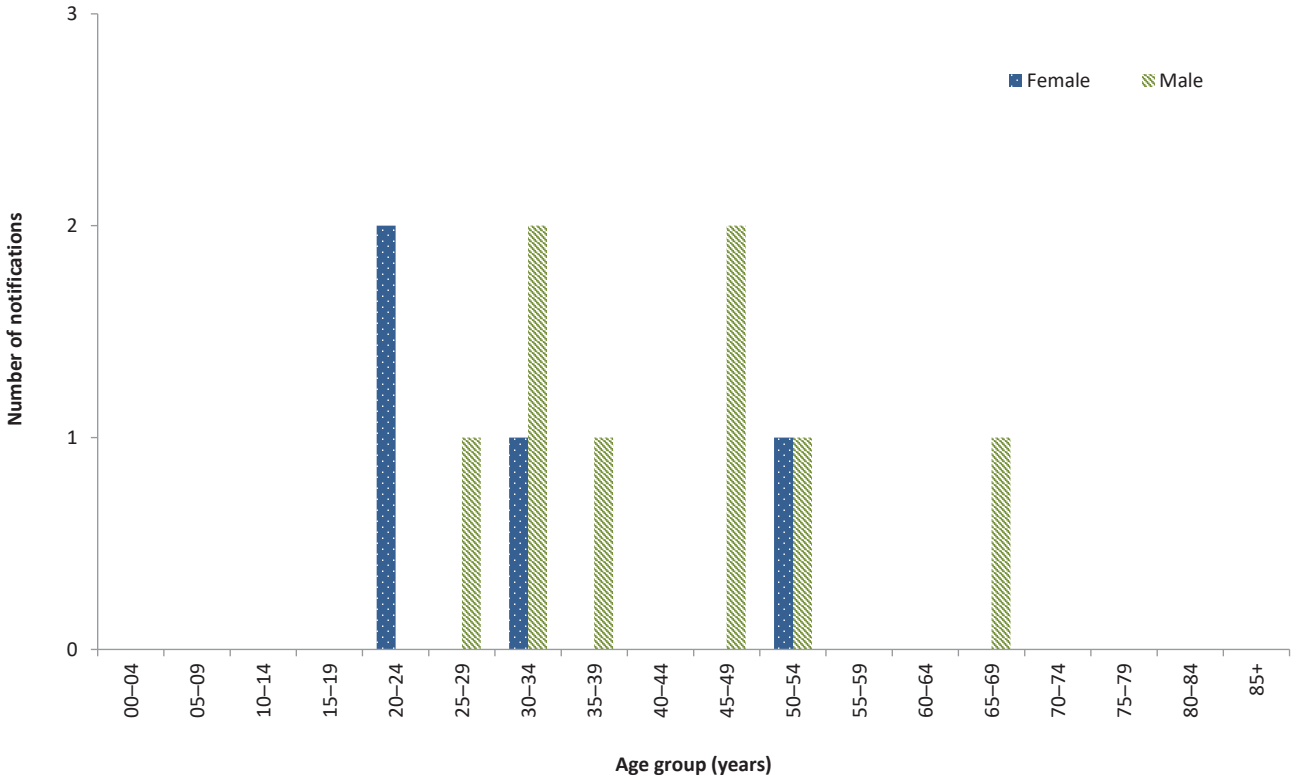


Table 21: Notifications of flavivirus unspecified 2015, by virus, place of acquisition and quarter

Category	Country	Virus	Jan–Mar	Apr–Jun	Jul–Sept	Oct–Dec	Total
Overseas acquired	Colombia	Zika virus (ZIKV)	0	0	0	1	1
	Costa Rica	Unspecified	0	0	0	1	1
	El Salvador	ZIKV	0	0	0	1	1
	Fiji	ZIKV	0	1	0	0	1
	Indonesia	ZIKV	1	0	0	0	1
	Marshall Islands	ZIKV	0	0	0	1	1
	Polynesia (excludes Hawaii), NFD	ZIKV	0	0	1	0	1
	Solomon Islands	ZIKV	2	0	0	0	2
	Vanuatu	ZIKV	2	0	0	0	2
Overseas acquired Total			**5**	**1**	**1**	**4**	**11**
Unknown	Place of acquisition unknown	Sindbis	0	1	0	0	1
Total			**5**	**2**	**1**	**4**	**12**

Japanese encephalitis virus

There were 3 cases of JEV notified in 2015. All were acquired in Indonesia.

No specific treatment is available for illness caused by JEV infection, and care is largely supportive. A vaccine is available to prevent JEV infection.[29] Infection is usually asymptomatic or produces a non-specific illness, but a small percentage of cases progress to encephalomyelitis of variable severity. The last locally acquired case was in 1998,[144] and all cases since then have been acquired overseas.

Epidemiological situation in 2015

In 2015, there were 3 notifications of JEV, all of them acquired in Indonesia (Table 22). There were a total of 6 cases between 2010 and 2014, 5 of them acquired in South-East Asia and one in Taiwan. ■

West Nile virus (including Kunjin virus)

- There was one case of WNV/KUNV notified in 2015.
- This case acquired infection in the United States of America.

No specific treatment is available for infections with WNV/KUNV, and care is largely supportive. There is no vaccine. Infection is usually asymptomatic or produces a non-specific illness, but a small percentage of cases progress to encephalomyelitis of variable severity. *Culex annulirostris* is the major vector of WNV/KUNV in Australia.

Epidemiological situation in 2015

In 2015, there was one notification of WNV/KUNV. The case was a male in New South Wales aged between 60 and 64 years, and the infection was acquired in the United States of America. Between 2010 and 2014, there were 7 notifications of WNV/KUNV in total, with 5 of these acquired in the Australasian region and one acquired in Djibouti. There was one case for whom the place of acquisition was unknown (Table 23). ■

Table 22: Notifications of Japanese encephalitis virus infection, Australia, 2010 to 2015

Year	State/territory	Country of acquisition	Month	Age group	Sex
2012	Qld	Philippines	February	15–19	Female
2013	Qld	Philippines	September	70–74	Male
2013	Qld	Taiwan	July	45–49	Male
2013	SA	Thailand	June	55–59	Male
2013	WA	Indonesia	April	40–44	Female
2014	SA	Indonesia	August	50–54	Male
2015	NSW	Indonesia	January	25–29	Female
2015	Qld	Indonesia	November	40–44	Female
2015	Vic	Indonesia	January	45–49	Male

Table 23: Notifications of West Nile virus (including Kunjin virus) infection, Australia, 2010 to 2015

Year	State/territory	Country of acquisition	Month	Age group	Sex
2010	NT	Australia	June	80–84	Male
2010	Qld	Place of acquisition unknown	February	40–44	Male
2011	NSW	Australia	December	40–44	Female
2011	NT	Australia	April	60–64	Male
2013	Qld	Papua New Guinea	November	25–29	Male
2013	Qld	Timor-Leste	October	35–39	Male
2014	Vic	Djibouti	April	45–49	Male
2015	NSW	United States of America	October	60–64	Male

Malaria

- Notified cases of malaria were 39% below the 5-year mean in 2015, continuing the decreasing numbers notified since 2004 and 2005.
- All cases in 2015 were overseas acquired, with most reported to be acquired in Papua New Guinea.
- The majority of cases were reported in men aged 15–49 years.

Malaria is a serious acute febrile illness that is transmitted from person to person through the bite of an infected mosquito of the genus *Anopheles*. It is caused by a protozoan parasite in the genus *Plasmodium* that includes 5 species that infect humans: *Plasmodium vivax*, *Plasmodium falciparum*, *Plasmodium malariae*, *Plasmodium ovale* and *Plasmodium knowlesi*.[21,145]

Australia is free of endemic malaria, but suitable vectors are present in northern Australia, and the area remains malaria-receptive. Malaria in Australia is therefore a disease associated with residing or travelling overseas in areas with endemic transmission. A case series in the Northern Territory showed that malaria cases were reported in travellers returning from endemic areas, but also reflected current events such as military operations and increased refugee arrivals from malaria-endemic areas.[146] The last cases acquired on mainland Australia were during an outbreak in North Queensland in 2002.[147] Limited transmission occurs occasionally in the Torres Strait following importation.

Epidemiological situation in 2015

In 2015, there were 233 notifications of malaria, representing a rate of 1.0 per 100,000. This number of cases is a 39% reduction compared with the 5-year average (381.4 cases), and continues a previously reported trend of gradually decreasing notifications in Australia since 2004–05.[126] This is consistent with the steady decline in malaria incidence globally between 2000 and 2015.[148]

Geographical distribution

The largest number of notifications was in Victoria (n=57), with similar numbers also in Queensland (n=56), but the highest rate was in the Northern Territory (4.9 per 100,000) (Figure 95).

In 2015, all malaria cases were acquired overseas, most frequently in Papua New Guinea (n=38), Sudan (n=29) and Uganda (n=20) (Table 24). There were 4 notifications for which the place of acquisition was unknown. The most recent locally acquired cases of malaria in Australia were a single case in 2013 acquired on Saibai Island in the Torres Strait and 7 locally acquired cases in the Torres Strait in 2011.

Figure 95: Notifications of malaria, Australia, 2010 to 2015, by month and year and state or territory

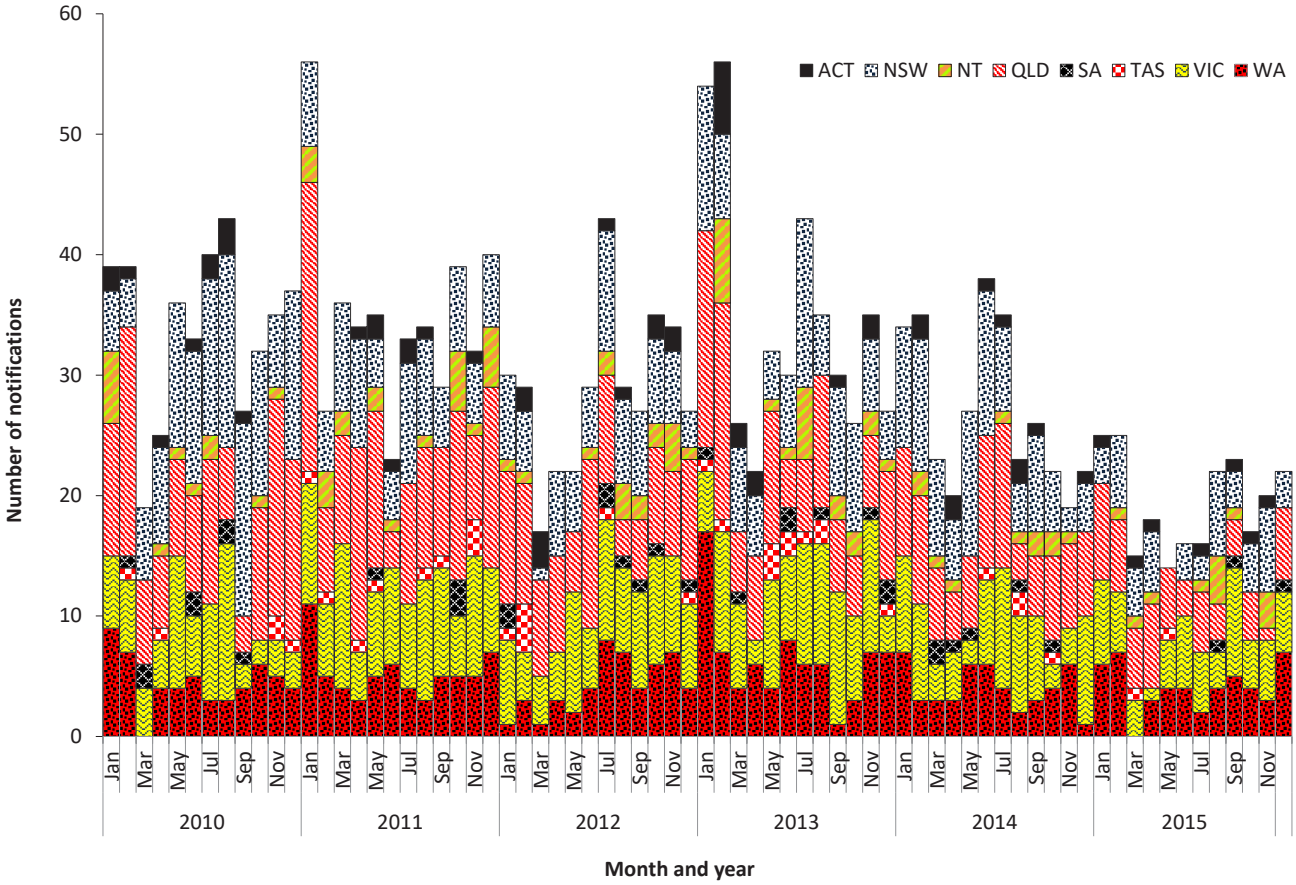
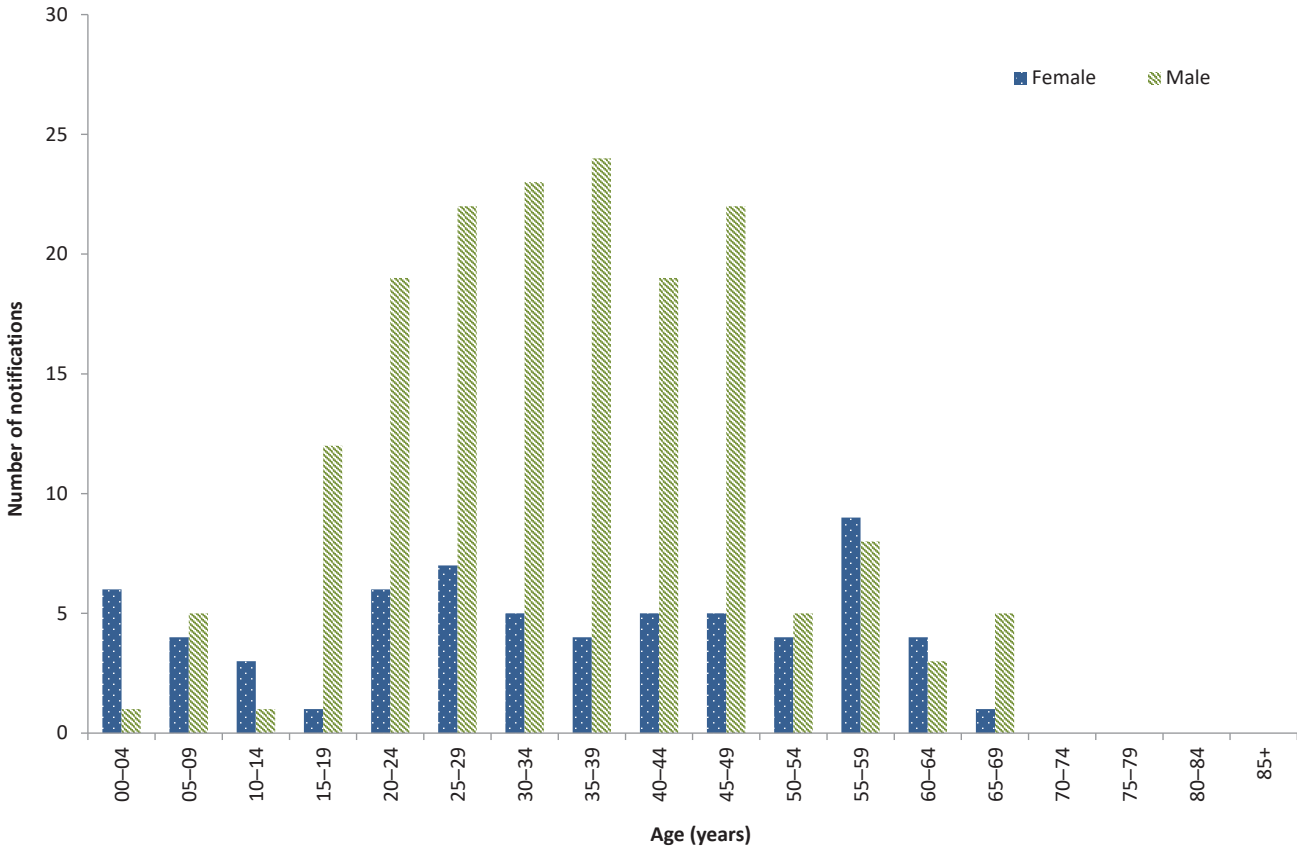


Table 24: Cases of malaria, Australia, 2015, by *Plasmodium* species and country or region of acquisition

Country of acquisition	P. falciparum	P. falciparum and P. vivax	P. malariae	P. ovale	P. species	P. vivax	Total	% of cases
Papua New Guinea	18	0	0	1	2	17	38	16%
Sudan	25	0	0	3	0	1	29	12%
Uganda	18	0	2	0	0	0	20	9%
India	0	0	0	0	0	17	17	7%
Nigeria	13	0	0	3	0	0	16	7%
Kenya	13	0	0	2	0	0	15	6%
Tanzania	7	0	1	0	0	0	8	3%
Ghana	6	0	0	0	0	0	6	3%
Indonesia	4	0	0	0	0	2	6	3%
Solomon Islands	1	0	0	0	0	5	6	3%
Zambia	4	0	1	0	1	0	6	3%
Cameroon	5	0	0	0	0	0	5	2%
Ethiopia	3	0	0	0	0	2	5	2%
Pakistan	0	0	0	0	1	4	5	2%
Mali	4	0	0	0	0	0	4	2%
Rwanda	3	0	0	0	0	1	4	2%
Other countries	17	1	1	1	1	8	29	12%
Overseas - country unknown	6	0	0	0	0	4	10	4%
Place of acquisition unknown	0	0	2	2	0	0	4	2%
Total	**147**	**1**	**7**	**12**	**5**	**61**	**233**	100%

Figure 96: Notifications of malaria, 2015, by age group and sex



Age and sex distribution

Malaria is most commonly reported in younger and middle-aged adults, and in Australia disproportionately affects male travellers, of whom some are likely to be working in endemic countries when infected. The median age of notifications in 2015 was 35 years (range: 2 to 69 years) and 73% of cases were male. Notifications peaked in males aged between 20 and 49 years (Figure 96).

Seasonality

Diseases that are almost exclusively acquired overseas (such as malaria) can tend to increase during peak periods of travel by Australians overseas, or during increases in a particular country or region. In 2015, no particular seasonal trend was observed. ■

Murray Valley encephalitis virus

There were 2 cases of MVEV, notified in 2015.

No specific treatment is available for infections with MVEV and care is largely supportive. No vaccine is available. Infection with MVEV is usually asymptomatic or produces a non-specific illness, but a small percentage of cases progress to encephalomyelitis of variable severity. *Culex annulirostris* is the major vector of MVEV.

