Government of **Western Australia**
Department of **Health**

Review of Notifiable Infectious Diseases in Western Australia

2010-2019

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Acknowledgments

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Disclaimer

Every endeavour has been made to ensure that the information provided in this document was accurate at the time of writing. However, infectious disease notification data are continuously updated and subject to change.

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Abbreviations

APSGN	acute post-streptococcal glomerulonephritis
ASR	age-standardised rate(s)
BCG	bacille Calmette-Guérin
BFV	Barmah Forest virus
CCC	childcare centre
CDCD	Communicable Disease Control Directorate
CDNA	Communicable Diseases Network Australia
CJD	Creutzfeldt-Jakob disease
DENV	dengue virus
ESF	enhanced surveillance forms
HIV	human immunodeficiency virus infection
HUS	haemolytic uraemic syndrome
IMD	invasive meningococcal disease
IPD	invasive pneumococcal disease
JEV	Japanese encephalitis virus
MERS	Middle East respiratory syndrome
MMR	measles-mumps-rubella
MMRV	measles-mumps-rubella-varicella
MSM	men who have sex with men
MVE	Murray valley encephalitis
NID	notifiable infectious diseases
NIP	national immunisation program
ODOO	optimal date of onset
PCR	polymerase chain reaction
PCV	pneumococcal conjugate vaccine
PHU	population health unit
RCF	residential care facility
RRV	Ross River virus
STEC	shiga toxin-producing *E. coli*
STI	sexually transmissible infection
TB	tuberculosis
VBD	vector-borne disease
VPD	vaccine preventable disease
VZV	varicella zoster virus
WA	Western Australia
WANIDD	Western Australian notifiable infectious diseases database

Executive Summary

This report provides an insight into 10 years of trends of notifiable infectious diseases and conditions (NIDs) (as specified in the *Public Health Act, 2016*) reported to the Western Australian (WA) Department of Health from 2010 to 2019.

Notifiable infectious diseases and conditions (NIDs) contribute to a large burden of illness in the WA community. There are 75 NIDs in WA, of which 58 were notified during the 2010 to 2019 period. Diseases that were newly notifiable in this period included Middle East respiratory syndrome (MERS) coronavirus", acute post-streptococcal glomerulonephritis (APSGN) and amoebic meningitis. The remaining 17 NIDs are rarely reported due to very low levels of transmission in WA and/or most other countries. The Communicable Disease Control Directorate (CDCD) and Population Health Units (PHUs) within the Health Service Providers, with assistance from other agencies, conduct surveillance of NIDs in WA, and investigate notifications and outbreaks to prevent further transmission through targeted disease control interventions.

From 2010 to 2019, there was a general trend of increasing numbers and rates of notifications. Notifications increased from 24,889 in 2010 (rate 1,045 cases per 100,000 population) to 54,802 notifications in 2019 (rate 2,100 cases per 100,000 population). This increase is in part likely due to changes in laboratory testing practices.

Of the total NID notifications for the 2010 to 2019 period:

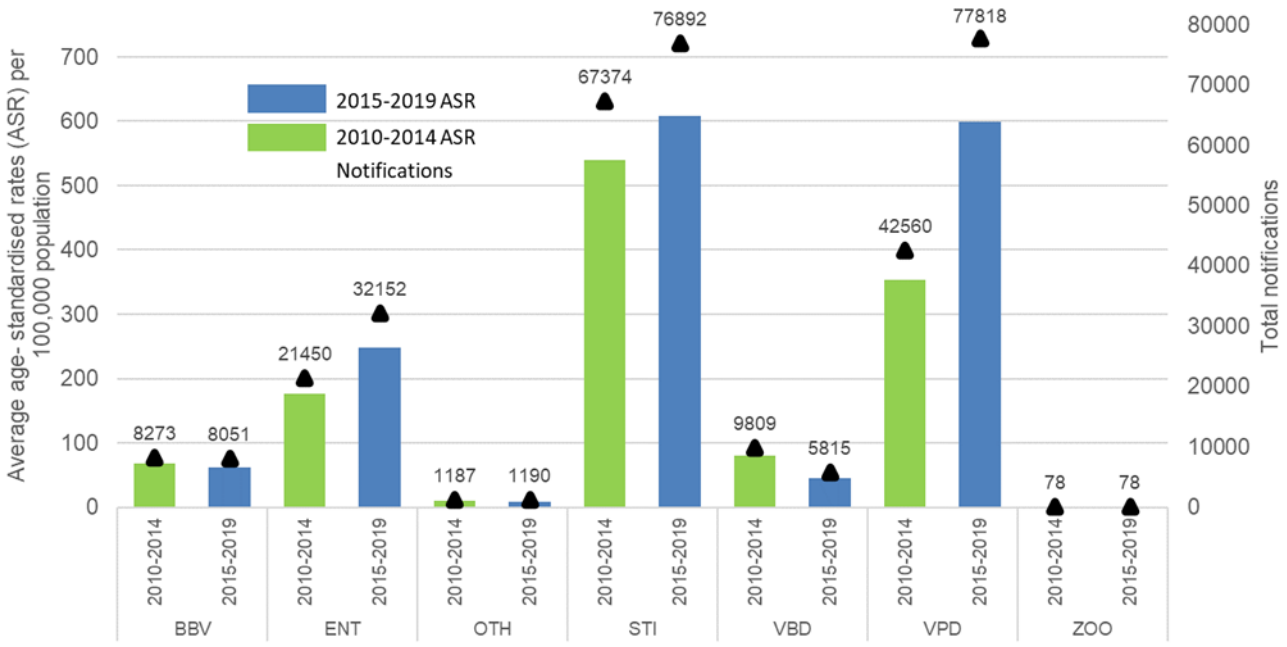
- The highest disease rates were seen in the 15 to 24 year old age group, with rates of 2,632 to 3,296 cases per 100,000 population.
- The notification rate was 10% higher in females compared to males.
- The rate of disease for Aboriginal people was 3.0-fold higher than for non-Aboriginal people, with a range of 2.9 to 3.2-fold.
- The Kimberley region had the highest notification rate at 4,914 cases per 100,000 population, and the Wheatbelt region had the lowest rate at 1,071 cases per 100,000 population.
- For notifications with a known place of acquisition, 87.2% acquired their infection in WA, 11.5% were acquired overseas and 1.3% were acquired interstate.

The NIDs with the highest number of notifications from 2010 to 2019 included:

- Chlamydial infections, which comprised of 21% to 42% of total notifications per year, with the highest notification rates of all NIDs, ranging from 419 to 482 cases per 100,000 population.
- Influenza infections, which had the second highest notification rate with 262 cases per 100,000 population. This was driven by the higher influenza season in 2019, during which 23,195 cases were notified compared to the previous five-year average of 6,170 cases.
- The diseases with the next highest rates were campylobacteriosis with 110 cases per 100,000 population, and gonococcal infections with 104 cases per 100,000 population.

When comparing the five-year periods of 2010 - 2014 and 2015 - 2019, most NIDs (32/58) had rate increases between the two periods.

- Shiga-toxin producing *E. coli* (STEC) had the highest rate increase (18.3-fold increase), attributed to the introduction of polymerase chain reaction (PCR) tests which are more sensitive in detecting STEC.
- Mumps had a 9-fold increase due to an outbreak, mainly in regional WA in 2015 and 2016.
- Infectious syphilis had a 3.6-fold increase as a result of an outbreak, mainly affecting Aboriginal people and starting in the Kimberley region in 2014, followed by increases in the Pilbara region from 2018. Large increases in cases were also reported in the metropolitan region among men who have sex with men (MSM).
- Salmonellosis increased by 57%, mainly due to increases in *Salmonella* Typhimurium infections and outbreaks linked to consumption of contaminated raw/undercooked egg dishes.
- A 57% increase in gonococcal infection notifications were observed, likely due to increased transmission. The main risk populations were Aboriginal people, with a 14.9-fold higher rate that non-Aboriginal people, and MSM, who comprised 20% of notifications.
- An increase in invasive meningococcal disease notifications was also observed with the emergence of *Neisseria meningitidis* strain W125 in 2017 with a rate of 1.7 cases per 100,000 population, compared to the previous five-year average of 0.7 cases per 100,000 population. This increase led to a targeted campaign to vaccinate at-risk groups with a MenACWY vaccine.
- A 2.3-fold increase in gastroenteritis outbreaks, with the number of food-borne outbreaks investigated increasing from 59 to 138 outbreaks between the two five-year periods.



Note: Numbers in figure are total notifications. BBV: blood-borne viruses. ENT: Enteric diseases. Other: Other diseases. STI: sexually transmissible infections. VBD: Vector-borne diseases. VPD: Vaccine preventable diseases. ZOO: zoonotic diseases.

Figure: Number and age-specific notification rates (per 100,000 population) of notifiable infectious disease categories in Western Australia, by 5 year periods (2010-2014 and 2015–2019)

Introduction

This report provides an overview of all notifiable infectious diseases and conditions (NIDs) reported to the Communicable Disease Control Directorate (CDCD), Department of Health between 2010 and 2019 in Western Australia (WA). The communicable disease notification system supports disease surveillance in the population, which enables the management and control of these diseases and helps to inform, evaluate and improve public health policies and programs.

In WA, the notification of specified NIDs and related conditions is mandated under the *Public Health Act, 2016* and the *Public Health Regulations, 2017*. The Act provides the legal framework for the establishment of the list of diseases deemed to be notifiable, the associated case definitions and the notification type (Notification of infectious diseases and related conditions (health.wa.gov.au) required for each condition. In accordance with the Act, it is mandatory for medical and nurse practitioners and pathology laboratories to notify cases of specified infectious diseases to the Chief Health Officer.

Information relating to all notified diseases, with the exception of human immunodeficiency virus (HIV), is stored on the Western Australian Notifiable Infectious Diseases Database (WANIDD). WANIDD is an intranet-based real-time application and database that stores information on person(s) with notifiable infectious diseases from 1990 onwards. Data-cleaning procedures initiated by CDCD, in cooperation with the responsible PHUs, are conducted regularly to validate as well as maintain the quality and integrity of the data. HIV notifications are stored in the WA HIV Notifications Database.

At the end of 2019, there were 75 infectious diseases or conditions that are required to be notified in WA, which are grouped into major disease categories (Table 1). The majority of the notifiable diseases are nationally notifiable and have standardised national surveillance case definitions, as endorsed by the Communicable Diseases Network Australia (CDNA). A subset of notifiable diseases in WA, such as melioidosis and *Vibrio parahaemolyticus* infection, are not nationally notifiable, primarily because they have public health significance in select jurisdictions, rather than in all jurisdictions. Refer to the full list of current notifiable diseases in WA and their case definitions, along with details of the notifications process.

Table 1. Diseases and related conditions notifiable in Western Australia by the major disease categories and gazettal date

Disease Category	Disease/Conditions	Gazettal Date*
Blood-borne Viruses	Hepatitis B (Newly acquired and unspecified)	19/01/1951
	Hepatitis C (Newly acquired and unspecified)	12/02/1993
	Hepatitis D	01/01/2001
Enteric Diseases	Botulism (foodborne)	01/01/2001
	Campylobacteriosis	24/05/1985
	Cholera	PHA

Disease Category	Disease/Conditions	Gazettal Date*
	Cryptosporidiosis	01/01/2001
	Hepatitis A	22/08/1958
	Hepatitis E	01/01/2001
	Listeriosis	17/12/1990
	Paratyphoid fever	PHA
	Rotavirus	26/07/2006
	Salmonellosis	19/01/1951
	Shiga toxin-producing *E. coli* (STEC) infection	01/01/2001
	Shigellosis	PHA
	Typhoid fever	PHA
	Vibrio parahaemolyticus infection	24/05/1985
	Yersiniosis (other than plague)	24/05/1985
Sexually Transmissible Infections	Chancroid	PHA
	Chlamydial infection	12/02/1993
	Donovanosis	PHA
	Gonococcal infection	PHA
	HIV	09/09/1983
	Syphilis (congenital)	PHA
	Syphilis (Infectious)	PHA
	Syphilis (non-infectious)	PHA
Vector-borne Diseases	Barmah Forest virus infection	24/06/1994
	Chikungunya virus infection	14/05/2008
	Dengue virus infection	24/06/1994
	Japanese encephalitis virus infection	21/09/2017
	Kokabera virus infection	21/09/2017
	Malaria	PHA
	Murray Valley encephalitis virus infection	21/09/2017
	Other flavivirus infection	21/09/2017
	Plague	PHA
	Ross River virus infection	24/05/1985
	Typhus	PHA
	West Nile virus / Kunjin virus infection	21/09/2017
	Yellow fever	PHA
	Zika virus infection	21/09/2017
Vaccine-preventable Diseases	Diphtheria	PHA
	Haemophilus influenzae type b (invasive)	15/03/1991
	Influenza	01/01/2001
	Measles	29/08/1986
	Mumps	12/02/1993
	Pertussis	24/05/1985
	Invasive pneumococcal disease	01/01/2001
	Poliovirus infection	PHA
	Rubella (non-congenital)	12/02/1993
	Rubella (congenital)	24/05/1985

Disease Category	Disease/Conditions	Gazettal Date*
	Smallpox	16/01/2004
	Tetanus	05/09/1947
	Varicella zoster virus (chickenpox)	28/07/2006
	Varicella zoster virus (shingles)	28/07/2006
	Varicella zoster virus (unspecified)	28/07/2006
Zoonotic Diseases	Anthrax	PHA
	Brucellosis	19/01/1951
	Hendra virus infection	21/09/2017
	Leptospirosis	19/01/1951
	Lyssavirus infection (Australian Bat Lyssavirus, rabies, other)	01/01/2001
	Psittacosis	19/01/1951
	Q fever	24/05/1985
	Tularaemia	16/01/2004
Other Diseases	Acute post-streptococcal glomerulonephritis (APSGN)	21/09/2017
	Amoebic meningitis	21/09/2017
	Creutzfeldt-Jakob disease	16/01/2004
	Haemolytic uraemic syndrome	21/04/1995
	Legionellosis	24/05/1985
	Leprosy	PHA
	Melioidosis	01/01/2001
	Invasive meningococcal disease	19/01/1995
	Severe acute respiratory syndrome (SARS)	24/04/2003
	Middle East respiratory syndrome (MERS) coronavirus	02/07/2014
	Tuberculosis	PHA
	Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	12/02/1993

*PHA: *Public Health Act, 2016*

Methods

Data on notifiable diseases for the ten-year period from 2010 to 2019 were extracted from WANIDD and the WA HIV Notifications database on 26 March 2021. In this report, HIV data have been included in the sexually transmissible infections section, as HIV is predominantly acquired through sexual contact in WA.

Data extraction and cleaning

In this report, all analysis of data for long-term and/or chronic infections such as non-infectious syphilis, HIV, unspecified hepatitis B infection, unspecified hepatitis C infection, Creutzfeldt-Jakob disease, leprosy and tuberculosis was exported from WANIDD using the date of receipt of notification, i.e. the date on which the notification was first received by CDCD. Data for all other notifiable diseases were exported using optimal date of onset (ODOO) in WANIDD. The ODOO

is a composite of the ‘true’ date of onset provided by the notifying doctor, the date of specimen collection for laboratory notified cases, and when neither of these dates are available, the date of notification by the doctor or laboratory, or the date of receipt of the notification, whichever is earliest is used.

Because of differences in inclusion criteria or different dates of export, during which time the notification data could have been revised, notification numbers in this report may vary slightly from the numbers reported in quarterly and annual reports published by the CDCD; these minor changes to the data will not substantially affect the overall trends and patterns.

For the purposes of this report, only those notifications with a WA residential address were included in the analyses. Notifications from Immigration Detention Centres located at Christmas Island, Curtin, Leonora, Perth and Yongah Hill were also excluded from analyses because of potential bias introduced through the inclusion of cases detected by screening of asylum seekers at these locations.

Aboriginal status

As of June 2019, 3.9% of the WA population identified as Aboriginal and/or Torres Strait Islander based on the 2016 Australian Bureau of Statistics Census data. For the purposes of this report, the term Aboriginal is used in preference to Aboriginal and Torres Strait Islander to recognise that Aboriginal people are the original inhabitants of WA. Due to the relatively small size of the Aboriginal population in WA, especially in remote regions of the state, inaccuracies in the population estimates for Aboriginal people can have a disproportionate impact on calculated rates. In the preparation of this report, these factors are acknowledged as limitations.

Information on Aboriginal status is missing for some notifications. In this report, records with missing Aboriginal status were excluded from analyses by Aboriginal status.

Regional boundaries

WA is divided into ten health administrative regions (Figure 1). Three of the regions are in the Perth metropolitan area (North, South and East) and the seven regional areas are Goldfields-Esperance (Goldfields), Great Southern, Kimberley, Midwest-Gascoyne (Midwest), Pilbara, South West and Wheatbelt. Within each region, there is a PHU that is responsible for public health activities, which include follow-up of notifiable infectious disease cases. In addition, the CDCD in Perth is responsible for providing public health and epidemiological advice to PHUs and for the follow-up of specified notifiable diseases.

Where numbers permitted, notification data were analysed by PHU regions. For this report, the three metropolitan regions have been combined into one metropolitan Perth region. The residential postcode of the case at the time of disease notification was used to identify the region. It should be noted that the residential postcode does not represent the place where the disease was acquired.

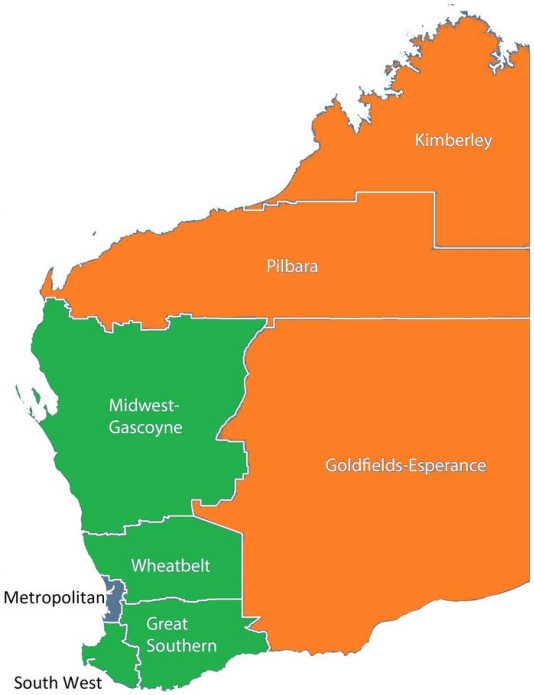


Figure 1. Public Health administrative regions in Western Australia (Orange regions: remote regional. Green regions: non-remote regional areas. Purple region: metropolitan Perth)

Calculation of notification rates

The population denominators for WA used in this report were sourced from the Rates Calculator version 9.5.5 (Epidemiology Branch, WA Department of Health). The Rates Calculator is an internal Department of Health population calculator that generates population estimates based on 2016 Australian Bureau of Statistics Census data. Rates Calculator provides yearly population estimates by age, sex, Aboriginal status and region of residence in WA.

Direct age-standardisation was utilised to control differences in the size and age structure of the Aboriginal and non-Aboriginal populations in the various regions of WA. The age population structure used for standardisation was based on the Australian estimated resident population from the 2001 census. Age-standardised rates (ASR) are expressed per 100,000 population. Age-specific notification rates, based on five-year age groups, were calculated by dividing the number of notifications in a particular age group by the population in the corresponding age group. Age-specific notification rates are also expressed per 100,000 population. It should be noted that small numbers of notifications can give unstable and imprecise notification rates.

Overview of notifications during the 10-year period: 2010 to 2019

A total of 358,247 notifications were recorded by the Department of Health between 2010 and 2019. Since 2010, there was a gradual increase in the total number of notifications each year, reaching a peak of 39,240 notifications in 2016 (58% increase compared to 2010 notifications) followed by a 7% decrease to 36,648 notifications in 2018 (Figure 2 and Table 2). A subsequent 48% rise in notifications occurred in 2019 (n=54,802) compared to 2018, largely driven by record-high seasonal influenza activity in WA.

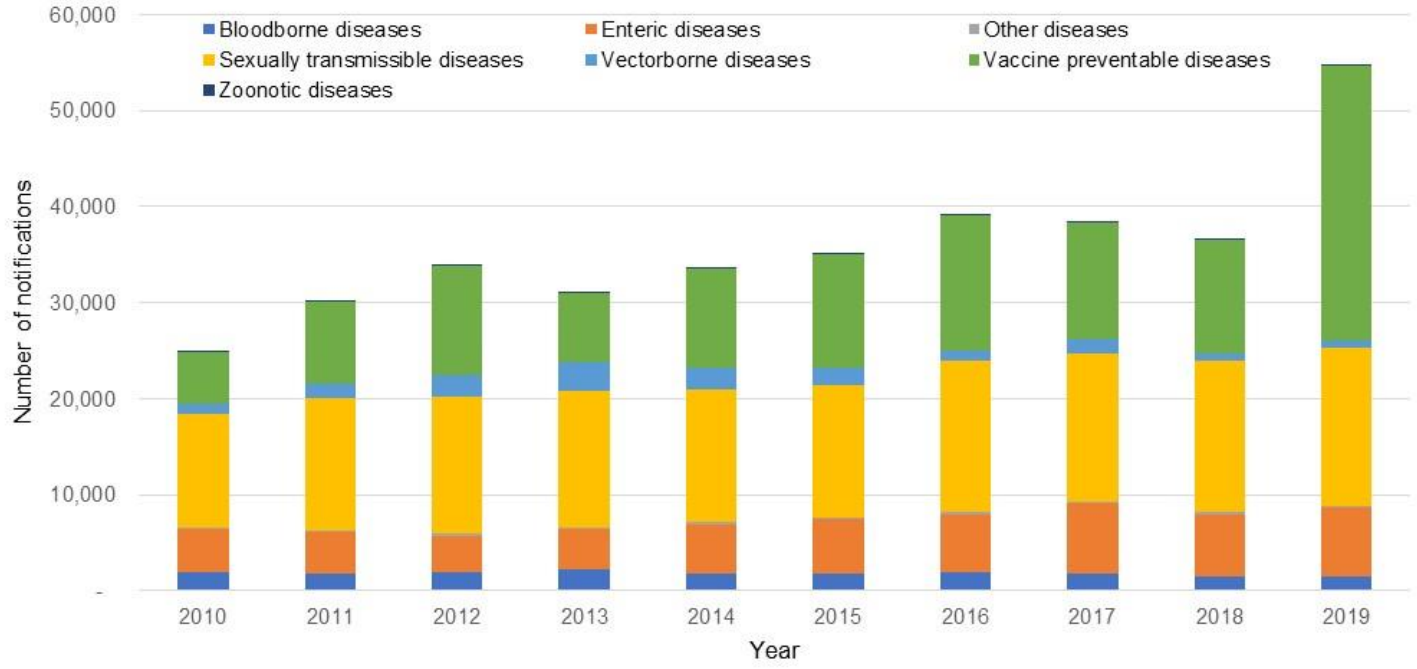


Figure 2. Trends in notifications, by disease category and year, in Western Australia, 2010-2019

Over the ten-year period (2010 to 2019), the most commonly notified disease categories were sexually transmissible infections (n=145,681, 41% of all notifications), vaccine preventable diseases (n=121,675, 34% of all notifications) and enteric diseases (54,451, 15% of all notifications). This rank order was maintained in all years except in 2019, when vaccine preventable diseases was the most commonly notified disease category due to the large number of influenza notifications (Table 2).

Table 2. Number and proportion of disease notifications in the Western Australian Notifiable Infectious Diseases Database, by disease category, in Western Australia, 2010–2019

Disease Category	2010 N=24,889		2011 N=30,233		2012 N=33,944		2013 N=31,104		2014 N=33,715		2015 N=35,211		2016 N=39,240		2017 N=38,461		2018 N=36,648		2019 N=54,802		2010–2019 N=358,247	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Blood-borne Viruses	1,836	7.4	1,726	5.7	1,967	5.8	2,259	7.3	1,795	5.3	1,721	4.9	1,906	4.9	1,743	4.5	1,527	4.2	1,463	2.7	**17,943**	**5**
Enteric Diseases	4,576	18.4	4,322	14.3	3,742	11	4,082	13.1	5,123	15.2	5,684	16.1	6,049	15.4	7,303	19	6,418	17.5	7,152	13.1	**54,451**	**15.2**
Sexually Tansmissible Infections	11,879	47.7	13,911	46	14,322	42.2	14,201	45.7	13,912	41.3	13,924	39.5	15,757	40.2	15,489	40.3	15,755	43	16,531	30.2	**145,681**	**40.7**
Vaccine-preventable Diseases	5,331	21.4	8,576	28.4	11,406	33.6	7,244	23.3	10,403	30.9	11,964	34	14,071	35.9	12,181	31.7	11,918	32.5	28,581	52.2	**121,675**	**34**
Vector-borne Diseases	1,055	4.2	1,444	4.8	2,207	6.5	3,033	9.8	2,179	6.5	1,664	4.7	1,181	3	1,487	3.9	751	2	834	1.5	**15,835**	**4.4**
Zoonotic Diseases	16	0.1	19	0.1	20	0.1	12	0	11	0	14	0	20	0.1	15	0	19	0.1	13	0	**159**	**0**
Other Diseases	196	0.8	235	0.8	280	0.8	273	0.9	292	0.9	240	0.7	256	0.7	243	0.6	260	0.7	228	0.4	**2,503**	**0.7**

The total number of notifications between 2010 and 2019 for each disease in the different disease categories is reported in Table 3. Of the 358,247 notifications, 1.6% (n=5,520) were excluded from all analyses as they were non-WA residents (Table 3).

Table 3. Number of notifications on Western Australian Notifiable Infectious Diseases database, by disease and Western Australian residency status, 2010–2019

Disease Category/Disease	WA residents	Overseas/Interstate residents	Total
	N=352,727	N=5,520	N=358,247
BLOOD-BORNE VIRUSES (BBV)			
Hepatitis B			
Newly Acquired	258	1	259
Unspecified	5,281	1,051	6,332
Hepatitis C			
Newly Acquired	1,278	2	1,280
Unspecified	9,475	564	10,039
Hepatitis D	32	1	33
TOTAL BBV	**16,324**	**1,619**	**17,943**
ENTERIC DISEASES			
Botulism	1	0	1
Campylobacteriosis	27,828	377	28,205
Cholera	2	1	3
Cryptosporidiosis	2,664	20	2,684
Hepatitis A	178	6	184
Hepatitis E	26	1	27
Listeriosis	64	0	64
Paratyphoid fever	88	8	96
Rotavirus	4,034	50	4,084
Salmonellosis	16,582	321	16,903
Shiga toxin-producing *E. coli* (STEC) infection	354	4	358
Shigellosis	1,398	37	1,435
Typhoid fever	123	19	142
Vibrio parahaemolyticus infection	148	5	153
Yersiniosis (other than plague)	112	0	112
TOTAL Enteric Diseases	**53,602**	**849**	**54,451**
SEXUALLY TRANSMISSIBLE INFECTIONS (STI)			
Chlamydial infection	114,200	870	115,070
Donovanosis	2	0	2
Gonococcal infection	25,750	315	26,065
HIV	914	0	914

Disease Category/Disease	WA residents	Overseas/Interstate residents	Total
	N=352,727	N=5,520	N=358,247
Syphilis			
Infectious	2,262	32	2,294
Non-Infectious	1,133	198	1,331
Congenital	5	0	5
TOTAL STI	**144,266**	**1,415**	**145,681**
VACCINE PREVENTABLE DISEASES (VPD)			
Diphtheria	1	0	1
Haemophilus influenzae type b (invasive)	11	0	11
Influenza	65,141	752	65,893
Measles	210	10	220
Mumps	1,120	9	1,129
Pertussis	18,984	65	19,049
Invasive pneumococcal disease	2,086	25	2,111
Poliovirus infection	0	0	0
Rubella	29	1	30
Smallpox	0	0	0
Tetanus	6	0	6
Varicella zoster infection			
Chicken pox	5,029	66	5,095
Shingles	14,972	213	15,185
Unspecified	12,789	156	12,945
TOTAL VPD	**120,378**	**1,297**	**121,675**
VECTOR-BORNE DISEASES (VBD)			
Barmah Forest virus infection	1,674	9	1,683
Chikungunya virus infection	146	1	147
Dengue virus infection	3,970	108	4,078
Japanese encephalitis virus infection	2	0	2
Kokabera virus infection	0	0	0
Malaria	544	26	570
Murray Valley encephalitis virus infection	10	0	10
Other flavivirus infection	0	0	0
Plague	0	0	0
Ross River virus infection	9,004	65	9,069
Typhus	251	1	252
West Nile virus / Kunjin virus infection	4	1	5
Yellow fever	0	0	0
Zika virus infection	19	0	19
TOTAL VBD	**15,624**	**211**	**15,835**

Disease Category/Disease	WA residents	Overseas/Interstate residents	Total
	N=352,727	N=5,520	N=358,247
ZOONOTIC DISEASES			
Anthrax	0	0	0
Brucellosis	4	1	5
Hendra virus infection	0	0	0
Leptospirosis	33	1	34
Lyssavirus infection (ABL, rabies, other)	0	0	0
Psittacosis	28	0	28
Q fever	91	1	92
Tularaemia	0	0	0
TOTAL Zoonotic Diseases	**156**	**3**	**159**
OTHER DISEASES			
Acute post-streptococcal glomerulonephritis (APSGN)	39	0	39
Amoebic meningitis	0	0	0
Creutzfeldt-Jakob disease	54	0	54
Haemolytic uraemic syndrome	10	0	10
Legionellosis	680	17	697
Leprosy	27	0	27
Melioidosis	49	5	54
Invasive meningococcal disease	240	9	249
Middle East respiratory syndrome (MERS) coronavirus	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0
Tuberculosis	1,278	95	1,373
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0
TOTAL Other Diseases	**2,377**	**126**	**2,503**

Hereafter, all numbers and rates reported are based only on the analysis of 352,727 notifications from WA residents. The number of notifications and ASR per 100,000 population for each disease, by year, in WA are shown in Table 4 and Table 5, respectively. The number of notifications and ASR per 100,000 population for each disease, by year and sex, in WA are shown in Appendix 1. The number of notifications and ASR per 100,000 population for each disease, by year and Aboriginal status, in WA are shown in Appendix 2. The number of notifications and ASR per 100,000 population for each disease, by year, in the different regions of WA are shown in Appendix 3.

Table 4. Number of notifications, by disease and year, in WA, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
	N=24,267	N=29,656	N=33,056	N=29,864	N=33,128	N=34,609	N=38,616	N=37,825	N=36,157	N=54,112	N=352,727
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	604	551	579	584	588	544	645	513	486	445	5,539
Newly Acquired	32	18	25	39	24	29	25	18	25	23	258
Unspecified	572	533	554	545	564	515	620	495	461	422	5,281
Hepatitis C *(Total)*	1,045	1,065	1,049	1,081	1,116	1,083	1,186	1,156	991	981	10,753
Newly Acquired	76	117	128	123	161	182	120	127	125	119	1,278
Unspecified	969	948	921	958	955	901	1,066	1,029	866	862	9,475
Hepatitis D	0	2	2	4	3	0	1	2	8	10	32
ENTERIC DISEASES											
Botulism	0	0	0	0	0	1	0	0	0	0	1
Campylobacteriosis	2,313	2,166	1,881	1,917	2,944	2,880	3,388	3,371	3,442	3,526	27,828
Cholera	0	1	0	0	0	0	0	1	0	0	2
Cryptosporidiosis	137	451	167	370	308	255	244	400	121	211	2,664
Hepatitis A	32	11	14	14	19	25	16	12	12	23	178
Hepatitis E	3	4	1	3	0	2	3	4	2	4	26
Listeriosis	3	7	8	8	5	6	6	6	8	7	64
Paratyphoid fever	9	9	8	8	9	11	12	4	9	9	88
Rotavirus	617	186	347	344	410	596	179	519	297	539	4,034
Salmonellosis	1,254	1,301	1,152	1,251	1,244	1,693	1,941	2,564	2,044	2,138	16,582
Shiga toxin-producing *E. coli* (STEC) infection	8	3	1	4	2	0	33	60	93	150	354
Shigellosis	113	83	48	50	66	97	92	198	263	388	1,398
Typhoid fever	9	13	12	8	11	8	9	21	13	19	123
Vibrio parahaemolyticus infection	10	13	14	15	15	7	24	20	14	16	148
Yersiniosis (other than plague)	3	1	3	5	4	31	15	15	11	24	112

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
	N=24,267	N=29,656	N=33,056	N=29,864	N=33,128	N=34,609	N=38,616	N=37,825	N=36,157	N=54,112	N=352,727
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	10,148	11,669	11,766	11,723	11,330	11,164	11,807	11,494	11,519	11,580	114,200
Donovanosis	0	0	1	0	1	0	0	0	0	0	2
Gonococcal infection	1,376	1,809	2,084	1,947	2,188	2,307	3,361	3,335	3,416	3,927	25,750
HIV	88	85	104	85	109	108	95	79	58	103	914
Syphilis											
Infectious	79	119	78	86	93	162	336	320	424	565	2,262
Non-Infectious	61	93	108	79	62	68	59	160	217	226	1,133
Congenital	1	0	0	2	0	0	0	0	1	1	5
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	1	0	0	1
Haemophilus influenzae type b (invasive)	2	1	1	0	1	2	1	0	1	2	11
Influenza	1,616	1,863	5,229	2,389	5,238	5,974	7,813	5,989	5,835	23,195	65,141
Measles	11	16	6	11	43	7	11	17	36	52	210
Mumps	14	13	19	43	23	454	481	23	18	32	1,120
Pertussis	1,453	4,017	3,373	1,639	1,747	1,866	1,521	1,507	1,311	550	18,984
Invasive pneumococcal disease	196	241	236	192	205	166	200	197	206	247	2,086
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	3	15	2	1	1	2	1	2	1	1	29
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	1	1	1	1	0	1	0	1	0	6
Varicella zoster infection											
Chicken pox	402	437	333	347	426	487	615	691	667	624	5,029
Shingles	724	909	1,055	1,266	1,380	1,460	1,730	2,000	2,217	2,231	14,972

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
	N=24,267	N=29,656	N=33,056	N=29,864	N=33,128	N=34,609	N=38,616	N=37,825	N=36,157	N=54,112	N=352,727
Unspecified	854	995	1,072	1,260	1,236	1,400	1,515	1,558	1,512	1,387	12,789
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	74	150	215	1,025	54	46	13	47	36	14	1,674
Chikungunya virus infection	10	4	4	54	25	11	15	11	3	9	146
Dengue virus infection	494	317	520	471	446	541	552	172	132	325	3,970
Japanese encephalitis virus infection	0	0	0	1	0	0	0	0	1	0	2
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	53	60	47	75	44	48	55	57	46	59	544
Murray Valley encephalitis virus infection	0	9	0	0	0	0	0	0	1	0	10
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	388	850	1,373	1,363	1,568	953	476	1,156	494	383	9,004
Typhus	13	37	32	20	13	31	39	19	18	29	251
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	4	0	0	4
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	2	15	1	1	0	19
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	1	1	0	0	0	2	0	0	0	4
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	5	2	4	0	3	1	6	3	5	4	33
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
	N=24,267	N=29,656	N=33,056	N=29,864	N=33,128	N=34,609	N=38,616	N=37,825	N=36,157	N=54,112	N=352,727
Psittacosis	3	7	8	4	2	1	0	3	0	0	28
Q fever	8	9	7	8	6	12	12	9	13	7	91
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5	24	10	39
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	5	7	1	2	5	4	6	6	7	11	54
Haemolytic uraemic syndrome	0	0	0	0	1	1	3	3	1	1	10
Legionellosis	54	75	85	93	114	72	69	38	43	37	680
Leprosy	2	2	0	3	5	2	7	3	1	2	27
Melioidosis	4	4	3	8	6	6	3	7	5	3	49
Invasive meningococcal disease	22	21	18	15	17	17	21	45	40	24	240
Middle East respiratory syndrome (MERS) coronavirus	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	102	112	143	122	136	120	140	132	135	136	1,278
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: False positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 5. ASR (per 100,000 population), by disease and year, in WA 2010–2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
BLOOD-BORNE VIRUSES											
(Total)	26.3	23.1	23.5	22.8	22.8	20.7	24.0	18.7	17.3	15.4	22.1
Newly Acquired	1.4	0.8	1.0	1.5	0.9	1.1	0.9	0.7	0.9	0.8	1.0
Unspecified	25.0	22.3	22.5	21.2	21.9	19.6	23.1	18.0	16.4	14.6	21.1
Hepatitis C *(Total)*	45.5	44.8	42.4	42.4	42.9	41.3	44.1	42.2	35.7	34.6	42.9
Newly Acquired	3.2	4.8	5.0	4.7	6.1	6.9	4.4	4.6	4.5	4.2	5.1
Unspecified	42.2	40.0	37.4	37.7	36.7	34.4	39.6	37.6	31.2	30.3	37.8
Hepatitis D	0.0	0.1	0.1	0.2	0.1	0.0	0.0	0.1	0.3	0.4	0.1
ENTERIC DISEASES											
Botulism	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Campylobacteriosis	100.5	91.1	76.8	76.3	115.4	112.1	131.2	129.2	131.5	133.3	110.3
Cholera	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cryptosporidiosis	5.9	19.4	6.9	14.9	12.2	10.1	9.5	15.7	4.7	8.2	10.7
Hepatitis A	1.4	0.5	0.6	0.6	0.8	1.0	0.6	0.5	0.5	0.9	0.7
Hepatitis E	0.1	0.2	0.0	0.1	0.0	0.1	0.1	0.2	0.1	0.1	0.1
Listeriosis	0.1	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.2
Paratyphoid fever	0.4	0.4	0.3	0.3	0.3	0.4	0.5	0.2	0.3	0.4	0.4
Rotavirus	26.9	7.9	14.2	13.7	16.0	22.9	6.9	19.9	11.4	20.3	16.0
Salmonellosis	54.4	55.0	47.2	49.8	48.8	65.9	75.4	99.3	78.3	81.8	66.1
Shiga toxin-producing *E. coli* (STEC) infection	0.3	0.1	0.0	0.2	0.1	0.0	1.3	2.3	3.6	5.6	1.4
Shigellosis	4.9	3.5	2.0	2.0	2.6	3.8	3.5	7.7	10.2	14.8	5.6
Typhoid fever	0.4	0.6	0.5	0.3	0.4	0.3	0.3	0.8	0.5	0.8	0.5
Vibrio parahaemolyticus infection	0.4	0.5	0.6	0.6	0.6	0.3	1.0	0.7	0.5	0.6	0.6
Yersiniosis (other than plague)	0.1	0.0	0.1	0.2	0.2	1.2	0.6	0.6	0.4	0.9	0.4

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlamydial infection	429.3	481.6	467.5	453.0	434.9	428.6	439.0	425.6	423.1	418.7	459.7
Donovanosis	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonococcal infection	59.3	75.8	84.4	76.8	84.5	88.4	125.2	123.2	123.8	139.6	104.0
HIV	3.8	3.6	4.2	3.4	4.2	4.3	3.7	3.0	2.2	3.9	3.6
Syphilis											
Infectious	3.4	5.0	3.1	3.3	3.6	6.2	12.6	11.8	15.4	20.2	9.1
Non-Infectious	2.6	3.9	4.3	3.0	2.3	2.6	2.2	5.8	7.7	7.7	4.5
Congenital	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
VACCINE PREVENTABLE DISEASES											
Diphtheria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Haemophilus influenzae type b (invasive)	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.0
Influenza	71.0	79.5	218.2	96.2	208.1	236.0	305.4	229.2	223.9	890.4	262.0
Measles	0.5	0.7	0.3	0.5	1.8	0.3	0.4	0.7	1.4	2.1	0.9
Mumps	0.6	0.6	0.8	1.7	0.9	18.6	19.8	0.9	0.8	1.3	4.7
Pertussis	64.4	176.4	141.4	66.7	69.9	73.9	60.8	59.8	50.7	21.1	77.2
Invasive pneumococcal disease	8.5	10.2	9.8	7.7	8.0	6.3	7.6	7.3	7.6	9.1	8.2
Poliovirus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rubella	0.1	0.6	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1
Smallpox	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tetanus	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Varicella zoster infection											
Chicken pox	18.4	19.6	14.5	14.6	17.8	20.0	25.2	27.9	27.0	25.0	21.1
Shingles	31.4	38.3	43.2	50.5	54.0	56.1	65.7	74.7	81.4	81.0	58.3

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
Unspecified	37.1	42.1	44.2	50.4	48.6	54.2	58.0	58.7	55.6	51.0	50.3
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	3.2	6.2	8.8	41.0	2.1	1.8	0.5	1.8	1.4	0.5	6.7
Chikungunya virus infection	0.5	0.2	0.2	2.2	0.9	0.4	0.6	0.4	0.1	0.3	0.6
Dengue virus infection	21.2	13.2	21.0	18.7	17.5	21.0	21.4	6.6	5.0	12.2	15.7
Japanese encephalitis virus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kokabera virus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Malaria	2.3	2.5	1.9	3.0	1.7	1.9	2.2	2.2	1.7	2.3	2.2
Murray Valley encephalitis virus infection	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other flavivirus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plague	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ross River virus infection	16.7	35.8	56.0	54.2	61.7	37.3	18.4	44.3	18.7	14.2	35.7
Typhus	0.6	1.5	1.3	0.8	0.5	1.2	1.5	0.7	0.7	1.1	1.0
West Nile virus / Kunjin virus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Yellow fever	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zika virus infection	0.0	0.0	0.0	0.0	0.0	0.1	0.6	0.0	0.0	0.0	0.1
ZOONOTIC DISEASES											
Anthrax	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Brucellosis	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Hendra virus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Leptospirosis	0.2	0.1	0.2	0.0	0.1	0.0	0.2	0.1	0.2	0.1	0.1
Lyssavirus infection (ABL, rabies, other)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Psittacosis	0.1	0.3	0.3	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.1

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
Q fever	0.4	0.4	0.3	0.3	0.2	0.5	0.5	0.3	0.5	0.3	0.4
Tularaemia	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.2	1.0	0.4	0.2
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0
Creutzfeldt-Jakob disease	0.2	0.3	0.0	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.2
Haemolytic uraemic syndrome	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Legionellosis	2.3	3.1	3.5	3.7	4.4	2.7	2.5	1.4	1.5	1.3	2.6
Leprosy	0.1	0.1	0.0	0.1	0.2	0.1	0.3	0.1	0.0	0.1	0.1
Melioidosis	0.2	0.1	0.1	0.3	0.2	0.2	0.1	0.3	0.2	0.1	0.2
Invasive meningococcal disease	1.0	0.9	0.7	0.6	0.7	0.7	0.9	1.7	1.6	0.9	1.0
Middle East respiratory syndrome (MERS) coronavirus	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Severe acute respiratory syndrome (SARS)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tuberculosis	4.5	4.8	5.8	4.9	5.4	4.6	5.5	5.1	5.2	5.1	5.1
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

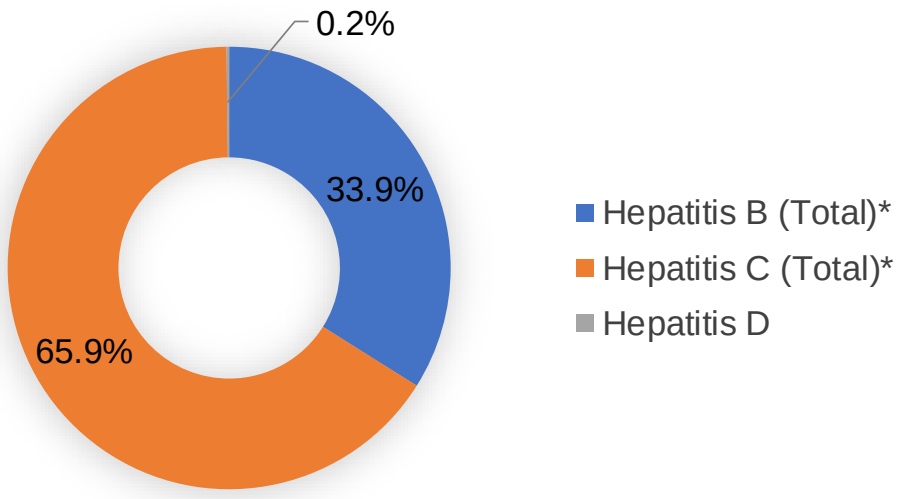
*Note: False positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Blood-borne Viruses

A blood-borne virus (BBV) is one in which the pathogen is transmitted through blood or body fluids that contain blood from a person who is infected with the virus, into the bloodstream of another person via a break in the skin or mucous membrane. Notifiable BBVs in WA include hepatitis B, hepatitis C and hepatitis D infections (Table 1).

Between 2010 and 2019, there were a total of 16,324 notifications among WA residents (Table 3), reflecting a mean annual ASR of 64.9 per 100,000 population over the ten-year period. There were 1,436 blood-borne disease notifications in WA in 2019, representing a 3% decrease from 2018 (n= 1,485) and a 14% decrease in comparison to the 2014 to 2018 five-year average of 1,664.4 notifications per year (Table 4 and Table 5).

Over the ten-year period (2010-2019), the most frequently notified BBV was hepatitis C (66%; n=10,753) followed by hepatitis B (34%; n=5,539) and hepatitis D (<1%; n=32); Figure 3. Between 2010 and 2019, the mean annual ASR for BBV among Aboriginal people was 5.4-fold higher than non-Aboriginal people (280.7 versus 52.3 per 100,000 population, respectively). The region with the highest mean annual ASR was the Great Southern region with 95.8 notifications per 100,000 population.



*Total includes newly acquired and unspecified infections

Figure 3. Proportion of notified cases of blood-borne viruses in WA, 2010- 2019

Hepatitis B

Hepatitis B virus is spread between people by body fluids and affects the liver. Most adults recover completely from the infection, but it can be potentially fatal. However, some people will eradicate the virus from their body and go on to develop a chronic infection. People with chronic hepatitis B infection often do not feel sick, but can develop serious liver diseases, including liver failure and liver cancer, 20 or more years after first becoming infected. There is a safe and effective vaccine

against hepatitis B, and while treatment is available to manage chronic hepatitis B infection it will not cure the disease.

Over the ten-year period (2010 to 2019), there was a total of 5,539 hepatitis B notifications in WA, equating to a mean annual ASR of 22.1 per 100,000 population (Table 4 and Table 5). In WA, notifications for hepatitis B are classified into 'newly acquired' (evidence of infection having been acquired in the 24 months prior to diagnosis) and 'unspecified' (infections of unknown duration).

Newly acquired hepatitis B

Temporal Trends

Between 2010 and 2019, newly acquired hepatitis B notifications represented 5% (n=258) of total hepatitis B notifications. The notification rate fluctuated during this period but there was an overall decrease of 43% from 2010 to 2019 (1.4 to 0.8 per 100,000 population); (Figure 4). The number of notifications was highest in 2013 (n=39).

Sex and Age

Overall, the mean annual ASR was 3.5 fold higher among males than in females (1.6 versus 0.5 per 100,000 population, respectively) (Appendix 1). Over the ten-year period, 28% of newly acquired hepatitis B notifications occurred in people aged 50 years or older (n=72/258) and the highest notification rate occurred in those aged 40 to 44 years (2.1 per 100,000 population) (Figure 5).

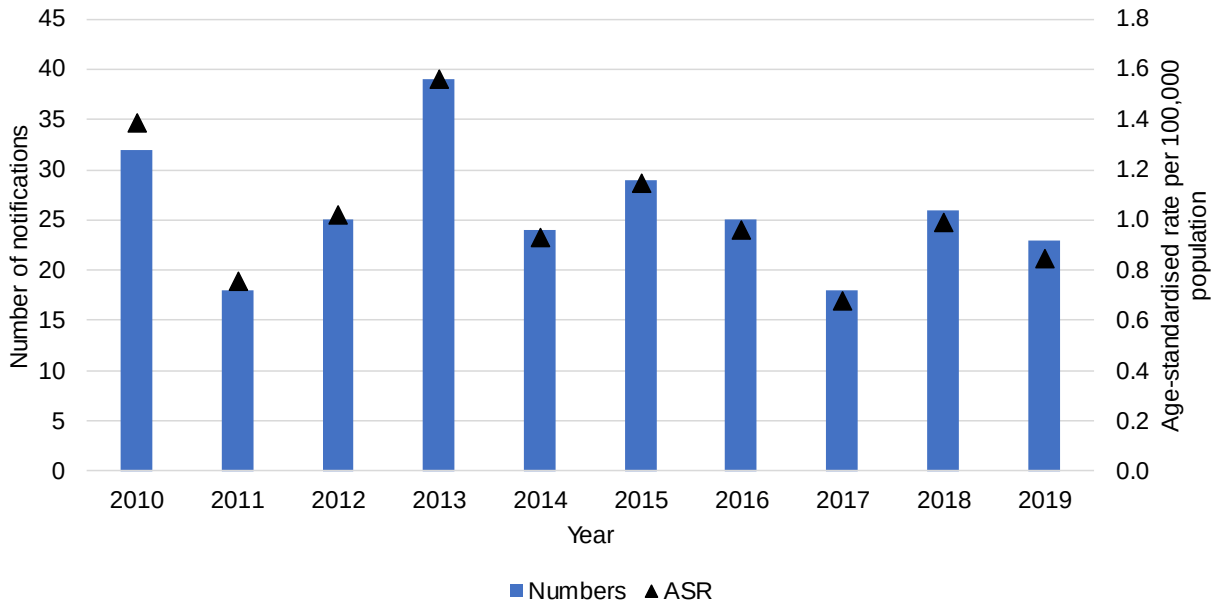


Figure 4. Number and ASR (per 100,000 population) for newly acquired hepatitis B notifications, by year, in WA, 2010–2019

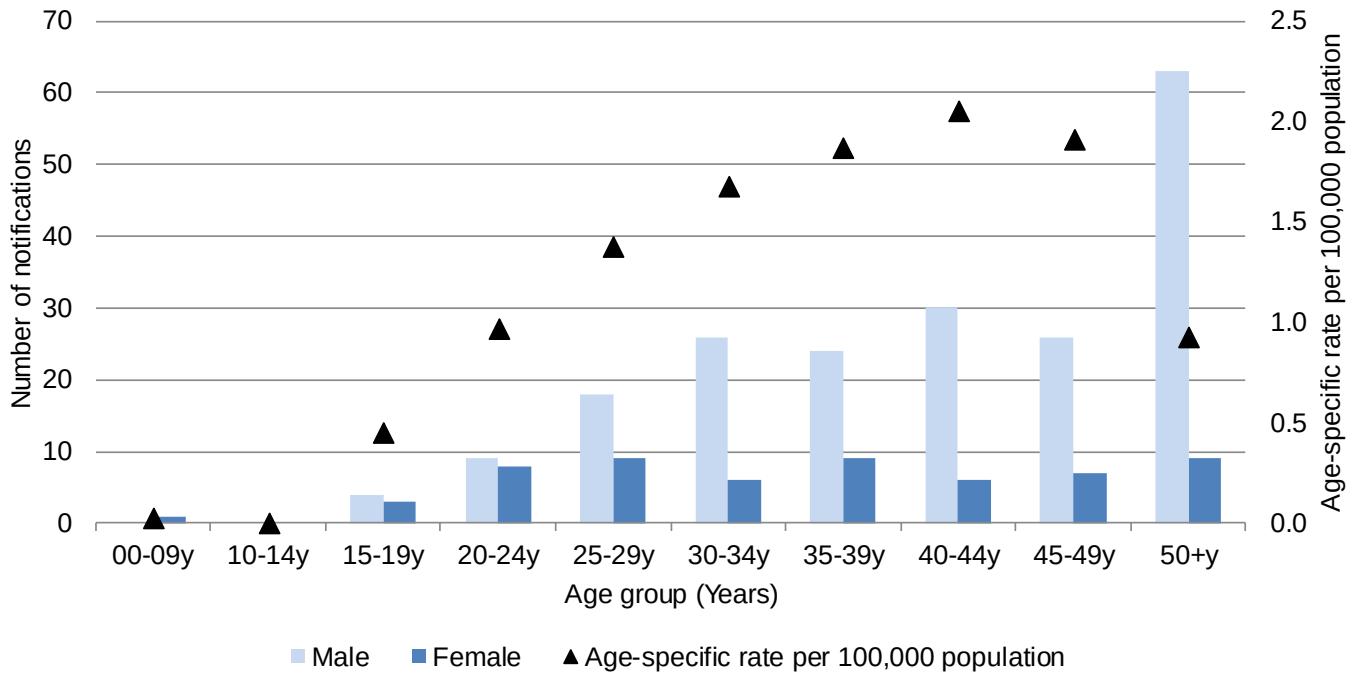


Figure 5. Number and age-specific rates (per 100,000 population) for newly acquired hepatitis B notifications, by sex and age group, in WA, 2010–2019

Aboriginal Status

Between 2010 and 2019, the overall mean annual ASR was 2.2-fold higher in the Aboriginal population compared to the non-Aboriginal population (2.2 versus 1.0 per 100,000 population) (Appendix 2). The disparity between the Aboriginal and non-Aboriginal population varied each year and in 2019, the Aboriginal to non-Aboriginal rate ratio was 9.8:1 (

Figure *6*).

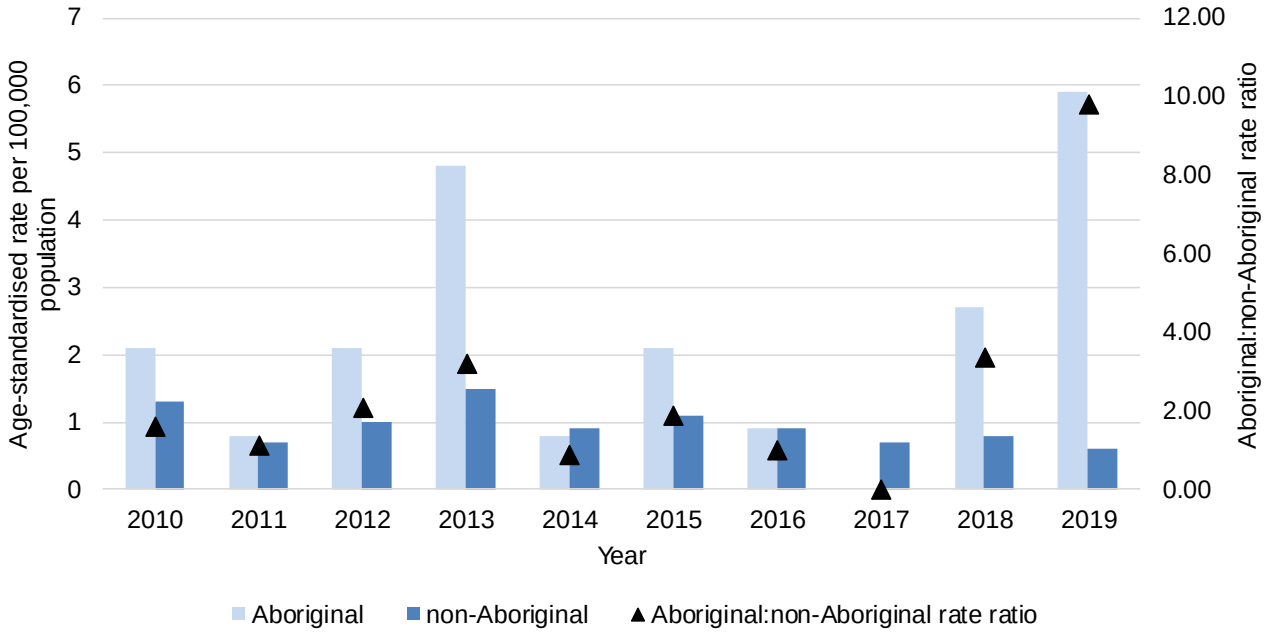


Figure 6. ASR (per 100,000 population) by Aboriginal status and the Aboriginal to non-Aboriginal rate ratio for newly acquired hepatitis B notifications in WA, 2010-2019

Region

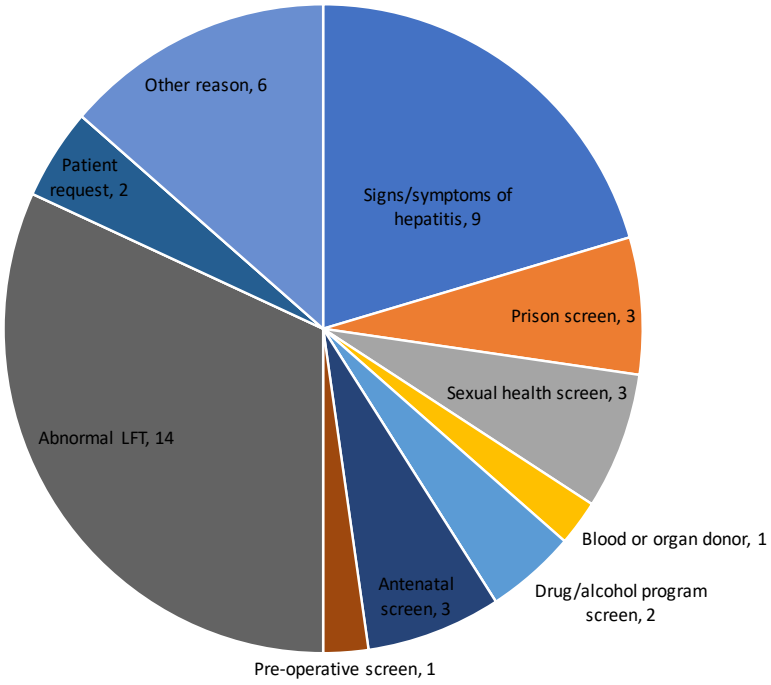
Over the ten-year period, the highest number of newly acquired hepatitis B notifications were reported from the Perth metropolitan region (n=215/258, 83%). Trends in the newly acquired hepatitis B notification rate varied between regions and the small number of notifications in most non-metropolitan regions makes it difficult to interpret any changes in rate (Appendix 3).

Place of Acquisition

Of the 212 (82%) newly acquired hepatitis B notifications over the ten-year period that had place of acquisition recorded, 71% were reported as having been acquired in WA. This trend was comparable in males and females, although a larger proportion of males (30%) acquired their infection overseas than females (14%). For the majority of the overseas acquired cases, the source of infection was reported as being South-East Asia.

Newly Acquired Hepatitis B Enhanced Surveillance

Enhanced surveillance of hepatitis B began in 2012 with forms sent to the diagnosing doctors of all newly acquired hepatitis B cases in WA. Between 2012 and 2019, forms were completed for 16% (n=34/208) of notifications: 18% (n=3/17) of Aboriginal notifications, and 16% (n=31/191) of non-Aboriginal notifications. Overall, having symptoms of hepatitis or abnormal liver function test results were the most common reasons for hepatitis B virus testing (Figure 7).



*LFT = liver function tests

Figure 7. Reason for hepatitis B testing in WA, 2010–2019

The majority of cases reported no history of injecting drug use (62%), while 24% reported injecting drug use in the previous two years. Unprotected casual sex with a person of the opposite sex was reported among 32% of cases (Figure 8). Thirty-eight per cent of cases were born in Australia and acquired the infection in Australia.

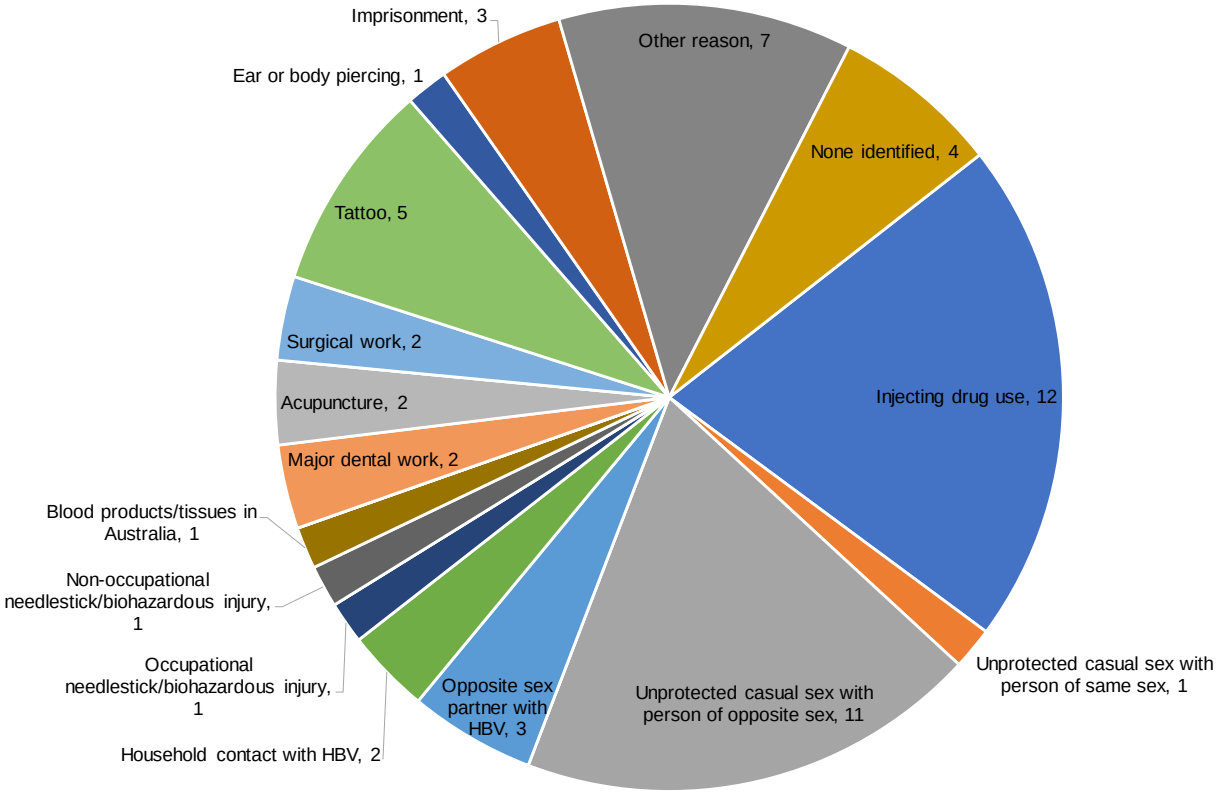


Figure 8. Risk factors for hepatitis B in WA, 2010–2019

Unspecified hepatitis B

Temporal Trends

Between 2010 and 2019, unspecified hepatitis B notifications represented 95% (n=5,281) of total hepatitis B notifications, equating to a mean annual ASR of 21.1 per 100,000 population (Table 4 and Table 5). The number of notifications reached a peak in 2016 (n=620); and subsequently decreased in the following years with 422 notifications in 2019. The notification rate decreased by 42% from 2010 to 2019 (25.0 to 14.6 per 100,000 population) (Figure 9).

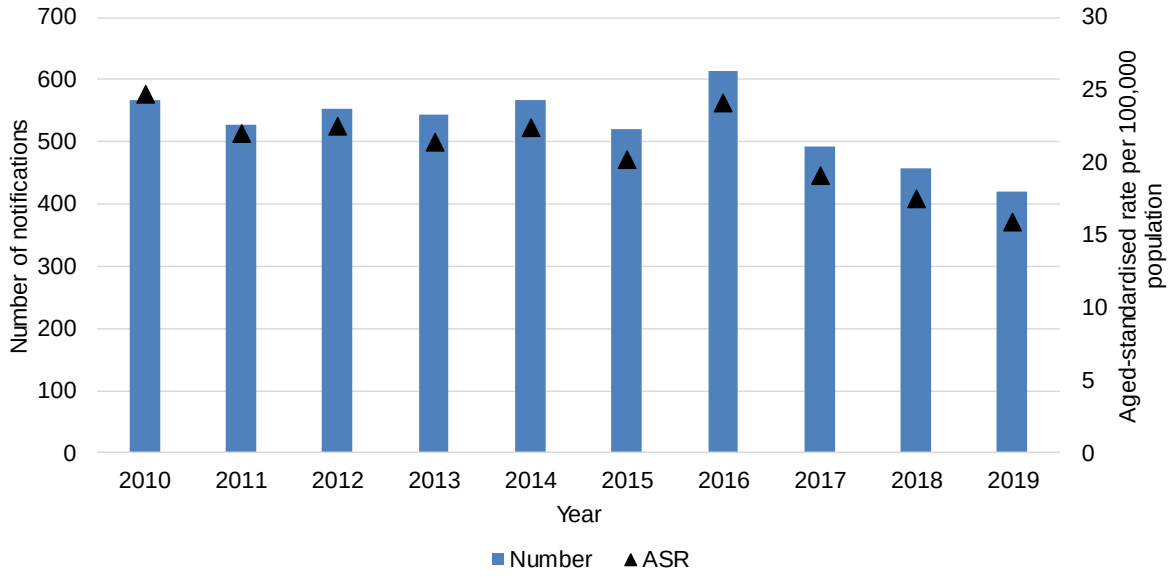


Figure 9. Number and ASR (per 100,000 population) for unspecified hepatitis B notifications, by year, in WA, 2010–2019

Sex and Age

Overall, the mean annual ASR was slightly higher among males than females: 21.9 versus 20.3 per 100,000 population (Appendix 1). Over the ten-year period, 21% of unspecified hepatitis B notifications occurred in people aged 50 years or older (n=1,132/5,281) and the highest notification rate occurred in those aged 30 to 34 years (52.2 per 100,000 population) (Figure 10).

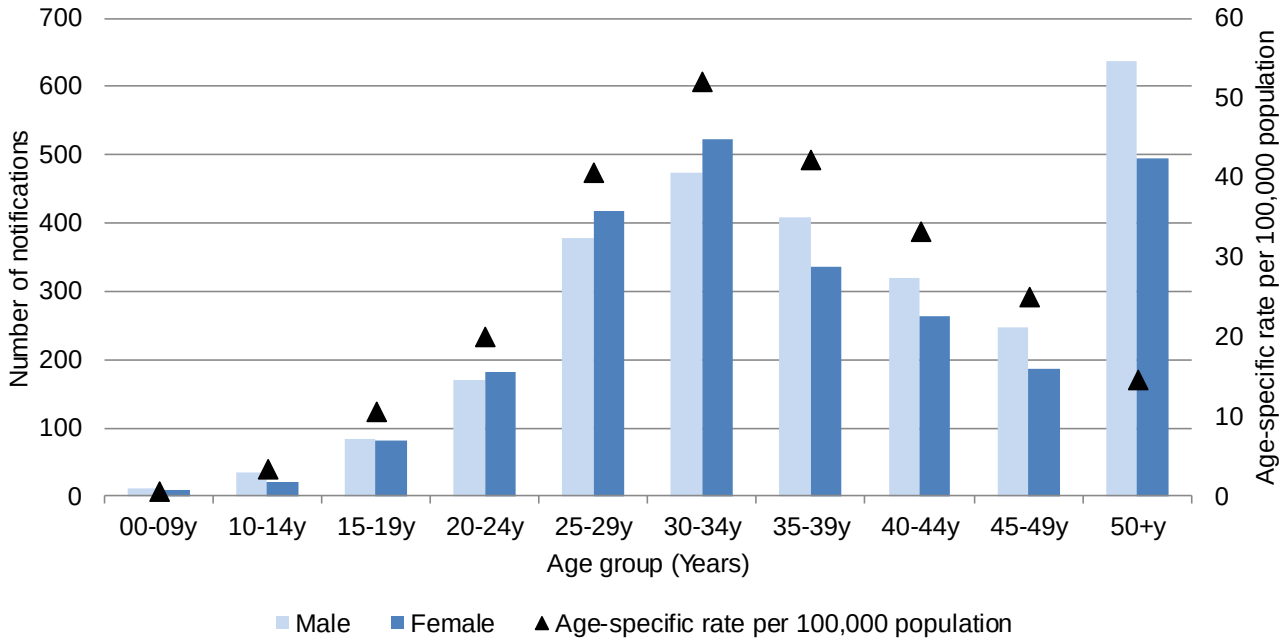


Figure 10. Number and age-specific rates (per 100,000 population) for unspecified hepatitis B notifications, by sex and age group, in WA, 2010–2019

Aboriginal Status

Between 2010 and 2019, 5% of unspecified hepatitis B notifications were reported in Aboriginal people, 84% in non-Aboriginal people, while 10% of notifications were of unknown Aboriginal status. The overall mean annual ASR was 2.5 fold higher in the Aboriginal population compared to the non-Aboriginal population (43.8 versus 17.7 per 100,000 population) (Appendix 2). The Aboriginal to non-Aboriginal rate ratio decreased from 2010 to 2015 (3.5:1 to 1.6:1) but increased sharply in 2017 to 3.5:1. In 2018, at 1.5:1, the Aboriginal to non-Aboriginal rate ratio was the lowest reported in the ten-year period, but in 2019 it increased again, to 2.1:1 (Figure 11).

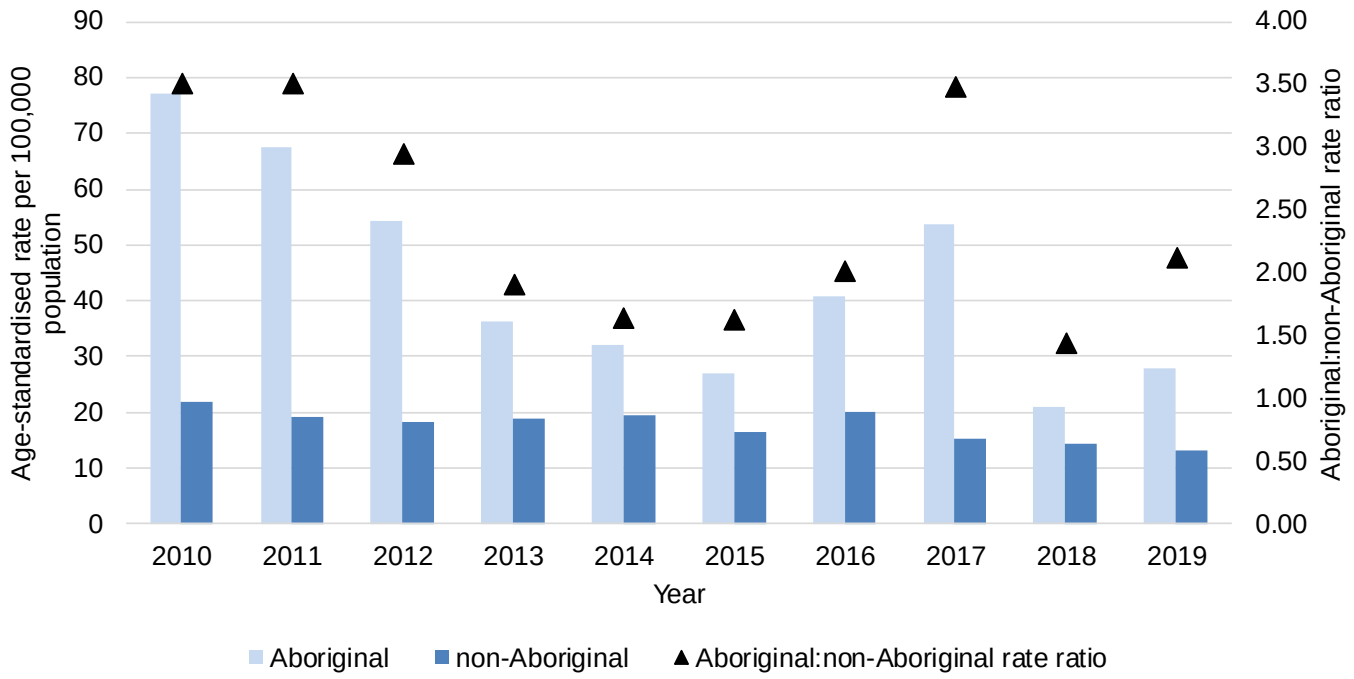


Figure 11. ASR (per 100,000 population) by Aboriginal status and the Aboriginal to non-Aboriginal rate ratio for unspecified hepatitis B notifications in WA, 2010–2019

Region

Over the ten year period, the highest unspecified hepatitis B rates were mostly reported in the Kimberley region, with a mean annual ASR of 36.2 per 100,000 population (n=123), followed by the Goldfields region (28.1 per 100,000) (Table 6).

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Table 6. Numbers and ASR (per 100,000 population) for unspecified hepatitis B notifications, by year and region, in WA, 2010–2019

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	572	533	554	545	564	515	620	495	461	422	5,281
	rate	25	22.3	22.5	21.2	21.9	19.6	23.1	18	16.4	14.6	21.1
Goldfields	*n*	24	26	23	11	13	14	15	11	14	12	163
	rate	42.6	41.4	35.4	16.6	19.5	21.8	25.3	20.3	22.7	21	28.1
Great Southern	*n*	6	13	12	10	6	3	5	4	4	6	69
	rate	14	25.3	21.7	18.2	13.1	6.1	8.8	8.4	7.1	9.7	13.4
Kimberley	*n*	15	20	20	19	6	9	9	14	8	3	123
	rate	46.8	53.1	57.5	54.3	17.8	22.2	23.4	38.4	24.2	6.5	36.2
Metropolitan Perth	*n*	468	431	455	455	491	442	546	426	394	373	4,481
	rate	26.1	23.1	23.4	22.5	24.2	21.1	25.7	19.5	17.5	16.2	22.5
Midwest	*n*	9	12	8	6	8	10	4	12	5	4	78
	rate	14.8	18.3	11.6	8.7	12.9	14.3	5.6	17	7.3	5.4	12.1
Pilbara	*n*	14	8	15	15	15	18	12	13	13	10	133
	rate	22.8	11.6	26.9	17.5	15.5	25.3	28.5	25.1	14.1	18.7	22.4
South West	*n*	17	13	17	21	12	15	17	5	19	11	147
	rate	11.9	8.9	11.3	13.3	7.9	9.4	9.9	2.8	10.2	5.5	9.3
Wheatbelt	*n*	13	4	3	5	12	2	8	7	3	1	58
	rate	18.3	5.9	4.3	7	16.2	3.2	11.9	10.8	4.5	1.3	8.4
Unknown	*n*	6	6	1	3	1	2	4	3	1	2	29

Notes: Unknown = Unknown residential address within WA

Place of Acquisition

Of the 2,713 (51%) unspecified hepatitis B notifications over the ten-year period that had place of acquisition recorded, 85% were reported as having been acquired overseas, predominately in South-East Asia, and 13% in WA.

Hepatitis B testing

From 2010 and 2019, the overall hepatitis B testing rate increased by 32% (45.1 to 59.4 per 1,000 population) while the notification and test positivity rates decreased by 52% (33.7 to 16.2 per 100,000 population) and 67% (0.50% to 0.17%), respectively. This indicates that the decrease in notifications from 2010 was predominately due to decreased disease transmission (Figure 12).

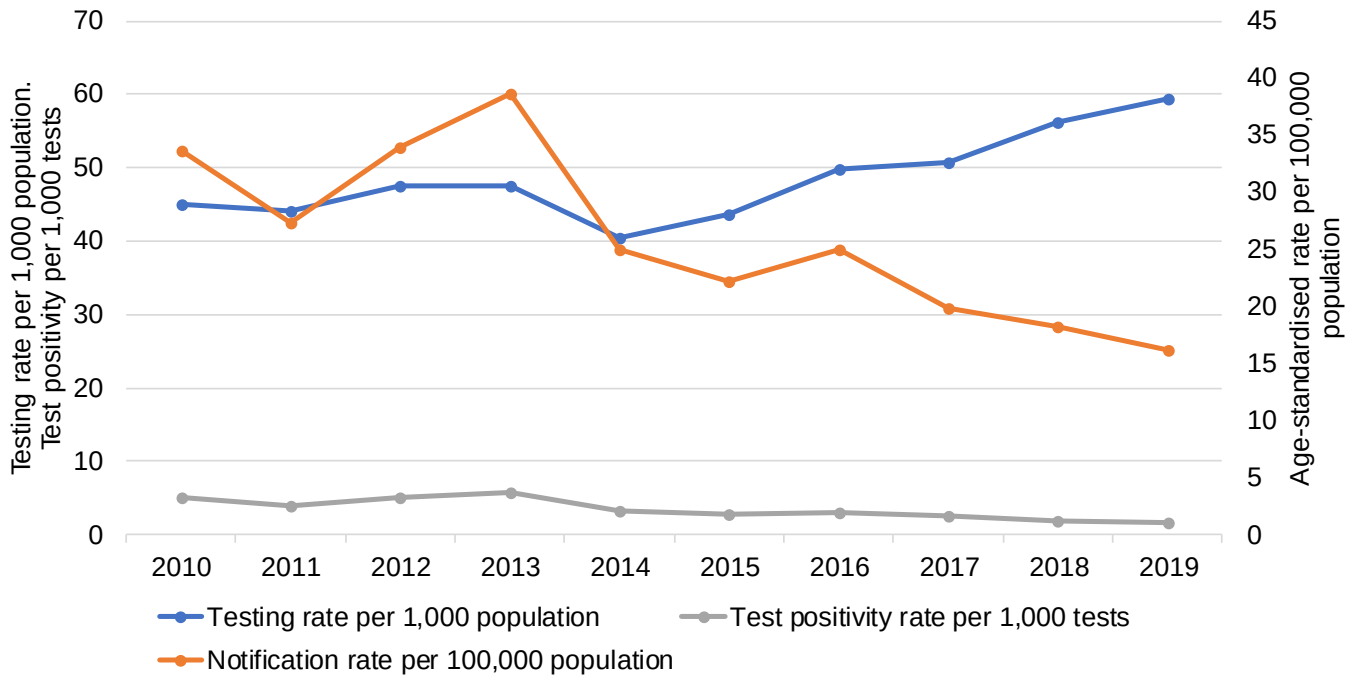


Figure 12. Hepatitis B testing rate (per 1,000 population), ASR (per 100,000 population) and test positivity rate (per 1,000 population), by year, in WA, 2010–2019

Hepatitis C

Hepatitis C virus causes inflammation and damage to the liver. There is no vaccine against hepatitis C infection, but a highly effective cure is now available. Without treatment, chronic hepatitis C infection can lead to liver disease and liver cancer.

Over the ten-year period from 2010 to 2019, there was a total of 10,753 hepatitis C notifications in WA, equating to a mean annual ASR of 42.9 per 100,000 population (Table 4 and Table 5). Hepatitis C notifications are classified as ‘newly acquired’ (evidence of infection having been acquired in the 24 months prior to diagnosis) and ‘unspecified’ (infections of unknown duration).

Newly acquired hepatitis C

Temporal Trends

Between 2010 and 2019, newly acquired hepatitis C notifications represented 12% (n=1,278) of total hepatitis C notifications equating to a mean annual ASR of 5.1 per 100,000 population (Table 4 and Table 5). In the ten-year period, the number of newly acquired hepatitis C notifications started at 76 notifications in 2010 before peaking at 182 notifications in 2015. The number of notifications in 2019 (n=119) was lower than the number of notifications in 2018 (n=125) and 17% lower than the 2014 to 2018 five-year average of 143 notifications per year (Figure 13).

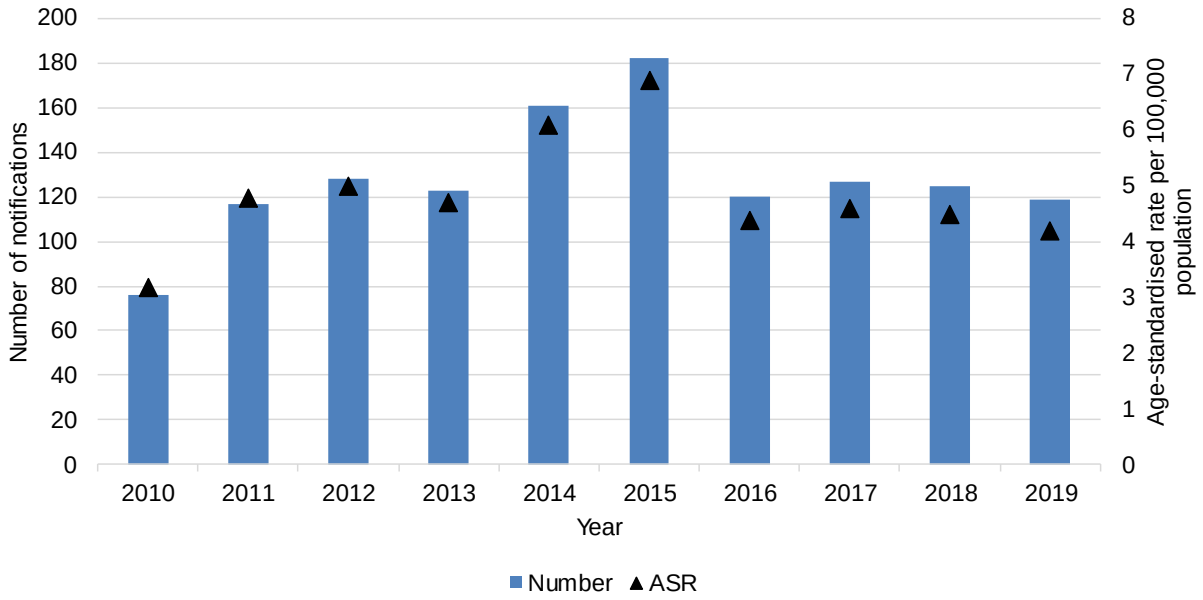


Figure 13. Number and (per 100,000 population) for newly acquired hepatitis C notifications, by year, in WA, 2010–2019

Sex and Age

Overall, the mean annual ASR for newly acquired hepatitis C was 2.6 fold higher among males than females – 7.2 versus 2.8 per 100,000 population (Appendix 1). The higher rate in males is likely due to the high level of testing in the male prison population - a population generally at higher risk of BBVs. Over the ten-year period, 50% of newly acquired hepatitis C notifications occurred in people aged 20 to 29 years (n=633/1,278) and the highest notification rate occurred in those aged 20 to 24 years (21.0 per 100,000 population) (Figure 14).

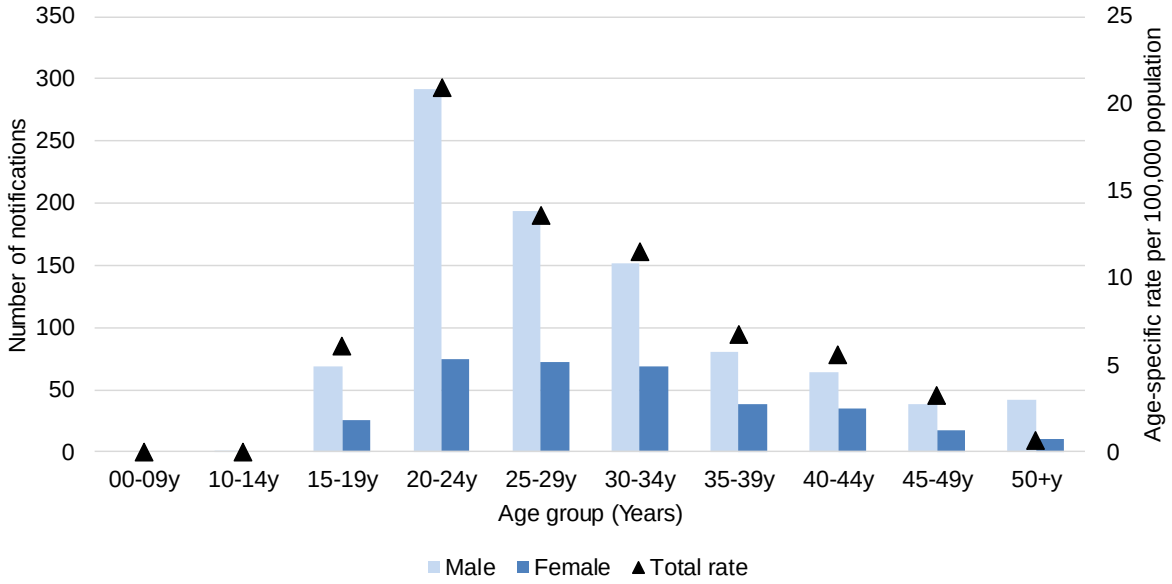


Figure 14. Number and age-specific rates (per 100,000 population) for newly acquired hepatitis C notifications, by sex, in WA, 2010–2019

Aboriginal Status

Between 2010 and 2019, 43% of newly acquired hepatitis C notifications were reported in Aboriginal people and 57% in non-Aboriginal people. The overall mean annual ASR 17.8 fold higher in the Aboriginal population compared to the non-Aboriginal population (52.0 versus 2.9 per 100,000 population) (Appendix 2). The Aboriginal to non-Aboriginal rate ratio fluctuated over the period between 2010 and 2013, reached a ten-year high of 29.1:1 in 2017 then decreased to 21.9:1 in 2019 (

Figure *15*).

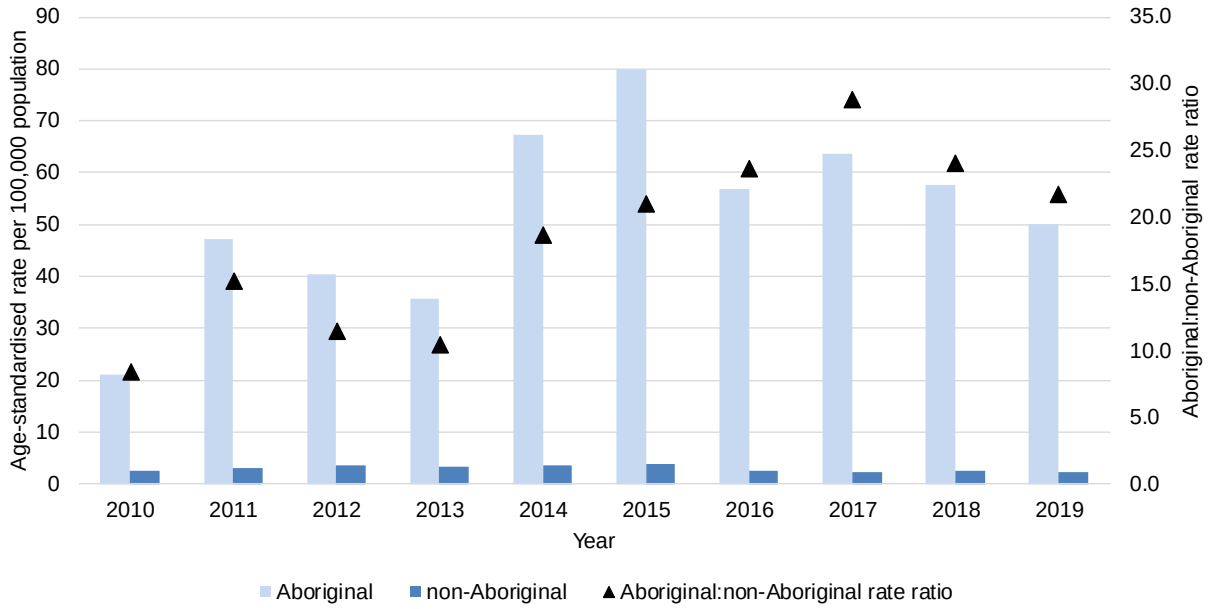


Figure 15. ASR (per 100,000 population) by Aboriginal status and the Aboriginal to non-Aboriginal rate ratio for newly acquired hepatitis C notifications in WA, 2010–2019

Region

The highest newly acquired hepatitis C rates have generally been reported from the Great Southern region, with a mean annual ASR of 20.8 per 100,000 population (n=92) over the ten-year period (Table 7). In 2019, the rate in the Great Southern region was five-fold higher than the overall WA rate (21.3 versus 4.2 per 100,000 population). The higher rate in the Great Southern region is likely due to location of two male prisons in this region and the high level of testing in the male prison population.

Table 7. Numbers (n) and ASR (per 100,000 population) for newly acquired hepatitis C notifications, by year and region, in WA, 2010–2019

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	76	117	128	123	161	182	120	127	125	119	1,278
	rate	3.2	4.8	5	4.7	6.1	6.9	4.4	4.6	4.5	4.2	5.1
Goldfields	*n*	2	5	2	0	1	8	5	1	6	7	37
	rate	2.9	7.7	3.2	0	1.5	11.9	8.1	1.7	9.2	11	6.2
Great Southern	*n*	3	1	11	11	16	14	6	12	9	9	92
	rate	6.9	2.2	26.1	24.3	35.7	31.7	12.8	26.5	20.1	21.3	20.8
Kimberley	*n*	1	1	1	1	1	1	0	2	1	2	11
	rate	2.1	2.6	1.8	2.6	2.6	1.8	0	5.1	1.8	4.6	2.7
Metropolitan Perth	*n*	61	95	99	96	124	143	94	94	97	88	991
	rate	3.3	4.9	4.9	4.7	5.9	6.7	4.3	4.1	4.3	3.8	4.9
Midwest	*n*	2	5	3	5	7	5	6	9	6	5	53
	rate	3.3	8.3	4.9	8.1	12	8.7	10	15.2	9.8	9.1	9.4
Pilbara	*n*	0	2	3	2	0	0	4	2	3	4	20
	rate	0	2.8	3.7	3.3	0	0	3.6	2.2	4.9	3.8	2.7
South West	*n*	6	7	6	6	9	7	3	0	2	4	51
	rate	4.7	5.1	4.2	3.8	6.3	4.9	2.1	0	1.4	2.9	3.7
Wheatbelt	*n*	1	1	2	2	3	4	2	7	1	0	23
	rate	1.8	1.7	3.1	3.3	4.9	6.3	1.9	11.5	1.6	0	3.7
Unknown	*n*	0	0	1	0	0	0	0	0	0	0	0

Notes: Unknown = Unknown residential address within WA

Place of Acquisition

Of the 797 (62%) newly acquired hepatitis C notifications over the ten-year period that had place of acquisition recorded, 98% were reported as having been acquired in WA. This trend was similar in males and females.

Unspecified hepatitis C

Temporal Trends

Between 2010 and 2019, unspecified hepatitis C notifications represented 88% (n=9,475) of total hepatitis C notifications equating to a mean annual ASR of 37.8 per 100,000 population (Table 4 and Table 5). The number of unspecified hepatitis C notifications peaked at 1,066 in 2016 before reaching a ten-year low of 862 in 2019. The notification rate decreased by 28% from 2010 to 2019 (42.2 to 30.3 per 100,000 population) (Figure 16).

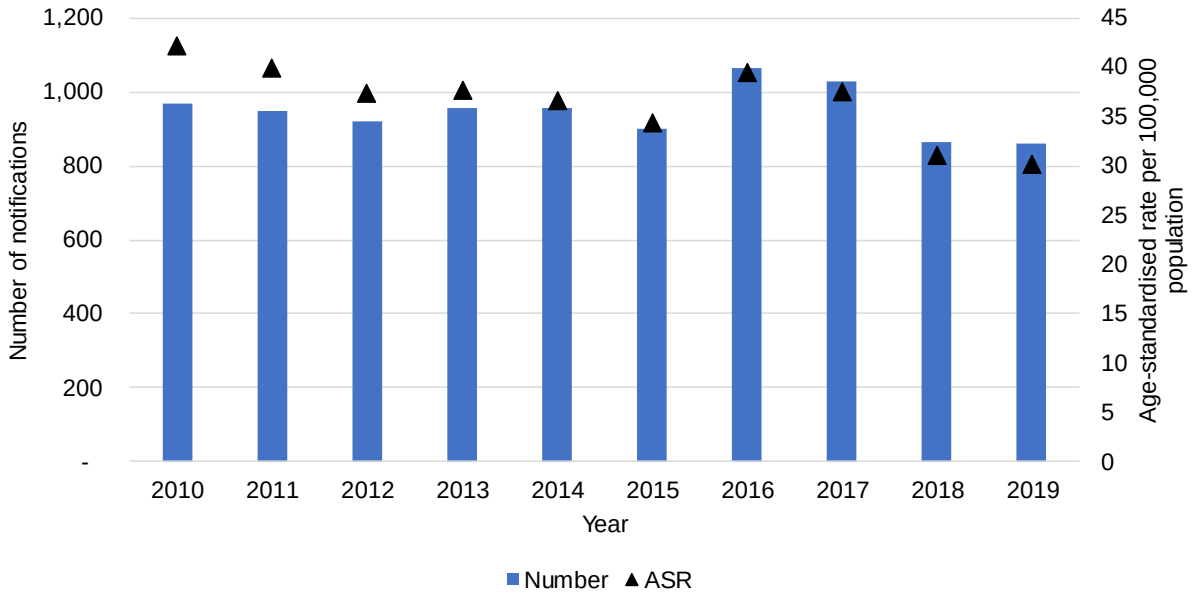


Figure 16. Number and ASR (per 100,000 population) for unspecified hepatitis C, by year, in WA, 2010–2019

Sex and Age

Overall, the mean annual ASR was 1.9 fold higher among males than females: 49.1 versus 26.5 per 100,000 population (Appendix 1). Over the ten-year period, 25% of unspecified hepatitis C notifications occurred in people aged 50 years or older (n=2,401/9,475) and the highest notification rate occurred in those aged 35 to 39 years (74.7 per 100,000 population) (Figure 17).

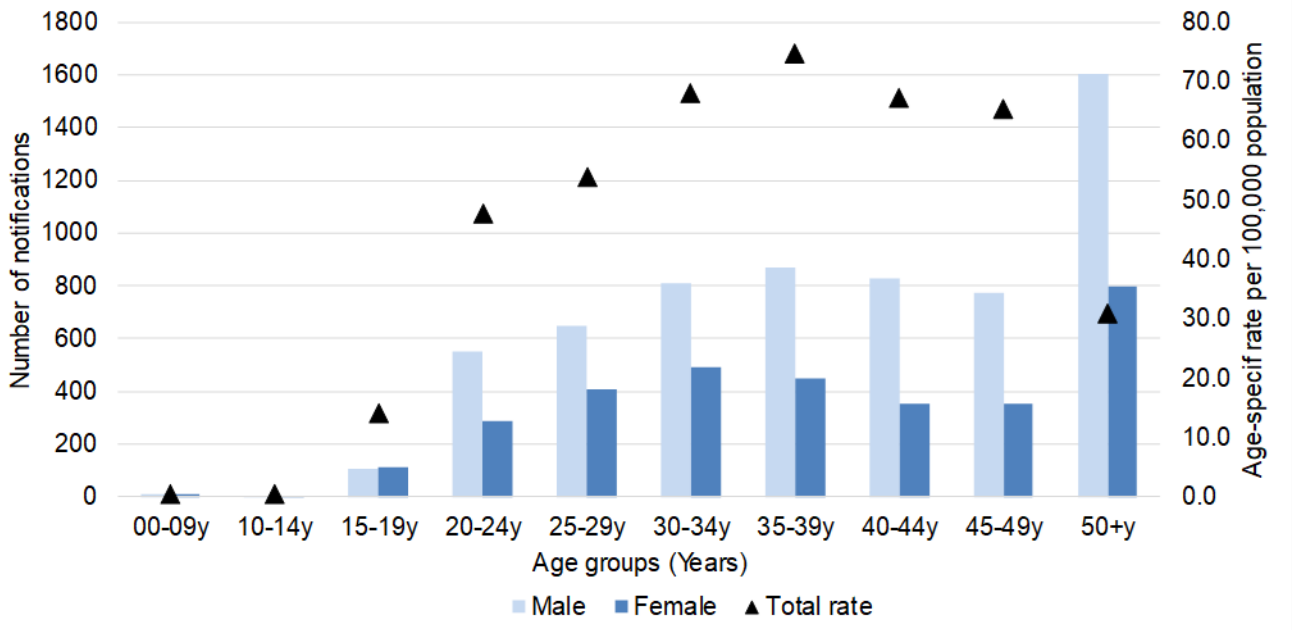


Figure 17. Number and age-specific rates (per 100,000 population) for unspecified hepatitis C notifications, by sex, in WA, 2010–2019

Aboriginal Status

From 2010 to 2019, 18% of unspecified hepatitis C notifications were reported in Aboriginal people and 76% in non-Aboriginal people, while 5% of notifications were of unknown Aboriginal status. The overall mean annual ASR was 6.5 fold higher in the Aboriginal population compared to the non-Aboriginal population (189.9 versus 29.1 per 100,000 population); Appendix 2. The Aboriginal to non-Aboriginal rate ratio increased from 2011 (3.4:1) to the highest reported in the ten-year period in 2019 (11.3:1) (

Figure *18*).

Region

The highest unspecified hepatitis C rates have generally been reported from the Great Southern and Midwest regions (Table 8). In 2019, the notification rate in the Great Southern region was more than double the overall WA rate (64.6 versus 30.3 per 100,000 population).

Place of Acquisition

Of the 2,907 (31%) unspecified hepatitis C notifications over the ten-year period that had place of acquisition recorded, 76% were reported as having been acquired in WA. For the majority of the overseas acquired cases, the source of infection was reported as the South-East Asia region.

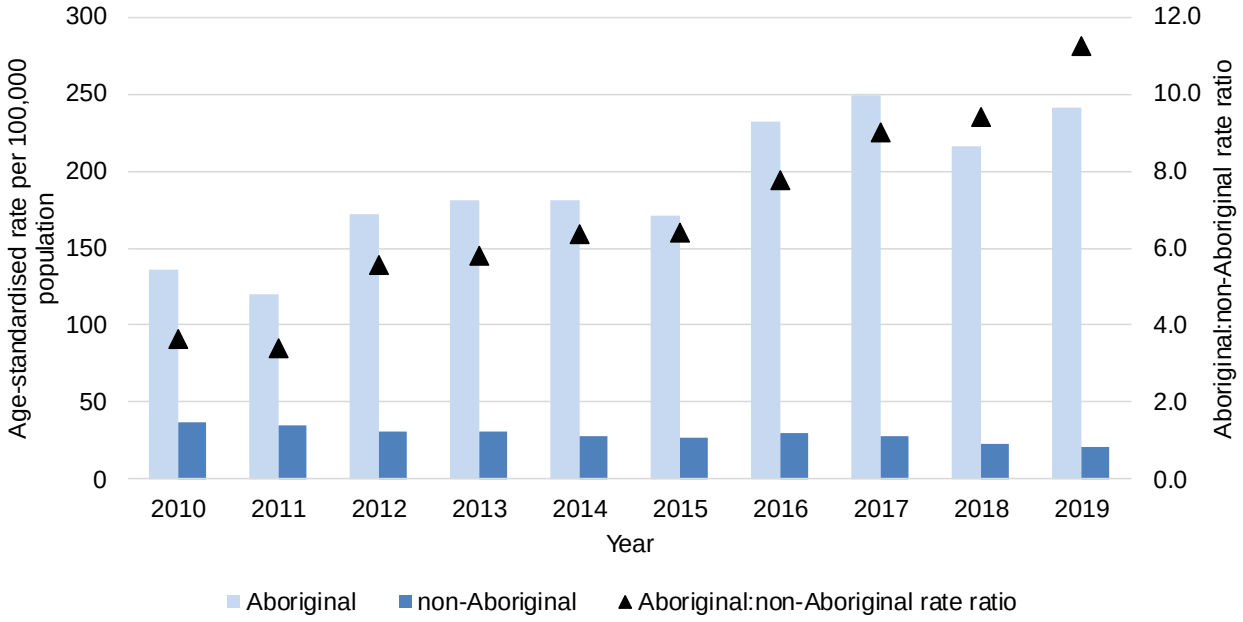


Figure 18. ASR (per 100,000 population) by Aboriginal status and the Aboriginal to non-Aboriginal rate ratio for unspecified hepatitis C notifications in WA, 2010–2019

Table 8. Numbers (n) and ASR (per 100,000 population) for unspecified hepatitis C notifications, by year and region, in WA, 2010–2019

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	969	948	921	958	955	901	1,066	1,029	866	862	9,475
	rate	42.2	40	37.4	37.7	36.7	34.4	39.6	37.6	31.2	30.3	37.8
Goldfields	*n*	51	43	38	34	25	26	29	24	29	41	339
	rate	82.4	68.8	59.3	52.2	38.6	40.7	44.8	37.3	44.8	61.4	56.7
Great Southern	*n*	27	32	35	28	29	29	40	38	26	33	317
	rate	52.7	62.8	69.6	53	58	53	76.3	76.5	45.8	64.6	61.9
Kimberley	*n*	28	17	20	22	20	18	16	26	11	16	194
	rate	75.8	44.5	49.6	54.9	50	52.5	40.7	58.5	26.9	38.1	52.5
Metropolitan Perth	*n*	691	698	666	759	734	670	796	774	657	598	7,043
	rate	38.6	37.6	34.5	38	35.8	32.4	37.5	35.7	29.8	26.3	35.5
Midwest	*n*	24	30	43	29	31	40	47	43	39	48	373
	rate	37.9	48.4	67.2	45.2	47	61.6	68	62.3	58.3	73	60.3
Pilbara	*n*	21	26	17	24	18	24	23	13	17	13	196
	rate	33	36.2	23.8	32.6	24.1	30.3	28.4	16.6	20.4	14	27.4
South West	*n*	76	68	78	46	71	64	74	67	61	77	680
	rate	51.3	45.8	49.3	28.6	45.2	39.4	43.5	37.6	35.1	42.9	42.9
Wheatbelt	*n*	28	16	19	16	25	28	39	43	24	33	271
	rate	42.6	24.5	29.3	22	34.8	37.5	55.5	57.5	34	47.3	39
Unknown	*n*	23	18	5	0	2	2	2	1	2	3	62

Notes: Unknown = Unknown residential address within WA

From 2010 to 2019, the overall hepatitis C testing rate increased by 7% (50.5 to 54.0 per 1,000 population) while the notification rate decreased by 24% (46.5 to 35.4 per 100,000 population) and the test positivity rate remained stable (0.49% to 0.47%) (Figure 19).

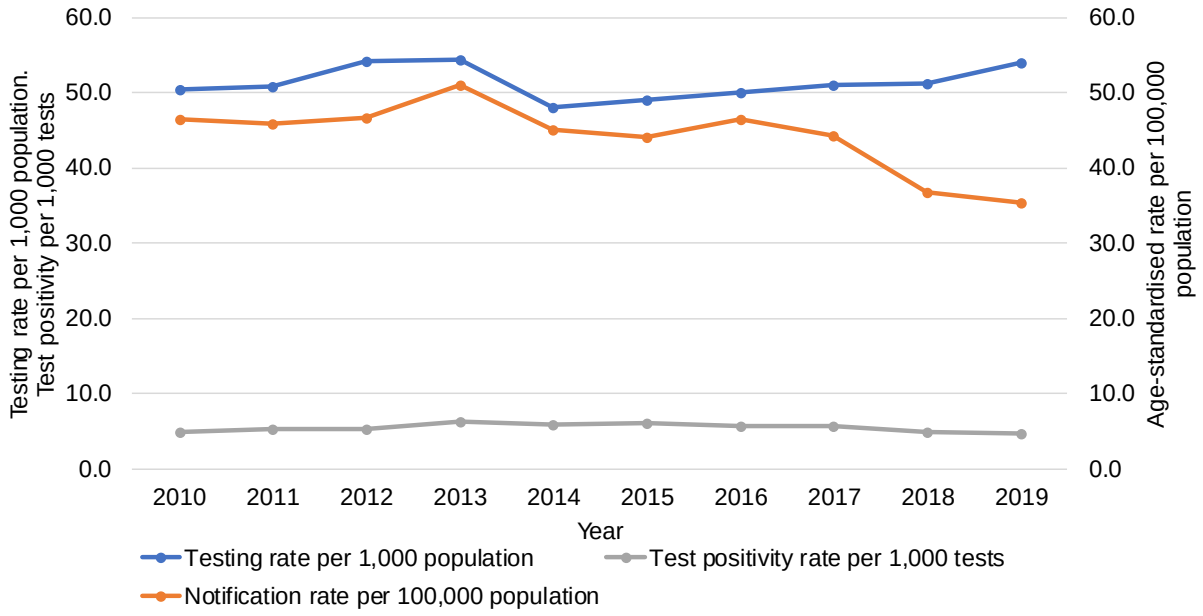


Figure 19. Hepatitis C testing rate (per 1,000 population), ASR (per 100,000 population) and test positivity rate (per 1,000 population), by year, in WA.

Enhanced hepatitis C surveillance

Between 2010 and 2019, enhanced surveillance forms (ESF) were sent to the diagnosing doctors of all newly acquired hepatitis C cases and a randomly selected one-third of unspecified hepatitis C cases in WA. The surveillance forms were completed for 69% (n=881/1,278) of newly acquired cases and 55% (n=1,532/2,768) of unspecified cases. Completed forms were received for 71% (n=760/1,073) of Aboriginal notifications and 57% (n=1,644/2,890) of non-Aboriginal notifications.

Overall, having a history of risk factors was the most common reason for hepatitis C testing among both Aboriginal and non-Aboriginal people. A greater proportion of Aboriginal people were diagnosed with hepatitis C as part of voluntary prison entry testing while a greater proportion of non-Aboriginal people were diagnosed as a result of an abnormal liver test. Injecting drug use was the most common hepatitis C infection risk factor for both Aboriginal and non-Aboriginal people. A greater proportion of Aboriginal people had a history of imprisonment as a risk factor for hepatitis C infections.

Hepatitis D

Hepatitis D is a virus-like particle consisting of a coat of hepatitis B virus surface antigen and a unique internal antigen, the delta antigen. The virus is unique in that it can only replicate in the presence of hepatitis B virus and can therefore only occur among people who have hepatitis B infection. Hepatitis D can accelerate the health impacts of hepatitis B infection, leading to more severe health outcomes for people living with both viruses.

Between 2010 and 2019, there were a total of 32 confirmed cases of hepatitis D notified in WA, ranging from no cases in 2010 to a high of 10 cases in 2019 (Table 4). Most cases were non-Aboriginal (94%; n=30) and resided in metropolitan Perth (91%; n=29). The number of notifications among males (n=18) was comparable to those among females (n=14) and cases ranged in age from 20 to 74 years (median: 46 years). Of the 13 (43%) hepatitis D notifications over the ten-year period that had place of acquisition recorded, 92% were reported as having been acquired overseas, primarily in the South-East Asia region.

Table 9 Behavioural and demographic characteristics of people notified with hepatitis C, by Aboriginality, in WA, 2010–2019

Behavioural and demographic characteristics		Aboriginal		non-Aboriginal		Total	
		Number	Percent	Number	Percent	Number	Percent
Sex	Male	550	72%	1126	68%	1682	70%
	Female	210	28%	518	32%	731	30%
Reason for testing	History of risk factors	541	71%	941	57%	1486	62%
	Signs/symptoms of hepatitis	46	6%	134	8%	180	7%
	Abnormal liver test	104	14%	487	30%	593	25%
	Prison screen	418	55%	374	23%	793	33%
	Antenatal screen	38	5%	71	4%	109	5%
	Sexual health screen	46	6%	106	6%	154	6%
	Employment screen	1	0%	9	1%	10	0%
	Blood or organ donor	0	0%	15	1%	15	1%
	Drug/alcohol program screen	22	3%	97	6%	119	5%
	Migrant/refugee screen	1	0%	12	1%	13	1%
	Occupational exposure - exposed	1	0%	5	0%	6	0%
	Occupational exposure - source	0	0%	0	0%	0	0%
	Patient request	85	11%	242	15%	328	14%
	Other	56	7%	191	12%	248	10%
Risk factors	Injecting drug use	614	81%	1043	63%	1662	69%
	Blood products/tissues in Australia	7	1%	44	3%	51	2%
	Blood products/tissues overseas	0	0%	24	1%	24	1%
	Organ transplant	0	0%	0	0%	0	0%
	Dialysis	0	0%	0	0%	0	0%
	Needlestick/biohazardous injury in healthcare worker	1	0%	8	0%	9	0%
	Needlestick/biohazardous injury in non-healthcare worker	21	3%	58	4%	79	3%
	Surgical/endoscopy procedure	22	3%	122	7%	144	6%
	Major dental work	11	1%	68	4%	79	3%
	Tattoos	129	17%	365	22%	496	21%
	Acupuncture	2	0%	37	2%	39	2%
	Ear piercing	38	5%	173	11%	212	9%
	Body piercing	7	1%	84	5%	92	4%
	Perinatal transmission	207	27%	586	36%	796	33%
	Same sex partner with HCV	17	2%	43	3%	60	2%
	Opposite sex partner with HCV	106	14%	237	14%	343	14%
	Imprisonment	458	60%	429	26%	889	37%
	Health care worker with no documented exposure	1	0%	20	1%	21	1%
	Household contact with HCV	34	4%	87	5%	121	5%
	Other risk factor	19	3%	68	4%	87	4%

Enteric Diseases

Enteric infections are infections of the gastrointestinal tract commonly resulting in gastroenteritis. Symptoms generally include diarrhoea and/or vomiting. Gastroenteritis can be caused by a variety of microorganisms including bacteria, viruses and parasites. Transmission usually occurs from ingesting the microorganisms (by drinking or eating something contaminated), or through contact with microscopic amounts of faeces or vomit from an ill person, or handling pets and other animals. Enteric disease causes a large burden of illness in the WA community.

The 15 notifiable diseases that were included under the 'Enteric Diseases' category on WANIDD, over the ten-year period 2010-2019, are listed in Table 1. Between 2010 and 2019, there were a total of 53,602 notifications among WA residents (Table 3), reflecting a mean annual ASR of 213.1 notifications per 100,000 population over the ten-year period. In the 2015 to 2019 period there was 50% increase in enteric notifications compared to the previous five year period. It should be noted that changes in enteric disease notifications over the ten years are at least partly due to the introduction of culture-independent diagnostic testing in WA laboratories during this period. This increase can also be partly attributed to the gastroenteritis outbreaks investigated. During this 10 year period, there were 1,580 gastroenteritis outbreaks reported. Most (74%, n=1,171) of these outbreaks were due to person-person transmission, with 12% (n=197) due to an unknown mode of transmission. Of the outbreaks, 12% were due to food-borne transmission, which increased from an average of 59 outbreaks in the 2010 to 2014 period to an average of 138 outbreaks in the 2015 to 2019 period. Most of the food-borne outbreaks were caused by notifiable enteric diseases such as salmonellosis. Further information on outbreaks can be found in specific disease sections below and in the OzFoodNet reports online Enteric infection reports and publications (OzFoodNet) (health.wa.gov.au).

The overall notification rate was heavily influenced by notifications of campylobacteriosis and salmonellosis, which comprised 52% and 31% of all enteric notifications, respectively (Figure 20). The 0-4 year age group had the highest enteric disease rate (598.6 notifications per 100,000 population; n=10,042) which was 2.8 fold the overall rate for WA. Between 2010 and 2019, the mean annual ASR among Aboriginal people was 44% higher than for non-Aboriginal people (253.2 versus 195.7 per 100,000 population). The region with the highest mean annual ASR was the Kimberley region with 511.7 notifications per 100,000 population.

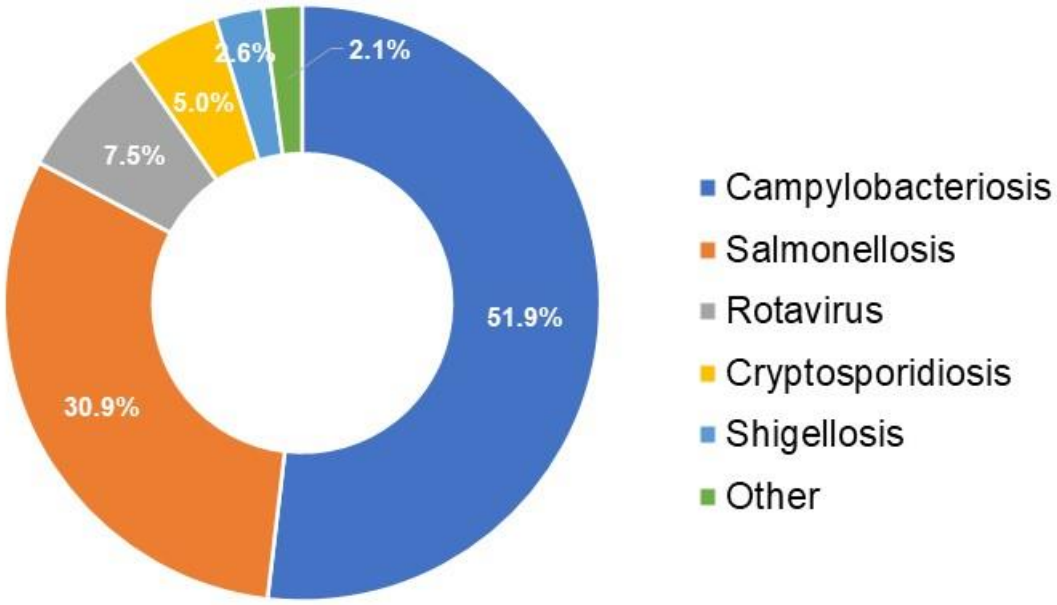


Figure 20. Proportions of enteric disease notifications in WA, 2010–2019

Campylobacteriosis

Campylobacteriosis is an infection of the gastrointestinal system caused by *Campylobacter* bacteria. Handling and consumption of contaminated poultry and poultry products, especially undercooked chicken products, have been identified as key sources of human infection. Person-to-person, water-borne and animal-to-person spread can also occur, however this is considered less common. *Campylobacter* does not grow in food, which is thought to be one of the reasons that point-source outbreaks are uncommon. There is also no molecular subtyping system for *Campylobacter* routinely used for surveillance in WA or in Australia, so identification of outbreaks is difficult.

Temporal Trends

From 2010 to 2019, campylobacteriosis was the most commonly notified enteric infection in WA accounting for approximately half of all enteric disease notifications (27,828/ 53,602; 51.9%) with an overall mean ASR of 110 cases per 100,000 population (Table 4 and Table 5). There was a decline in notifications from 2010 to 2013 (Figure 21), but the factors that contributed to this decline are unclear.

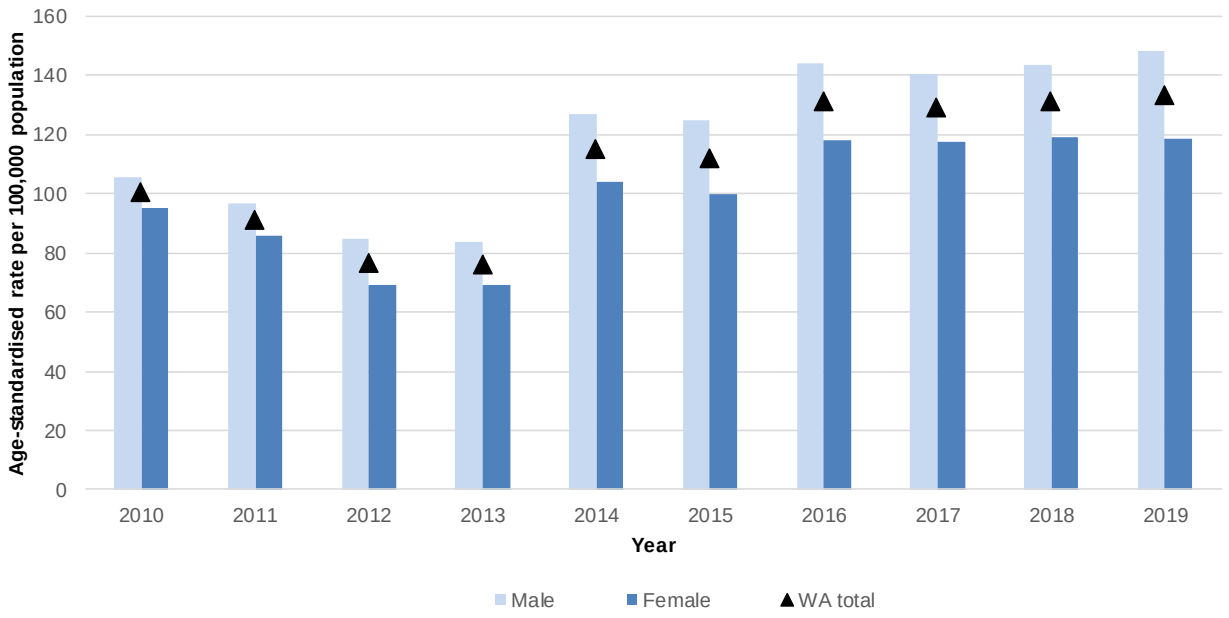


Figure 21. ASR (per 100,000 population) for campylobacteriosis notifications, by sex and year of disease onset, in WA, 2010–2019

Since 2014, there has been an increase in campylobacteriosis notifications, which is at least partly due to the introduction of PCR testing by private laboratories from 2014 onwards, which is more sensitive than culture for detecting *Campylobacter*. In general, notifications for campylobacteriosis increased between October and January annually (Figure 22); however, a plausible explanation for this seasonal increase has not yet been identified.

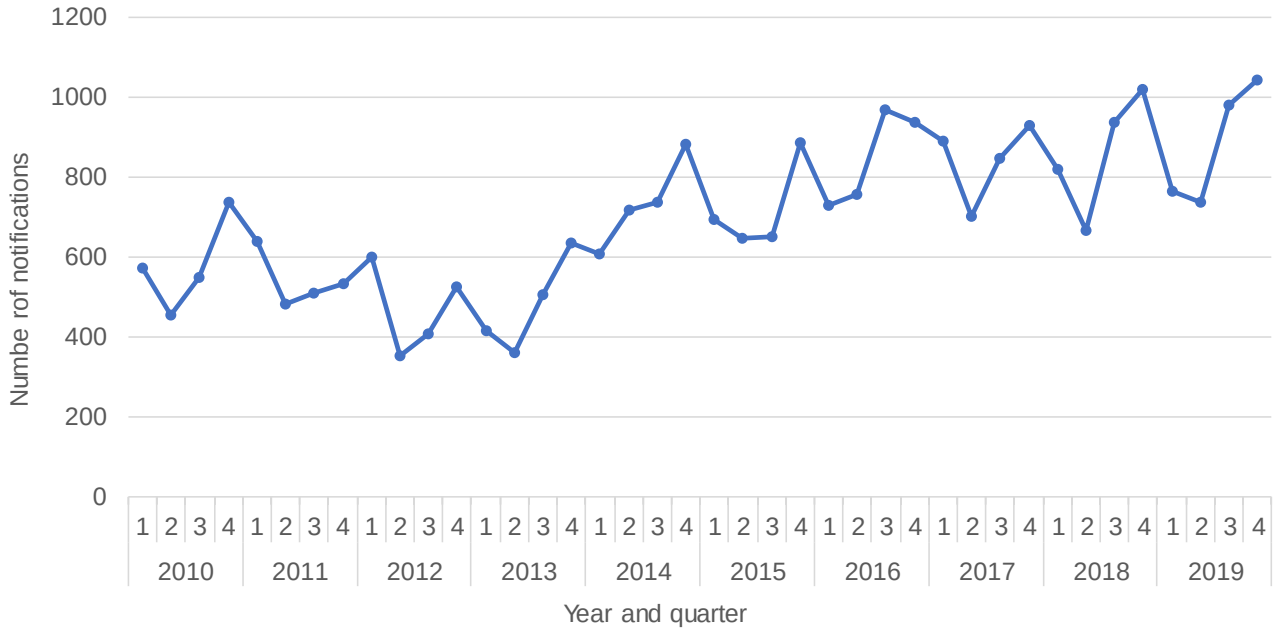


Figure 22. Number of campylobacteriosis notifications, by year and quarter of optimal date of onset, in WA, 2010–2019

Sex and Age

For the period 2010 to 2019, the mean annual ASR of campylobacteriosis were 1.2 fold higher among males compared to females (121 versus 100 per 100,000 population) (Appendix 1). Rates were higher among males than females in all age groups except 20-24 years. The highest male to female ratios were observed in the 0-4 years and the 85+ year age groups (Figure 23). The 0-4 year age group, with a rate of 159.8 per 100,000 population (n=2,680), had the highest rate followed by the 75-79 year age group (149.5 per 100,000; n=879) (Figure 23).

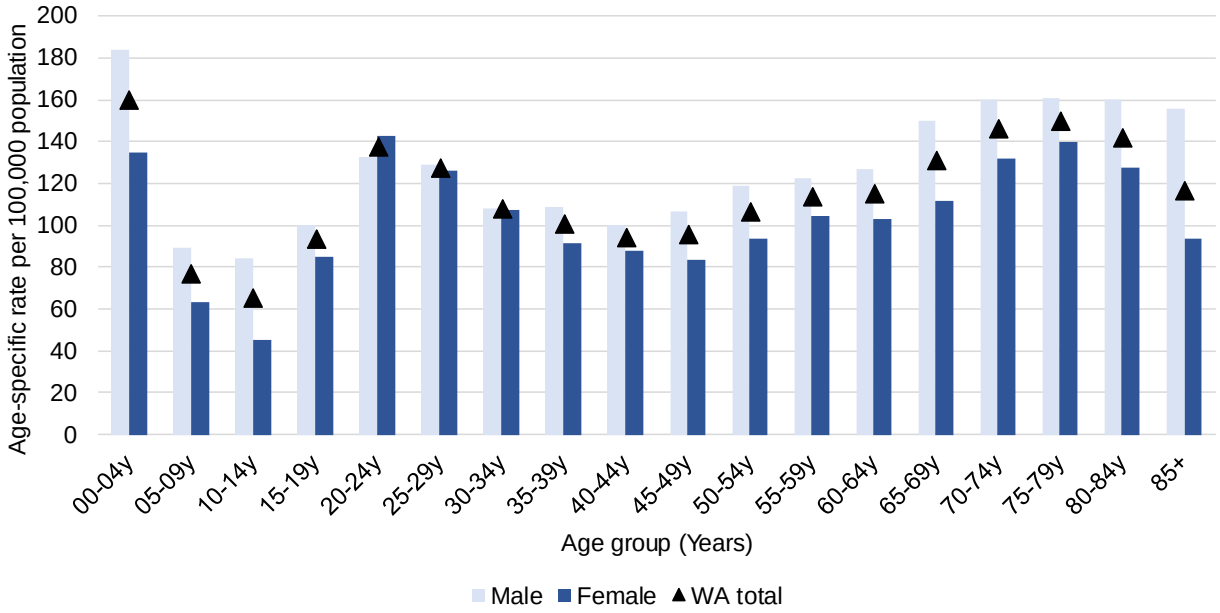


Figure 23. Age-specific rates (per 100,000 population) for campylobacteriosis notifications, by sex, in WA, 2010–2019

Aboriginal Status

Overall, the ASR among non-Aboriginal people (103 per 100,000 population) was 2.3-fold higher than in Aboriginal people (46 per 100,000 population) (Appendix 2). The rate difference between Aboriginal and non-Aboriginal people increased from 2014 onwards, with rates increasing in non-Aboriginal people from 2013 to 2019 while rates in Aboriginal people remained stable (Figure 24).

Region

Over the ten-year period, the South West and Great Southern regions had the highest mean annual ASR both with 132 notifications per 100,000 population. The Pilbara region had the lowest notification rate of 74 notifications per 100,000).

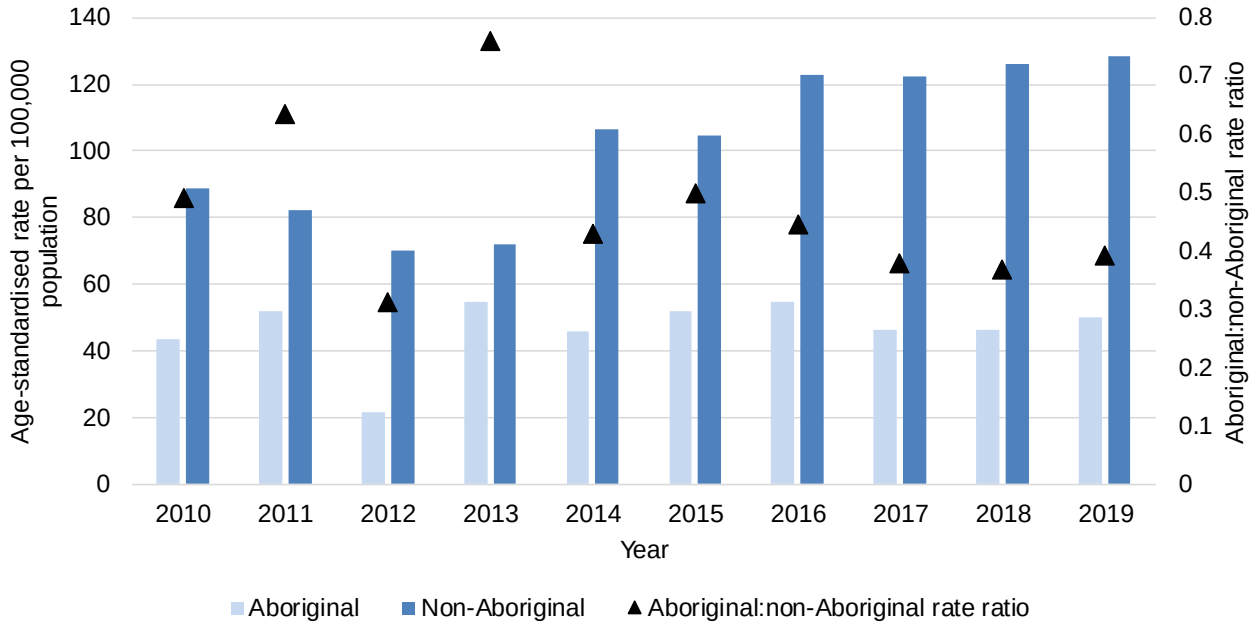


Figure 24. ASR (per 100,000 population) for campylobacteriosis notifications, by Aboriginal status and year of disease onset, in WA, 2010–2019

Table 10. Numbers (n) and ASR (per 100,000 population) for campylobacteriosis notifications, by year and region, in WA, 2010–2019

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	2,313	2,166	1,881	1,917	2,944	2,880	3,388	3,371	3,442	3,526	27,828
	rate	100.5	91.1	76.8	76.3	115.4	112.1	131.2	129.2	131.5	133.3	110.3
Goldfields	*n*	57	51	28	46	68	55	63	61	62	44	535
	rate	106.8	87.2	45.7	75.1	111	93.1	114.8	106.9	110.9	81.4	92.3
Great Southern	*n*	68	69	53	72	82	83	96	94	96	87	800
	rate	120.5	117.6	85.8	120	135.1	133.3	161	157.3	149.1	144.8	132.1
Kimberley	*n*	38	36	44	35	44	31	30	37	45	40	380
	rate	99.8	91.3	101.8	79.5	106.6	85.1	81.5	102.5	133	117.1	100.4
Metropolitan Perth	*n*	1,778	1,655	1,470	1,439	2,324	2,250	2,715	2,679	2,729	2,881	21,920
	rate	99.1	89	76.5	73	115.7	110.9	132.7	129.4	131.1	136.4	110.2
Midwest	*n*	45	52	47	54	57	76	80	82	67	51	611
	rate	70.9	77	69.3	80.8	87.4	112.9	120.8	122.1	104.6	79.4	92.8
Pilbara	*n*	33	41	27	34	48	79	52	58	56	73	501
	rate	51.2	60.5	38.4	47.5	69.4	117.9	80.4	83.2	79.4	116.7	74.3
South West	*n*	211	170	162	167	249	239	271	251	283	265	2,268
	rate	134.5	107.2	95.2	98.3	142.9	136.7	153.6	140.8	161	149.1	132.1
Wheatbelt	*n*	83	92	50	70	72	67	81	109	104	85	813
	rate	109.8	118	66.4	91.8	84.9	85.4	100.2	136.4	132.9	110.4	103.2

Place of Acquisition

The place of acquisition was known for approximately 58% (n=16,106) of campylobacteriosis notifications. Of these, 75% (n=12,041) were acquired in WA, 24% (n=3,840) overseas and 1% (n=225) interstate. There was no change in this pattern of acquisition over the ten-year period.

Outbreaks

There were six outbreaks identified and investigated over the ten-year period. The source was unknown for three outbreaks, two were foodborne due to undercooked poultry liver paté dishes and one was a suspected person-to-person transmission in a childcare centre (CCC).

Salmonellosis

Salmonellosis is an infection of the digestive tract, caused by non-typhoidal *Salmonella* bacteria. There are thousands of *Salmonella* types that can infect both people and animals, and can also grow in food and the environment. Infection with *Salmonella* occurs by ingesting the bacteria, especially by eating contaminated undercooked meat (most commonly chicken), eating contaminated raw or undercooked eggs, or other food that has been cross-contaminated with *Salmonella*; by handling animals and raw meat; or by drinking water or other solutions that have been contaminated, usually by animals or sewage. Person-to-person spread can also happen through faecal-oral transmission.

Temporal Trends

Salmonellosis was the second most common notifiable enteric disease with 16,582 cases between 2010 and 2019 (66.1 notifications per 100,000 population) (Table 4 and Table 5). From 2010 to 2014, notifications of salmonellosis remained stable (Figure 25).

Notifications increased from 2015 to 2019, peaking in 2017 with 2,564 notifications (99.3 per 100,000 population), which was almost two-fold higher than the mean notification rate for the 2010 to 2014 period (51.0 per 100,000 population). Some of the increase in salmonellosis notifications is likely to be due to the introduction of PCR testing in WA laboratories from 2014. Salmonellosis notifications peaked in the summer and autumn months (January-May) and notifications were generally lower from June to September.

Sex and Age

For the period 2010 to 2019, the mean annual ASR of salmonellosis was slightly higher among females compared to males (68.1 versus 64.0 per 100,000 population) (Appendix 1). Over the ten-year period, children aged under 5 years were the most affected group (218.2 per 100,000 population), accounting for 22% (n=3,660) of all salmonellosis notifications (Figure 26). The notification rate for females was slightly higher than males for most age groups but the opposite was observed for those aged 14 years or younger.

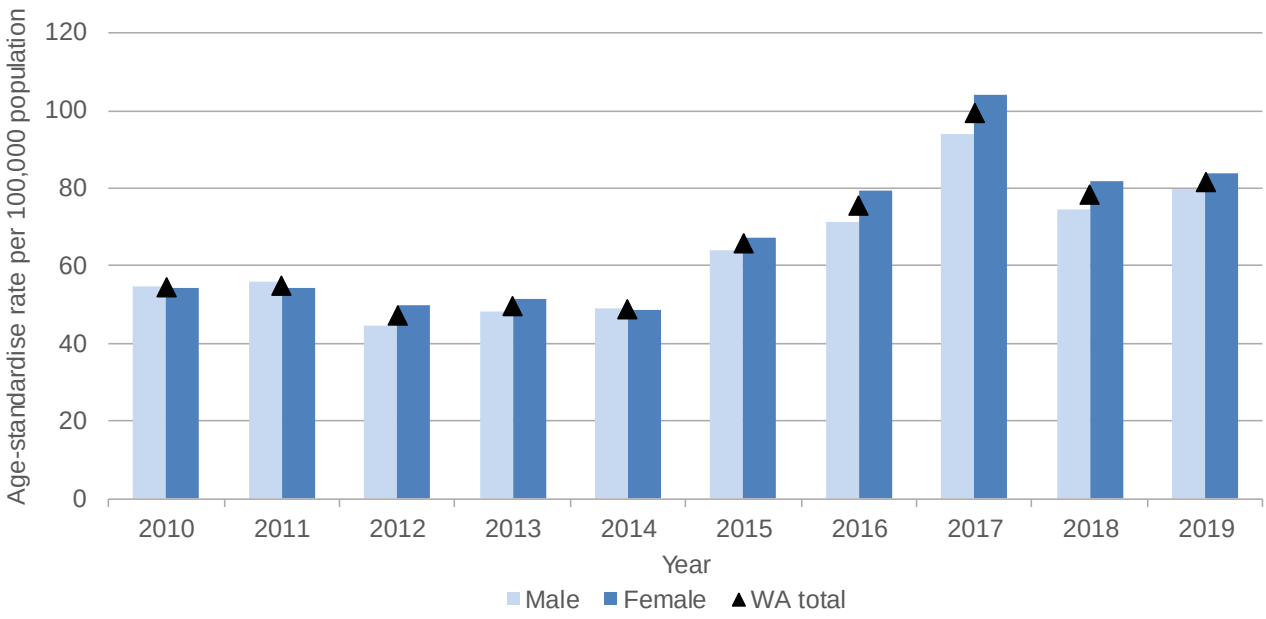


Figure 25. ASR (per 100,000 population) for salmonellosis notifications, by sex and year of disease onset, in WA, 2010–2019

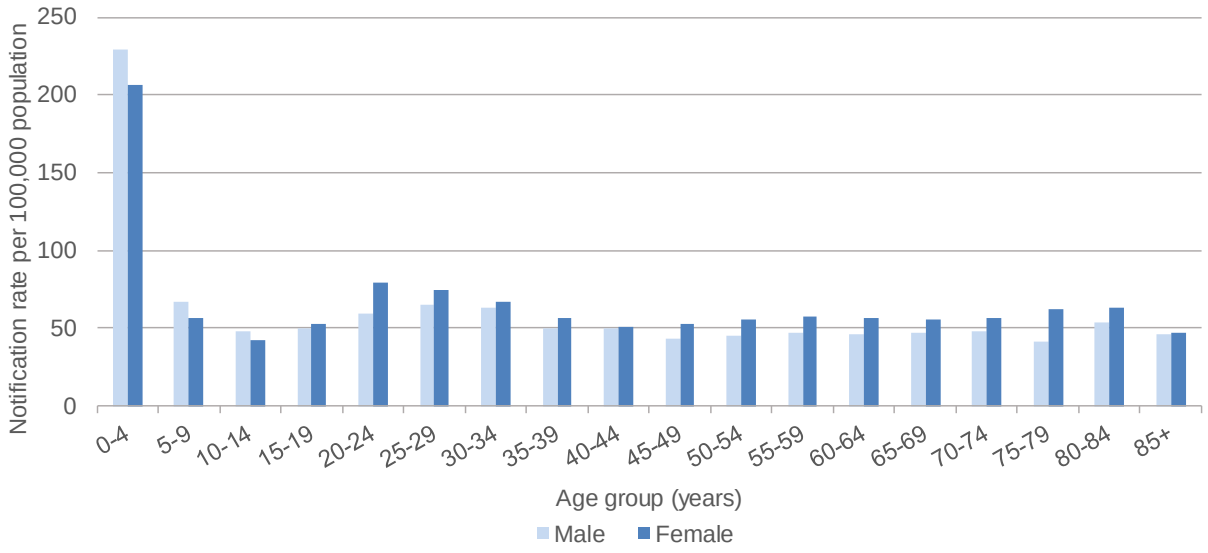


Figure 26. Age-specific rates (per 100,000 population) for salmonellosis notifications, by sex, in WA, 2010–2019

Aboriginal Status

Between 2010 and 2019, approximately 6% of salmonellosis notifications were reported in Aboriginal people (n=920) and 90% in non-Aboriginal people (n=14,864); 5% of notifications were of unknown Aboriginal status (n=798). The mean annual ASR was 1.6-fold higher in the Aboriginal population than in the non-Aboriginal population (100.6 versus 62.0 per 100,000) (Appendix 2). The salmonellosis notification rate among Aboriginal people was highest in 2015 while non-Aboriginal rates peaked in 2017 (

Figure 27).

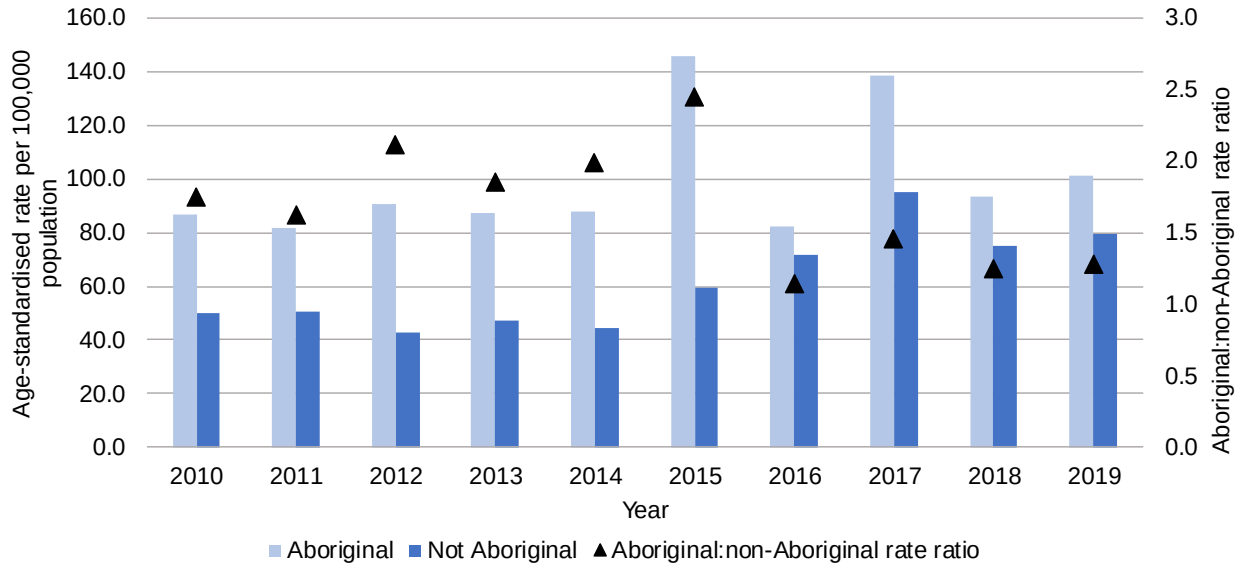


Figure 27. ASR (per 100,000 population) for salmonellosis notifications, by Aboriginal status in WA, 2010–2019

Region

The highest salmonellosis rates have consistently been reported from the Kimberley region with the mean annual ASR in the Kimberley being 3.3-fold higher than the overall WA rate (218.8 versus 66.1 per 100,000 population) (Table 11 and Appendix 3). The Pilbara region had the second highest rate (91.5 per 100,000 population) while the Great Southern region reported the lowest rate (53.1 per 100,000 population). The high rates in the Kimberley and Pilbara regions may be due to the higher temperatures in these regions increasing the load of *Salmonella* on animal food products or increased environmental prevalence of *Salmonella* in these regions.

Table 11. Numbers (n) and ASR (per 100,000 population) for salmonellosis notifications, by year and region in WA, 2010–2019

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	1,254	1,301	1,152	1,251	1,244	1,693	1,941	2,564	2,044	2,138	16,582
	rate	54.4	55.0	47.2	49.8	48.8	65.9	75.4	99.3	78.3	81.8	66.1
Goldfields	*n*	18	36	19	44	23	43	47	76	36	47	389
	rate	28.3	57.2	29.1	67.5	35.5	73.9	81.8	124.8	62.3	88.3	64.7
Great Southern	*n*	24	29	31	29	18	28	38	36	43	27	303
	rate	44.2	55.1	53.4	46.7	34.2	45.5	65.0	62.0	80.9	44.6	53.1
Kimberley	*n*	85	90	73	85	92	97	75	110	79	60	846
	rate	225.9	229.6	166.2	195.9	240.1	259.3	210.0	288.3	202.0	167.1	218.8
Metropolitan Perth	*n*	911	904	834	880	875	1,257	1,509	1,999	1,602	1,699	12,470
	rate	50.7	49.2	43.6	44.7	43.6	62.1	74.0	97.5	77.1	81.3	63.1
Midwest	*n*	37	53	43	48	43	62	50	70	46	44	496
	rate	56.2	79.6	65.2	71.0	63.1	93.9	76.2	109.9	70.9	72.1	76.1
Pilbara	*n*	42	63	48	50	56	54	48	82	57	60	560

	rate	61.9	94.8	101.7	79.2	76.0	93.4	86.4	122.9	92.6	99.0	91.5
South West	*n*	97	80	79	77	94	98	136	128	135	146	1,070
	rate	62.9	50.8	48.9	45.6	55.9	56.9	81.3	75.3	79.0	82.0	64.1
Wheatbelt	*n*	40	46	25	38	43	54	38	63	46	55	448
	rate	56.7	65.3	31.7	48.4	55.5	69.5	48.0	86.6	55.8	82.0	59.5

Serotype

As part of enhanced surveillance and outbreak detection, *Salmonella* is serotyped at PathWest (WA reference laboratory). During the period 2010 to 2019, over 200 unique *Salmonella* serotypes were identified, with *S.* Typhimurium (STM) the most commonly reported serotype in WA with 6,781 cases (40.9%), followed by *S.* Enteritidis (13.9%). *S.* Typhimurium increased from 28.4% of salmonellosis notifications between 2010 and 2014, to 48.4% between 2015 and 2019 (Figure 28). The increase in *S.* Typhimurium infections was driven by two large community outbreaks associated with egg consumption.

Serotypes varied by place of acquisition (Table 12). Half of all *Salmonella* infections acquired overseas were caused by *S.* Enteritidis (50.0%), followed by *S.* Paratyphi B bv Java (9.7%) and *S.* Typhimurium (7.0%). Amongst infections that were recorded as being acquired in WA, *S.* Typhimurium (59.1%) was the most common serotype followed by *S.* Saintpaul (3.8%) and *S.* Infantis (2.5%). Serotypes also varied by region; notifications in the northern remote regions include a variety of serotypes and illness was mostly sporadic compared to the other regions where *S.* Typhimurium predominated.

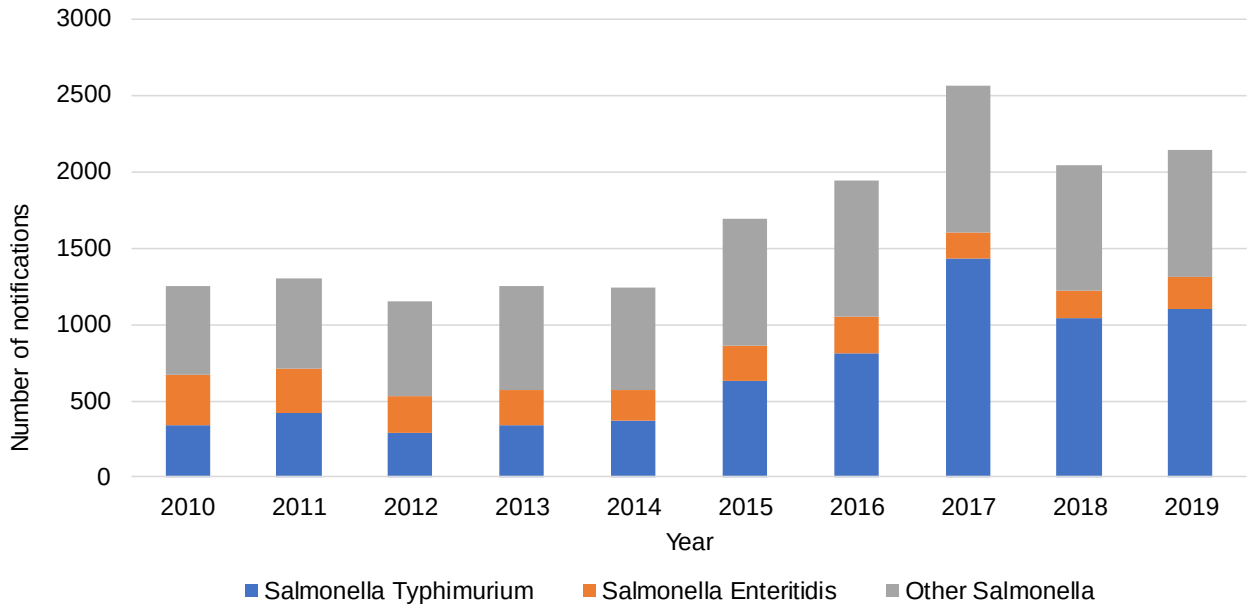


Figure 28. Number of salmonellosis notifications, by serotype, in WA, 2010–2019

Table 12. Number and proportion of salmonellosis notifications, by serotype (top 10) and place of acquisition, in WA, 2010–2019

Serotype	Salmonellosis notifications (N=16,582)		% acquired overseas
	n	%	
***Salmonella* Typhimurium**	6,781	40.9%	5.5%
***Salmonella* Enteritidis**	2,302	13.9%	93.1%
***Salmonella* Paratyphi B bv Java**	710	4.5%	77.8%
***Salmonella* Saintpaul**	474	2.9%	9.2%
***Salmonella* Stanley**	351	2.1%	67.0%
***Salmonella* Infantis**	342	2.1%	12.3%
***Salmonella* Virchow**	312	1.9%	18.7%
***Salmonella* Chester**	293	1.8%	10.0%
***Salmonella* Muenchen**	272	1.6%	2.9%
***Salmonella* Weltevreden**	248	1.5%	66.1%

Place of Acquisition

Over the ten-year period, of the 12,921 (78%) salmonellosis notifications that had place of acquisition recorded, 66% of people acquired their illness in WA, 33% overseas and 1% interstate. Where infection was acquired overseas, the most common countries of acquisition were Indonesia (n=2,691; 63.6%), Thailand (n=397; 9.4%), Malaysia (n=253; 6.0%), Singapore (n=136; 3.2%) and Vietnam (n=124; 2.9%).

Outbreaks

S. Typhimurium was identified in 139 of 154 *Salmonella* point-source outbreaks investigated between 2010 and 2019. Of the *S.* Typhimurium outbreaks, most (n=130, 94%) were due to food-borne or probable foodborne transmission, especially consumption of raw or undercooked eggs.

Rotavirus

Rotavirus is a virus that infects the digestive system. It is the most common cause of infectious diarrhoea in children around the world and is associated with approximately one-third to one-half of all diarrhoea-related hospitalisations in infants and children aged less than five years. Infection is mainly spread person-to-person, when infected people do not wash their hands effectively after going to the toilet and then prepare food for other people, or touch surfaces or objects that are used by other people (e.g. toys, changing tables, or doorknobs). Vaccination against rotavirus infection is offered to children under the national immunisation program (NIP) in Australia.

Temporal Trends

Between 2010 and 2019, rotavirus infection was the third most commonly notified enteric infection in WA, accounting for approximately 7.5% (n=4,034) of enteric notifications, with an overall mean annual ASR of 16.0 notifications per 100,000 population (Table 4 and Table 5). The ASR varied over the ten-year period, with the highest rates observed in 2010 (26.9 per 100,000; n=617) and the lowest in 2016 (6.9 per 100,000; n=179) (Figure 29). Rotavirus exhibits a pattern of biennial peaks in WA similar to other countries and regions with a mass rotavirus immunisation program in place (Figure 29).

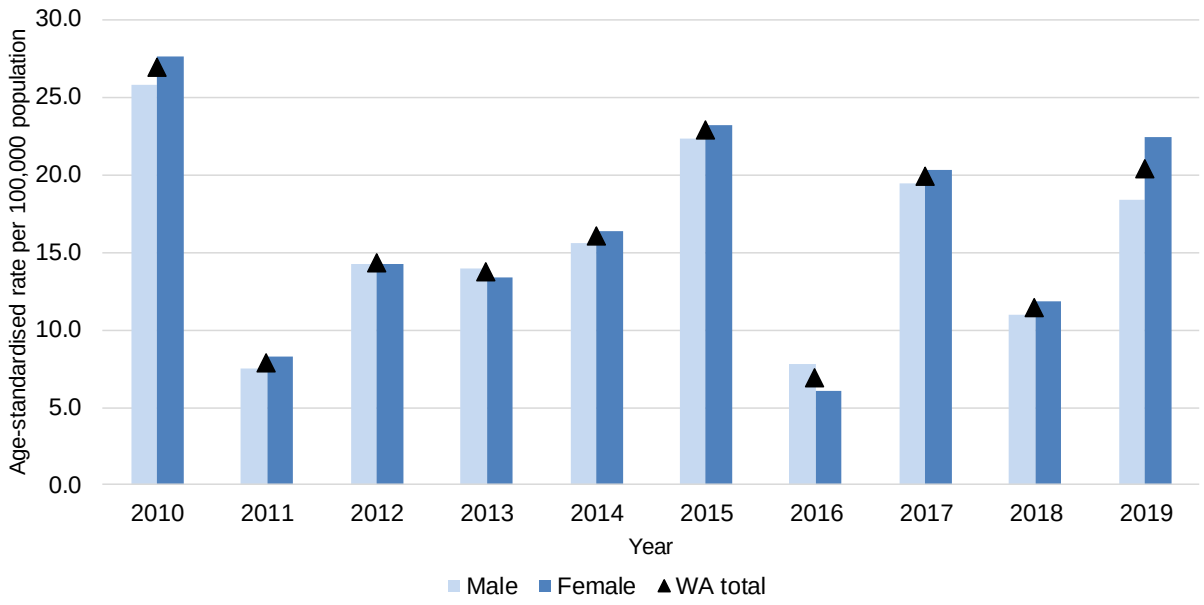


Figure 29. ASR per 100,000 for rotavirus notifications, by sex and year of disease onset, in WA, 2010–2019

Unlike the seasonal pattern of most other common notifiable enteric pathogens, rotavirus infection is more common in the winter months (May-August) in WA (Figure 30).

Sex and Age

Between 2010 and 2019, the mean annual ASR in females was slightly higher compared to males (16.3 versus 15.5 per 100,000 population) (Appendix 1). The rates in females were slightly higher than males in 8 of the 10 years reviewed, with 2019 showing a 22% higher rate in females compared to males (Figure 29). The 0-4 year age group with a mean annual notification rate of 135.1 per 100,000 population had the highest rate followed by the 85+ year age group (40.3 per 100,000 population) (Figure 31). Females had higher rates than males for all age groups, except for those aged 0 to 14 years where females had lower rates than males.

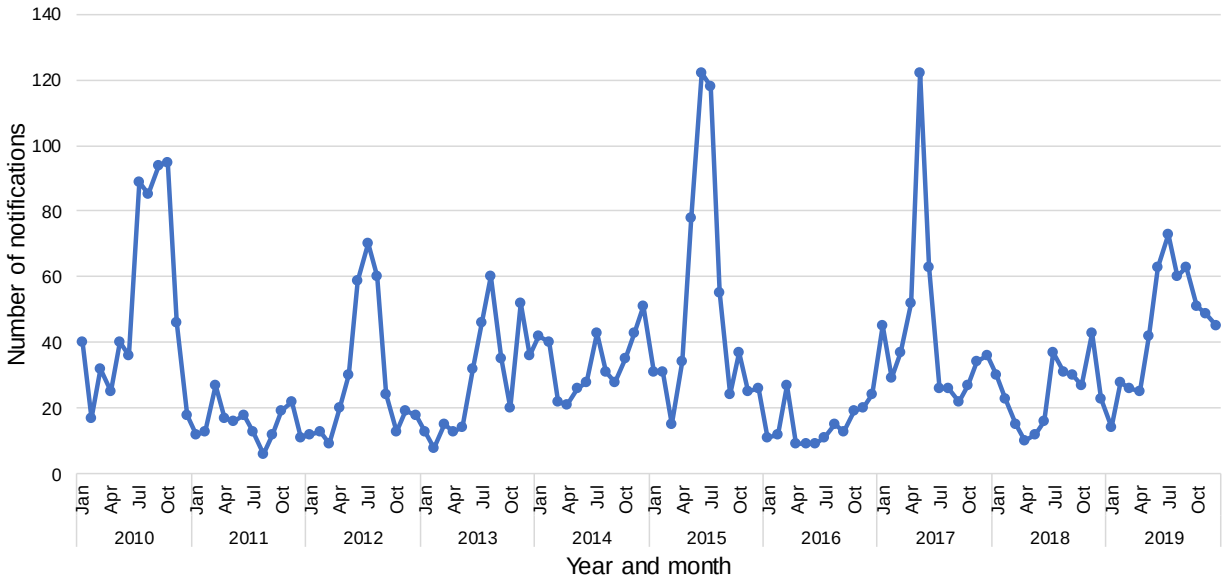


Figure 30. Number of rotavirus notifications in WA, by month and year, in WA 2010–2019

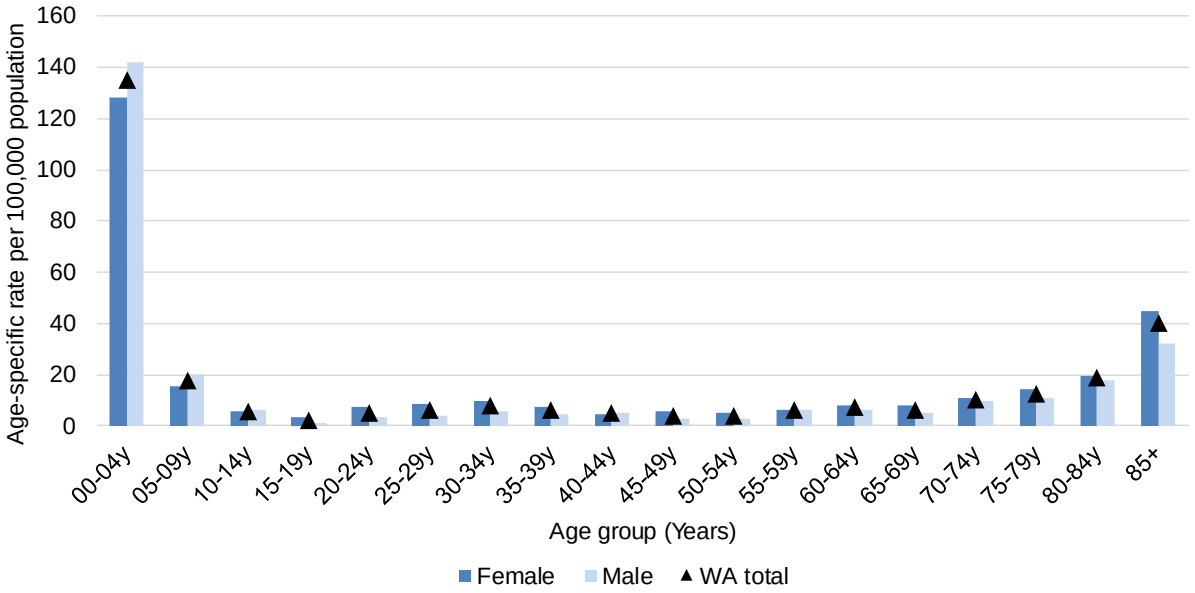


Figure 31. Age-specific rates (per 100,000 population) for rotavirus infection notifications, by sex, in WA, 2010–2019

Aboriginal Status

Over the ten-year period, the mean annual ASR for rotavirus infection among the Aboriginal population was two-fold higher than that of the non-Aboriginal population (28.0 versus 14.0 per 100,000) (Appendix 2). The notification rates in Aboriginal people were higher than non-Aboriginal people for each of the 10 years examined, and the largest difference in rates was observed in 2017 with 4.6-fold higher rates observed in Aboriginal people (Figure 32).