Epidemiological situation in 2015

In 2015, there were 2 notifications of MVEV infection. Both cases were acquired in Australia (Table 25). This compares with a total of 17 cases between 2010 and 2014, 16 of them in 2011. The details of the 16 cases in 2011 were published elsewhere;[149] the remaining case was acquired in Papua New Guinea in 2012 (Figure 97). MVEV acquired in Australia is most commonly reported during the warmer, wetter months, with all cases between 2010 and 2015 having dates of diagnosis between December and May. ■

Table 25: Notifications of Murray Valley encephalitis virus infection, by country of acquisition, state or territory, age group and sex

Country of acquisition	Month	State or territory	Age group	Sex
Australia	February	NT	0–4	Female
Australia	May	NT	5–9	Male

Figure 97: Notifications of Murray Valley encephalitis virus infection, Australia, 2010 to 2015, by month and place of acquisition

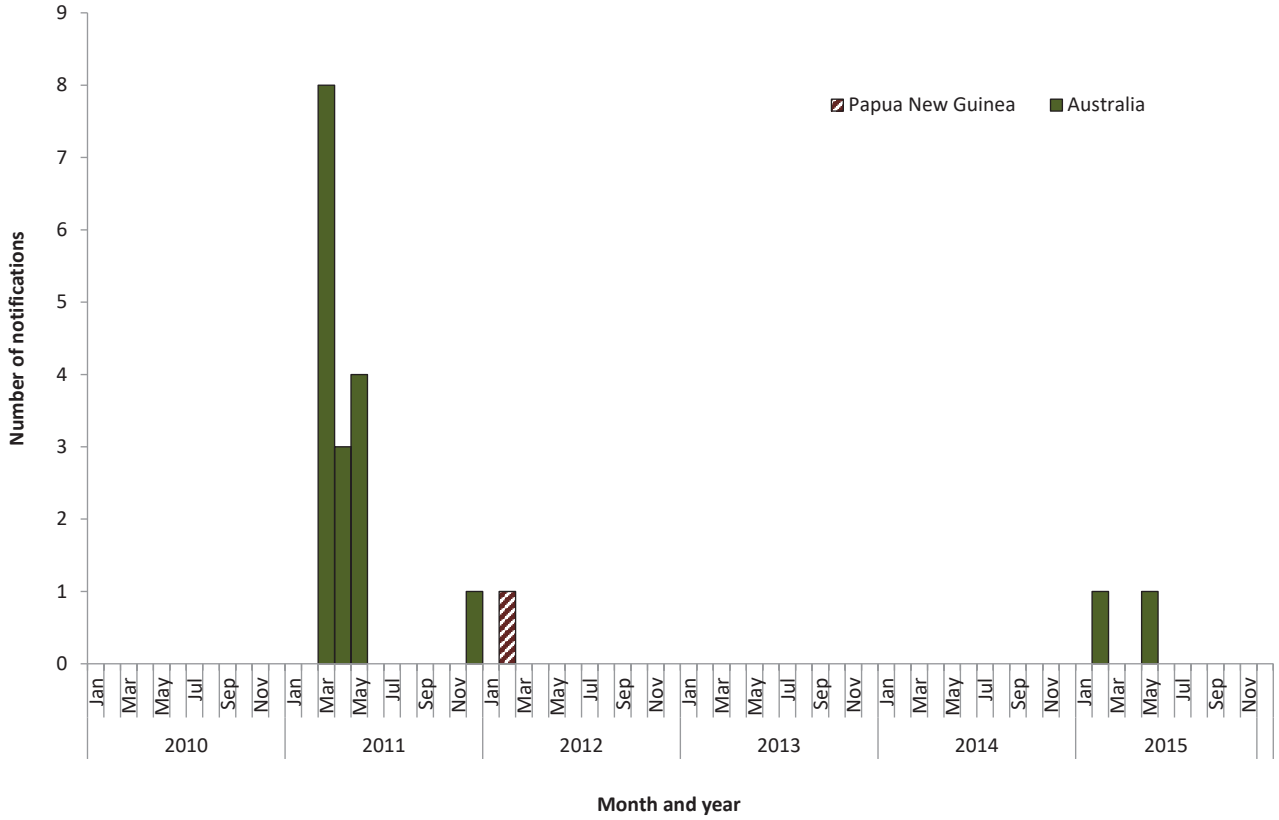
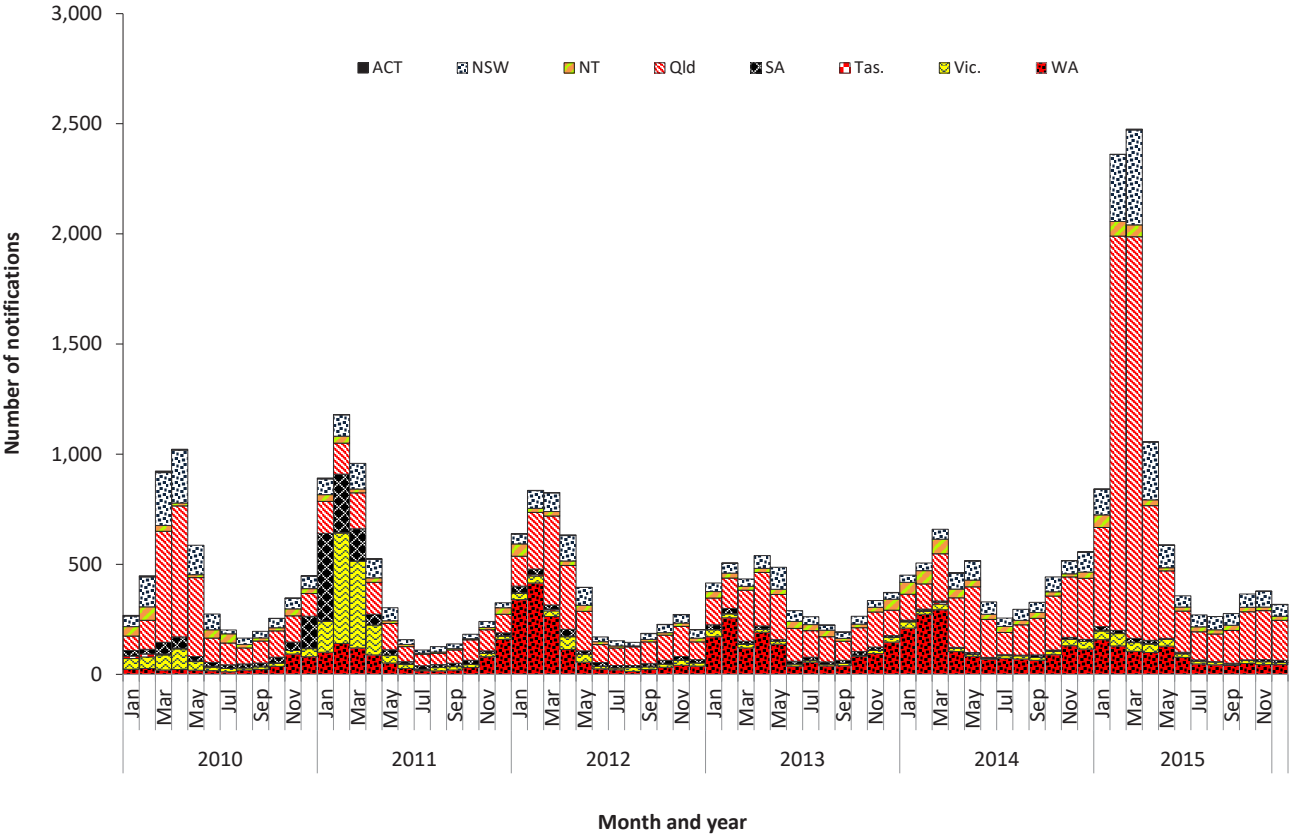


Figure 98: Notifications of Ross River virus infection, Australia, 2010 to 2015, by month and year and state or territory



Ross River virus

- Case numbers and notification rates of RRV were almost double the 5-year mean in 2015.
- The majority of RRV was reported in middle-aged to older age groups.
- Notifications peaked between January and April in 2015, which is during the season when vector numbers are at their highest.

RRV occurs exclusively in the Australasian region.[115] Infection can cause a clinical illness, which is characterised by fever, rash and polyarthritis. The virus is transmitted by numerous species of mosquito that breed in diverse environments.[116] In 2015, the national case definition for RRV required only a single IgM positive test to BFV, in the absence of IgM to RRV.[117] It is unclear what proportion of notifications represent true cases. A revised case definition was implemented on 1 January 2016, under which a single IgM is no longer considered sufficient evidence for a confirmed case.

Epidemiological situation in 2015

In 2015, there were 9,550 notifications of RRV, representing a rate of 40.1 per 100,000. This is almost double the 5-year mean of 4,915.6 notifications (1.9 times) and the 5-year mean rate of 21.6 per 100,000 (1.9 times), and also higher than 2014 (5,316 notifications, rate 22.7 per 100,000) (Figure 98). The increase was largely due to a spike in case numbers and rates in Queensland and New South Wales during January to April (Figure 99).

Geographical distribution

The largest number of notifications was in Queensland (n=6,192), but the highest rate was in the Northern Territory (147.2 per 100,000).

Figure 99: Notification rates of Ross River virus infection, Australia, 2010 to 2015, by state or territory and year

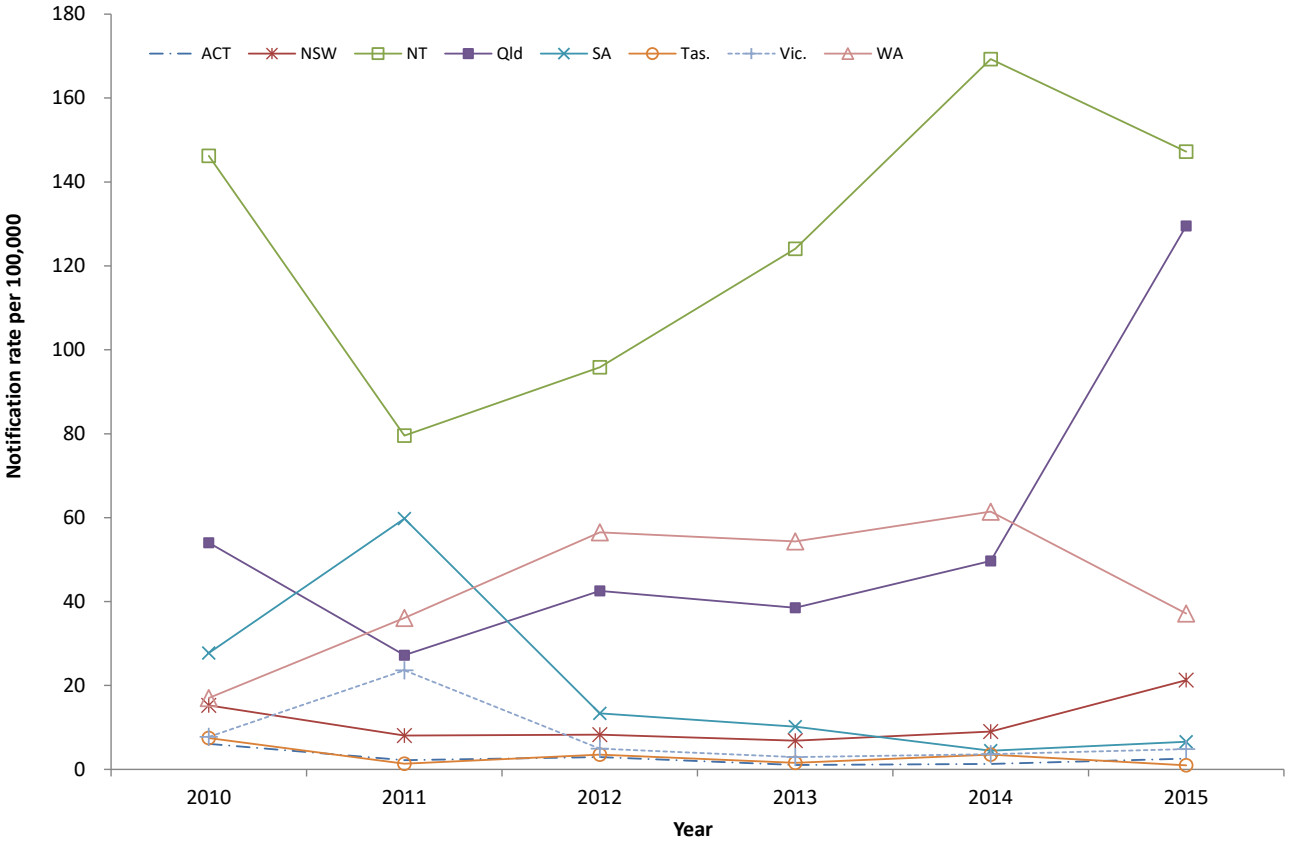
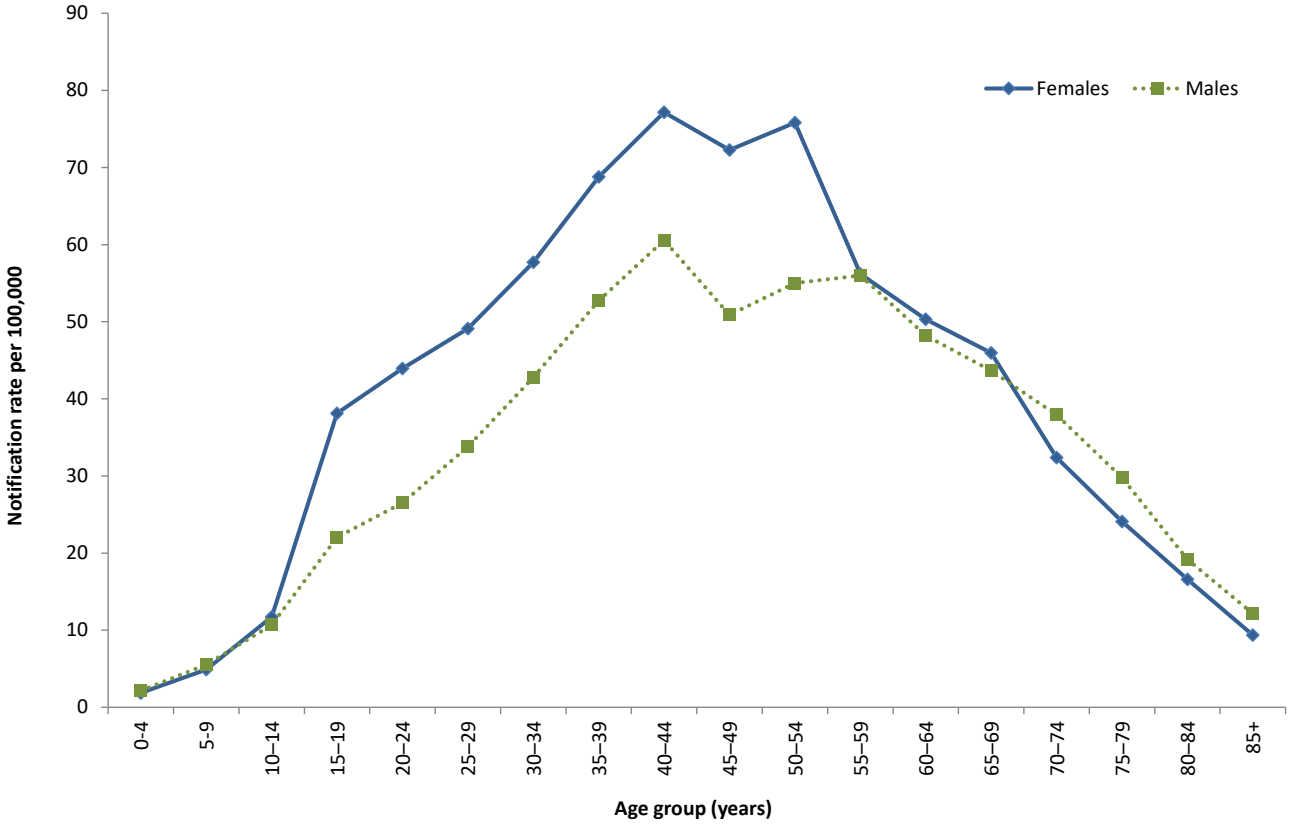


Figure 100: Notification rates for Ross River virus infection, 2015, by age group and sex



It is important to note that seasonal trends vary between and within states and territories according to differences in mosquito vectors, hosts and climate. In addition, comparisons between regions are likely to be influenced by accuracy of case-ascertainment, which may vary between jurisdictions because of some differences in reporting criteria and the quality of diagnostic tests used.

Age and sex distribution

RRV is most commonly reported in middle-aged and older adults. The median age of notifications in 2015 was 44 years (range: 0 to 93 years), and 44% of cases were male. Rates of RRV peaked in females and males aged 40–44 years (77.2 and 60.6 per 100,000 respectively) (Figure 100).

Seasonality

In 2015, RFV was most commonly reported between January and April, with 77% (323/9,550) of cases notified during these months. This is a more pronounced seasonality than that observed between 2010 and 2014, when 63% of cases were reported during these months. ■

ZOONOSES

Overview

Zoonoses are those infectious diseases which are naturally transmitted between vertebrate animals and humans.[150] Approximately 60% to 70% of emerging human infectious diseases are zoonoses[151, 152, 153] and more than 70% of emerging zoonoses originate from wildlife.[152] An emerging zoonosis is defined by WHO as 'a zoonosis that is newly recognised or newly evolved, or that has occurred previously but shows an increase in incidence or expansion in geographical, host or vector range'.[154]

The zoonoses notifiable to the NNDSS included in this chapter are: anthrax, Australian bat lyssavirus (ABVL) or lyssavirus (unspecified) infection, brucellosis, leptospirosis, ornithosis, Q fever, and tularaemia. In 2015, zoonoses comprised 0.2% of all notifications to the NNDSS.

Several zoonoses notifiable to the NNDSS are included under other headings in this report. For example, salmonellosis and campylobacteriosis are typically acquired from contaminated food and are listed under the gastrointestinal diseases section. Rabies is listed under 'Quarantinable diseases'.

Anthrax

- There were no cases of anthrax notified in 2015.
- The last case of human anthrax reported in Australia was in 2010.

Anthrax is caused by the bacterium *Bacillus anthracis* and most frequently causes cutaneous infection. However, it can also cause gastrointestinal and respiratory infections. Anthrax is primarily a disease of herbivores; humans and carnivores are incidental hosts. It can be an occupational hazard for veterinarians and for agriculture, wildlife and livestock workers who handle infected animals or by-products.