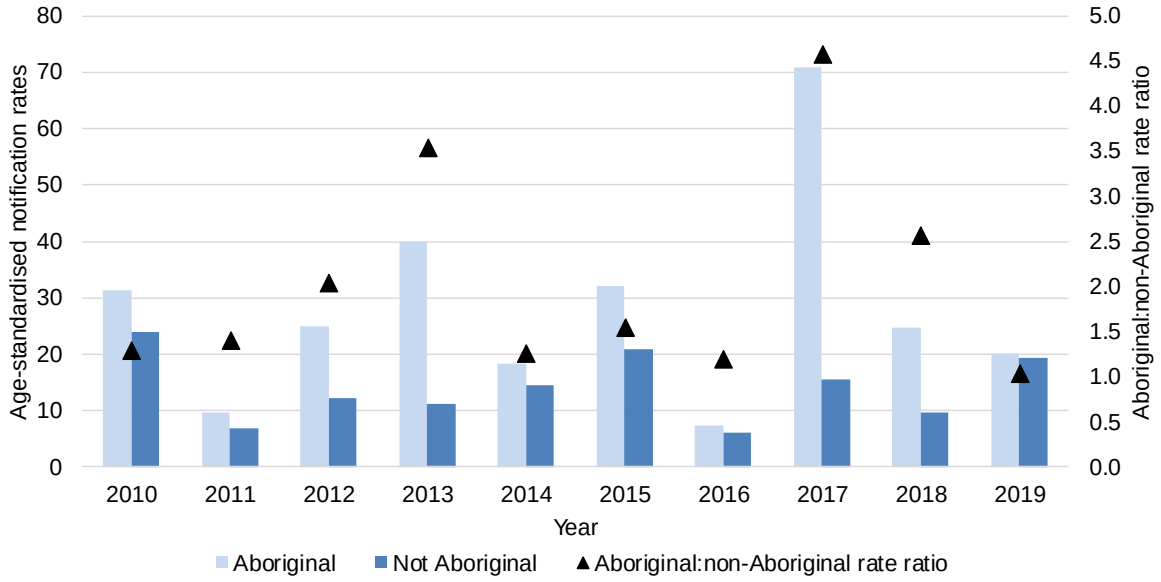


Figure 32. ASR (per 100,000 population) for rotavirus notifications, by Aboriginal status and year of disease onset in WA, 2010–2019

Region

Over the ten-year period, the mean annual ASR was highest in the Kimberley region (49.3 per 100,000; n=224) followed by the Pilbara region (31.8 per 100,000 population; n=230). For at least seven of the 10 years analysed, these two regions had consistently higher rates than the other regions (Table 13 and Appendix 3). The higher rate in these regions is strongly influenced by the observed higher rates among Aboriginal people (Figure 32 and Appendix 2) with these regions having a higher proportion of Aboriginal people compared to other regions. For the same period, the Great Southern region had the lowest rate, at 8.5 per 100,000 population (n=50).

Table 13. Numbers (n) and ASR (per 100,000 population) for rotavirus notifications, by year and region, in WA, 2010–2019

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	617	186	347	344	410	596	179	519	297	539	4,034
	rate	26.9	7.9	14.2	13.7	16.0	22.9	6.9	19.9	11.4	20.3	16.0
Goldfields	*n*	4	4	10	9	14	22	7	32	12	8	122
	rate	5.9	8.0	14.5	14.4	20.9	32.6	10.7	51.3	18.5	12.5	18.8
Great Southern	*n*	9	0	8	4	3	10	2	2	7	5	50
	rate	15.8	0.0	13.4	6.4	5.7	17.1	3.5	3.0	10.7	8.7	8.5
Kimberley	*n*	7	7	25	41	16	23	2	75	25	3	224
	rate	14.7	14.5	61.1	88.8	33.6	48.3	4.0	164.5	56.8	6.2	49.3
Metropolitan Perth	*n*	500	155	250	235	306	433	152	327	220	458	3,036
	rate	28.3	8.5	13.2	12.0	15.3	21.2	7.4	15.9	10.6	21.6	15.3
Midwest	*n*	12	3	7	6	6	14	5	15	4	17	89

	rate	17.6	4.4	10.1	8.9	8.9	19.6	7.6	23.7	6.8	27.5	13.4
Pilbara	*n*	26	8	26	32	27	36	3	42	18	12	230
	rate	39.2	12.4	37.7	43.9	37.1	48.3	4.0	56.0	23.2	17.5	31.8
South West	*n*	39	6	14	10	29	37	4	18	7	26	190
	rate	24.4	3.6	8.0	5.7	16.5	20.6	2.3	9.7	4.4	14.8	10.9
Wheatbelt	*n*	20	3	7	7	9	21	4	8	4	10	93
	rate	25.5	3.4	9.0	8.7	12.5	26.7	4.9	11.5	6.2	12.5	12.0

Outbreaks

Over the ten-year period, there were 35 rotavirus outbreaks investigated, with most outbreaks investigated in 2010 (16 outbreaks), followed by 2015 (8 outbreaks). The most common setting for rotavirus infection outbreaks was residential care facilities (RCFs) (24 outbreaks), followed by CCCs (five outbreaks). In 2017, there was a concurrent increase noted in rotavirus infection and *Shigella* in Aboriginal communities in the Northern Territory, South Australia and WA. In WA, cases were noted in the Kimberley, Pilbara, Midwest and Goldfields regions. This increase in rotavirus infection was due to increased transmission of strain G2P[4] [1].

Immunisation

In Australia, two rotavirus infection vaccines (Rotarix and RotaTeq) have been included in the NIP for all infants born since 1 May 2007. The WA program provided Rotarix at ages 2 and 4 months from July 2007, and then changed to RotaTeq at ages 2, 4 and 6 months from July 2009. Since July 2017, WA reverted back to using the Rotarix vaccine as it was supplied by the Commonwealth Government as part of the NIP.

During this ten-year period there were 1,959 rotavirus infection notifications in children aged 0-2 years. Of these cases it was reported that 59% were fully vaccinated for age, 18% partially vaccinated, 15% not vaccinated and 5% with vaccination status unknown.

Cryptosporidiosis

Cryptosporidiosis is a form of gastroenteritis that is caused by the parasite *Cryptosporidium*. The parasite is a single celled organism that is found in faeces of infected humans and some animals (including cattle). Transmission of *Cryptosporidium* infection can be person-to-person, waterborne, animal-to-person, or less commonly by ingestion of contaminated food (e.g. raw cow's milk). Outbreaks can occur if swimming pools or local drinking water supplies have been contaminated, or through person-to-person transmission. Waterborne outbreaks can be particularly common for *Cryptosporidium* as people can continue to shed the parasite for up to several weeks after symptoms resolve and it is more resistant than other pathogens to chlorine concentrations used in water treatment.

[1] Australian Rotavirus Surveillance Program: Annual Report, 2017. Communicable Diseases Intelligence 2019 - Australian Rotavirus Surveillance Program: Annual Report, 2017 (health.gov.au)

Temporal Trends

Cryptosporidiosis was the fourth most common notifiable enteric disease with 2,664 notifications between 2010 and 2019, equating to a mean annual ASR of 10.7 per 100,000 (Table 4 and Table 5). The notification rate was highest in 2011 (19.4 per 100,000 population; n=451) followed by 2017 (15.7 per 100,000; n=400), due to large community outbreaks (mostly in the metropolitan area) in these years (Figure 33). PCR testing for *Cryptosporidium* was introduced in 2014 and 2016 in two WA pathology labs; however, this had no observable impact on the notification rate, with variable increases or decreases over the ten-year period. During this 10 year period there was a clear seasonality, with peaks in the summer and autumn months (January-May) and notifications generally lower from June to October (Figure 34).

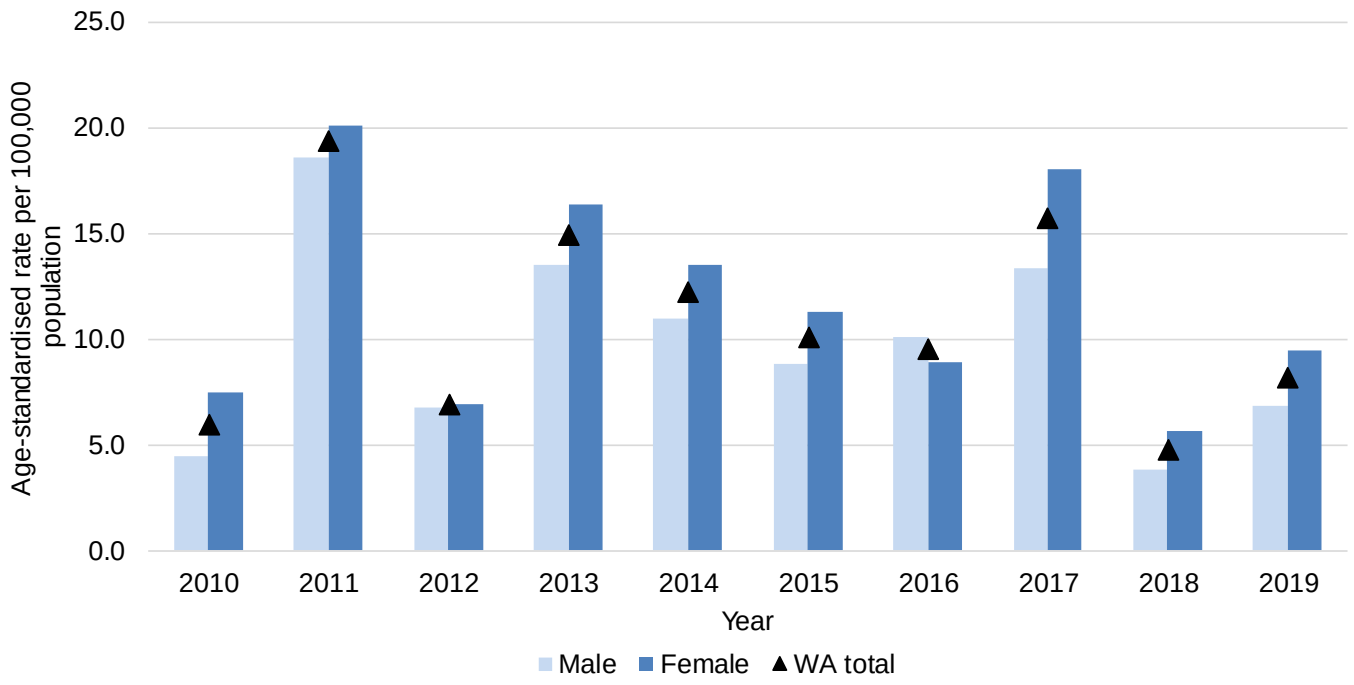


Figure 33. ASR (per 100,000 population) for cryptosporidiosis notifications, by sex and year of disease onset, in WA 2010–2019

Sex and Age

Between 2010 and 2019, the mean annual ASR in females was 1.2-fold higher than males (11.8 versus 9.7 per 100,000 population) (Appendix 1). With the exception of 2016, the ASR were consistently higher among females compared to males over the surveillance period; however, the female-to-male ratio varied over the ten-year period (Figure 33). Children aged less than 5 years were the most affected group with a mean annual notification rate of 62.2 per 100,000 population, accounting for 39% (n=1,044) of cryptosporidiosis notifications, followed by children aged 5-9 years (18.8 per 100,000; n=305) (Figure 35). Among adults, notification rates were particularly higher among those aged 25-39 years, especially among females, possibly reflecting carers of children aged less than 10 years who are at highest risk for this disease.

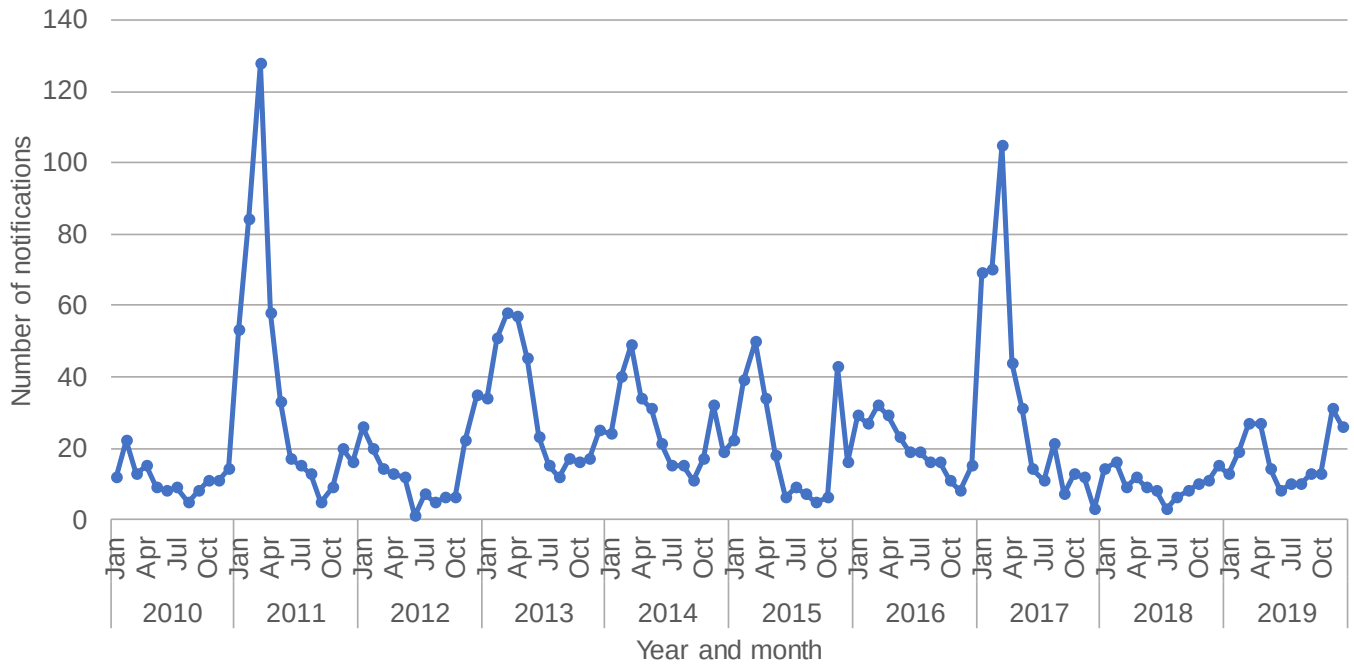


Figure 34. Number of cryptosporidiosis notifications, by month and year of disease onset, in WA 2010–2019

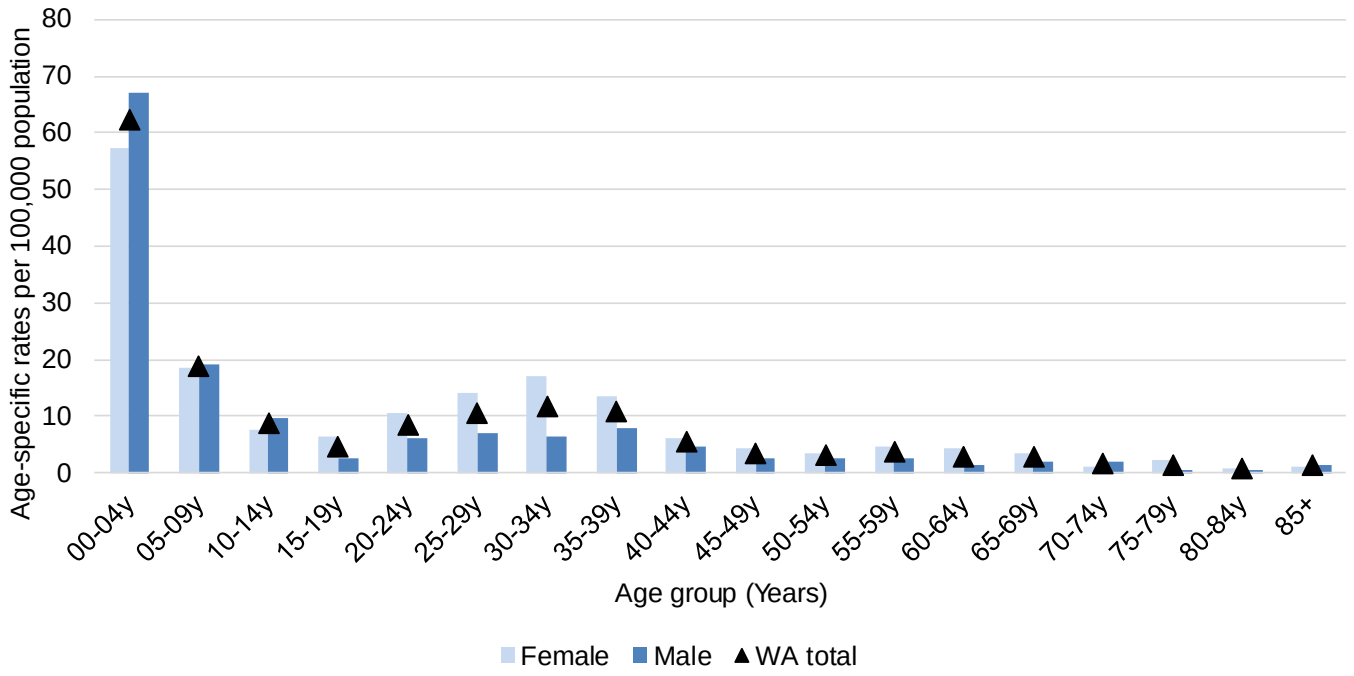


Figure 35. Age-specific rates (per 100,000 population) for cryptosporidiosis notifications, by sex, in WA 2010–2019

Aboriginal Status

Approximately 5% (n=143) of all notifications for cryptosporidiosis did not have Aboriginal status reported. Between 2010 and 2019, the mean annual ASR among Aboriginal people was 2.8-fold higher than in the non-Aboriginal population (25.1 versus 9.0 per 100,000 population) (Appendix

2). The ASR among Aboriginal people were highest in 2011 (57.3 per 100,000; n=96) and declined from 2015 to 2019 (Figure 36). Among the Aboriginal population, children aged 0-4 years accounted for nearly 90% of all notifications (n=364/408), with a mean annual notification rate of 320.1 per 100,000 population. In contrast, only 40% (n=630/2,113) of all notifications among the non-Aboriginal population were in children aged 0-4 years with a mean annual notification rate of 40.3 per 100,000 population.

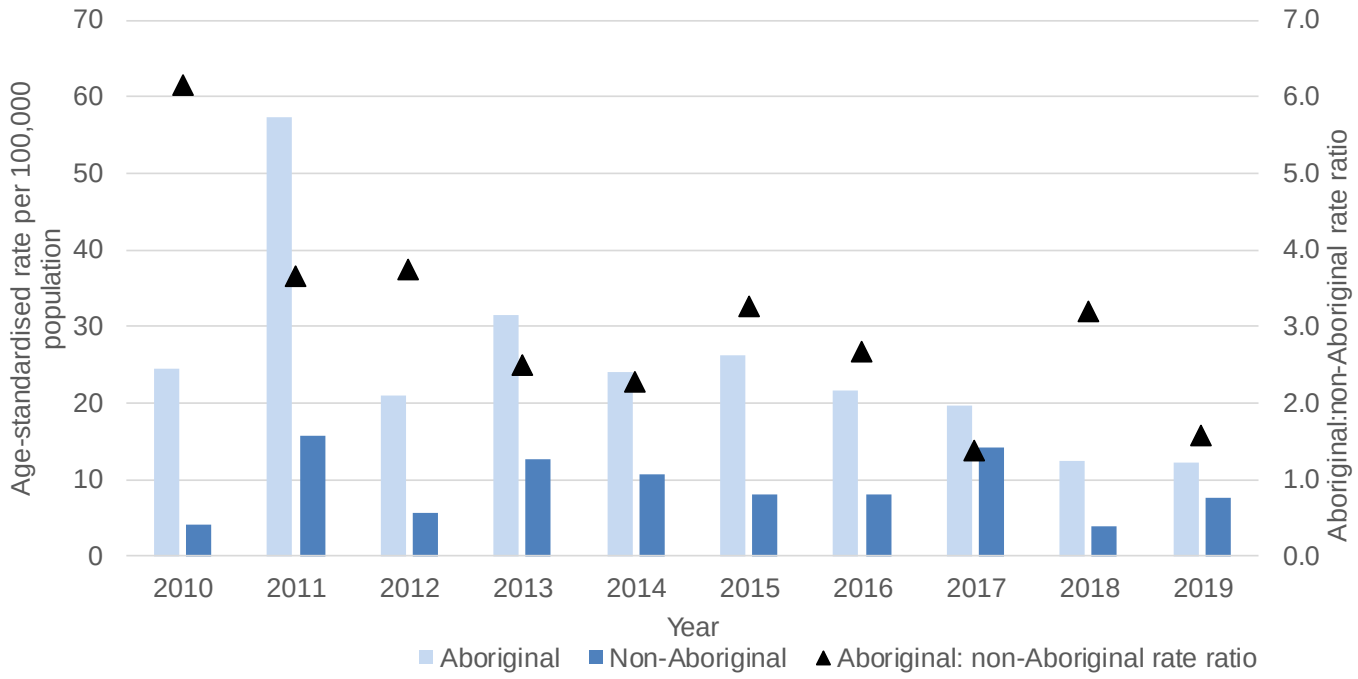


Figure 36. ASR (per 100,000 population), for cryptosporidiosis notifications, by Aboriginal status, in WA 2010–2019

Region

The highest cryptosporidiosis rates have consistently been reported in the Kimberley region, with the mean annual ASR in the Kimberley region 7-fold higher than the overall WA notification rate (74.9 versus 10.7 per 100,000 population) (Table 14). The Pilbara region had the second highest rate (26.1 per 100,000 population) while the Perth metropolitan region reported the lowest rate (8.1 per 100,000 population).

Place of Acquisition

Of the 2,010 (75%) cryptosporidiosis notifications that had place of acquisition recorded over the ten-year period, 85% (n=1,710) of people acquired their illness in WA, 14% (n=280) overseas and 1% interstate.

Outbreaks

During the reporting period, a total of 18 outbreaks due to cryptosporidiosis were identified. Of these outbreaks, eight were person-to-person transmission mostly in CCCs, seven were waterborne (recreational water) and three were due to animal-to-person transmission. There were

two significant increases of cryptosporidiosis in 2011 and 2017. In 2011 there was a community-wide outbreak in regional and metropolitan areas from January to April which included person-to-person outbreaks in CCCs and an RCF, a cluster in an Aboriginal community, and a metropolitan public pool visited by a number of cases. The source of the outbreak was not determined but may have been due to several reasons including a new strain of *Cryptosporidium* circulating in the community, a new cohort of susceptible (<10 years old) people in the community and/or contamination of swimming pools. From January to May 2017, there was another large increase in cryptosporidiosis notifications in the metropolitan area. Part of this increase was associated with three public swimming pool outbreaks in the first quarter of 2017.

Table 14. Numbers (n) and ASR (per 100,000 population) for cryptosporidiosis notifications, by year and region, in WA (2010–2019)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	137	451	167	370	308	255	244	400	121	211	2,664
	rate	5.9	19.4	6.9	14.9	12.2	10.1	9.5	15.7	4.7	8.2	10.7
Goldfields	*n*	6	15	11	15	10	1	8	18	0	4	88
	rate	8.9	21.6	16.0	22.3	15.0	1.9	11.8	28.8	-	6.9	13.5
Great Southern	*n*	3	11	10	9	6	3	3	5	9	2	61
	rate	6.7	22.0	18.4	17.1	9.2	5.1	5.3	10.7	18.0	3.6	11.6
Kimberley	*n*	18	60	41	58	26	57	20	18	18	36	352
	rate	37.5	125.4	89.3	118.6	54.3	121.9	42.9	38.1	37.8	82.4	74.9
Metropolitan Perth	*n*	58	248	83	214	205	124	168	292	65	122	1,579
	rate	3.2	13.9	4.4	11.1	10.4	6.2	8.3	14.5	3.2	5.8	8.1
Midwest	*n*	11	40	1	9	7	3	4	15	1	3	94
	rate	16.1	61.3	1.4	13.4	10.1	4.1	6.1	23.9	1.6	5.4	14.5
Pilbara	*n*	13	24	10	18	19	41	21	20	8	14	188
	rate	19.3	33.7	15.0	24.6	25.5	54.0	26.7	30.9	10.6	19.9	26.1
South West	*n*	17	39	7	36	26	20	14	18	17	28	222
	rate	11.0	25.0	4.7	22.5	16.0	12.6	8.9	11.1	10.2	17.5	13.9
Wheatbelt	*n*	11	14	4	11	9	6	6	14	3	2	80
	rate	14.9	18.9	6.3	13.5	13.1	8.7	9.5	20.0	5.1	3.0	11.4

Shigellosis

Shigellosis is an infection of the digestive tract, caused by *Shigella* bacteria. The most common mode of transmission is person-to-person, although foodborne transmission has been reported. Shigellosis is more common among people living in remote regions of WA, overseas travellers and MSM.

Temporal Trends

Between 2010 and 2019, shigellosis was the fifth most commonly notified infection in WA accounting for approximately 2.6% of all enteric disease notifications (n=1,398/ 53,602) with a mean annual ASR of 5.6 per 100,000 population (Table 4 and Table 5). Notification rates for shigellosis remained stable from 2010 to 2016 but since 2017 there has been a steady annual increase in the number of notifications. The increase in shigellosis notifications in 2018 and 2019 can be attributed to a change in the shigellosis case definition. Prior to the third quarter of 2018, only culture confirmed cases were notifiable. Subsequently, probable cases (specimens positive for *Shigella* by PCR) were also notifiable.

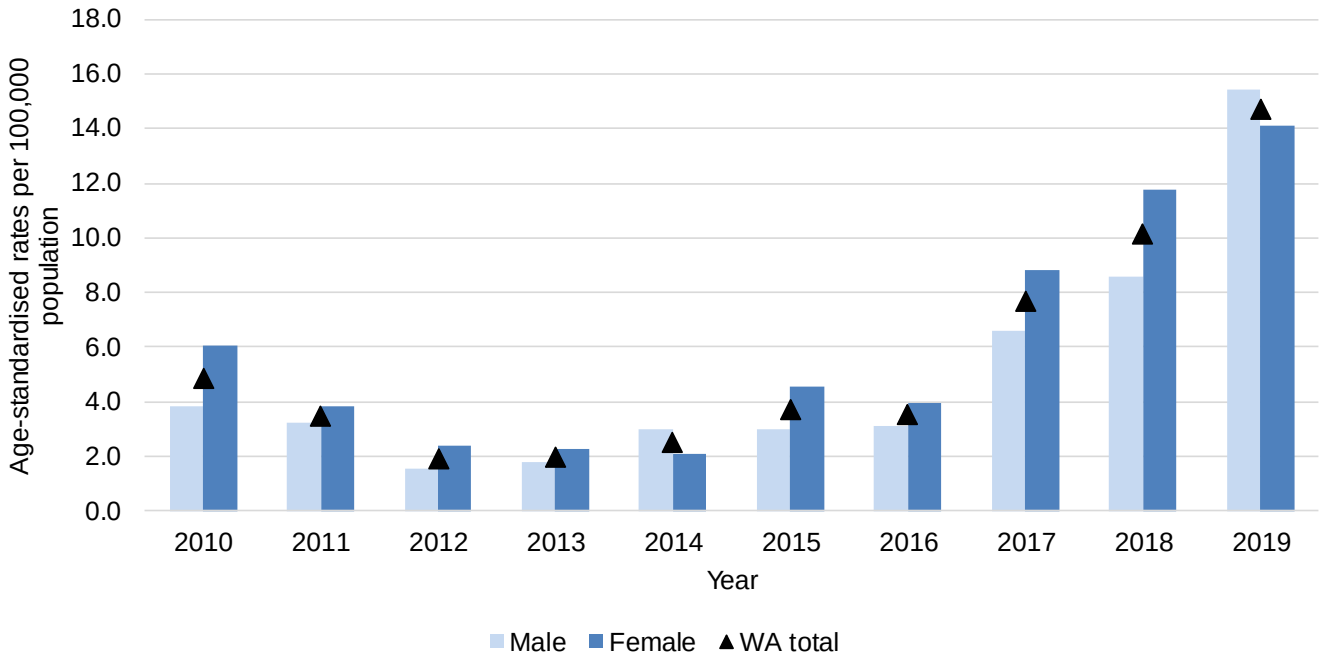


Figure 37. ASR (per 100,000 population) for shigellosis notifications, by sex and year of disease onset, in WA 2010–2019

Sex and Age

Between 2010 and 2019, the rate of shigellosis was 20% higher in females compared to males with mean annual ASR of 6.1 and 5.1 per 100,000 population, respectively. The rate in females was higher than males for 8 of the 10 years reviewed; however, the female to male rate ratio varied over the years (Figure 37). Approximately 21% (n=291) of all shigellosis notifications were in the 0-4 year age group reflecting a mean annual notification rate of 17.3 per 100,000 population, followed by the 5-9 year age group with 8.1 per 100,000 population (n=132). Notification rates were higher in females than males for most age groups, with the biggest difference between females and males observed in the 20-29 year age group (Figure 38).

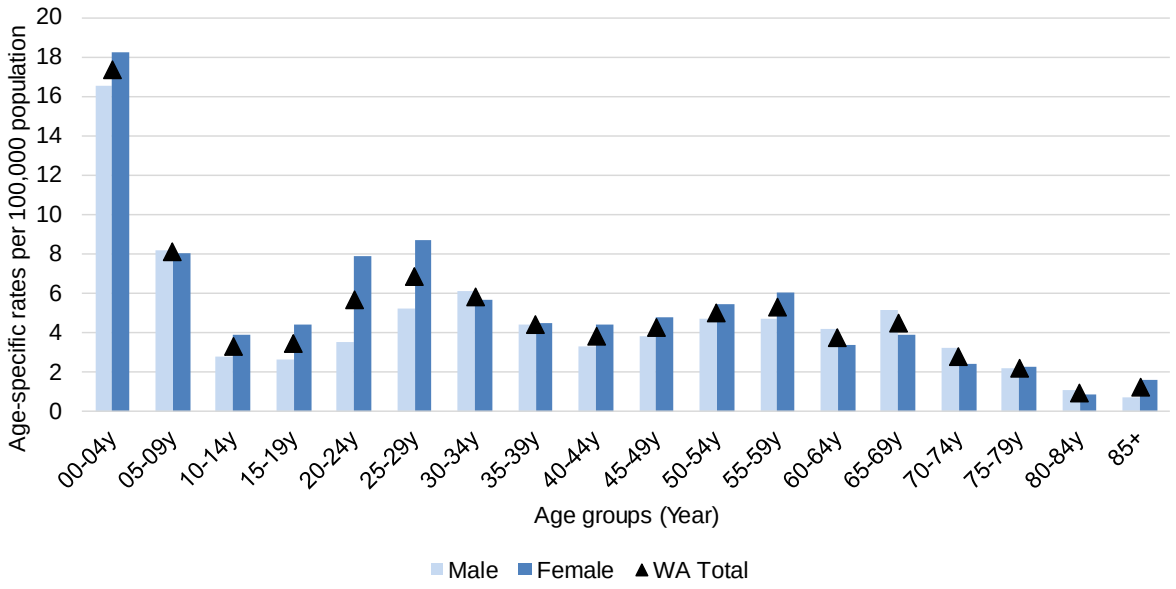


Figure 38. Age-specific rates (per 100,000 population) for shigellosis notifications, by sex, in WA 2010–2019

Aboriginal Status

Over the ten-year period, the mean annual ASR among the Aboriginal population was nearly 15-fold higher than that of the non-Aboriginal population (50.3 versus 3.4 per 100,000 population) (Figure 39 and Appendix 2). The ASR among Aboriginal people was higher than non-Aboriginal people for each of the 10 years examined, and the largest difference in rates was observed in 2017 when notification rates were 34-fold higher in Aboriginal people compared to non-Aboriginal people (101.1 vs 3.0 per 100,000 population).

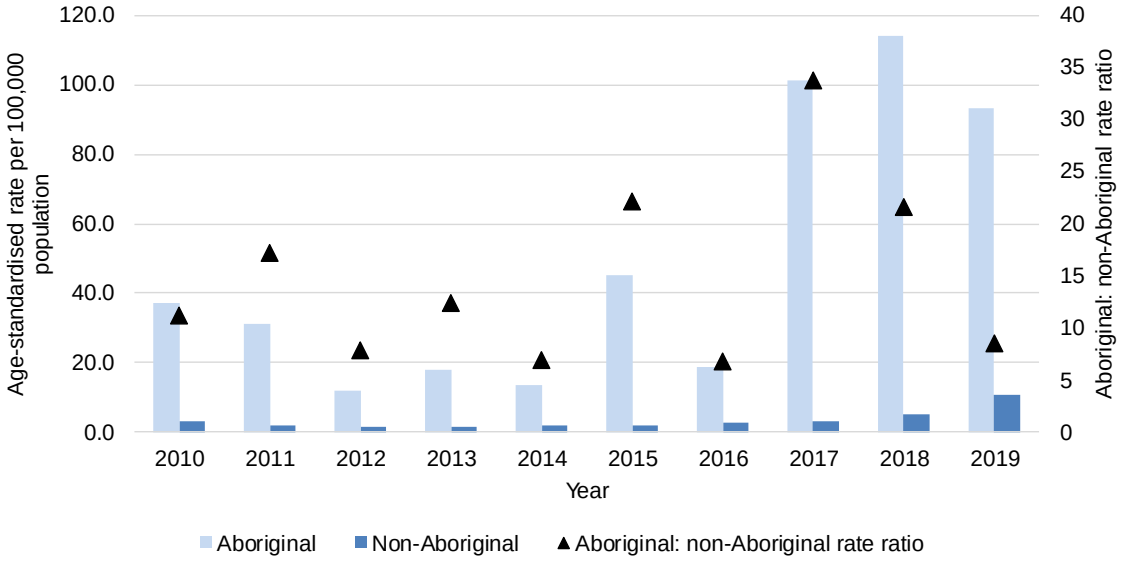


Figure 39. ASR (per 100,000 population) for shigellosis notifications, by Aboriginal status and year of disease onset, in WA 2010–2019

Region

Over the ten-year period, the Kimberley had the highest mean annual ASR at 63.6 per 100,000 population (n=255), which was 11-fold higher than the overall WA rate, followed by the Pilbara (19.1 per 100,000; n=117) and Goldfields (18.6 per 100,000; n=113) (Appendix 3). The higher rate in the remote regions is strongly influenced by the observed higher rates in Aboriginal people (Figure 39) with these regions having a higher proportion of Aboriginal people compared to other regions. The South West region had the lowest rate of shigellosis notifications (2.1 per 100,000 population; n=35).

Subtype

Speciation data was available for 79% (n=11,107) of shigellosis notifications. Of these, more than half (52%; n=580) were *S. sonnei*, followed by *S. flexneri* (36%; n=501), *S. boydii* (2%; n=17) and *S. dysenteriae* (<1%, n=9). Of the *S. sonnei*, biotype A (44%; n=255) and biotype G (43%; n=248) were the most common subtypes identified.

Place of Acquisition

Of the shigellosis cases for which travel history could be obtained (n=1,017), 59% (n=597) were acquired in WA, 41% overseas and 1% interstate. The most common countries of acquisition were Indonesia (n=185), India (n=67) and Vietnam (n=17). Of the *S. sonnei* cases, biotype G was most commonly associated with overseas travel (52%; n=128/248), while 64% (n=164/255) of biotype A were acquired in WA. *S. flexneri* cases were mostly associated with acquisition in WA (63%; n=317/501).

Outbreaks

During the ten-year period, two outbreaks of shigellosis in Aboriginal communities were investigated. Emergence and increased transmission of *S. sonnei* biotype A was observed between December 2014 and March 2015 and continued to circulate at higher levels until mid-2017, mainly in the Kimberley, Pilbara and Midwest regions. This was followed by the emergence and increased transmission of *S. flexneri* serotype 2B, and to a lesser extent serotype 2A, in these regions from the second quarter of 2017 onwards.

Shiga toxin-producing *E. coli* infection

Shiga toxin-producing *E. coli* (STEC) is a type of *Escherichia coli* which produce toxins that can be pathogenic in people. STEC is mainly found in the faeces of cows, sheep and other ruminants. Infection with STEC occurs through ingestion of the bacteria, which may occur through eating undercooked beef or lamb or contaminated fresh produce, drinking unpasteurised milk or contaminated water, contact with farm animals and their faeces, or person-to-person transmission from an infected person. A small proportion of people with STEC infection, most commonly children under five and the elderly, may develop haemolytic uraemic syndrome (HUS).

Temporal Trends

There were 354 cases of STEC infection notified from 2010 to 2019, equating to a mean annual ASR of 1.4 per 100,000 population. Between 2010 and 2015, less than 10 cases were notified per year. However, since 2015 rates increased from 0 in 2015 to 5.6 notifications per 100,000 population (n=150 notifications) in 2019 (Figure 40 and Table 4). The increase in STEC infection notification rates since 2016 is largely due to the introduction of PCR tests on faecal samples for STEC by two pathology laboratories.

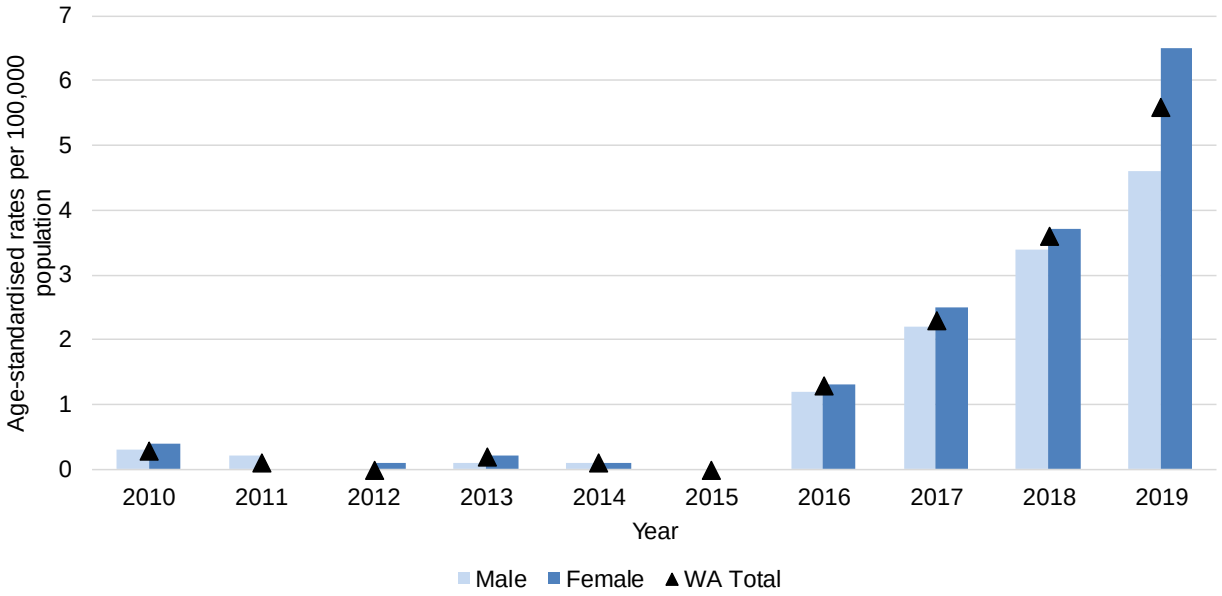


Figure 40. ASR (per 100,000 population) for Shiga toxin-producing E. coli *notifications, by sex and year of disease onset, in WA 2010–2019*

Sex and Age

Over the ten-year period, the mean annual ASR was slightly higher among females than males (1.5 versus 1.3 per 100,000 population) (Appendix 1). People aged over 85 years had the highest mean annual notification rate (3.8 per 100,000 population; n=15) followed by those aged 75-79 years (3.2 per 100,000; n=19) and children aged <5 years (2.3 per 100,000; n=39).

Aboriginal Status

Between 2010 and 2019, 5% (n=17) of STEC infection notifications were reported in Aboriginal people, 90% (n=319) in non-Aboriginal people and 5% (n=18) of notifications were of unknown Aboriginal status. The mean annual ASR for the period 2010 to 2019 was 1.7 fold higher among the Aboriginal population than in the non-Aboriginal population (2.3 vs 1.3 per 100,000 population) (Appendix 2).

Region

Over the ten-year period, the mean annual ASR were highest in the Great Southern region (2.6 per 100,000 population; n=16) followed by the Midwest region (2.1 per 100,000 population; n=-15);

whilst in contrast the Wheatbelt region reported the lowest rate at 0.7 per 100,000 population (Appendix 3).

Serotype

For the reporting period (2010 to 2019), serogroup information was available for 174 (49%) STEC infection cases. Serogroup information was obtained by serotyping cultured isolates or by PCR targeting serogroup-specific genes. The remaining cases were either not able to be serotyped or were Shiga toxin positive by PCR and/or culture negative. The most common serogroups identified were O157 (n=67), O128 (n=25), O26 (n=16), O111 (n=8) and O91 (n=6). The severity of illness varied among the different serogroups with O157 most commonly associated with bloody diarrhoea and hospitalisation, while O128 and O91 were more frequently associated with milder illness.

Place of Acquisition

Over the ten-year period, of the 321 (91%) STEC infection notifications that had place of acquisition recorded, 78% of people acquired their illness in WA, 21% overseas and 1% interstate. During the reporting period, no local clusters or outbreaks were identified.

Hepatitis A

The hepatitis A virus causes an infection of the liver and is found in the faeces of people with the infection. Transmission is via the faecal-oral route, and it is usually spread by close personal contact with an infected person (including sexual contact), or by eating or drinking contaminated food or water.

Temporal Trends

From 2010 to 2019, a total of 178 hepatitis A infections were notified, equating to a mean annual ASR of 0.7 per 100,000 population (Table 4 and Table 5). Over the ten-year period, there were several small peaks in notifications associated with outbreaks (see Outbreak section below).

Sex and Age

The overall ASR was 1.5 fold higher in males than in females (0.9 vs 0.6 per 100,000) (Appendix 1). Notification rates were higher in males than females for 8 of the 10 years reviewed, with 2012 showing 3 fold higher rates in males than females (Appendix 1). Approximately 30% (n=54) of all notifications for hepatitis A were among children aged less than 15 years.

Aboriginal Status

Over the ten-year period, there were no reports of hepatitis A in Aboriginal people. Since 2005, vaccination of young Aboriginal children with a hepatitis A vaccine has been recommended and

funded in WA, which has reduced the incidence of this disease in Aboriginal people and throughout the community.

Region

Over the ten-year period, the South West had the highest mean annual ASR of 0.9 per 100,000 population (n=14), which was due to two small outbreaks (four and five cases). The Goldfields region and metropolitan Perth region had the next highest rates (0.8 per 100,000; n=5), with the Goldfields rate mostly influenced by a small outbreak (four cases). In the metropolitan region notifications were mostly due to sporadic infections acquired overseas.

Place of Acquisition

Travel history was available for 98% (n=174) of all hepatitis A notifications. Of these, nearly 74% (n=128) acquired the infection overseas and 26% (n=45) in WA. The most common countries of acquisition were Indonesia (n=21), India (n=14) and the Philippines (n=11).

Outbreaks

During the ten-year period, 17 outbreaks of hepatitis A were investigated. Most of these outbreaks (n=12) were due to person-to-person transmission. There were three multi-jurisdictional foodborne outbreaks due to frozen berries (n=1), frozen pomegranate seeds (n=1) and semi-dried tomatoes (n=1). There were also two foodborne outbreaks where transmission was only reported in WA, which were due to frozen berries (n=1) and kava (n=1).

Vibrio parahaemolyticus infection

Vibrio parahaemolyticus is a bacterium found in estuarine and marine environments. *V. parahaemolyticus* infection can be acquired by eating raw or undercooked seafood, particularly oysters or other shellfish, or drinking contaminated water. Infection usually causes gastrointestinal symptoms but can also cause wound infections when seawater contaminates open wounds.

From 2010 to 2019, 148 cases of *V. parahaemolyticus* infection were reported in WA. The mean annual ASR in males was double that in females (0.8 vs. 0.4 per 100,000 population). Cases ranged in age from 5 years to 89 years (median: 30 years), with 85% (n=126) of all notifications among adults aged 25 to 69 years.

Approximately 94% (n=139) of notifications were among non-Aboriginal people with only 3% (n=4) among Aboriginal people; 3% (n=5) did not have Aboriginal status reported. Among the regions, the mean annual ASR was highest in the Pilbara (1.1 per 100,000; n=7) followed by the Midwest region (0.9 per 100,000; n=5) (Appendix 3).

Over the ten-year period, most cases (71%; n=105) acquired their illness overseas. The most common countries of acquisition were Indonesia (n=38), Thailand (n=29) and Vietnam (n=15). Of the remaining infections, 42 were acquired in WA and one interstate. Of the Australian acquired cases, 24 were wound infections, 18 were gastrointestinal infections and one was from a sputum

sample in a case with no wound infection or symptoms of gastroenteritis. All 18 gastroenteritis cases reported eating seafood, most commonly oysters (n=15), including an outbreak of five cases in 2016.

Typhoid fever

Typhoid fever is an infection caused by *Salmonella* Typhi bacteria, and is usually spread by close personal contact with an infected person, or by eating or drinking contaminated food or water. Some people can become chronic typhoid carriers.

Between 2010 and 2019, there were 123 notifications of typhoid fever, with a mean annual ASR of 0.5 per 100,000 population. Overall, females and males were equally affected (Appendix 1). Approximately 87% (n=107) of the notifications were among people aged less than 35 years. Most (89%; n=110) of the cases resided in Perth metropolitan region. Almost all (98%; n=121) cases of typhoid fever were acquired overseas. The most common countries of acquisition were India (n=80), Indonesia (n=17) and Pakistan (7). Over the ten-year period, two small outbreaks of typhoid fever were investigated within family groups.

Yersiniosis

Yersiniosis is a gastroenteritis infection caused by *Yersinia* species bacteria, of which *Y. enterocolitica* and *Y. pseudotuberculosis* are notifiable in WA. The majority of cases are caused by *Y. enterocolitica*, whereas *Y. pseudotuberculosis* is relatively uncommon in WA. Many domesticated and wild animals carry *Yersinia* in their intestines. Transmission to humans occurs by ingestion of contaminated food and/or water. Contact with infected animals may also cause infection.

There were 112 cases of yersiniosis notified between 2010 and 2019 (Table 4). Notifications increased from 2015 following the introduction of PCR testing of faecal specimens for *Yersinia* by a private pathology laboratory in WA; most (86%) of the yersiniosis notifications between 2015 and 2019 were reported by this pathology laboratory. No cases of *Y. pseudotuberculosis* were reported. There were 57 female and 55 male cases with a median age of 30 years (range between <1 and 88 years). Approximately 91% (n=102) of the notifications were from non-Aboriginal people, with only one notification from an Aboriginal person (Appendix 2).

Of the 81 (72%) yersiniosis notifications over the ten-year period that had place of acquisition recorded, 82% (n=66) acquired their illness in WA, with 17% (n=14) acquiring their illness overseas and 1% acquiring their illness interstate. During the reporting period, three local clusters were investigated in 2015, 2016 and 2019.

Paratyphoid fever

Paratyphoid fever is caused by *Salmonella* Paratyphi bacteria and is usually spread by close personal contact with an infected person, or by eating or drinking contaminated food or water.

A total of 88 cases of paratyphoid fever were notified over the ten-year period, with four to 12 notifications (mean: 8 notifications) each year (Table 4). Overall, there were 51 notifications among males and 37 among females (Appendix 1). Cases ranged in age from 1 to 83 years (median: 29 years) and most of the notifications (44%; n=39) occurred in the 25-34 year age group. Over the ten-year period, all cases of paratyphoid fever were in non-Aboriginal people and most (96%; n=84) resided in the Perth metropolitan region.

Almost all cases of paratyphoid fever (99%; n=87) were acquired overseas. The most common countries of acquisition were India (n=46), Indonesia (n=15) and Bangladesh (n=11). Over the ten-year period, there was one outbreak (n=3) of paratyphoid fever investigated, which was associated with a group who travelled to India for a wedding. The mode of transmission was not identified for the outbreak.

Listeriosis

Listeriosis is a rare but potentially severe illness caused by the bacterium *Listeria monocytogenes* which are widespread in the environment. While infection is uncommon in healthy people; people at greater risk include pregnant women and their unborn babies, and people with chronic medical conditions (such as cancer, diabetes and alcohol abuse) or who are on medications (such as steroids and anti-cancer drugs) that weaken the immune system. Listeriosis can result in miscarriage, premature birth or stillbirth. In other people at risk, listeriosis may cause septicaemia and meningitis.

There were 64 cases of listeriosis notified between 2010 and 2019 in WA, with three to eight cases notified per year (Table 4 and Table 5). Over the ten-year period, the median age of cases was 69 years (range: <1 year to 94 years), with 56% (n=36) of notifications occurring in people aged 60 years or older, and 53% (n=34) of notifications in females. Three cases were in Aboriginal people, with the remainder (n=61) non-Aboriginal people. The majority (89%; n=57) of cases were from the Perth metropolitan region. Most cases (92%; n=59) acquired their illness in WA.

There were 11 pregnancy related listeriosis notifications of which there was one maternal-foetal pair, and one instance where only the neonate was diagnosed. Of these 11 notifications, there were no maternal deaths, however there were three associated foetal deaths. There were three deaths due to listeriosis in non-pregnancy cases.

Two listeriosis outbreaks involving WA cases occurred between 2010 and 2019, including a multi-jurisdictional outbreak associated with consumption of brie and camembert cheeses in 2012 - 2013 and a local outbreak linked to a frozen meal delivery service in 2013.

Hepatitis E

The hepatitis E virus is found in the faeces of people with the infection. It is usually spread by close personal contact with an infected person, or by eating or drinking contaminated food or water.

Between 2010 and 2019, there were 26 notifications of hepatitis E in WA, with up to four notifications each year (Table 4). Most hepatitis E notifications were in males (77%; n=20) with six in females. Of the notifications with known Aboriginality status, the majority (96%; n=24/25) were in non-Aboriginal people, with one case in an Aboriginal person. Twenty-four of the notifications were among residents of Perth metropolitan region and two from the Kimberley region (Appendix 3).

Of the notifications with known travel history, most (83%; n=20/24) acquired their illness overseas with four cases acquiring their illness in WA. The most common countries of acquisition were India (n=10), Bangladesh (n=2) and Thailand (n=2). During the ten-year period, there was one small (n=3) outbreak of hepatitis E investigated associated with a maritime vessel that had returned from the Middle East.

Cholera

Cholera is a bacterial gastroenteritis caused by toxigenic *Vibrio cholerae* serogroup O1 and O139. Transmission occurs through ingestion of food or water contaminated directly or indirectly by the faeces of an infected individual.

In Australia, cholera is usually notified among returning travellers infected in endemic countries. Over the reporting period (2010 to 2019) there were two notifications of cholera in WA (one each in 2011 and 2017) (Table 4). Both were O1 serogroup and acquired overseas in the Philippines (n=1) and Thailand (n=1).

Botulism

Botulism is caused by the toxin of *Clostridium botulinum* bacteria and transmission can be food-borne (ingestion of pre-formed toxin in food or spores from soil or dust) or environmental (wound contamination with spores).

Over the ten-year period (2010 to 2019), there was only one case of botulism reported (2015) in a female child aged seven months. The mode of transmission was not identified.

Sexually Transmissible Infections

Sexually transmissible infections (STIs) are passed from person-to-person by unprotected vaginal, oral or anal sex with an infected person. Some STIs can also be transmitted vertically from mother to child. For this report, notifiable STIs in WA include chlamydial infection, gonococcal infection, syphilis, donovanosis and chancroid. As HIV is predominantly acquired through sexual contact in WA, HIV has been included in this section. Hepatitis B, hepatitis C and hepatitis D viruses can also be sexually transmitted but are discussed in the section on blood-borne viruses.

Between 2010 and 2019, STIs were the most frequently notified group of diseases in WA with a total of 144,266 notifications, reflecting a mean annual ASR of 580.9 per 100,000 population over the ten-year period. There were 16,402 STI notifications in WA in 2019 representing a 5% increase from 2018 (n=15,577) and a 10% increase in comparison to the 2014 to 2018 five-year average of 14,764.8 notifications per year (Table 4). Over the ten-year period, the most frequently notified STIs were chlamydial infection (n=114,200 79%) and gonococcal infection (n=25,750; 17.8%); Figure 41.

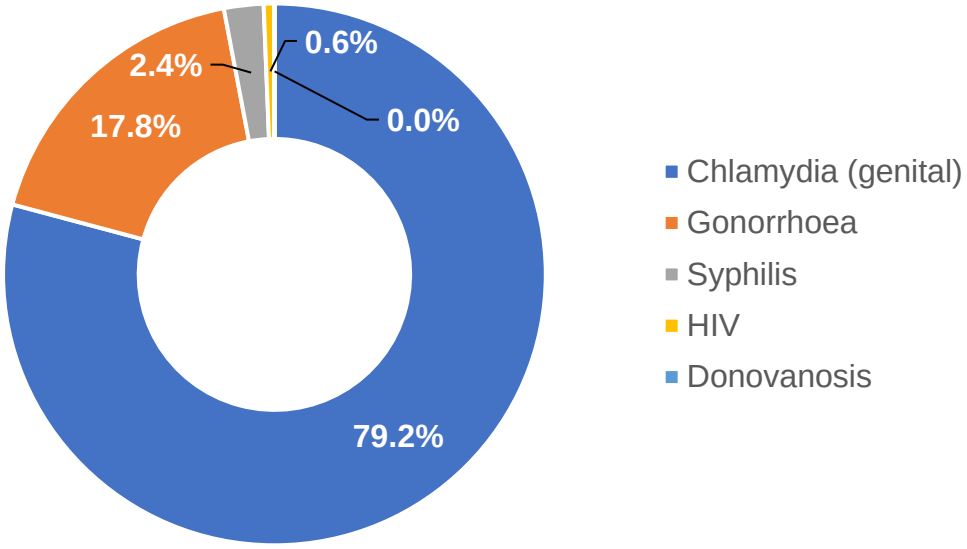


Figure 41. Proportion of notified cases of sexually transmitted infections in WA, 2010–2019

Chlamydial infection

Chlamydial infection is caused by *Chlamydia trachomatis* bacteria and can be passed from person-to-person by unprotected vaginal, oral or anal sex with an infected person. The infection can also be transmitted vertically from mother to child.

Temporal Trends

Between 2010 and 2018, chlamydial infection was the most frequently notified disease in WA (n=114,200) and the mean annual ASR was 459.7 per 100,000 population (Table 4 and Table 5). The number of notifications in 2019 (n=11,580) was comparable to the 2014 to 2018 five-year average of 11,463 notifications per year. The notification rate remained stable from 2010 to 2019 (429.3 to 418.7 per 100,000 population) (Figure 42). Over this time period, the chlamydia testing rate increased by 34% (53.5 to 71.5 per 1,000 population) while the test positivity rate decreased by 31% (5.8% to 4.0%). This indicates that the stability in notifications from 2010 was the result of a combination of increased testing and decreased disease transmission (Figure 43).

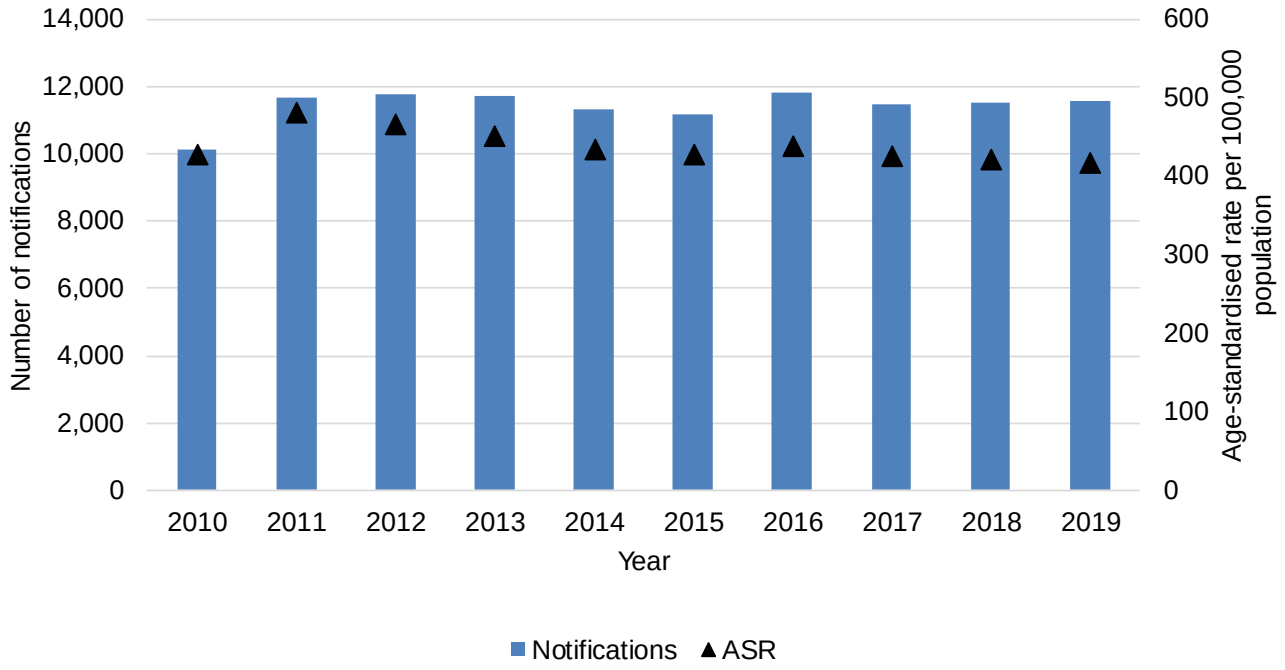


Figure 42. Number and ASR (per 100,000 population) for chlamydial infection notifications, by year, in WA, 2010–2019

Sex and Age

Overall, between 2010 and 2019, the mean annual ASR was 1.4 fold higher among females than males – 543.0 vs 382.4 per 100,000 population (Appendix 1). Over the ten-year period, 77% of chlamydial infection notifications occurred in people aged between 15 and 29 years (n=88,483/114,200) and the highest notification rate occurred in those aged 20 to 24 years (2,232.6 per 100,000 population). The predominance of females was evident in people aged 24 years or younger, but the opposite was observed in those aged 30 years or older (Figure 44).

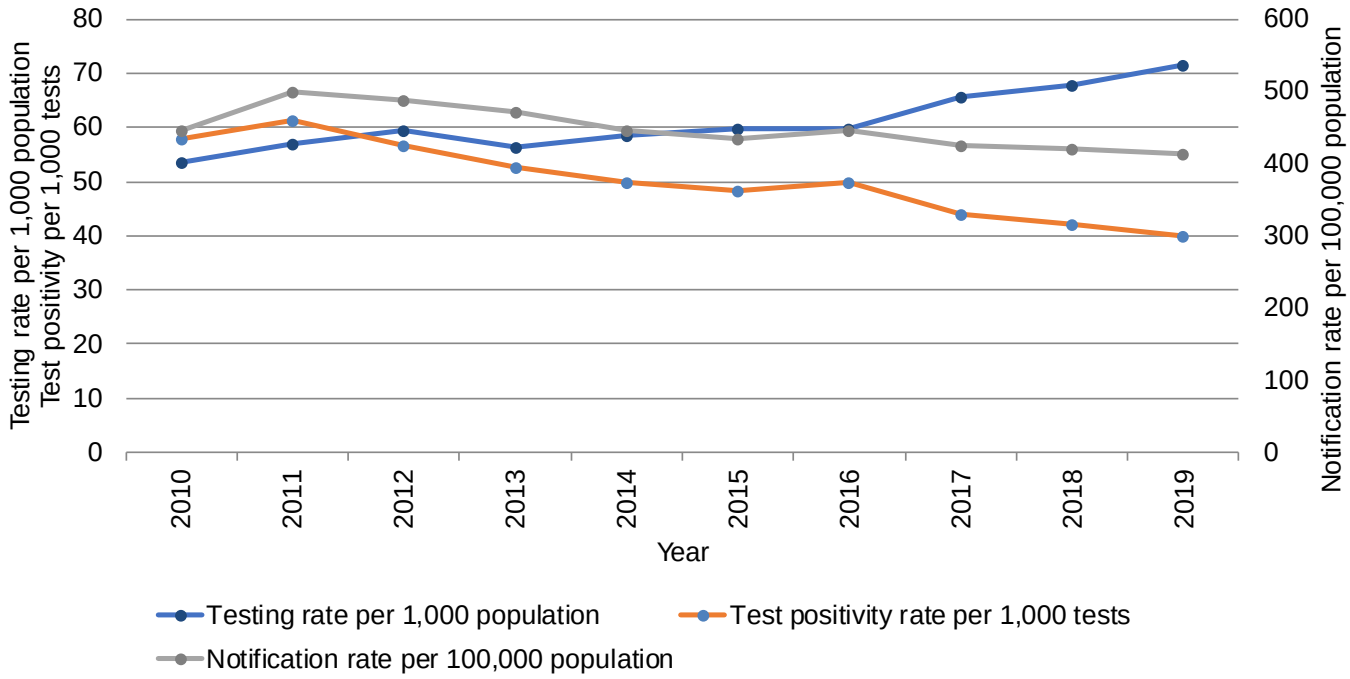


Figure 43. Chlamydia testing rate (per 1,000 population), ASR (per 100,000 population) and test positivity rate (per 1,000 population), by year, in WA, 2010–2019

Aboriginal Status

From 2010 to 2019, 14% of chlamydial infection notifications were reported in Aboriginal people, 80% in non-Aboriginal people; 7% of notifications were of unknown Aboriginal status. The overall mean annual ASR was 3.5-fold higher in the Aboriginal population compared to the non-Aboriginal population (1,296.5 vs 365.4 per 100,000 population) (Appendix 2). Chlamydial infection rates among both Aboriginal and non-Aboriginal people declined from 2011 to 2015 (Figure 45). From 2015 to 2019, the rate among Aboriginal people increased by 15% while the rate among non-Aboriginal people remained stable. The Aboriginal to non-Aboriginal rate ratio declined between 2010 and 2015 (4.3:1 to 3.1:1) but then increased to 2019 (3.5:1) (Figure 45).

Region

The highest chlamydial infection rates have consistently been reported in the Kimberley region. In 2019, the rate was more than three-fold higher than the overall WA rate (1,418.1 versus 418.7 per 100,000 population) (Table 15).

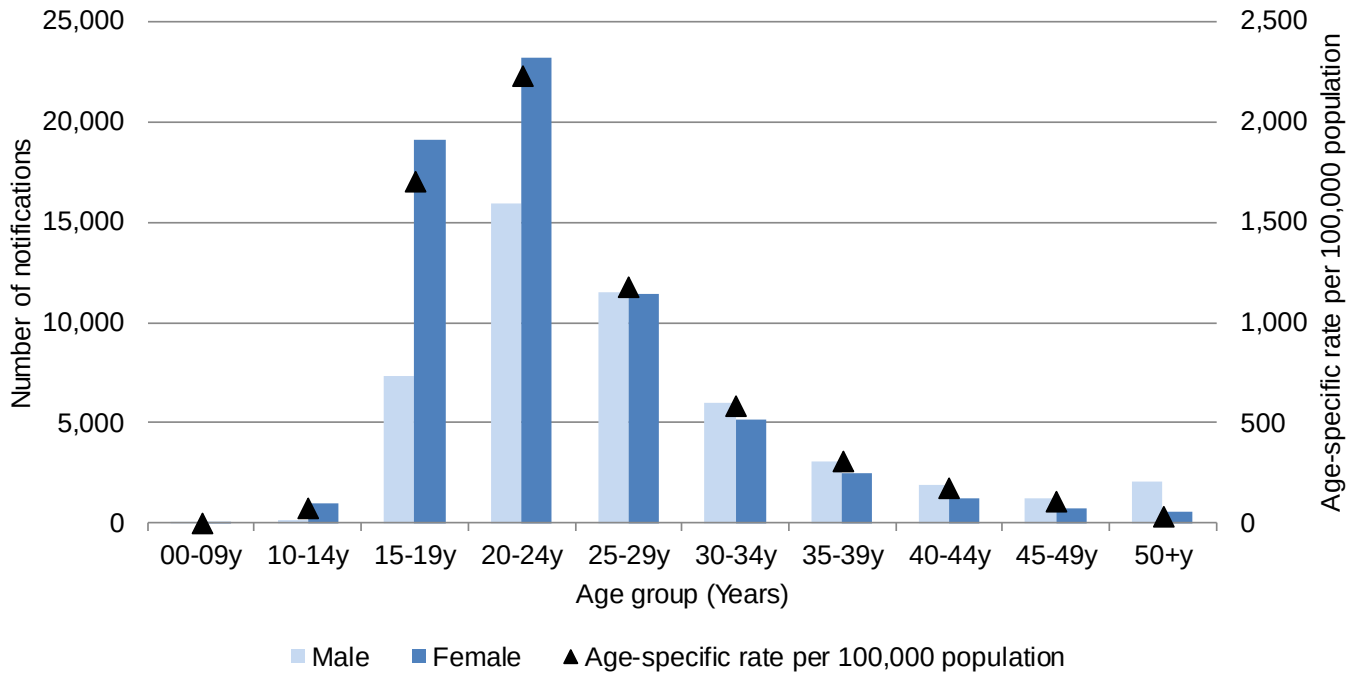


Figure 44. Number and age-specific rates (per 100,000 population) for chlamydial infection notifications, by sex, in WA, 2010–2019

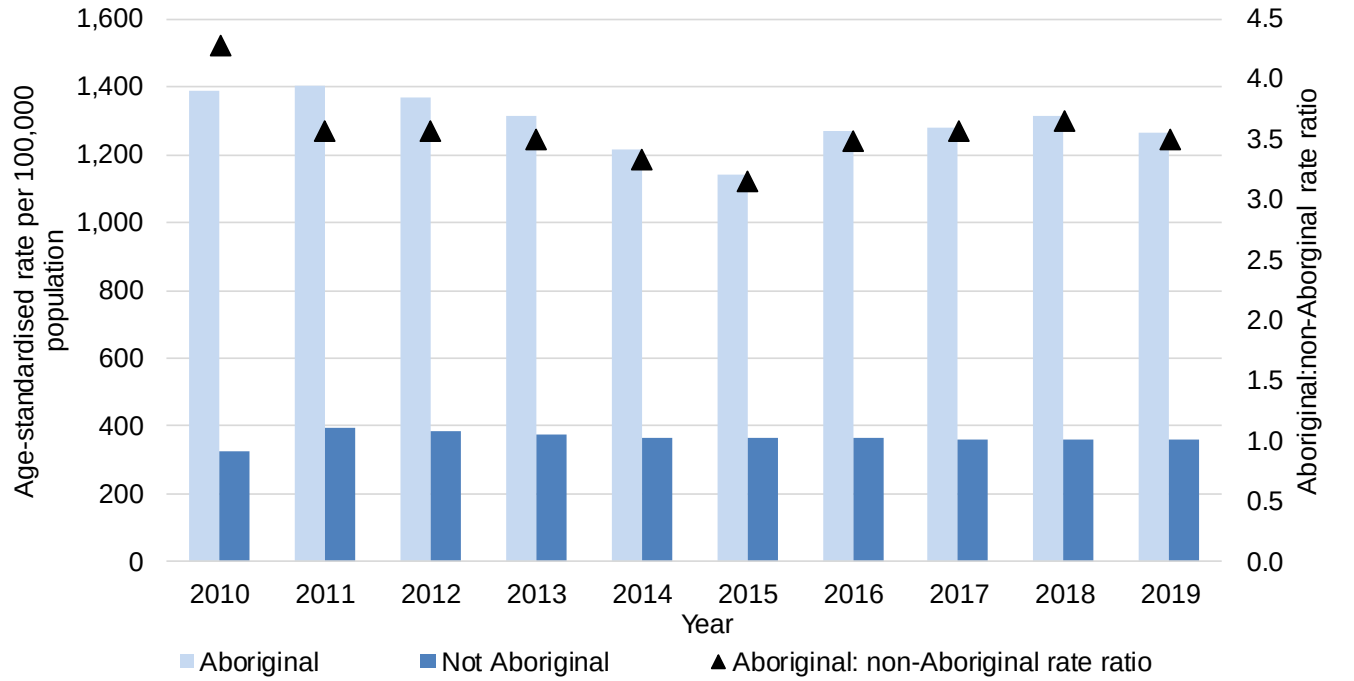


Figure 45. ASR (per 100,000 population) by Aboriginal status and the Aboriginal to non-Aboriginal rate ratio for chlamydial infection notifications in WA, 2010–2019

Place of Acquisition

Of the 80,209 (70%) chlamydial infection notifications over the ten-year period that had place of acquisition recorded, 94% were reported as having been acquired in WA. This trend was

comparable in males and females, although a larger proportion of males (8%) acquired their infections overseas than females (2%).

Table 15. Notification numbers (n) and ASR (per 100,000 population) for chlamydial infection, by year and region, in WA, 2010–2019

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	10,148	11,669	11,766	11,723	11,330	11,164	11,807	11,494	11,519	11,580	114,200
	rate	429	482	468	453	435	429	439	426	423	419	460
Goldfields	*n*	411	436	410	411	367	302	396	319	344	327	3,725
	rate	659	699	638	629	586	495	641	515	572	541	651
Great Southern	*n*	145	208	210	185	177	188	180	163	186	165	1,807
	rate	321	447	449	382	379	399	375	347	404	364	387
Kimberley	*n*	650	632	701	666	667	645	597	636	630	536	6,360
	rate	1,649	1,584	1,775	1,630	1,727	1,689	1,515	1,656	1,667	1,418	1,706
Metropolitan Perth	*n*	7,475	8,722	8,865	8,886	8,636	8,606	9,121	8,986	9,021	9,171	87,489
	rate	395	448	436	424	408	405	415	406	404	403	432
Midwest	*n*	363	464	387	380	310	286	352	306	261	222	3,331
	rate	629	792	646	630	521	491	595	528	457	393	594
Pilbara	*n*	408	380	418	426	384	362	384	342	327	366	3,797
	rate	638	577	637	647	597	594	613	597	565	642	646
South West	*n*	506	590	537	548	563	579	561	521	567	570	5,544
	rate	374	432	379	379	385	397	374	345	372	368	395
Wheatbelt	*n*	162	199	206	185	200	173	174	177	153	181	1,810
	rate	281	350	353	313	345	302	298	307	271	321	321
Unknown	*n*	28	38	32	36	26	23	42	44	30	42	337

Notes: Unknown = Unknown residential address within WA

Gonococcal infection

Gonococcal infection is caused by the bacterium *Neisseria gonorrhoeae* and can be passed from one person to another by unprotected vaginal, oral or anal sex with an infected person. The infection can also be transmitted from an infected mother to the baby during birth.

Temporal Trends

Between 2010 and 2019, gonococcal infection was the second most frequently notified STI in WA (n=25,750) with a mean annual ASR of 104.0 per 100,000 population (Table 4 and Table 5). The number of notifications more than doubled from 2010 to 2016 (n=1,376 to 3,361) and then remained stable between 2016 and 2018 (n=3,416) before increasing to a ten-year high in 2019 (n=3,927) (Figure 46). The notification rate more than doubled from 2010 to 2019 (59.3 to 139.6 per 100,000 population) (Figure 46). Over this time period, the testing and test positivity rates increased by 45% (48.1 to 69.8 per 1,000 population) and 46% (1.0% to 1.4%), respectively

(Figure 47). This indicates that the increase in notifications from 2010 was the result of a combination of increased testing and disease transmission.

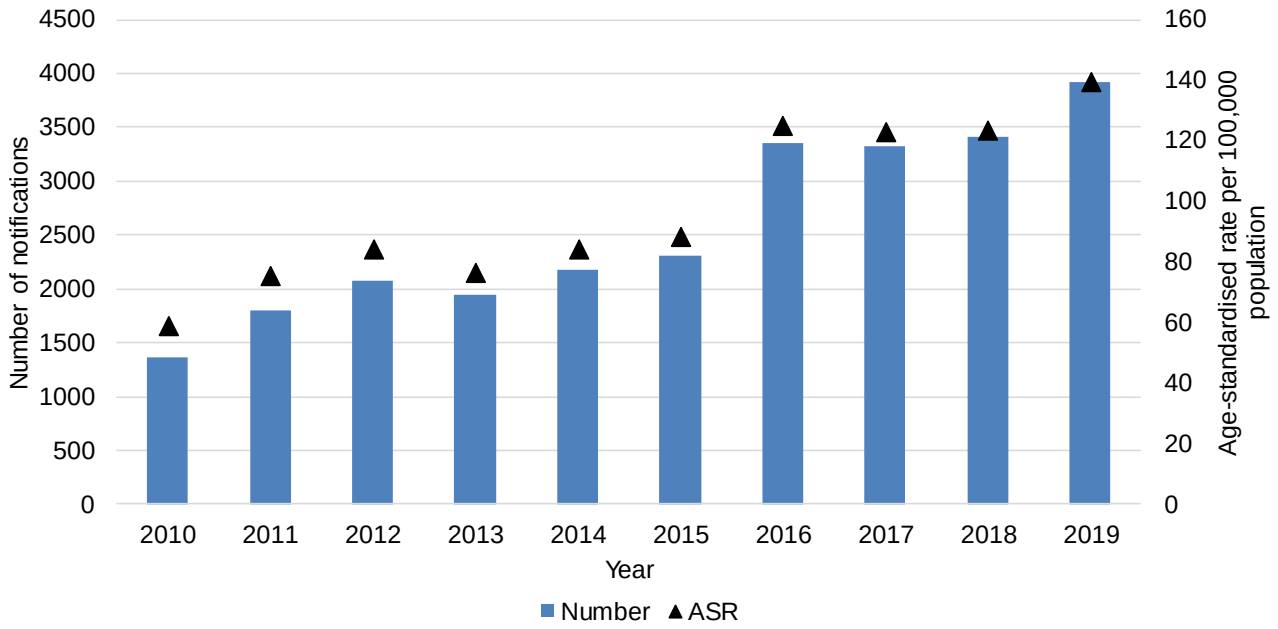


Figure 46. Number and ASR (per 100,000 population) for gonococcal infection notifications, by year, in WA, 2010–2019

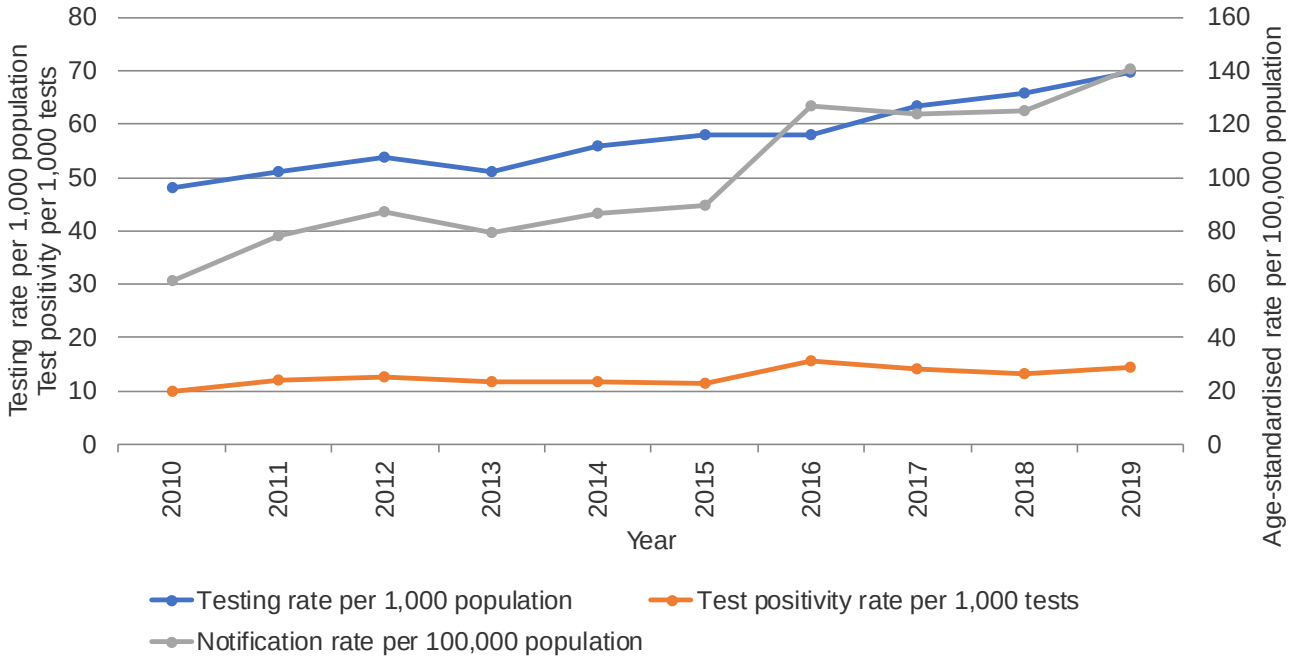


Figure 47. Gonococcal testing rate (per 1,000 population), ASR (per 100,000 population) and test positivity rate (per 1,000 population), by year, in WA, 2010–2019

Sex and Age

Between 2010 and 2019, the mean annual ASR was 1.4-fold higher among males than females (121.1 vs 85.3 per 100,000 population) (Appendix 1). Over the ten-year period, 61% of gonococcal infection notifications occurred in people aged 15 to 29 years (n=15,579/25,750) and the highest notification rate occurred in those aged 20 to 24 years (329.7 per 100,000 population). The predominance of males was evident in people aged 20 years or older, but the opposite was observed in those aged less than 20 years (Figure 48).

Aboriginal Status

Between 2010 and 2019, 40% of gonococcal infection notifications were reported in Aboriginal people and 60% in non-Aboriginal people; only 36 notifications had an unknown Aboriginal status. The Aboriginal to non-Aboriginal rate ratio declined from 2010 (33.1:1) to a ten-year low in 2019 (8.0:1), mainly due to an increase in non-Aboriginal rates (Figure 49).

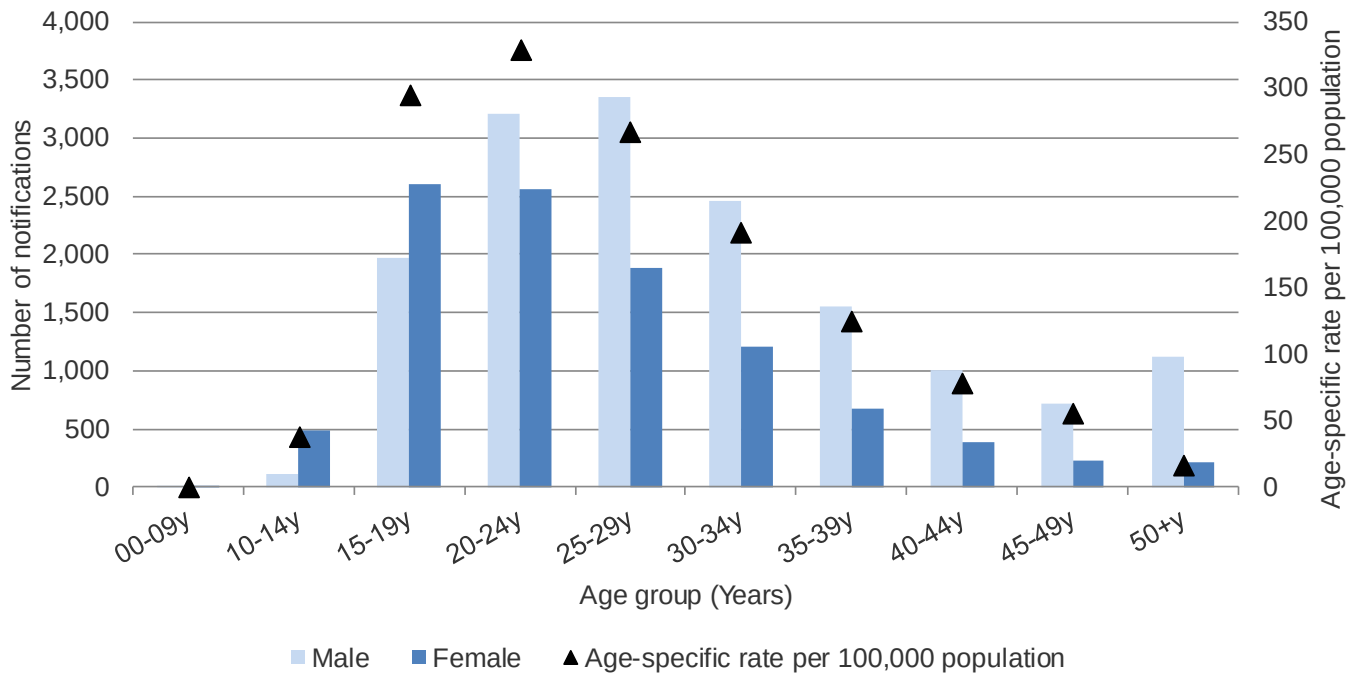


Figure 48. Number and age-specific rates (per 100,000 population) for gonococcal infection notifications, by sex, in WA, 2010–2019

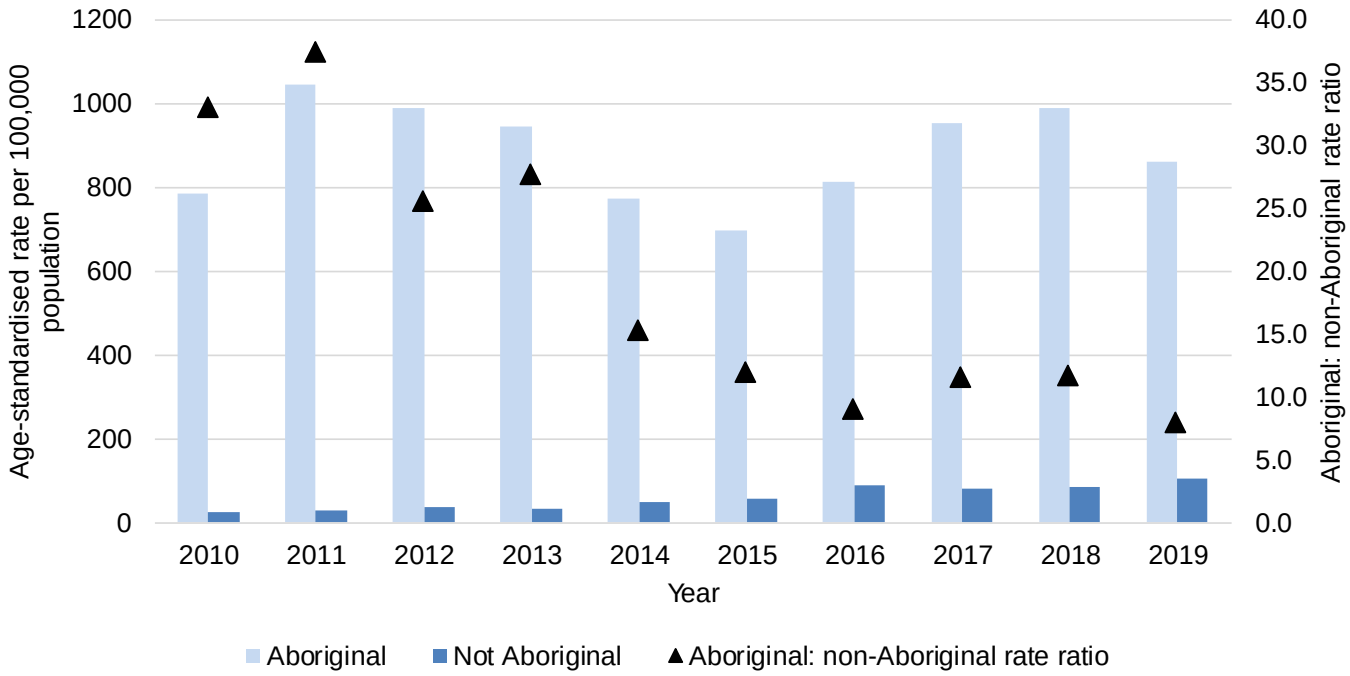


Figure 49. ASR (per 100,000 population) by Aboriginal status and Aboriginal to non-Aboriginal rate ratios for gonococcal infection notifications in WA, 2010–2019

Region

The highest gonococcal infection rates have consistently been reported in the Kimberley region. Overall, the rate was 3.7-fold greater than the overall WA rate (1,706 vs. 460 per 100,000 population) (Table 16).

Place of Acquisition

Of the 23,612 (92%) gonococcal infection notifications over the ten-year period that had place of acquisition recorded, 92% were reported as having been acquired in WA. This trend was comparable in males and females, although a larger proportion of males (9%) acquired their infections overseas than females (2%).

Enhanced Gonococcal Infection Surveillance

Between 2010 and 2019, complete enhanced surveillance data were available for 74% (n=19,111/25,750) of all gonococcal infection notifications. Of the completed gonococcal infection ESF, 34% were for Aboriginal people and 66% were non-Aboriginal people, which is similar to proportions of Aboriginal/non-Aboriginal people notified. Of the completed forms, 37% were female, 36% were males with a heterosexual exposure, and 20% were MSM.

Among Aboriginal people, gonococcal infection notifications were equally distributed between the sexes. The majority (41%) of Aboriginal people were diagnosed at a public hospital/community health clinic or an Aboriginal medical service via a urine sample and were treated with amoxycillin/probenecid or a combination of amoxycillin/probenecid and azithromycin. The vast

majority (83%) of Aboriginal people reported acquiring the infection from a person of the opposite sex, and 0.2% of cases reported being a current sex worker.

Among non-Aboriginal people, gonococcal infection notifications were higher for males than females. In comparison to Aboriginal people, cases among non-Aboriginal people were more likely to be diagnosed at a general practice and to be treated with a combination of ceftriaxone and azithromycin. While the majority of non-Aboriginal people with confirmed gonococcal infection reported acquiring the infection from a person of the opposite sex, 28% reported acquiring the infection from a person of the same sex, of which almost all were male. Less than 1.5% of cases were current sex workers.

The majority of MSM notified with gonococcal infection were non-Aboriginal, lived in the Perth metropolitan region and reported acquiring the infection in WA; 1.0% of cases reported being a current sex worker. Most MSM were diagnosed at a sexual health clinic based on a rectal or throat swab. The majority were treated with a combination of ceftriaxone and azithromycin.

Table 16. Notification numbers (n) and ASR (per 100,000 population) for gonococcal infection, by year and region, in WA, 2010–2019

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	10,148	11,669	11,766	11,723	11,330	11,164	11,807	11,494	11,519	11,580	114,200
	rate	429	482	468	453	435	429	439	426	423	419	460
Goldfields	*n*	411	436	410	411	367	302	396	319	344	327	3,725
	rate	659	699	638	629	586	495	641	515	572	541	651
Great Southern	*n*	145	208	210	185	177	188	180	163	186	165	1,807
	rate	321	447	449	382	379	399	375	347	404	364	387
Kimberley	*n*	650	632	701	666	667	645	597	636	630	536	6,360
	rate	1,649	1,584	1,775	1,630	1,727	1,689	1,515	1,656	1,667	1,418	1,706
Metropolitan Perth	*n*	7,475	8,722	8,865	8,886	8,636	8,606	9,121	8,986	9,021	9,171	87,489
	rate	395	448	436	424	408	405	415	406	404	403	432
Midwest	*n*	363	464	387	380	310	286	352	306	261	222	3,331
	rate	629	792	646	630	521	491	595	528	457	393	594
Pilbara	*n*	408	380	418	426	384	362	384	342	327	366	3,797
	rate	638	577	637	647	597	594	613	597	565	642	646
South West	*n*	506	590	537	548	563	579	561	521	567	570	5,544
	rate	374	432	379	379	385	397	374	345	372	368	395
Wheatbelt	*n*	162	199	206	185	200	173	174	177	153	181	1,810
	rate	281	350	353	313	345	302	298	307	271	321	321
Unknown	*n*	28	38	32	36	26	23	42	44	30	42	337

Notes: Unknown = Unknown residential address within WA

Table 17. Behavioural and demographic characteristics of people notified with gonococcal infection, by Aboriginality, in WA, 2010–2019

Behavioural and demographic characteristics		Aboriginal		non-Aboriginal		Total	
		Number	Percent	Number	Percent	Number	Percent
Sex	Male	3,163	48%	8,853	70%	12,024	63%
	Female	3,364	52%	3,714	30%	7,081	37%
Clinical setting	Public hospital/community health clinic	2,704	41%	1,012	8%	3,717	19%
	Sexual health clinic/family planning clinic	162	2%	3,116	25%	3,278	17%
	Aboriginal medical service	2,368	36%	48	0%	2,416	13%
	General practice	777	12%	8,047	64%	8,833	46%
	Prison/detention centre	428	7%	181	1%	609	3%
	Other	71	1%	145	1%	217	1%
	Unknown	0	0%	0	0%	0	0%
Treatment	Ceftriaxone and Azithromycin	2,268	35%	9,786	78%	12,060	63%
	Amoxycillin/Probenecid	3,708	57%	383	3%	4,092	21%
	Ciprofloxacin	31	0%	192	2%	223	1%
	Other drugs	685	10%	2,316	18%	3,005	16%
	Unknown	0	0%	0	0%	0	0%
Sexual exposure	Person(s) of opposite sex only	5,427	83%	7,587	60%	13,021	68%
	Person(s) of same sex only	133	2%	3,566	28%	3,699	19%
	Person(s) of either sex	14	0%	279	2%	293	2%
	No sexual contact	4	0%	17	0%	21	0%
	Unknown	949	15%	1,124	9%	2,077	11%

Table 18. Behavioural and demographic characteristics of people notified with gonococcal infection, by exposure category, WA, 2010–2019

Behavioural and demographic characteristics		MSM		Heterosexual Male		Female	
		Number	Percent	Number	Percent	Number	Percent
Aboriginality	Aboriginal	104	3%	2,556	38%	3,364	48%
	non-Aboriginal	3,793	97%	4,230	62%	3,714	52%
Area	Metro	3,661	95%	4,114	61%	3,822	54%
	non-Metro	202	5%	2,655	39%	3,251	46%
Clinical setting	Public hospital/clinic	109	3%	1,424	21%	1,897	27%
	SHC	2,437	63%	415	6%	400	6%
	AMS	30	1%	864	13%	1,333	19%
	GP	1,269	33%	3,658	54%	3,149	45%
	Prison/remand centre	13	0%	354	5%	191	3%
	Other	29	1%	63	1%	102	1%
Specimen site	Urine	1,271	24%	5,606	67%	4,735	57%
	Urethral swab	915	17%	2,599	31%	68	1%
	Cervical/vaginal swab	0	0%	0	0%	3,153	38%
	Throat swab	1,524	28%	147	2%	229	3%
	Rectal swab	1,640	31%	0	0%	91	1%
	Other	9	0%	43	1%	60	1%
	Unknown	2	0%	7	0%	11	0%

Syphilis

Syphilis is caused by the spirochaete bacterium *Treponema pallidum* and can be passed from person-to-person by unprotected vaginal, oral or anal sex with an infected person. It can also be spread through intimate or skin-to-skin contact with an infected person. Infection during pregnancy can result in transmission of syphilis to the baby via the placenta.

Left untreated, syphilis progresses through several characteristic stages of disease that include the primary, secondary and tertiary stages.

Syphilis notifications in WA have been classified into 'infectious' (primary syphilis + secondary syphilis + early latent syphilis [less than two years duration]), 'non-infectious' (more than two years or unknown duration) and 'congenital' syphilis.

Infectious syphilis

Temporal Trends

Between 2010 and 2019, there were a total of 2,262 notifications for infectious syphilis in WA, equating to a mean annual ASR of 9.1 per 100,000 population (Table 4 and Table 5). The notification rate increased almost six-fold from 2010 to a ten-year high in 2019 (3.4 to 20.2 per 100,000 population; n=79 to 565) (Figure 50).

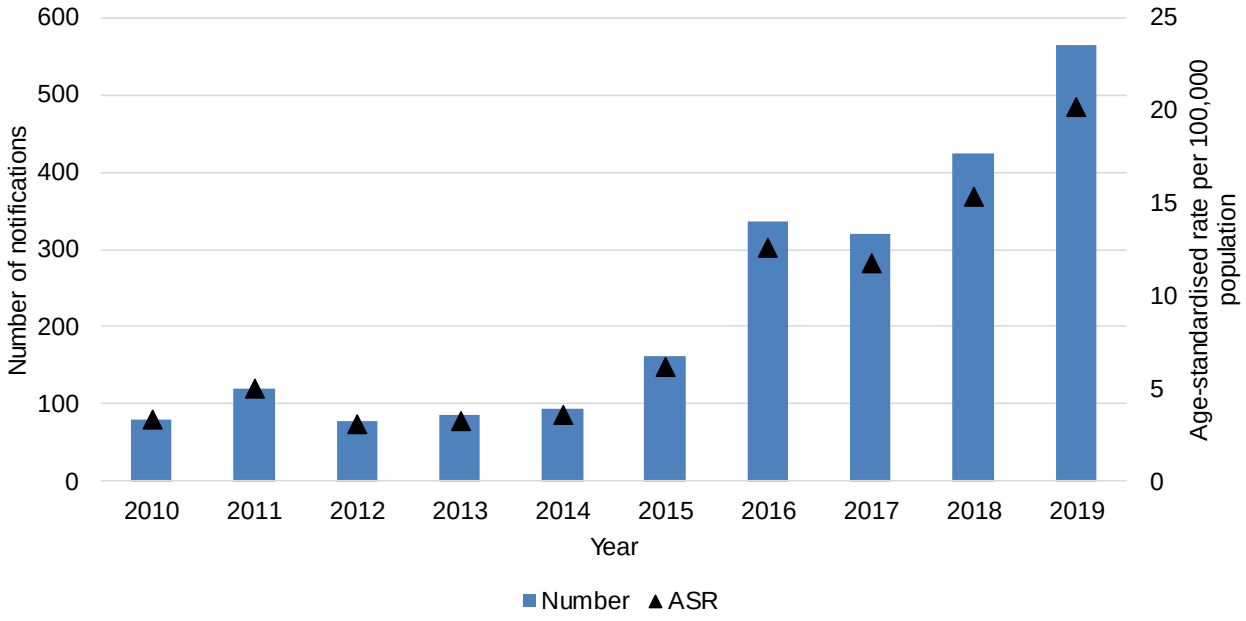


Figure 50. Number and ASR (per 100,000 population) for infectious syphilis notifications, by year, in WA, 2010–2019

Sex and Age

Between 2010 and 2019, the mean annual ASR was nearly 4-fold higher among males than females – 14.2 vs 3.7 per 100,000 population (Appendix 1). Over the ten-year period, 41% infectious syphilis notifications occurred in people aged between 20 and 34 years (n=1,071/2,262)

and the highest notification rate occurred in those aged 25 to 29 years (20.0 per 100,000 population). Among those aged 20 years or older, there were more notifications among males (Figure 51).

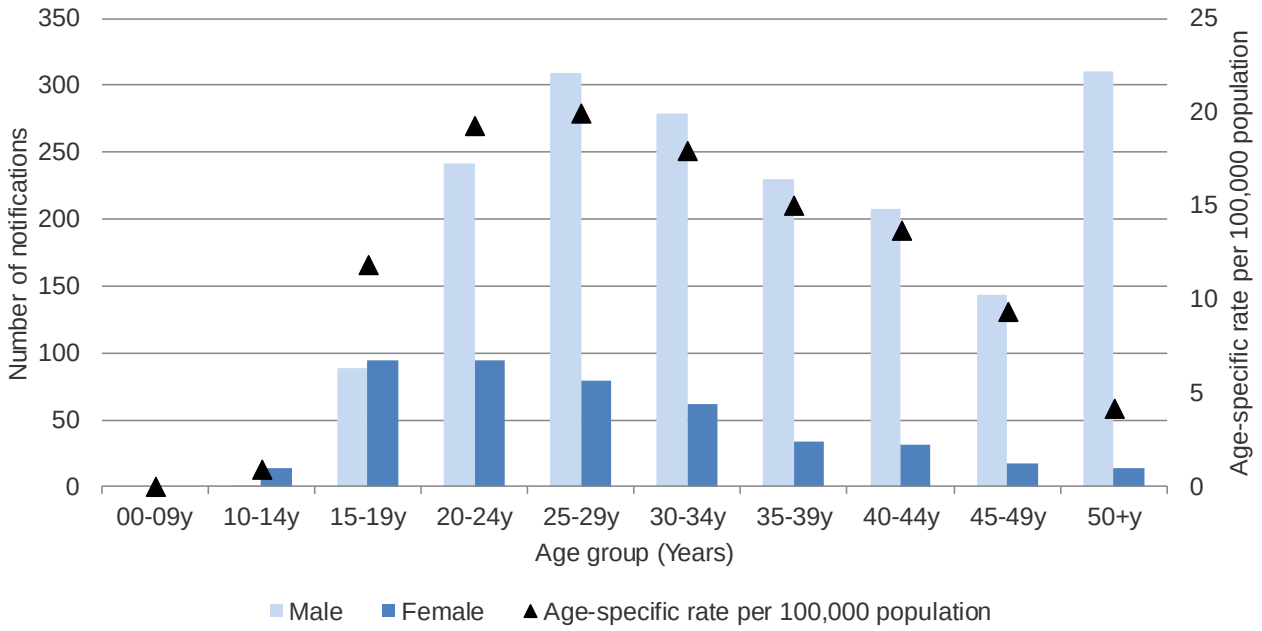


Figure 51. Number and age-specific rates (per 100,000 population) for infectious syphilis notifications, by sex, in WA, 2010–2019

Aboriginal Status

Between 2010 and 2019, 26% of infectious syphilis notifications were reported in Aboriginal people, and 74% in non-Aboriginal people; no notifications had an unknown Aboriginal status. The overall mean annual ASR was 8.7-fold higher in the Aboriginal population compared to the non-Aboriginal population (56.0 vs 6.4 per 100,000 population) (Appendix 2). The Aboriginal to non-Aboriginal rate ratio increased from 2010 (7.8:1) to a ten-year high in 2019 (19.2:1) (

Figure 52).

Region

The highest infectious syphilis rates have predominately been reported from the Kimberley region (Table 19 and Appendix 3). In 2019, the rate in the Kimberley region was 11-fold greater than the overall WA rate (222.0 vs. 20.2 per 100,000 population).

Place of Acquisition

Of the 2,195 (97%) infectious syphilis notifications over the ten-year period that had place of acquisition recorded, 84% were reported as having been acquired in WA and 10% and 6% acquired their infection overseas and interstate, respectively. This trend was comparable in males and females, although a larger proportion of males (12%) acquired their infections overseas than females (3%).

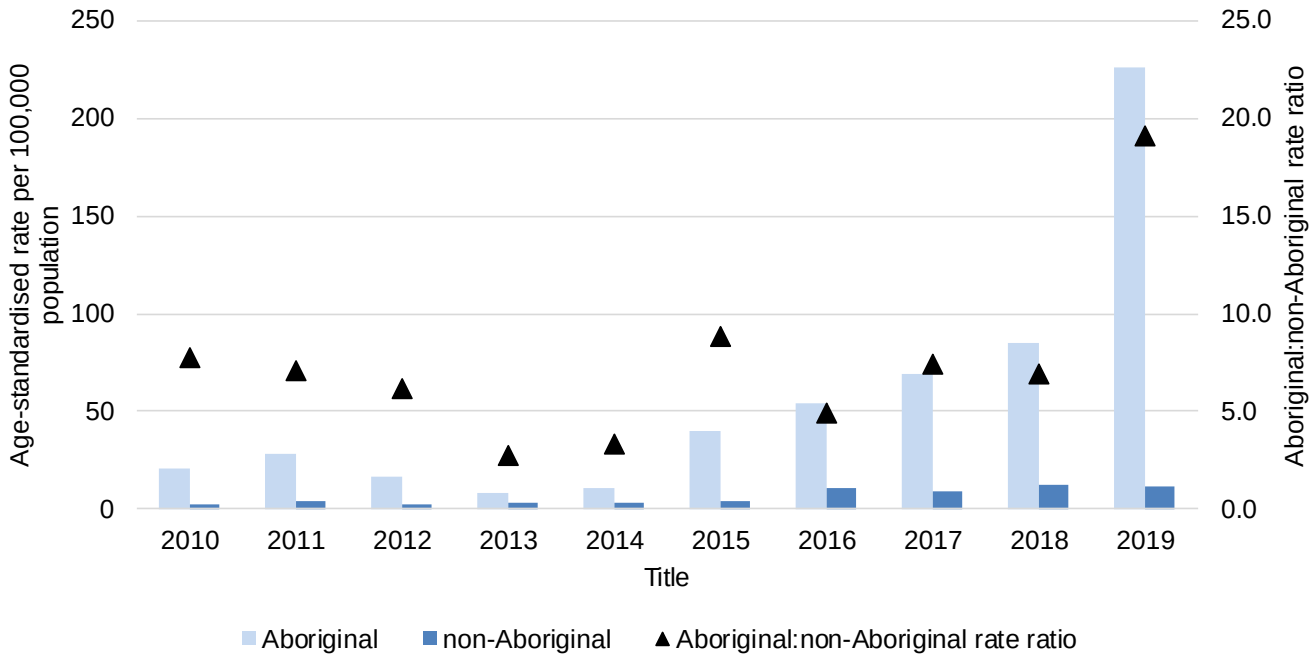


Figure 52. ASR (per 100,000 population) by Aboriginal status, and Aboriginal to non-Aboriginal rate ratios for infectious syphilis notifications in WA, 2010–2019

Table 19. Notification numbers (n) and ASR (per 100,000 population) for infectious syphilis, by year and region, in WA (2010–2019)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	79	119	78	86	93	162	336	320	424	565	2,262
	rate	3.4	5	3.1	3.3	3.6	6.2	12.6	11.8	15.4	20.2	9.1
Goldfields	*n*	5	5	6	2	4	9	5	6	10	32	86
	rate	8	7.5	10	2.8	6.5	14.5	8.7	9.9	14.7	49.5	14.6
Great Southern	*n*	3	2	2	0	0	0	1	2	2	7	19
	rate	7.3	4.8	4.6	0	0	0	2.1	4.3	4.3	14.8	4.3
Kimberley	*n*	9	10	0	0	11	36	44	58	46	89	303
	rate	23	26.1	0	0	33.4	91.6	109	155.8	118.2	222	81
Metropolitan Perth	*n*	54	92	67	71	75	114	263	239	304	328	1,607
	rate	3	4.8	3.4	3.5	3.6	5.4	12.3	10.8	13.8	14.3	8.1
Midwest	*n*	3	3	0	3	1	0	6	3	4	9	32
	rate	5.3	4.7	0	5	1.5	0	9.7	4.7	4.9	14.4	5.3
Pilbara	*n*	4	3	1	2	0	2	2	1	45	88	148
	rate	5.8	5.8	0.9	1.8	0	2.4	2.1	1.4	81.1	171.6	27.2
South West	*n*	0	3	2	1	0	1	8	8	7	3	33
	rate	0	2.1	1.2	0.6	0	0.6	4.5	5.2	4	1.7	2.1
Wheatbelt	*n*	1	0	0	5	2	0	5	2	4	5	27
	rate	1.6	0	0	7.3	2.2	0	8	2.7	6.1	8.1	4.3
Unknown	*n*	0	1	0	2	0	0	2	1	2	4	7

Notes: Unknown = Unknown residential address within WA

Enhanced infectious syphilis surveillance

Between 2010 and 2019, complete enhanced surveillance data were available for 90% (n=2,046/2,262) of all infectious syphilis notifications. Of the completed infectious syphilis ESF, 74% were for non-Aboriginal people, 26% were for Aboriginal people, 58% were MSM, 20% were males with a heterosexual exposure and 19% were female.

Among Aboriginal people, infectious syphilis notifications were equally distributed between the sexes. The majority (49%) were diagnosed at an Aboriginal medical service as part of a sexual health screen. Most cases among Aboriginal people were acquired through vaginal intercourse with a casual partner of the opposite sex. In contrast, the majority (93%) of infectious syphilis cases among non-Aboriginal people were males and were diagnosed at a GP or sexual health clinic after presenting with symptoms. Most cases among non-Aboriginal people were acquired through anal (58%) or oral sex (63%) with a casual partner of the same sex.

The majority of MSM notified with infectious syphilis were non-Aboriginal and were diagnosed at a sexual health clinic or GP after presenting with relevant symptoms. Most cases among MSM were acquired through anal or oral sex with a casual partner of the same sex.

Table 20. Behavioural and demographic characteristics of people notified with infectious syphilis, by Aboriginality, WA, 2010–2019

Behavioural and demographic characteristics		Aboriginal		non-Aboriginal	
		Number	Percent	Number	Percent
Sex	Male	236	45%	1,406	93%
	Female	290	55%	106	7%
Clinical setting	Public hospital/community health clinic	153	29%	81	5%
	Sexual health clinic/family planning clinic	17	3%	622	41%
	Aboriginal medical service	258	49%	5	0%
	General practice	38	7%	741	49%
	Prison/Detention centre	36	7%	23	2%
	Other	6	1%	23	2%
	Unknown	14	3%	16	1%
Reason for presentation	Symptomatic	129	25%	749	49%
	Opportunistic testing - Sexual health	262	50%	594	39%
	Antenatal/pap smear	28	5%	8	1%
	Named as contact (i.e. Asymptomatic)	112	21%	167	11%
	Other	25	5%	98	6%
Sex of partner for this episode	Person(s) of opposite sex	471	90%	327	22%
	Person(s) of same sex	36	7%	1,081	71%
	Person(s) of either sex	1	0%	67	4%
	No sexual contact	0	0%	0	0%
	Unknown	18	3%	45	3%
Infection acquired from	Casual partner	312	59%	1,048	69%
	Regular partner	143	27%	309	20%
	Sex worker	2	0%	24	2%
	Client (i.e. patient is a sex worker)	0	0%	7	0%
	Other	2	0%	14	1%
	Unknown	67	13%	118	8%
Mode of transmission	Vaginal intercourse	445	85%	313	21%
	Anal intercourse	31	6%	876	58%
	Oral sex	49	9%	963	63%
	Other	0	0%	4	0%
	Unknown	54	10%	221	15%

Table 21. Behavioural and demographic characteristics of people notified with infectious syphilis, by exposure category, WA, 2010–2019

Behavioural and demographic characteristics		MSM		Heterosexual		Female	
		Number	Percent	Number	Percent	Number	Percent
Aboriginality	Aboriginal	35	3%	192	46%	290	73%
	non-Aboriginal	1,145	97%	224	54%	106	27%
Clinical setting	Public hospital/clinic	64	5%	69	17%	96	25%
	SHC	571	49%	39	9%	22	6%
	AMS	14	1%	85	20%	159	41%
	GP	493	42%	162	39%	95	24%
	Prison/remand centre	9	1%	39	9%	7	2%
	Other	15	1%	7	2%	5	1%
	Unknown	8	1%	14	3%	7	2%
Reason for presentation	Symptomatic	573	46%	196	45%	86	20%
	Sexual health	483	39%	148	34%	196	47%
	Antenatal/pap smear	0	0%	0	0%	33	8%
	Named as contact	125	10%	67	15%	83	20%
	Other	73	6%	27	6%	22	5%
Sex of partner for this episode	Opposite sex only	0	0%	414	100%	378	95%
	Same sex only	1,109	94%	0	0%	3	1%
	Either sex	70	6%	0	0%	3	1%
	No sexual contact	0	0%	0	0%	0	0%
	Unknown	1	0%	2	0%	12	3%
Infection acquired from	Casual partner	887	75%	267	64%	192	48%
	Regular partner	212	18%	85	20%	150	38%
	Sex worker	4	0%	21	5%	0	0%
	Client	4	0%	0	0%	2	1%
	Other	10	1%	2	0%	4	1%
	Unknown	63	5%	41	10%	48	12%
Mode of transmission	Vaginal	54	3%	350	67%	354	77%
	Anal	859	45%	26	5%	15	3%
	Oral	846	44%	109	21%	48	11%
	Other	3	0%	1	0%	0	0%
	Unknown	151	8%	40	8%	40	9%

Note: MSM: Men who have sex with men. AMS: Aboriginal medical service. SHC: Sexual health clinic

Outbreaks and other investigations

The high infectious syphilis notification rates in the remote regions of WA reflect an ongoing outbreak among Aboriginal people that commenced in northern QLD in 2011, spread to nearby areas in the NT in 2013, to the Kimberley region in 2014, to the Pilbara region in 2018 and then to the Goldfields region in 2019 (Figure 53).

By the end of 2019, a total of 278 cases of infectious syphilis (166 female, 112 male) had been notified in the Kimberley region since the first case was identified in June 2014. Prior to 2014, there had been no infectious syphilis notifications in the Kimberley region for two years. In the Pilbara region, a total of 128 cases (70 female, 58 male) were notified to the end of 2019 since the first outbreak case was identified in February 2018. A total of 29 cases (18 female, 11 male) were notified to the end of 2019 in the Goldfields region since the first case was identified in January 2019. Almost all cases across these three regions reported heterosexual exposure and were among Aboriginal people. Further information about the infectious syphilis outbreak affecting

Aboriginal people living in northern Australia is available here: https://www1.health.gov.au/internet/main/publishing.nsf/Content/ohp-infectious-syphilis-outbreak.htm.

Over the ten-year period, between 68% and 80% of infectious syphilis notifications in the Perth metropolitan area were among MSM. There has also been an increasing number of cases in the Perth metropolitan area among those with a heterosexual exposure. This has been particularly apparent among females of reproductive age, with annual notifications increasing by 80% from 2018 to 2019 (n= 21 to 38) and increasing more than three-fold in comparison to the previous five-year average of 10.8 notifications per year.

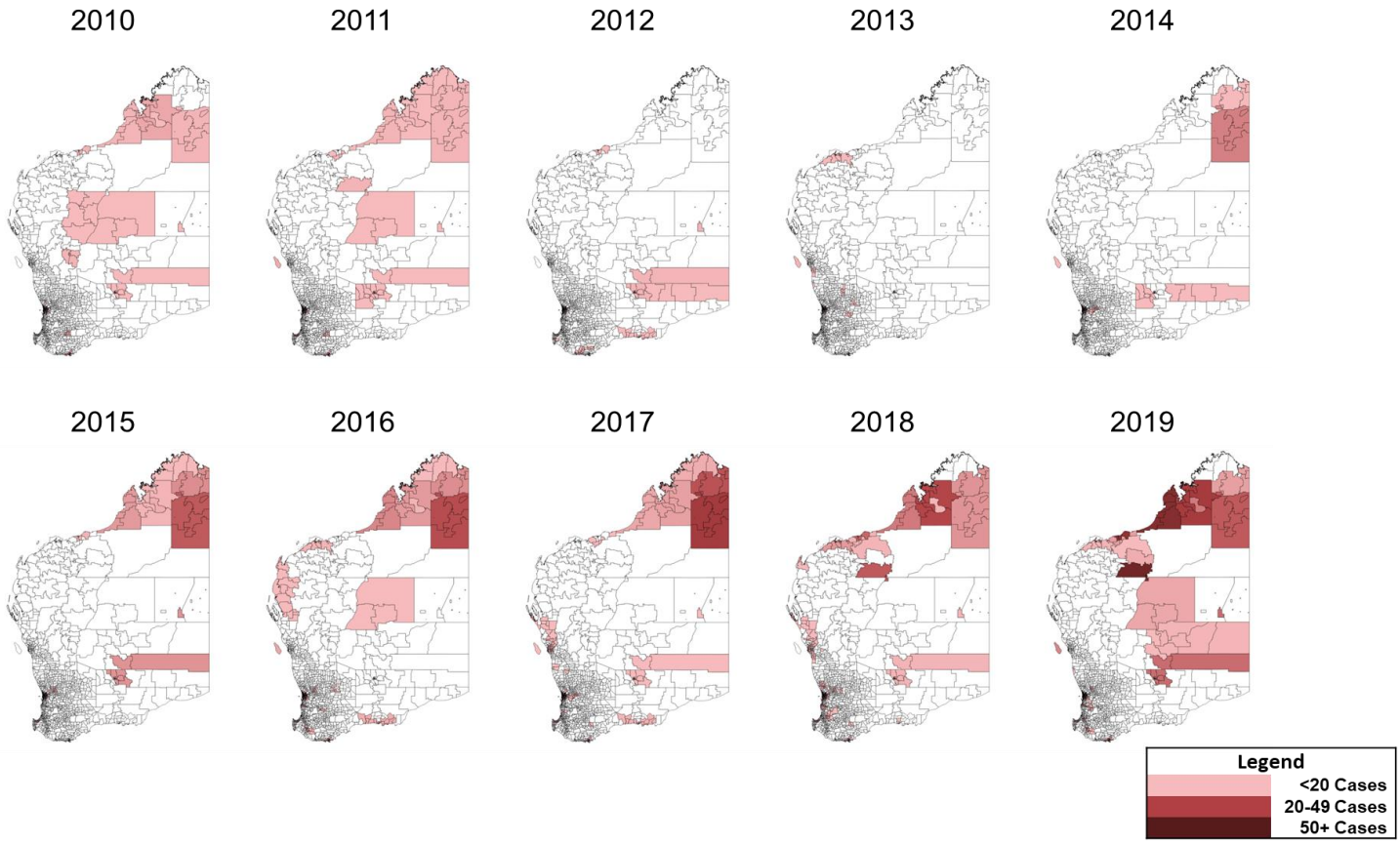


Figure 53. Number of notifications of infectious syphilis, by year and region, in WA 2010–2019

Non-infectious syphilis

Temporal Trends

Between 2010 and 2019, there was a total of 1,133 notifications for non-infectious syphilis in WA, equating to a mean annual ASR of 4.5 per 100,000 population (Table 4 and Table 5). The non-infectious syphilis notification rate increased almost three-fold from 2010 to a ten-year high in 2019 (2.6 to 7.7 per 100,000 population; n=61 to 226) (Figure 54).

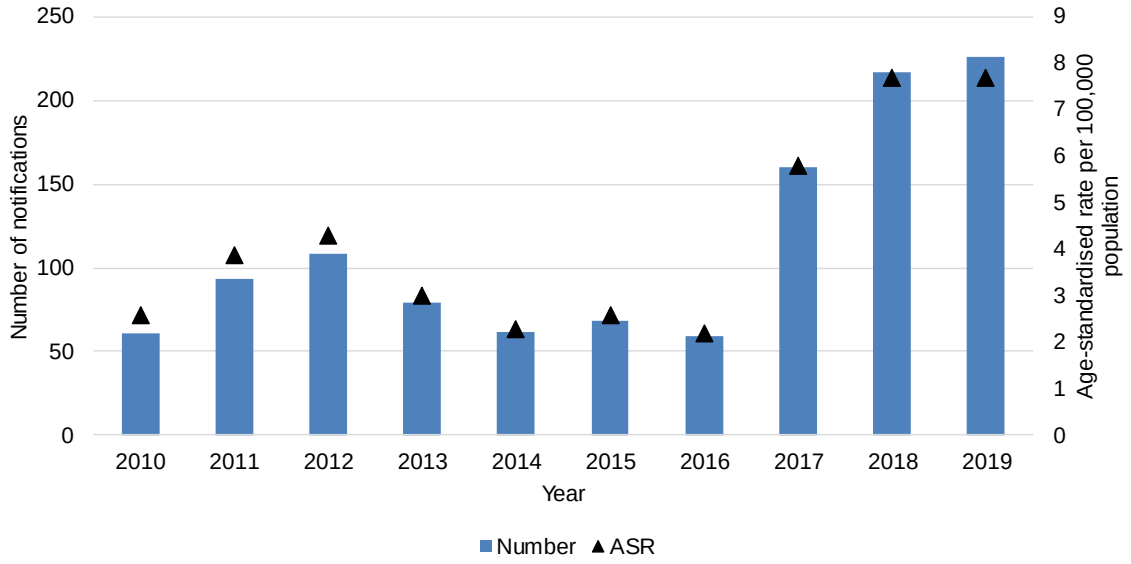


Figure 54. Number and ASR (per 100,000 population) for non-infectious syphilis notifications, by year, in WA, 2010–2019

Sex and Age

Between 2010 and 2019, the mean annual ASR was 1.9-fold higher among males than females – 5.7 vs 3.1 per 100,000 population (Appendix 1). Over the ten-year period, 32% of non-infectious syphilis notifications occurred in people aged 50 years or older (n=366/1,133) and the highest notification rate occurred in those aged 30 to 34 years (8.0 per 100,000 population). There were more notifications in males among those aged 20 years or older (Figure 55).

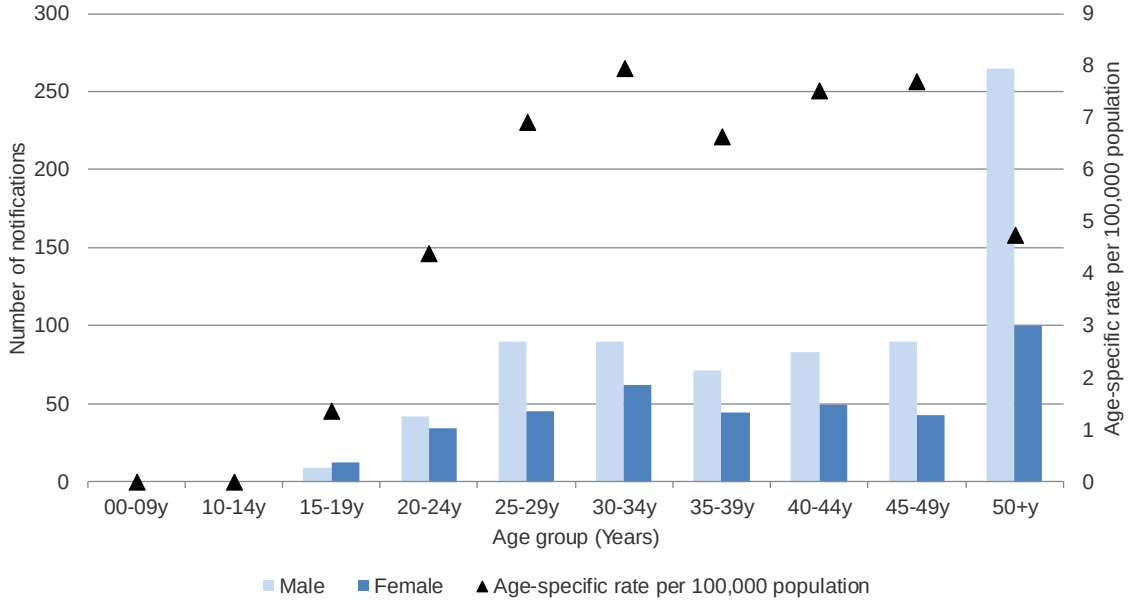


Figure 55. Number and age-specific notification rates (per 100,000 population) for infectious syphilis notifications, by sex, in WA, 2010–2019

Aboriginal Status

Between 2010 and 2019, 22% of non-infectious syphilis notifications were reported in Aboriginal people and 76% in non-Aboriginal people; 2% had an unknown Aboriginal status. The overall mean annual ASR was 11.5 fold higher in the Aboriginal population compared to the non-Aboriginal population (38.1 vs 3.3 per 100,000 population) (Appendix 2). The Aboriginal to non-Aboriginal rate ratio decreased from a peak of 17.7:1 in 2010 to 5.4:1 in 2017 but then climbed to 16.9:1 by 2019 due to a greater increase among Aboriginal people, rather than a reduction in non-Aboriginal people (Figure 56).

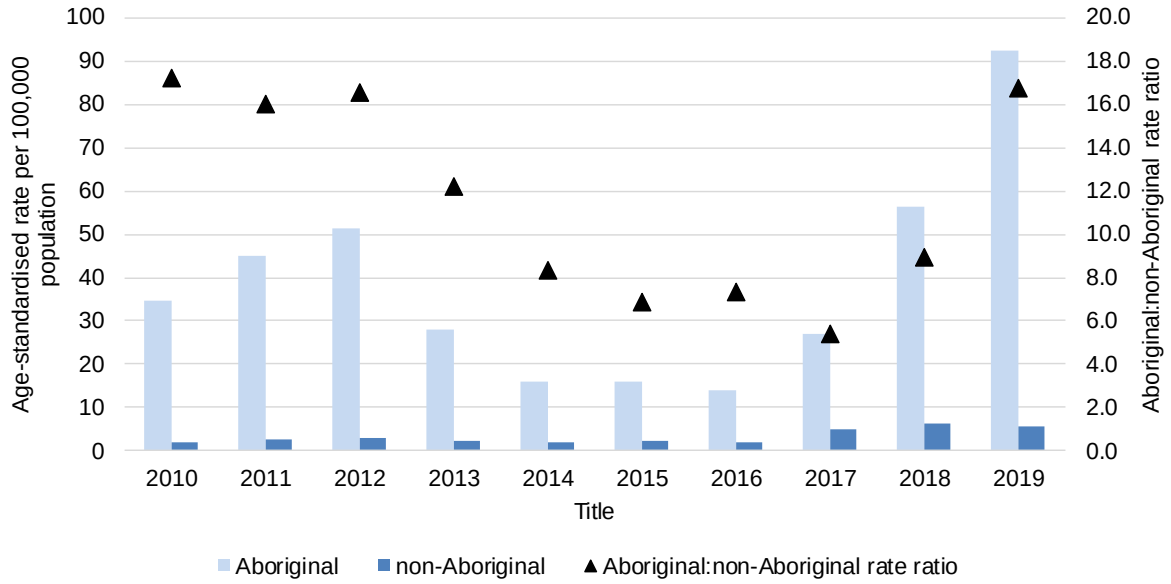


Figure 56. ASR (per 100,000 population) by Aboriginal status and Aboriginal to non-Aboriginal rate ratios for infectious syphilis notifications in WA, 2010 to 2019

Region

The highest non-infectious syphilis rates have predominately been reported from the Goldfields and Kimberley regions (Table 22). In 2019, the rate in the Goldfields region was more than seven-fold greater than the overall WA rate (57.9 vs. 7.7 per 100,000 population).

Place of Acquisition

Of the 1,795 (79%) non-infectious syphilis notifications over the ten-year period that had place of acquisition recorded, 63% were reported as having been acquired in WA and 23% overseas. This trend was comparable in males and females.

Table 22. Notification numbers (n) and ASR (per 100,000 population) for non-infectious syphilis, by year and region, in WA (2010–2019)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	61	93	108	79	62	68	59	160	217	226	1,133
	rate	2.6	3.9	4.3	3	2.3	2.6	2.2	5.8	7.7	7.7	4.5
Goldfields	*n*	2	12	13	2	3	3	4	7	16	35	96
	rate	7.2	19.8	22.7	3.2	4.7	5.8	6.8	11.4	24.7	57.9	17
Great Southern	*n*	1	0	2	1	0	0	0	0	1	3	8
	rate	2.6	0	4.2	1.1	0	0	0	0	2.1	5	1.6
Kimberley	*n*	10	12	6	4	2	0	1	4	2	5	46
	rate	33.6	42.3	15.9	10.3	5.9	0	2.4	15.9	5.1	13.4	14.8
Metropolitan Perth	*n*	43	62	70	67	50	59	49	138	166	154	858
	rate	2.4	3.3	3.5	3.3	2.3	2.9	2.3	6.3	7.5	6.6	4.3
Midwest	*n*	2	2	2	2	2	1	0	1	10	7	29
	rate	2.9	2.7	2.9	3.3	2.6	1.9	0	1.6	13.9	9.8	4.5
Pilbara	*n*	1	2	4	3	3	1	2	4	12	9	41
	rate	1.5	8.3	4.2	3.6	4.1	1.3	13.4	4	21.5	25.8	9.9
South West	*n*	1	3	8	0	1	3	2	4	6	5	33
	rate	0.8	2.2	5	0	0.7	1.9	1.2	2.5	3.5	3.1	2.1
Wheatbelt	*n*	1	0	2	0	0	0	0	0	1	4	8
	rate	0.9	0	2.5	0	0	0	0	0	0.8	6.6	1.1
Unknown	*n*	0	0	1	0	1	1	1	2	3	4	14

Notes: Unknown = Unknown residential address within WA

Congenital syphilis

From 2010 to 2019, there was a total of five congenital syphilis notifications: one in 2010, two in 2013 and one each in 2018 and 2019. Two of the five cases were non-Aboriginal (both in the Perth metropolitan region) and three were Aboriginal (one in the Perth metropolitan region and two in non-metropolitan areas).

Syphilis testing

From 2010 to 2019, the syphilis testing, notification and test positivity rates all increased: by 31% (34.4 to 44.9 per 1,000 population), more than four-fold (6.4 to 28.6 per 100,000 population) and more than three-fold (0.13% to 0.44%), respectively (Figure 57). This indicates that the increase in notifications from 2010 was predominately due to increased disease transmission.

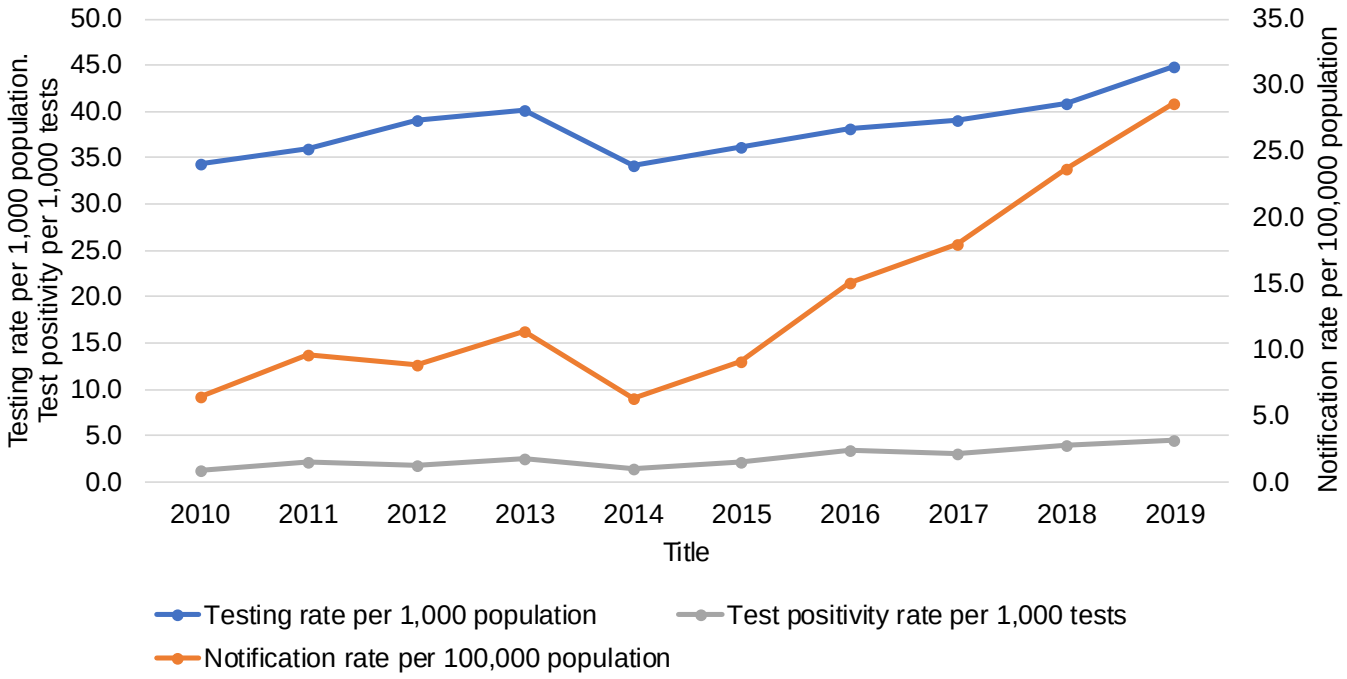


Figure 57. Syphilis testing rate, notification rate and test positivity rate, in WA, 2010 to 2019

HIV

HIV (human immunodeficiency virus) is a virus that is transmitted from person-to-person through infected body fluids (e.g. blood, semen, vaginal fluid, anal fluid or breast milk) into the bloodstream, usually through a break in skin or mucous membrane. Transmission of HIV can occur through unsafe sexual practices (mainly unprotected anal or vaginal sex), sharing injecting equipment, vertical transmission (during pregnancy, birth or breastfeeding), unsterile body piercing and tattooing, and unsafe medical and dental procedures. Effective anti-retroviral treatment is available for HIV, which allows people with HIV to lead a healthy life. Pre-exposure prophylaxis (PrEP) is also available for HIV-negative people to prevent HIV infection.

Temporal Trends

The number of HIV notifications in WA fluctuated in the first half of the decade, ranging from 85 to 109 cases per year from 2010 to 2014. In following years, annual notifications steadily declined to 58 cases in 2018, a 47% decrease since notifications peaked at 109 cases in 2014 (Figure 58). This decrease was particularly evident among MSM and was attributed to the availability of PrEP in WA. However, in 2019 the number of HIV cases dramatically increased to 103 cases, representing a 78% increase compared to 2018. This increase was largely due to a rise in HIV cases among heterosexual men who acquired HIV while travelling overseas.

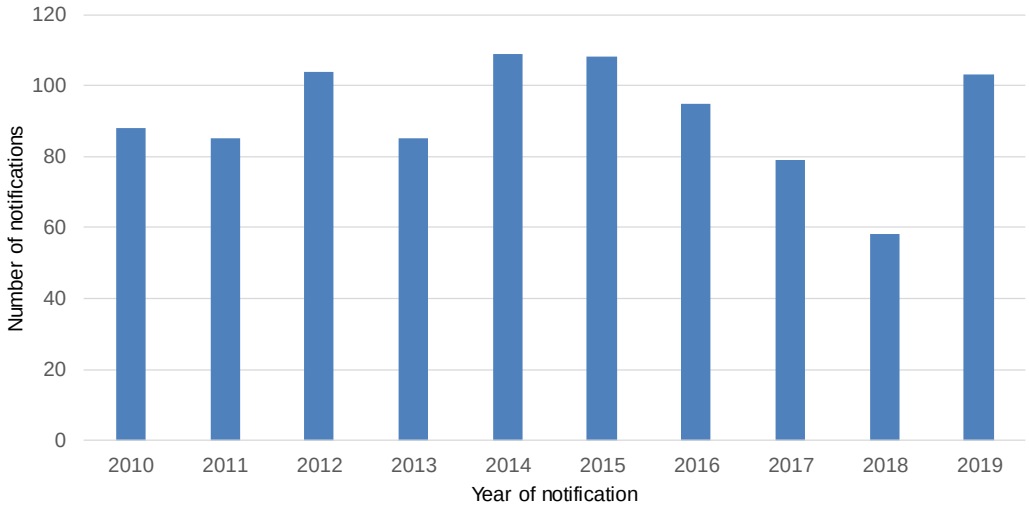


Figure 58. Number of HIV notifications, by year, in WA, 2010–2019

Over the 10-year reporting period, notifications of HIV cases were predominately among metropolitan residents (87%; n=799). During this period only 12% (n=108) of HIV cases resided in the non-metropolitan area, with numbers ranging between 7 and 18 cases per year. Between 2010 and 2019, the ASR for HIV notifications in the metropolitan area was also eight times the rate in the non-metropolitan area (3.2 vs 0.4 per 100,000 population).

Sex and Age

Of the 914 HIV cases newly diagnosed in WA between 2010 and 2019, 82% (n=752) were male, 17% (n=159) were female and <1% (n=4) were transgender. Correspondingly, the ASR for males was 4.5 times the rate for females over the 10-year reporting period (5.9 vs 1.3 per 100,000 population) (Appendix 1) (Figure 59).

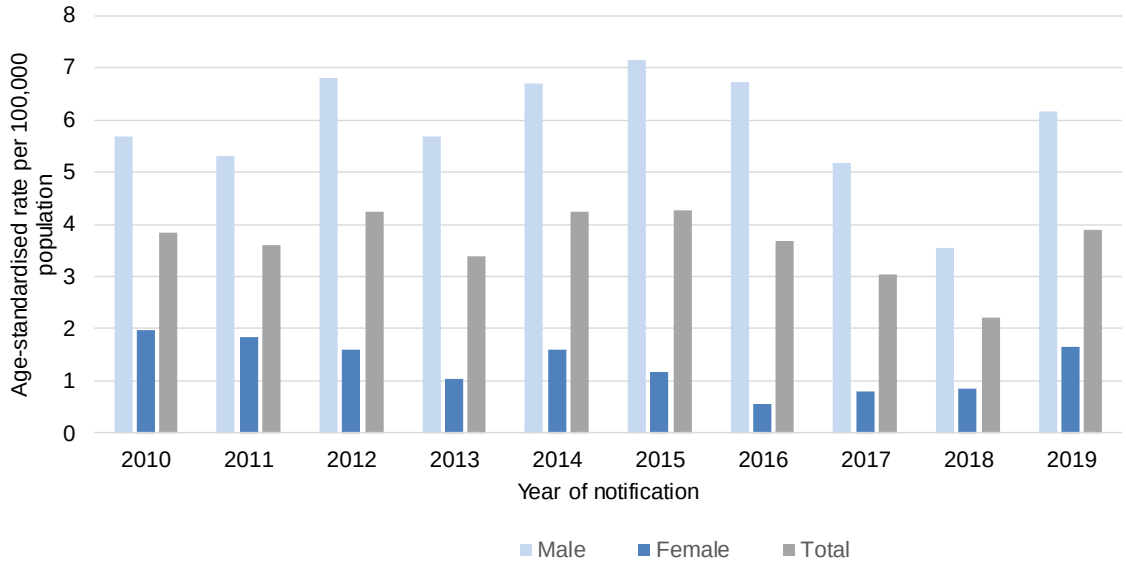


Figure 59. Number and ASR (per 100,000 population) for HIV, by year, in WA, 2010–2019

Between 2010 and 2019, the median age of HIV notifications in WA was 37 years, with the median age for females being five years younger (33 years) than the median age for males (38 years). Over the 10-year reporting period, the highest proportion of cases were from the 30 to 39 year age group (30%; n=276), followed by cases aged 20 to 29 years (24%; n=219) and 40 to 49 years (23%; n=213).

Aboriginal Status

The number of HIV notifications in Aboriginal people remained low over the 2010 to 2019 period, ranging between 0 and 6 cases per year. Over the same period, the HIV ASR for Aboriginal people was slightly lower than the rate for non-Aboriginal people (3.1 vs 3.7 per 100,000 population) (Appendix 2). Between 2010 and 2019, females made up a larger proportion of Aboriginal HIV cases (41%; n=12) compared to non-Aboriginal cases (16%; n=146), which is reflective of most Aboriginal HIV cases reporting heterosexual risk exposures over the 10-year period. HIV notifications among Aboriginal people were also more likely to be in non-metropolitan residents, with 69% of notifications coming from the non-metropolitan area (n=20).

Risk Exposure

In the 10-year period from 2010 to 2019, just over half of all HIV notifications were in MSM (51%; n=470), followed by cases reporting heterosexual risk exposures (43%; n=389). While in most years HIV notifications were predominant among MSM, there were a number of years where heterosexual acquisition was the most commonly reported risk exposure (Figure 60). This trend was largely due to an increase in heterosexual HIV cases arriving in WA from high prevalence regions (2010-2011), as well as increases in heterosexual men acquiring HIV while travelling overseas to high prevalence regions (in 2017 and 2019). HIV notifications were largely stable for other HIV risk exposure categories including injecting drug use (IDU) and vertical transmission. Only a small proportion of notifications were attributed to IDU in the 10-year period (2%; n=17). In contrast to total HIV notifications, most Aboriginal HIV cases reported heterosexual risk exposures (55%; n=16) followed by MSM exposure risk (28%; n=8), between 2010 to 2019. There were only three cases (10%) of HIV reporting IDU among Aboriginal people over the 10-year period.

Place of Acquisition

Over the 10-year reporting period, trends in the country of HIV acquisition differed according to risk exposure. From 2010 to 2019, over half of HIV cases in WA were acquired in Australia (55%; n=502). The majority of these identified as MSM (73%; n=367), most of whom were also born in Australia (60%; n=219). Over the same period, 42% (n=385) of HIV notifications reported overseas acquisition, with most of those cases reporting heterosexual acquisition (69%; n=265). Of those reporting heterosexual acquisition of HIV overseas, 56% had acquired it in South-East Asia (56%; n=149), followed by Sub-Saharan Africa (30%; n=80). In the 10-year reporting period, heterosexual HIV acquisition in South-East Asia was mostly travel associated cases among males, as the majority of those cases were males born in either Australia (49%; n=73) or another

region outside South-East Asia (23%; n=34). In contrast, most cases reporting heterosexual acquisition in Sub-Saharan Africa were males and females who were born in that region (86%; n=69).

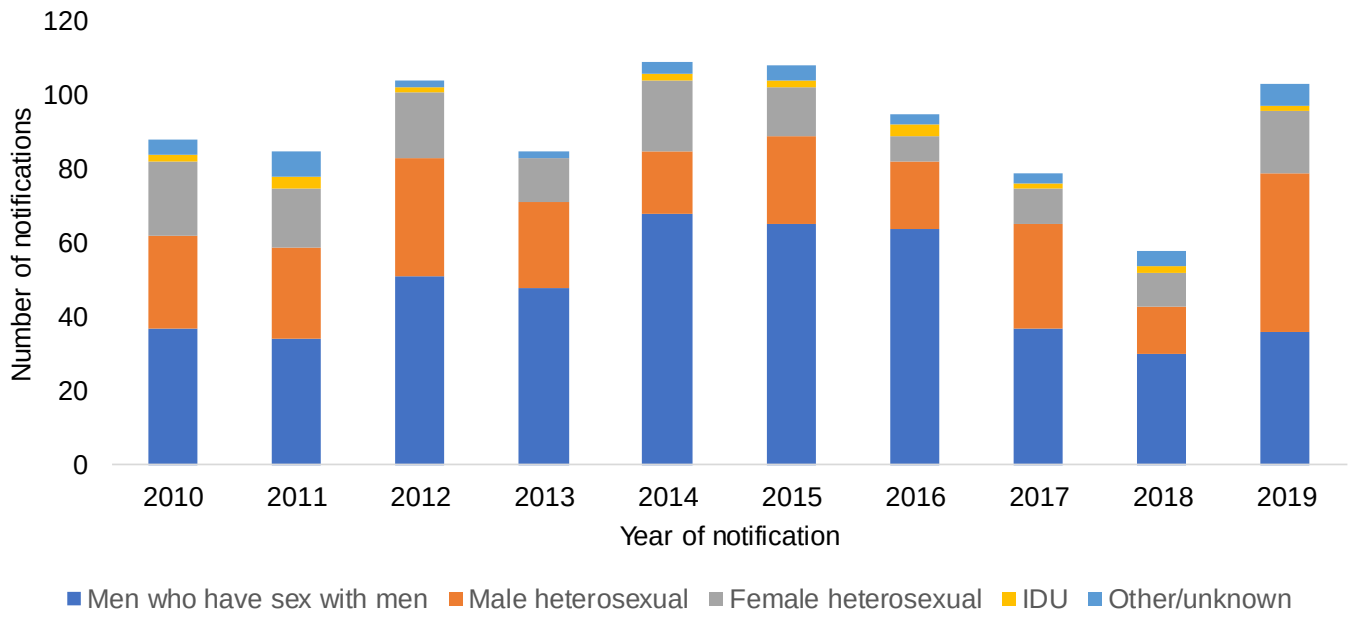


Figure 60. Number of HIV notifications by exposure category and year of notification, WA, 2010-2019

Donovanosis

Donovanosis (granuloma inguinale) is an STI caused by the bacterium *Klebsiella granulomatis*. Donovanosis is uncommon in Australia and is not highly contagious.

There was a total of two donovanosis notifications between 2010 and 2019. In 2012, there was one case of a non-Aboriginal male in the 20-24 years age group who resided in the Perth metropolitan area. The infection was reported to have been acquired in WA from a contact who was likely infected overseas, and the clinical presentation of this case was not typical of donovanosis[2]. In 2014, there was one case of an Aboriginal female in the 35-40 years age group who resided in a remote area of WA. The infection was reported to have been acquired in WA and no source was identified.

Chancroid

Chancroid is an STI caused by the bacterium *Haemophilus ducreyi*. The infection is very rare in Australia and is usually acquired overseas, in tropical and subtropical areas such as South-East Asia, India and parts of Africa, where it is widespread. There were no cases of chancroid during the 2010 to 2019 reporting period. The last case in WA was reported in 2009.

[2] . Australian Burden of Disease Study: Impact and causes of illness and death in Australia 2015

Vaccine Preventable Diseases

Vaccine preventable diseases (VPDs) are diseases for which there are vaccines available to prevent infection. According to the Australian Burden of Disease Study 2015, infectious diseases were responsible for 2% of the total burden of disease in Australia in 2015, of which 11% were due to VPDs[2]. Key vaccines are free through the NIP for eligible people, including young children, older Australians, pregnant women, individuals with at-risk medical conditions and Aboriginal and Torres Strait Islander people.

Between 2010 and 2019, 13 diseases were included under the VPD category on WANIDD (Table 1). Overall, a total of 121,675 VPDs were notified in WA during the ten-year period, of which 120,378 (99%) were among WA residents (Table 2 and Table 3). Influenza was the most commonly notified disease in this category accounting for more than half (54.1%; n=65,141) of all notifications, followed by varicella zoster virus (27.2%, n=32,790) and pertussis (15.8%, n=18,984); Figure 61. Overall, the median age at infection of VPD was 36 years (range: 1 day to 105 years) and more than a quarter of all cases (n=32,353) occurred in children aged less than 15 years. The ASR in the Aboriginal population was 1.7-fold higher than the rate in the non-Aboriginal population (733.7 vs 430.9 per 100,000 population).

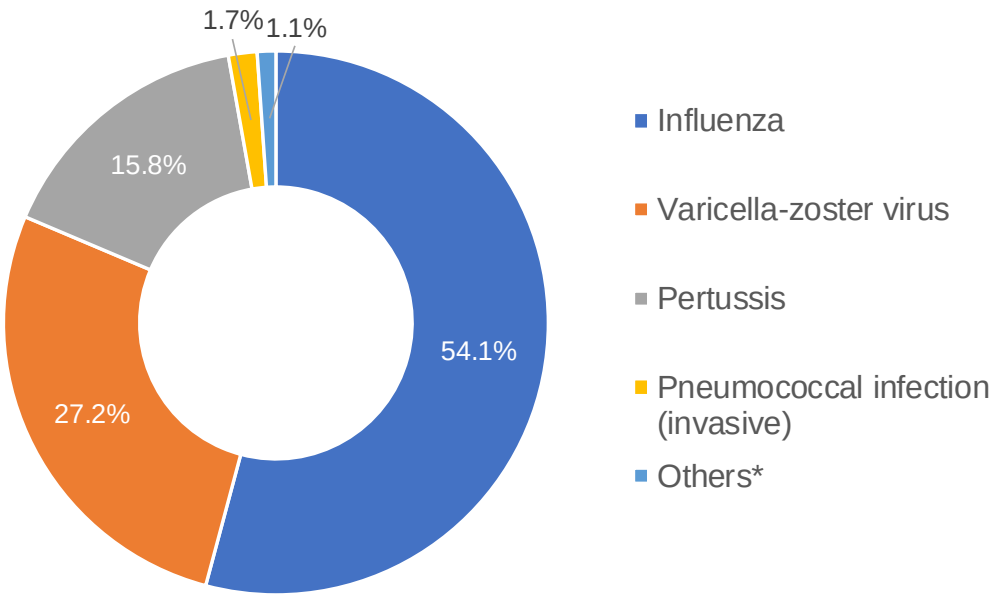


Figure 61. Proportion (%) of notified cases of vaccine preventable diseases in WA 2010–2019

Influenza

Influenza is caused by influenza viruses of which there are four types: A, B, C and D. In general, influenza A and B cause seasonal epidemics of disease in humans. Based on the viral proteins haemagglutinin (H) and neuraminidase (N) present on the virus surface, influenza A viruses are

further classified into subtypes such as A(H1N1) and A(H3N2). Influenza infections commonly occur in winter. Transmission occurs by direct contact with secretions and contaminated surfaces or through inhalation of respiratory droplets.

Temporal Trends

Between 2010 and 2019, there were 65,141 confirmed cases of influenza notified among WA residents, equating to a mean annual ASR of 262.0 per 100,000 (Table 4 and Table 5). Over the ten-year period, the mean annual ASR for influenza infection was lowest in 2010 (71.0 per 100,000; n=1,616) and highest in 2019 (890.4 per 100,000; n=23,195). The 2019 notification rate was almost 4.8-fold higher compared to the previous 9-year mean ASR of 185 per 100,000. High levels of influenza were also reported in 2019 in other Australian jurisdictions[3] (Figure 62). In contrast, the USA experienced a moderate influenza season for the 2018/2019 periods[4]. While it is unclear why the Australian 2019 season was high compared to previous years, it has been speculated that a low 2018 influenza season may have led to a more susceptible population, together with the introduction of virus from overseas.

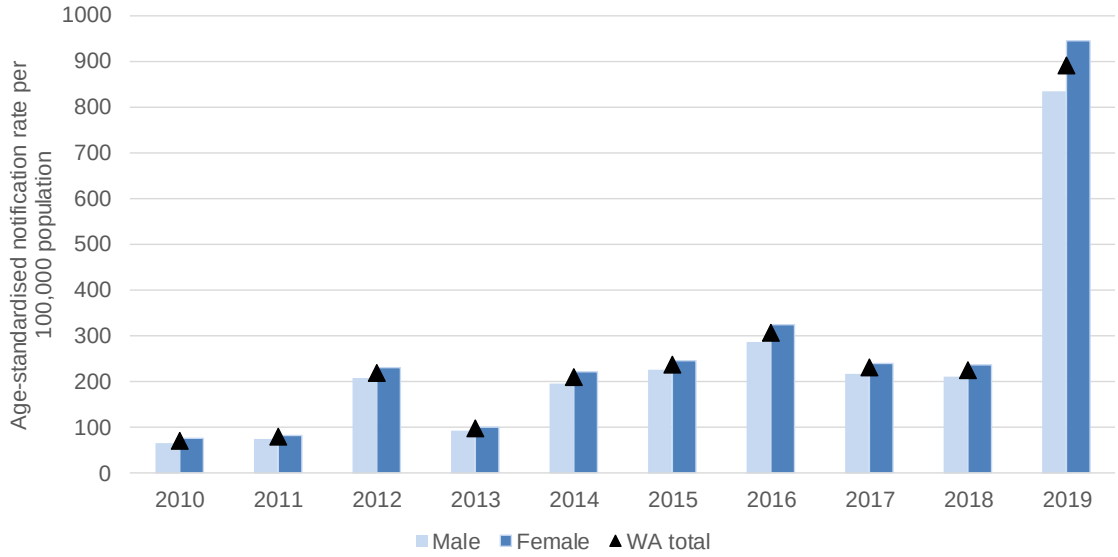


Figure 62. ASR (per 100,000 population) for influenza by sex and year of disease onset in WA, 2010–2019.

Influenza notifications typically exhibited a clear winter seasonal pattern (May to October) with notifications peaking in July/August except for 2019 when notifications began to increase in April (Figure 63).

[3] aisr-2019-national-influenza-season-summary.docx (live.com)
[4] Update: Influenza Activity in the United States During the 2018–19 Season and Composition of the 2019–20 Influenza Vaccine - PMC (nih.gov)

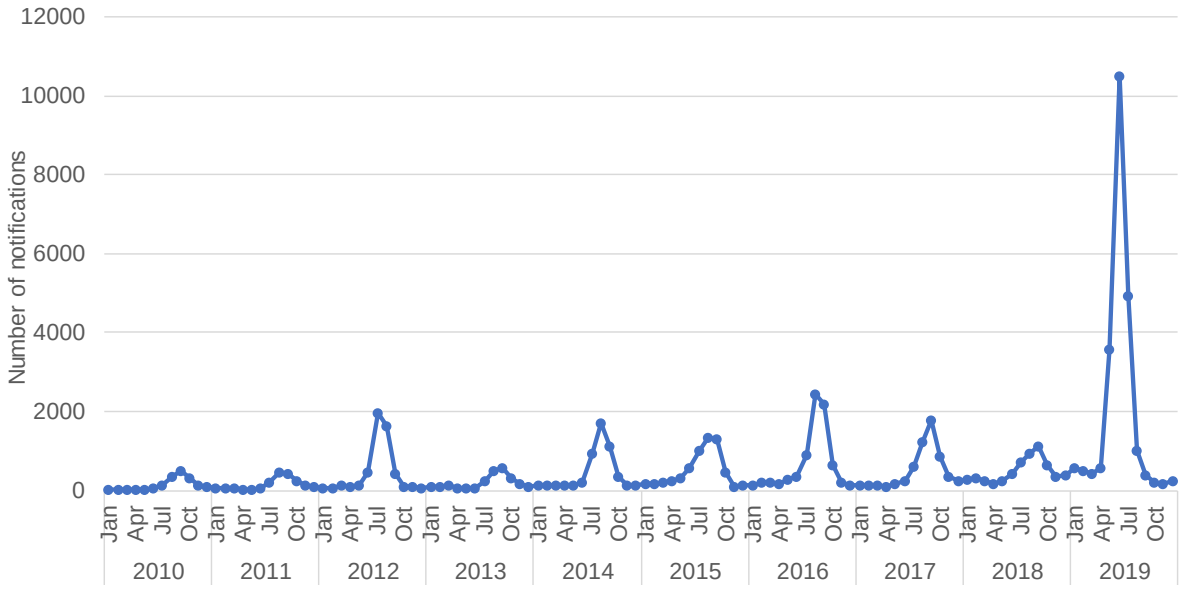


Figure 63. Number of notifications for influenza by month and year of disease onset in WA, 2010–2019

Sex and Age

Females had a higher notification rate than males with a mean annual rate of 277.4 vs 247.1 per 100,000 in males (Figure 64, Appendix 1). Over the ten-year period, cases ranged in age from <1 to 105 years (median: 35 years). The mean annual notification rate was highest among adults aged 85 years and older (655.3 per 100,000; n=2,603) and approximately 41% (n=1,065) of all notifications in this age group occurred in 2019. Among children, the mean annual notification rate was highest among those aged between 5 and 9 years (435.5 per 100,000; n=2,402), followed by those aged less than 5 years (385.5 per 100,000; n=6,467) (Figure 64). In 2019, influenza vaccination coverage for children aged 6 months to 4 years (52%) was greater than for children aged 5 to 9 years (42%), which may have contributed to lower notification rates in younger children.

Aboriginal Status

Aboriginal status was available for 89% (n=58,110) of all notified cases. The mean annual rates were nearly two times higher in the Aboriginal population than in the non-Aboriginal population (421.9 per 100,000 [n=3,502] vs 228.5 per 100,000 [n=54,608]) (Appendix 2). The age-distribution of cases was similar in Aboriginal and non-Aboriginal populations with the highest rates observed in those aged 85 years and older (Figure 65).

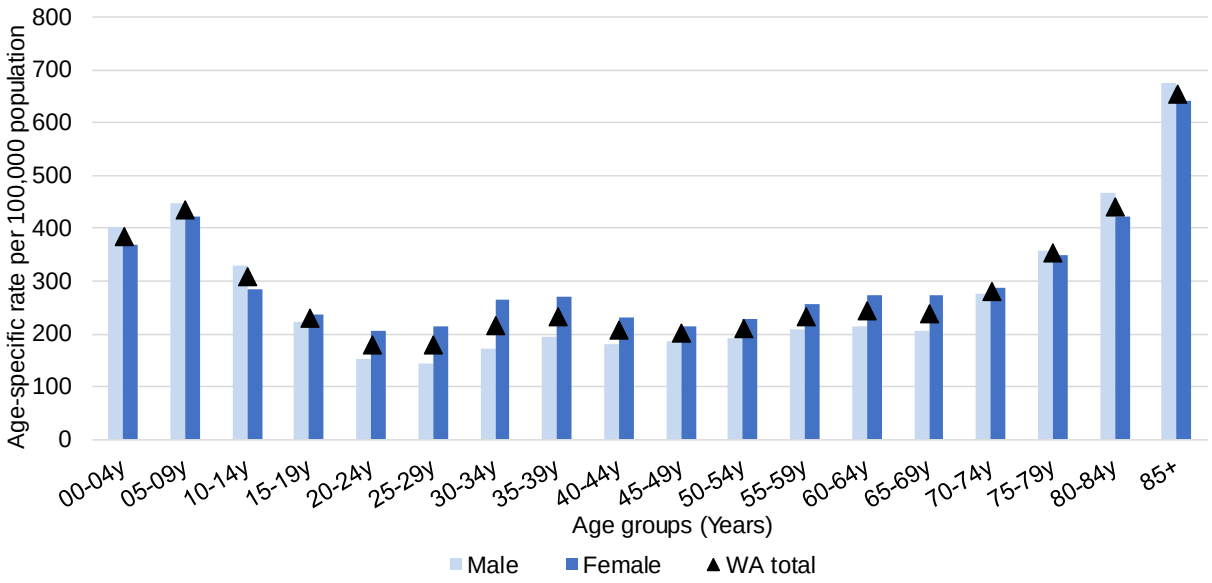


Figure 64. Age-specific notification rates (per 100,000 population) for influenza by sex in WA, 2010 to 2019

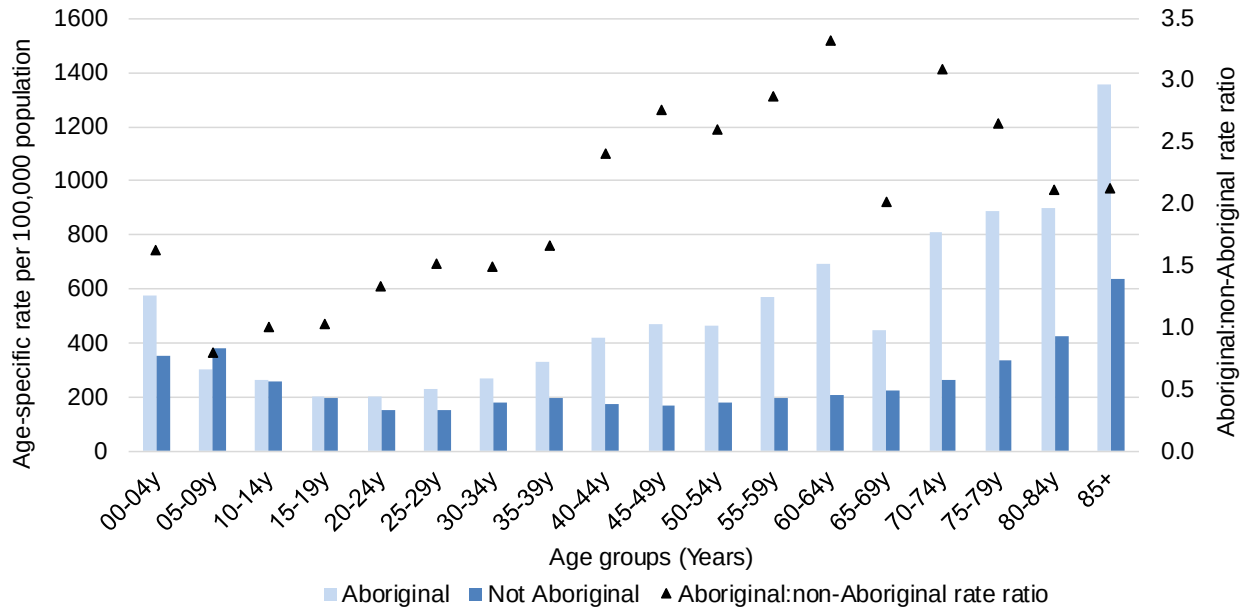


Figure 65. Age-specific notification rates (per 100,000 population) for influenza by Aboriginal status in WA, 2010–2019

Region

Influenza incidence varied by year in each region in WA (Table 23). Over the ten-year period, the Kimberley region had the highest mean annual ASR (571.6 per 100,000; n=2,085), followed by the Midwest region (390.8 per 100,000; n=2,532). In 2019, an increase in notification rates was observed in all regions compared to 2018, notification rates were more than 6-fold higher in the Goldfields and Wheatbelt regions (Table 23).