In Australia, the areas of anthrax risk are well defined. They include the northern and north-eastern districts of Victoria and central New South Wales.[155] Anthrax occurs only sporadically in livestock in the at-risk areas. Rare or isolated incidents or cases in animals have historically occurred in Queensland, South Australia, Tasmania and Western Australia.[155]

Epidemiological situation in 2015

In 2015, there were no notified cases of anthrax in Australia. Over the previous 10 years, only 3 human cases of anthrax were reported in Australia, in 2006, 2007 and 2010.[156,157,158] All had domestic farm or animal related exposures and all were cutaneous anthrax. Australia has never recorded a human case of inhalational or gastrointestinal anthrax.

There were 4 anthrax incidents reported in livestock in Australia in 2015; 3 occurred in New South Wales and 1 in Victoria. All cases were on properties within the known anthrax endemic area.[155] ■

Australian bat lyssavirus and lyssavirus (unspecified)

- There were no cases of ABLV notified in 2015.
- The last case of ABLV reported in Australia was in 2013.

ABLV belongs to the genus lyssavirus, which also includes the rabies virus. Both invariably result in progressive, fatal encephalomyelitis in humans.[159] ABLV was first identified in Australia in 1996[160,161] It is present in several Australian species of bats (including flying foxes and microbats). Australia is free of terrestrial rabies.

The best way to prevent ABLV infection is to avoid contact with bats. For people whose occupation (including volunteer work) or recreational activities place them at increased risk of being exposed to ABLV, rabies virus vaccine is effective in preventing infection. Pre-exposure immunisation with rabies virus vaccine is recommended for bat handlers, veterinarians and laboratory personnel working with live lyssaviruses.[162] Post-exposure prophylaxis for ABLV consists of wound care and administration of a combination of rabies virus vaccine and human rabies virus immunoglobulin, depending on exposure category and prior immunisation or antibody status.[29,162]

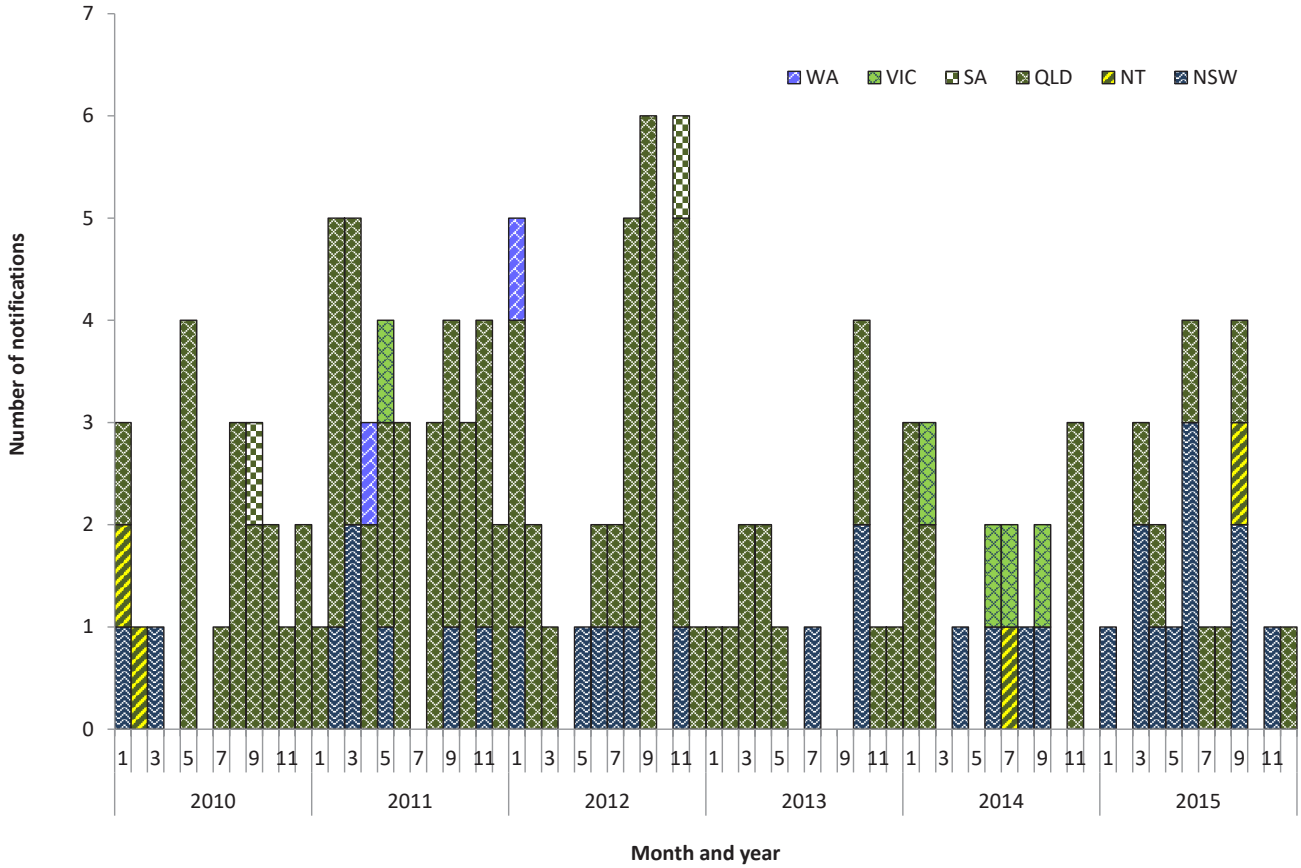
Epidemiological situation in 2015

In 2015, there were no notified cases of ABLV or lyssavirus (unspecified) infection in Australia.

There have been 3 cases of ABLV infection notified in humans in Australia, with single cases notified in each of 1996, 1998 and 2013. All 3 cases occurred following close contact with an infected bat in Queensland and all were fatal.[163,164,165] In 2013, the Queensland Department of Agriculture, Fisheries and Forestry (DAFF) confirmed the first known equine cases of ABLV infection in 2 horses on a Queensland property.[166, 167]

The Bat Health Focus Group of Wildlife Health Australia (formerly the Australian Wildlife Health Network) gathers and collates information from a range of organisations on opportunistic testing of bats for ABLV. In 2015, there were 22 ABLV detections in bats, compared with 32 detections during 2014.[168] ■

Figure 101: Notifications of brucellosis, Australia, 2010 to 2015, by month and year of diagnosis and state or territory



Brucellosis

- There were 19 cases of brucellosis notified in 2015, a 21% decrease compared to the 5-year mean.
- In 2015, 58% of brucellosis cases were in New South Wales residents and 37% in Queensland.
- Eighty-nine per cent of cases reported in 2015 were male.

Brucellosis is characterised by a fever of variable duration with a range of other symptoms including headache, weakness, profuse sweating, chills, arthralgia, depression, weight loss and generalised aching.[21] *Brucella* species that can cause illness in humans include *Brucella melitensis* acquired from sheep and goats, *Brucella suis* from pigs and *Brucella abortus* from cattle. *B. abortus* was eradicated from Australian cattle herds in 1989 and *B. melitensis* has never been reported in Australian sheep or goats.[169] Therefore, all cases of *B. melitensis* or *B. abortus* in Australia are related to overseas travel. Eales et al (2010)[170] found that feral pig hunting was the most common risk factor for brucellosis in Townsville during 1996 to 2009.

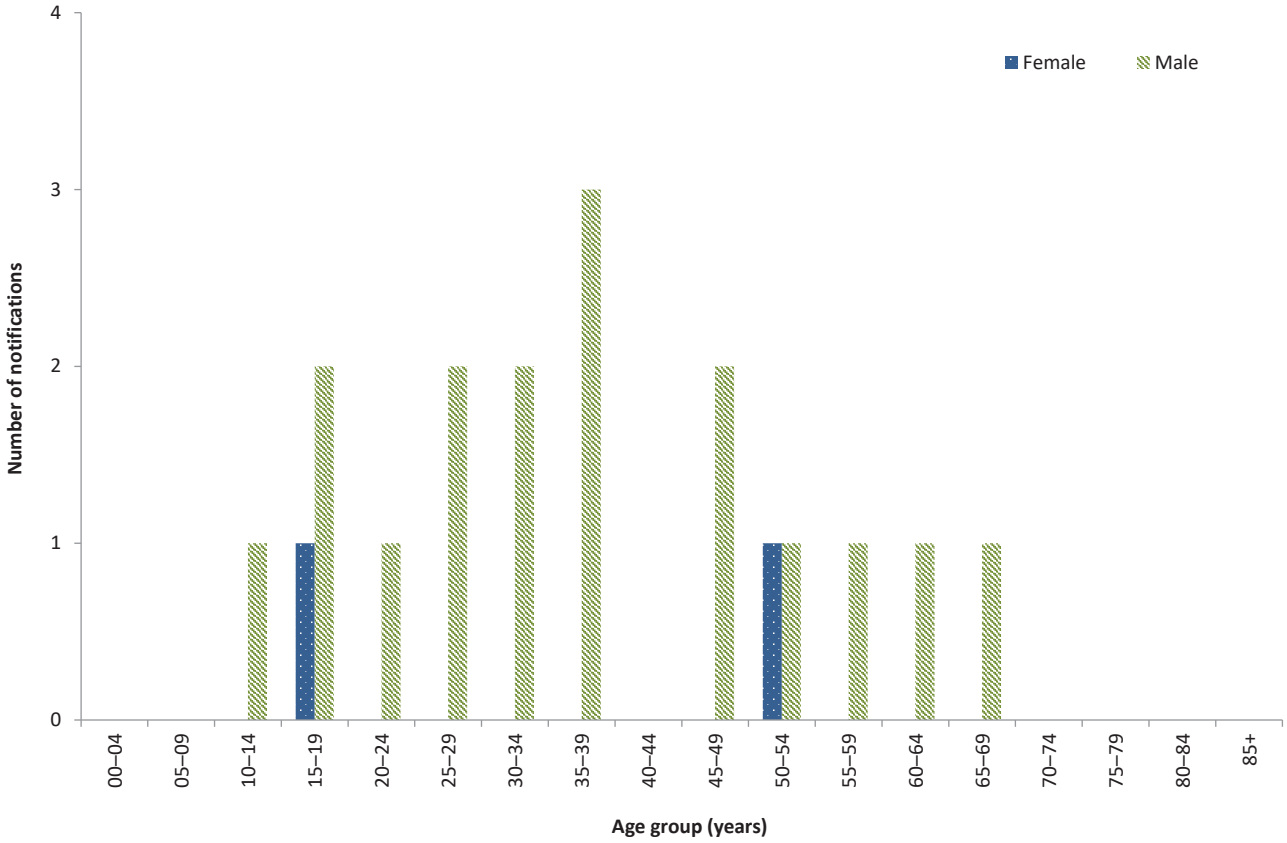
Epidemiological situation in 2015

In 2015, there were 19 notified cases of brucellosis in Australia (0.1 per 100,000), a 21% decrease compared to the 5-year (2010 to 2014) mean (n=24).

Geographical distribution

In 2015, over half of the notified brucellosis cases were in New South Wales residents (58%, 11/19) (Figure 101), 37% of cases were in Queensland residents (7/19) and 1 in a Northern Territory resident.

Figure 102: Notifications of brucellosis, Australia, 2015, by age group and sex



Since 1991, 81% of cases have been notified in Queensland residents and 12% of cases have been notified in New South Wales residents. In 2015, New South Wales had the highest proportion of cases and the highest number of cases of brucellosis on record for the state.[171]

Of the 11 cases reported in New South Wales residents, 5 were acquired overseas in Middle Eastern countries from consuming unpasteurised dairy or animal exposures, and 6 cases were acquired locally, of which 4 had reported hunting feral pigs.

Both New South Wales and Queensland have a state-specific notification rate of 0.1 per 100,000 and the Northern Territory has a rate of 0.4 per 100,000.

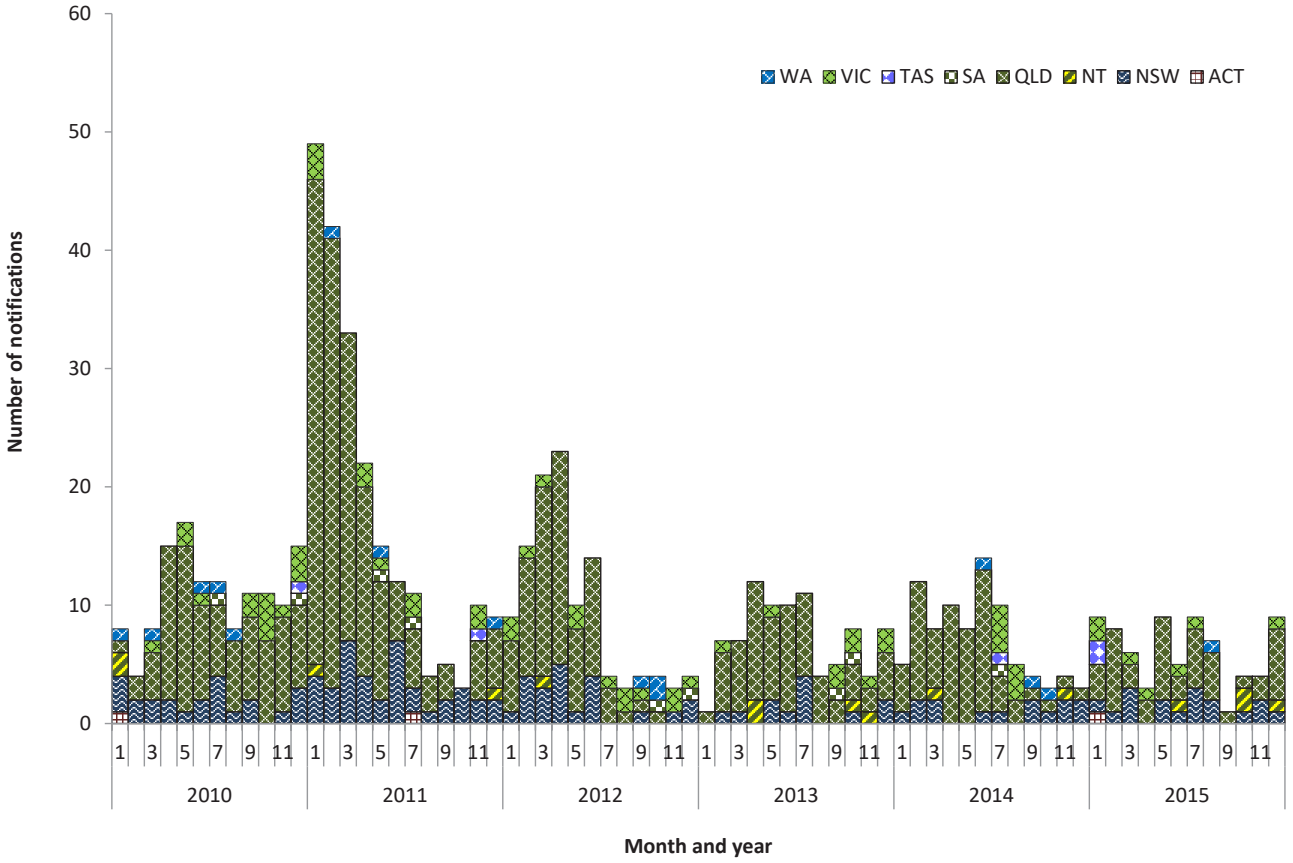
Age and sex distribution

In 2015, the median age of notified brucellosis cases was 36 years (range: 14 to 66 years), and 89% (17/19) were male (Figure 102).

Microbiological trends

The species of the infecting organism was available for 53% (10/19) of notified cases in 2015. There were 6 cases of *B. suis,* 2 from New South Wales and 4 from Queensland; all cases were male. There were 4 cases of *B. melitensis*, with the countries of acquisition listed as Iraq, Lebanon, Jordan and Saudi Arabia. The 9 remaining cases, where the infecting organism was not specified, were acquired in Australia (n=7), Lebanon (n=1) and an overseas unknown country (n=1). ■

Figure 103: Notifications of leptospirosis, Australia, 2010 to 2015, by month and year of diagnosis and state or territory



Leptospirosis

- There were 74 cases of leptospirosis notified in 2015.
- The highest numbers of cases were observed in males aged 15-19 years and 25-29 years.

Leptospirosis can cause a variety of illnesses varying in severity from a mild influenza-like illness to Weil's syndrome, meningitis or pulmonary haemorrhage with respiratory failure possibly leading to death.[21] Leptospirosis is caused by spirochaetes of the genus *Leptospira,* which is found in the genital tract and renal tubules of domestic and wild animals. In affected areas, where there is exposure to infected urine of domestic and wild animals, this disease can be an occupational and recreational hazard (such as in certain agricultural sectors and from swimming or wading in contaminated water).[172, 173] The last reported death in Australia attributed to leptospirosis was in 2002.[174]

Epidemiological situation in 2015

In 2015, there were 74 notified cases of leptospirosis in Australia (0.3 per 100,000), a 42% decrease compared with the 5-year (2010 to 2014) mean (n=127).