Type

Influenza typing data were available for 99.9% (n=65,045) of cases. Influenza A was identified in nearly 73% (n=47,280) of influenza cases over the ten-year period (Figure 66). While the proportion of influenza A and B varied over the years, influenza A was dominant across all years except 2015, where influenza A and B were identified equally in all notified cases.

Table 23. Influenza notification numbers (n) and ASR (per 100,000 population), by year and region, in WA (2010–2019)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	1,616	1,863	5,229	2,389	5,238	5,974	7,813	5,989	5,835	23,195	65,141
	rate	71.0	79.5	218.2	96.2	208.1	236.0	305.4	229.2	223.9	890.4	262.0
Goldfields	*n*	32	88	92	29	118	137	103	138	79	471	1287
	rate	52.4	140.4	154.2	47.6	192.6	229.4	191.4	244.5	133.8	891.4	223.6
Great Southern	*n*	77	28	133	38	126	124	217	128	137	521	1529
	rate	145.2	50.9	227.1	59.7	209.1	204.9	341.3	193.7	233.7	836.1	252.0
Kimberley	*n*	28	85	299	64	370	212	217	242	182	386	2,085
	rate	74.4	210.2	775.3	162.9	987.4	588.5	599.1	702.1	517.9	1,091.0	571.6
Metropolitan Perth	*n*	1,251	1,385	3,956	1,949	3,758	4,703	6,115	4,475	4,663	18,467	50,722
	rate	71.0	75.8	211.9	100.4	190.5	236.4	301.5	216.3	226.1	889.0	259.4
Midwest	*n*	29	66	289	86	189	221	251	230	194	977	2,532
	rate	43.0	104.3	436.3	130.0	279.2	336.5	391.2	359.9	306.0	1,603.6	390.8
Pilbara	*n*	55	73	121	70	122	125	424	190	105	500	1,785
	rate	113.1	119.8	194.3	119.7	198.6	195.9	1,039.9	320.8	171.4	832.2	315.3
South West	*n*	76	57	153	94	340	317	330	445	379	1,348	3,539
	rate	51.2	35.3	92.0	54.6	195.2	175.6	182.8	237.6	211.3	756.9	204.4
Wheatbelt	*n*	68	81	186	59	215	135	156	141	96	525	1662
	rate	92.7	108.6	240.5	74.4	276.5	163.3	184.2	162.3	114.4	698.1	211.4

Hospitalisation and mortality

Over the ten-year period, hospitalisation status was available for 75% of all cases (n=48,935; 2,864 Aboriginal people and 44,138 non-Aboriginal people). Of these, 27% (n=13,228) were recorded as being hospitalised; 53% were Aboriginal people (n=1,517) and 26% non-Aboriginal people (n=44,138). Over the ten-year period, 394 (0.6%) of all notified cases (n=24 Aboriginal people and n=363 non-Aboriginal people) were reported as having died due to influenza, with an average of 39 deaths/year. In 2019, there were 97 deaths due to influenza.

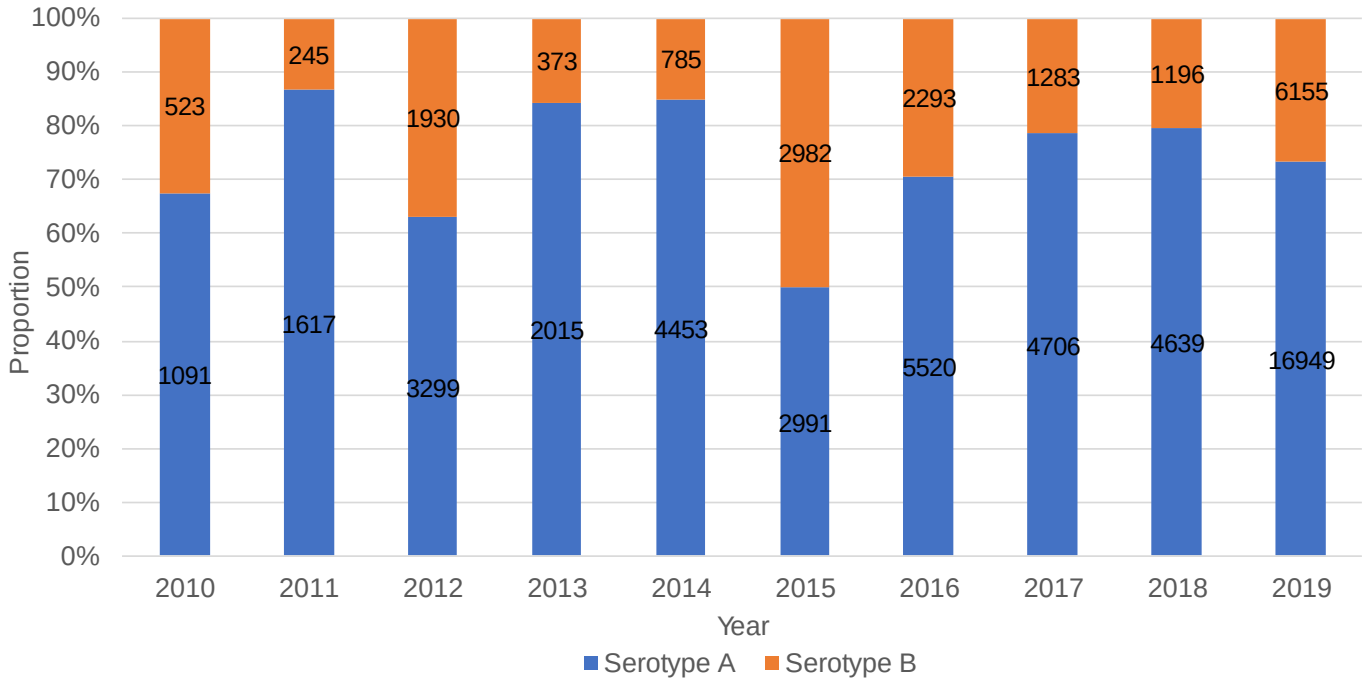


Figure 66. Proportion of influenza type identified by year of disease onset in WA, 2010–2019

Immunisation

Annual seasonal influenza vaccination is recommended for everyone ≥6 months of age, with a NIP-funded program in place since 1999 for all adults aged ≥65 years (Aboriginal adults aged ≥50 years) and for pregnant women since 2010. In WA, a state-funded seasonal influenza vaccination program for all children aged 6 months to <5 years has been in place since 2008. Other significant events in influenza vaccination practice in Australia are detailed in https://www.ncirs.org.au/sites/default/files/2021-07/Influenza-history-July%202021.pdf . The immunisation status was available for 87.4% (n=5,650/6,467) of all notified cases aged <5 years. Of these, only 8.8% (n=499) were fully vaccinated for age and 79.6% (n=4,496) were not vaccinated (Table 24).

Table 24. Immunisation status of notified cases of influenza, aged <5 years, by Aboriginality in WA, 2010–2019

Vaccination Status	Aboriginal (N=573)		Non-Aboriginal (N=4834)		Total* (N=5650)	
	n	%	n	%	n	%
Fully vaccinated for age for this disease	35	6.1	447	9.2	499	8.8
Partially vaccinated for age for this disease	31	5.4	230	4.8	266	4.7
Not age-eligible	84	14.7	291	6.0	389	6.9
Not vaccinated for this disease	423	73.8	3,866	80.0	4,496	79.6

*Total includes cases where Aboriginal status was not recorded

Pertussis

Pertussis (whooping cough) is a respiratory infection caused by the bacterium *Bordetella pertussis*. Transmission occurs by direct contact with secretions and contaminated surfaces, or through inhalation of respiratory droplets.

Temporal Trends

Between 2010 and 2019, a total of 18,984 cases of pertussis were notified among WA residents, reflecting a mean annual ASR of 77.2 per 100,000 (Table 4 and Table 5). Notifications reached a peak of 176.4 notifications per 100,000 population (n=4,017) in 2011. This outbreak was widespread in Australia and thought to be due to waning immunity[5]. In WA after 2011, notifications declined by 88% to a low rate of 21.1 notifications per 100,000 (n=550) in 2019 (Figure 67).

Figure 67. ASR (per 100,000 population) for pertussis by sex and year of disease onset in WA, 2010–2019

Sex and Age

Notification rates were higher in females than in males each year and the overall mean annual ASR was 86.1 per 100,000 among females and 68.6 per 100,000 among males (Figure 67 and Appendix 1). Over the ten-year period, cases ranged in age from <1 to 101 years (median: 34 years). Children aged 10 to 14 years had the highest notification rates for pertussis in both males and females, followed by those in the 5-9 years and 0-4 years age groups (Figure 68).

[5] Pertussis vaccines for Australians Pertussis factsheet June 2023.pdf (ncirs.org.au)

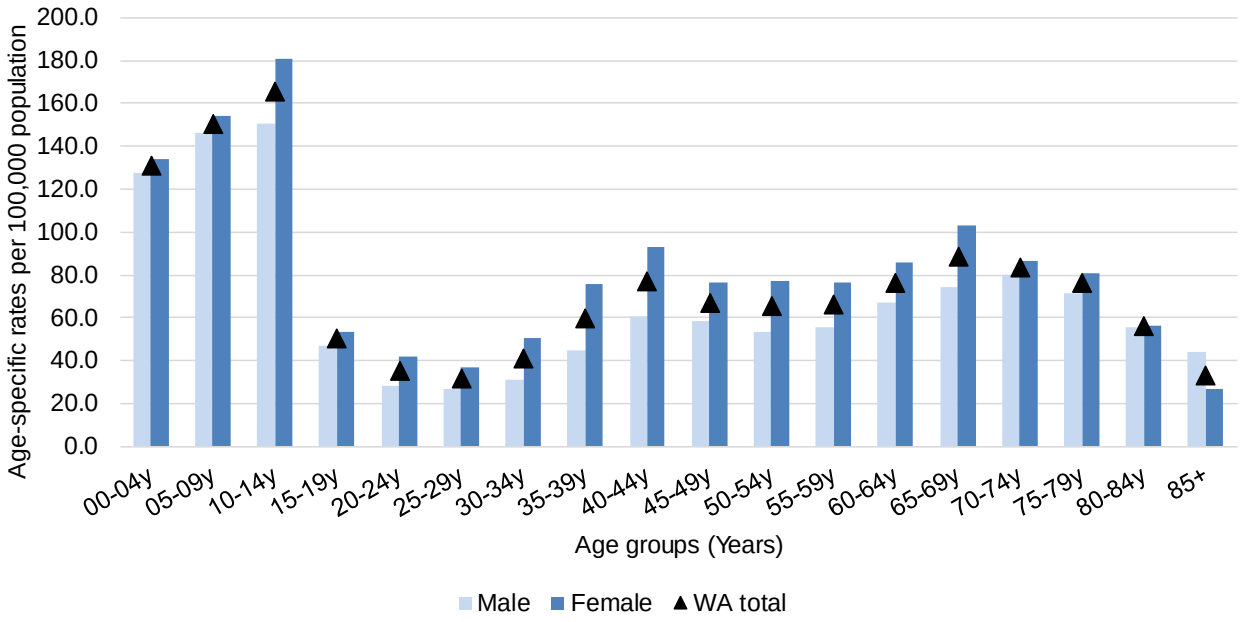


Figure 68. Age-specific notification rates (per 100,000 population) for pertussis by sex in WA, 2010–2019

Aboriginal Status

Aboriginal status was available for 95% (n=18,090) of all notified cases. The mean annual ASR was 1.6-fold higher in the non-Aboriginal population than in the Aboriginal population (74.8 vs 47.4 per 100,000); however, the notification ratio of non-Aboriginal to Aboriginal population varied over the years (Figure 69; Appendix 2).

The age distribution of the pertussis cases varied by Aboriginal status. The median age at disease onset was 10 years (range: 9 days to 87 years) in the Aboriginal population and 35 years (range: 8 days to 101 years) in the non-Aboriginal population. Aboriginal children aged less than 5 years had the highest mean annual notification rate (157.4 per 100,000; n=179) followed by children aged 5 to 9 years (94.4 per 100,000; n=105). Among the non-Aboriginal population, children aged 10 to 14 years had the highest mean annual notification rate (165.6 per 100,000; n=2,374) followed by children aged 5 to 9 years (149.9 per 100,000; n=2,266) (Figure 70).

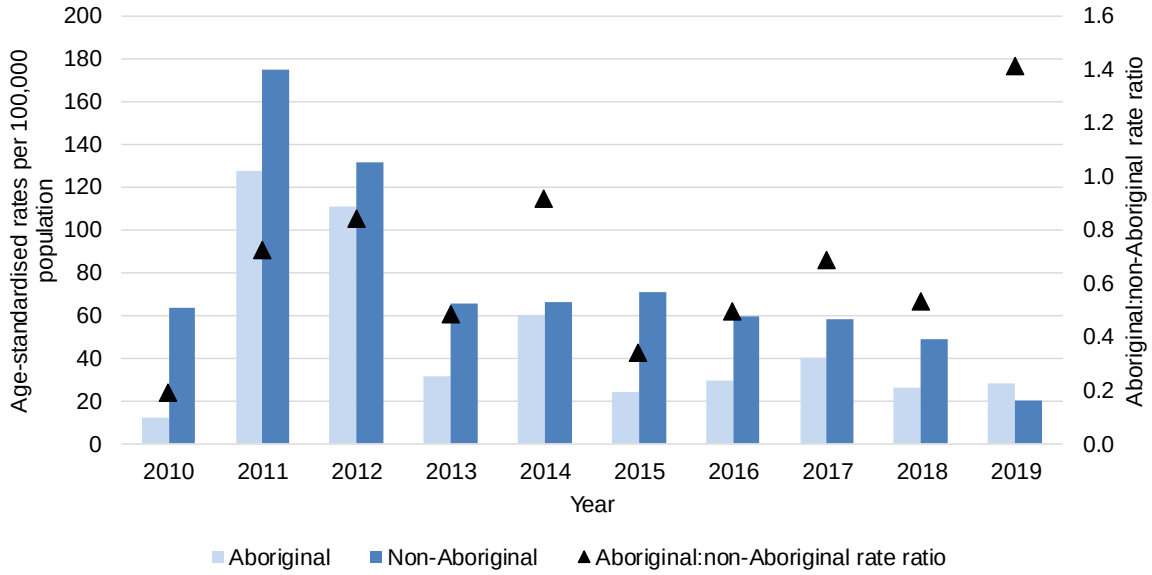


Figure 69. ASR (per 100,000 population) for pertussis by Aboriginality and year of disease onset in WA, 2010–2019

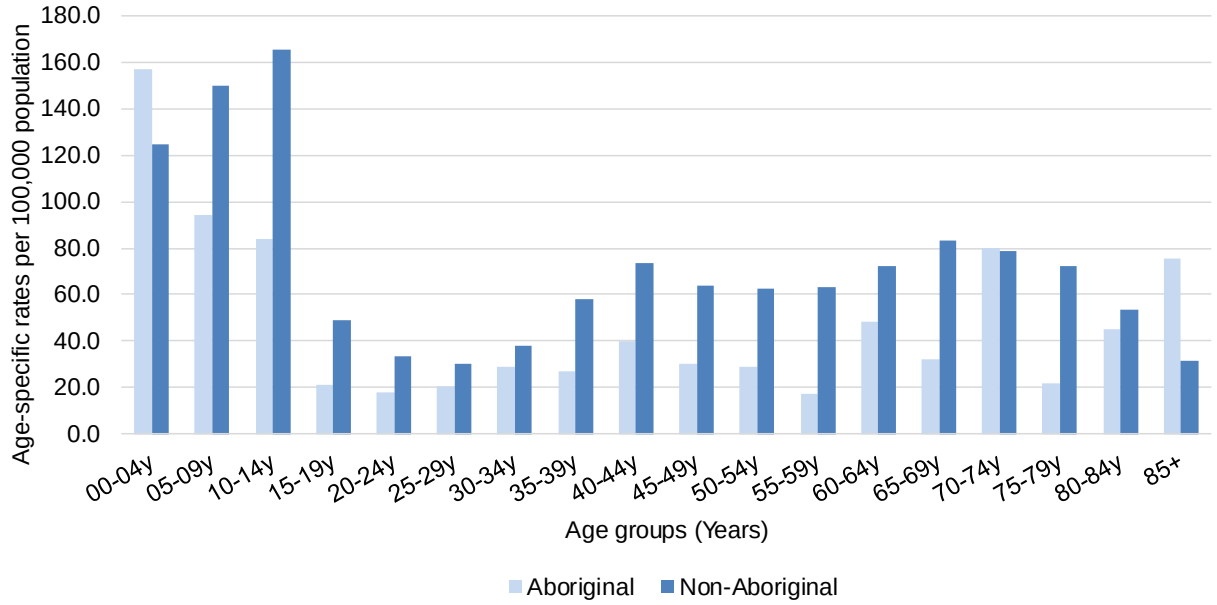


Figure 70. Age-specific notification rates (per 100,000 population) for pertussis by Aboriginality in WA, 2010–2019

Region

Approximately 74% (n=14,034) of all pertussis notifications were among residents of metropolitan Perth. The Great Southern region had the highest mean annual ASR of 145.5 per 100,000 (n=843) followed by the South West region (141.2 per 100,000; n=2,416). Following the large outbreak in 2011, there was a general decline in notification rates in regions with a further decline in notification rates in 2019. For example, in the Great Southern region, compared to 2018, the ASR in 2019 declined by 98% in 2019 (195.7 vs 3.1 per 100,000) and an 80% decline was

observed in the South West region (from 112.4 per 100,000 in 2018 to 22.4 per 100,000 in 2019) (Table 25). However, notification rates in the Kimberley increased from 24.2 per 100,000 in 2018 to 112.2 per 100,000 in 2019 (Table 25).

Immunisation

In Australia, pertussis containing vaccines have been funded through the NIP for infants since 1975. Apart from the infant vaccine schedule, pertussis-containing vaccines were funded in WA for parents, grandparents and carers of infants aged <7 months in 2011 and 2012, and for women during the third trimester of pregnancy since 2015. Significant events in pertussis vaccination practice in Australia are available at

https://www.ncirs.org.au/sites/default/files/2018-11/Diphtheria-tetanus-pertussis-history-July-2018.pdf.

Table 25. Pertussis notification numbers (n) and ASR (per 100,000 population), by year and region, in WA (2010–2019)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	1,453	4,017	3,373	1,639	1,747	1,866	1,521	1,507	1,311	550	18,984
	rate	64.4	176.4	141.4	66.7	69.9	73.9	60.8	59.8	50.7	21.1	77.2
Goldfields	*n*	40	17	15	11	13	34	21	6	4	4	165
	rate	63.2	26.8	24.4	17.4	20.3	59.6	36.2	11.5	6.5	7.3	27.8
Great Southern	*n*	106	182	89	32	27	23	106	163	112	3	843
	rate	183.7	324.6	157.3	50.6	40.8	37.7	183.7	281.8	195.7	3.1	145.5
Kimberley	*n*	3	112	89	18	46	3	17	41	9	45	383
	rate	15.8	286.2	210.1	47.8	109.9	7.3	41.7	99.0	24.2	112.2	94.5
Metropolitan Perth	*n*	879	2,995	2,585	1,338	1,340	1,326	1,178	1,037	916	440	14,034
	rate	50.0	170.3	139.3	69.9	68.1	66.5	59.9	52.2	44.5	21.2	72.7
Midwest	*n*	15	45	151	38	36	31	18	12	51	7	404
	rate	21.9	69.0	228.9	52.9	52.5	44.0	27.6	19.9	78.8	9.4	61.1
Pilbara	*n*	46	54	70	31	10	9	4	15	5	2	246
	rate	122.1	82.2	119.9	48.9	17.6	12.6	8.6	26.3	7.8	2.1	42.7
South West	*n*	316	455	300	101	243	413	156	200	194	38	2,416
	rate	200.4	280.5	181.6	59.5	139.5	233.9	88.4	115.2	112.4	22.4	141.2
Wheatbelt	*n*	48	157	74	70	32	27	21	33	20	11	493
	rate	63.8	219.0	93.0	91.8	43.1	33.4	26.6	45.7	27.4	13.9	66.7

Pertussis immunisation status was available for nearly 99% (n=2,168/2,191) of all notified cases aged <5 years. Of these, 71.9% (n=1558) were fully vaccinated for age and 14.4% (n=312) were not vaccinated (Table 26).

Table 26. Vaccination status of notified cases of pertussis by Aboriginality in WA, 2010–2019

Vaccination Status	Aboriginal (N=176)		Non-Aboriginal (N=1936)		Total* (N=2168)	
	n	%	n	%	n	%
Fully vaccinated for age for this disease	120	68.2	1,397	72.2	1,558	71.9
Partially vaccinated for age for this disease	23	13.1	193	10.0	221	10.2
Not age-eligible	12	6.8	65	3.4	77	3.6
Not vaccinated for this disease	21	11.9	281	14.5	312	14.4

*Total includes cases where Aboriginal status was not recorded

Varicella zoster infection

Varicella zoster virus (VZV) causes chickenpox and shingles. VZV infections are reported in three categories on WANIDD: chickenpox, shingles and unspecified. The laboratory notifies the identification of VZV; further categorisation of the case as chickenpox or shingles is based on follow-up conducted by the PHUs or clinician notifications.

Temporal Trends

Between 2010 and 2019, a total of 32,790 cases of VZV were notified among WA residents, reflecting a mean annual ASR of 129.7 per 100,000 population. Since 2010, notification numbers have shown a steady increase; compared to 2010 (n=1,980), there was a 122% increase in notifications in 2018 (n=4,396) (Figure 71 and Table 4). Overall, approximately 15% (n=5,029) of VZV notifications were classified as chickenpox, 46% (n=14,972) as shingles, and 39% (n=12,789) as VZV unspecified (Table 4).

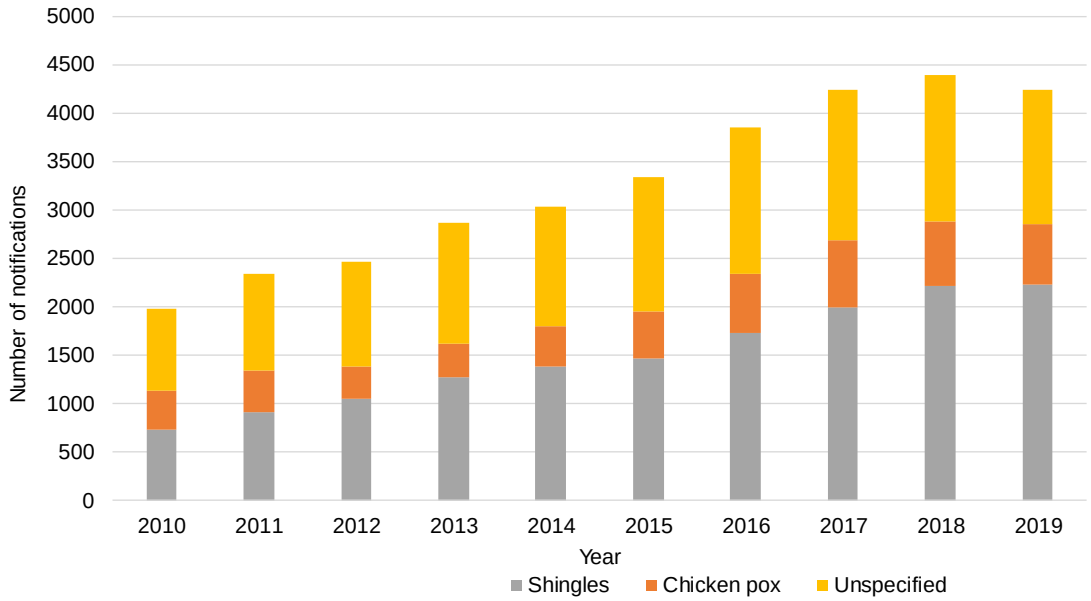


Figure 71. Number of notifications of varicella zoster virus infections by category and year of disease onset in WA, 2010–2019

Varicella zoster (chickenpox)

Chickenpox is the primary illness caused by VZV. Person-to-person transmission occurs through inhalation of respiratory aerosols (produced by coughing) during the early stage of illness and through direct contact with vesicle fluid during the rash/blister phase of the illness.

Temporal Trends

Between 2010 and 2019, there were 5,029 notifications of confirmed cases of chickenpox among WA residents. The mean annual ASR over the ten-year period was 21.1 per 100,000 population. Notification rates ranged from 14.5 per 100,000 (n=333) in 2012 to 27.9 per 100,000 (n=691) in 2017 (Figure 72).

Sex and Age

Over the ten-year period, the mean annual ASR among males was 21.6 per 100,000 versus 20.6 per 100,000 in females. The male to female notification ratio varied by year (Figure 72). Chickenpox cases ranged in age from <1 to 66 years (median: 9 years) with the majority of cases (72%; n=3,638) occurring in children aged less than 15 years. The mean annual notification rate was highest in children aged 5 to 9 years (105.6 per 100,000; n=1,713) followed by children aged less than 5 years (61.5 per 100,000; n=1,032) (Figure 73).

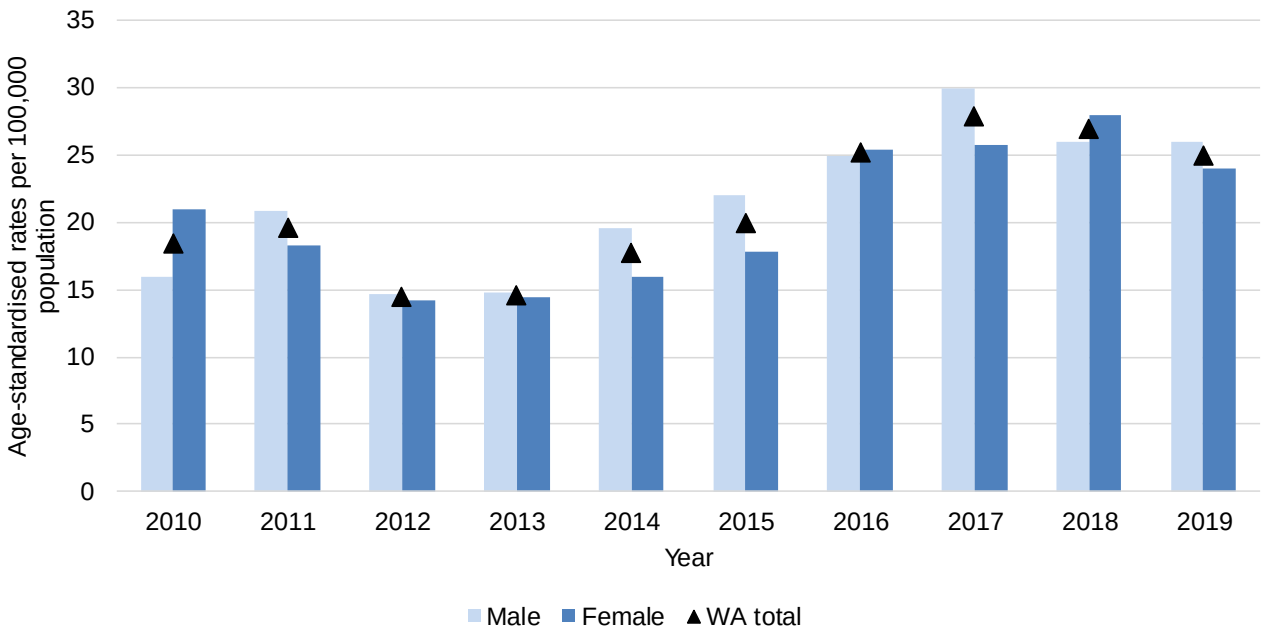


Figure 72. ASR (per 100,000 population) for chickenpox by sex and year of disease onset in WA, 2010–2019

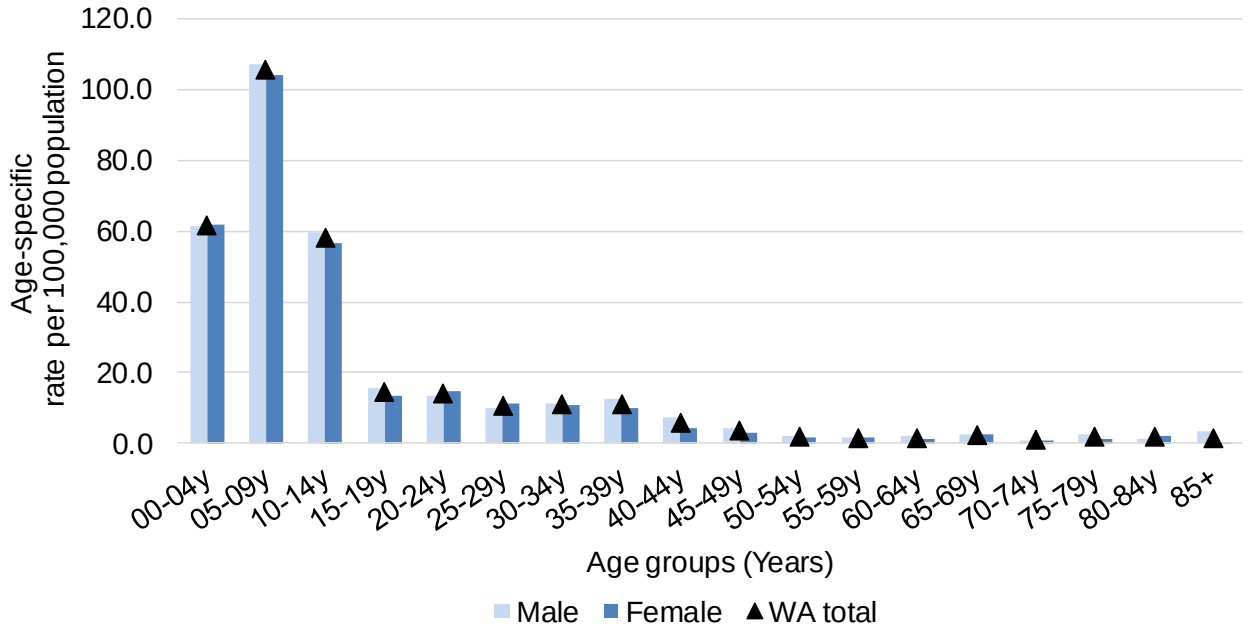


Figure 73. Age-specific notification rates (per 100,000 population) for chickenpox by sex in WA, 2010–2019

Aboriginal Status

Aboriginal status was available for 97% (n=4,892) of all chickenpox notifications. The mean annual ASR over the ten-year period was 19.3 per 100,000 (n=289) in the Aboriginal population and 20.6 per 100,000 (n=4,603) in the non-Aboriginal population. Apart from in 2012, when there was a school-related outbreak among Aboriginal children in the Kimberley region, the ASR have generally been higher in the non-Aboriginal population than in the Aboriginal population (Figure 74 and Appendix 2). Approximately 90% (n=254) of all notifications in the Aboriginal population and 72% (n=3,290) in non-Aboriginal population were among children aged less than 15 years.

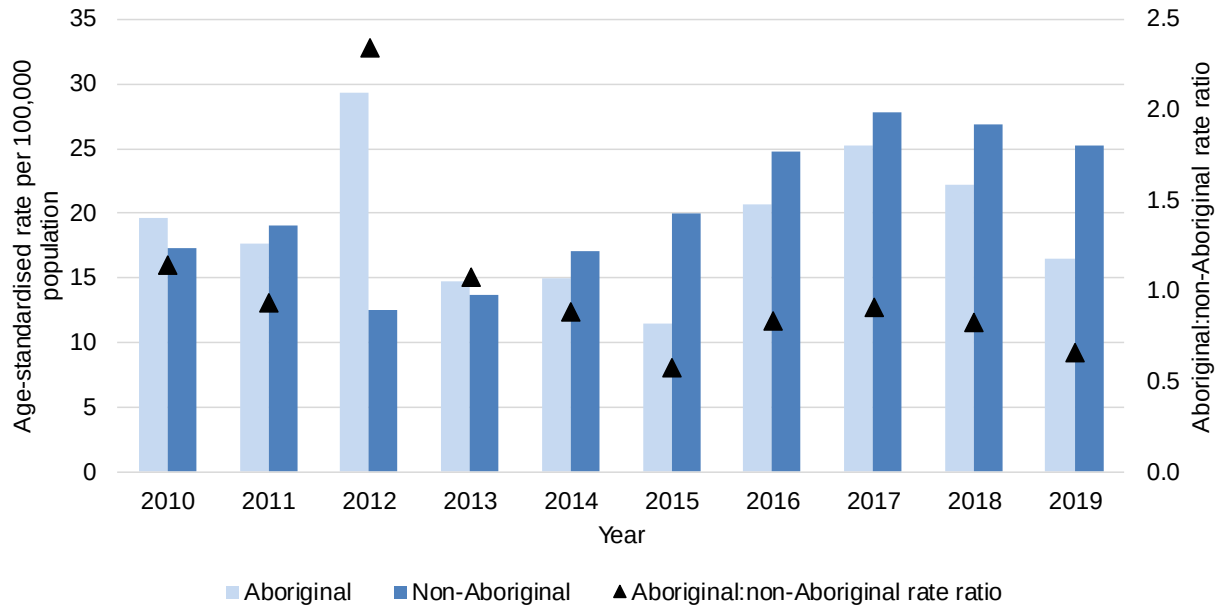


Figure 74. ASR (per 100,000 population) for chickenpox by Aboriginal status and year of disease onset in WA, 2010–2019

Region

The Kimberley region had the highest mean annual ASR (47.2 per 100,000; n=202) and metropolitan Perth and the Midwest region had the lowest ASR (19.7 and 19.8 per 100,000 respectively).

Immunisation

In Australia, funded varicella (chickenpox) immunisation through the NIP commenced in November 2005 with a single dose of varicella vaccine scheduled at 18 months of age. A nationally funded school-based catch-up program, for children aged 10 to 13 years with no history of varicella vaccination, was in place from 2006 to 2017. Significant events in varicella vaccination practice in Australia are available at https://www.ncirs.org.au/sites/default/files/2018-11/Varicella-history-July-2018.pdf.

Varicella immunisation status was available for approximately 90% (n=395/439) of all notified chickenpox cases among children aged 2 to 4 years. Of these, 72.2% (n=317) were fully vaccinated, 17.5% (n=77) were unvaccinated, and 10.3% (n=45) did not have immunisation status reported.

Table 27. Varicella-zoster (chickenpox) notification numbers (n) and ASR (per 100,000 population, by year and region, in WA (2010–2019)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	402	437	333	347	426	487	615	691	667	624	5,029
	rate	18.4	19.6	14.5	14.6	17.8	20	25.2	27.9	27	25	21.1
Goldfields	*n*	40	11	8	11	24	17	11	19	13	21	175
	rate	62.2	16.1	11.9	17	39.2	26.7	18.6	32.1	23.6	37.6	28.3
Great Southern	*n*	11	8	6	5	15	16	19	27	26	21	154
	rate	20.2	14.1	11.2	8.6	27.5	28.3	35	48.2	45.6	39.4	27.7
Kimberley	*n*	24	19	47	9	15	3	26	17	18	24	202
	rate	53.6	44.8	108.7	24.4	34.4	7.8	63.2	40	38.1	58.3	47.2
Metropolitan Perth	*n*	256	347	200	256	284	383	501	487	491	476	3,681
	rate	15.3	20.3	11.1	13.9	15	20	26	24.9	25.1	24	19.7
Midwest	*n*	9	11	22	8	19	14	14	4	15	10	126
	rate	14	17	34.2	11.9	28.8	21.2	21.3	6.6	25	16.7	19.8
Pilbara	*n*	3	6	3	23	16	16	8	47	16	14	152
	rate	5.7	10.9	4	37.5	26.6	25.9	12.9	72.9	24.5	25.7	24.7
South West	*n*	38	28	35	27	27	35	27	75	70	40	402
	rate	24.5	18.2	21.4	16.2	16.3	21.2	16.2	44.3	41.4	23.8	24.4
Wheatbelt	*n*	21	7	12	8	26	3	9	15	18	18	137
	rate	28.9	9.2	16.7	12.6	37.1	4.9	13.9	22.8	27	26.5	19.9

Varicella zoster (shingles)

Shingles is caused by reactivation of VZV, which remains in a latent state in a nerve (the dorsal root ganglia) of the spine after causing primary infection (chickenpox). Approximately 20-30% of all

chickenpox cases will get shingles. The incidence of shingles increases with age, with most cases occurring over the age of 40 years. Shingles can be transmitted by direct contact with the vesicular rash and can cause chickenpox in non-immune people. Shingles is more common in older adults and people who are immunocompromised.

Temporal Trends

Between 2010 and 2019, 14,972 confirmed cases of shingles were notified among WA residents reflecting a mean annual ASR of 58.3 per 100,000 population. From 2010 to 2019, there was a steady increase in shingles notification rates with an overall 2.6-fold increase (Figure 75).

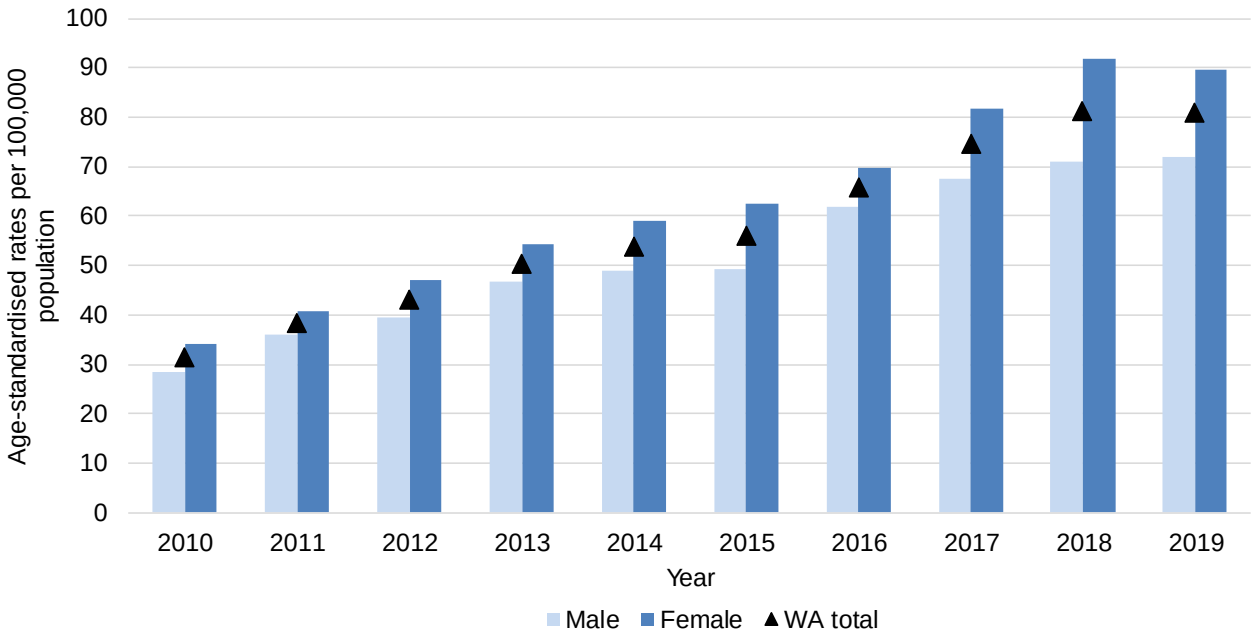


Figure 75. ASR (per 100,000 population) for shingles by sex and year of disease onset in WA, 2010–2019

Sex and Age

Over the ten-year period, notification rates were higher in females compared with males in each year and the mean annual age-specific notification rate in females was 63.9 per 100,000 compared to 52.7 per 100,000 among males (Figure 76 and Appendix 1). Notification rates increased with age with the highest notification rate observed in those aged 85 years and above (Figure 76).

Aboriginal Status

Aboriginal status was available for 98% (n=14,612) of all shingles notifications. Notification rates increased in both Aboriginal and non-Aboriginal populations over the ten-year period (Appendix 2). The mean annual ASR over the ten-year period was 65.9 per 100,000 (n=465) in the Aboriginal population and 56.7 per 100,000 (n=14,147) in the non-Aboriginal population. The median age at infection was 37 years (range: 8 months to 89 years) among Aboriginal people and 53 years

(range: 2 days to 104 years) among non-Aboriginal people. Aboriginal notification rates were consistently higher than non-Aboriginal rates in adults aged 45 years and older (Figure 77).

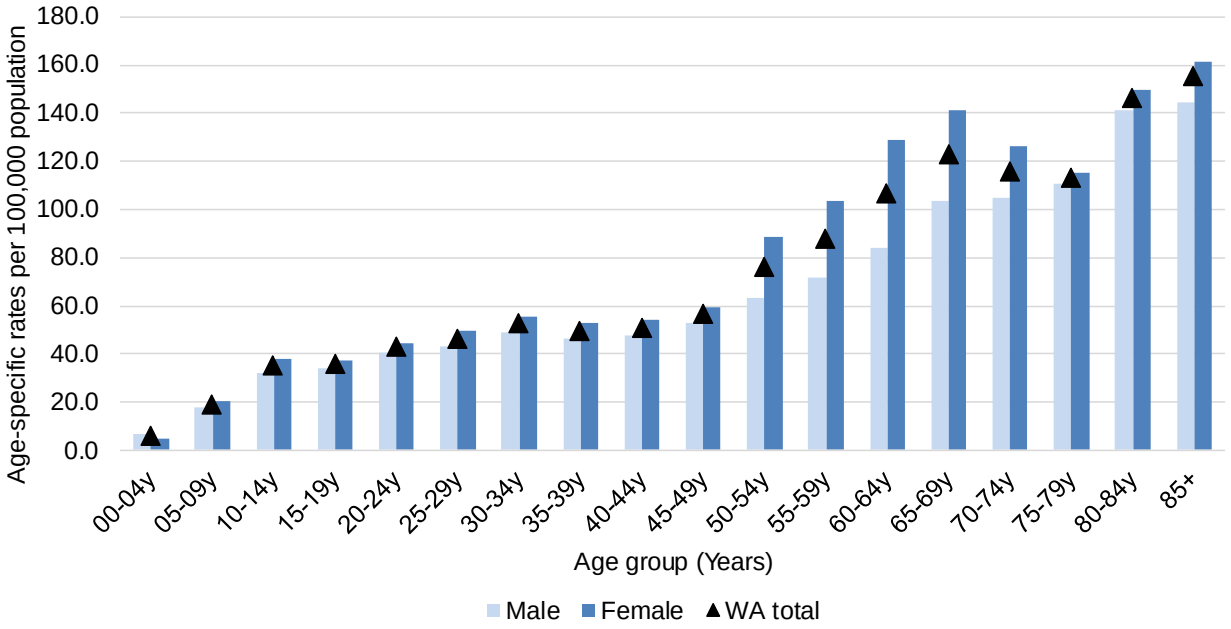


Figure 76. Age-specific notification rates (per 100,00 population) for shingles by sex and age-group in WA, 2010–2019

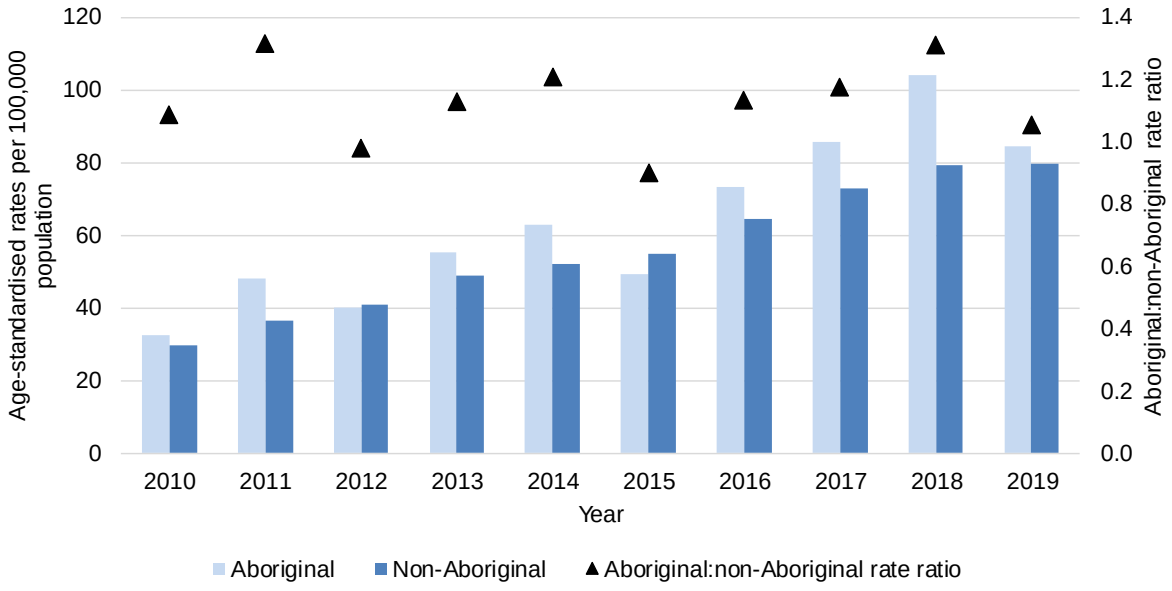


Figure 77. ASR (per 100,000 population) for shingles by Aboriginal status in WA, 2010–2019

Region

The Kimberley region had the highest mean annual ASR (129.4 per 100,000; n=414) followed by the Great Southern region (91.9 per 100,000; n=634) (

Table 28). Almost all regions showed a marked increase from 2016 onwards.

Table 28. Shingles notification numbers (n) and ASR (per 100,000 population), by year and region, in WA (2010–2019)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	724	909	1,055	1,266	1,380	1,460	1,730	2,000	2,217	2,231	14,972
	rate	31.4	38.3	43.2	50.5	54.0	56.1	65.7	74.7	81.4	81.0	58.3
Goldfields	*n*	21	19	18	19	14	16	35	43	50	65	300
	rate	40.7	38.2	34.8	31.4	26.0	28.9	69.6	83.6	95.6	121.4	56.5
Great Southern	*n*	33	37	52	52	55	52	84	74	90	105	634
	rate	51.7	56.0	80.9	75.9	81.3	72.5	118.7	100.2	128.6	147.7	91.9
Kimberley	*n*	21	27	28	39	41	45	45	48	65	55	414
	rate	72.3	86.1	79.9	121.5	127.0	127.8	141.2	168.4	214.6	169.5	129.4
Metropolitan Perth	*n*	488	658	765	995	1,060	1,130	1,285	1,426	1,607	1,607	11,021
	rate	27.2	35.5	40.1	50.6	52.9	55.3	62.1	67.5	74.6	73.5	54.7
Midwest	*n*	17	33	37	18	33	40	71	85	58	50	442
	rate	25.8	51.6	56.7	25.9	49.0	55.9	100.1	128.4	84.0	71.9	64.7
Pilbara	*n*	15	12	6	22	27	28	36	39	34	48	267
	rate	35.7	19.8	7.4	33.0	54.7	49.6	85.1	56.2	72.4	82.5	49.0
South West	*n*	83	71	93	62	74	100	126	205	235	235	1,284
	rate	50.8	41.4	54.1	35.0	40.1	51.6	65.2	105.5	118.9	123.9	69.6
Wheatbelt	*n*	46	52	56	59	76	49	48	80	78	66	610
	rate	58.8	61.7	64.8	68.4	86.0	57.7	51.2	90.0	88.1	67.3	69.3

Immunisation

In Australia, since 2009, zoster vaccine has been recommended for adults aged ≥60 years who have not previously received zoster vaccine; since 2016 zoster vaccine has been funded through the NIP for eligible adults.

Among those aged more than 70 years and notified with shingles between 2017 and 2019, 13.8% (n=159/1,156) were fully vaccinated and 57.0% (n=659) were unvaccinated; vaccination status was unknown for approximately 30% of this cohort.

Varicella zoster (unspecified)

Temporal Trends

Over the ten-year period, a total of 12,789 unspecified VZV cases were notified among WA residents, equating to a mean annual ASR of 50.3 per 100,000. The notification rate increased over the years from a low of 37.1 per 100,000 (n=854) in 2010 to 58.7 per 100,000 (n=1,558) in 2017 and then declined by 13% to 51.0 per 100,000 (n=1,387) in 2019 (Figure 78).

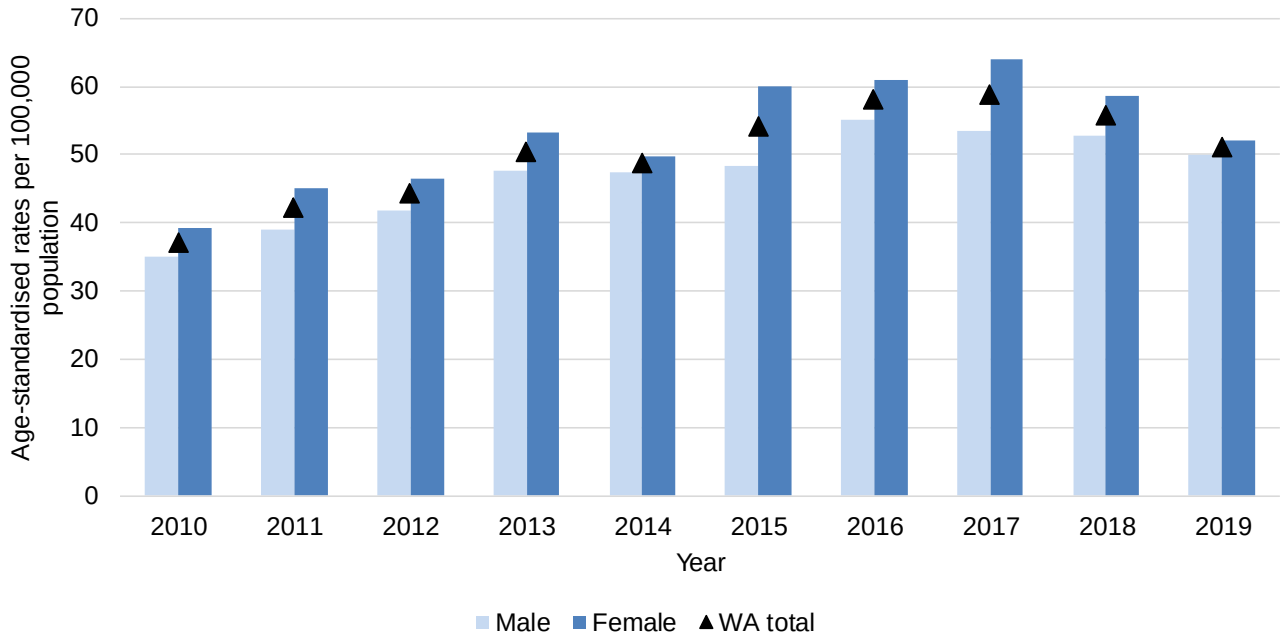


Figure 78. ASR per 100,000 for unspecified VZV infections by sex and year of disease onset in WA, 2010–2019

Sex and Age

The majority of notifications were from females (54%; n=6,847) and the male to female ratio was stable over the 10 year period (Figure 78). The mean annual ASR in females was 53.2 per 100,000 compared to 47.3 per 100,000 among males (Appendix 1). The age distribution of notified unspecified VZV infections was similar to the age distribution for shingles, wherein the notification rates increased with age and the highest notification rates were observed in people aged 85 years and older (128.6 per 100,000; n=511) (Figure 79). Females predominated across all age-groups except children aged less than 5 years and adults aged 80 years and older (Figure 79).

Aboriginal status

Aboriginal status was available for 83% (n=10,676) of all unspecified VZV notifications. The mean annual ASR over the ten-year period was 1.8-fold higher in the non-Aboriginal population (42.4 per 100,000; n=10,459) than in the Aboriginal population (24.1 per 100,000; n=217) (Appendix 2). Cases ranged in age from <1 to 72 years (median: 27 years) among Aboriginal people and from <1 to 103 years (median: 49 years) among non-Aboriginal people.

Region

Notification rates for unspecified VZV were consistently highest in metropolitan Perth over the ten-year period, with a mean annual ASR of 58.9 per 100,000 (n=11,805).

Compared to previous years, the number of notifications for unspecified VZV declined in the Goldfields, Kimberley, Midwest, Pilbara and South West regions since 2017 (Table 24).

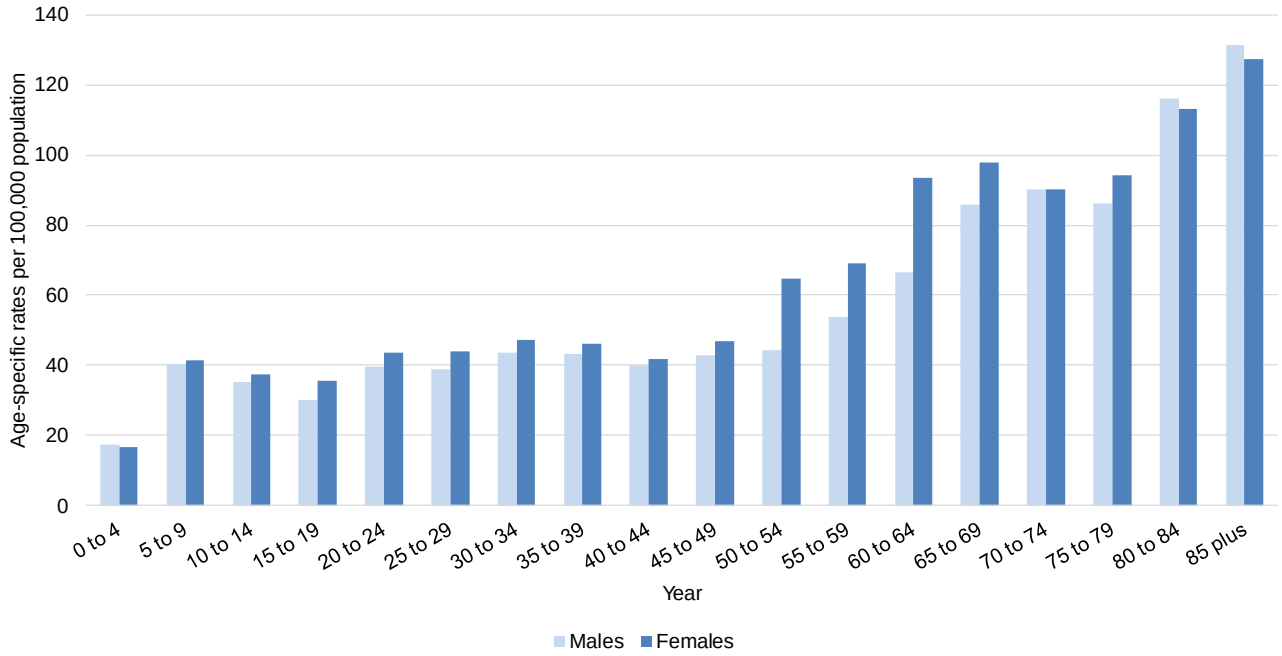


Figure 79. Age-specific notification rates (per 100,000 population) for unspecified VZV infections by sex in WA, 2010–2019

Table 29. VZV (unspecified) notification numbers (n) and ASR (per 100,000 population, by year and region, in WA (2010–2019)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	854	995	1,072	1,260	1,236	1,400	1,515	1,558	1,512	1,387	12,789
	rate	37.1	42.1	44.2	50.4	48.6	54.2	58.0	58.7	55.6	51.0	50.3
Goldfields	*n*	1	3	9	5	11	4	7	2	3	1	46
	rate	1.6	4.7	19.1	7.7	19.9	6.5	15.1	3.6	4.9	1.4	8.6
Great Southern	*n*	6	19	8	9	16	14	13	22	18	25	150
	rate	9.4	32.1	13.5	13.3	24.7	17.7	19.1	31.3	27.7	32.8	22.2
Kimberley	*n*	15	0	29	10	8	1	0	0	0	0	63
	rate	39.0	0.0	70.6	33.6	22.9	2.9	0.0	0.0	0.0	0.0	17.3
Metropolitan Perth	*n*	775	916	971	1,100	1,072	1,253	1,377	1,523	1,482	1,336	11,805
	rate	43.1	49.6	51.1	56.1	53.8	61.6	66.8	72.6	68.7	61.8	58.9
Midwest	*n*	5	3	8	37	29	20	7	0	0	5	114
	rate	8.2	4.8	12.2	54.5	38.4	31.3	10.8	0.0	0.0	8.1	17.1
Pilbara	*n*	15	10	12	6	2	1	4	0	3	0	53
	rate	28.7	16.2	16.3	7.6	3.7	1.4	7.1	0.0	6.2	0.0	8.6
South West	*n*	28	33	30	85	91	87	96	10	4	0	464
	rate	17.1	19.4	17.3	49.5	49.8	48.2	49.9	4.5	2.3	0.0	25.7
Wheatbelt	*n*	9	11	5	8	7	20	11	1	2	20	94
	rate	10.8	14.8	6.6	7.8	8.1	23.5	11.7	1.3	2.5	23.4	11.0

Invasive pneumococcal disease

Streptococcus pneumoniae, also called pneumococcus, is a bacterium that can cause acute infection. Invasive pneumococcal disease (IPD) is diagnosed when the bacterium is detected in normally sterile sites such as the blood, cerebrospinal fluid, pleural fluid or in the joints.

Temporal Trends

During the ten-year period, a total of 2,086 confirmed cases of IPD were notified in WA, reflecting a mean annual ASR of 8.2 per 100,000 (n=2,086). Notification rates ranged from 6.3 per 100,000 (n=166) in 2015 to 10.2 per 100,000 (n=241) in 2011 (Figure 80). A clear seasonal pattern in notifications for IPD was observed, with higher number of cases reported between June and October each year (Figure 81).

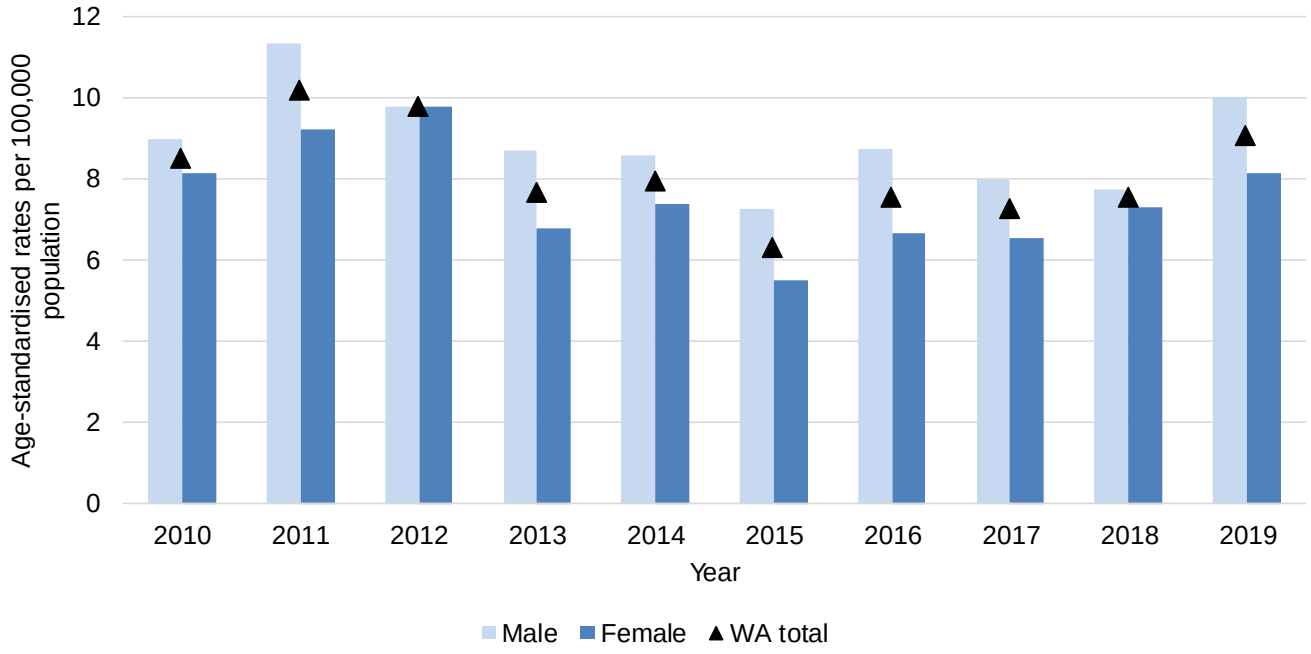


Figure 80. ASR (per 100,000 population) for IPD, by sex and year of disease onset, in WA, 2010–2019

Sex and Age

The male-to-female ratio varied over the ten-year period with the mean annual ASR being slightly higher in males (8.9 per 100,000; n=1,119) than in females (7.6 per 100,000; n=967) (Figure 82 and Appendix 1). Cases ranged in age from <1 to 99 years (median: 46 years), with approximately 16% (n=329) of notifications occurring in children aged 0 to 4 years. The highest mean annual notification rate was observed in the age group 85 years and older (24.2 per 100,000; n=97) followed by the 0-4 years age group (19.6 per 100,000). The age distribution of the cases was similar among both males and females (Figure 82).

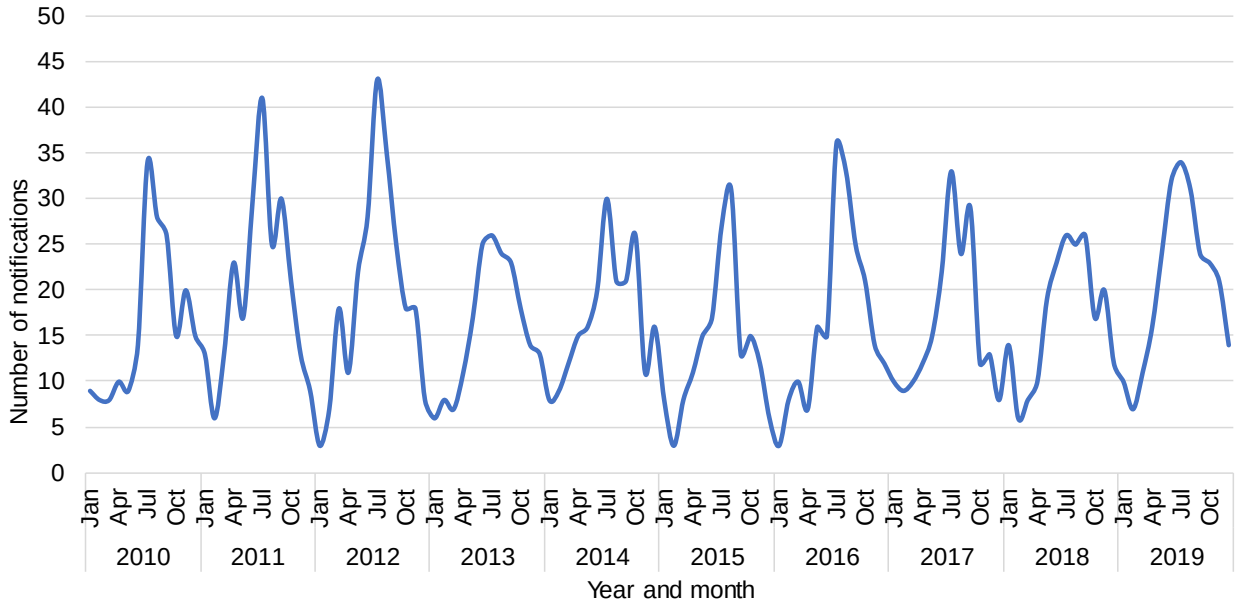


Figure 81. Number of notifications for IPD by month and year of disease onset in WA, 2010–2019

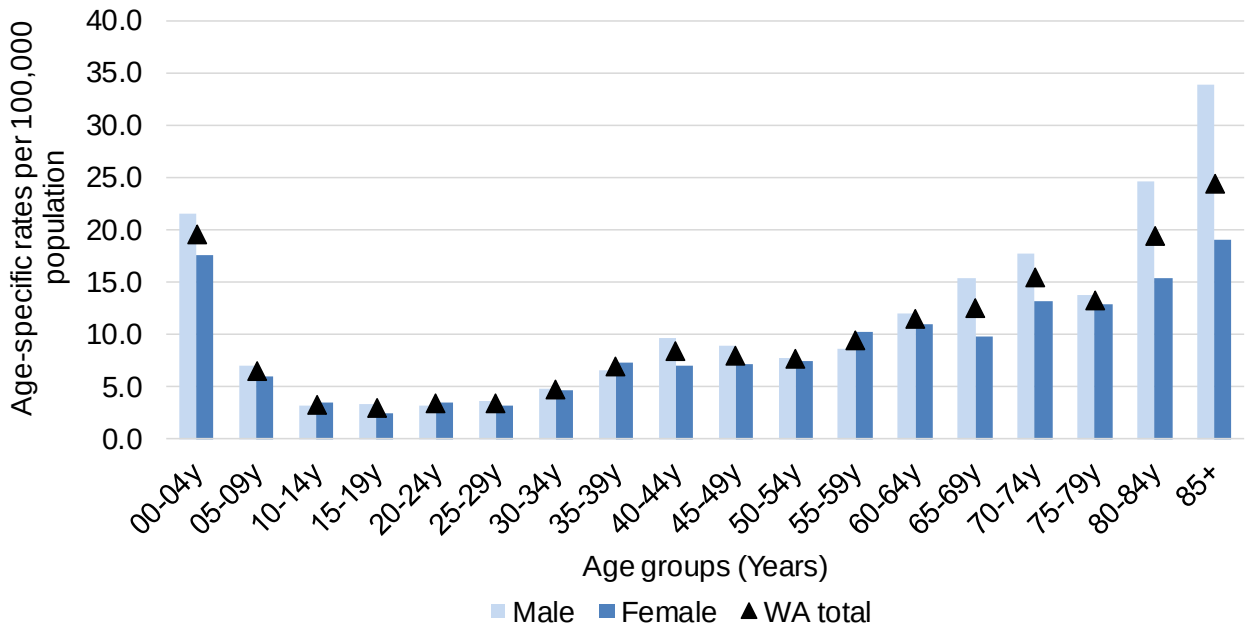


Figure 82. Age-specific notification rate (per 100,000 population) for IPD by sex in WA, 2010–2019

Aboriginal Status

For the ten-year period, the Aboriginal status was available for >99% (n=2,080) of all notified cases. The mean annual ASR was 15-fold higher in the Aboriginal population compared to the non-Aboriginal (84.4 per 100,000 vs 5.6 per 100,000) (Appendix 2). Since 2011, notification rates in the Aboriginal population have declined; compared to 2011, the notification rate was nearly 43% lower in 2019 (133.6 per 100,000 vs 76.2 per 100,000). No discernible temporal changes in disease trend were observed in the non-Aboriginal population over the 10 years (Figure 83).

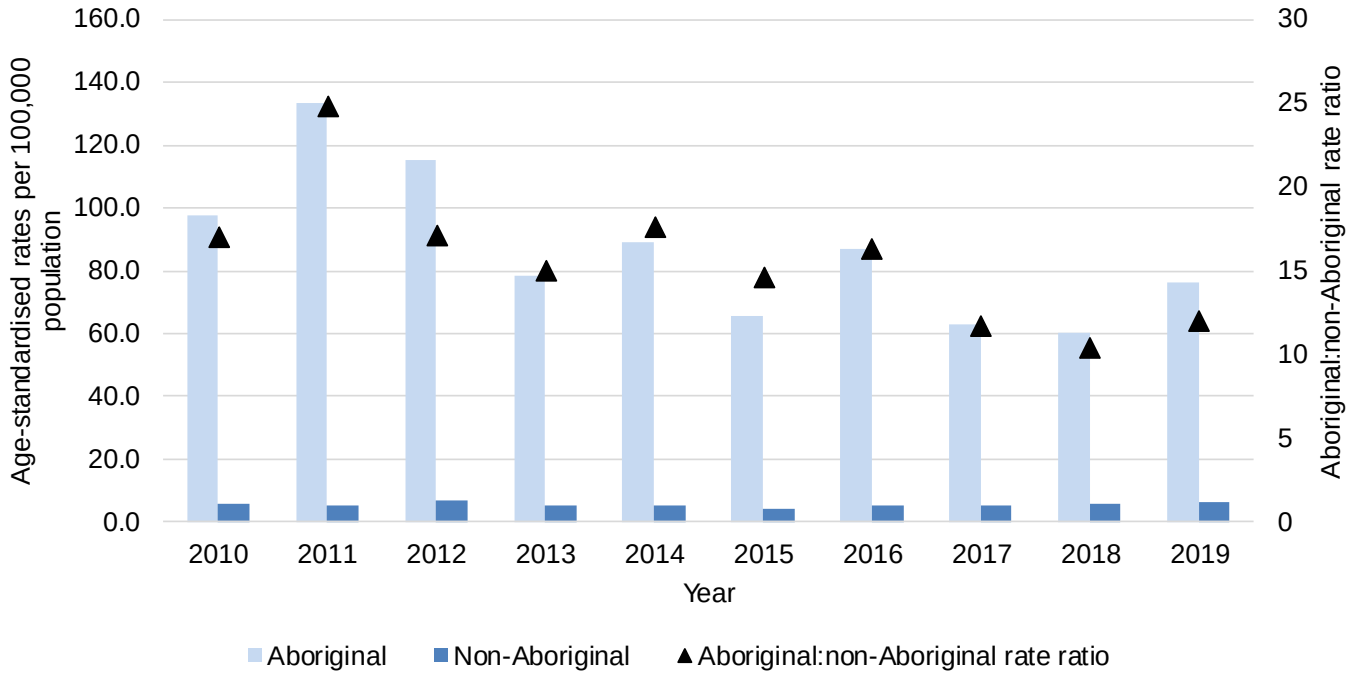


Figure 83. ASR (per 100,000 population) for IPD by Aboriginal status year of disease onset in WA, 2010–2019

In the non-Aboriginal population, the mean annual notification rates were highest in children under 5 years and adults over 80 years. Among the Aboriginal population, a fifth of all notifications were among those aged 40-49 years; notification rates were highest in adults aged 35 years and older (Table 30).

Table 30. Number and mean age-specific annual rate (per 100,000 population) of notifications for IPD among Aboriginal and non-Aboriginal population in WA, 2010–2019

Age group	Aboriginal			Non-Aboriginal			Rate ratio*
	n	%	Rate	n	%	Rate	
0-4y	92	13.3	80.9	236	17.0	15.1	5.4
5-9y	34	4.9	30.6	72	5.2	4.8	6.4
10-14y	30	4.3	28.9	20	1.4	1.4	20.7
15-19y	33	4.8	34.5	12	0.9	0.8	41.8
20-24y	36	5.2	39.5	23	1.7	1.4	28.4
25-29y	34	4.9	41.1	32	2.3	1.7	24.0
30-34y	50	7.2	72.8	41	2.9	2.2	32.7
35-39y	62	9.0	104.1	60	4.3	3.5	29.5
40-44y	80	11.6	138.2	67	4.8	4.0	35.0
45-49y	69	10.0	129.8	67	4.8	4.0	32.4
50-54y	59	8.6	132.1	65	4.7	4.1	32.1
55-59y	50	7.2	142.5	91	6.5	6.2	22.8
60-64y	31	4.5	125.3	119	8.6	9.3	13.5
65-69y	14	2.0	89.7	121	8.7	11.3	7.9
70-74y	8	1.2	91.4	117	8.4	14.6	6.3

75-79y	3	0.4	65.0	74	5.3	12.7	5.1
80-84y	3	0.4	134.6	78	5.6	18.8	7.1
85+y	2	0.3	150.8	95	6.8	24.0	6.3
Total	690	100	84.4^	1390	100	5.6	15.1^

*Rate ratio comparing Aboriginal to non-Aboriginal population

Region

By region, the mean annual ASR were highest in the remote regions of Kimberley (57.1 per 100,000; n=219), Pilbara (37.5 per 100,000; n= 194) and the Goldfields (22.4 per 100,000; n=129) (Table 31).

Immunisation

In July 2001, the 7-valent pneumococcal conjugate vaccine (7vPCV) was added to the NIP for all Aboriginal children and any non-Aboriginal child at high risk of IPD. From January 2005, the program was expanded to include all children. In July 2011, the 7vPCV was replaced by the 13-valent PCV (13vPCV). For adults aged ≥65 years, pneumococcal vaccines have been funded since 2005. People with high risk medical conditions have been eligible for additional doses of pneumococcal vaccines.

In the 10-year period, of the children aged less than 2 years who were notified with IPD (n=180), 66% (n=119) were fully vaccinated for age, 14% (n=26) were partially vaccinated, 8% (n=14) were not vaccinated and 12% (n=21) were not age-eligible to have received the vaccine (Table 32).

Table 31. IPD notification numbers (n) and ASR (per 100,000 population, by year and region, in WA (2010–2019)

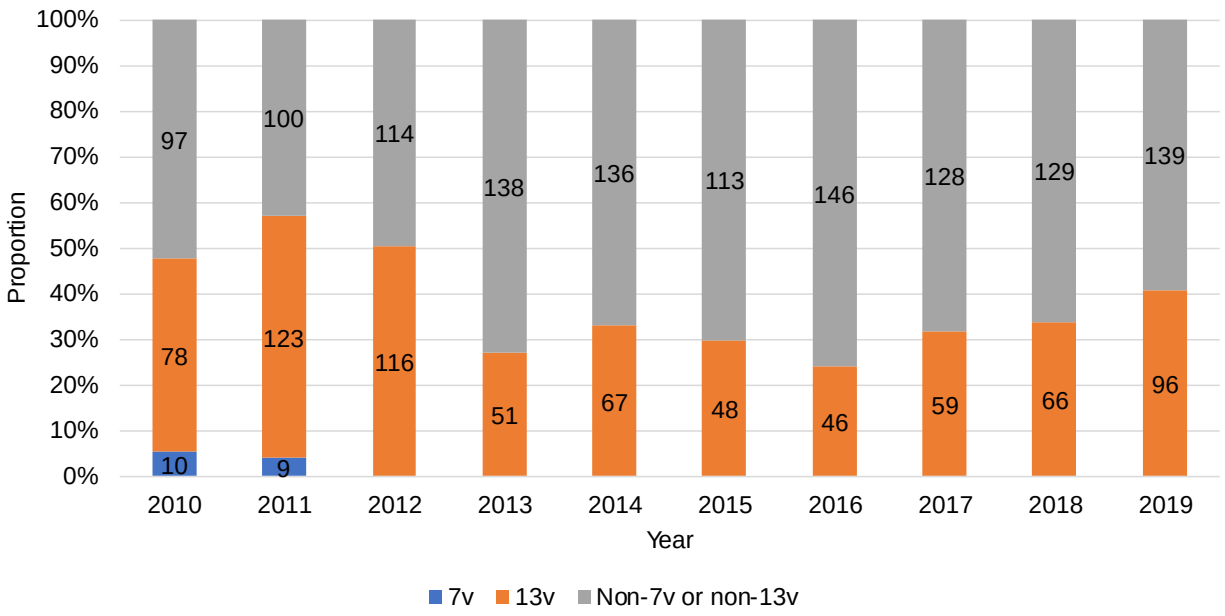
		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	196	241	236	192	205	166	200	197	206	247	2,086
	rate	8.5	10.2	9.8	7.7	8.0	6.3	7.6	7.3	7.6	9.1	8.2
Goldfields	*n*	16	16	11	6	14	8	10	16	15	17	129
	rate	29.5	26.0	19.0	12.0	22.1	12.7	16.0	29.6	24.3	34.5	22.4
Great Southern	*n*	5	5	8	5	5	4	4	4	6	5	51
	rate	8.6	8.4	11.6	7.6	6.1	4.6	5.5	6.1	10.3	8.0	7.6
Kimberley	*n*	18	47	22	19	26	21	15	15	13	23	219
	rate	44.7	115.8	54.6	43.3	65.1	62.2	40.6	39.5	35.9	67.0	57.1
Metropolitan Perth	*n*	115	108	139	109	113	100	112	127	124	150	1,197
	rate	6.4	5.8	7.4	5.6	5.6	4.9	5.3	5.9	5.7	6.8	6.0
Midwest	*n*	5	18	16	14	8	11	9	8	11	11	111
	rate	8.2	28.8	24.8	20.8	12.0	16.0	13.7	12.6	16.9	15.9	17.2
Pilbara	*n*	16	30	25	20	19	7	24	15	18	20	194
	rate	23.9	44.8	46.1	40.8	27.8	10.7	78.1	23.6	41.5	48.1	37.5
South West	*n*	17	11	6	14	10	6	19	10	12	17	122
	rate	10.3	6.3	3.7	7.9	5.5	2.8	9.8	4.7	6.5	9.3	6.7
Wheatbelt	*n*	4	6	9	5	10	9	7	2	7	4	63
	rate	5.1	6.7	11.9	6.3	12.5	11.2	7.5	2.5	8.3	4.8	7.8

Table 32. Vaccination status of children aged <2 years notified for IPD, by Aboriginal status, in WA, 2010–2019

Vaccination status	Aboriginal		Not Aboriginal		Total	
	n	%	n	%	n	%
Fully vaccinated for age for this disease	30	51.7	89	73	119	66.1
Partially vaccinated for age for this disease	13	22.4	13	10.7	26	14.4
Not Applicable	8	13.8	13	10.7	21	11.7
Not vaccinated for this disease	7	12.1	7	5.7	14	7.8

Serotyping

For the 10-year period, serotyping data was available for 96% of all notified cases. As part of the NIP in mid-2011, the 7vPCV was replaced with the 13vPCV (has 7 valent types plus 6 others). From 2010 to 2012, the proportion of non-13vPCV serotypes (includes 7vPCV) ranged from 46% to 52% (Figure 84). From 2013 onwards, the proportion of non-13v serotypes (includes 7vPCV) increased, ranging from 61% to 73% (Figure 84).