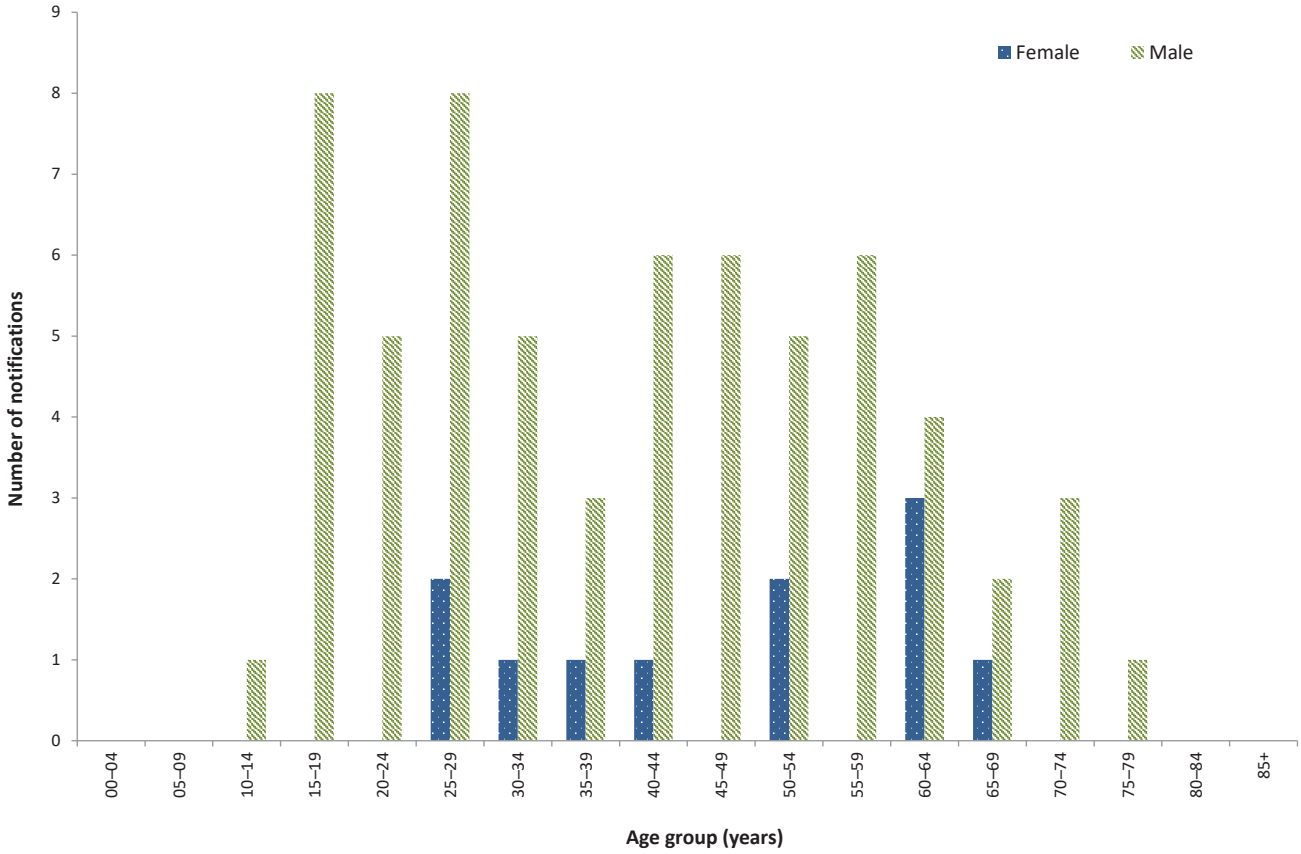
Geographical distribution

Over half (57%, 42/74) of notified cases were Queensland residents (Figure 103), with a state-specific notification rate of 0.9 per 100,000.

Age and sex distribution

The highest number of cases were observed in 15–19 years old males (n=8) and 25–29 years old males (n=8) (Figure 104). In 2015, the median

Figure 104: Notifications of leptospirosis, Australia, 2015, by age group and sex



age of notified leptospirosis cases was 42 years (range: 13 to 79 years), and 85% (63/74) were male.

Microbiological trends

The WHO/Food and Agriculture Organization / World Organisation for Animal Health Collaborating Centre for Reference and Research on Leptospirosis (Leptospirosis Reference Laboratory, Queensland) routinely conducts PCR-based serotyping for leptospirosis cases from Queensland (whence the majority of cases are reported), and collates national data that may be submitted to the laboratory from other states or territories. At the time of compiling this report, data for 2015 were not publicly available.

In Australia, serotyping is only conducted on pathogenic *Leptospira* species typing information was available for 87% (55/63) of these cases. In 2015, the most frequently reported serovars were *L. borgpetersenii* serovar Arborea (24%, 13/55), *L. interrogans* serovar Australis (20%, 11/55) and *L. interrogans* serovar Zanoni (20%, 11/55). In 2014, *L. interrogans* serovar Zanoni was the most frequently reported serovar of those available (18/78).

In 2015, 47% (35/74) of reported leptospirosis cases were acquired locally, 16% (12/74) were acquired overseas and 36% (27/74) were acquired in an unknown location (Table 26). ■

Table 26: Notifications of leptospirosis, Australia, 2015, by serovar

Leptospira serovars	Locally acquired	Overseas acquired	Place of acquisition unknown
L. borgpetersenii serovar Arborea	7	0	6
L. borgpetersenii serovar Hardjobovis	1	0	2
L. borgpetersenii serovar Tarassovi	1	0	0
L. interrogans serovar Australis	5	2	4
L. interrogans serovar Canicola	0	0	1
L. interrogans serovar Copenhageni	1	3	0
L. interrogans serovar Kremastos	0	1	0
L. interrogans serovar Pomona	2	1	1
L. interrogans serovar Szwajizak	2	0	0
L. interrogans serovar Zanoni	4	0	7
L. kirschneri serovar Grippotyphosa	0	1	0
L. weilii serovar Topaz	1	1	1
Serotype unknown	11	3	5
Total	35	12	27

Ornithosis

- There were 16 cases of ornithosis notified in 2015, a 74% decrease compared with the 5-year mean.
- As in previous years, the majority of notifications in 2015 were residents of Victoria.
- Seventy-five per cent of cases reported in 2015 were male.

Ornithosis (or psittacosis) is a pneumonia-like illness caused by infection with the bacterium *Chlamydophila psittaci*.[21] It is transmitted to humans primarily from infected parrots, but transmission to humans has also been known to occur from poultry and a range of other birds.[175] Transmission to humans occurs via the inhalation of contaminated dried faeces, nasal or eye secretions and dust from the feathers. Individuals at risk of contracting ornithosis include bird owners and those with occupational exposure to birds.[176]

Epidemiological situation in 2015

In 2015, there were 16 notified cases of ornithosis in Australia (0.1 per 100,000), a 74% decrease compared with the 5-year mean (n=62).

Geographical distribution

As in previous years, more than two-thirds of the 2015 notifications were residents of Victoria (69%, 11/16) (Figure 105).

Age and sex distribution

In 2015, the median age of ornithosis notifications was 61 years (range: 18 to 80 years), and 75% (12/16) were male (Figure 106). ■

Figure 105: Notifications of ornithosis, Australia, 2010 to 2015, by month and year of diagnosis and state or territory

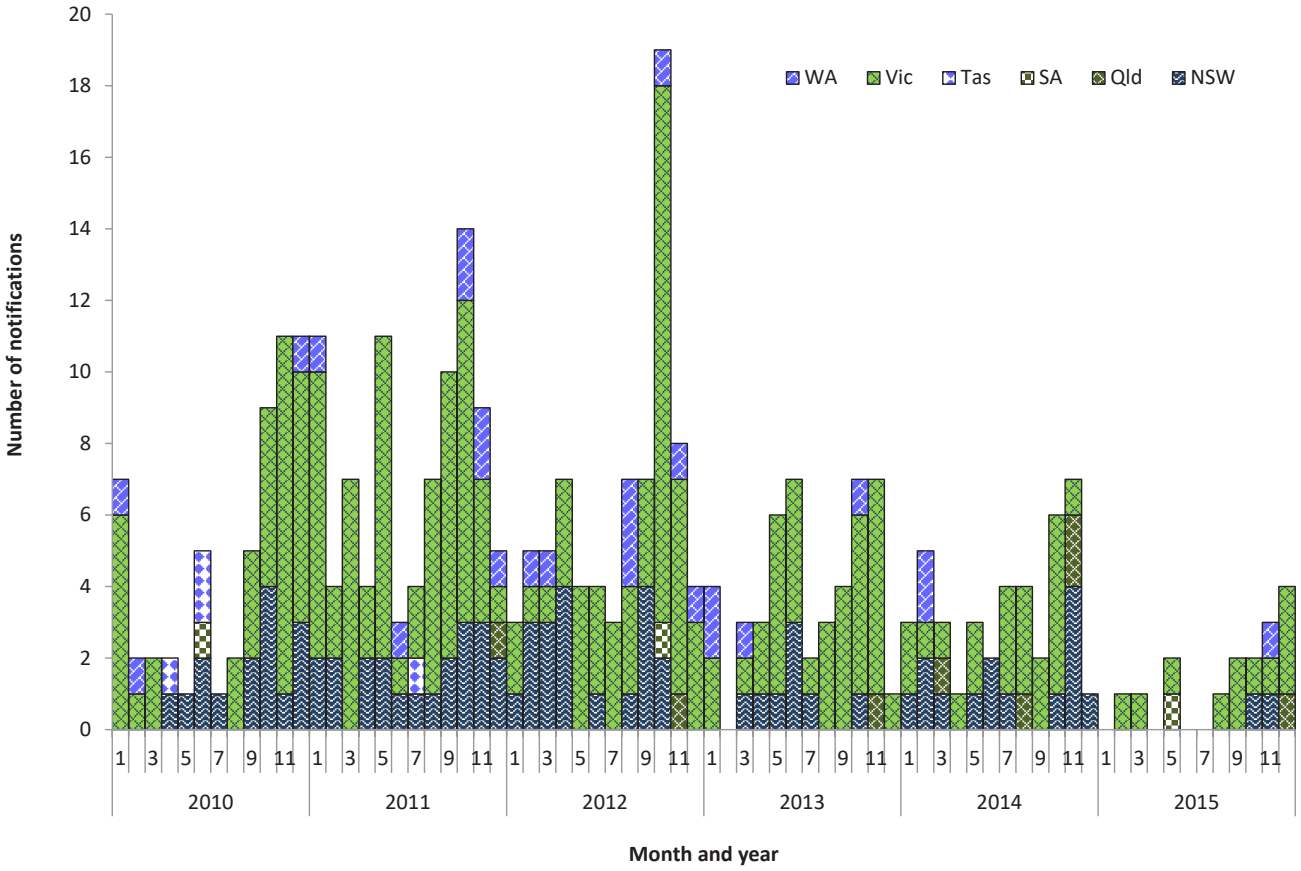
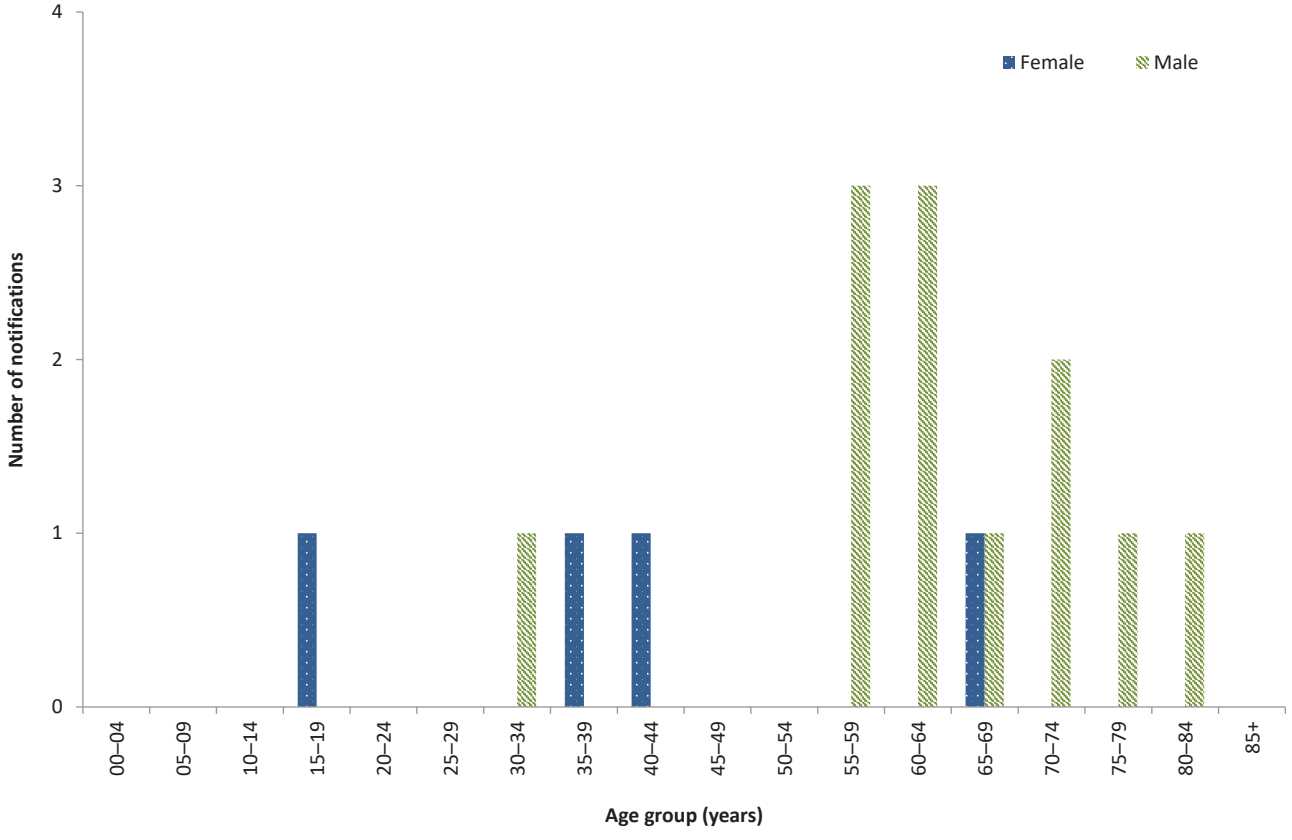


Figure 106: Notifications of ornithosis, Australia, 2015, by age group and sex



Q fever

- Cases of Q fever were reported in all jurisdictions except Tasmania and the Australian Capital Territory. The highest notification rate was in Queensland, at 5.3 per 100,000.
- Seventy-six per cent cases reported in 2015 were male.

There were 601 cases of Q fever notified in 2015.

Q fever is caused by infection with the bacterium *Coxiella burnetii*. The primary reservoirs of these bacteria are cattle, sheep and goats. *C. burnetii* is resistant to environmental conditions and many common disinfectants.[177] Q fever is most commonly transmitted via the airborne route, where the organism is carried in dust contaminated with tissue, birth fluids or excreta from infected animals.[178] Prior to the commencement of immunisation programs in Australia, approximately half of all cases in New South Wales, Queensland and Victoria were among abattoir workers.[179,180]

The Australian Government funded the National Q Fever Management Program (NQFMP) between 2001 and 2006 for states and territories to provide free vaccine to at risk occupational groups (such as abattoir workers).[181]

Adults at risk of Q fever infection, including abattoir workers, farmers, veterinarians, stockyard workers, shearers and animal transporters, should be considered for immunisation. The administration of the Q fever vaccine requires a pre-immunisation screening test to exclude those recipients with a previous (possibly unrecognised) exposure to the organism, including previous immunisation. Q fever vaccine may cause an adverse reaction in a person who has already been exposed to the bacterium. Immunisation is not recommended for children under 15 years of age or pregnant females.[29]

Epidemiological situation in 2015

In 2015, there were 601 notified cases of Q fever in Australia (2.5 per 100,000), a 48% increase compared with the 5-year (2010 to 2014) mean (n=405). Between 1991 and 2001, and prior to the introduction of the NQFMP, Q fever notification rates ranged between 2.5 and 4.9 cases per 100,000.[181] There has been an increase in the national Q fever notification rate since 2009 (1.4 per 100,000), with the notification rate in 2015 (2.5 per 100,000) being the highest since 2003 (2.8 per 100,000).

Geographical distribution

The highest notification rate was in Queensland (5.3 per 100,000, n=255). Cases were reported in all jurisdictions except Tasmania and the Australian Capital Territory (Figure 107).

'Hot spots' for Q fever occur in central Queensland and in the areas that border Queensland and New South Wales (Figure 108). The Statistical Area of Outback South in south-west Queensland had the highest notification rate in 2015, with 135 cases per 100,000 (n=27), which is a decrease from 2014 (142 cases per 100,000; n=29). The Statistical Area of Bourke Cobar Coonamble in northern New South Wales had a large increase in the notification rate in 2015 (102 per 100,000; n=27) compared to 2014 (37 per 100,000; n=10) and the 5-year mean notification rate of 31 per 100,000 (n=8).

Age and sex distribution

The median age of Q fever cases was 47 years (range: 1 to 85 years), and 76% (454/601) were male. More than a third (34%, 205/601) of notified cases were males aged between 45 and 64 years (Figure 109). This is consistent with a report that found higher rates of Q fever in men aged 50 to 59 years, and that agriculture-related occupations (including farming) are the most commonly reported occupation.[178] ■

Figure 107: Notifications of Q fever, Australia, 2010 to 2015, by month and year of diagnosis and state or territory

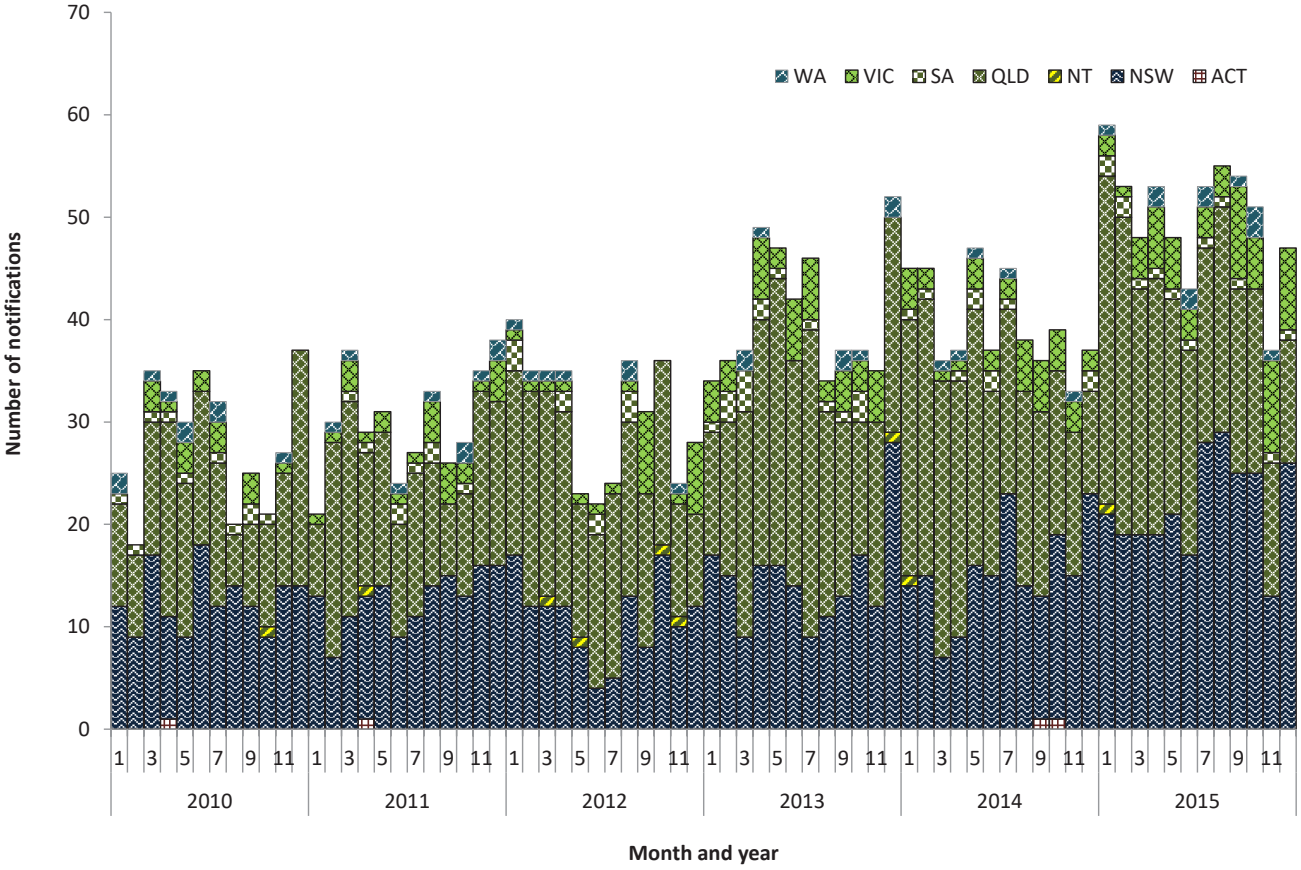


Figure 108: Notification rate for Q fever, Australia, 2015, by Statistical Area Level 3