*For the years 2010 and 2011, 13vPCV refers to the serotypes present in 13vPCV that are not included in 7vPCV. 13vPCV replaced 7vPCV in mid-2011

Figure 84. Number and proportion of vaccine- and non-vaccine-type serotypes identified in notified cases of IPD in WA, 2010–2019

Over the ten-year period, among the non-vaccine serotypes, the most commonly identified serotype was 22F (n=160; 13%) followed by serotype 8 (n=140; 10.9%). Among the vaccine serotypes, 19A (included in 13vPCV) was the most commonly identified serotype between 2010 and 2015, whilst serotype 3 (included in 13vPCV) was the most common from 2016 to 2019 (Figure 85).

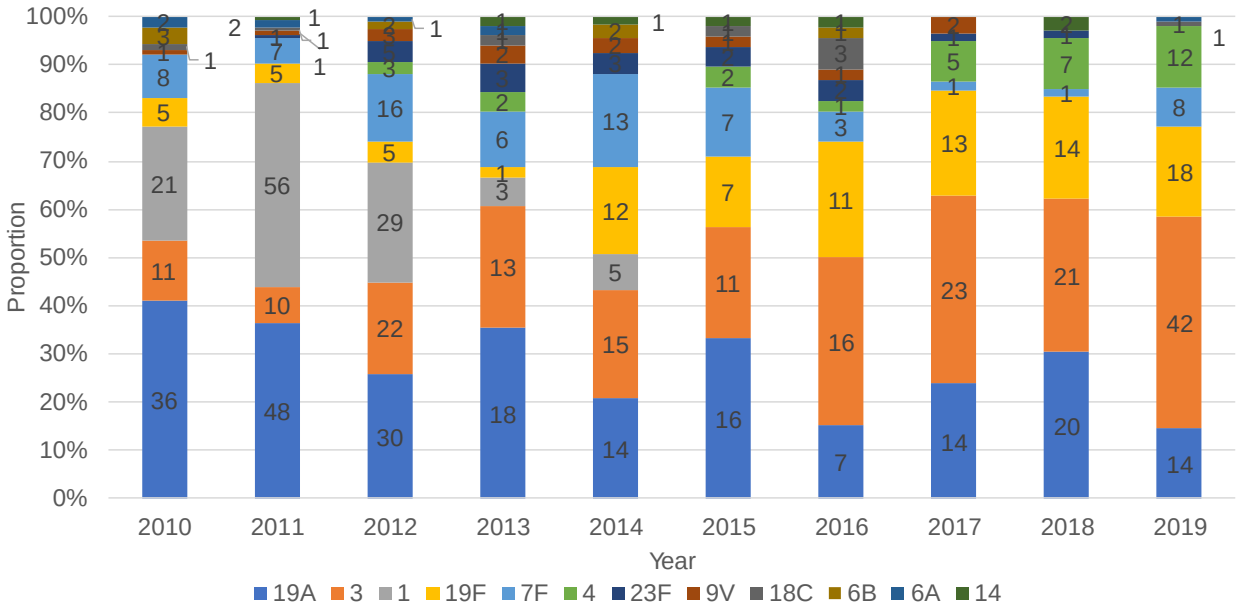


Figure 85. Number and proportion of vaccine serotypes (7vPCV and 13vPCV) identified in notified cases of IPD in WA, 2010–2019

Mumps

Mumps is an acute contagious viral infection which primarily affects the salivary glands. The infection is usually self-limiting. Person-to-person transmission occurs through inhalation of respiratory droplets or by direct contact with secretions of the infected person.

Temporal Trends

Over the period 2010 and 2019, 1,120 mumps cases were notified in WA (Table 4), which included 893 cases associated with a large mumps outbreak in 2015-2016, mostly in remote regional areas of WA. Apart from the two outbreak years, there was an average of 23 cases (range: 13 to 43) notified annually, with an ASR between 0.6 to 1.7 per 100,000 in the non-outbreak periods (2010-2014 and 2017–2019); the notification rate in the outbreak period (2015-2016) was 19.2 per 100,000 population (Figure 86). The control of the outbreak in 2015 and 2016 was mainly due to contact tracing, targeted vaccination in remote regions and public health messaging.

Sex and Age

Overall, approximately 53% (n=597) of all cases were males, but the male-to-female ratio for mumps cases varied over the 10-year period (Figure 86). Cases ranged in age from <1 to 81 years (median: 22 years). The median age was slightly lower in the outbreak period (21 years; range: <1 to 64 years) compared to the non-outbreak period (30 years; range: 2 to 81 years). For the ten-year period, the mean annual notification rate was highest in the 15-19 years age group (12.6 per 100,000; n=195), followed by the 10-14 years age group (10.7 per 100,000; n=165), in

both males and females (Appendix 1). However, the age distribution of the cases varied between the outbreak and non-outbreak years (Figure 87).

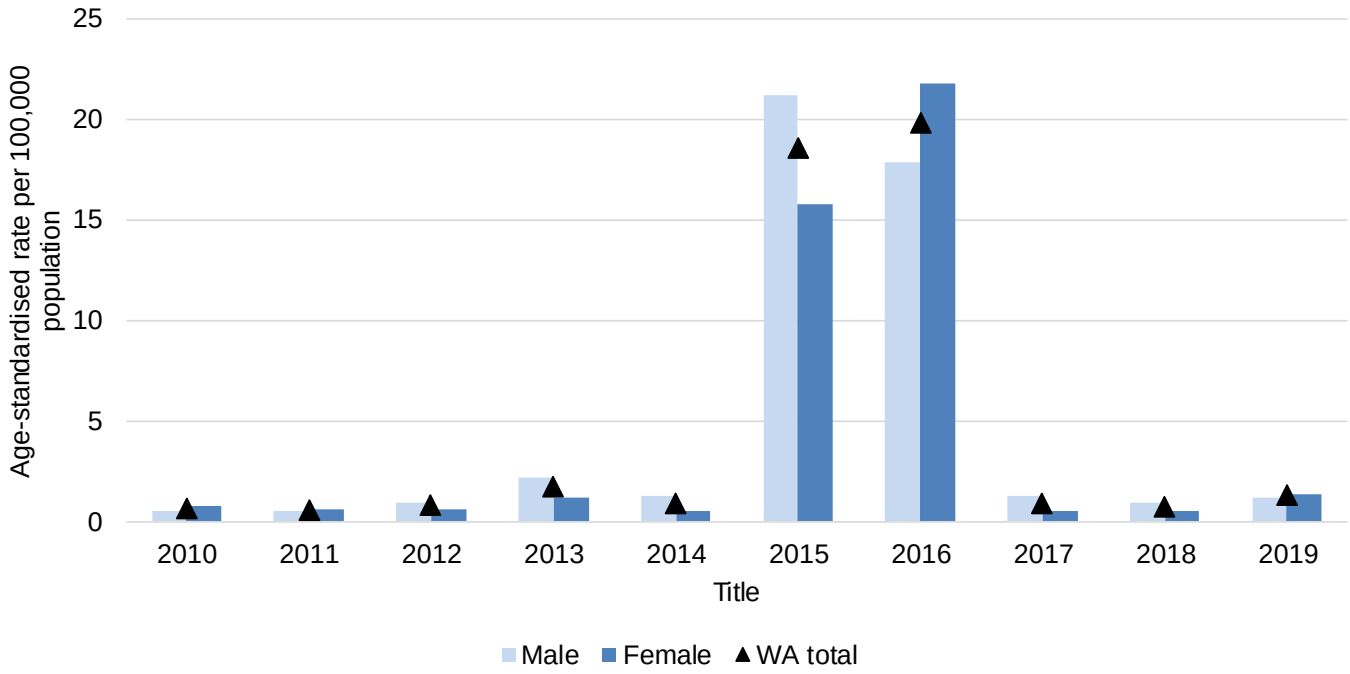


Figure 86. ASR (per 100,000 population) for mumps, by sex and year, in WA, 2010–2019

Aboriginal Status

Aboriginal people comprised approximately 73% (n=815; mean annual ASR: 69.8 per 100,000 population) of all mumps notifications between 2010 and 2019; the proportion was 7% (n=12; ASR: 1.2 per 100,000) during the non-outbreak periods and 86% (n=803; 337.7 per 100,000) in the outbreak period. The overall mean annual ASR among the non-Aboriginal population was 1.3 per 100,000 (n=305); 0.9 per 100,000 (n=173) in the non-outbreak periods and 2.8 per 100,000 (n=132) in the outbreak period (Appendix 2).

Region

Mumps notifications and rates in WA were strongly influenced by the outbreak years in 2015-2016 in remote regions. For the 10-year period, the Kimberley region had the highest mean annual ASR of 113.5 per 100,000 (n=445), followed by the Pilbara (39.4 per 100,000) and the Goldfields (22.5 per 100,000) regions; however most of these notifications occurred only in the two outbreak years (Appendix 3). For the 10-year period, the rates for the non-remote regions and the metropolitan area ranged from 0.8 to 8.8 per 100,000 (Appendix 3).

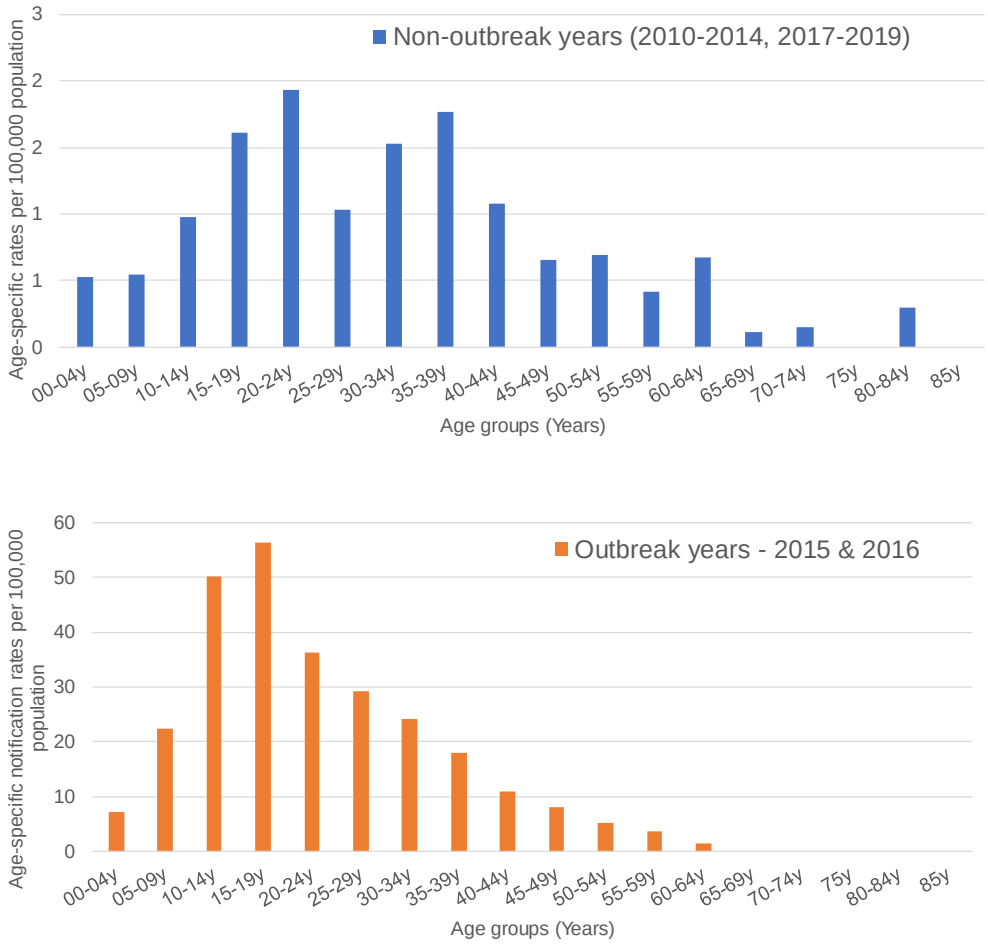
Place of Acquisition

During the non-outbreak years, approximately 29% (n=54/185) of all cases acquired their infections overseas, mostly from South and South-East Asia, particularly Indonesia (n=14) and the Philippines (n=6).

Immunisation

Mumps-containing vaccines have been funded in Australia since 1983. In 2019 in WA, the 2-dose mumps-containing vaccine was recommended and funded for children at ages 12 months (as mumps-measles-rubella [MMR] vaccine) and 18 months (as mumps-measles-rubella-varicella [MMRV] vaccine). Since 2019, the vaccine has been funded for anyone born during or after 1966 who has not received two doses of MMR vaccine.

Vaccination status was available for 76% (n=854) of notifications and of these, 72% (n=616) were fully vaccinated for age, 19% (n=162) were partially vaccinated, 7% (n=63) were not vaccinated and 2% (n=13) were not age-eligible to have been vaccinated.



*Note the differences in scale

Figure 87. Age-specific notification rates (per 100,000 population) for mumps in WA, 2010–2019: non-outbreak years and outbreak years

Measles

Measles is a disease caused by the measles virus, with transmission occurring through the inhalation of respiratory droplets or by direct contact with nasopharyngeal secretions. Measles is highly contagious; nearly 9 out of 10 non-immune people who come in contact with the virus will get the disease.

Temporal Trends

There were 210 cases of measles notified in WA during the period 2010 to 2019, representing a mean annual ASR of 0.9 per 100,000 (Table 4 and Table 5). Compared with an average of 11 notifications (range: 6 to 11) annually in the preceding 4-year period (2010-2013), there was a fourfold increase in the number of cases in 2014 (n=43), and since 2016, there was a gradual increase in the number of measles cases notified in WA (Figure 88).

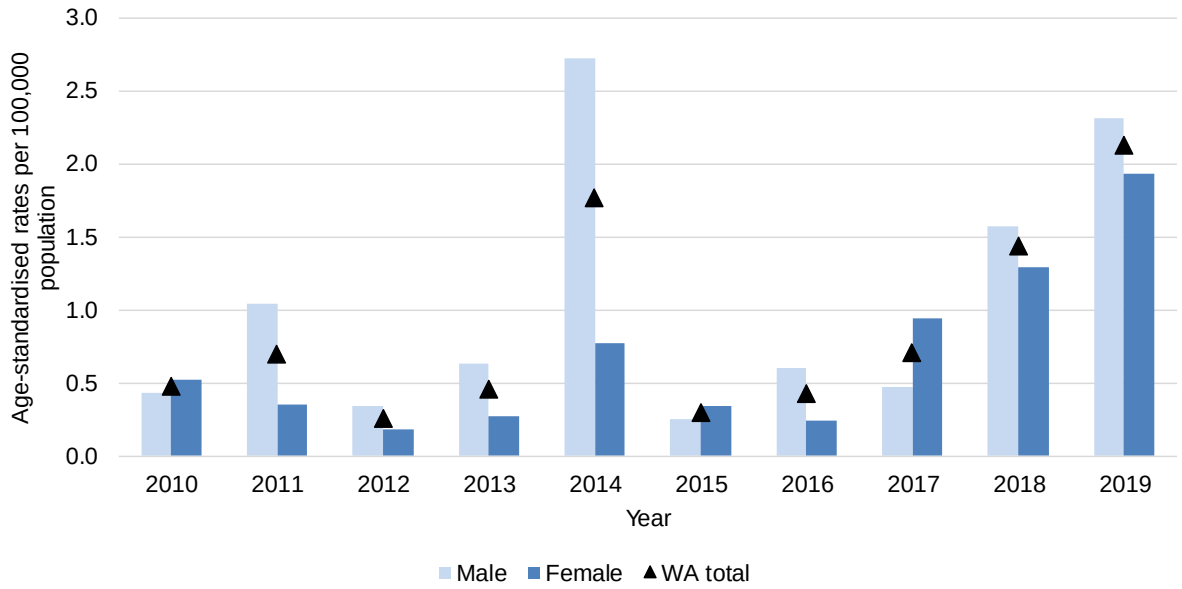


Figure 88. ASR (per 100,000 population) for measles, by sex and year, in WA, 2010–2019

Sex and Age

The majority of measles cases were male (61%; n=129) and the mean annual ASR was 1.5-fold higher among males than females (1.0 vs 0.7 per 100,000 population) (Appendix 1). The male to female rate ratio varied across the different years, with biggest difference observed in 2014, when the notification rate in males was 3.5-fold higher than in females (2.7 vs 0.8 per 100,000) (Figure 88). Cases ranged in age from <1 to 55 years (median: 23 years), with the highest mean annual notification rate observed in the 20-24 years age group (2.0 per 100,000) (Figure 89).

Aboriginal Status

Between 2010 and 2019, only three measles cases identified as being Aboriginal. The mean annual ASR among non-Aboriginal people was 0.9 per 100,000 population (Appendix 2).

Region

The highest mean annual ASR for measles was among residents of the Great Southern region (2.0 per 100,000; n=10) due to an outbreak in 2014 with seven linked cases. The next highest rate was in the metropolitan Perth (0.9 per 100,000; n=181) (Appendix 3).

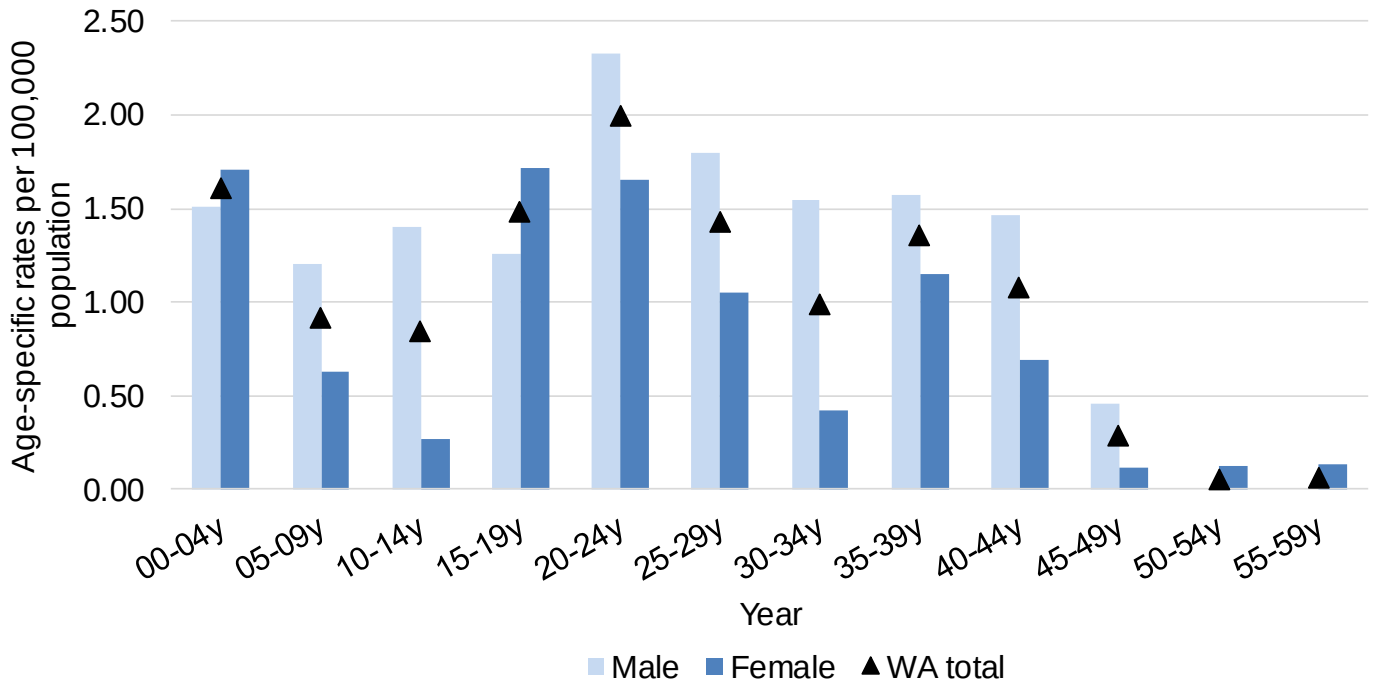


Figure 89. Age-specific notification rate (per 100,000 population) for measles, by sex and age group, in WA, 2010–2019

Place of Acquisition

Just over half (52%; n=110) of all cases acquired the infection locally, 46% (n=96) overseas and 25% (n=4) interstate. In 2014 and 2018 there were six outbreaks and in 2019 there were nine outbreaks that involved local transmission. Of the locally acquired cases, epidemiological links to overseas or interstate acquired case(s) were identified for 92 (84%) cases; no links were ascertained for the remaining 18 cases. Of the locally acquired cases, five were in the Southwest region, seven in Great Southern, one in the Wheatbelt and the remainder were in the Perth metropolitan region. More than half (n=50/96) of the imported cases were from two countries: Indonesia (38%; n=36) and the Philippines (15%; n=14).

Immunisation

Measles-containing vaccines have been funded in Australia since 1970. Currently in WA, the 2-dose measles-containing vaccine is recommended and funded for children at age 12 months (MMR vaccine) and 18 months (MMRV vaccine). Since 2019, the vaccine has been funded for anyone born during or after 1966 who has not received two doses of MMR vaccine. As measles is not endemic in Australia, measles cases are sporadic.

Approximately 98% (n=205) of all measles cases were born after 1965 and thus were eligible to have received at least 1 funded dose of a measles-containing vaccine. Of these, 13 cases were aged <1 year and therefore were not age-eligible to have received the first dose of the vaccine, and immunisation status was not reported for 18% (n=35). Among the 157 age-eligible cases, over half (55%; n=87) were not vaccinated, 25% (n=39) were fully vaccinated for age, and 20% (n=31) were partially vaccinated for age.

Rubella (non-congenital)

Rubella (also known as German measles) is a viral illness caused by the rubella virus. The illness is spread from person-to-person by respiratory secretions.

Temporal Trends

Between 2010 and 2019, there were 29 cases of rubella notified in WA. There were one to two cases notified each year, except in 2011 when there were 15 cases (Figure 90). The increase in cases in 2011 was attributed to nine cases associated with two workplace-related clusters in Perth.

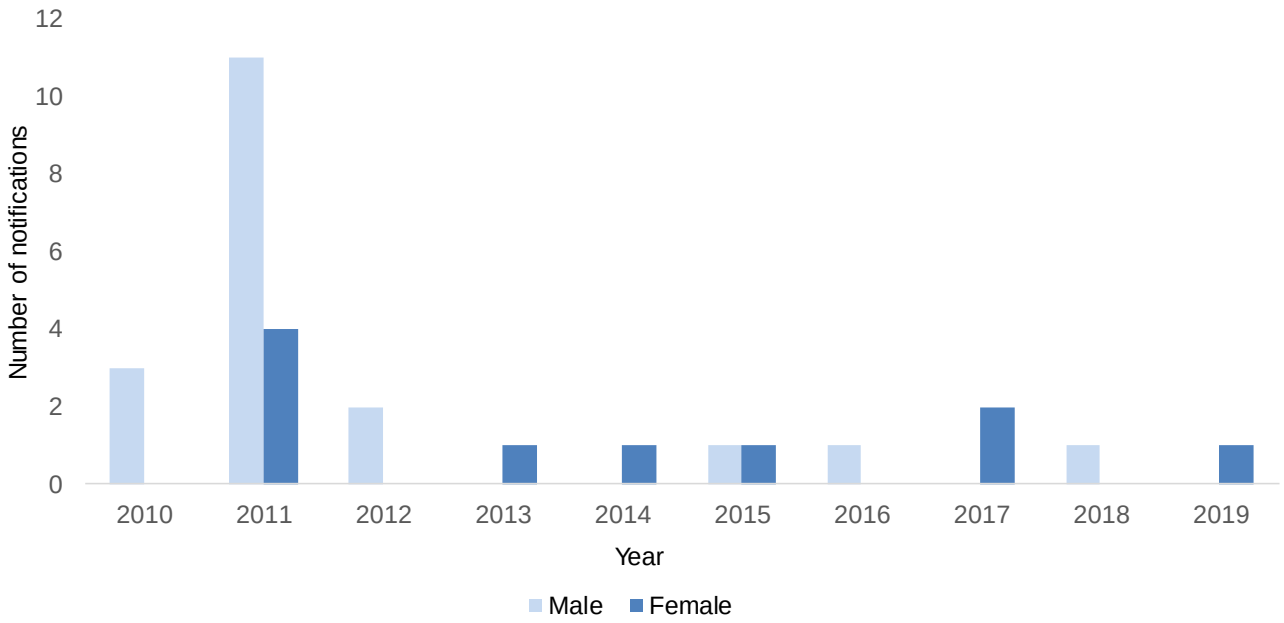


Figure 90. Number of notifications for rubella, by sex and year, in WA, 2010–2019

Of the 29 cases notified between 2010 and 2019, 19 were male and 10 were female (Figure 90). The cases ranged in age from 3 to 62 years (median: 32 years), with the majority of cases (93%; n=27) occurring in people aged over 23 years. Only one case reported as being Aboriginal. Other than two notifications (one in the Pilbara and one in the South West); the remainder of the notifications (n=27) were metropolitan Perth residents.

Place of Acquisition

Approximately 34% (n=10) of cases acquired their infection overseas, with the majority of these imported cases from Indonesia (n=7).

Immunisation

Rubella-containing vaccines have been funded in Australia since 1971. Currently in WA, the 2-dose rubella-containing vaccine is recommended and funded for children at 12 months of age (MMR vaccine) and 18 months (MMRV vaccine). Since 2019, the vaccine has been funded for anyone born during or after 1966 who has not received two doses of MMR vaccine.

Information on vaccination was available for 62% (n=18) of rubella cases, and of these, four cases were fully vaccinated for age, one was partially vaccinated for age and 72% (n=13) were unvaccinated.

Haemophilus influenzae type b (invasive)

Haemophilus influenzae type b (Hib) is a bacterium commonly carried in the nasopharynx of healthy people, but can cause severe infections. Person-to-person transmission occurs mainly through inhalation of respiratory droplets or by direct contact with nasopharyngeal secretions of an infected person. Since 1993, a Hib-containing vaccine has been included in the NIP and recommended in a 4-dose schedule at 2, 4, 6 and 18 months of age for all children.

A total of 11 cases were notified between 2010 and 2019. Over half of the notified cases were female (64%; n=7). Seven cases (64%) were Aboriginal, representing a mean annual ASR of 0.4 per 100,000, compared to 0.02 per 100,000 (n=4) among the non-Aboriginal population. Cases ranged in age from <1 to 6 years; approximately 91% (n=10) of the cases were aged 0 to 4 years, of which 70% (n=7) were aged less than 12 months. The mean annual notification rate in the 0-4 years age group was 0.6 per 100,000 (6.2 per 100,000 among Aboriginal children and 0.2 per 100,000 among non-Aboriginal children). Nine cases were residents of non-metropolitan regions of WA, and all cases acquired their infection in WA. Of the 11 cases, 9 were fully vaccinated for age, 2 were partially vaccinated for age and one was unvaccinated.

Tetanus

Tetanus is a bacterial infection cause by *Clostridium tetani*. The spores of this bacteria are present in soil, dust and manure and it enters the body through open wounds. In Australia, tetanus vaccine has been available through the NIP since 2015. Tetanus immunisation is recommended for children at ages 2, 4, 6 and 18 months and 4 years, and adolescents aged 11-13 years.

Between 2010 and 2019, there were six notifications of tetanus in WA. All cases occurred in non-Aboriginal adults (five females and one male) aged between 42 and 86 years. Five cases reported sustaining an injury during gardening and one case reported being bitten/scratched by a cat. Four of the cases showed clinical signs of lock jaw; the other two cases had painful muscle spasms. Of the six cases, one was partially vaccinated for age, three were unvaccinated and two did not have a vaccination status reported. No tetanus-related deaths were reported.

Diphtheria

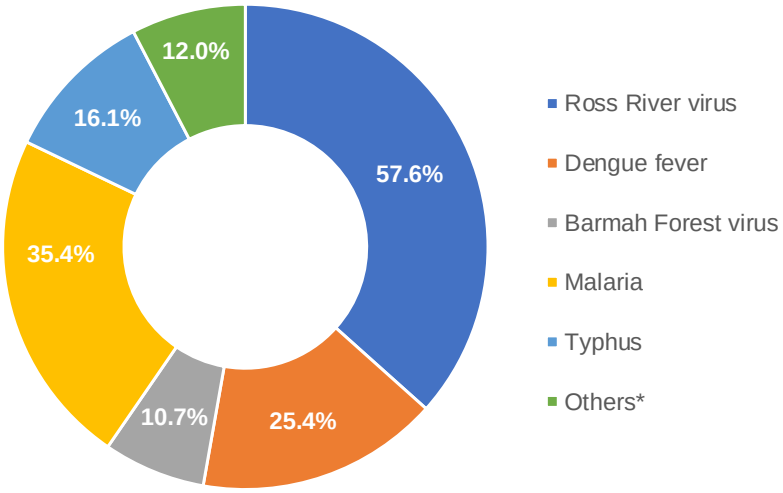
Diphtheria is an acute bacterial infection caused by *Corynebacterium diphtheriae*. *C. diphtheriae* is usually transmitted by respiratory droplets (sneezing or coughing) or by direct contact with nasopharyngeal secretions or skin lesions. Approximately 10% of people with diphtheria die from the disease. The NIP recommends diphtheria-containing vaccines for children at ages 2, 4, 6 and 18 months, and 4 years, and adolescents aged 11–13 years.

There was only one case of diphtheria notified between 2010 and 2019 in WA which was a cutaneous infection acquired overseas.

Vector-Borne Diseases

Vectors are living organisms that transmit disease-causing pathogens (viruses, bacteria and parasites) to susceptible humans (and other animals). The vectors, mainly arthropods such as mosquitoes, ticks, fleas and flies, usually transmit the pathogen through their bite. The incidence, distribution and seasonality of vector-borne diseases (VBD) are significantly influenced by complex interactions between climatic (including temperature and rainfall), demographic and social (including host/vector availability and urbanisation of forest/swamp lands) factors. For example, mosquito-borne viral infections increase when conditions are warm enough for the viruses to be active and wet enough for the breeding of mosquitoes.

Notifiable diseases that are included under the vector-borne category in WANIDD are listed in Table 1. Between 2010 and 2019, there were a total of 15,624 VBD notifications among WA residents. Ross River virus infection was the most commonly notified VBD, accounting for more than half (58%; n=9,004) of all notifications (Figure 91), followed by malaria (35%), dengue virus infection (25%) and typhus (16%). Overall, the median age at infection was 43 years (range: <1 to 97 years); approximately 83% (n=12,911) of all cases were aged 20-64 years. Notification rates in the non-Aboriginal population were more than two-fold higher than the Aboriginal population (59.3 vs 26.4 per 100,000 population).



*Includes infections caused by Chikungunya virus, Zika virus, Murray Valley encephalitis virus, West Nile virus and Japanese encephalitis virus

Figure 91. Proportion of notified cases of VBD in WA 2010–2019

Ross River virus infection

Ross River virus (RRV) infection is caused by a mosquito-borne alphavirus. In Australia, kangaroos, wallabies and wild rodents act as the natural host for the virus, and the virus is transmitted to humans by the bite of a wide variety of mosquito species (including *Aedes* and *Culex* species). RRV infection occurs widely in Australia, especially in Queensland, Northern

Territory and W. RRV epidemics and outbreaks tend to occur after periods of heavy rainfall and/or flooding. There is currently no vaccine against RRV.

Temporal Trends

Between 2010 and 2019, there were 9,004 confirmed cases of RRV infection notified in WA representing a mean annual ASR of 35.7 per 100,000 (Table 4 and Table 5). Notifications for RRV infection varied over the years ranging from a high of 1,568 notifications (ASR: 61.7 per 100,000) in 2014 to a low of 383 notifications (ASR: 14.2 per 100,000) in 2019. In general, notifications peaked in January-March (Figure 92); however, it should be noted that due to differences in mosquito activity and climatic conditions (including temperature and rainfall) between the northern and southern half of WA, seasonal trends for RRV infections varied within regions of WA.

Sex and Age

Overall, 53% (n=4,729) of all RRV infection notifications were female (Appendix 1). Females also had a slightly higher notification rate in each year compared to males with a mean annual ASR of 37.9 per 100,000 versus 34.1 per 100,000 among males (Appendix 1). The highest notification rate was observed in those aged 40-44 years (59.6 per 100,000). Males had higher notification rates than females among those aged ≥60 years (Figure 93).

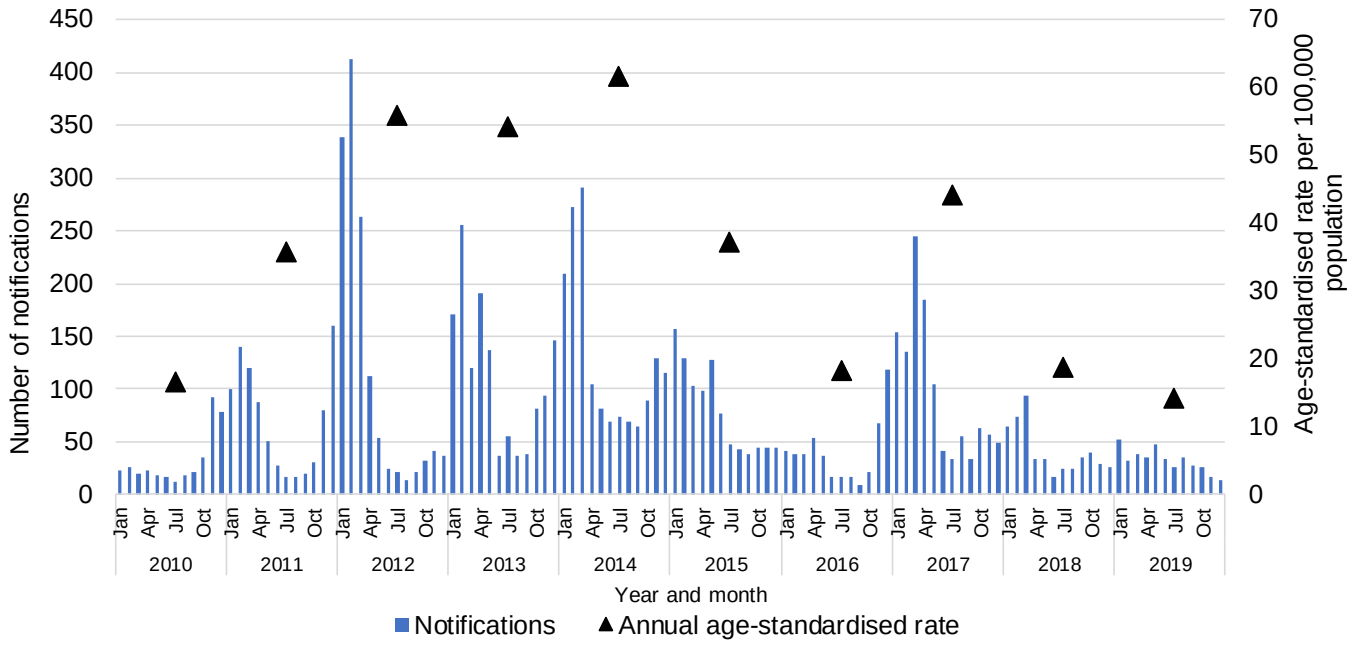


Figure 92. Number of notifications for RRV infection by month and ASR (per 100,000 population) by year of disease onset, in WA 2010–2019

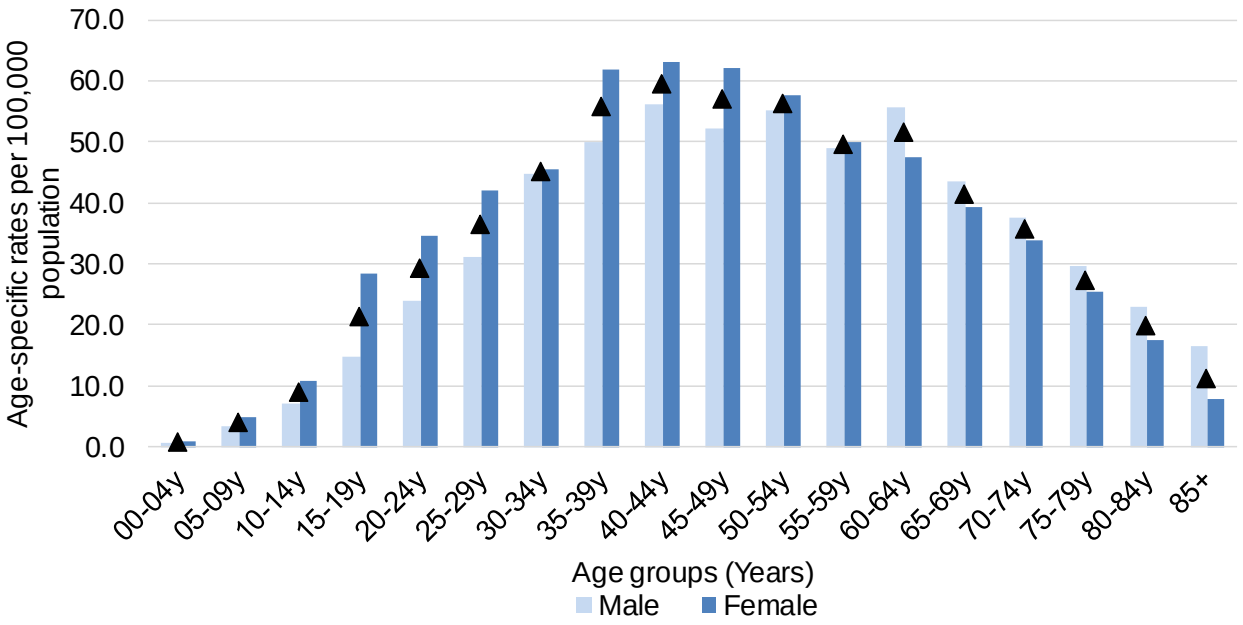


Figure 93. Age-specific notification rates per 100,000 for RRV infection, by sex, in WA 2010–2019

Aboriginal Status

Approximately 90% (n=8,065) of the RRV infection cases had Aboriginal status recorded. The mean annual ASR was 1.4-fold higher in the non-Aboriginal population (32.3 per 100,000; n=7,873) than in the Aboriginal population (22.9 per 100,000; n=192) (Figure 94 and Appendix 2).

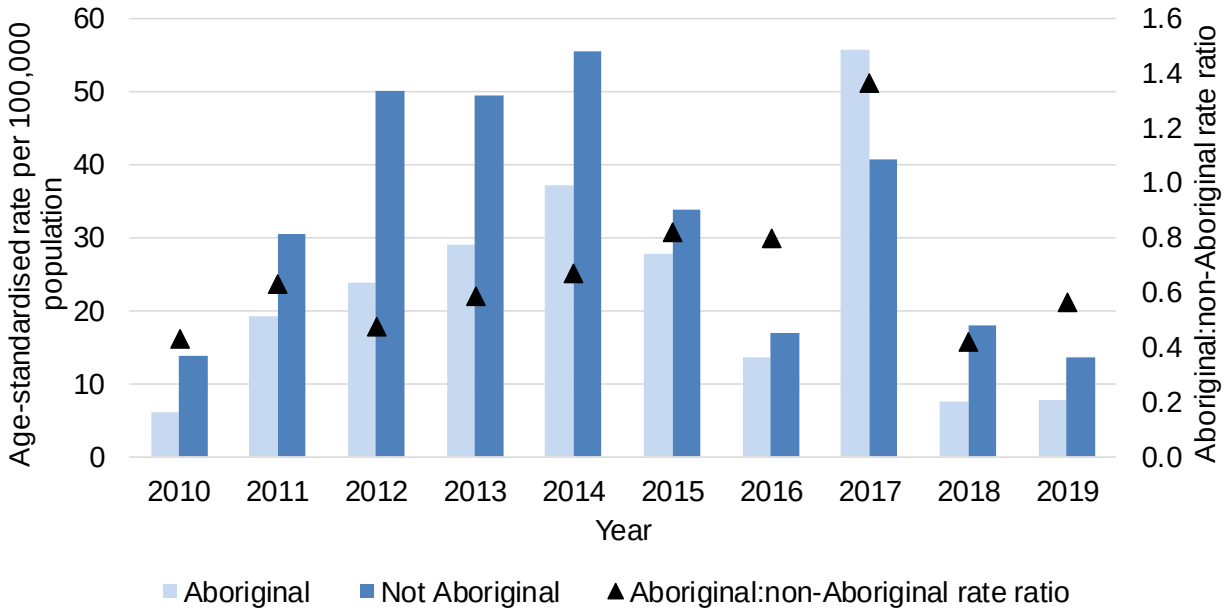


Figure 94. ASR (per 100,000 population) for RRV infection, by Aboriginal status and year of disease onset, in WA 2010–2019

Region

Due to climatic variability, RRV infection notification rates in the regions varied over time (Table 33 and Appendix 3). Overall, the Kimberley had the highest mean annual ASR (149.8 per 100,000 population) followed by the Goldfields (80.6 per 100,000 population). However, it must be noted

that while the Kimberley region consistently had relatively higher annual rates compared to other regions across the ten-year period, the high overall rate in the Goldfields is largely due to the increased disease incidence during 2013.

Place of Acquisition

Approximately 57% (n=5,200) of all cases acquired their infection in WA, 1% (n=98) overseas and 1% (n=96) interstate. The place of acquisition was not known for 40% (n=3,610) of cases. Among the overseas acquired cases, 61% (n=60) acquired their infection in Indonesia.

Outbreak investigations

In response to an outbreak of RRV infection in the Goldfields region in 2013, a public education campaign was undertaken to help reduce transmission.

Table 33. Notification numbers (n) and ASR (per 100,000 population) for RRV infection by year and Public Health Units in WA (2010–2019)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	388	850	1,373	1,363	1,568	953	476	1,156	494	383	9,004
	rate	16.7	35.8	56.0	54.2	61.7	37.3	18.4	44.3	18.7	14.2	35.7
Goldfields	*n*	5	15	21	224	61	13	32	84	10	9	474
	rate	8.3	25.6	34.1	355.9	101.8	20.7	55.7	149.3	18.0	19.1	80.6
Great Southern	*n*	15	43	89	34	53	29	20	40	11	13	347
	rate	27.3	74.2	152.1	55.9	92.8	50.6	32.0	66.9	14.9	19.1	58.8
Kimberley	*n*	30	123	46	54	79	43	22	106	36	6	545
	rate	103.5	327.5	118.2	131.8	205.5	115.3	68.3	298.3	97.4	27.7	149.8
Metropolitan Perth	*n*	251	386	958	764	987	568	232	609	347	261	5,363
	rate	13.8	20.8	50.0	38.9	49.5	28.3	11.3	29.5	16.6	12.0	27.0
Midwest	*n*	13	34	17	17	58	152	10	22	6	6	335
	rate	20.0	52.4	25.2	26.7	87.6	227.6	16.1	37.2	9.2	10.2	52.0
Pilbara	*n*	28	47	33	18	118	39	9	59	14	18	383
	rate	59.3	81.3	43.1	22.8	153.9	55.5	12.6	98.1	18.5	25.8	56.5
South West	*n*	33	154	152	181	162	77	105	148	60	59	1,131
	rate	21.0	95.2	93.4	105.7	94.1	44.5	61.2	83.8	34.7	32.6	66.5
Wheatbelt	*n*	13	48	57	71	50	32	46	88	10	11	426
	rate	17.4	64.0	67.7	83.2	62.5	37.5	56.0	109.3	11.6	11.4	52.5

Dengue virus infection

Dengue virus infection is a mosquito-borne flavivirus infection that mostly occurs in the tropical and subtropical parts of the world. The infection can be caused by one of four dengue viruses (DENV 1-4). Infection with one dengue virus serotype does not provide immunity against other serotypes. Transmission of dengue virus is generally through the bite of female mosquitoes of the species *Aedes aegypti* and, to a lesser extent, *Aedes albopictus*.

Dengue virus infection is not endemic in Australia, however in parts of Australia where suitable mosquito vectors are present (in Queensland, *Aedes aegypti*; in the Torres Strait, *Aedes albopictus*), local transmission can occur if a returned traveller with dengue virus infection is viraemic.

Temporal Trends

Over the ten-year period, there were 3,970 confirmed cases of dengue virus infection notified in WA equating to a mean annual ASR of 15.7 per 100,000 population (Table 4 and Table 5). Notification numbers varied over the years ranging from a high of 552 notifications in 2016 to a low of 132 notifications in 2018 (Figure 95). The declines seen in 2017 (n=172) and 2018 (n=132) are possibly reflective of declines during this period in the Americas and Western Pacific region where local transmission can be common.

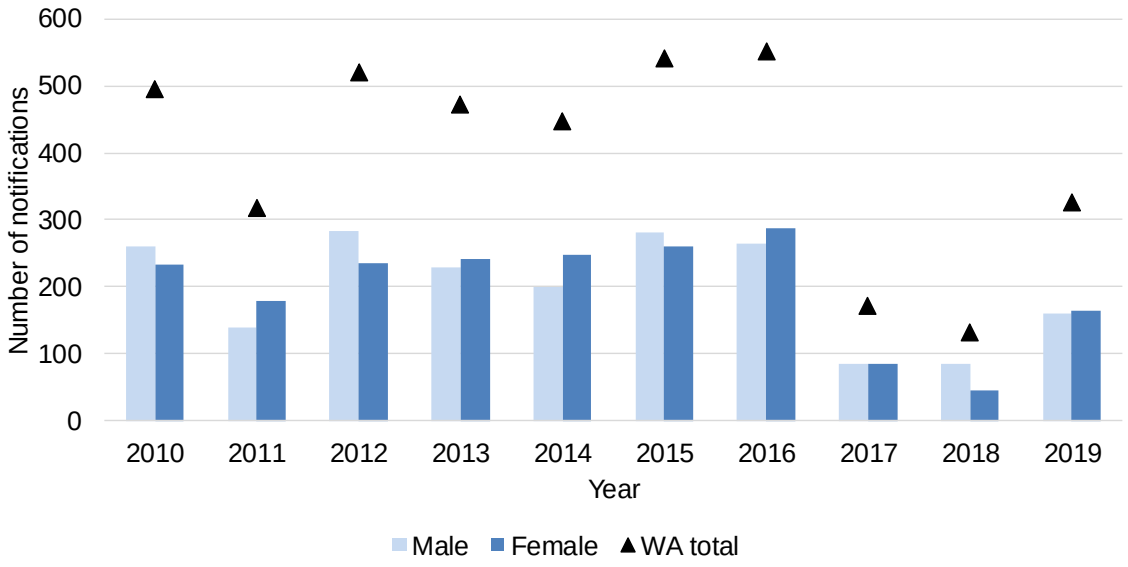


Figure 95. Number of notifications for dengue virus infection, by sex and year, in WA, 2010–2019

Sex and Age

Overall, the mean annual ASR were similar in males (15.6 per 100,000; n=1,989) and females (15.9 per 100,000; n=1,981); Figure 95. Approximately 84% of all infections were among adults aged between 20 and 64 years with age-specific notification rates being highest among adults aged between 40 and 54 years (Figure 96).

Aboriginal Status

Thirty-seven cases (~1%) did not have Aboriginal status reported. The mean annual ASR was 7-fold higher among the non-Aboriginal population than in the Aboriginal population: 16.1 (n=3,915) vs 2.3 (n=18) per 100,000 (Appendix 2).

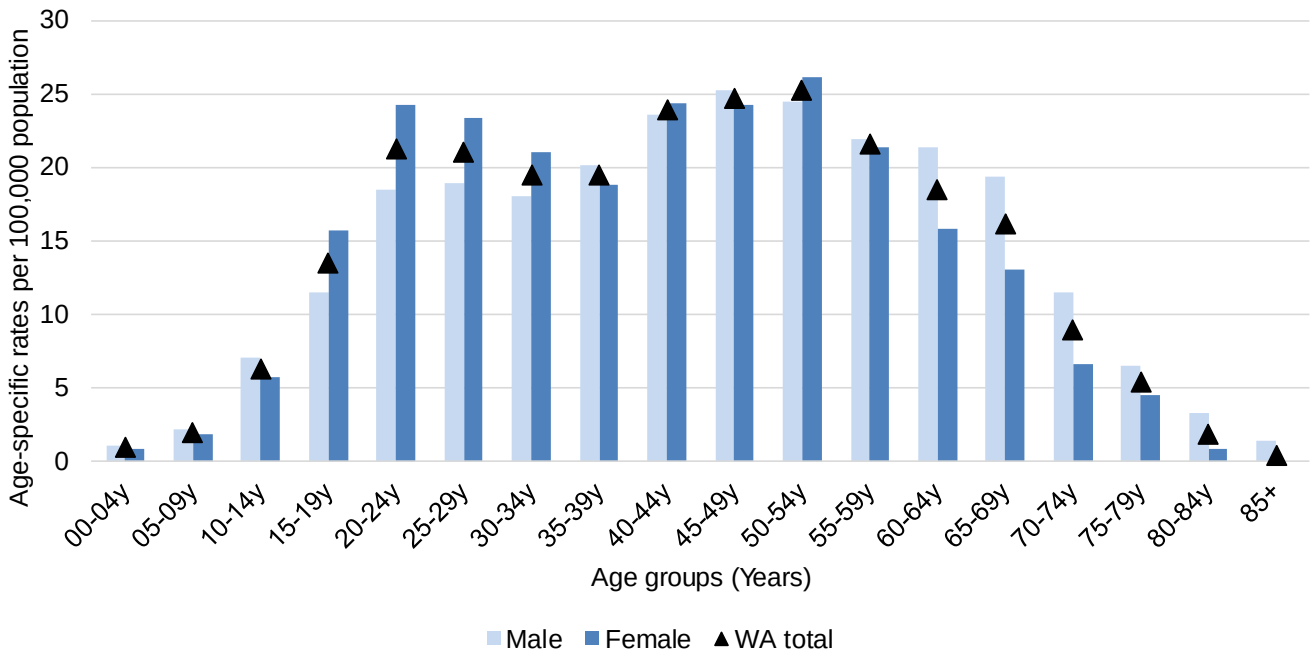


Figure 96. Age-specific notification rates (per 100,000 population) for dengue virus infection, by sex, in WA 2010–2019

Region

The highest notification rate was observed in the South West region (ASR: 18.2 per 100,000; n=298) followed by the metropolitan Perth region (16.4 per 100,000; n=3,274). The Goldfields had the lowest notification rate at 8.8 per 100,000 (n=52) (Table 34).

Table 34. Notification numbers (n) and ASR (per 100,000 population) for dengue virus infection, by year of disease onset, and region in WA (2010–2019)

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
WA (total)	*n*	494	317	520	471	446	541	552	172	132	325	3,970
	rate	21.2	13.2	21.0	18.7	17.5	21.0	21.4	6.6	5.0	12.2	15.7
Goldfields	*n*	7	5	4	5	5	10	8	4	0	4	52
	rate	12.1	7.8	6.3	8.0	8.0	17.2	13.9	6.8	-	8.0	8.8
Great Southern	*n*	3	8	9	7	7	6	10	1	2	5	58
	rate	5.2	15.6	15.0	10.9	11.2	8.1	18.4	1.1	3.3	10.4	9.9
Kimberley	*n*	9	2	7	7	8	5	1	1	1	2	43
	rate	24.2	5.5	17.8	19.0	19.9	14.6	2.6	2.8	2.3	5.5	11.5
Metropolitan Perth	*n*	402	264	437	370	353	451	455	149	118	275	3,274
	rate	22.1	14.0	22.5	18.8	17.5	22.1	22.2	7.2	5.6	12.9	16.4
Midwest	*n*	15	5	15	9	13	11	9	2	0	7	86
	rate	22.1	8.0	23.3	14.4	19.9	16.9	12.5	2.8	-	11.3	13.3
Pilbara	*n*	15	4	14	10	14	8	11	3	4	7	90
	rate	22.1	5.9	18.1	13.6	17.7	10.4	14.6	3.6	5.7	12.4	12.6
South West	*n*	33	19	25	55	42	38	47	10	7	22	298
	rate	21.0	12.2	16.0	32.6	26.1	22.4	27.9	5.8	5.1	12.9	18.1
Wheatbelt	*n*	10	10	9	8	4	12	11	2	0	3	69
	rate	13.3	15.0	10.9	10.7	6.5	16.6	16.2	1.5	-	3.5	9.6

Place of Acquisition

The majority of the dengue virus infections (n=3,963/3,970) were acquired overseas. Of the remaining seven cases, three acquired their infection interstate (two in Queensland, one in the Torres Strait Islands) and two were locally acquired in WA (one needle-stick injury from a patient with dengue virus infection and the other from an unknown source). The place of acquisition was missing for two cases. Indonesia was the largest source (75%, n=2,978) of all overseas acquired cases followed by Thailand (8%; n=321).

Serotype

Serotype results were available for 68% (n=2,694) of cases. The proportion of each serotype causing infection varied by year (Figure 97), but overall, DENV-2 was the predominant serotype (42%; n=1,132) identified, followed by DENV-1 (31%; n=839), DENV-3 (19%; n=516) and DENV-4 (7%; n=194); 13 cases had mixed serotypes.

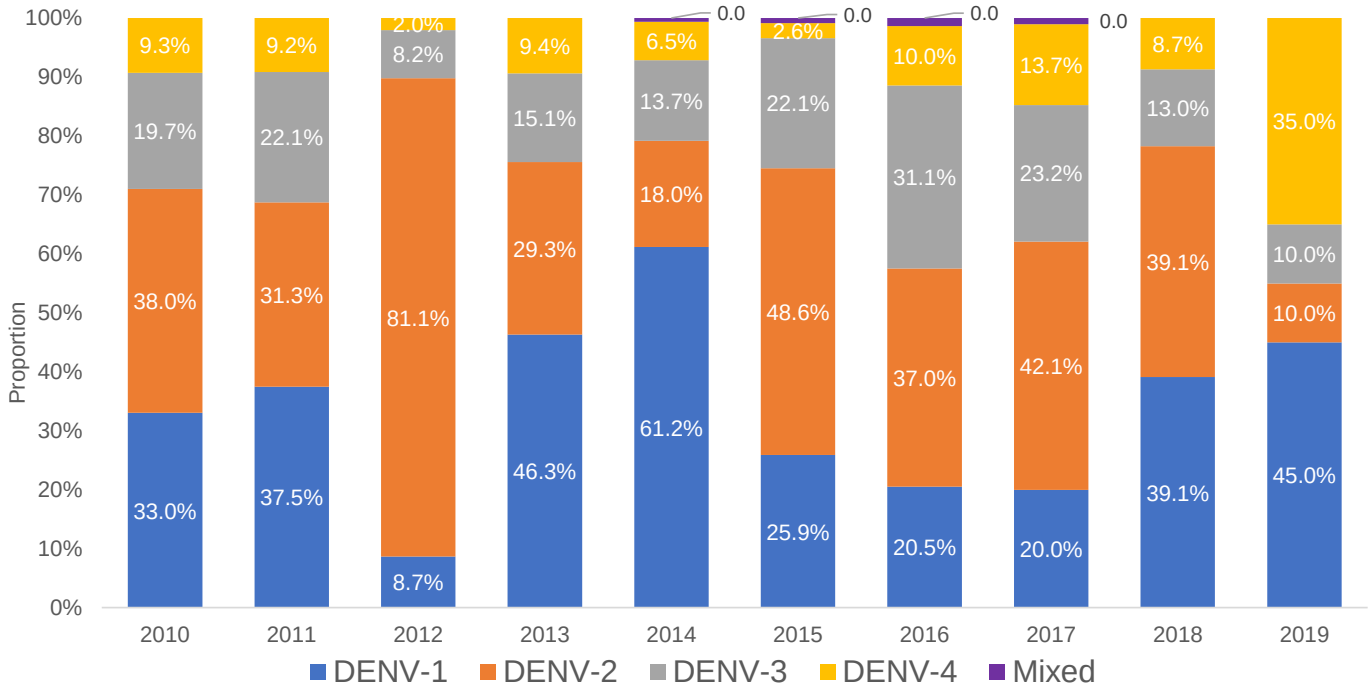


Figure 97. Proportion of dengue virus serotypes identified among notified cases, by year of disease onset, in WA 2010–2019

Barmah Forest virus infection

Barmah Forest virus (BFV) infection, identified exclusively in Australasia, is caused by BFV (an alphavirus). The mosquitoes (*Aedes vigilax* in coastal areas and *Culex annulirostris* in inland freshwater habitats) contract the virus from infected marsupials (especially possums, kangaroos and wallabies) or from infected humans and then transmit the infection through their bite. There is currently no preventive vaccine available for BFV infection.

Temporal Trends

There were 1,674 confirmed cases of BFV infection notified in WA between 2010 and 2019 (Table 4). Approximately 61% (n=1,025) of the cases were notified in 2013 (Figure 98). There was a considerable increase in notifications in from December 2012 to September 2013 which was attributed to faulty commercial test kits that produced a high rate of false positive IgM test results. These faulty kits were recalled in September 2013. Removing the false positive notifications, there were 604 notifications for the 2010-2019 period. In general, notifications increased between January and March (Figure 98); however, it should be noted that due to differences in mosquito activity and climatic conditions (including temperature and rainfall) between the northern and southern areas of WA, seasonal trends for BFV infection varied within regions of WA.

Sex and Age

The mean annual ASR for females and males was 2.5 and 2.3 cases per 100,000, respectively. The median age of cases over the ten-year period was 45 years (range: 8 to 87 years) with the highest notification rate in the 55-59 years age group (mean annual rate: 5.1 per 100,000) followed by the 40-49 years age group (3.9 per 100,000).

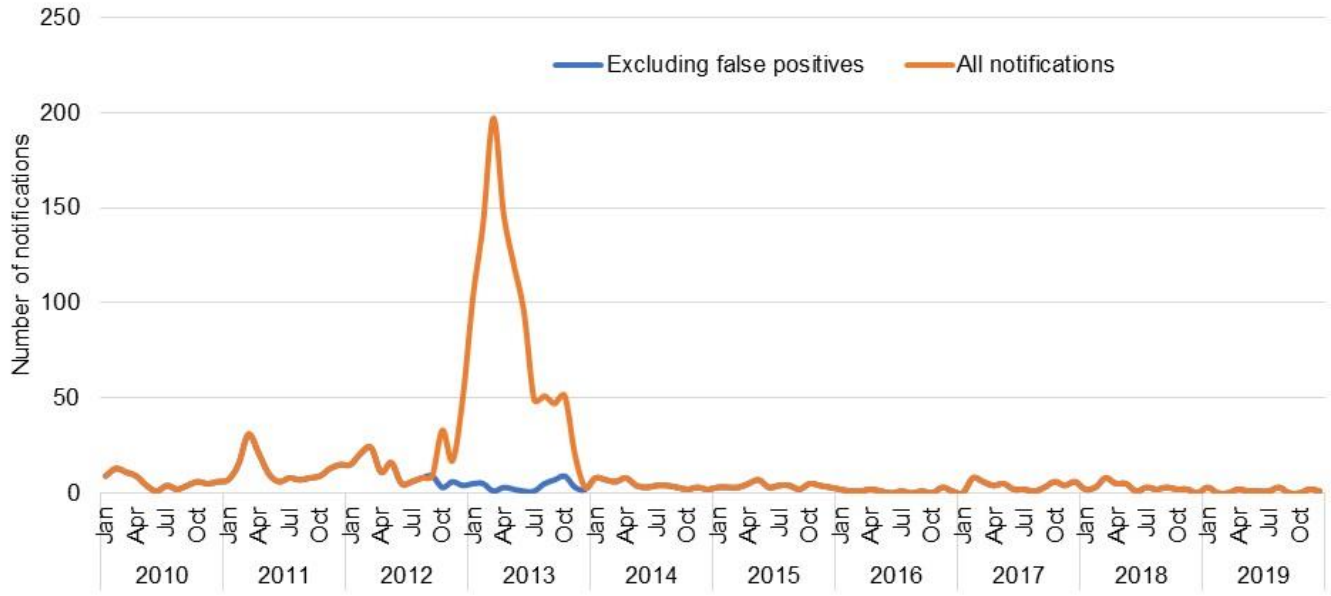


Figure 98. Number of notifications for BFV infection, by month and year of disease onset for all notifications and when excluding false positive laboratory notifications in WA, 2010–2019

Aboriginal Status

The mean annual ASR was approximately 1.6-fold higher in the Aboriginal population than in the non-Aboriginal population (2.1 vs 3.3 per 100,000; n=508 and n=28 respectively), excluding false positive notifications.

Region

With false positive notifications excluded, the highest notification rate was observed in the Kimberley region (mean annual ASR: 21.2 per 100,000; n=78) followed by the Great Southern (7.2 per 100,000; n=45).

Place of Acquisition

Of the 604 notifications, 40% had unknown place of acquisition. Of the 362 cases that had place of infection acquisition recorded, 96% (n=348) acquired their infection in WA.

Malaria

Malaria is an infection caused by four different species of the *Plasmodium* parasite (*P. ovale, P. malariae, P. vivax* and *P. falciparum*). The parasite is transmitted to humans through the bite of infected female *Anopheles* mosquitoes. Malaria is rare in Australia with most cases reported in travellers returning from overseas. However, local cases occasionally occur in north eastern Australia including the Torres Strait Islands. There is currently no licensed vaccine available against malaria, but several prophylactic drugs are available for travellers to high-risk areas.

Temporal Trends

During the ten-year period 2010 to 2019, a total of 544 (mean annual ASR: 2.2 per 100,000) confirmed cases of malaria were notified in WA, ranging from a high of 75 notifications in 2013 to a low of 44 notifications in 2014 (Figure 99).

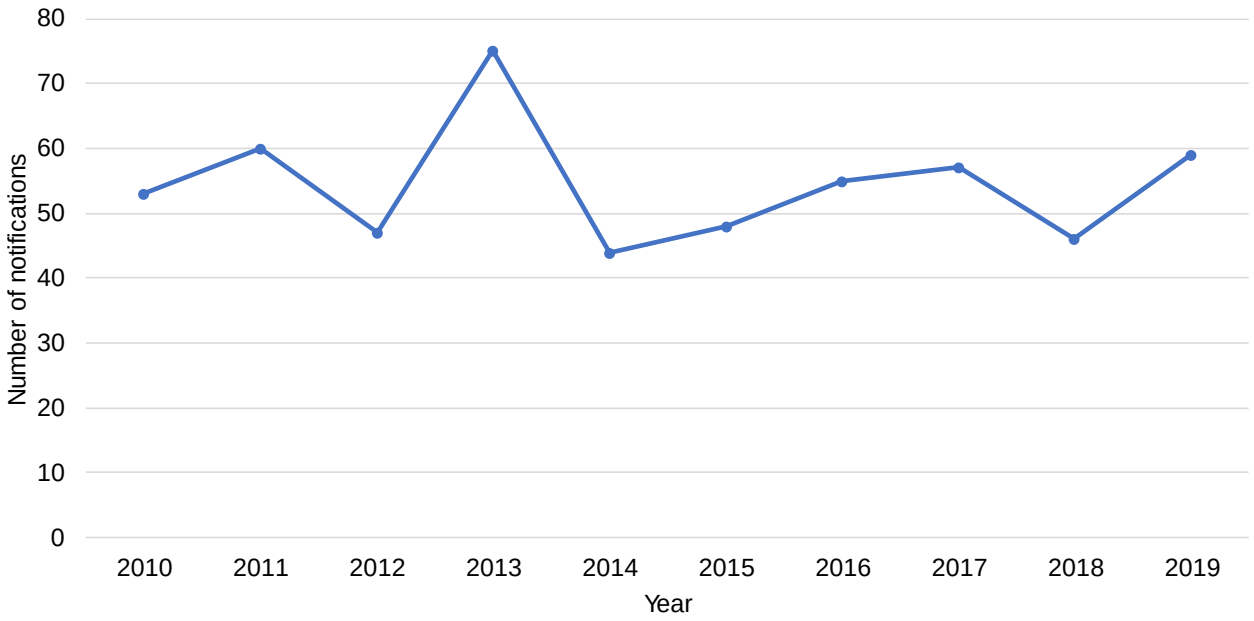


Figure 99. Number of notifications for malaria, by year of disease onset, in WA 2010–2019

Sex and Age

Approximately 74% of the notified cases were male (n=403) with a mean annual ASR of 3.2 notifications per 100,000 compared to females with a rate of 1.1 per 100,000 (Appendix 1). The cases ranged in age from 1 to 80 years (median: 36 years). More than 80% of all cases were among those aged ≥20 years in both males and females (Figure 100). Among males, the age-specific notification rate was highest in those aged 45-49 years whereas among females the highest rate was among those aged 25-29 years (Figure 100).

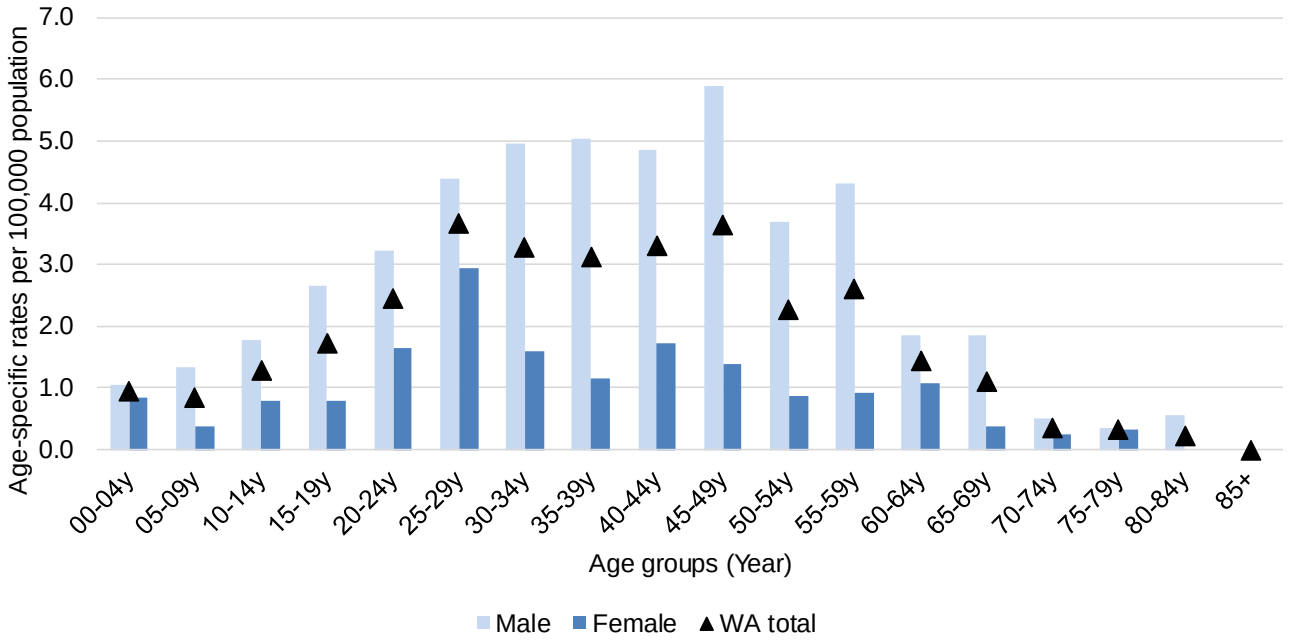


Figure 100. Age-specific notification malaria rates (per 100,000 population), by sex, in WA 2010 to 2019

Aboriginal Status

Almost all cases reported were non-Aboriginal (n=541); Aboriginal status was unknown for 2 cases.

Region

Approximately 87% of all notifications for malaria were in the Perth metropolitan region (n=474), with a mean annual ASR of 2.4 per 100,000, followed by the Goldfields (2.1 per 100,000; n=13) (Appendix 3).

Place of Acquisition

Nearly all (n=542/544) cases acquired their infection overseas; the place of acquisition was not reported for only two cases. Over 75% (n=416) of cases acquired their infection in African countries, with Sudan (n=67) and Uganda (n=47) accounting for more than a quarter of cases collectively. Papua New Guinea (n=37) and India (n=34) were the most common countries of acquisition among non-African countries.

Malaria species

P. falciparum was most commonly identified in cases (n=402/544, 74%), followed by *P. vivax* (n=86, 16%). Almost all cases with *P. falciparum* (n=360/402, 89%) acquired their illness in African countries. The main countries associated with *P. vivax* were India (n=32, 37%) and Papua New Guinea (n=21, 24%).

Typhus

Typhus, also known as typhus fever, is a group of infections (epidemic typhus, scrub typhus, murine typhus and spotted fever group rickettsiae) caused by several types of *Rickettsia* bacteria. The bacteria are transmitted to humans through the bites of infected fleas (murine typhus: *R. typhi*), lice (epidemic typhus: *R. prowazekii*), ticks (spotted fever group rickettsiae: *R. australis / honei/ conorii/ felis*) or mites (scrub typhus: *Orientia tsutsugamushi*). There is currently no preventive vaccine available for typhus.

Temporal Trends

A total of 251 cases of typhus were notified in WA between 2010 and 2019, ranging from a high of 39 notifications in 2016 to a low of 13 notifications in 2010 and 2014 (Figure 101).

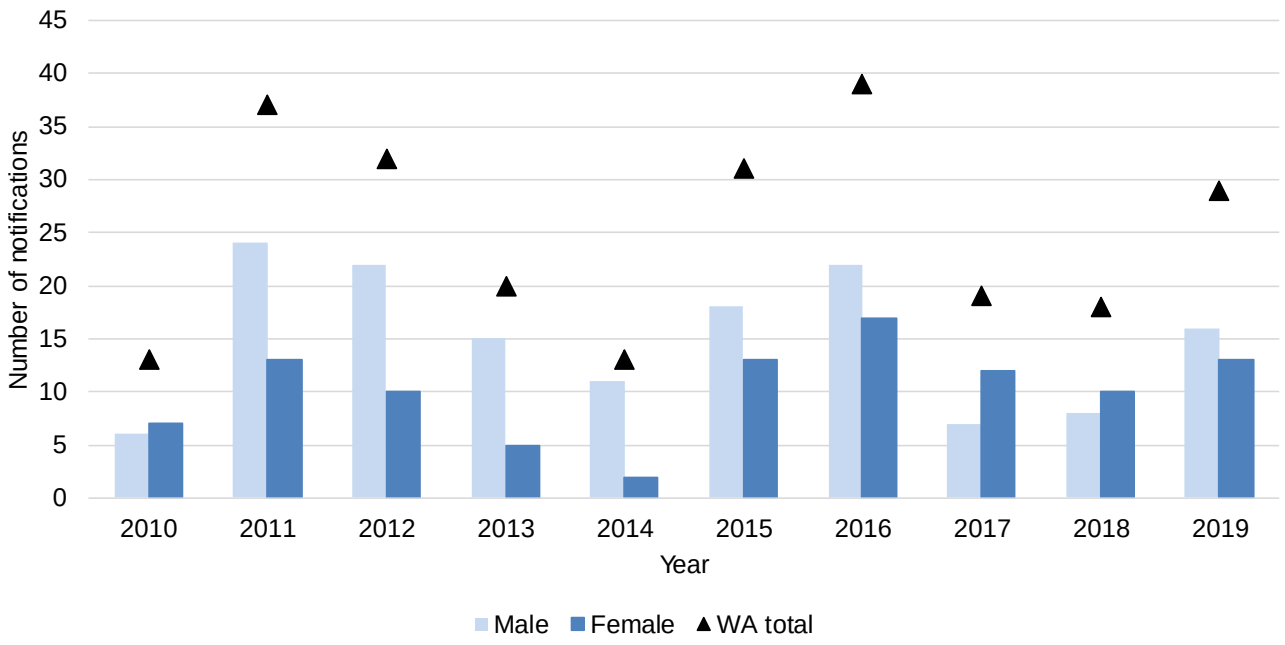


Figure 101. Number of notifications for typhus, by year of disease onset and sex, in WA 2010–2019

Sex and Age

Over half (59%, n=149) of all notified cases were male, however the male-to-female ratio varied over the ten-year period (Figure 101). The cases ranged in age from 10 to 82 years (median: 46 years). The mean annual notification rate for typhus was highest among those aged 60-69 years (1.8 per 100,000). Nearly half (50.9%; n=127) of the notifications for typhus were among adults

aged 35 to 59 years with a mean annual notification rate of 1.5 per 100,000 population for these age groups. Cases were predominantly male in all age groups, except for the 75-79 years age group (Figure 102).

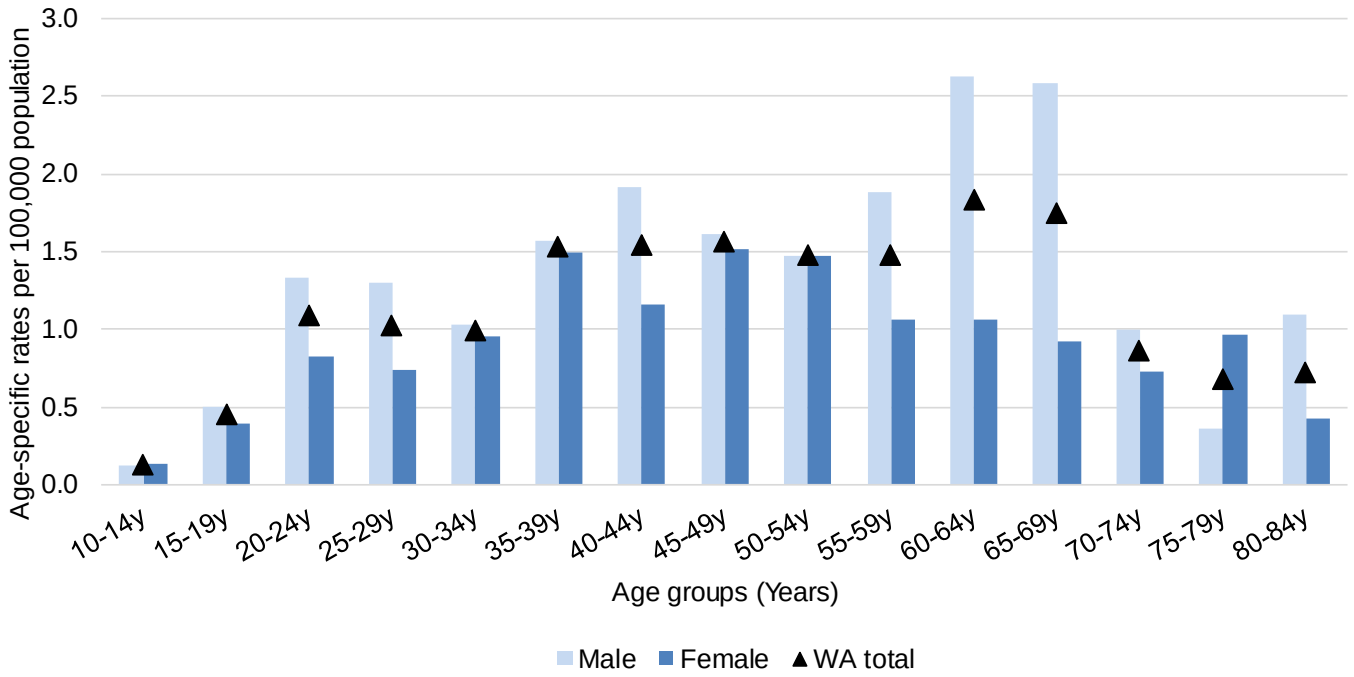


Figure 102. Age-specific notification rates (per 100,000 population) for typhus, by sex, in WA, 2010–2019

Aboriginal Status

Almost all (99%, n=249) notifications had Aboriginal status recorded. Of these, 97% (n=243) were non-Aboriginal, with a mean annual ASR of 1.0 per 100,000 compared to 0.7 per 100,000 (n=6) among the Aboriginal population (Appendix 2).

Region

Approximately 68% of typhus notifications resided in the Perth metropolitan region (n=171). The mean annual ASR was highest in the Great Southern region (3.4 per 100,000; n=19) with most (n=14/19, 74%) infections acquired in WA. The next highest rate was in Midwest region residents (2.3 per 100,000; n=14) who mostly (n=9/14, 64%) acquired their infection in WA (Appendix 3).

Place of Acquisition

Most cases acquired their infection overseas (61%; n=152) and of these, the majority were acquired in Indonesia (36%; n=54) and South Africa (18%; n=28).

Rickettsia species

R. typhi (28%; n=70), *R. conorii* (26%; n=66) and *O. tsutsugamushi* (25%; n=62) were the most commonly identified pathogens. There were no significant differences observed in the distribution of the causative pathogen by place of infection acquired.