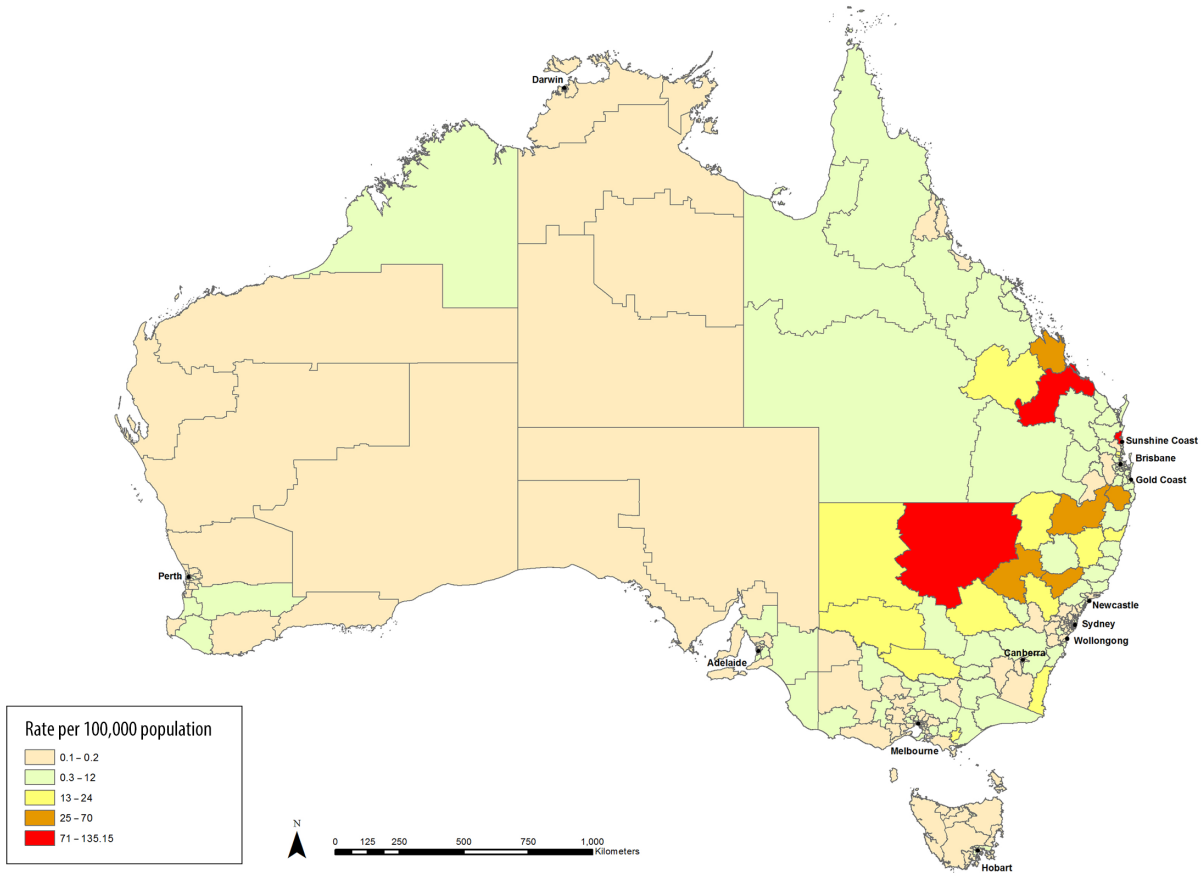
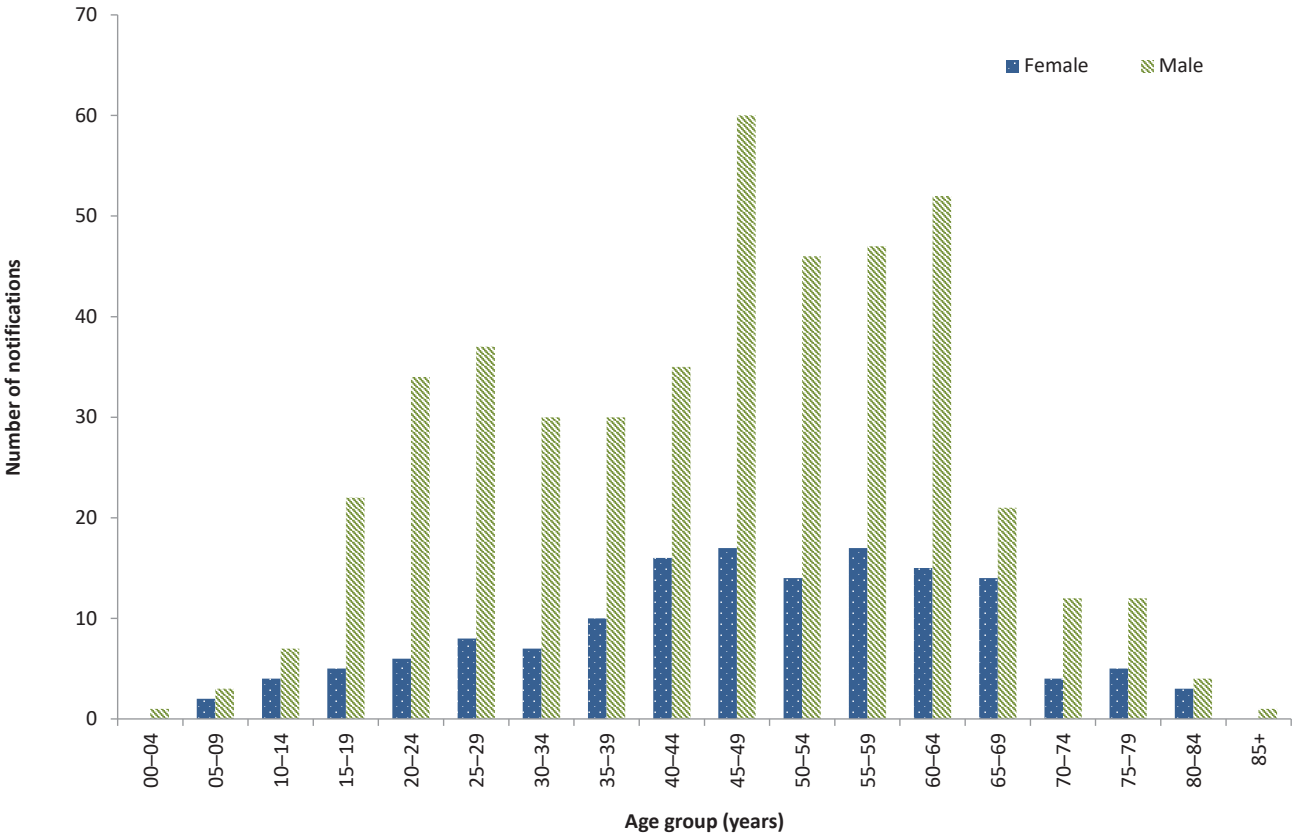


Figure 109: Notifications of Q fever, Australia, 2015, by age group and sex



Tularemia

- There were no cases of tularaemia notified in 2015.
- The last case of tularaemia reported in Australia was in 2011.

Tularaemia is a non-specific disease with diverse manifestations, often with an influenza-like onset, caused by infection with the bacterium *Francisella tularensis*.[21] The most common modes of transmission are through arthropod bites, handling infected animals, inhalation of infectious aerosols or exposure to contaminated food or water. Small mammals such as rodents, rabbits and hares are often the reservoir.[182]

Epidemiological situation in 2015

In 2015, there were no notified cases of tularaemia in Australia. Tularaemia was last notified in 2011, with 2 cases in Tasmanian residents. This was the first time *F. tularensis* type B had been detected in the Southern Hemisphere.[183,184,185]

OTHER BACTERIAL INFECTIONS

Other bacterial diseases in the national notifiable disease list are legionellosis, leprosy, invasive meningococcal disease and tuberculosis. In 2015, there were 1,815 cases of other bacterial infections notified to the NNDSS, representing 1% of all reported cases and less than the number notified in 2014 (n=1,947). Common objectives for the surveillance of diseases in this section are to monitor their epidemiology and to identify risk groups to accurately target control strategies.

Legionellosis

- There were 365 cases of legionellosis notified in 2015.
- Compared with 2014, notifications of legionellosis declined by 14% in 2015.
- *Legionella pneumophila*, commonly associated with man-made water systems, was the most frequently reported causative species in 2015.

Legionellosis is an environmentally acquired pneumonia caused by the bacteria *Legionella*. It can take the form of either legionnaire's disease, a severe form of infection of the lungs, or Pontiac fever, a milder influenza-like illness.[21] The species most commonly associated with human disease in Australia are *Legionella pneumophila* and *Legionella longbeachae*. *Legionella* bacteria are found naturally in low levels in the environment. In the absence of effective environmental treatments, *Legionella* organisms can proliferate in air conditioning cooling towers, hot water systems, showerheads, spa pools, fountains, commercial potting mix and other decomposing material such as bark and sawdust.[186,187,188,189] *Legionella* is generally transmitted to humans through contaminated water or dust aerosols.

Epidemiological situation in 2015

In 2015, there were 365 notifications of legionellosis, representing a notification rate of 1.5 per 100,000. This was a 14% decline in the number of notifications reported in 2014 (n=425) (Figure 110).

In 2015, data on the causative species were available for 97% (n=354) of notifications reported. Of these cases, the most frequently reported causative species were *L. pneumophila* (53%, 188/354), followed by *L. longbeachae* (47%, 165/354). A single notification of *Legionella bozemanii* was also reported (Table 27). Serogroup information was reported for 70% (132/188) of *L. pneumophila* notifications. The majority of these were serogroup 1 infections, with one case reported as having a mixed serogroup infection. For *L. longbeachae* notifications, serogroup information was provided for 7% (12/165) of cases, and all of these were serogroup 1 infections.

Figure 110: Notifications of legionellosis, Australia, 2010-2015, by species and year

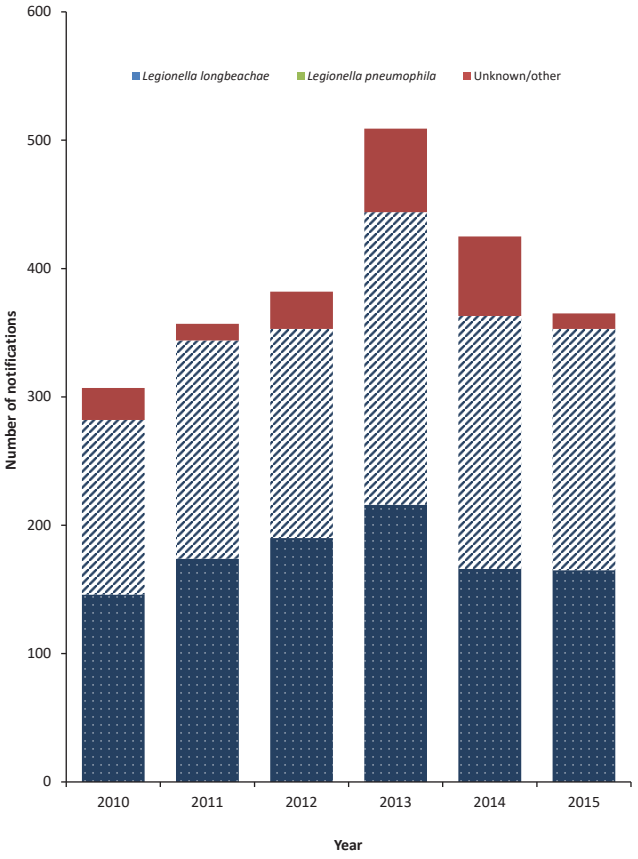


Table 27: Notifications, notification rates and deaths for legionellosis, Australia, 2015, by species and state or territory

Species	State or territory									Deaths due to legionellosis
	ACT	NSW	NT	Qld	SA	Tas.	Vic.	WA	Australia	
L. pneumophila	0	67	2	37	13	4	52	13	188	5
L. longbeachae	1	30	5	39	13	3	13	61	165	1
L. bozemanii	0	1	0	0	0	0	0	0	1	1
Unknown species	1	0	0	4	0	0	6	0	11	0
Total	**2**	**98**	**7**	**80**	**26**	**7**	**71**	**74**	**365**	**7**
Rate (per 100,000)	**0.5**	**1.3**	**2.9**	**1.7**	**1.5**	**1.4**	**1.2**	**2.9**	**1.5**	**0**

Over the period of 2010 to 2015, the number of notified cases of *L. pneumophila* ranged from 136 to 228 per annum, While notified cases of L. longbeachae ranged from 146 to 216 per annum (Figure 110). Compared with 2014, notifications of *L. pneumophila* declined by 5% and there were a similar number of notifications for *L. longbeachae*.

In 2015, mortality data were available for 67% (246/365) of notifications. Of these, 3% (7/246) were reported to have died due to legionellosis. This was similar to the number of deaths reported in previous years. The majority of deaths were attributed to infection with *L. pneumophila* (71%, 5/7) (Table 27). Over the last 6 years (2010 to 2015) the mortality data completeness for legionellosis notifications has improved with the proportion of notifications with mortality information increasing from 58% in 2010.

Geographic distribution

In 2015, jurisdiction specific rates of legionellosis varied from 0.5 per 100,000 in the Australian Capital Territory to 2.9 per 100,000 in both Western Australia and the Northern Territory (Table 27).

In 2015, *L. pneumophila* was the most notified causative species in New South Wales and Victoria, while *L. longbeachae* was more frequently notified in the Northern Territory and Western Australia. Queensland, South Australia and Tasmania reported either equal or similar proportions of both species. The most frequent species annually reported by each jurisdiction can vary between *L. pneumophila* and *L. longbeachae*. However, generally Western Australia and the Northern Territory tend to report more *L. longbeachae* notifications, while New South Wales, South Australia and Victoria tend to report more *L. pneumophila* notifications. Queensland reported an approximately equal proportion of *L. longbeachae* and *L. pneumophila* notifications. The Australian Capital Territory and Tasmania tend to report only a small number of notifications each year with no clear species predominance.

Age and sex distribution

In 2015, males accounted for a higher proportion (64%) of the notifications compared to females; representing a male to female ratio of 1.7:1. While the age range of cases in 2015 was between 6 and 97 years, cases tended to be among adults aged 45 years and over, peaking among those aged 75–79 years. In males, notifications

were highest in the 75–79 years age group (11.2 per 100,000); however for females notifications peaked among cases aged 85 years and over (4.3 per 100,000) (Figure 111).

Of the 7 cases reported to have died due to legionellosis in 2015, their ages ranged between 60 and 86 years (median: 78 years); 3 deaths were in males and 4 were in females.

In 2015, the demographic profile of legionellosis remained consistent with the recognised epidemiology of the disease.[21,190,191]

Seasonality

In 2015, diagnoses of legionellosis were highest in April and October, with 44 and 40 notified cases for these months respectively. The diagnosis of *L. pneumophila* peaked in April (n=25) and the diagnosis of *L. longbeachae* peaked across September and October (n=22 and n=23, respectively). Between 2010 and 2015, the diagnosis of *L. longbeachae* more commonly occurred in winter and spring. In the same period, the diagnosis of *L. pneumophila* commonly occurred in the late summer and autumn months, except for 2013, when diagnoses peaked at the end of winter (Figure 112). This winter 2013 peak is not likely to be a seasonal-related rise, as the increase was most likely associated with increased testing in Queensland that occurred following a legionellosis outbreak at a hospital.

Place of acquisition

In 2015, a place of acquisition was reported in 94% (n=343) of legionellosis notifications. Of these, 91% (311/343) were reported to be acquired within Australia and 9% (32/343) were reported to be acquired overseas. Of the overseas acquired notifications, the United States of America (22%; 7/32) and both Singapore and Fiji (each 13%; 4/32), were the most commonly reported places of acquisition.