Chikungunya virus infection

Chikungunya virus infection is caused by a mosquito-borne alphavirus. The chikungunya virus is transmitted from person-to-person by the bite of an infected mosquito (*Aedes* species) that breed in stagnant water. Chikungunya virus infection has become a major arboviral public health threat in the last decade with the spread of the Asian and Indian Ocean lineages to all continents. There have been sporadic outbreaks of chikungunya virus infection in several countries since 2011. Almost all cases in Australia are reported among travellers returning from overseas. There is currently no preventive vaccine available for this disease.

Between 2010 and 2019, a total of 146 confirmed cases were notified in WA, representing a mean annual ASR of 0.6 per 100,000 (Table 4 and Table 5). The spike in notification numbers in WA in 2013 reflects a large outbreak in South-East Asia during this period, with 53 of the 54 cases notified having acquired the infection in this region (Figure 103). Approximately 64% (n=93) of all cases were female.

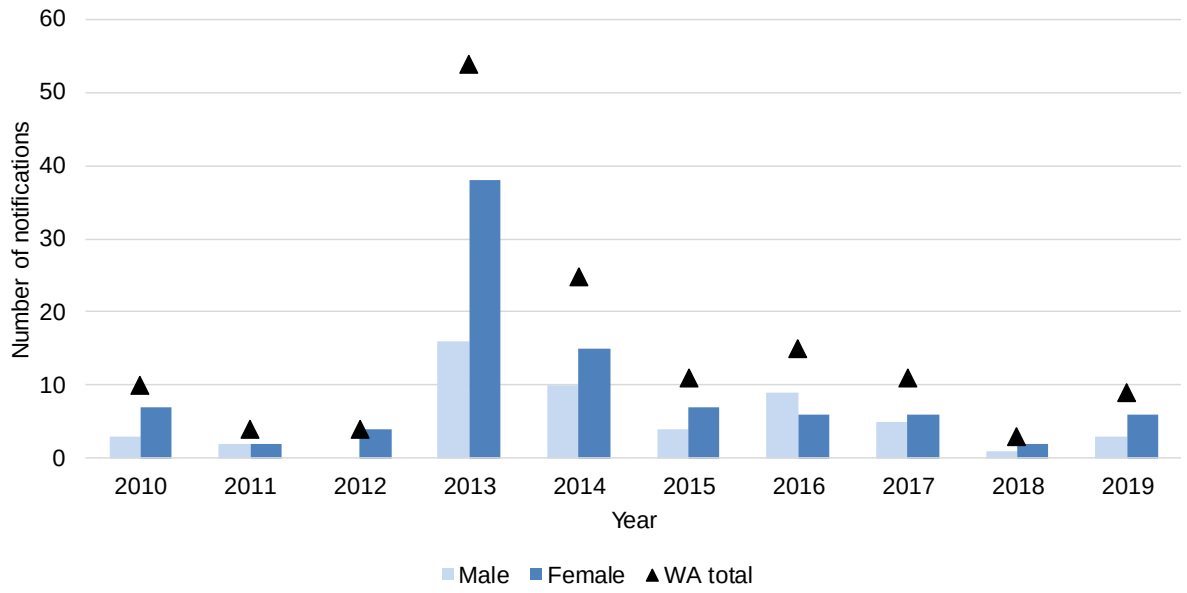


Figure 103. Number of notifications for chikungunya virus infection, by year of disease onset and sex, in WA 2010–2019.

Cases ranged in age from 10 to 82 years (median: 46 years). Approximately 76% (n=111) occurred in adults aged 25-59 years, with the highest age-specific notification rate observed in those aged 50-54 years (mean annual rate: 1.4 per 100,000; n=22), followed by those aged 40-44 (1.1 per 100,000; n=19). Four cases were aged 10-15 years.

Other than two cases for whom Aboriginal status was not reported, the remainder (n=144) of cases were non-Aboriginal. The majority of the notifications (88%; n=129) were from the Perth metropolitan region. All cases acquired their infection overseas, with Indonesia (n=89) and India (n=19) accounting for nearly three quarters (74%) of the notifications.

Zika virus infection

Zika virus is a flavivirus which is primarily transmitted from person-to-person by the bite of an infected mosquito from the *Aedes* genus. Other possible modes of transmission include sexual contact, transfusion of blood and blood products, organ transplantation and transfer from mother to foetus during pregnancy. There is currently no vaccine against this disease.

There were 19 confirmed cases of Zika virus infection notified in WA between 2010 and 2019, ranging from a high of 15 cases in 2016 to two cases in 2015 and one case each in 2017 and 2018 (Table 4). Four cases (n=4) were in children aged ≤15 years. Of the adult cases, the median age of disease onset was 40 years (range: 27 to 62 years). More than half (53%; n=10) of the cases were female (Appendix 1) and none were pregnant. All cases were among non-Aboriginal people (Appendix 2) who acquired their infection overseas from a range of tropical areas including seven cases from Central America, and four cases each from the Pacific region, West Indies and South-East Asia.

Murray Valley encephalitis virus

Murray Valley encephalitis (MVE) virus infection is a rare disease. In Australia, *Culex annulirostris* is the most common mosquito species that transmits the virus from fresh-water birds to humans. MVE virus infection usually occurs in remote north-western Australia and is occasionally seen in other parts of Australia following heavy rainfall and flooding (conditions that favour bird and mosquito breeding). There is currently no preventive vaccine available for this disease.

Between 2010 and 2019, there were 10 confirmed cases of MVE virus infection notified in WA, of which nine were notified in 2011 and one in 2018 (Table 4). A record wet season rainfall associated with significant flooding and increased levels of mosquito activity, occurred in many areas of Australia in the summer and autumn of 2011. This resulted in higher levels of MVE virus infections in south-eastern and northern parts of Australia including northern and central WA. Of the nine cases in 2011, five were female and two-thirds (n=6) were non-Aboriginal (Appendix 1). Two of these cases were aged ≤2 years, while the remainder were aged between 25 and 67 years (median: 41 years). All nine cases in 2011 were either residents (n=7) of or had recently visited (n=2) the regions of increased MVE virus activity (Kimberley, Pilbara and Midwest). There was one death reported among the cases in 2011. The single case in 2018 occurred in a non-Aboriginal adult aged in his 50s who had just returned from extensive travel in the Kimberley region.

West Nile virus/Kunjin virus infection

West Nile virus is a rare virus transmitted by a mosquito-borne flavivirus. West Nile virus/Kunjin is a strain of West Nile virus endemic in parts of Australia. In Australia, *Culex annulirostris* is the most common mosquito species that transmits the virus from fresh water birds to humans. There is currently no preventive vaccine available for this disease.

A total of four locally acquired cases of West Nile virus/Kunjin virus infection were notified in WA in the ten-year period 2010 to 2019 (Table 4). All four cases were notified in 2017 and occurred among adults (three non-Aboriginal people and one Aboriginal person) aged 20-54 years. Males and females were equally represented (Appendix 1). All cases were residents of the Kimberley region and reported a history of mosquito bites prior to onset of symptoms. No deaths were reported.

Japanese encephalitis virus infection

Japanese encephalitis is a rare disease caused by a mosquito-borne flavivirus called Japanese encephalitis virus (JEV). A number of mosquito species, including *Culex* transmit JEV between pigs, water birds and humans. Two JEV vaccines are available for use in Australia for eligible people.

There were two cases of JEV infection notified in WA between 2010 and 2019: one in 2013 and one in 2018 (Table 4). Both cases were linked to overseas travel (Indonesia and Thailand) and occurred in non-Aboriginal adults residing in metropolitan Perth.

Zoonotic Diseases

Zoonotic diseases or zoonoses are diseases which are transmitted to humans from infected animals, either through direct contact with the body fluids of an infected animal (via touch/scratch/bite) or through indirect contact via contaminated food, water or environmental surfaces. Zoonotic pathogens include viruses, bacteria, parasites, fungi and other agents (prions). Zoonoses comprise a major portion of all current human pathogens and most emerging infectious diseases worldwide and, thus, represents not only a major public health problem but are also regarded as a significant growing threat to global security and economic growth.

The notifiable zoonotic diseases included in the ‘Zoonotic’ category in WANIDD are listed in Table 1. The epidemiology of other notifiable zoonotic diseases in WA (e.g. campylobacteriosis, salmonellosis and rabies) are detailed in other sections in this report. Between 2010 and 2019, there were 156 notifications of zoonotic diseases among WA residents, with a mean annual ASR of 0.6 notifications per 100,000 population over the ten-year period. Q fever was the most commonly notified infection in this category accounting for more than half of all notifications each year (Figure 104). All notifications in this category were aged ≥15 years (median: 50 years) and approximately 96% (n=150) of all notifications were among the non-Aboriginal population.

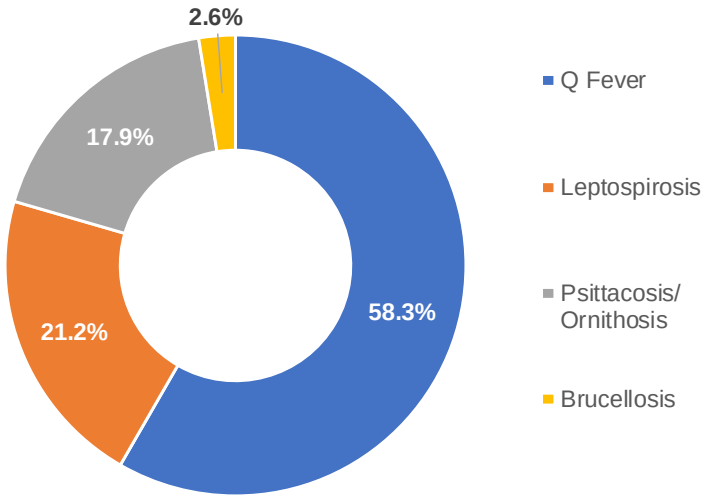


Figure 104. Proportion (%) of notified cases of zoonotic infections, WA 2010–2019

No cases of anthrax, Hendra virus infection, lyssavirus infection (including rabies and Australian bat lyssavirus) or tularaemia were notified between 2010 and 2019.

Q fever

Q fever is a zoonotic disease caused by the bacterium *Coxiella burnetii*. Although the bacteria can be found on a variety of mammals, the main reservoirs and frequent source of human infection are birds and arthropods, farm animals (cattle, sheep and goats) and domestic pets (cats and dogs). Transmission to humans occurs through the inhalation of contaminated aerosols from animal tissues or wool. Person-to-person transmission is rare. It is recommended that adolescents aged ≥15 years and adults who are increased risk of infection be vaccinated.

Between 2010 and 2019, there were 91 confirmed cases of Q fever notified in WA with six to 13 notifications reported each year (Table 4). The cases ranged in age from 15 to 82 years (median: 52 years) and were predominantly male (82%; n=75). People aged 60-64 years had the highest notification rate (0.92 per 100,000; n=12) followed by those aged 75-79 years (0.85 per 100,000; n=8) (Figure 105). Of the cases, 85 reported as being non-Aboriginal and four as Aboriginal. Aboriginal status was not available for two cases.

The notification rate was highest among residents of the Wheatbelt (2.6 per 100,000) and Great Southern (2.4 per 100,000) regions of WA (Figure 105). Most of the cases (81%; n=74) acquired the infection in WA and more than 90% of the cases reported working in high-risk occupations (including farmers, abattoir workers, staff at veterinarian clinics and meat industry workers) or reported having had recent contact with farm or feral animals.

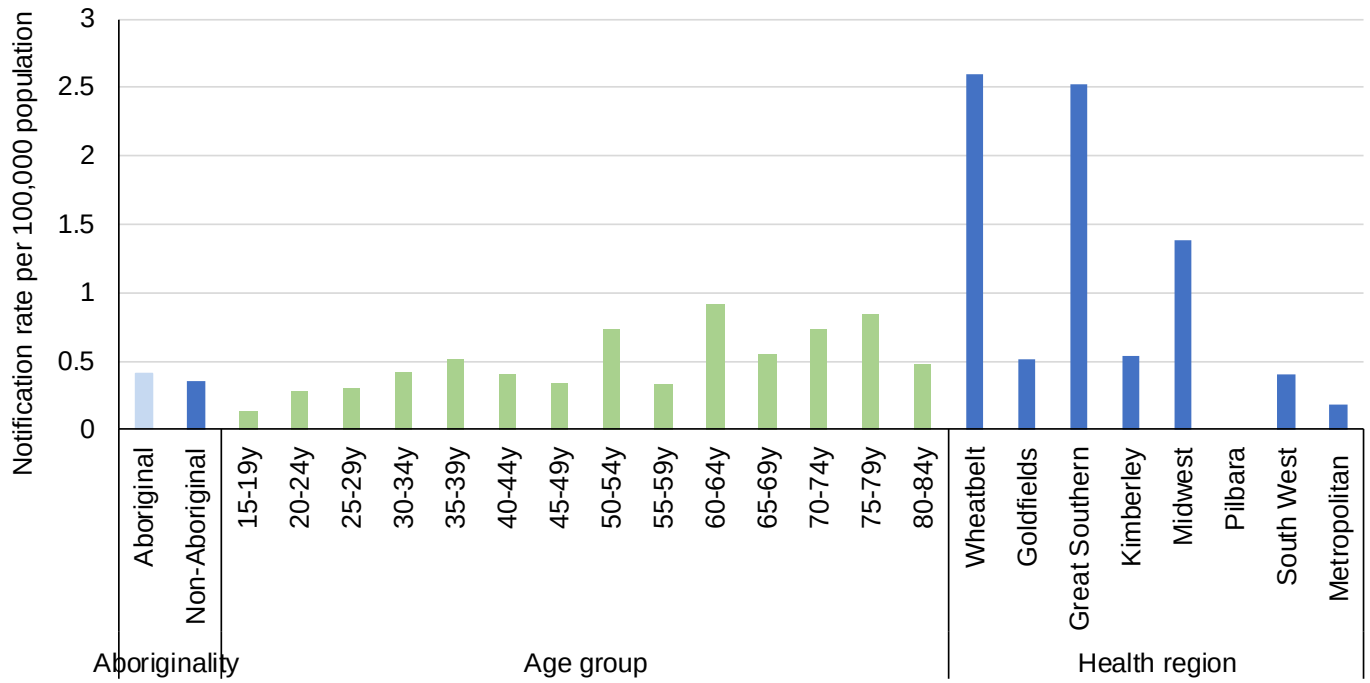


Figure 105. ASR (per 100,000 population) of Q fever, by Aboriginal status, age-group and health regions, WA (2010–2019)

Leptospirosis

Leptospirosis is caused by *Leptospira* spirochaete bacteria. The bacteria are excreted in the urine of infected animals. Rodent urine is the most common source of human infection. Transmission to humans occur through direct contact with, or ingestion of contaminated food, water, vegetation or soil. Infection can also be acquired through the inhalation of aerosolised contaminated urine. Person-to-person transmission is rare. Leptospirosis is endemic in many tropical regions and causes large epidemics after heavy rainfall and flooding. In Australia, although leptospirosis is rare (<1,000 cases per year), it is more common in warm tropical regions such as north-eastern NSW and Queensland.

Between 2010 and 2019, there were a total of 33 confirmed cases of leptospirosis notified in WA, ranging from a low of no cases in 2013 to a high of six cases in 2016 (Table 4). All cases were non-Aboriginal adults ranging in age from 20 to 71 years (median: 42 years) and were predominantly male (85%; n=28). Approximately 73% (n=24) of cases resided in metropolitan Perth, while 21% (n=7) were residents of the South West region (Appendix 3).

Twenty-one cases (64%) acquired their infection overseas, 11 of which had a history of travel to Indonesia. More than half of the overseas acquired cases reported a history of river rafting or kayaking, whereas among WA-acquired infections, the main exposure was contact with farm animals. Twenty-seven cases (82%) were admitted to hospital and one case died of septic shock.

Psittacosis

Psittacosis, also known as ornithosis or parrot fever, is a bacterial zoonosis caused by *Chlamydia psittaci*. Although birds belonging to the order *Psittaciformes* (parakeets, parrots, budgerigars, lorikeets and cockatoos), serve as the major reservoir, the organism has also been found in other birds and animal species such as poultry, sheep, and cattle. The infection is transmitted to humans through inhalation of aerosolised organisms from secretions/droppings and dust from feathers of infected birds, or by direct contact with the infected birds. Person-to-person transmission is rare.

A total of 28 cases of psittacosis were notified between 2010 and 2019 (Table 4). While, notifications were slightly higher among females (57.3%) than males, the sex distribution varied from year to year (Appendix 1). All notified cases were among non-Aboriginal adults aged 20 to 68 years (median: 53 years). Notification rates were highest in the 60 to 64 years age group (0.46 per 100,000; n=6) followed by the 50 to 54 years age group (0.31 per 100,000; n=5).

The majority of cases (64.3%; n=18) resided in the Perth metropolitan region (Appendix 3). Approximately 86% (n=24) of cases were acquired in WA. With the exception of one case, all other cases (irrespective of place of acquisition of infection) reported history of contact with birds (including parrots, finches, cockatiels, pigeons and chickens). Approximately 57% (n=16) of all cases were hospitalised due to their illness.

Brucellosis

Brucellosis is a bacterial zoonosis caused by *Brucella* species. People can become infected through direct contact with infected animals (including feral pigs, dogs, cattle, goats, sheep and camels) and/or their placentas or aborted foetuses. People may also be infected through consumption of contaminated dairy products and uncooked meat. Person-to-person transmission is rare.

Brucellosis is quite rare in Australia. *B. suis* (from pigs)*, B. melitensis* (sheep and goats)*, B. abortus* (cattle) and *B. canis* (dogs) are the most common species responsible for disease in humans. In Australia, while most *Brucella* species have been eradicated or not observed, *B. suis* (from feral pigs) remains a source of human infection. The majority of cases diagnosed in Australia are among returned travellers and migrants.

Between 2010 and 2019, four confirmed cases of brucellosis were notified in WA (Table 4). All four cases were among non-Aboriginal adults (three males and one female) aged 30 to 63 years. All cases acquired the infection overseas: two reported consumption of unpasteurised milk, one reported being in contact with domestic animals, and the fourth was a recent migrant from Africa. *B. melitensis* was isolated from all four cases.

Other Diseases

Diseases and syndromes classified as 'Other diseases' on WANIDD are listed in Table 1. Between 2010 and 2019, there were a total of 2,503 notifications in this category in WA. Of these, 2,377 (95%) notifications were WA residents, reflecting a mean annual ASR of 9.3 per 100,000 population over the ten-year period.

The median age at infection was 46 years (range: <1 to 90 years). Mean annual ASR in the Aboriginal population were nearly two-fold higher than that of the non-Aboriginal population (17.2 vs 8.9 per 100,000 population). Tuberculosis was the most commonly notified disease in this category accounting for more than half (54%; n=1,278) of all notifications, with legionellosis (29%; n=680) being the second most commonly notified disease (Figure 106).

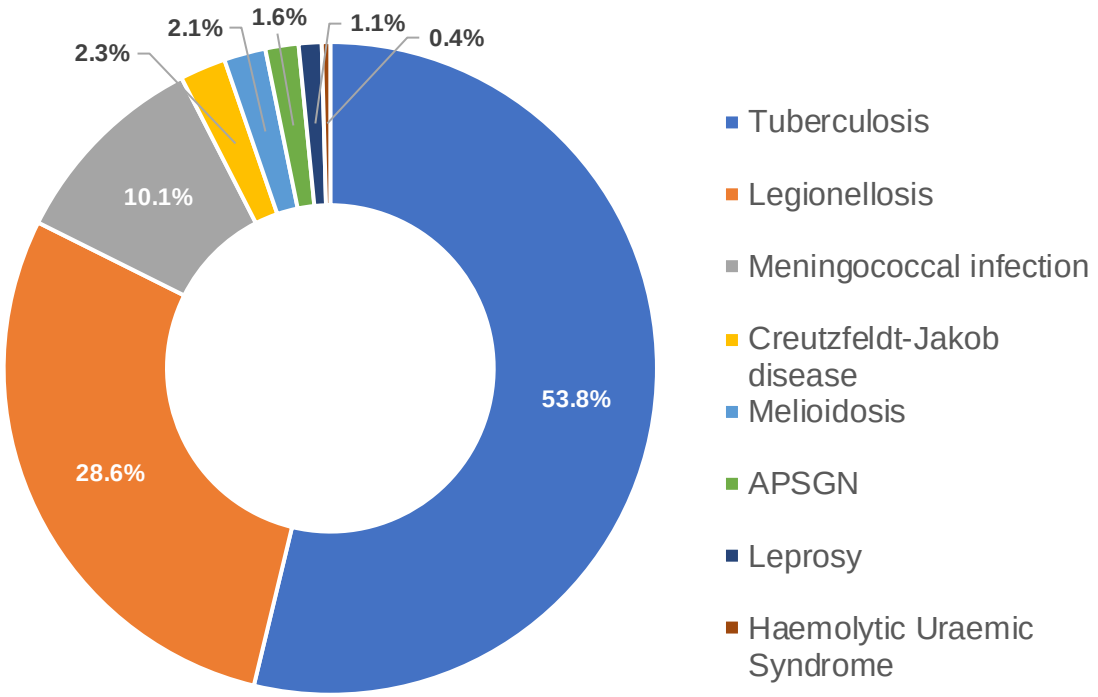


Figure 106. Proportion of notified cases in 'Other Diseases' category in WA 2010–2019

No cases of amoebic meningitis, severe acute respiratory syndrome (SARS), Middle East respiratory syndrome (MERS) coronavirus or viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg) were notified in WA between 2010 and 2019.

Tuberculosis

Tuberculosis (TB) is a chronic disease, caused by infection with the bacteria *Mycobacterium tuberculosis.* It usually affects the lungs but can also affect other parts of the body. Most people infected with TB are asymptomatic as the immune system can control the infection. However, the

bacteria remain alive in a dormant or inactive state; this is called latent TB infection. When infection leads to illness or disease, it is known as active TB infection. The data presented in this section only relates to cases of active TB.

TB is spread through airborne transmission, which usually occurs through close contact with a case who has active TB. Medications are available for the treatment of TB and are taken over a period of at least six months. A TB vaccine (Bacillus Calmette-Guérin; BCG) is available but is not routinely administered in Australia.

Temporal Trends

Between 2010 and 2019, a total of 1,278 TB cases were notified in WA. The annual number of notifications increased by 40% from 2010 to 2012 (102 to 143 cases), before decreasing 15% to 122 cases in 2013. Thereafter, the number of TB notifications ranged from 120 to 140 cases between 2014 and 2019 (Figure 107). Over the ten-year period, 17 cases of multi-drug resistant TB (MDR-TB) and no cases of extensively drug resistant TB were notified in WA. The vast majority of TB cases notified were new cases (96%; n=1,229), with only a small proportion of relapsed cases reporting previous treatment in Australia (1%; n=12) or overseas (3%; n=32). TB notifications between 2010 and 2019 comprised 58% (n=612) pulmonary cases and 42% (n=537) extrapulmonary cases. During this period, just under half of TB cases were laboratory-confirmed sputum positive cases (n=557).

Sex and Age

Between 2010 and 2019, TB notifications were similarly distributed between male (n=644) and female cases (n=634) equating to a mean annual ASR of 5.1 per 100,000 population among both males and females (Figure 108 and Appendix 1). The median age of TB cases over the ten-year period was 37 years (range: 2 to 90 years); the median age for male cases was four years older than for females (39 vs 35 years).

Aboriginal Status

The number of annual TB cases among Aboriginal people remained low over the 2010 to 2019 period, with a total of 19 cases notified over the 10 years, which ranged from 0 to 4 cases per year. The mean annual ASR for TB was lower among Aboriginal people than that reported for non-Aboriginal people (2.5 vs 5.2 cases per 100,000 population).

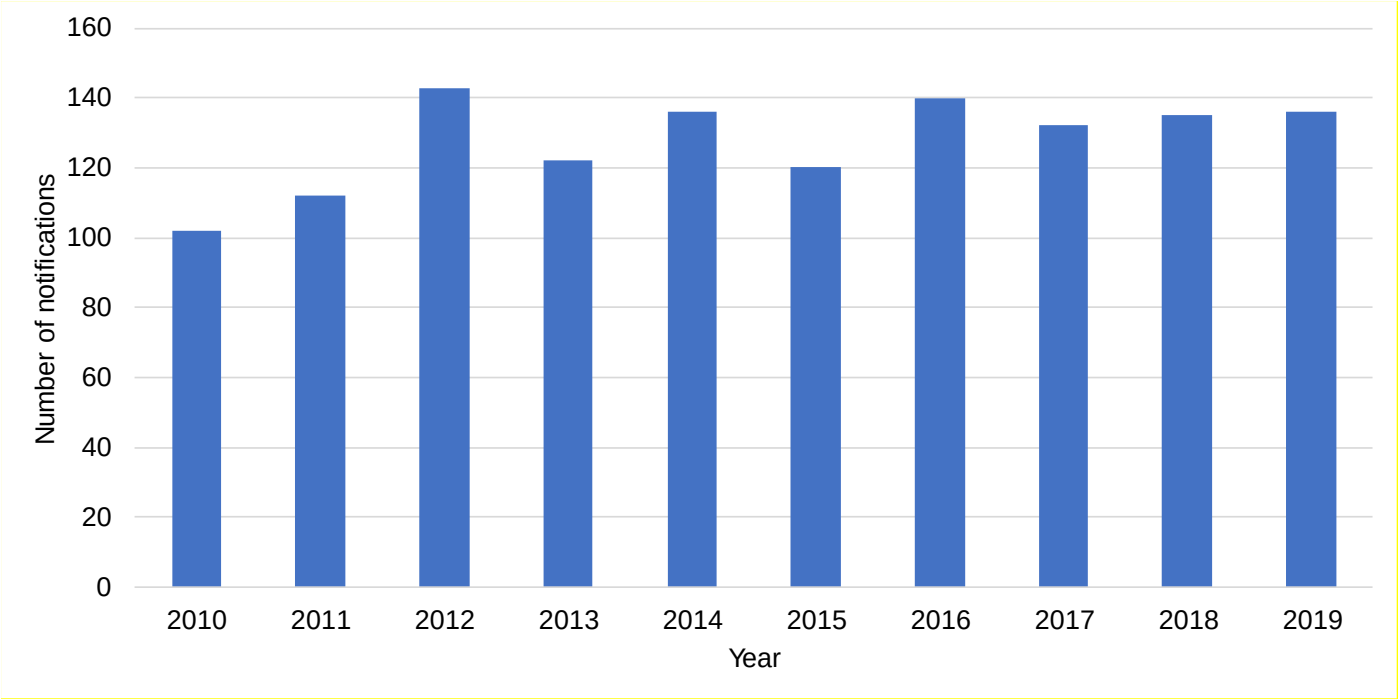


Figure 107. Notified cases of TB by year of notification, WA 2010–2019

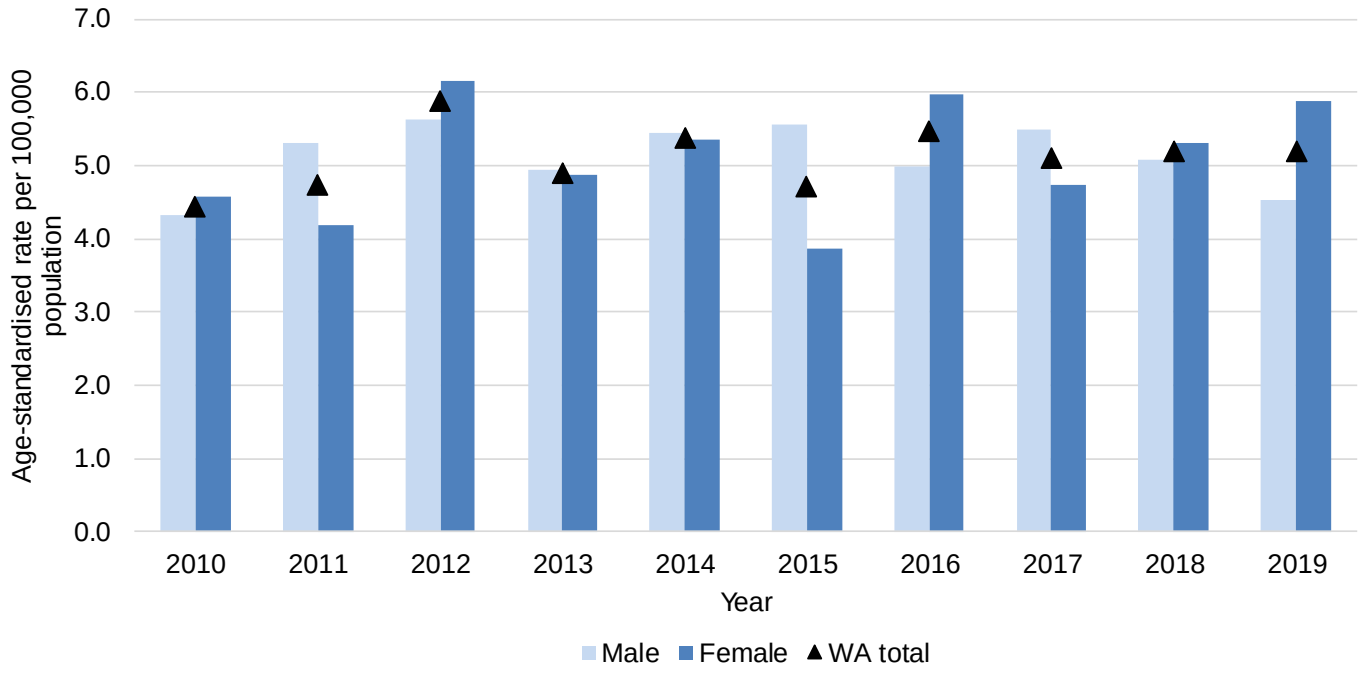


Figure 108. ASR (per 100,000 population) for TB cases, by sex and year of notification, in WA, 2010–2019

Region

TB notifications in WA were predominately in the Perth metropolitan region, making up 90% (n=1,152) of total cases between 2010 and 2019 (Appendix 3). TB cases from the non-metropolitan regions remained relatively low in comparison, ranging between six and 20 cases per annum over the ten-year period. The mean annual ASR for TB was 2.4-fold higher in the

metropolitan area than in the non-metropolitan area (5.8 vs 2.4 per 100,000 population). In contrast, the majority of the TB notifications from Aboriginal people were from non-metropolitan regions (68%; n=13).

Place of Acquisition

Between 2010 and 2019, the vast majority of TB cases were among overseas-born people who acquired the infection overseas (80%; n=1,020). Most cases over this period were born in Asia (66%; n=843), particularly in high TB prevalent countries. India and the Philippines the most commonly reported countries of birth, representing 16% (n=206) and 13% (n=162) of total cases respectively. Over the same period, Australian-born people made up 11% (n=138) of TB notifications and only 9% (n=120) reported TB acquisition in Australia.

Risk Exposure

From 2010 to 2019, 69% (n=888) of cases were assessed with regards to risk exposure for TB. Of those, the largest proportion of cases reported travel or residency in a high-risk country (43%; n=385), followed by cases reporting a household member or close contact with TB (22%; n=197).

Legionellosis

Legionellosis is a collective term for diseases caused by *Legionella* bacteria. The diseases can manifest as pneumonic (Legionnaire's disease, a severe form of atypical pneumonia) or non-pneumonic (Pontiac fever, a mild influenza-like illness) forms of infection. *Legionella* species are ubiquitous in the environment, and some species (including *L. pneumophila* and *L. longbeachae*) are known to cause disease in humans. *L. pneumophila* is commonly found in water and can colonise manufactured water systems such as hot water systems, air-conditioning cooling towers, spa pools, showerheads, humidifiers and water fountains. Infection occurs by inhalation of contaminated aerosols from these systems. *L. longbeachae* can be found in potting mixes and compost and the pathogen enters the host either by the oral route or through inhalation.

Temporal Trends

Between 2010 and 2019, there were 680 confirmed cases of legionellosis notified in WA, reflecting a mean annual ASR of 2.6 per 100,000 over the ten-year period. From 2010, the notification rate increased each subsequent year and reached a high of 4.4 per 100,000 in 2014 (Figure 109). Since then, there has been a 71% decline in the notification rate to 1.3 per 100,000 in 2019.

L. longbeachae was the most commonly identified organism accounting for approximately 79% (n=534) of all infections; *L. bozemanii* was identified in one case and *L. pneumophila* was identified in the remainder of cases (n=145). Over the ten-year period, the rate of *L. longbeachae* decreased from an average of 2.8 cases per 100,000 for the 2010 to 2014 period to 1.3 cases per

100,000 for the 2015 to 2019 period. *L. pneumophila* notifications during the period were relatively stable (ranged from 0.3 per 100,000 (n=8) to 0.8 per 100,000 (n=21)); Figure 109.

During the ten-year period, 73% (n=499) of cases were hospitalised; cases ranged in age from 37 to 87 years (median 75 years). There were associated 15 deaths (11 males and 4 female), with *L. pneumophila* associated with 9 deaths and *L. longbeachae* associated with 6 deaths.

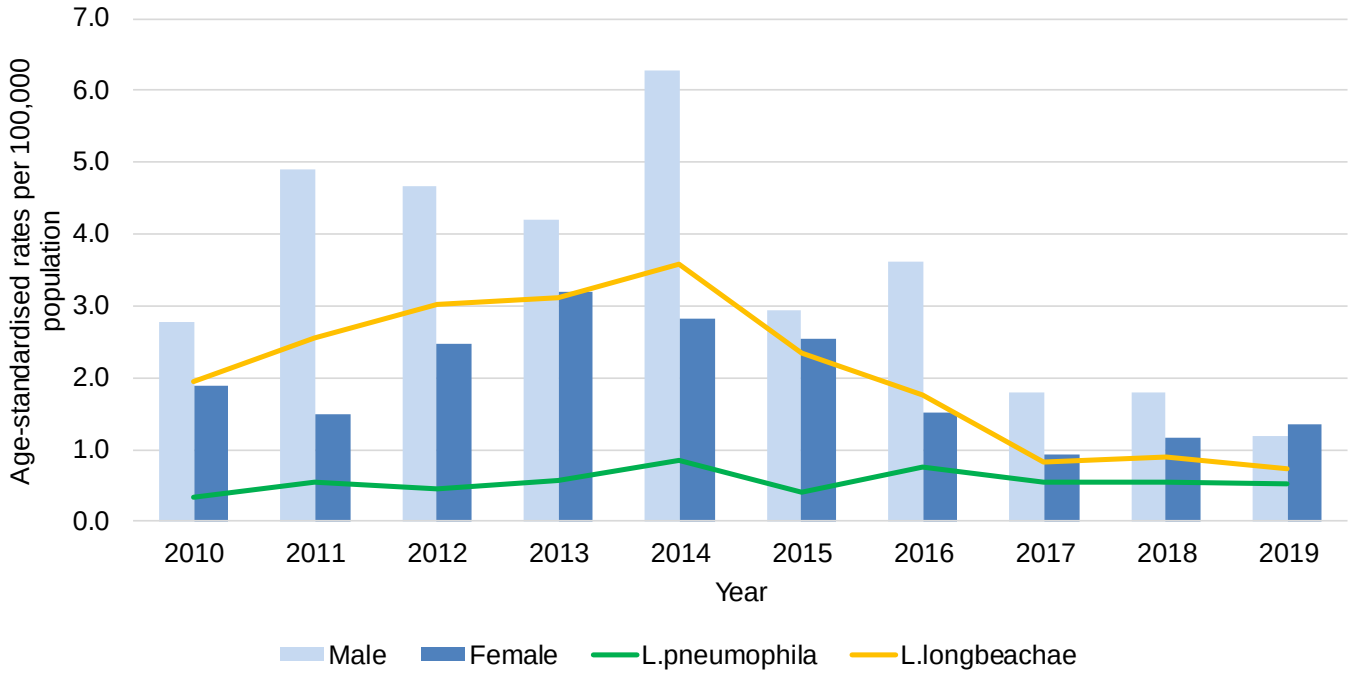


Figure 109. ASR for legionellosis by sex, year of disease onset and species in WA 2010–2019

Sex and Age

Males were more likely to be notified with legionellosis than females. The mean annual ASR among males was 3.3 per 100,000 compared to 1.9 per 100,000 among females (Appendix 1). The majority of the notifications (98%; n=667) were among adults aged ≥30 years (Figure 110). There were no cases in children aged <10 years. In general, notification rates increased with age in both males and females (Figure 110), with the highest notification rates for females observed in the 75 to 79 years age group (10.3 per 100,000; n=32) and for males in the 80 to 84 years age group (20.8 per 100,000; n=38).

Aboriginal Status

Legionellosis notification rates were higher in the Aboriginal population compared to the non-Aboriginal population (5.0 vs 2.5 per 100,000) (Appendix 2). Approximately 65% (n=15/23) of notifications among the Aboriginal population were due to *L. longbeachae* compared to 79% (n=509/646) in the non-Aboriginal population.

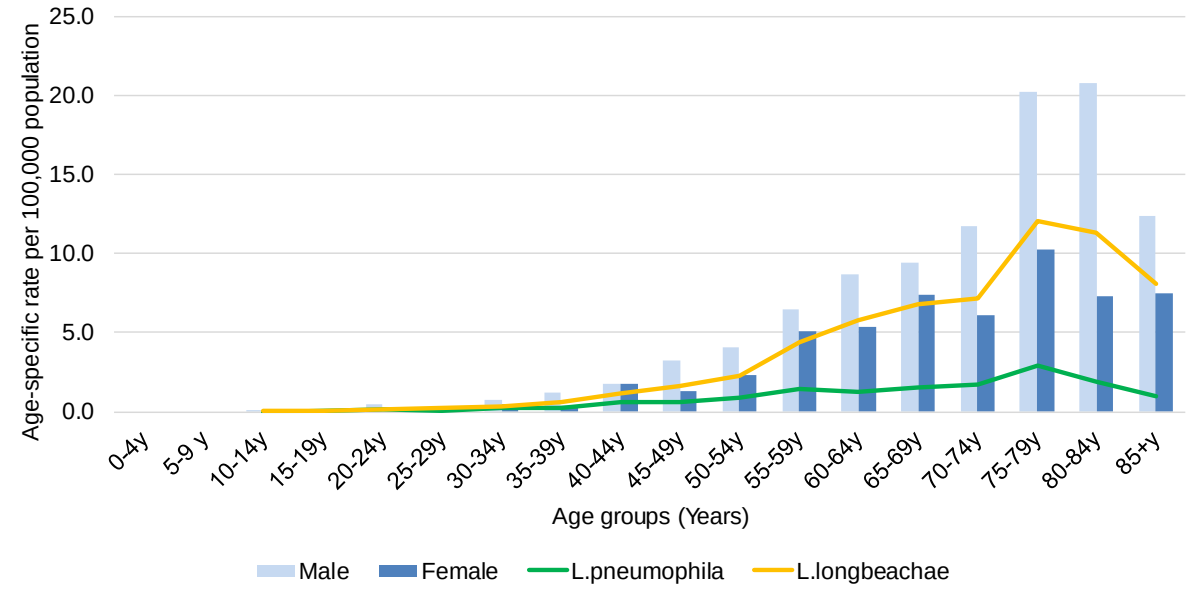


Figure 110. Age-specific notification rates (per 100,000 population) for legionellosis, by sex and Legionella species in WA 2010–2019

Region

Over the ten-year period, the mean annual ASR for legionellosis was highest in the Midwest region (4.8 per 100,000; n=36), followed by the Kimberley region (3.8 per 100,000; n=13); however, the number and rate of notifications in each region varied by year (Appendix 3). The proportion of infection attributable to the different *Legionella* species varied by region (Figure 111).

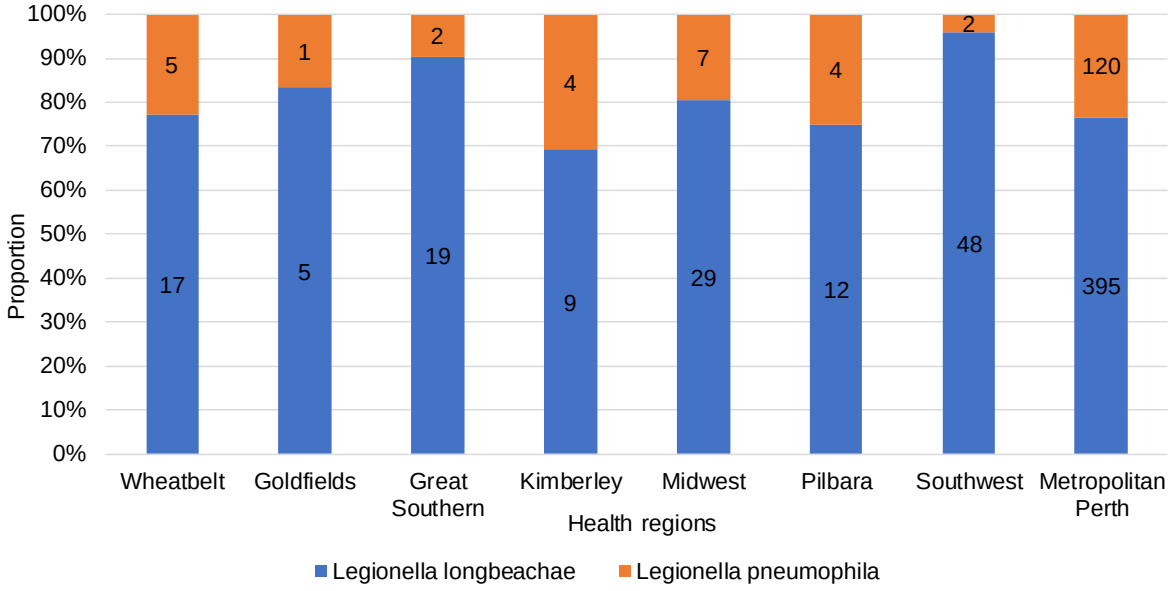


Figure 111. Number and proportion of legionellosis notifications, by species, in the different regions in WA, 2010–2019

Place of Acquisition

The majority (73%; n=493) of legionellosis cases were acquired in WA, with approximately 12% (n=78) acquired overseas. Of the overseas acquired infections, more than half (54%; n=42) were acquired in Indonesia. Place of acquisition was not available for 102 cases and 7 were acquired interstate.

Invasive meningococcal disease

Invasive meningococcal disease (IMD) is caused by the bacterium *Neisseria meningitidis*. There are 13 serogroups of meningococcal bacteria, however most disease is caused by serogroups A, B, C, Y and W. The bacteria are present in approximately 10% of all healthy people without causing disease. However, in a small proportion of people, the bacteria can enter the bloodstream and cause IMD.

Temporal Trends

A total of 240 confirmed cases of IMD were notified in WA between 2010 and 2019 (Table 4). In 2017, the highest number of notifications was recorded (n=45), followed by 2018 (n=40) (See Outbreak section). The ratio of males to females varied over the ten-year period (Figure 112). Approximately 96% of all notifications were acquired in WA. Over the ten-year period, 25 cases died from meningococcal disease; of these 12 were females and 13 males. Ten deaths occurred in children aged ≤5 years.

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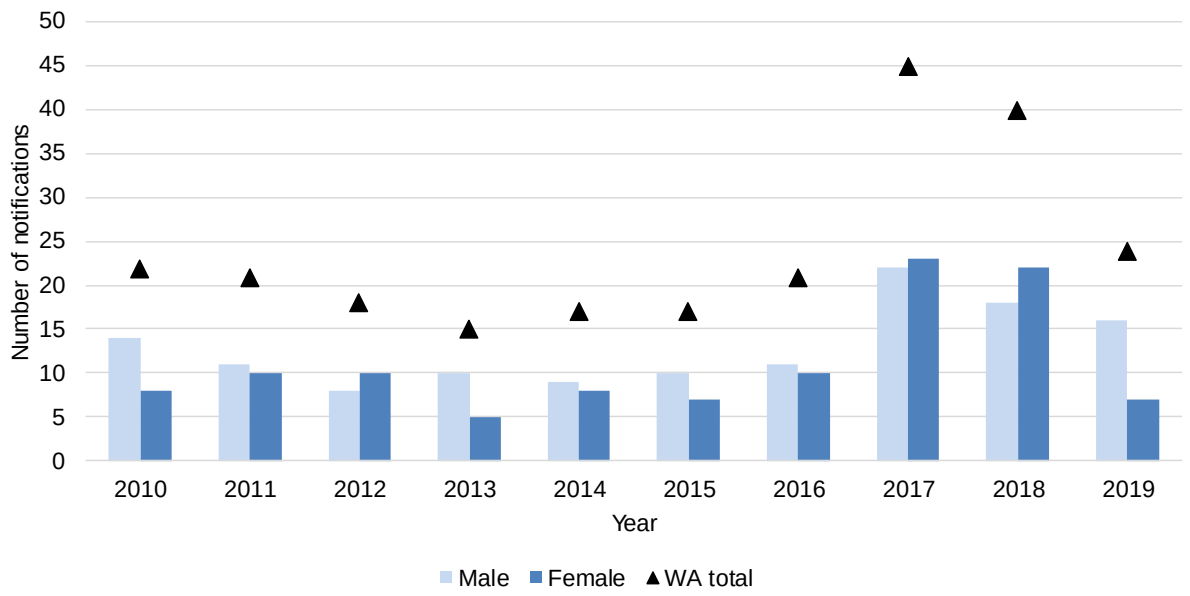

Figure 112. Number of notifications of IMD, by sex and year of disease onset in WA, 2010–2019

Serogroup

Meningococcal serogroup data was available for nearly 98% (n=235) of cases. Of these, serogroup B accounted for 120 cases (51%) and serogroup W135 was identified in 82 cases (35%). The proportion of serogroups varied by year; serogroup B was the dominant strain among notified cases from 2010 until 2015, and W135 was the dominant serogroup identified in cases from 2016 to 2019 (Figure 113). Serogroup B was identified in 12 deaths, serogroup W135 in 11 deaths and serogroups C and Y in 1 death each.

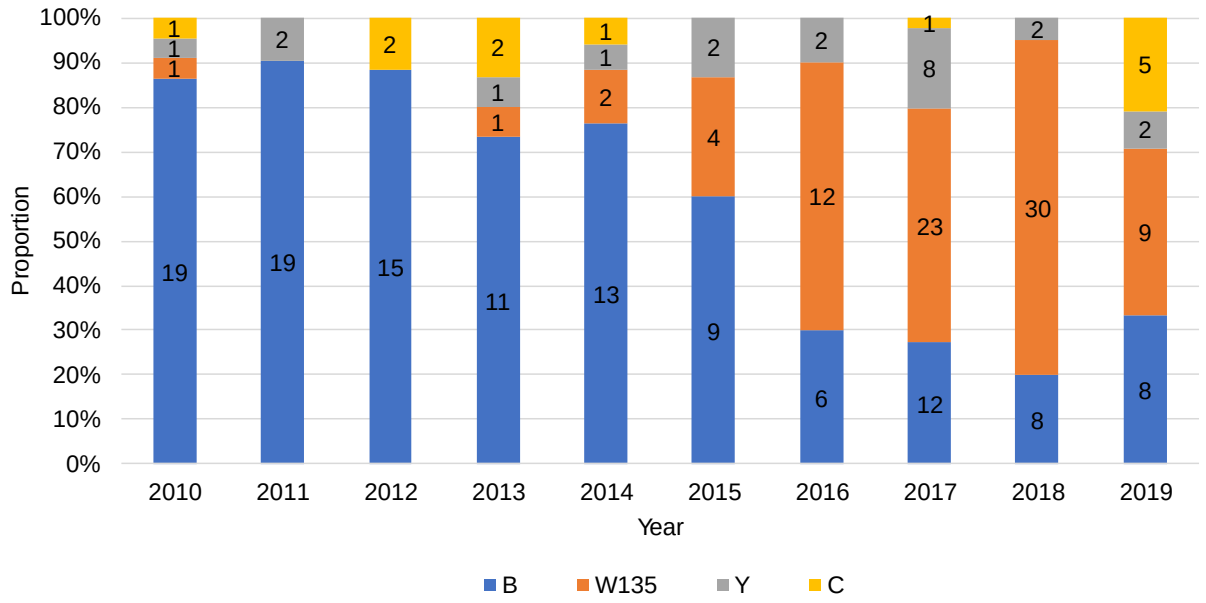

Figure 113. Number and proportion of notified IMD by serogroups (B, W135, Y and C) and year of disease onset in WA 2010–2019

Sex and Age

Between 2010 and 2019, just over half (54%; n=129) of all notifications were males, and the ratio of males to females varied over the period (Figure 114). Overall, the mean annual notification rates were highest in those aged 0-4 years (4.8 per 100,000) followed by the 80-84 years age group (1.9 per 100,000) and the 15-19 years age group (1.8 per 100,000) (Figure 114). Over the ten-year period, serogroup B was predominant in most age groups; however, post-2014, serogroup W135 emerged as the most commonly identified serogroup in most age groups.

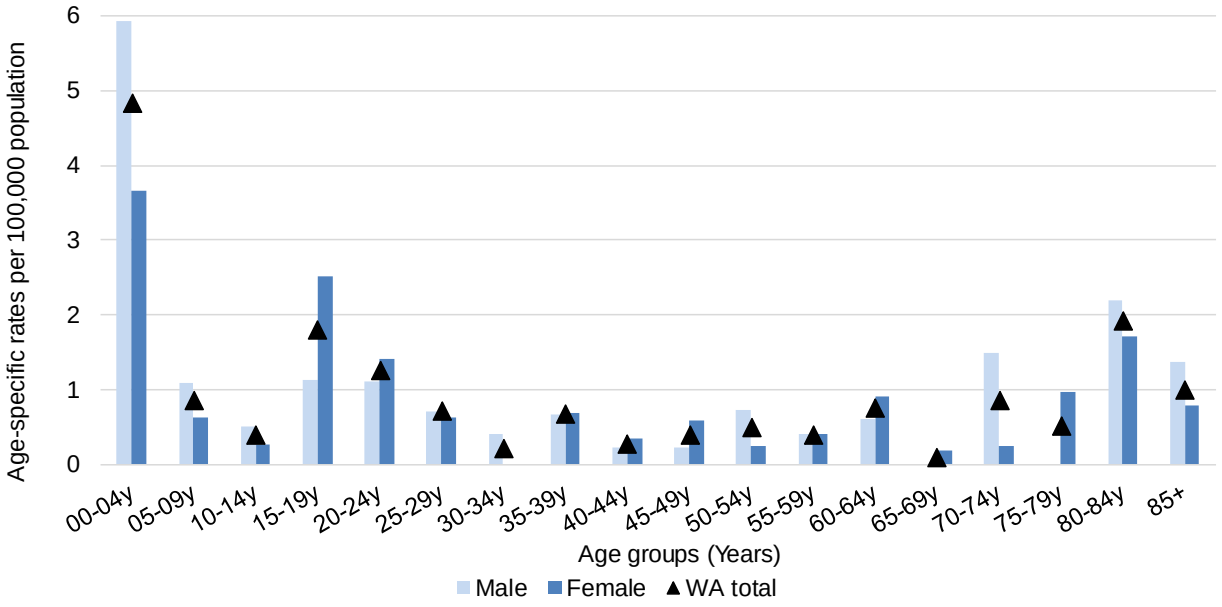

Figure 114. Age-specific notification rates for IMD by age group, sex in WA, 2010–2019

Aboriginal Status

Between 2010 and 2019, nearly 29% (n=62) of notifications were among the Aboriginal population with a mean annual ASR almost 10-fold higher than that in the non-Aboriginal population (7.1 vs 0.7 per 100,000) (Appendix 3). The age distribution of cases varied between the Aboriginal and non-Aboriginal population. Approximately 65% (n=45) of all notifications among the Aboriginal population were in children aged <5 years, corresponding to a mean annual rate of 39.6 per 100,000; only 21% (n=36; 2.3 per 100,000) of all notifications among the non-Aboriginal population were among children aged <5 years (Table 35).

Table 35. Number and age-specific notification rate (per 100,000 population) for IMD, by Aboriginal status and age group, in WA 2010–2019

Age group	Aboriginal		Non-Aboriginal	
	n	Rate	n	Rate
0-4y	45	39.6	36	2.3
5-9y	8	7.2	6	0.4
10-14y	2	1.9	4	0.3
15-24y	2	1.1	48	1.5
25-34y	4	2.6	14	0.4
35-44y	5	4.3	12	0.4
45-54y	3	3.1	12	0.4
55-64y	0	-	16	0.6
65-74y	0	-	8	0.4
75-84y	0	-	11	1.1
85+	0	-	4	1.0
Total	**69**	**7.1**	**171**	**0.7**

Over the ten-year period, the W135 serogroup was more commonly identified (55%; n=38) than serogroup B (33%; n=23) among the Aboriginal population (Table 36). In contrast, serogroup B (57%; n=97) was the most commonly identified serogroup among the non-Aboriginal population, followed by serogroup W135 (26%; n=44) and serogroup Y (12%; n=21).

Table 36. Meningococcal serogroup by Aboriginal status in WA 2010–2019

	B	W135	Y	C	Untypable/missing	Total
Aboriginal	23	38	0	7	1	69
Not Aboriginal	97	44	21	5	4	171
Total	**120**	**82**	**21**	**12**	**3**	**240**

Region

The mean annual ASR was highest in the Goldfields region (3.5 per 100,000; n=20) followed by the Midwest region (2.4 per 100,000; n=16); however, the rates in each region varied by year (Appendix 3).

Immunisation

In Australia, vaccines are available against meningococcal serogroups A, B, C, W and Y. Meningococcal C vaccine has been recommended and funded for children and at-risk adults since 2003. Meningococcal ACWY (MenACWY) vaccines have been registered for use since 2011 and funded for at-risk groups (children aged 1 to 4 years and young people 15 to 19 years of age) since 2017 in WA.

Outbreak

An increase in meningococcal notifications in 2017 that continued to 2019 was mainly in the Goldfields (in 2016), Midwest (2018) and Pilbara (2019) regions and due to the W135 strain. In response, there was a targeted MenACWY vaccine programs in these regions and WA wide that included public health education messages.

Creutzfeldt-Jakob disease

Creutzfeldt-Jakob disease (CJD) is a rare and fatal degenerative brain disease, caused by mutations within a person's brain that results in the accumulation of abnormal proteins known as prions. The majority of people die within 6 months of diagnosis. There are three types of CJD: sporadic, familial and variant. Variant CJD is associated with the consumption of meat products from cattle infected with bovine spongiform encephalopathy (mad cow disease). Sporadic and familial CJD tend to occur in people aged 50 years and older while variant CJD tends to occur in younger people. There is no treatment or cure for CJD.

There were 54 confirmed cases of CJD notified in WA between 2010 and 2019, ranging from a high of 11 cases in 2019 to a low of 1 case in 2012 (Table 4). Cases ranged in age from 44 to 87

years, with a little over half of the cases (52%; n=28) occurring among people aged 65-74 years. There were no cases in Aboriginal people. All cases died as a result of CJD.

Melioidosis

Melioidosis is a bacterial disease caused by *Burkholderia pseudomallei* which is found in contaminated soil and water. Transmission usually occurs through inhalation of contaminated dust or water droplets, or contact with contaminated soil, especially through skin abrasions, or very rarely through the ingestion of contaminated water. Person-to-person transmission is rare. In Australia, melioidosis occurs mainly in the northern parts of the country.

Between 2010 and 2019, there were 49 confirmed cases of melioidosis notified among WA residents ranging from a high of eight cases in 2013 to a low of three cases in 2012, 2016 and 2019 (Table 4). Nearly two-thirds of cases were male (n=31). The median age at onset of illness was 58 years (range: 0 to 92 years) with 46 cases aged ≥21 years. Approximately 78% (n=38) of cases were non-Aboriginal (Appendix 2). Twenty-eight cases acquired the infection in WA, 12 overseas (all cases had history of travel or residence in South-East Asian countries) and 9 acquired the infection interstate (Northern Territory). The Kimberley region had the highest number of cases (n=15) in WA (Appendix 3). There were no melioidosis-associated deaths reported over the ten-year period.

Acute post-streptococcal glomerulonephritis

Acute post-streptococcal glomerulonephritis (APSGN) is an inflammation of the kidney tubules following a Group A streptococcal infection of the skin or throat. Prompt treatment can prevent complications and lead to full recovery. It most commonly affects children but can occur at any age.

APSGN has been notifiable since 2017. Since then, there have been 39 (34 confirmed and 5 probable) cases notified in WA (Table 4). The majority of the cases were male (64%; n=25). Except for one case, all were children aged ≤15 years. Nearly 90% (n=35) of the cases were Aboriginal. All cases were acquired locally in WA and the majority of the cases (n=30; 77%) were residents of the Kimberley region.

Leprosy

Leprosy, also known as Hansen’s disease, is a chronic bacterial disease caused by *Mycobacterium leprae*. Person-to-person transmission can occur through inhalation of nasal droplets; however, extended close contact is required for transmission. Most healthy people exposed to leprosy bacteria do not develop the disease due to inherent protective natural immunity. The disease is rare in Australia, but sporadic cases do occur among the Aboriginal and migrant populations.

Between 2010 and 2019, 27 confirmed cases of leprosy were notified in WA residents (Table 4). Nearly two-thirds of the notifications were females (n=17). Cases ranged in age from 17 to 63 years (median: 36 years). Aboriginal status was available for all cases, with 17 cases in non-Aboriginal people and 10 cases in Aboriginal people. Of the cases who acquired their infection overseas (n=17), 15 were born or had lived in a South / South-East Asian country. All locally acquired cases were among the Aboriginal population living in the Kimberley region.

Haemolytic uraemic syndrome

Haemolytic uraemic syndrome (HUS) is a rare condition characterised by microangiopathic haemolytic anaemia, thrombocytopaenia and acute renal failure. HUS can be fatal in a small number of people. This syndrome most commonly results from STEC infections, but can also be caused by other infections, certain medications and conditions.

There was a total of 10 notified cases of HUS between 2010 and 2019 (Table 4). Cases ranged in age from 2 to 42 years with six cases aged <15 years. Of the 10 cases, 8 were females and 9 were non-Aboriginal.

STEC was identified in six cases. The cause of the other four cases was unknown. Of those that were caused by STEC, five had a serogroup identified, which included serotypes: O157, O111, O26, O128 and O75. The remaining HUS case caused by STEC was epidemiologically linked to the O111 case but serogroup was unable to be confirmed as the case was only PCR positive for shiga toxin. For the remaining four HUS cases, all had a recent onset of diarrhoea and three had a stool specimen tested which was PCR negative for STEC. Possible risk factors identified for HUS cases included homemade salami, organic produce, self-slaughtered lamb and contact with farms and farm animals. Of the 10 cases, nine were hospitalised and there were no HUS-related deaths reported.

Appendix 1

Notifications by Sex

Female

Table 37. Number of notifications, by disease and year, among females in WA, 2010–2019

Disease	2010 N=12,803	2011 N=15,555	2012 N=17,500	2013 N=15,812	2014 N=17,117	2015 N=17,895	2016 N=19,823	2017 N=19,303	2018 N=18,293	2019 N=27,723	2010–2019 N=181,824
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	286	237	259	266	272	268	307	238	228	214	2575
Newly Acquired	10	6	6	9	3	3	2	5	7	7	58
Unspecified	276	231	253	257	269	265	305	233	221	207	2517
Hepatitis C *(Total)*	371	335	347	381	363	355	400	368	365	334	3619
Newly Acquired	21	31	36	33	39	51	32	28	38	35	344
Unspecified	350	304	311	348	324	304	368	340	327	299	3275
Hepatitis D	0	1	1	1	1	0	0	2	2	6	14
ENTERIC DISEASES											
Botulism	0	0	0	0	0	1	0	0	0	0	1
Campylobacteriosis	1088	1012	840	869	1323	1282	1531	1534	1560	1572	12,611
Cholera	0	0	0	0	0	0	0	0	0	0	0
Cryptosporidiosis	85	231	83	200	167	140	113	227	71	121	1438
Hepatitis A	17	3	3	4	7	10	5	3	5	12	69
Hepatitis E	0	1	0	1	0	0	0	0	1	3	6
Listeriosis	1	4	6	4	2	3	4	5	1	4	34
Paratyphoid fever	4	4	5	5	2	4	4	3	3	3	37
Rotavirus infection	323	97	175	168	210	303	77	261	152	294	2060
Salmonellosis	617	635	603	637	612	868	1015	1341	1067	1093	8488

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
	N=12,803	N=15,555	N=17,500	N=15,812	N=17,117	N=17,895	N=19,823	N=19,303	N=18,293	N=27,723	N=181,824
Shiga toxin-producing *E. coli* infection	4	0	1	3	1	0	18	32	48	90	197
Shigellosis	69	44	29	28	27	58	51	112	150	183	751
Typhoid fever	3	4	7	8	2	4	7	9	6	12	62
Vibrio parahaemolyticus infection	1	2	7	6	5	3	11	4	7	6	52
Yersiniosis (other than plague)	1	0	2	2	3	18	7	9	5	10	57
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	5860	6777	6880	6816	6543	6379	6676	6353	6349	6291	64924
Donovanosis	0	0	0	0	1	0	0	0	0	0	1
Gonococcal infection	537	748	892	762	770	945	1382	1408	1280	1532	10256
HIV	22	21	19	13	20	14	7	10	11	21	158
Syphilis											
Infectious	14	16	7	15	11	37	45	53	75	169	442
Non-Infectious	20	41	42	19	19	27	16	46	67	92	389
Congenital	1	0	0	0	0	0	0	0	1	0	2
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	0	0	0	0
Haemophilus influenzae type b (invasive)	1	1	1	0	1	0	1	0	1	1	7
Influenza	846	975	2762	1256	2798	3127	4220	3190	3111	12401	34686
Measles	6	4	2	3	9	4	3	11	16	23	81
Mumps	8	7	7	14	7	191	259	7	6	17	523
Pertussis	828	2185	1880	922	978	1023	818	849	718	296	10497
Invasive pneumococcal disease	94	109	120	86	95	72	89	90	101	111	967
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	0	4	0	1	1	1	0	2	0	1	10

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
	N=12,803	N=15,555	N=17,500	N=15,812	N=17,117	N=17,895	N=19,823	N=19,303	N=18,293	N=27,723	N=181,824
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	1	1	1	0	0	1	0	1	0	5
Varicella											
Chicken pox	224	199	160	168	186	214	306	314	338	294	2403
Shingles	399	490	580	689	763	826	933	1115	1273	1261	8329
Unspecified	456	538	565	672	643	783	807	856	806	721	6847
VECTOR-BORNE DISEASES											
Barmah Forest virus infection*	42	86	124	678	25	19	7	26	17	7	1031
Chikungunya virus infection	7	2	4	38	15	7	6	6	2	6	93
Dengue virus infection	234	178	236	242	247	260	287	86	46	165	1981
Japanese encephalitis virus infection	0	0	0	1	0	0	0	0	0	0	1
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	10	13	7	21	12	15	17	19	12	15	141
Murray valley encephalitis virus infection	0	5	0	0	0	0	0	0	0	0	5
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	229	440	712	688	850	520	244	588	248	210	4729
Typhus	7	13	10	5	2	13	17	12	10	13	102
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	2	0	0	2
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	0	10	0	0	0	10
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010–2019
	N=12,803	N=15,555	N=17,500	N=15,812	N=17,117	N=17,895	N=19,823	N=19,303	N=18,293	N=27,723	N=181,824
Brucellosis	0	0	0	0	0	0	1	0	0	0	1
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	0	0	0	0	1	0	1	0	1	2	5
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0
Psittacosis	1	6	4	3	1	0	0	1	0	0	16
Q fever	1	1	0	1	0	3	1	2	6	1	16
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1	11	2	14
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	3	3	0	2	3	1	5	3	4	6	30
Haemolytic uraemic syndrome	0	0	0	0	1	1	2	2	1	1	8
Legionellosis	22	20	31	41	38	36	23	14	17	20	262
Leprosy	0	2	0	3	4	0	3	2	1	2	17
Melioidosis	1	1	2	4	1	4	0	3	1	1	18
Invasive meningococcal disease	8	10	10	5	8	7	10	23	22	7	110
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	52	49	74	60	67	49	76	61	69	77	634
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: False positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136.

Table 38. ASR (per 100,000 population), by disease and year, among females in WA, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	25.4	20.3	21.5	21.4	21.9	21.1	24.3	18.5	17.6	16.1	20.8
Newly Acquired	0.9	0.5	0.5	0.7	0.2	0.2	0.2	0.4	0.5	0.5	0.5
Unspecified	24.5	19.8	21.0	20.6	21.7	20.8	24.1	18.0	17.0	15.6	20.3
Hepatitis C *(Total)*	33.0	28.7	28.8	31.0	29.0	28.1	31.5	28.9	28.1	25.8	29.3
Newly Acquired	1.9	2.7	2.9	2.7	3.2	4.0	2.5	2.2	3.1	2.8	2.8
Unspecified	31.1	26.0	25.9	28.3	25.8	24.0	29.0	26.7	25.0	23.0	26.5
Hepatitis D	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.2	0.1	0.5	0.1
ENTERIC DISEASES											
Botulism	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0
Campylobacteriosis	95.3	85.6	69.0	69.3	104.2	99.7	118.3	117.8	119.3	118.7	100.3
Cholera	-	-	-	-	-	-	-	-	-	-	-
Cryptosporidiosis	7.5	20.1	7.0	16.4	13.5	11.3	8.9	18.0	5.6	9.5	11.8
Hepatitis A	1.5	0.3	0.3	0.4	0.6	0.8	0.4	0.2	0.4	1.0	0.6
Hepatitis E	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.0
Listeriosis	0.1	0.3	0.5	0.3	0.2	0.2	0.3	0.3	0.1	0.3	0.3
Paratyphoid fever	0.3	0.4	0.4	0.4	0.2	0.3	0.3	0.2	0.2	0.2	0.3
Rotavirus infection	27.7	8.3	14.3	13.4	16.3	23.2	6.0	20.3	11.9	22.4	16.3
Salmonellosis	54.1	54.4	49.9	51.5	48.5	67.4	79.5	104.1	81.9	83.9	68.1
Shiga toxin-producing *E. coli* infection	0.4	0.0	0.1	0.2	0.1	0.0	1.3	2.5	3.7	6.5	1.5
Shigellosis	6.0	3.8	2.4	2.3	2.1	4.6	3.9	8.8	11.8	14.1	6.1
Typhoid fever	0.3	0.4	0.6	0.7	0.2	0.3	0.5	0.7	0.5	1.0	0.5
Vibrio parahaemolyticus infection	0.1	0.2	0.6	0.5	0.4	0.3	0.9	0.3	0.5	0.4	0.4
Yersiniosis (other than plague)	0.1	0.0	0.2	0.2	0.2	1.4	0.6	0.7	0.4	0.8	0.5

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	513.4	581.1	572.4	557.0	531.6	519.1	546.1	524.9	528.3	526.3	543.0
Donovanosis	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Gonococcal infection	48.0	65.0	75.8	63.9	63.5	77.1	113.6	116.1	104.7	125.3	85.3
HIV	2.0	1.8	1.6	1.0	1.6	1.2	0.6	0.8	0.9	1.7	1.3
Syphilis											
Infectious	1.3	1.4	0.6	1.2	1.0	3.0	3.7	4.4	6.1	14.1	3.7
Non-Infectious	1.8	3.5	3.5	1.5	1.4	2.1	1.3	3.7	5.1	7.0	3.1
Congenital	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	-	-	-	-
Haemophilus influenzae type b (invasive)	0.1	0.1	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.1
Influenza	75.2	83.4	229.5	100.7	222.6	245.9	325.2	241.0	237.9	946.6	277.4
Measles	0.5	0.4	0.2	0.3	0.8	0.3	0.2	0.9	1.3	1.9	0.7
Mumps	0.7	0.6	0.6	1.2	0.5	15.8	21.8	0.5	0.5	1.4	4.4
Pertussis	74.3	194.2	159.2	75.2	78.7	81.4	66.1	68.2	55.8	22.8	86.1
Invasive pneumococcal disease	8.1	9.3	9.8	6.8	7.4	5.5	6.7	6.6	7.3	8.2	7.6
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	0.0	0.3	0.0	0.1	0.1	0.1	0.0	0.2	0.0	0.1	0.1
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	0.0	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0
Varicella											
Chicken pox	21.0	18.2	14.2	14.5	15.9	17.9	25.5	25.8	28.0	24.0	20.6
Shingles	34.2	40.8	47.1	54.3	58.9	62.5	69.6	81.7	91.7	89.6	63.9

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Unspecified	39.2	45.1	46.5	53.3	49.7	60.0	61.0	63.9	58.6	52.2	53.2
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	3.7	7.3	10.3	55.2	2.0	1.5	0.5	2.0	1.4	0.5	8.4
Chikungunya virus infection	0.7	0.2	0.3	3.1	1.2	0.5	0.5	0.5	0.2	0.5	0.7
Dengue virus infection	20.4	15.1	19.4	19.4	19.8	20.5	22.5	6.7	3.5	12.5	15.9
Japanese encephalitis virus infection	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	0.9	1.1	0.6	1.7	0.9	1.2	1.3	1.5	0.9	1.1	1.1
Murray valley encephalitis virus infection	0.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	20.1	37.5	58.6	55.3	68.3	41.3	18.9	45.2	18.9	15.8	37.9
Typhus	0.6	1.1	0.8	0.4	0.2	1.0	1.3	0.9	0.8	1.0	0.8
West Nile virus / Kunjin virus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.1
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.1	0.0
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	0.1	0.5	0.3	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.1

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Q fever	0.1	0.1	0.0	0.1	0.0	0.3	0.1	0.1	0.4	0.1	0.1
Tularaemia	-	-	-	-	-	-	-	-	-	-	-
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1	0.9	0.2	0.1
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-
Creutzfeldt-Jakob disease	0.2	0.3	0.0	0.2	0.2	0.1	0.3	0.2	0.2	0.4	0.2
Haemolytic uraemic syndrome	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.1	0.1	0.1
Legionellosis	1.9	1.5	2.5	3.2	2.8	2.6	1.5	0.9	1.2	1.3	1.9
Leprosy	0.0	0.2	0.0	0.3	0.3	0.0	0.3	0.2	0.1	0.2	0.1
Melioidosis	0.1	0.1	0.1	0.3	0.1	0.3	0.0	0.2	0.1	0.1	0.1
Invasive meningococcal disease	0.7	0.9	0.8	0.4	0.6	0.6	0.8	1.8	1.7	0.5	0.9
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	4.7	4.2	6.0	4.8	5.3	3.9	6.0	4.8	5.4	5.8	5.1
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: False positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 39. Number of notifications, by disease and year, among males in WA, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=11,622	N=14,262	N=15,714	N=14,189	N=16,155	N=16,833	N=18,949	N=18,655	N=17,959	N=26,527	N=170,865
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	318	314	320	318	316	276	338	275	258	231	2964
Newly Acquired	22	12	19	30	21	26	23	13	18	16	200
Unspecified	296	302	301	288	295	250	315	262	240	215	2764
Hepatitis C *(Total)*	674	730	701	700	753	728	786	788	626	647	7133
Newly Acquired	55	86	92	90	122	131	88	99	87	84	934
Unspecified	619	644	609	610	631	597	698	689	539	563	6199
Hepatitis D	*0*	1	1	3	2	0	1	0	6	4	18
ENTERIC DISEASES											
Botulism	0	0	0	0	0	0	0	0	0	0	0
Campylobacteriosis	1225	1154	1041	1048	1621	1598	1857	1837	1882	1954	15217
Cholera	0	1	0	0	0	0	0	1	0	0	2
Cryptosporidiosis	52	220	84	170	141	115	131	173	50	90	1,226
Hepatitis A	15	8	11	10	12	15	11	9	7	11	109
Hepatitis E	3	3	1	2	0	2	3	4	1	1	20
Listeriosis	2	3	2	4	3	3	2	1	7	3	30
Paratyphoid fever	5	5	3	3	7	7	8	1	6	6	51
Rotavirus infection	294	89	172	176	200	293	102	258	145	245	1974
Salmonellosis	637	666	549	614	632	825	926	1223	977	1045	8094
Shiga toxin-producing *E. coli* infection	4	3	0	1	1	0	15	28	45	60	157
Shigellosis	44	39	19	22	39	39	41	86	113	205	647
Typhoid fever	6	9	5	0	9	4	2	12	7	7	61
Vibrio parahaemolyticus infection	9	11	7	9	10	4	13	16	7	10	96

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=11,622	N=14,262	N=15,714	N=14,189	N=16,155	N=16,833	N=18,949	N=18,655	N=17,959	N=26,527	N=170,865
Yersiniosis (other than plague)	2	1	1	3	1	13	8	6	6	14	55
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	4288	4892	4886	4907	4787	4783	5130	5141	5167	5286	49267
Donovanosis	0	0	1	0	0	0	0	0	0	0	1
Gonococcal infection	839	1061	1192	1185	1418	1361	1979	1926	2135	2389	15485
HIV	66	64	85	72	88	92	88	68	47	82	752
Syphilis											
Infectious	65	103	71	71	82	124	289	267	346	393	1811
Non-Infectious	41	52	66	60	43	41	43	114	149	131	740
Congenital	0	0	0	2	0	0	0	0	0	1	3
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	1	0	0	1
Haemophilus influenzae type b (invasive)	1	0	0	0	0	2	0	0	0	1	4
Influenza	770	888	2467	1133	2440	2847	3593	2799	2724	10793	30454
Measles	5	12	4	8	34	3	8	6	20	29	129
Mumps	6	6	12	29	16	263	222	16	12	15	597
Pertussis	625	1832	1493	717	769	843	703	658	593	254	8487
Invasive pneumococcal disease	102	132	116	106	110	94	111	107	105	136	1119
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	3	11	2	0	0	1	1	0	1	0	19
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	0	0	0	1	0	0	0	0	0	1
Varicella											
Chicken pox	178	238	173	179	240	273	309	377	329	330	2626

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=11,622	N=14,262	N=15,714	N=14,189	N=16,155	N=16,833	N=18,949	N=18,655	N=17,959	N=26,527	N=170,865
Shingles	325	419	475	577	617	634	797	885	944	970	6643
Unspecified	398	457	507	588	593	617	708	702	706	666	5942
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	32	64	91	347	29	27	6	21	19	7	643
Chikungunya virus infection	3	2	0	16	10	4	9	5	1	3	53
Dengue virus infection	260	139	284	229	199	281	265	86	86	160	1989
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	1	0	1
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	43	47	40	54	32	33	38	38	34	44	403
Murray valley encephalitis virus infection	0	4	0	0	0	0	0	0	1	0	5
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	159	410	661	675	718	433	232	568	246	173	4275
Typhus	6	24	22	15	11	18	22	7	8	16	149
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	2	0	0	2
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	2	5	1	1	0	9
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	1	1	0	0	0	1	0	0	0	3
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	5	2	4	0	2	1	5	3	4	2	28

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=11,622	N=14,262	N=15,714	N=14,189	N=16,155	N=16,833	N=18,949	N=18,655	N=17,959	N=26,527	N=170,865
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0
Psittacosis	2	1	4	1	1	1	0	2	0	0	12
Q fever	7	8	7	7	6	9	11	7	7	6	75
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4	13	8	25
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	2	4	1	0	2	3	1	3	3	5	24
Haemolytic uraemic syndrome	0	0	0	0	0	0	1	1	0	0	2
Legionellosis	32	55	54	52	76	36	46	24	26	17	418
Leprosy	2	0	0	0	1	2	4	1	0	0	10
Melioidosis	3	3	1	4	5	2	3	4	4	2	31
Invasive meningococcal disease	14	11	8	10	9	10	11	22	18	16	129
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	50	63	69	62	69	71	64	71	66	59	644
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: False positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 40. ASR (per 100,000 population), by disease and year, among males in WA, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	27.4	25.8	25.7	24.9	24.6	21.3	26.4	21.3	19.7	17.5	23.5
Newly Acquired	1.9	1.0	1.5	2.4	1.6	2.1	1.8	1.0	1.4	1.2	1.6
Unspecified	25.5	24.8	24.2	22.5	23.0	19.3	24.7	20.3	18.4	16.3	21.9
Hepatitis C *(Total)*	57.8	60.4	56.0	54.5	57.8	55.9	60.8	60.7	48.6	50.1	56.3
Newly Acquired	4.5	6.8	7.0	6.8	9.1	9.9	6.8	7.6	6.8	6.7	7.2
Unspecified	53.3	53.6	48.9	47.7	48.7	46.1	54.0	53.1	41.8	43.4	49.1
Hepatitis D	0.0	0.1	0.1	0.2	0.2	0.0	0.1	0.0	0.5	0.3	0.1
ENTERIC DISEASES											
Botulism	-	-	-	-	-	-	-	-	-	-	-
Campylobacteriosis	105.7	96.6	84.8	83.5	126.9	124.7	144.1	140.6	143.8	148.1	120.5
Cholera	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Cryptosporidiosis	4.5	18.6	6.8	13.5	11.0	8.9	10.1	13.4	3.9	6.8	9.7
Hepatitis A	1.3	0.7	0.9	0.8	0.9	1.2	0.8	0.7	0.6	0.8	0.9
Hepatitis E	0.2	0.3	0.1	0.1	0.0	0.2	0.2	0.3	0.1	0.1	0.2
Listeriosis	0.2	0.2	0.2	0.4	0.3	0.2	0.2	0.1	0.5	0.2	0.2
Paratyphoid fever	0.4	0.4	0.3	0.2	0.5	0.5	0.6	0.1	0.5	0.5	0.4
Rotavirus infection	25.8	7.5	14.2	14.0	15.6	22.4	7.7	19.5	11.0	18.3	15.5
Salmonellosis	54.5	55.7	44.5	48.2	49.2	64.1	71.3	94.2	74.7	79.9	64.0
Shiga toxin-producing *E. coli* infection	0.3	0.2	0.0	0.1	0.1	0.0	1.2	2.2	3.4	4.6	1.3
Shigellosis	3.8	3.3	1.5	1.8	3.0	3.0	3.1	6.6	8.6	15.4	5.1
Typhoid fever	0.5	0.7	0.4	0.0	0.7	0.3	0.2	0.9	0.5	0.5	0.5
Vibrio parahaemolyticus infection	0.8	0.9	0.6	0.7	0.8	0.3	1.0	1.1	0.6	0.8	0.8
Yersiniosis (other than plague)	0.2	0.1	0.1	0.2	0.1	1.0	0.6	0.5	0.5	1.1	0.4