Figure 111: Notification rate for legionellosis, Australia, 2015, by age group, sex and species

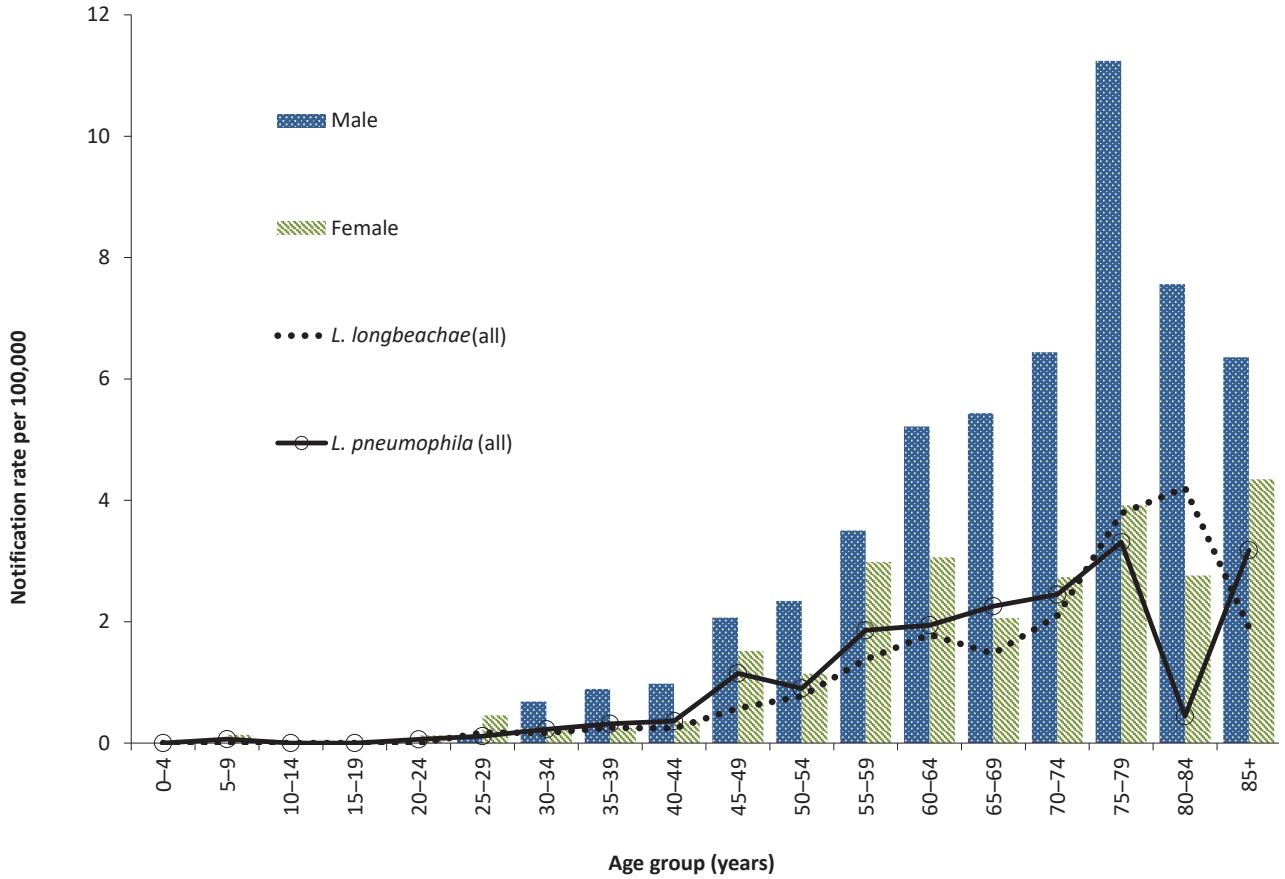
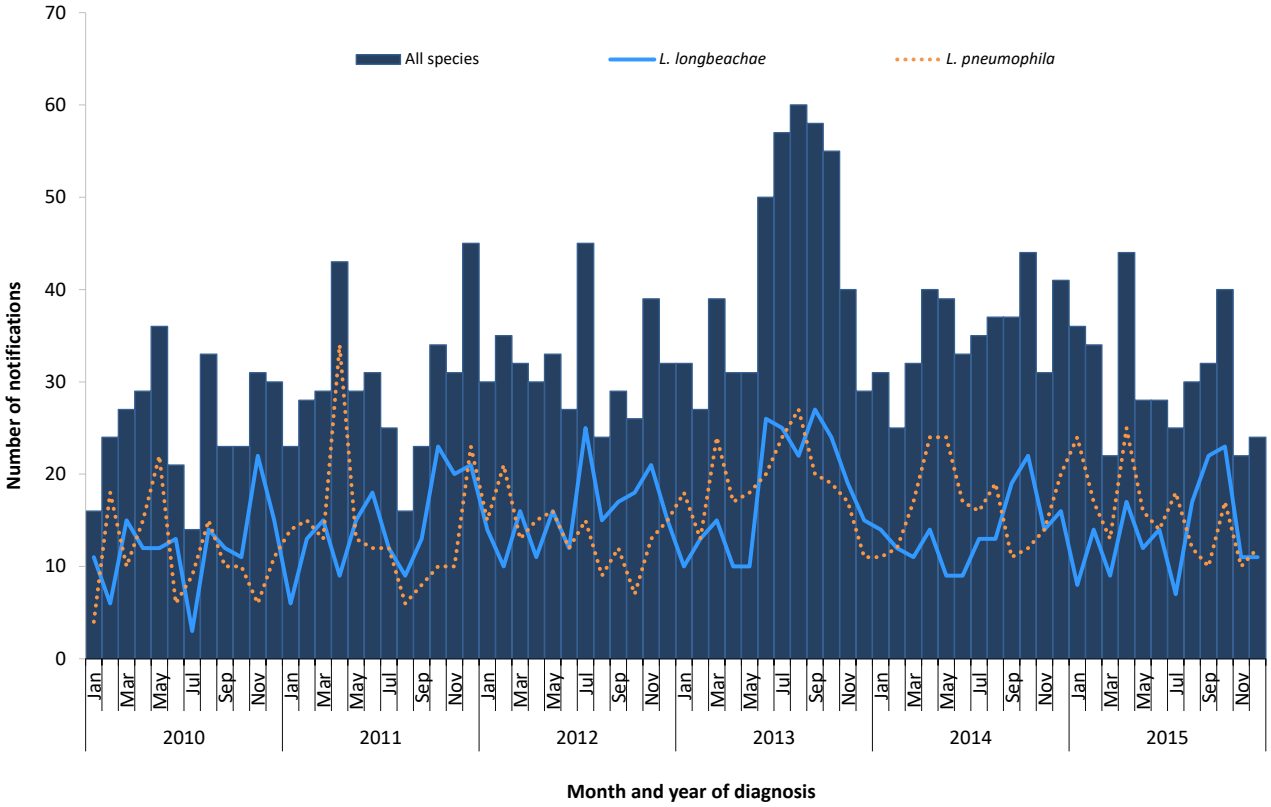


Figure 112: Notifications of legionellosis, Australia, 2010 to 2015, by month and year of diagnosis and species

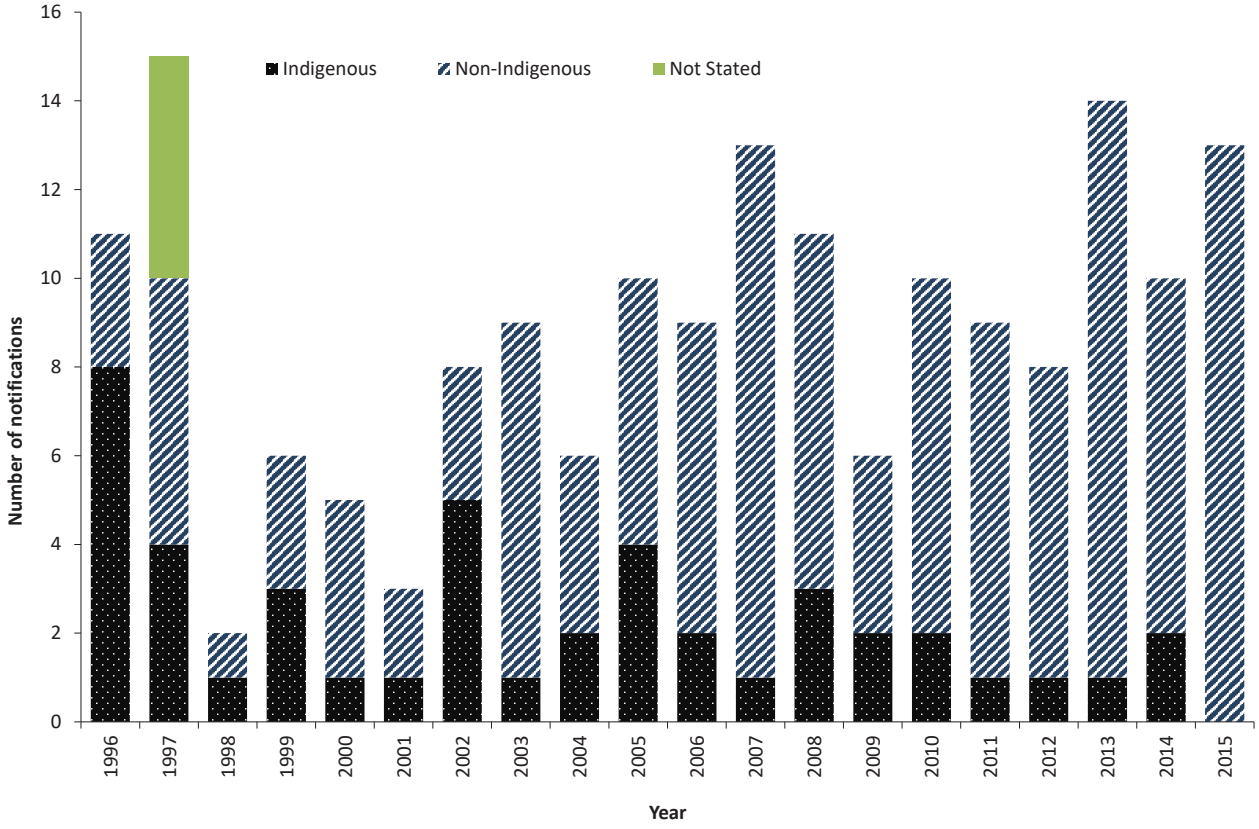


Outbreaks

In 2015, 4 outbreaks of legionellosis were identified, 1 in Western Australia and 3 in Victoria. In Western Australia, 2 confirmed cases of Legionnaire's disease and 1 confirmed case of Pontiac fever were identified among crew members of a seismic survey vessel operating in the seas of northern Western Australia. The cases were residents of Queensland, New South Wales and Tasmania. Following environmental investigations, *Legionella* bacteria were detected in shower heads and hand basin mixing tap aerators in cabins, with a higher number of positive samples in the cabins of cases. Disinfection and other remediation measures were undertaken, with no further cases reported. (Email communication, C. Giele, Department of Health Western Australia, December 2016)

In Victoria there were 3 outbreaks of legionellosis reported in 2015, involving a total of 8 cases. All 3 outbreaks were due to *L. pneumophila* serogroup 1, and there were no positive environmental detections associated with the investigations. Outbreak cases were aged from 46 to 73 years with a median age of 55 years. All but 1 of the cases were male. All 3 outbreaks occurred in the greater Melbourne metropolitan area, in April, June and October. The settings where the outbreaks occurred were the airport, a residential apartment carwash, and a shopping complex. Of the 4 cases linked to the airport outbreak, all cases reported overseas travel exposures, in Thailand, Indonesia and China. As a result of this outbreak, Victoria's protocol was updated to recognise that overseas travel is a much more likely exposure source for cases related to airports. (Email communication, L. Franklin, Vic. Department of Health and Human Services, November 2016) ■

Figure 113: Notifications of leprosy, Australia, 1996 to 2015, by year and Indigenous status



Leprosy

- There were 13 cases of leprosy notified in 2015, maintaining a notification rate of less than 0.1 per 100,000.
- All cases of leprosy notified in 2015 were acquired overseas.

Leprosy is a chronic infection of the skin and peripheral nerves with the bacterium *Mycobacterium leprae*. Leprosy is an uncommon disease in Australia with the majority of cases occurring in migrants from leprosy-endemic countries and Indigenous populations. The incidence of leprosy worldwide is declining due to various factors including economic development, bacille Calmette-Guérin (BCG) immunisation and high coverage with multidrug therapy.[21] Leprosy is not a highly infectious disease and is typically slow to progress to a symptomatic stage. The incubation period for leprosy is about 5 years; however, it can take as long as 20 years for symptoms to appear.[192] People at risk are generally in close and frequent contact with leprosy patients or living in countries where the disease is more common. Leprosy is curable and once a person with leprosy begins appropriate treatment, they quickly become non-infectious.

Epidemiological situation in 2015

In 2015, a total of 13 cases of leprosy (8 male, 5 female), representing a rate of less than 0.1 per 100,000. There were 5 cases notified in Victoria, 3 in New South Wales, 2 each in Western Australia and Queensland and 1 in the Northern Territory. Cases ranged in age from 22 to 71 years of age, with a median age of 39 years. All cases were reported as being non-Indigenous and as having acquired their infection overseas: Sri Lanka (n=3), Afghanistan (n=1), Bangladesh (n=1), China (n=1), Guinea (n=1), India (n=1), the Philippines (n=1), Samoa (n=1), South Africa (n=1), Vietnam (n=1) and

unknown[iv] (n=1). Since 1996, annual notifications of leprosy have ranged from 2 to 15 cases per year (Figure 113). ■

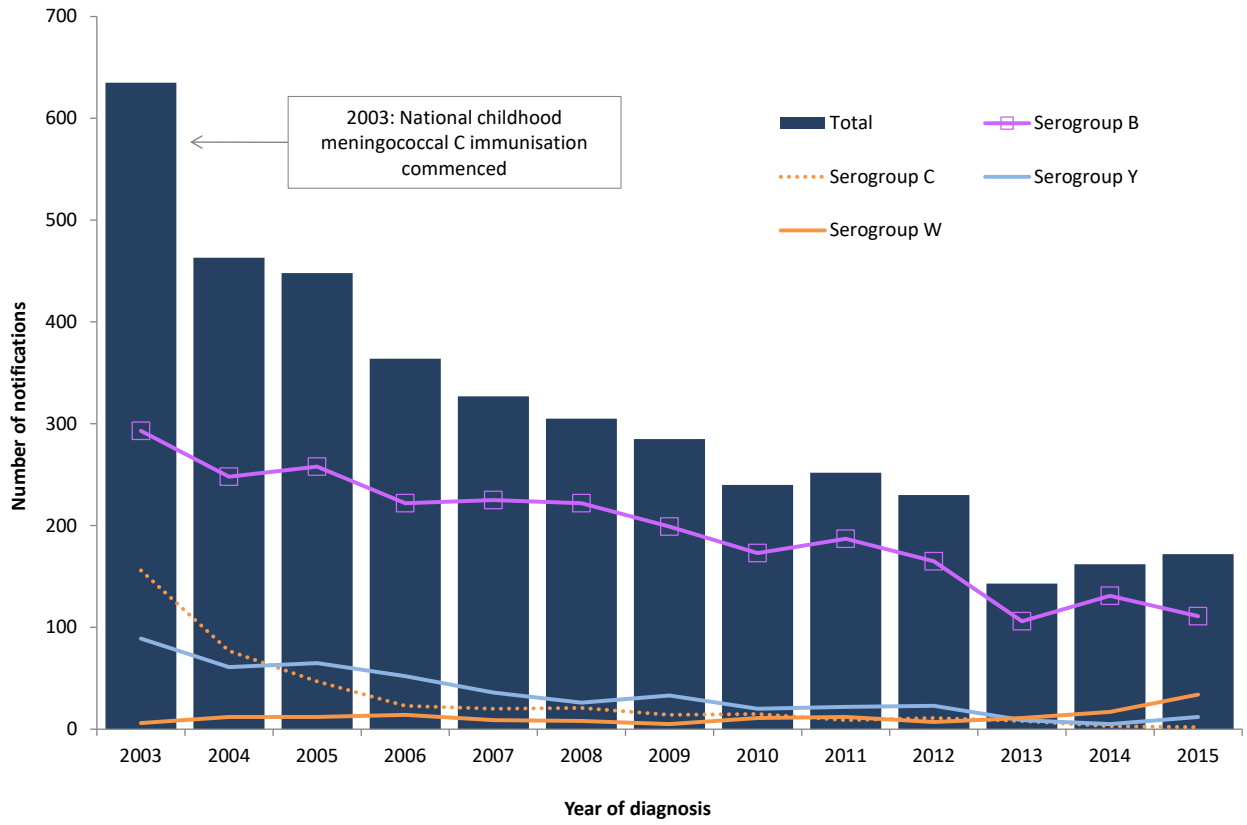
iv The infection is known to be acquired overseas; however, the country in which the infection was acquired is unknown.

Meningococcal Disease (invasive)

- There were 182 cases and 12 deaths related to invasive meningococcal disease (IMD) notified in 2015.
- The majority (66%) of IMD cases were caused by serogroup B infections.
- Infections with serogroup W represented an increasing proportion of IMD notifications.
- Sixty per cent of IMD cases notified in 2015 were less than 25 years of age.

Invasive meningococcal disease (IMD) is caused when the bacterium *Neisseria meningitidis* enters a normally sterile site, usually the blood (septicaemia), cerebrospinal fluid (meningitis) or both. Asymptomatic respiratory tract carriage of meningococci is present in around

Figure 114: Notifications of invasive meningococcal disease by selected serogroup, Australia, 2003 to 2015



10% of the population, and prevalence may be higher when groups of people occupy confined living space.[21,29] The disease is transmitted via respiratory droplets and has an incubation period of between 1 and 10 days, commonly 3 to 4 days.[21,193] It can rapidly progress to serious illness, most commonly occurring in previously healthy children and young adults. While there are 13 known serogroups globally, serogroups A, B, C, X, W and Y commonly cause invasive disease.[194] Historically, *N. meningitidis* serogroups B and C have been the major cause of IMD in Australia in recent decades. However since 2013, there has been a rise in the cases associated with serogroup W and Y organisms.

Epidemiological situation in 2015

In 2015, there were 182 notified cases of IMD representing a rate of 0.8 per 100,000. This was an increase of 8% compared with 2014 (n=169) but less than the number of cases notified between 2003 and 2012 (range: 556 to 223 cases) (Figure 114). While numbers in 2015 remained low, this was the second consecutive year in which notifications of IMD have increased. This rise is due to an increase in the number of infections caused by serogroup W and serogroup Y organisms.

The majority of cases reported in 2015 (97%, n=176) met the case definition as a confirmed case being diagnosed based on laboratory definitive evidence, or laboratory suggestive evidence and clinical evidence.[193] A small number of cases (n=6) were reported as probable and diagnosed based on clinical evidence only.

In 2015, all states and territories reported cases of IMD (Table 28), with notification rates ranging from 0.4 per 100,000 in the Northern Territory and Tasmania to 1.7 per 100,000 in South Australia (Table 28). Mortality data were available for 79% (n=144) of cases. Of these, 12 cases were reported as having died from IMD, including 7 from infection with serogroup W organisms, 4 from infection with serogroup B organisms and 1 from infection with serogroup Y organisms (Table 28). All deaths reported in 2015 occurred in adolescents and adults (age range: 17 to 88 years). Of the deaths associated with serogroup W organisms, 4 were less than 30 years of age and 3 were between the ages 65 and 80 years. Of the deaths associated with IMD infection caused by serogroup B organisms, 1 case occurred in an adolescent aged 17 years and 3 occurred in adults aged between 35 and 69 years. The 1 death caused by serogroup Y organisms occurred in an adult aged 88 years.

Table 28: Notifications and notification rates of invasive meningococcal disease and deaths due to invasive meningococcal disease, Australia, 2015, by serogroup and state or territory

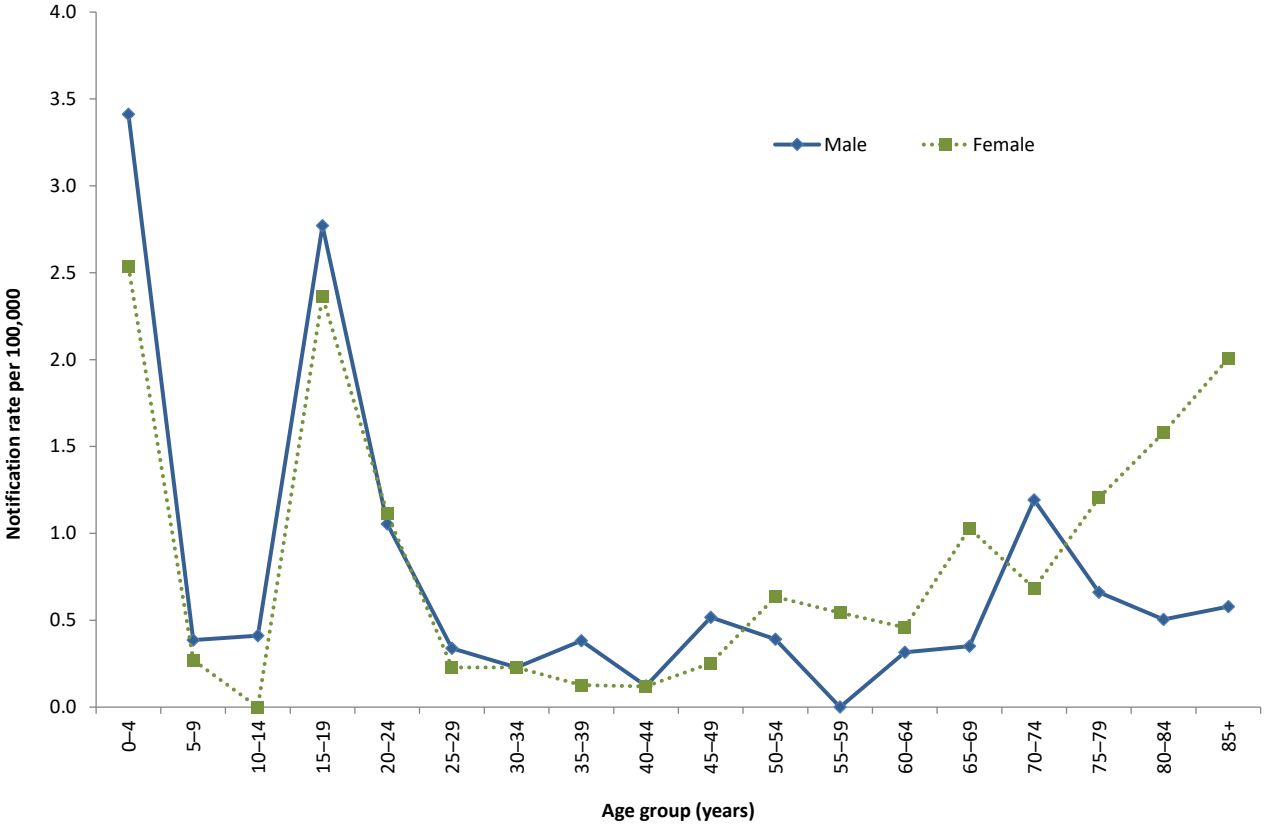
	State or territory									
	ACT#	NSW#	NT	Qld	SA	Tas	Vic	WA	Australia	Deaths
B	1	23	1	19	28	1	29	9	111	4
C	0	2	0	0	0	0	0	0	2	0
W	0	8	0	4	0	1	17	4	34	7
Y	1	7	0	2	1	0	9	2	22	1
Other*	0	5	0	5	0	0	1	2	13	0
Total	2	45	1	30	29	2	56	17	182	12
Rate per 100,000	0.5	0.6	0.4	0.6	1.7	0.4	0.9	0.7	0.8	0

* Includes notifications where serogroup was reported as non-groupable or not grouped.[i]

\# Cases of conjunctival meningococcal infection are also reported under the local case definition, and reported to the national dataset by the jurisdiction. Conjunctival cases cannot be distinguished from invasive cases in the national dataset.

i Not grouped is where no serogroup is available; non-groupable is where the serogroup is reported by the reference laboratory as a non-groupable strain.

Figure 115: Notification rate for invasive meningococcal disease, Australia, 2015, by age and sex



Age and sex distribution

In 2015, approximately the same number of IMD cases were notified in males (51%, n=92) as were notified in females (49%, n=90). Proportionally, 60% (n=110) of all cases reported were less than 25 years of age, of which 42% were children less than 5 years of age (n=46). The highest notification rates in 2015 for both males and females occurred in the 0–4 years age group (3.4 per 100,000 for males and 2.5 per 100,000 for females), with a second peak in adolescents in the 15–19 years age group (Figure 115).

Serogroup analysis

Data on serogroup were available for 93% (n=169) of cases in 2015, of which 66% (111/169) were caused by serogroup B organisms, 20% (34/169) by serogroup W organisms, 13% (22/169) by serogroup Y organisms and 1% (2/169) by serogroup C organisms (Table 28). One case was reported as non-groupable. In 2015, cases caused by serogroup Y organisms (n=22) were the highest since reporting began in 1991, and twice the annual average over the previous 10-year period (average=10.7).

Cases of IMD caused by serogroup C organisms continue to decrease, with 2 cases notified in 2015 compared with 3 in 2014 and 8 in 2013. This decline represents a 99% decrease in case numbers since the introduction of the meningococcal C vaccine on the NIP in 2003. Of the cases of IMD due to serogroup C organisms reported in 2015, both were under the age of 25 years, with 1 in the 0–4 years age group, and the other in the 20–24 years age group. Age-specific rates of serogroup C infections have remained below 0.2 cases per 100,000 since 2010.

Serogroup B accounted for the majority of cases across all age groups in 2015, with the exceptions of the 55–59 years, 70–74 years and 75–79 years age groups. Compared with 2014, notification rates for serogroup B declined across all age groups except the 15–19 years age group, which increased from 1.6 per 100,000 in 2014 to 2.2 per 100,000 in 2015 (Figure 116).

Figure 116: Notification rate for serogroup B invasive meningococcal disease, Australia, 2010 to 2015, by select age groups

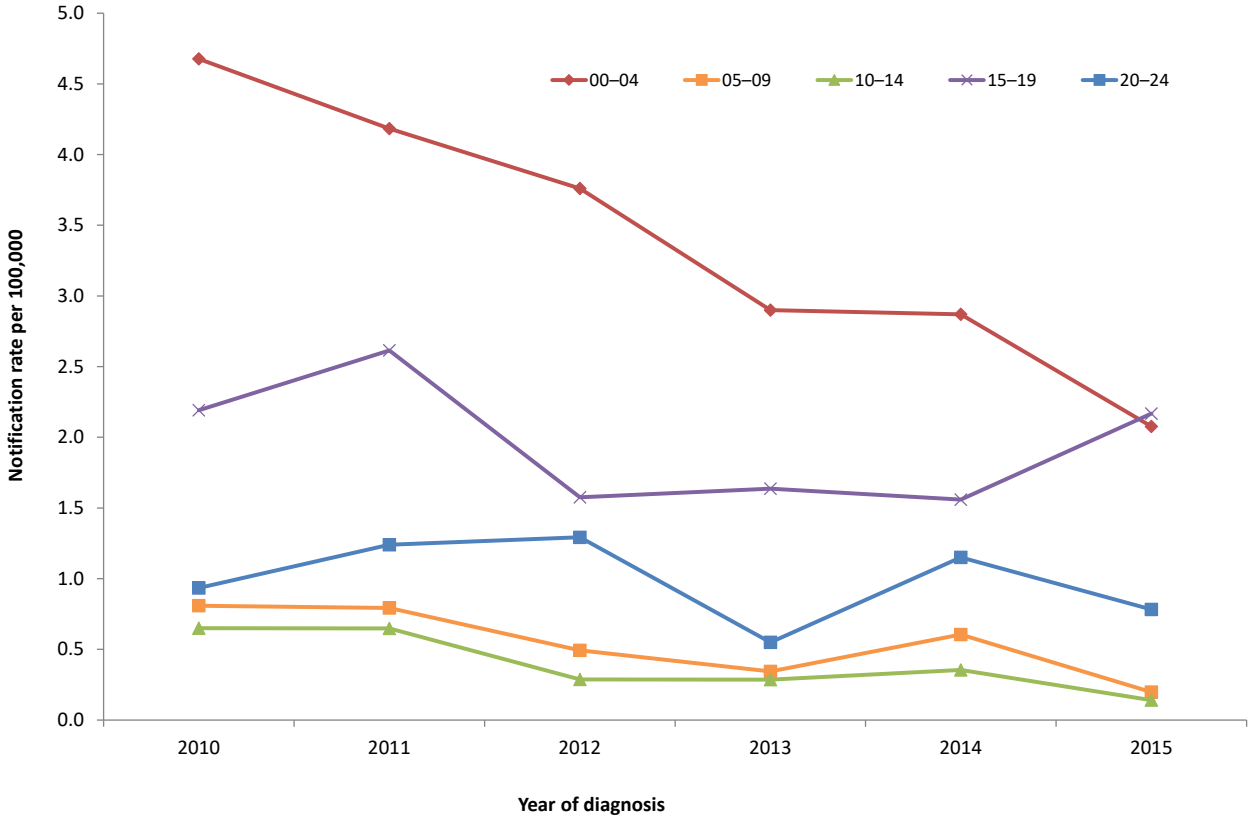
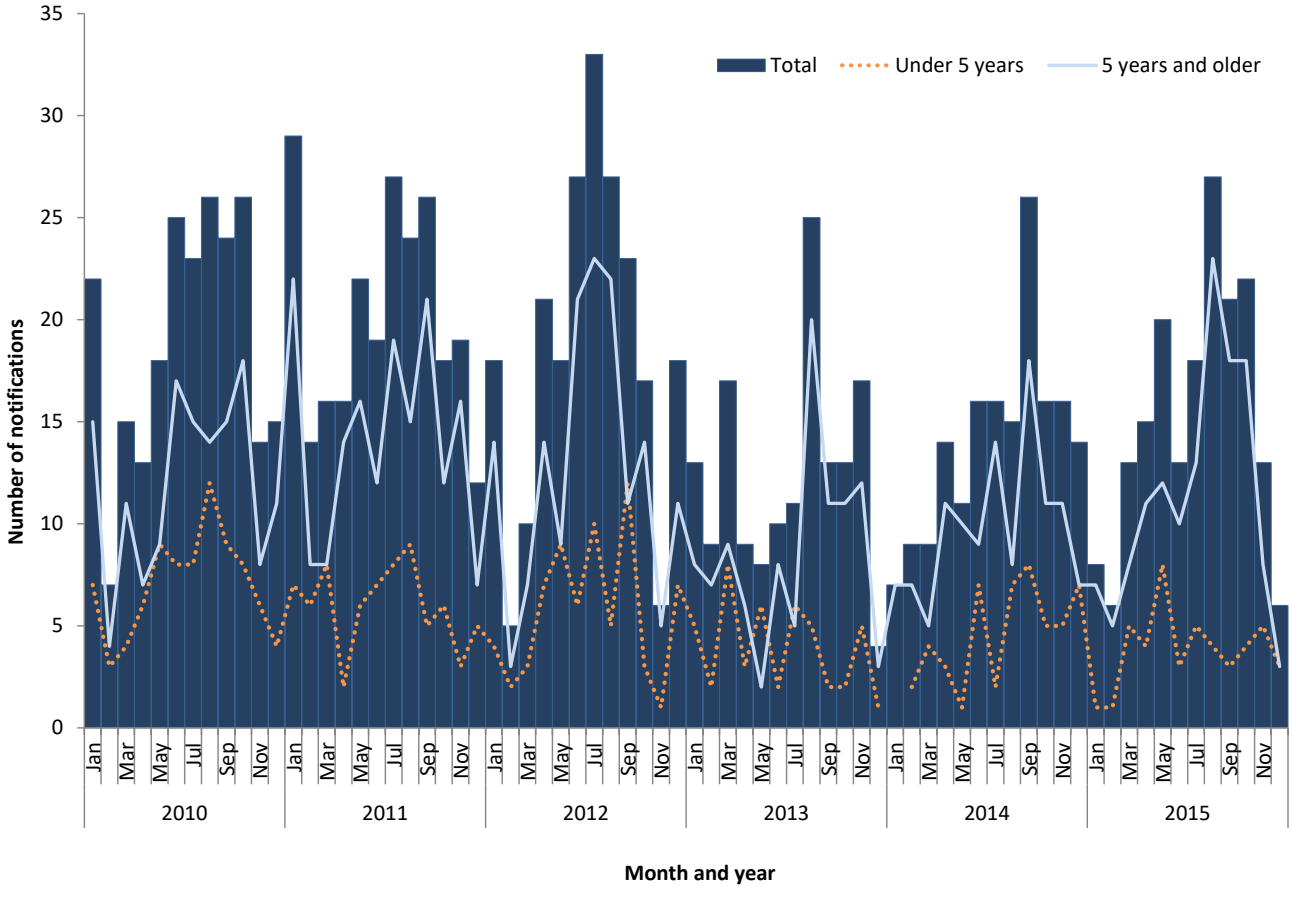


Figure 117: Notifications of invasive meningococcal disease, Australia, 2010 to 2015, by age group and month and year of diagnosis



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In 2014, an increase in cases due to serogroup W organisms was evident, with numbers almost 2 times higher than the annual average of the previous 5 years. This observed rise continued in 2015, with 34 cases reported compared with 17 cases in 2014, 11 cases in 2013 and 7 cases in 2012.

Seasonality

In 2015, an average of 15 cases of IMD were reported monthly, with a range of 6 to 27 cases. A clear seasonal pattern was apparent in 2015, with the highest number of notifications reported towards the end of winter (August) and early spring. The 2015 season peaked in August, with 27 cases reported, and was similar to the seasonal pattern displayed from 2010 to 2014 with notifications peaking in mid to late winter (Figure 117). Consistent with the previous 5 years, the 2015 seasonal trend was more apparent in cases aged 5 years and older compared with those less than 5 years of age.

Immunisation

From 2003, the meningococcal C vaccine has been available for infants aged 12 months on the NIP. A catch up program provided access to the meningococcal C vaccine for children and adolescents born between 1984 and 2001.

Both cases of IMD caused by serogroup C organisms reported in 2015 were in children aged 12 months or older, and were therefore eligible for immunisation under the NIP. One case was 1 year of age and was reported to be vaccinated, and the second was 12 years of age and reported as not vaccinated.

Susceptibility

The Australian Meningococcal Surveillance Program (AMSP) was established in 1994 for the purpose of monitoring and analysing isolates of *N. meningitidis* from cases of IMD in Australia. The program is undertaken by a network of reference laboratories in each state and territory, using standardised methodology to determine the phenotype (serogroup, serotype and serosubtype) and the susceptibility of *N. meningitidis* to a core group of antibiotics. Annual reports of the AMSP are published in CDI.

Data from AMSP for 2015, show that 10% of isolates tested were fully sensitive and 86% demonstrated decreased susceptibility to the penicillin group of antibiotics.[195] A very small number of isolates tested in 2015 exhibited resistance to penicillin (n=4, 3.4%). All tested IMD isolates were susceptible to ceftriaxone and ciprofloxacin, and 1 isolate was resistant to rifampicin.

Discussion

The overall incidence of IMD in Australia is low and has decreased since the introduction of the serogroup C vaccine on the NIP in 2003. However, from 2014 there has been a rise of IMD cases nationally.

Since 2013, serogroup W has accounted for an increasing proportion of IMD cases, with 10% of cases in 2014 attributed to this organism, and 19% in 2015. The situation in Australia with regard to this is evolving and continues to be closely monitored. A national working group was formed in 2014 under the auspices of CNDA to further assess the situation and ensure consistent collection of enhanced data. Lessons learned from the international experience will be important in informing the public health response.[196] ■

Tuberculosis

- There were 1,255 cases of TB notified in 2015.
- In 2015, the notification rate of TB has decreased slightly from 5.7 per 100,000 in 2014 to 5.3 per 100,000.

Tuberculosis (TB) is an infection caused by organisms of the *Mycobacterium tuberculosis* complex and consists of *M. tuberculosis*, *M. bovis*, *M. microti*, *M. canetti*, *M. africanum*. *M. tuberculosis* is the cause of almost all TB in Australia. TB is transmitted by airborne droplets produced by people with pulmonary or respiratory tract TB when coughing or sneezing. While most people infected with TB remain asymptomatic, there is a 10% lifetime risk of developing clinical illness, sometimes many years after the original infection. While Australia has one of the lowest rates of tuberculosis in the world, the disease remains a public health issue, particularly in Australia's overseas-born population and also Aboriginal and Torres Strait Islander people in the central and northern regions of Australia.[29,197]

Epidemiological situation in 2015

In 2015, a total of 1,255 cases of TB were notified to the NNDSS representing a rate of 5.3 per 100,000. This is a decrease on the rate of 5.7 per 100,000 (n=1,343) reported in 2014 and less than the preceding 5-year mean (2010 to 2014) of 5.9 per 100,000. Australia has achieved good TB control and has maintained overall low rates of TB since the mid 1980s (Figure 118).

Geographic distribution

New South Wales (n=445), Victoria (n=352), Queensland (n=183) and Western Australia (n=132) accounted for 89% of all cases of TB diagnosed in Australia (Table 4). The Northern Territory (11.0 per 100,000), Victoria (5.9 per 100,000) and New South Wales (5.8 per 100,000) all reported rates higher than the national notification rate (Table 5). In 2015, Queensland, South Australia and Tasmania reported notifica-

Figure 118: Notification rate for tuberculosis, Australia, 1960 to 2015, by year

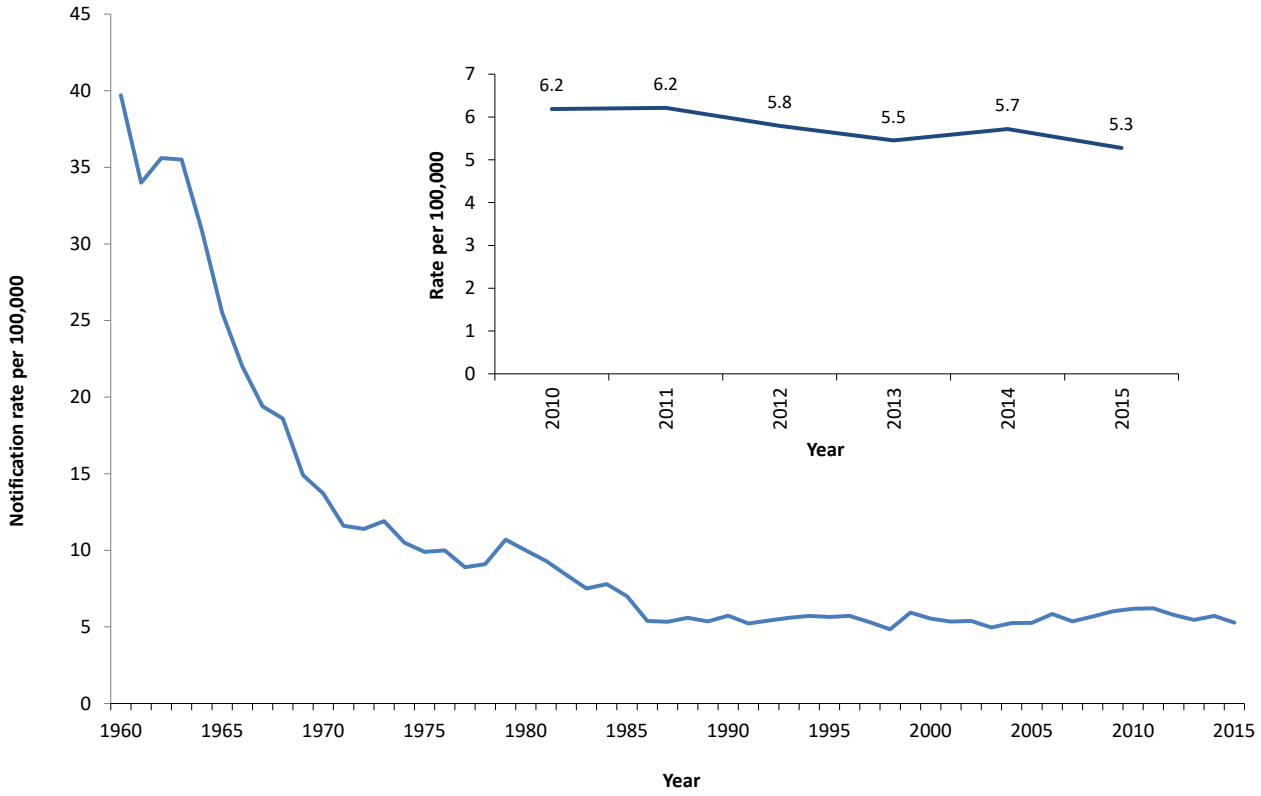
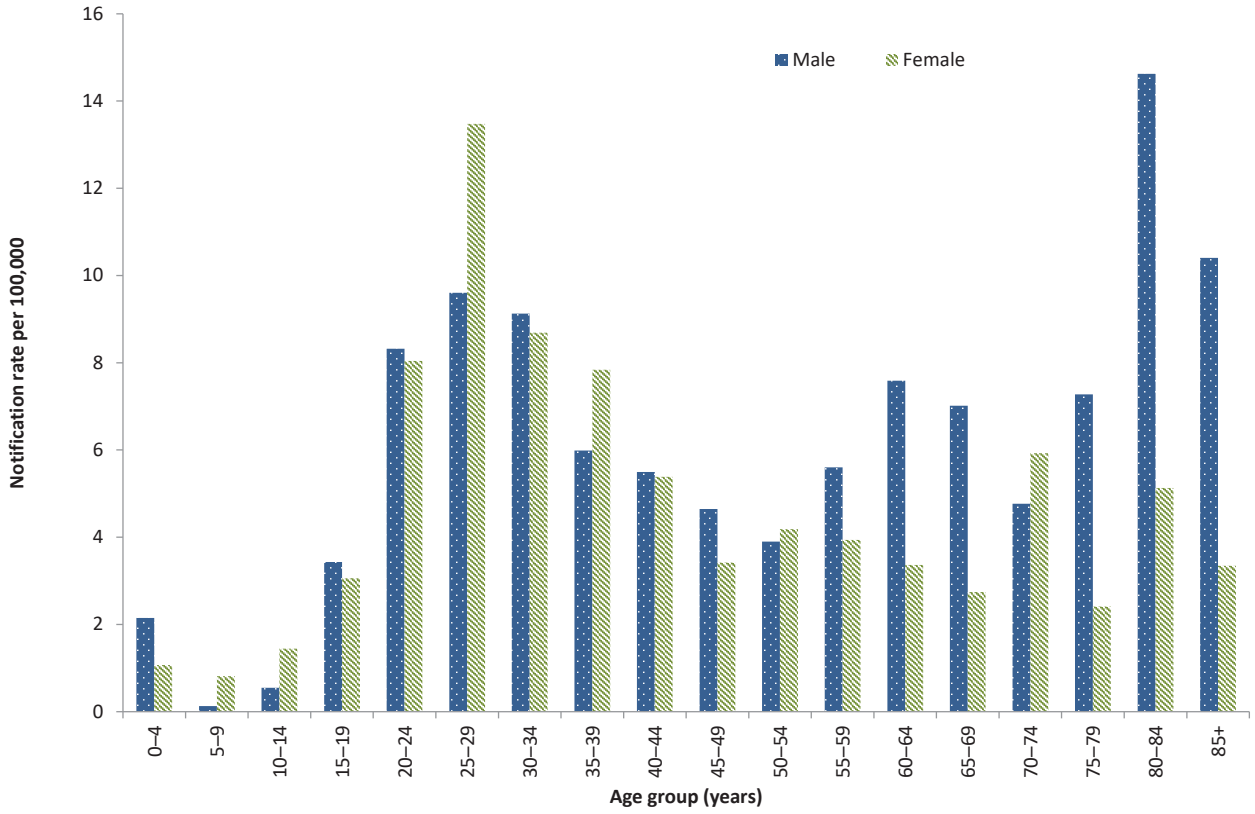


Figure 119: Notification rate for tuberculosis, Australia, 2015, by age group and sex



tion rates higher than the previous year. All the other states and territories reported a decrease compared to the previous year.

Age and sex distribution

Overall, the age groups with the highest notification rates were the 25–29 and 80–84 years age groups (11.5 and 9.3 per 100,000 respectively), followed by the 30–34 years age group (8.9 per 100,000). The highest age and sex specific rates were observed in men aged 80–84 years (14.6 per 100,000) and women aged 25–29 years (13.5 per 100,000) (Figure 119). Males accounted for 53% of the TB notifications in 2015.

Immunisation

The BCG vaccine was first introduced for protection against tuberculosis in the 1920s and, despite variable evidence on the efficacy of the vaccine, it remains the only vaccine in use for TB today.[198,199]

According to national guidelines developed by Australia's National Tuberculosis Advisory Committee,[29,200] BCG immunisation is recommended for Aboriginal and Torres Strait Islander neonates in communities with a high incidence of TB; neonates and children under 5 years of age who will be travelling to or living in countries or areas with a high incidence of TB for extended periods; and neonates born to parents with leprosy or a family history of leprosy. Additionally, BCG immunisation may be considered for: children over 5 years of age who will be travelling to or living in countries or areas with a high prevalence of TB for extended periods; and health care workers who may be at high risk of exposure to drug resistant TB.

BCG immunisation is not recommended for general use in the Australian population, given Australia's low incidence of TB. The vaccine is contraindicated in HIV-infected people.[200] Note that BCG immunisation practices may vary between states and territories due to differences in jurisdiction-specific TB immunisation policies and population demographics.

While public health follow-up is undertaken for all notifications of TB, completeness of the vaccine fields in the NNDSS dataset is poor.

Enhanced surveillance

Enhanced data are collected on all cases of TB. Further analyses, including identification of risk groups and reporting on treatment outcomes, can be found in the TB annual report series also published in the *Communicable Diseases Intelligence* journal.[201] ■

Appendices

APPENDIX 1

December estimate of Australian population, 2015, by state or territory

	State or Territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aus
Males	194,077	3,779,400	129,322	2,379,360	841,627	257,371	2,936,956	1,308,102	11,828,330
Females	196,953	3,840,042	115,180	2,401,339	857,393	259,316	3,003,986	1,282,459	11,957,793
Total	391,030	7,619,442	244,502	4,780,699	1,699,020	516,687	5,940,942	2,590,561	23,786,123

Source : ABS 3101.0 Table 4, Estimated Resident Population, State and Terrritories. Australian Demographic Statistics, Dec 2015

APPENDIX 2

December estimate of Australian population, 2015, by state or territory and age

Age Group	State or Territory								
	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Aus
00–04	27,264	491,896	18,993	318,348	101,429	30,671	378,393	173,484	1,540,640
05–09	24,653	483,082	17,974	321,128	100,789	32,283	366,598	168,816	1,515,475
10–14	21,761	452,508	16,976	304,754	96,808	31,236	340,632	155,420	1,420,278
15–19	23,064	469,102	16,013	309,376	104,353	33,481	360,611	160,298	1,476,479
20–24	31,105	520,623	18,880	338,352	114,411	31,748	425,632	180,100	1,661,035
25–29	33,911	546,832	23,429	342,749	115,974	29,196	457,136	211,152	1,760,725
30–34	33,305	554,453	22,335	337,881	113,912	29,539	453,247	206,140	1,751,262
35–39	28,605	503,974	18,713	310,169	103,435	28,666	402,439	179,767	1,576,031
40–44	28,505	524,984	18,146	337,703	111,818	33,252	415,774	184,376	1,654,809
45–49	25,622	487,882	16,468	316,520	113,515	34,025	395,199	174,935	1,564,379
50–54	24,531	500,043	15,387	313,866	115,537	36,905	382,808	168,441	1,557,738
55–59	22,157	470,527	13,528	287,685	110,636	36,956	355,501	153,851	1,451,023
60–64	19,008	418,101	10,874	255,757	100,668	34,158	314,370	133,516	1,286,654
65–69	16,732	377,248	7,567	231,503	92,738	31,329	282,072	114,273	1,153,581
70–74	11,367	285,810	4,542	171,481	68,901	23,402	210,489	81,928	857,984
75–79	8,069	213,899	2,432	119,930	52,419	16,795	160,413	60,335	634,332
80–84	5,538	154,412	1,310	81,456	38,524	11,722	116,835	41,841	451,655
85+	5,833	164,066	935	82,041	43,153	11,323	122,793	41,888	472,043
Total	391,030	7,619,442	244,502	4,780,699	1,699,020	516,687	5,940,942	2,590,561	23,786,123

Source : ABS 3101.0 Australian Demographic Statistics Tables, Dec 2015.

APPENDIX 3

Indigenous status, National Notifiable Diseases Surveillance System, Australia, 2015, by notifiable disease*

Disease name	Aboriginal but not Torres Strait Islander origin	Torres Strait Islander but not Aboriginal origin	Aboriginal and Torres Strait Islander origin	Not Indigenous	Not stated	Blank/ missing	Total	% complete	Number complete	Number incomplete
Barmah Forest virus infection	7	0	2	156	321	142	628	26	165	463
Botulism	0	0	0	3	0	0	3	100	3	0
Brucellosis	1	0	0	17	1	0	19	95	18	1
Campylobacteriosis	342	20	31	10,599	11,163	418	22,573	49	10,992	11,581
Chikungunya virus infection	1	0	0	82	24	3	110	76	83	27
Chlamydial infection	5,315	815	360	25,557	18,229	21,987	72,263	44	32,047	40,216
Cholera	0	0	0	2	0	0	2	100	2	0
Cryptosporidiosis	174	1	10	2,012	1,512	355	4,064	54	2,197	1,867
Dengue virus infection	12	1	3	1,437	209	52	1,714	85	1,453	261
Diphtheria	0	1	0	1	0	0	2	100	2	0
Flavivirus infection (unspecified)	0	0	0	9	3	0	12	75	9	3
Gonococcal infection	3,126	266	114	8,324	4,161	2,559	18,550	64	11,830	6,720
Haemolytic uraemic syndrome (HUS)	0	0	0	16	2	0	18	89	16	2
Haemophilus influenzae type b	3	0	0	13	0	0	16	100	16	0
Hepatitis A	1	2	1	169	4	1	178	97	173	5
Hepatitis B (newly acquired)	13	1	1	115	9	1	140	93	130	10
Hepatitis B (unspecified)	171	33	3	2,077	2,027	2,054	6,365	36	2,284	4,081
Hepatitis C (newly acquired)	128	0	0	283	22	0	433	95	411	22
Hepatitis C (unspecified)	760	20	24	3,131	3,365	3,060	10,360	38	3,935	6,425
Hepatitis D	0	0	0	30	7	2	39	77	30	9
Hepatitis E	1	0	0	38	2	0	41	95	39	2
Influenza (laboratory confirmed)	1,601	101	74	34,165	35,508	29,134	100,583	36	35,941	64,642
Japanese encephalitis virus infection	0	0	0	3	0	0	3	100	3	0
Legionellosis	14	0	0	335	11	5	365	96	349	16

Disease name	Aboriginal but not Torres Strait Islander origin	Torres Strait Islander but not Aboriginal origin	Aboriginal and Torres Strait Islander origin	Not Indigenous	Not stated	Blank/ missing	Total	% complete	Number complete	Number incomplete
Leprosy	0	0	0	13	0	0	13	100	13	0
Leptospirosis	3	0	0	55	16	0	74	78	58	16
Listeriosis	2	0	0	62	6	0	70	91	64	6
Malaria	1	0	1	199	26	6	233	86	201	32
Measles	2	0	0	72	0	0	74	100	74	0
Meningococcal disease (invasive)	14	1	2	162	3	0	182	98	179	3
Mumps	404	0	0	205	26	9	644	95	609	35
Murray Valley encephalitis virus infection	2	0	0	0	0	0	2	100	2	0
Ornithosis	0	0	0	15	1	0	16	94	15	1
Paratyphoid	1	0	0	72	2	1	76	96	73	3
Pertussis	296	8	32	11,556	4,703	5,951	22,546	53	11,892	10,654
Pneumococcal disease (invasive)	196	4	8	1,132	159	0	1,499	89	1,340	159
Q fever	32	0	2	492	59	16	601	88	526	75
Ross River virus infection	138	14	11	2,717	5,229	1,441	9,550	30	2,880	6,670
Rubella	0	0	0	15	1	1	17	88	15	2
Rubella congenital	0	0	0	1	0	0	1	100	1	0
STEC	1	0	0	118	16	2	137	87	119	18
Salmonellosis	497	38	22	8,267	4,917	3,272	17,013	52	8,824	8,189
Shigellosis	201	2	11	695	112	17	1,038	88	909	129
Syphilis < 2 years	405	16	12	2,025	239	16	2,713	91	2,458	255
Syphilis > 2 years or unspecified duration	231	21	5	1,100	516	66	1,939	70	1,357	582
Syphilis congenital	0	0	2	1	0	0	3	100	3	0
Tetanus	0	0	0	2	0	0	2	100	2	0
Tuberculosis	27	7	0	1,212	9	0	1,255	99	1,246	9
Typhoid Fever	1	1	1	108	4	0	115	97	111	4
Varicella zoster (chickenpox)	80	3	4	2,238	133	21	2,479	94	2,325	154
Varicella zoster (shingles)	143	5	1	5,541	565	88	6,343	90	5,690	653

Disease name	Aboriginal but not Torres Strait Islander origin	Torres Strait Islander but not Aboriginal origin	Aboriginal and Torres Strait Islander origin	Not Indigenous	Not stated	Blank/ missing	Total	% complete	Number complete	Number incomplete
Varicella zoster (unspecified)	146	16	14	2,712	10,159	316	13,363	22	2,888	10,475
West Nile / Kunjin virus infection	0	0	0	1	0	0	1	100	1	0
Grand total	**14,493**	**1,397**	**751**	**129,361**	**103,481**	**70,996**	**320,479**	**46**	**146,002**	**174,477**

* Indigenous status is usually obtained from medical notification and completeness varies by disease and by state and territory. This reflects differences in notification requirements (i.e. depending on the jurisdiction, some diseases are primarily or completely notified by pathology laboratories rather than clinicians) and the fact that it is not possible to follow-up all cases for diseases with a large volume of notifications and/or not requiring specific case-based public health action.

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Abbreviations

Abbreviation	Definition
7vPCV	7 valent pneumococcal conjugate vaccine
13vPCV	13 valent pneumococcal conjugate vaccine
23vPPV	23 valent pneumococcal polysaccharide vaccine
ABLV	Australian bat lyssavirus
AFP	acute flaccid paralysis
AGSP	Australian Gonococcal Surveillance Programme
AIDS	acquired immune deficiency syndrome
AMSP	Australian Meningococcal Surveillance Programme
ANCJDR	Australian National Creutzfeldt-Jakob Disease Registry
BCG	bacille Calmette-Guérin
BFV	Barmah Forest virus
CDI	Communicable Diseases Intelligence
CDNA	Communicable Diseases Network Australia
CDWG	Case Definitions Working Group
CHIKV	Chikungunya Virus
CIDT	culture-independent diagnostic testing
CJD	Creutzfeldt-Jakob disease
CRS	congenital rubella syndrome
DAFF	Queensland Department of Agriculture, Fisheries and Forestry
DENV	dengue virus
Hib	*Haemophilus influenzae* type b
HIV	human immunodeficiency virus
HPAIH	highly pathogenic avian influenza in humans
HUS	haemolytic uraemic syndrome
ICU	intensive care unit
ILI	influenza like illness
IMD	invasive meningococcal disease
IPD	invasive pneumococcal disease
JEV	Japanese encephalitis virus

Abbreviation	Definition
KUNV	Kunjin virus
MMR	measles-mumps-rubella
MSM	men who have sex with men
MVEV	Murray Valley encephalitis virus
NAMAC	National Arbovirus and Malaria Advisory Committee
NEC	not elsewhere classified
NFD	Not further defined
NIA	neuraminidase inhibition assay
NIP	National Immunisation Program
NN	not notifiable
NNDSS	National Notifiable Diseases Surveillance System
NQFMP	National Q fever Management Program
NSC	National Surveillance Committee
NS1	non-structural protein 1
PCR	polymerase chain reaction
QIV	quadirivalent influenza vaccine
RRV	Ross River virus
SACC	Standard Australian Classification of Countries
SARS	severe acute respiratory syndrome
STEC	Shiga toxin-producing *Escherichia coli*
STI(s)	sexually transmissible infections(s)
TB	tuberculosis
TIV	trivalent influenza vaccine
tOPV	trivalent oral polio vaccine
VPD(s)	vaccine preventable disease(s)
VZV	varicella zoster virus
WNV	West Nile virus
WHO	World Health Organization
WHOCC	World Health Organization Collaborating Centre for Reference and Research on Influenza
ZIKV	Zika virus

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