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	350.6	387.8	374.8	369.2	361.2	363.0	393.4	399.6	406.2	418.5	382.4
Donovanosis	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gonococcal infection	70.3	86.1	93.6	91.4	108.1	103.7	152.1	150.2	167.5	188.3	121.1
HIV	5.7	5.3	6.8	5.7	6.7	7.2	6.7	5.2	3.6	6.2	5.9
Syphilis											
Infectious	5.5	8.4	5.6	5.4	6.3	9.5	22.6	20.8	27.1	30.8	14.2
Non-Infectious	3.5	4.2	5.3	4.6	3.3	3.2	3.3	8.8	11.4	9.7	5.7
Congenital	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.1	0.0
VACCINE PREVENTABLE DISEASES											
Diphtheria	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Haemophilus influenzae type b (invasive)	0.1	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.1	0.0
Influenza	67.1	76.0	207.4	92.7	194.5	226.6	285.9	217.7	209.8	833.9	247.1
Measles	0.4	1.0	0.3	0.6	2.7	0.3	0.6	0.5	1.6	2.3	1.0
Mumps	0.5	0.5	1.0	2.2	1.3	21.2	17.9	1.3	1.0	1.2	4.9
Pertussis	54.9	159.2	124.3	58.4	61.5	66.7	55.7	51.7	45.7	19.4	68.6
Invasive pneumococcal disease	9.0	11.4	9.8	8.7	8.6	7.3	8.7	8.0	7.8	10.0	8.9
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	0.3	0.9	0.2	0.0	0.0	0.1	0.1	0.0	0.1	0.0	0.1
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Varicella											
Chicken pox	15.9	20.9	14.7	14.8	19.6	22.0	25.0	30.0	26.0	26.0	21.6
Shingles	28.5	35.8	39.5	46.6	49.0	49.2	61.9	67.7	70.9	71.9	52.7

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Unspecified	35.0	39.1	41.9	47.8	47.5	48.3	55.0	53.5	52.7	49.9	47.3
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	2.7	5.3	7.4	27.4	2.3	2.1	0.5	1.6	1.4	0.5	5.1
Chikungunya virus infection	0.3	0.2	0.0	1.3	0.7	0.3	0.7	0.4	0.1	0.2	0.4
Dengue virus infection	22.0	11.4	22.6	18.1	15.3	21.6	20.3	6.5	6.5	12.0	15.6
Japanese encephalitis virus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	3.7	3.9	3.2	4.3	2.5	2.6	3.0	2.9	2.6	3.4	3.2
Murray valley encephalitis virus infection	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	13.6	34.2	53.6	53.2	55.6	33.4	17.9	43.5	18.5	12.6	33.6
Typhus	0.5	1.9	1.8	1.2	0.8	1.3	1.6	0.5	0.6	1.1	1.1
West Nile virus / Kunjin virus infection	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.0
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	0.0	0.0	0.0	0.0	0.0	0.2	0.4	0.1	0.1	0.0	0.1
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	0.4	0.2	0.3	0.0	0.2	0.1	0.3	0.2	0.3	0.2	0.2
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	0.2	0.1	0.3	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.1

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Q fever	0.6	0.7	0.6	0.5	0.5	0.7	0.9	0.5	0.5	0.4	0.6
Tularaemia	-	-	-	-	-	-	-	-	-	-	-
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.3	1.0	0.6	0.2
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-
Creutzfeldt-Jakob disease	0.2	0.3	0.1	0.0	0.2	0.2	0.1	0.2	0.2	0.3	0.2
Haemolytic uraemic syndrome	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0
Legionellosis	2.8	4.9	4.7	4.2	6.3	2.9	3.6	1.8	1.8	1.2	3.3
Leprosy	0.2	0.0	0.0	0.0	0.1	0.2	0.3	0.1	0.0	0.0	0.1
Melioidosis	0.2	0.2	0.1	0.3	0.4	0.2	0.2	0.3	0.3	0.1	0.2
Invasive meningococcal disease	1.2	1.0	0.6	0.8	0.7	0.8	0.9	1.7	1.4	1.2	1.0
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	4.4	5.4	5.7	4.9	5.5	5.4	5.0	5.6	5.1	4.4	5.1
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: False positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Appendix 2

Notifications by Aboriginal status

Table 41. Number of notifications, by disease and year, among the Aboriginal population in WA, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=3,095	N=3,849	N=3,994	N=3,559	N=3,641	N=3,773	N=4,208	N=4,267	N=4,105	N=4,639	N=39,130
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	40	50	46	26	24	27	25	31	18	18	305
Newly Acquired	2	1	2	3	1	2	1		2	6	20
Unspecified	38	49	44	23	23	25	24	31	16	12	285
Hepatitis C *(Total)*	129	150	189	200	239	242	277	298	257	291	2,272
Newly Acquired	21	47	42	37	70	85	59	68	59	58	546
Unspecified	108	103	147	163	169	157	218	230	198	233	1,726
Hepatitis D	0	1	1	0	0	0	0	0	0	0	2
ENTERIC DISEASES											
Botulism	0	0	0	0	0	0	0	0	0	0	0
Campylobacteriosis	31	36	23	49	46	48	44	50	51	55	433
Cholera	0	0	0	0	0	0	0	0	0	0	0
Cryptosporidiosis	37	96	33	52	37	45	36	33	21	18	408
Hepatitis A	0	0	0	0	0	0	0	0	0	0	0
Hepatitis E	0	0	0	0	0	1	0	0	0	0	1
Listeriosis	0	0	0	0	0	0	0	0	1	2	3
Paratyphoid fever	0	0	0	0	0	0	0	0	0	0	0
Rotavirus infection	45	16	42	54	30	51	13	105	39	31	426
Salmonellosis	77	80	69	84	88	127	74	124	108	89	920
Shiga toxin-producing *E. coli* infection	0	0	0	0	1	0	3	6	3	4	17

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=3,095	N=3,849	N=3,994	N=3,559	N=3,641	N=3,773	N=4,208	N=4,267	N=4,105	N=4,639	N=39,130
Shigellosis	37	39	13	15	18	46	21	123	129	102	543
Typhoid fever	0	0	0	0	0	0	0	0	0	0	0
Vibrio parahaemolyticus infection	1	1	1	0	0	0	0	0	0	1	4
Yersiniosis (other than plague)	0	0	0	0	0	0	1	0	0	0	1
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	1,570	1,646	1,617	1,609	1,478	1,411	1,578	1,603	1,640	1,588	15,740
Donovanosis	0	0	0	0	1	0	0	0	0	0	1
Gonococcal infection	839	1,152	1,142	1,097	897	810	1,003	1,150	1,139	990	10,219
HIV	2	5	0	0	3	6	5	3	2	3	29
Syphilis											
Infectious	19	26	13	8	13	46	52	72	99	243	591
Non-Infectious	17	26	33	21	12	9	7	19	40	65	249
Congenital	1	0	0	1	0	0	0	0	0	1	3
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	0	0	0	0
Haemophilus influenzae type b (invasive)	2	0	1	0	1	1	0	0	1	1	7
Influenza	72	177	421	124	463	311	414	353	280	887	3,502
Measles	1	0	0	1	1	0	0	0	0	0	3
Mumps	0	0	0	1	1	390	413	0	6	4	815
Pertussis	17	125	119	31	67	26	37	55	32	36	545
Invasive pneumococcal disease	69	117	78	65	76	51	61	53	50	70	690
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	0	1	0	0	0	0	0	0	0	0	1
Smallpox	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=3,095	N=3,849	N=3,994	N=3,559	N=3,641	N=3,773	N=4,208	N=4,267	N=4,105	N=4,639	N=39,130
Tetanus	0	0	0	0	0	0	0	0	0	0	0
Varicella											
Chicken pox	30	27	44	21	23	16	31	35	36	26	289
Shingles	22	31	32	33	50	37	58	59	77	66	465
Unspecified	20	13	37	24	18	27	28	14	21	15	217
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	2	4	2	8	4	1	2	7	4	2	36
Chikungunya virus infection	0	0	0	0	0	0	0	0	0	0	0
Dengue virus infection	1	1	2	2	3	3	3	0	0	3	18
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	0	0	0	0	0	0	1	0	0	0	1
Murray valley encephalitis virus infection	0	3	0	0	0	0	0	0	0	0	3
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	5	16	22	23	34	25	7	47	7	6	192
Typhus	1	0	2	1	0	1	1	0	0	0	6
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	1	0	0	1
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	0	0	0	0	0	0
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=3,095	N=3,849	N=3,994	N=3,559	N=3,641	N=3,773	N=4,208	N=4,267	N=4,105	N=4,639	N=39,130
Brucellosis	0	0	0	0	0	0	0	0	0	0	0
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	0	0	0	0	0	0	0	0	0	0	0
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0
Psittacosis	0	0	0	0	0	0	0	0	0	0	0
Q fever	0	1	0	0	0	0	1	2	0	0	4
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5	21	9	35
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	0	0	0	0	0	0	0	0	0	0	0
Haemolytic uraemic syndrome	0	0	0	0	1	0	0	0	0	0	1
Legionellosis	1	0	4	4	5	7	0	2	0	0	23
Leprosy	1	0	0	1	2	0	3	2	0	1	10
Melioidosis	1	1	0	0	2	2	1	3	1	0	11
Invasive meningococcal disease	3	6	7	1	2	2	7	10	19	12	69
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	2	2	1	3	1	4	1	2	3	0	19
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: False positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 42. ASR (per 100,000 population), by disease and year, among the Aboriginal population in WA, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	79.2	68.2	56.6	41.2	32.8	29.0	41.5	53.7	23.6	33.9	46.0
Newly Acquired	2.1	0.8	2.1	4.8	0.8	2.1	0.9	-	2.7	5.9	2.2
Unspecified	77.1	67.5	54.4	36.4	32.0	26.9	40.7	53.7	20.9	28.0	43.8
Hepatitis C *(Total)*	156.8	167.8	212.6	216.6	248.1	250.7	288.6	313.1	273.4	290.9	241.9
Newly Acquired	21.0	47.3	40.4	35.6	67.3	79.8	56.8	63.6	57.7	50.0	52.0
Unspecified	135.8	120.5	172.3	181.0	180.8	170.9	231.8	249.4	215.7	240.9	189.9
Hepatitis D	-	1.4	4.6	-	-	-	-	-	-	-	0.5
ENTERIC DISEASES											
Botulism	-	-	-	-	-	-	-	-	-	-	-
Campylobacteriosis	43.5	52.1	21.8	54.6	45.7	52.1	54.5	46.2	46.3	50.0	45.7
Cholera	-	-	-	-	-	-	-	-	-	-	-
Cryptosporidiosis	24.6	57.3	21.0	31.6	24.0	26.3	21.7	19.7	12.4	12.1	25.1
Hepatitis A	-	-	-	-	-	-	-	-	-	-	-
Hepatitis E	-	-	-	-	-	0.6	-	-	-	-	0.1
Listeriosis	-	-	-	-	-	-	-	-	2.9	2.5	0.7
Paratyphoid fever	-	-	-	-	-	-	-	-	-	-	-
Rotavirus infection	31.3	9.7	25.0	40.0	18.4	32.2	7.5	70.9	24.7	20.1	28.0
Salmonellosis	87.0	82.0	90.5	87.5	87.7	145.6	82.2	138.4	93.5	101.4	100.6
Shiga toxin-producing *E. coli* infection	-	-	-	-	1.3	-	3.3	5.2	3.4	6.5	2.3
Shigellosis	37.3	31.1	12.0	17.8	13.5	45.1	18.9	101.1	113.9	93.1	50.3
Typhoid fever	-	-	-	-	-	-	-	-	-	-	-
Vibrio parahaemolyticus infection	0.8	1.3	1.0	-	-	-	-	-	-	0.6	0.4
Yersiniosis (other than plague)	-	-	-	-	-	-	1.6	-	-	-	0.2

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	1,387.3	1,404.0	1,368.2	1,316.8	1,213.6	1,143.8	1,272.0	1,282.1	1,314.3	1,263.2	1,296.5
Donovanosis	-	-	-	-	1.3	-	-	-	-	-	0.1
Gonococcal infection	787.0	1,046.6	992.1	947.3	776.1	696.8	812.4	952.6	988.3	861.2	886.0
HIV	2.6	4.9	-	-	3.7	6.4	5.4	3.3	1.7	3.1	3.1
Syphilis											
Infectious	21.0	28.6	16.8	8.6	10.7	39.8	54.4	69.1	84.9	225.8	56.0
Non-Infectious	34.5	44.9	51.4	28.1	15.9	15.9	14.0	27.1	56.3	92.4	38.1
Congenital	0.6	-	-	0.6	-	-	-	-	-	0.6	0.2
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	-	-	-	-
Haemophilus influenzae type b (invasive)	1.2	-	0.6	-	0.6	0.6	-	-	0.6	0.6	0.4
Influenza	90.4	206.0	472.9	152.6	537.2	391.2	622.2	410.8	307.2	891.8	421.9
Measles	1.3	-	-	1.3	0.7	-	-	-	-	-	0.3
Mumps	-	-	-	1.4	0.6	331.5	344.1	-	3.9	3.1	69.8
Pertussis	12.3	127.5	111.0	31.8	60.4	24.0	29.8	40.4	26.1	28.4	47.4
Invasive pneumococcal disease	97.5	133.6	115.2	78.5	89.0	65.5	86.9	63.1	60.1	76.2	84.4
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	-	0.6	-	-	-	-	-	-	-	-	0.1
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	-	-	-	-	-	-	-	-	-	-
Varicella											
Chicken pox	19.6	17.7	29.3	14.7	15.0	11.5	20.7	25.2	22.2	16.5	19.3
Shingles	32.3	48.1	40.1	55.4	62.9	49.4	73.3	85.8	104.1	84.3	65.9

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Unspecified	20.8	11.0	43.3	22.7	16.3	33.9	29.7	15.8	26.5	18.3	24.1
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	2.7	6.0	2.6	9.8	5.4	1.3	2.0	7.0	4.1	1.6	4.2
Chikungunya virus infection	-	-	-	-	-	-	-	-	-	-	-
Dengue virus infection	0.8	1.3	1.7	2.6	5.1	3.6	4.2	-	-	3.4	2.3
Japanese encephalitis virus infection	-	-	-	-	-	-	-	-	-	-	-
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	-	-	-	-	-	-	1.3	-	-	-	0.1
Murray valley encephalitis virus infection	0.0	2.9	-	-	-	-	-	-	-	-	0.3
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	6.0	19.3	23.8	29.0	37.2	27.8	13.5	55.7	7.5	7.7	22.9
Typhus	1.5	-	2.0	1.3	-	1.4	0.7	-	-	-	0.7
West Nile virus / Kunjin virus infection	-	-	-	-	-	-	-	0.7	-	-	0.1
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	-	-	-	-	-	-	-	-	-	-	-
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	-	-	-	-	-	-	-	-	-	-	-
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	-	-	-	-	-	-	-	-	-	-	-
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	-	-	-	-	-	-	-	-	-	-	-

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Q fever	-	1.3	-	-	-	-	0.8	2.9	-	-	0.5
Tularaemia	-	-	-	-	-	-	-	-	-	-	-
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3.1	12.7	5.6	2.2
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-
Creutzfeldt-Jakob disease	-	-	-	-	-	-	-	-	-	-	-
Haemolytic uraemic syndrome	-	-	-	-	1.3	-	-	-	-	-	0.1
Legionellosis	2.3	-	10.2	6.1	7.2	21.4	-	4.5	-	-	5.0
Leprosy	1.3	-	-	1.3	2.2	-	4.1	2.6	-	0.8	1.3
Melioidosis	1.5	1.8	-	-	2.2	2.4	1.3	3.7	0.8	-	1.4
Invasive meningococcal disease	1.8	5.1	5.8	0.7	1.2	1.1	4.0	6.2	12.9	9.0	4.8
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	3.0	2.0	1.3	4.5	1.5	4.1	1.4	2.7	4.3	0.0	2.5
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: False positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 43. Number of notifications, by disease and year, among the non-Aboriginal population in WA, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=18,991	N=23,977	N=26,919	N=24,781	N=27,410	N=28,834	N=32,369	N=31,783	N=30,617	N=44,056	N=289,737
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	514	458	462	508	508	448	548	429	417	387	4,679
Newly Acquired	29	17	23	36	23	27	24	18	23	17	237
Unspecified	485	441	439	472	485	421	524	411	394	370	4,442
Hepatitis C *(Total)*	880	876	823	851	804	773	840	792	685	655	7,979
Newly Acquired	55	70	86	86	91	97	61	59	66	61	732
Unspecified	*825*	806	737	765	713	676	779	733	619	594	7,247
Hepatitis D	0	1	1	4	3	0	1	2	8	10	30
ENTERIC DISEASES											
Botulism	0	0	0	0	0	1	0	0	0	0	1
Campylobacteriosis	1,956	1,877	1,650	1,738	2,611	2,592	3,044	3,065	3,168	3,262	24,963
Cholera	0	1	0	0	0	0	0	1	0	0	2
Cryptosporidiosis	87	343	128	295	252	192	196	342	93	185	2,113
Hepatitis A	32	11	14	14	19	25	16	12	12	23	178
Hepatitis E	3	4	1	3	0	1	3	3	2	4	24
Listeriosis	3	7	8	8	5	6	6	6	7	5	61
Paratyphoid fever	9	9	8	8	9	11	12	4	9	9	88
Rotavirus infection	519	154	280	268	351	513	152	383	238	490	3,348
Salmonellosis	1,095	1,141	999	1,129	1,078	1,462	1,770	2,340	1,874	1,976	14,864
Shiga toxin-producing *E. coli* infection	8	3	1	4	1	0	29	54	90	129	319
Shigellosis	73	41	35	34	48	51	70	75	132	275	834
Typhoid fever	9	13	12	8	11	8	9	21	13	19	123
Vibrio parahaemolyticus infection	9	11	13	15	13	7	24	20	13	14	139

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=18,991	N=23,977	N=26,919	N=24,781	N=27,410	N=28,834	N=32,369	N=31,783	N=30,617	N=44,056	N=289,737
Yersiniosis (other than plague)	2	1	3	5	3	27	13	15	11	22	102
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	7,357	9,127	9,276	9,373	9,130	9,103	9,437	9,338	9,398	9,573	91,112
Donovanosis	0	0	1	0	0	0	0	0	0	0	1
Gonococcal infection	534	652	939	848	1,287	1,490	2,355	2,185	2,272	2,933	15,495
HIV	86	80	104	85	106	102	90	76	56	100	885
Syphilis											
Infectious	60	93	65	78	80	116	284	248	325	322	1,671
Non-Infectious	44	66	74	58	49	58	50	135	173	156	863
Congenital	0	0	0	1	0	0	0	0	1	0	2
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	1	0	0	1
Haemophilus influenzae type b (invasive)	0	1	0	0	0	1	1	0	0	1	4
Influenza	1,378	1,551	4,516	2,179	4,416	5,275	6,965	5,247	5,259	17,822	54,608
Measles	10	16	6	10	42	7	11	17	36	51	206
Mumps	14	13	19	42	22	64	68	23	12	28	305
Pertussis	1,372	3,789	3,006	1,538	1,586	1,710	1,424	1,403	1,215	502	17,545
Invasive pneumococcal disease	127	124	158	127	128	115	139	144	155	173	1,390
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	3	14	2	1	1	2	1	2	1	1	28
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	1	1	1	1	0	1	0	1	0	6
Varicella											
Chicken pox	353	398	271	305	385	459	570	647	624	591	4,603

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=18,991	N=23,977	N=26,919	N=24,781	N=27,410	N=28,834	N=32,369	N=31,783	N=30,617	N=44,056	N=289,737
Shingles	666	842	972	1,194	1,292	1,389	1,654	1,900	2,103	2,135	14,147
Unspecified	658	782	843	1,072	958	1,109	1,233	1,298	1,296	1,210	10,459
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	60	125	184	916	45	42	10	38	32	12	1,464
Chikungunya virus infection	10	4	4	54	24	11	15	10	3	9	144
Dengue virus infection	490	316	514	464	439	531	545	170	129	317	3,915
Japanese encephalitis virus infection	0	0	0	1	0	0	0	0	1	0	2
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	53	60	47	75	44	47	54	57	46	58	541
Murray valley encephalitis virus infection	0	6	0	0	0	0	0	0	1	0	7
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	310	701	1,191	1,203	1,365	835	422	1,032	458	356	7,873
Typhus	12	37	30	19	13	30	37	19	18	28	243
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	3	0	0	3
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	2	15	1	1	0	19
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	1	1	0	0	0	2	0	0	0	4
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	5	2	4	0	3	1	6	3	5	4	33

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=18,991	N=23,977	N=26,919	N=24,781	N=27,410	N=28,834	N=32,369	N=31,783	N=30,617	N=44,056	N=289,737
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0
Psittacosis	3	7	8	4	2	1	0	3	0	0	28
Q fever	8	8	7	8	6	11	11	7	12	7	85
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	3	1	4
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	5	7	1	2	5	4	6	6	7	11	54
Haemolytic uraemic syndrome	0	0	0	0	0	1	3	3	1	1	9
Legionellosis	51	73	81	88	108	64	68	33	43	37	646
Leprosy	1	2	0	2	3	2	4	1	1	1	17
Melioidosis	3	3	3	8	4	4	2	4	4	3	38
Invasive meningococcal disease	19	15	11	14	15	15	14	35	21	12	171
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	100	110	142	119	135	116	139	130	132	136	1,259
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: False positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 44. ASR (per 100,000 population), by disease and year, among the non-Aboriginal population in WA, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	23.2	19.9	19.3	20.4	20.4	17.6	21.1	16.1	15.2	13.8	18.7
Newly Acquired	1.3	0.7	1.0	1.5	0.9	1.1	0.9	0.7	0.8	0.6	1.0
Unspecified	21.9	19.2	18.4	19.0	19.5	16.5	20.2	15.4	14.4	13.2	17.7
Hepatitis C *(Total)*	39.6	38.1	34.4	34.4	31.9	30.5	32.1	29.8	25.3	23.6	32.0
Newly Acquired	2.5	3.1	3.5	3.4	3.6	3.8	2.4	2.2	2.4	2.3	2.9
Unspecified	37.1	35.1	30.8	31.0	28.3	26.6	29.8	27.6	22.9	21.4	29.1
Hepatitis D	-	0.0	0.0	0.2	0.1	-	0.0	0.1	0.3	0.4	0.1
ENTERIC DISEASES											
Botulism	-	-	-	-	-	0.0	-	-	-	-	0.0
Campylobacteriosis	88.6	82.1	70.1	71.9	106.4	104.8	122.8	122.2	126.0	128.3	103.0
Cholera	-	0.0	-	-	-	-	-	0.0	-	-	0.0
Cryptosporidiosis	4.0	15.7	5.6	12.6	10.6	8.0	8.1	14.2	3.9	7.6	9.0
Hepatitis A	1.5	0.5	0.6	0.6	0.8	1.1	0.6	0.5	0.5	1.0	0.8
Hepatitis E	0.1	0.2	0.0	0.1	-	0.0	0.1	0.1	0.1	0.2	0.1
Listeriosis	0.1	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Paratyphoid fever	0.4	0.4	0.3	0.3	0.3	0.4	0.5	0.2	0.4	0.4	0.4
Rotavirus infection	24.0	6.9	12.2	11.3	14.5	20.8	6.2	15.5	9.6	19.4	14.0
Salmonellosis	49.8	50.6	42.8	47.1	44.2	59.6	72.0	94.9	75.1	79.3	62.0
Shiga toxin-producing *E. coli* infection	0.4	0.1	0.0	0.2	0.0	-	1.2	2.1	3.6	5.0	1.3
Shigellosis	3.3	1.8	1.5	1.4	1.9	2.0	2.8	3.0	5.2	10.8	3.4
Typhoid fever	0.4	0.6	0.5	0.3	0.5	0.3	0.4	0.9	0.5	0.8	0.5
Vibrio parahaemolyticus infection	0.4	0.5	0.5	0.6	0.5	0.3	1.0	0.8	0.5	0.5	0.6
Yersiniosis (other than plague)	0.1	0.0	0.1	0.2	0.1	1.1	0.5	0.6	0.4	0.9	0.4

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	325.0	393.7	383.9	376.8	364.7	363.9	365.5	360.0	359.7	360.8	365.4
Donovanosis	-	-	0.0	-	-	-	-	-	-	-	0.0
Gonococcal infection	23.8	27.9	38.8	34.2	50.6	58.2	89.6	82.4	84.4	107.2	59.7
HIV	3.9	3.5	4.4	3.5	4.3	4.2	3.6	3.0	2.2	3.9	3.7
Syphilis											
Infectious	2.7	4.0	2.7	3.1	3.2	4.5	11.0	9.3	12.2	11.8	6.4
Non-Infectious	2.0	2.8	3.1	2.3	1.9	2.3	1.9	5.0	6.3	5.5	3.3
Congenital	-	-	-	0.0	-	-	-	-	0.0	-	0.0
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	0.0	-	-	0.0
Haemophilus influenzae type b (invasive)	-	0.0	-	-	-	0.0	0.0	-	-	0.0	0.0
Influenza	63.7	69.0	196.8	90.9	182.4	216.5	282.5	208.2	210.6	710.3	228.5
Measles	0.5	0.7	0.3	0.4	1.8	0.3	0.5	0.7	1.5	2.2	0.9
Mumps	0.6	0.6	0.8	1.7	0.9	2.7	2.9	1.0	0.5	1.2	1.3
Pertussis	63.8	175.3	131.8	65.4	66.0	70.7	59.9	58.6	49.1	20.1	74.8
Invasive pneumococcal disease	5.8	5.4	6.8	5.2	5.1	4.5	5.4	5.4	5.8	6.4	5.6
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	0.1	0.6	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.1
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	0.1	0.0	0.0	0.0	-	0.0	-	0.0	-	0.0
Varicella											
Chicken pox	17.3	19.0	12.5	13.7	17.0	20.0	24.8	27.8	26.9	25.2	20.6
Shingles	29.8	36.6	40.9	49.0	52.0	55.0	64.7	73.1	79.5	79.9	56.7

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Unspecified	29.5	34.4	35.9	44.3	38.8	44.3	48.7	50.6	49.2	45.9	42.4
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	2.7	5.4	7.8	38.0	1.8	1.7	0.4	1.5	1.2	0.5	6.1
Chikungunya virus infection	0.5	0.2	0.2	2.3	0.9	0.4	0.6	0.4	0.1	0.4	0.6
Dengue virus infection	21.8	13.6	21.5	19.1	17.8	21.4	21.9	6.8	5.1	12.4	16.1
Japanese encephalitis virus infection	-	-	-	0.0	-	-	-	-	0.0	-	0.0
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	2.4	2.6	2.0	3.2	1.8	1.9	2.2	2.3	1.8	2.3	2.3
Murray valley encephalitis virus infection	-	0.2	-	-	-	-	-	-	0.0	-	0.0
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	13.8	30.5	50.0	49.4	55.6	33.8	16.9	40.8	17.9	13.6	32.2
Typhus	0.5	1.6	1.2	0.8	0.5	1.2	1.5	0.7	0.7	1.0	1.0
West Nile virus / Kunjin virus infection	-	-	-	-	-	-	-	0.1	-	-	0.0
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	-	-	-	-	-	0.1	0.6	0.0	0.0	-	0.1
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	-	0.0	0.0	-	-	-	0.1	-	-	-	0.0
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	0.2	0.1	0.2	-	0.1	0.0	0.2	0.1	0.2	0.2	0.1
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	0.1	0.3	0.3	0.2	0.1	0.0	-	0.1	-	-	0.1

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Q fever	0.4	0.4	0.3	0.3	0.2	0.4	0.4	0.3	0.4	0.3	0.3
Tularaemia	-	-	-	-	-	-	-	-	-	-	-
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	0.1	0.0	0.0
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-
Creutzfeldt-Jakob disease	0.2	0.3	0.0	0.1	0.2	0.1	0.2	0.2	0.2	0.3	0.2
Haemolytic uraemic syndrome	-	-	-	-	-	0.0	0.1	0.1	0.0	0.0	0.0
Legionellosis	2.2	3.1	3.4	3.6	4.3	2.5	2.5	1.2	1.5	1.3	2.5
Leprosy	0.0	0.1	-	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.1
Melioidosis	0.1	0.1	0.1	0.3	0.2	0.2	0.1	0.2	0.2	0.1	0.1
Invasive meningococcal disease	0.9	0.7	0.5	0.6	0.6	0.6	0.6	1.4	0.9	0.5	0.7
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	4.5	4.9	5.9	4.9	5.5	4.6	5.7	5.3	5.3	5.3	5.2
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: False positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Appendix 3

Notifications by Region

Table 45. Number of notifications, by disease and year, in Goldfields, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=917	N=985	N=861	N=1,057	N=943	N=954	N=1,007	N=1,126	N=1,007	N=1,321	N=10,184
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	24	26	23	13	13	15	15	11	15	14	169
Newly Acquired	0	0	0	2	0	1	0	0	1	2	6
Unspecified	24	26	23	11	13	14	15	11	14	12	163
Hepatitis C *(Total)*	53	48	40	34	26	34	34	25	35	48	376
Newly Acquired	2	5	2	0	1	8	5	1	6	7	37
Unspecified	51	43	38	34	25	26	29	24	29	41	339
Hepatitis D	0	1	1	0	0	0	0	0	0	0	2
ENTERIC DISEASES											
Botulism	0	0	0	0	0	0	0	0	0	0	0
Campylobacteriosis	57	51	28	46	68	55	63	61	62	44	535
Cholera	0	0	0	0	0	0	0	0	0	0	0
Cryptosporidiosis	6	15	11	15	10	1	8	18	0	4	88
Hepatitis A	0	0	0	4	0	0	0	1	0	0	5
Hepatitis E	0	0	0	0	0	0	0	0	0	0	0
Listeriosis	0	0	0	0	0	0	0	0	0	0	0
Paratyphoid fever	0	0	0	0	1	0	0	0	0	0	1
Rotavirus infection	4	4	10	9	14	22	7	32	12	8	122
Salmonellosis	18	36	19	44	23	43	47	76	36	47	389
Shiga toxin-producing *E. coli* infection	0	0	0	0	0	0	2	2	0	1	5

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=917	N=985	N=861	N=1,057	N=943	N=954	N=1,007	N=1,126	N=1,007	N=1,321	N=10,184
Shigellosis	1	11	2	6	0	5	6	27	27	28	113
Typhoid fever	0	0	1	0	0	0	0	1	1	0	3
Vibrio parahaemolyticus infection	0	1	0	0	0	0	1	0	0	1	3
Yersiniosis (other than plague)	0	0	0	1	0	0	0	0	1	0	2
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	
Chlamydial infection	411	436	410	411	367	302	396	319	344	327	3725
Donovanosis	0	0	0	0	1	0	0	0	0	0	1
Gonococcal infection	161	161	114	147	144	145	127	211	258	133	1605
Syphilis											
Infectious	5	5	6	2	4	9	5	6	10	32	86
Non-Infectious	2	12	13	2	3	3	4	7	16	35	96
Congenital	0	0	0	0	0	0	0	0	0	0	0
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	0	0	0	0
Haemophilus influenzae type b (invasive)	1	0	0	0	1	0	0	0	0	0	2
Influenza	32	88	92	29	118	137	103	138	79	471	1287
Measles	0	0	0	0	0	0	0	0	0	1	1
Mumps	2	0	0	1	0	73	50	1	1	3	131
Pertussis	40	17	15	11	13	34	21	6	4	4	165
Invasive pneumococcal disease	16	16	11	6	14	8	10	16	15	17	129
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	0	0	0	0	0	0	0	0	0	0	0
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=917	N=985	N=861	N=1,057	N=943	N=954	N=1,007	N=1,126	N=1,007	N=1,321	N=10,184
Varicella											
Chicken pox	40	11	8	11	24	17	11	19	13	21	175
Shingles	21	19	18	19	14	16	35	43	50	65	300
Unspecified	1	3	9	5	11	4	7	2	3	1	46
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	1	0	4	9	1	2	1	3	1	1	23
Chikungunya virus infection	0	0	0	0	0	0	1	1	0	0	2
Dengue virus infection	7	5	4	5	5	10	8	4	0	4	52
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	5	0	0	0	0	1	3	3	1	0	13
Murray valley encephalitis virus infection	0	1	0	0	0	0	0	0	0	0	1
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	5	15	21	224	61	13	32	84	10	9	474
Typhus	0	0	0	0	1	2	0	2	1	0	6
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	0	0	0	0	0	0
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=917	N=985	N=861	N=1,057	N=943	N=954	N=1,007	N=1,126	N=1,007	N=1,321	N=10,184
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	0	0	0	0	0	0	0	0	0	0	0
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0
Psittacosis	0	0	0	0	0	0	0	0	0	0	0
Q fever	0	0	0	1	0	1	0	1	0	0	3
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	3	2	5
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	0	0	0	0	0	0	0	0	0	0	0
Haemolytic uraemic syndrome	0	0	0	0	0	0	0	0	0	0	0
Legionellosis	0	1	0	1	1	0	3	0	0	0	6
Leprosy	0	0	0	0	0	0	0	0	0	0	0
Melioidosis	0	0	0	0	2	0	0	0	0	0	2
Invasive meningococcal disease	0	1	0	1	3	0	6	5	4	0	20
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	4	1	1	0	0	2	1	1	5	0	15
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 46. ASR (per 100,000 population), by disease and year, in Goldfields, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	42.6	41.4	35.4	20.1	19.5	23.4	25.3	20.3	24.2	24.1	29.1
Newly Acquired	-	-	-	3.5	-	1.6	-	-	1.5	3.1	1.0
Unspecified	42.6	41.4	35.4	16.6	19.5	21.8	25.3	20.3	22.7	21.0	28.1
Hepatitis C *(Total)*	85.4	76.5	62.5	52.2	40.1	52.6	52.9	39.1	54.1	72.4	62.9
Newly Acquired	2.9	7.7	3.2	0.0	1.5	11.9	8.1	1.7	9.2	11.0	6.2
Unspecified	82.4	68.8	59.3	52.2	38.6	40.7	44.8	37.3	44.8	61.4	56.7
Hepatitis D	-	1.6	2.5	-	-	-	-	-	-	-	0.4
ENTERIC DISEASES											
Botulism	-	-	-	-	-	-	-	-	-	-	-
Campylobacteriosis	106.8	87.2	45.7	75.1	111.0	93.1	114.8	106.9	110.9	81.4	92.3
Cholera	-	-	-	-	-	-	-	-	-	-	-
Cryptosporidiosis	8.9	21.6	16.0	22.3	15.0	1.9	11.8	28.8	0.0	6.9	13.5
Hepatitis A	-	-	-	6.3	-	-	-	1.6	-	-	0.8
Hepatitis E	-	-	-	-	-	-	-	-	-	-	-
Listeriosis	-	-	-	-	-	-	-	-	-	-	-
Paratyphoid fever	-	-	-	-	1.8	-	-	-	-	-	0.2
Rotavirus infection	5.9	8.0	14.5	14.4	20.9	32.6	10.7	51.3	18.5	12.5	18.8
Salmonellosis	28.3	57.2	29.1	67.5	35.5	73.9	81.8	124.8	62.3	88.3	64.7
Shiga toxin-producing *E. coli* infection	-	-	-	-	-	-	3.1	2.9	-	1.8	0.8
Shigellosis	1.6	16.4	3.3	10.0	-	8.4	10.0	45.7	46.1	50.9	18.6
Typhoid fever	-	-	1.6	-	-	-	-	1.6	1.8	-	0.5
Vibrio parahaemolyticus infection	-	1.7	-	-	-	-	2.0	-	-	1.8	0.5
Yersiniosis (other than plague)	-	-	-	1.4	-	-	-	-	1.9	-	0.3

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	658.6	698.9	638.3	629.2	586.2	495.3	641.2	515.4	571.7	540.6	651.4
Donovanosis	-	-	-	-	1.8	-	-	-	-	-	0.2
Gonococcal infection	262.3	255.8	177.2	232.1	231.8	237.3	208.3	345.6	421.6	217.8	280.3
HIV											
Syphilis											
Infectious	8.0	7.5	10.0	2.8	6.5	14.5	8.7	9.9	14.7	49.5	14.6
Non-Infectious	7.2	19.8	22.7	3.2	4.7	5.8	6.8	11.4	24.7	57.9	17.0
Congenital	-	-	-	-	-	-	-	-	-	-	-
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	-	-	-	-
Haemophilus influenzae type b (invasive)	1.4	-	-	-	1.4	-	-	-	-	-	0.3
Influenza	52.4	140.4	154.2	47.6	192.6	229.4	191.4	244.5	133.8	891.4	223.6
Measles	-	-	-	-	-	-	-	-	-	2.3	0.2
Mumps	3.3	-	-	1.6	-	126.2	89.4	1.6	2.0	5.2	22.5
Pertussis	63.2	26.8	24.4	17.4	20.3	59.6	36.2	11.5	6.5	7.3	27.8
Invasive pneumococcal disease	29.5	26.0	19.0	12.0	22.1	12.7	16.0	29.6	24.3	34.5	22.4
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	-	-	-	-	-	-	-	-	-	-	-
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	-	-	-	-	-	-	-	-	-	-
Varicella											
Chicken pox	62.2	16.1	11.9	17.0	39.2	26.7	18.6	32.1	23.6	37.6	28.3
Shingles	40.7	38.2	34.8	31.4	26.0	28.9	69.6	83.6	95.6	121.4	56.5

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Unspecified	1.6	4.7	19.1	7.7	19.9	6.5	15.1	3.6	4.9	1.4	8.6
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	1.6	-	6.4	15.1	1.8	3.4	1.7	4.7	1.4	1.7	3.9
Chikungunya virus infection	-	-	-	-	-	-	1.9	2.0	-	-	0.4
Dengue virus infection	12.1	7.8	6.3	8.0	8.0	17.2	13.9	6.8	0.0	8.0	8.8
Japanese encephalitis virus infection	-	-	-	-	-	-	-	-	-	-	-
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	8.4	-	-	-	-	1.5	4.9	5.3	1.5	-	2.1
Murray valley encephalitis virus infection	-	1.4	-	-	-	-	-	-	-	-	0.1
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	8.3	25.6	34.1	355.9	101.8	20.7	55.7	149.3	18.0	19.1	80.6
Typhus	-	-	-	-	1.8	3.3	-	3.2	1.5	-	1.0
West Nile virus / Kunjin virus infection	-	-	-	-	-	-	-	-	-	-	-
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	-	-	-	-	-	-	-	-	-	-	-
ZOONOTIC DISEASES	-	-	-	-	-	-	-	-	-	-	-
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	-	-	-	-	-	-	-	-	-	-	-
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	-	-	-	-	-	-	-	-	-	-	-
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	-	-	-	-	-	-	-	-	-	-	-

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Q fever	-	-	-	1.6	-	1.7	-	1.6	-	-	0.5
Tularaemia	-	-	-	-	-	-	-	-	-	-	-
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	5.4	3.3	0.8
Amoebic meningitis	-	-	-	-	-	-	-	-	-	-	-
Creutzfeldt-Jakob disease	-	-	-	-	-	-	-	-	-	-	-
Haemolytic uraemic syndrome	-	-	-	-	-	-	-	-	-	-	-
Legionellosis	-	1.7	-	1.7	1.5	-	7.8	-	-	-	1.2
Leprosy	-	-	-	-	-	-	-	-	-	-	-
Melioidosis	-	-	-	-	3.3	-	-	-	-	-	0.3
Invasive meningococcal disease	-	1.6	-	2.7	5.1	-	10.0	9.3	6.6	-	3.5
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	6.7	1.8	2.5	-	-	3.1	1.8	1.6	9.5	-	2.7
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 47. Number of notifications, by disease and year, in Great Southern, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=564	N=729	N=807	N=614	N=680	N=655	N=874	N=837	N=821	N=1,095	N=7.676
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	6	14	12	10	6	3	5	4	4	8	72
Newly Acquired	0	1	0	0	0	0	0	0	0	2	3
Unspecified	6	13	12	10	6	3	5	4	4	6	69
Hepatitis C *(Total)*	30	33	46	39	45	43	46	50	35	42	409
Newly Acquired	3	1	11	11	16	14	6	12	9	9	92
Unspecified	27	32	35	28	29	29	40	38	26	33	317
Hepatitis D	0	0	0	0	0	0	0	0	0	0	0
ENTERIC DISEASES											
Botulism	0	0	0	0	0	0	0	0	0	0	0
Campylobacteriosis	68	69	53	72	82	83	96	94	96	87	800
Cholera	0	0	0	0	0	0	0	0	0	0	0
Cryptosporidiosis	3	11	10	9	6	3	3	5	9	2	61
Hepatitis A	0	0	0	1	0	1	0	0	0	0	2
Hepatitis E	0	0	0	0	0	0	0	0	0	0	0
Listeriosis	0	0	0	0	0	0	0	0	1	0	1
Paratyphoid fever	0	0	0	0	0	0	0	0	0	0	0
Rotavirus infection	9	0	8	4	3	10	2	2	7	5	50
Salmonellosis	24	29	31	29	18	28	38	36	43	27	303
Shiga toxin-producing *E. coli* infection	3	0	0	1	1	0	2	1	4	4	16
Shigellosis	2	0	0	1	5	0	2	1	0	3	14
Typhoid fever	0	0	0	0	0	1	0	0	0	0	1
Vibrio parahaemolyticus infection	0	1	0	0	0	0	0	0	0	0	1

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=564	N=729	N=807	N=614	N=680	N=655	N=874	N=837	N=821	N=1,095	N=7.676
Yersiniosis (other than plague)	0	0	0	1	0	1	0	0	0	0	2
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	145	208	210	185	177	188	180	163	186	165	1807
Donovanosis	0	0	0	0	0	0	0	0	0	0	0
Gonococcal infection	4	13	11	21	8	11	14	11	14	31	138
Syphilis											
Infectious	3	2	2	0	0	0	1	2	2	7	19
Non-Infectious	1	0	2	1	0	0	0	0	1	3	8
Congenital	0	0	0	0	0	0	0	0	0	0	0
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	0	0	0	0
Haemophilus influenzae type b (invasive)	0	0	0	0	0	0	0	0	0	0	0
Influenza	77	28	133	38	126	124	217	128	137	521	1529
Measles	0	0	0	0	7	1	0	0	0	2	10
Mumps	1	1	0	0	1	0	2	0	0	1	6
Pertussis	106	182	89	32	27	23	106	163	112	3	843
Invasive pneumococcal disease	5	5	8	5	5	4	4	4	6	5	51
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	0	0	0	0	0	0	0	0	0	0	0
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	0	0	0	0	0	0	0	0	0	0
Varicella											
Chicken pox	11	8	6	5	15	16	19	27	26	21	154
Shingles	33	37	52	52	55	52	84	74	90	105	634

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=564	N=729	N=807	N=614	N=680	N=655	N=874	N=837	N=821	N=1,095	N=7.676
Unspecified	6	19	8	9	16	14	13	22	18	25	150
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	2	10	20	54	5	2	1	1	5	1	101
Chikungunya virus infection	0	1	0	0	0	0	0	0	0	0	1
Dengue virus infection	3	8	9	7	7	6	10	1	2	5	58
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	0	0	0	0	1	0	0	0	0	0	1
Murray valley encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	15	43	89	34	53	29	20	40	11	13	347
Typhus	2	2	1	0	1	4	1	1	3	4	19
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	0	0	0	0	0	0
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	0	0	0	0	0	0	0	0	0	0
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	0	0	0	0	0	0	0	1	0	0	1
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=564	N=729	N=807	N=614	N=680	N=655	N=874	N=837	N=821	N=1,095	N=7.676
Psittacosis	0	0	0	0	0	0	0	0	0	0	0
Q fever	1	2	2	1	1	5	1	1	1	0	15
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	0	1
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	1	0	0	0	0	0	1	0	0	0	2
Haemolytic uraemic syndrome	0	0	0	0	1	0	0	0	1	0	2
Legionellosis	1	1	1	3	5	1	4	2	2	1	21
Leprosy	0	0	0	0	0	0	0	0	0	0	0
Melioidosis	1	0	0	0	0	0	0	0	0	0	1
Invasive meningococcal disease	0	0	2	0	2	2	0	1	1	1	9
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	1	2	2	0	1	0	2	2	3	3	16
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 48. ASR (per 100,000 population), by disease and year, in Great Southern, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	14.0	27.6	21.7	18.2	13.1	6.1	8.8	8.4	7.1	12.9	14.0
Newly Acquired	-	2.4	-	-	-	-	-	-	-	3.2	0.6
Unspecified	14.0	25.3	21.7	18.2	13.1	6.1	8.8	8.4	7.1	9.7	13.4
Hepatitis C *(Total)*	59.5	65.1	95.8	77.3	93.7	84.7	89.1	102.9	65.8	85.9	82.7
Newly Acquired	6.9	2.2	26.1	24.3	35.7	31.7	12.8	26.5	20.1	21.3	20.8
Unspecified	52.7	62.8	69.6	53.0	58.0	53.0	76.3	76.5	45.8	64.6	61.9
Hepatitis D	-	-	-	-	-	-	-	-	-	-	-
ENTERIC DISEASES											
Botulism	-	-	-	-	-	-	-	-	-	-	-
Campylobacteriosis	120.5	117.6	85.8	120.0	135.1	133.3	161.0	157.3	149.1	144.8	132.1
Cholera	-	-	-	-	-	-	-	-	-	-	-
Cryptosporidiosis	6.7	22.0	18.4	17.1	9.2	5.1	5.3	10.7	18.0	3.6	11.6
Hepatitis A	-	-	-	2.3	-	2.2	-	-	-	-	0.5
Hepatitis E	-	-	-	-	-	-	-	-	-	-	-
Listeriosis	-	-	-	-	-	-	-	-	0.9	-	0.1
Paratyphoid fever	-	-	-	-	-	-	-	-	-	-	-
Rotavirus infection	15.8	-	13.4	6.4	5.7	17.1	3.5	3.0	10.7	8.7	8.5
Salmonellosis	44.2	55.1	53.4	46.7	34.2	45.5	65.0	62.0	80.9	44.6	53.1
Shiga toxin-producing *E. coli* infection	4.8	-	-	1.1	1.9	-	3.3	1.2	7.9	5.9	2.6
Shigellosis	3.2	-	-	1.9	9.1	-	3.9	1.2	-	4.4	2.4
Typhoid fever	-	-	-	-	-	1.8	-	-	-	-	0.2
Vibrio parahaemolyticus infection	-	1.9	-	-	-	-	-	-	-	-	0.2
Yersiniosis (other than plague)	-	-	-	1.8	-	1.9	-	-	-	-	0.4

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	321.3	446.5	449.2	381.5	378.6	398.6	375.2	346.7	404.2	363.8	386.6
Donovanosis	-	-	-	-	-	-	-	-	-	-	-
Gonococcal infection	8.1	26.4	21.3	41.7	16.5	20.9	30.4	23.6	30.1	65.9	28.8
Syphilis											
Infectious	7.3	4.8	4.6	-	-	-	2.1	4.3	4.3	14.8	4.3
Non-Infectious	2.6	-	4.2	1.1	-	-	-	-	2.1	5.0	1.6
Congenital	-	-	-	-	-	-	-	-	-	-	-
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	-	-	-	-
Haemophilus influenzae type b (invasive)	-	-	-	-	-	-	-	-	-	-	-
Influenza	145.2	50.9	227.1	59.7	209.1	204.9	341.3	193.7	233.7	836.1	252.0
Measles	-	-	-	-	13.1	2.2	-	-	-	4.5	2.0
Mumps	1.2	2.4	-	-	1.3	-	4.2	-	-	1.9	1.1
Pertussis	183.7	324.6	157.3	50.6	40.8	37.7	183.7	281.8	195.7	3.1	145.5
Invasive pneumococcal disease	8.6	8.4	11.6	7.6	6.1	4.6	5.5	6.1	10.3	8.0	7.6
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	-	-	-	-	-	-	-	-	-	-	-
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	-	-	-	-	-	-	-	-	-	-
Varicella											
Chicken pox	20.2	14.1	11.2	8.6	27.5	28.3	35.0	48.2	45.6	39.4	27.7
Shingles	51.7	56.0	80.9	75.9	81.3	72.5	118.7	100.2	128.6	147.7	91.9
Unspecified	9.4	32.1	13.5	13.3	24.7	17.7	19.1	31.3	27.7	32.8	22.2

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	4.8	15.0	31.4	93.7	7.5	3.0	1.2	2.4	8.6	1.0	16.9
Chikungunya virus infection	-	1.7	-	-	-	-	-	-	-	-	0.2
Dengue virus infection	5.2	15.6	15.0	10.9	11.2	8.1	18.4	1.1	3.3	10.4	9.9
Japanese encephalitis virus infection	-	-	-	-	-	-	-	-	-	-	-
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	-	-	-	-	1.7	-	-	-	-	-	0.2
Murray valley encephalitis virus infection	-	-	-	-	-	-	-	-	-	-	-
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	27.3	74.2	152.1	55.9	92.8	50.6	32.0	66.9	14.9	19.1	58.8
Typhus	3.0	4.6	1.9	-	1.7	6.8	0.9	2.3	6.9	5.7	3.4
West Nile virus / Kunjin virus	-	-	-	-	-	-	-	-	-	-	-
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus	-	-	-	-	-	-	-	-	-	-	-
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	-	-	-	-	-	-	-	-	-	-	-
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	-	-	-	-	-	-	-	2.4	-	-	0.2
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	-	-	-	-	-	-	-	-	-	-	-
Q fever	1.6	3.5	3.8	2.3	1.9	7.7	0.9	2.3	1.0	-	2.5
Tularaemia	-	-	-	-	-	-	-	-	-	-	-

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	2.1	-	0.2
Amoebic meningitis	-	-	-	-	-	-	-	-	-	-	-
Creutzfeldt-Jakob disease	1.2	-	-	-	-	-	1.0	-	-	-	0.2
Haemolytic uraemic syndrome	-	-	-	-	1.9	-	-	-	2.1	-	0.4
Legionellosis	1.6	1.2	1.3	4.1	6.0	1.5	4.7	2.8	2.3	1.0	2.7
Leprosy	-	-	-	-	-	-	-	-	-	-	-
Melioidosis	1.6	-	-	-	-	-	-	-	-	-	0.2
Invasive meningococcal disease	-	-	3.0	-	3.0	3.7	-	1.9	1.0	1.0	1.4
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	1.9	4.1	3.6	0.0	1.1	0.0	4.0	3.5	5.0	6.1	2.9
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 49. Number of notifications, by disease and year, in Kimberley, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,405	N=1,939	N=2,175	N=1,716	N=2,036	N=1,859	N=1,918	N=2,032	N=1,676	N=1,722	N=18,478
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	15	21	20	20	7	9	9	14	9	3	127
Newly Acquired	0	1	0	1	1	0	0	0	1	0	4
Unspecified	15	20	20	19	6	9	9	14	8	3	123
Hepatitis C *(Total)*	29	18	21	23	21	19	16	28	12	18	205
Newly Acquired	1	1	1	1	1	1	0	2	1	2	11
Unspecified	28	17	20	22	20	18	16	26	11	16	194
Hepatitis D	0	0	0	0	0	0	0	0	0	0	0
ENTERIC DISEASES											
Botulism	0	0	0	0	0	0	0	0	0	0	0
Campylobacteriosis	38	36	44	35	44	31	30	37	45	40	380
Cholera	0	0	0	0	0	0	0	0	0	0	0
Cryptosporidiosis	18	60	41	58	26	57	20	18	18	36	352
Hepatitis A	0	0	0	0	0	0	0	0	0	0	0
Hepatitis E	1	0	0	0	0	1	0	0	0	0	2
Listeriosis	0	1	0	0	0	0	0	0	1	0	2
Paratyphoid fever	0	0	0	0	0	0	1	0	0	0	1
Rotavirus infection	7	7	25	41	16	23	2	75	25	3	224
Salmonellosis	85	90	73	85	92	97	75	110	79	60	846
Shiga toxin-producing *E. coli* infection	0	0	0	0	0	0	2	2	0	1	5
Shigellosis	27	21	4	5	17	27	7	37	66	44	255
Typhoid fever	0	0	0	0	0	0	0	0	0	0	0
Vibrio parahaemolyticus infection	0	0	1	0	0	0	0	0	0	0	1

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,405	N=1,939	N=2,175	N=1,716	N=2,036	N=1,859	N=1,918	N=2,032	N=1,676	N=1,722	N=18,478
Yersiniosis (other than plague)	0	0	0	0	0	1	0	0	0	0	1
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	650	632	701	666	667	645	597	636	630	536	6,360
Donovanosis	0	0	0	0	0	0	0	0	0	0	0
Gonococcal infection	358	591	656	527	521	409	464	514	390	334	4,764
Syphilis											
Infectious	9	10	0	0	11	36	44	58	46	89	303
Non-Infectious	10	12	6	4	2	0	1	4	2	5	46
Congenital	0	0	0	0	0	0	0	0	0	0	0
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	0	0	0	0
Haemophilus influenzae type b (invasive)	0	0	0	0	0	0	0	0	0	0	0
Influenza	28	85	299	64	370	212	217	242	182	386	2,085
Measles	0	1	0	0	1	0	0	0	0	0	2
Mumps	0	0	0	0	0	149	296	0	0	0	445
Pertussis	3	112	89	18	46	3	17	41	9	45	383
Invasive pneumococcal disease	18	47	22	19	26	21	15	15	13	23	219
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	0	0	0	0	0	0	0	0	0	0	0
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	0	0	0	0	0	0	0	0	0	0
Varicella											
Chicken pox	24	19	47	9	15	3	26	17	18	24	202
Shingles	21	27	28	39	41	45	45	48	65	55	414

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,405	N=1,939	N=2,175	N=1,716	N=2,036	N=1,859	N=1,918	N=2,032	N=1,676	N=1,722	N=18,478
Unspecified	15	0	29	10	8	1	0	0	0	0	63
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	4	20	7	22	8	9	2	13	6	2	93
Chikungunya virus infection	0	0	0	0	1	0	0	0	0	0	1
Dengue virus infection	9	2	7	7	8	5	1	1	1	2	43
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	1	0	1	0	1	0	1	1	0	0	5
Murray Valley encephalitis virus infection	0	2	0	0	0	0	0	0	0	0	2
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	30	123	46	54	79	43	22	106	36	6	545
Typhus	1	0	0	1	0	1	1	2	0	0	6
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	4	0	0	4
Yellow fever											
Zika virus infection	0	0	0	0	0	0	1	0	0	0	1
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	0	0	0	0	0	0	0	0	0	0
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	0	0	0	0	0	0	0	0	0	0	0
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,405	N=1,939	N=2,175	N=1,716	N=2,036	N=1,859	N=1,918	N=2,032	N=1,676	N=1,722	N=18,478
Psittacosis	0	0	0	0	0	0	0	0	0	0	0
Q fever	1	0	0	0	0	0	0	0	1	0	2
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3	19	8	30
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	0	1	0	0	0	0	0	0	0	0	1
Haemolytic uraemic syndrome	0	0	0	0	0	0	0	0	0	0	0
Legionellosis	0	0	3	3	1	4	0	1	1	0	13
Leprosy	1	0	0	2	2	0	3	2	0	1	11
Melioidosis	1	1	1	2	2	3	1	3	0	1	15
Invasive meningococcal disease	1	0	1	1	1	1	2	0	2	0	9
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	0	0	3	1	2	4	0	0	0	0	10
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 50. ASR (per 100,000 population), by disease and year, in Kimberley, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	46.8	55.3	57.5	56.5	20.1	22.2	23.4	38.4	27.0	6.5	37.1
Newly Acquired	-	2.2	-	2.2	2.3	-	-	-	2.8	-	1.0
Unspecified	46.8	53.1	57.5	54.3	17.8	22.2	23.4	38.4	24.2	6.5	36.2
Hepatitis C *(Total)*	77.9	47.1	51.4	57.5	52.6	54.3	40.7	63.6	28.7	42.7	55.3
Newly Acquired	2.1	2.6	1.8	2.6	2.6	1.8	-	5.1	1.8	4.6	2.7
Unspecified	75.8	44.5	49.6	54.9	50.0	52.5	40.7	58.5	26.9	38.1	52.5
Hepatitis D	-	-	-	-	-	-	-	-	-	-	-
ENTERIC DISEASES											
Botulism	-	-	-	-	-	-	-	-	-	-	-
Campylobacteriosis	99.8	91.3	101.8	79.5	106.6	85.1	81.5	102.5	133.0	117.1	100.4
Cholera	-	-	-	-	-	-	-	-	-	-	-
Cryptosporidiosis	37.5	125.4	89.3	118.6	54.3	121.9	42.9	38.1	37.8	82.4	74.9
Hepatitis A	-	-	-	-	-	-	-	-	-	-	-
Hepatitis E	2.1	-	-	-	-	2.2	-	-	-	-	0.5
Listeriosis	-	3.3	-	-	-	-	-	-	11.9	-	1.4
Paratyphoid fever	-	-	-	-	-	-	2.6	-	-	-	0.3
Rotavirus infection	14.7	14.5	61.1	88.8	33.6	48.3	4.0	164.5	56.8	6.2	49.3
Salmonellosis	225.9	229.6	166.2	195.9	240.1	259.3	210.0	288.3	202.0	167.1	218.8
Shiga toxin-producing *E. coli* infection	-	-	-	-	-	-	5.5	5.8	-	7.9	2.0
Shigellosis	70.4	46.7	10.1	10.6	39.3	73.2	17.6	87.0	172.0	119.5	63.6
Typhoid fever	-	-	-	-	-	-	-	-	-	-	-
Vibrio parahaemolyticus infection	-	-	1.9	-	-	-	-	-	-	-	0.2
Yersiniosis (other than plague)	-	-	-	-	-	2.3	-	-	-	-	0.2

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	1,648.9	1,584.0	1,775.0	1,630.2	1,726.6	1,688.8	1,514.9	1,656.1	1,667.2	1,418.1	1,705.6
Donovanosis	-	-	-	-	-	-	-	-	-	-	-
Gonococcal infection	915.8	1,488.7	1,691.4	1,301.6	1,321.1	1,056.8	1,199.3	1,337.1	979.6	849.2	1,278.7
Syphilis											
Infectious	23.0	26.1	-	-	33.4	91.6	109.0	155.8	118.2	222.0	81.0
Non-Infectious	33.6	42.3	15.9	10.3	5.9	-	2.4	15.9	5.1	13.4	14.8
Congenital	-	-	-	-	-	-	-	-	-	-	-
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	-	-	-	-
Haemophilus influenzae type b (invasive)	-	-	-	-	-	-	-	-	-	-	-
Influenza	74.4	210.2	775.3	162.9	987.4	588.5	599.1	702.1	517.9	1,091.0	571.6
Measles	-	3.2	-	-	3.1	-	-	-	-	-	0.6
Mumps	-	-	-	-	-	377.2	768.6	-	-	-	113.5
Pertussis	15.8	286.2	210.1	47.8	109.9	7.3	41.7	99.0	24.2	112.2	94.5
Invasive pneumococcal disease	44.7	115.8	54.6	43.3	65.1	62.2	40.6	39.5	35.9	67.0	57.1
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	-	-	-	-	-	-	-	-	-	-	-
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	-	-	-	-	-	-	-	-	-	-
Varicella	-	-	-	-	-	-	-	-	-	-	-
Chicken pox	53.6	44.8	108.7	24.4	34.4	7.8	63.2	40.0	38.1	58.3	47.2
Shingles	72.3	86.1	79.9	121.5	127.0	127.8	141.2	168.4	214.6	169.5	129.4
Unspecified	39.0	-	70.6	33.6	22.9	2.9	-	-	-	-	17.3

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	12.1	52.0	21.3	53.2	21.2	25.8	5.4	36.8	16.0	6.2	24.9
Chikungunya virus infection	-	-	-	-	2.0	-	-	-	-	-	0.2
Dengue virus infection	24.2	5.5	17.8	19.0	19.9	14.6	2.6	2.8	2.3	5.5	11.5
Japanese encephalitis virus infection	-	-	-	-	-	-	-	-	-	-	-
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	2.9	-	2.5	-	2.5	-	2.9	2.3	-	-	1.3
Murray Valley encephalitis virus infection	-	4.0	-	-	-	-	-	-	-	-	0.4
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	103.5	327.5	118.2	131.8	205.5	115.3	68.3	298.3	97.4	27.7	149.8
Typhus	3.0	-	-	2.5	-	2.4	2.6	5.8	-	-	1.6
West Nile virus / Kunjin virus infection	-	-	-	-	-	-	-	10.8	-	-	1.0
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	-	-	-	-	-	-	3.0	-	-	-	0.3
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	-	-	-	-	-	-	-	-	-	-	-
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	-	-	-	-	-	-	-	-	-	-	-
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	-	-	-	-	-	-	-	-	-	-	-
Q fever	2.5	-	-	-	-	-	-	-	2.8	-	0.5

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Tularaemia	-	-	-	-	-	-	-	-	-	-	-
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.8	42.1	19.8	6.8
Amoebic meningitis	-	-	-	-	-	-	-	-	-	-	-
Creutzfeldt-Jakob disease	-	2.9	-	-	-	-	-	-	-	-	0.3
Haemolytic uraemic syndrome	-	-	-	-	-	-	-	-	-	-	-
Legionellosis	-	-	9.9	8.5	2.8	11.2	-	3.0	3.0	-	3.8
Leprosy	2.9	-	-	4.7	5.9	-	8.5	5.9	-	2.6	3.0
Melioidosis	3.1	2.7	3.1	6.4	5.4	7.6	3.0	7.0	-	5.0	4.4
Invasive meningococcal disease	2.0	-	2.0	2.5	2.1	3.1	4.0	-	5.4	-	2.1
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	-	-	9.3	1.8	5.3	10.1	-	-	-	-	2.7
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 51. Number of notifications, by disease and year, in Metropolitan Perth, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=17,419	N=21,291	N=24,383	N=22,212	N=24,548	N=25,904	N=29,476	N=28,470	N=27,933	N=42,645	N=264,281
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	500	446	478	483	513	466	568	439	414	389	4,696
Newly Acquired	32	15	23	28	22	24	22	13	20	16	215
Unspecified	468	431	455	455	491	442	546	426	394	373	4,481
Hepatitis C *(Total)*	752	793	765	855	858	813	890	868	754	686	8,034
Newly Acquired	61	95	99	96	124	143	94	94	97	88	991
Unspecified	691	698	666	759	734	670	796	774	657	598	7,043
Hepatitis D	0	1	1	4	3	0	1	2	7	10	29
ENTERIC DISEASES											
Botulism	0	0	0	0	0	1	0	0	0	0	1
Campylobacteriosis	1,778	1,655	1,470	1,439	2,324	2,250	2,715	2,679	2,729	2,881	21,920
Cholera	0	1	0	0	0	0	0	1	0	0	2
Cryptosporidiosis	58	248	83	214	205	124	168	292	65	122	1,579
Hepatitis A	26	9	12	9	14	22	16	10	11	22	151
Hepatitis E	2	4	1	3	0	1	3	4	2	4	24
Listeriosis	2	6	7	8	5	6	5	6	5	7	57
Paratyphoid fever	9	9	8	7	8	10	11	4	9	9	84
Rotavirus infection	500	155	250	235	306	433	152	327	220	458	3,036
Salmonellosis	911	904	834	880	875	1,257	1,509	1,999	1,602	1,699	12,470
Shiga toxin-producing *E. coli* infection	4	3	0	2	1	0	20	44	79	119	272
Shigellosis	54	36	32	31	37	41	59	56	123	277	746
Typhoid fever	6	11	11	7	10	7	9	19	12	18	110
Vibrio parahaemolyticus infection	7	9	11	13	14	5	22	18	14	12	125

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=17,419	N=21,291	N=24,383	N=22,212	N=24,548	N=25,904	N=29,476	N=28,470	N=27,933	N=42,645	N=264,281
Yersiniosis (other than plague)	2	1	3	2	2	23	12	14	10	22	91
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	2
Chlamydial infection	7,475	8,722	8,865	8,886	8,636	8,606	9,121	8,986	9,021	9,171	87,489
Donovanosis	0	0	1	0	0	0	0	0	0	0	1
Gonococcal infection	520	678	964	921	1,258	1,432	2,274	2,176	2,326	2,910	15,459
Syphilis											
Infectious	54	92	67	71	75	114	263	239	304	328	1,607
Non-Infectious	43	62	70	67	50	59	49	138	166	154	858
Congenital	0	0	0	2	0	0	0	0	1	0	3
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	1	0	0	1
Haemophilus influenzae type b (invasive)	0	0	0	0	0	1	0	0	0	1	2
Influenza	1,251	1,385	3,956	1,949	3,758	4,703	6,115	4,475	4,663	18,467	50,722
Measles	9	13	6	11	34	6	11	16	33	42	181
Mumps	9	12	18	41	20	46	28	19	17	17	227
Pertussis	879	2,995	2,585	1,338	1,340	1,326	1,178	1,037	916	440	14,034
Invasive pneumococcal disease	115	108	139	109	113	100	112	127	124	150	1,197
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	3	14	1	1	1	2	1	2	1	1	27
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	0	1	1	1	0	0	0	1	0	4
Varicella											
Chicken pox	256	347	200	256	284	383	501	487	491	476	3,681
Shingles	488	658	765	995	1,060	1,130	1,285	1,426	1,607	1,607	11,021

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=17,419	N=21,291	N=24,383	N=22,212	N=24,548	N=25,904	N=29,476	N=28,470	N=27,933	N=42,645	N=264,281
Unspecified	775	916	971	1,100	1,072	1,253	1,377	1,523	1,482	1,336	11,805
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	53	67	140	791	22	15	5	11	7	5	1,116
Chikungunya virus infection	9	2	4	51	22	8	14	9	1	9	129
Dengue virus infection	402	264	437	370	353	451	455	149	118	275	3,274
Japanese encephalitis virus infection	0	0	0	1	0	0	0	0	1	0	2
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	40	57	39	68	40	42	43	49	44	52	474
Murray Valley encephalitis virus infection	0	2	0	0	0	0	0	0	1	0	3
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	251	386	958	764	987	568	232	609	347	261	5,363
Typhus	8	31	18	15	10	19	29	11	10	20	171
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	2	13	1	1	0	17
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	1	1	0	0	0	2	0	0	0	4
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	4	2	2	0	2	1	3	1	5	4	24
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=17,419	N=21,291	N=24,383	N=22,212	N=24,548	N=25,904	N=29,476	N=28,470	N=27,933	N=42,645	N=264,281
Psittacosis	2	5	7	2	0	1	0	1	0	0	18
Q fever	2	4	2	3	3	2	5	5	6	3	35
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	3	4	1	1	4	4	3	4	5	9	38
Haemolytic uraemic syndrome	0	0	0	0	0	1	2	3	0	0	6
Legionellosis	45	52	60	71	91	50	50	30	37	30	516
Leprosy	1	2	0	1	2	2	4	1	1	1	15
Melioidosis	1	3	2	5	0	2	1	3	2	2	21
Invasive meningococcal disease	17	14	10	13	10	12	12	34	23	12	157
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	93	102	127	116	125	104	128	115	115	127	1,152
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 52. ASR (per 100,000 population), by disease and year, in Metropolitan Perth, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	27.8	23.9	24.6	23.9	25.2	22.3	26.7	20.1	18.4	16.9	23.6
Newly Acquired	1.8	0.8	1.2	1.4	1.1	1.2	1.0	0.6	0.9	0.7	1.1
Unspecified	26.1	23.1	23.4	22.5	24.2	21.1	25.7	19.5	17.5	16.2	22.5
Hepatitis C *(Total)*	41.8	42.5	39.4	42.6	41.7	39.1	41.8	39.9	34.1	30.1	40.4
Newly Acquired	3.3	4.9	4.9	4.7	5.9	6.7	4.3	4.1	4.3	3.8	4.9
Unspecified	38.6	37.6	34.5	38.0	35.8	32.4	37.5	35.7	29.8	26.3	35.5
Hepatitis D	-	0.1	0.0	0.2	0.2	-	0.0	0.1	0.3	0.5	0.1
ENTERIC DISEASES											
Botulism	-	-	-	-	-	0.0	-	-	-	-	0.0
Campylobacteriosis	99.1	89.0	76.5	73.0	115.7	110.9	132.7	129.4	131.1	136.4	110.2
Cholera	-	0.1	-	-	-	-	-	0.0	-	-	0.0
Cryptosporidiosis	3.2	13.9	4.4	11.1	10.4	6.2	8.3	14.5	3.2	5.8	8.1
Hepatitis A	1.5	0.5	0.6	0.5	0.7	1.1	0.8	0.5	0.6	1.1	0.8
Hepatitis E	0.1	0.2	0.0	0.1	-	0.1	0.1	0.2	0.1	0.2	0.1
Listeriosis	0.1	0.3	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.3	0.3
Paratyphoid fever	0.5	0.5	0.4	0.3	0.4	0.5	0.5	0.2	0.4	0.4	0.4
Rotavirus infection	28.3	8.5	13.2	12.0	15.3	21.2	7.4	15.9	10.6	21.6	15.3
Salmonellosis	50.7	49.2	43.6	44.7	43.6	62.1	74.0	97.5	77.1	81.3	63.1
Shiga toxin-producing *E. coli* infection	0.2	0.2	-	0.1	0.1	-	1.0	2.1	3.7	5.5	1.4
Shigellosis	3.0	1.9	1.7	1.6	1.8	1.9	2.8	2.7	5.9	13.0	3.7
Typhoid fever	0.3	0.6	0.6	0.4	0.5	0.3	0.4	0.9	0.6	0.9	0.6
Vibrio parahaemolyticus infection	0.4	0.5	0.6	0.6	0.7	0.2	1.1	0.8	0.7	0.6	0.6
Yersiniosis (other than plague)	0.1	0.1	0.2	0.1	0.1	1.1	0.6	0.7	0.5	1.1	0.5

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	394.6	447.5	436.1	424.0	407.5	404.7	414.8	405.9	403.6	403.1	432.3
Donovanosis	-	-	0.0	-		-	-	-	-	-	0.0
Gonococcal infection	28.2	35.5	48.3	44.9	59.7	66.9	103.4	97.7	103.2	126.5	76.7
Syphilis											
Infectious	3.0	4.8	3.4	3.5	3.6	5.4	12.3	10.8	13.8	14.3	8.1
Non-Infectious	2.4	3.3	3.5	3.3	2.3	2.9	2.3	6.3	7.5	6.6	4.3
Congenital	-	-	-	0.1	-	-	-	-	0.0	-	0.0
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	0.1	-	-	0.0
Haemophilus influenzae type b (invasive)	-	-	-	-	-	0.0	-	-	-	0.0	0.0
Influenza	71.0	75.8	211.9	100.4	190.5	236.4	301.5	216.3	226.1	889.0	259.4
Measles	0.5	0.7	0.3	0.6	1.7	0.3	0.5	0.8	1.6	2.1	0.9
Mumps	0.5	0.7	1.0	2.0	1.0	2.4	1.4	0.9	0.9	0.8	1.2
Pertussis	50.0	170.3	139.3	69.9	68.1	66.5	59.9	52.2	44.5	21.2	72.7
Invasive pneumococcal disease	6.4	5.8	7.4	5.6	5.6	4.9	5.3	5.9	5.7	6.8	6.0
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	0.2	0.7	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	-	0.0	0.1	0.1	-	-	-	0.1	-	0.0
Varicella											
Chicken pox	15.3	20.3	11.1	13.9	15.0	20.0	26.0	24.9	25.1	24.0	19.7
Shingles	27.2	35.5	40.1	50.6	52.9	55.3	62.1	67.5	74.6	73.5	54.7
Unspecified	43.1	49.6	51.1	56.1	53.8	61.6	66.8	72.6	68.7	61.8	58.9

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	2.9	3.6	7.3	40.3	1.1	0.7	0.2	0.5	0.4	0.2	5.7
Chikungunya virus infection	0.5	0.1	0.2	2.7	1.1	0.4	0.7	0.4	0.1	0.4	0.7
Dengue virus infection	22.1	14.0	22.5	18.8	17.5	22.1	22.2	7.2	5.6	12.9	16.4
Japanese encephalitis virus infection	-	-	-	0.1	-	-	-	-	0.0	-	0.0
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	2.2	3.1	2.1	3.5	2.0	2.1	2.2	2.4	2.1	2.5	2.4
Murray Valley encephalitis virus infection	-	0.1	-	-	-	-	-	-	0.0	-	0.0
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	13.8	20.8	50.0	38.9	49.5	28.3	11.3	29.5	16.6	12.0	27.0
Typhus	0.4	1.6	0.9	0.8	0.5	0.9	1.4	0.5	0.5	0.9	0.9
West Nile virus / Kunjin virus infection	-	-	-	-	-	-	-	-	-	-	-
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	-	-	-	-	-	0.1	0.7	0.0	0.1	-	0.1
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	-	0.1	0.1	-	-	-	0.1	-	-	-	0.0
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	0.2	0.1	0.1	-	0.1	0.0	0.1	0.0	0.2	0.2	0.1
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	0.1	0.3	0.4	0.1	-	0.0	-	0.0	-	-	0.1
Q fever	0.1	0.2	0.1	0.2	0.1	0.1	0.3	0.3	0.3	0.1	0.2

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Tularaemia	-	-	-	-	-	-	-	-	-	-	-
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-
Amoebic meningitis	-	-	-	-	-	-	-	-	-	-	-
Creutzfeldt-Jakob disease	0.1	0.2	0.0	0.1	0.2	0.2	0.1	0.2	0.2	0.4	0.2
Haemolytic uraemic syndrome	-	-	-	-	-	0.1	0.1	0.2	-	-	0.0
Legionellosis	2.4	2.7	3.2	3.6	4.6	2.4	2.3	1.4	1.6	1.3	2.5
Leprosy	0.0	0.1	-	0.1	0.1	0.1	0.2	0.0	0.0	0.0	0.1
Melioidosis	0.0	0.1	0.1	0.2	-	0.1	0.1	0.1	0.1	0.1	0.1
Invasive meningococcal disease	0.9	0.8	0.5	0.7	0.5	0.6	0.6	1.6	1.1	0.6	0.8
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	5.2	5.5	6.5	5.8	6.3	5.0	6.3	5.6	5.5	5.9	5.8
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 53. Number of notifications, by disease and year, in Midwest, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=675	N=1,035	N=1,222	N=871	N=925	N=1,102	N=1,131	N=1,075	N=881	N=1,619	N=10,536
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	9	12	8	6	8	10	4	12	5	4	78
Newly Acquired	0	0	0	0	0	0	0	0	0	0	0
Unspecified	9	12	8	6	8	10	4	12	5	4	78
Hepatitis C *(Total)*	26	35	46	34	38	45	53	52	45	53	426
Newly Acquired	2	5	3	5	7	5	6	9	6	5	53
Unspecified	24	30	43	29	31	40	47	43	39	48	373
Hepatitis D	0	0	0	0	0	0	0	0	0	0	0
ENTERIC DISEASES											
Botulism	0	0	0	0	0	0	0	0	0	0	0
Campylobacteriosis	45	52	47	54	57	76	80	82	67	51	611
Cholera	0	0	0	0	0	0	0	0	0	0	0
Cryptosporidiosis	11	40	1	9	7	3	4	15	1	3	94
Hepatitis A	0	1	1	0	0	0	0	0	0	1	3
Hepatitis E	0	0	0	0	0	0	0	0	0	0	0
Listeriosis	0	0	0	0	0	0	0	0	0	0	0
Paratyphoid fever	0	0	0	0	0	0	0	0	0	0	0
Rotavirus infection	12	3	7	6	6	14	5	15	4	17	89
Salmonellosis	37	53	43	48	43	62	50	70	46	44	496
Shiga toxin-producing *E. coli* infection	0	0	0	0	0	0	1	4	3	7	15
Shigellosis	9	7	4	3	0	12	6	31	11	15	98
Typhoid fever	0	0	0	0	0	0	0	0	0	0	0
Vibrio parahaemolyticus infection	0	1	1	1	0	1	0	0	0	1	5

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=675	N=1,035	N=1,222	N=871	N=925	N=1,102	N=1,131	N=1,075	N=881	N=1,619	N=10,536
Yersiniosis (other than plague)	0	0	0	1	0	1	1	0	0	0	3
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	363	464	387	380	310	286	352	306	261	222	3,331
Donovanosis	0	0	0	0	0	0	0	0	0	0	0
Gonococcal infection	40	103	95	76	61	55	129	111	76	99	846
Syphilis											
Infectious	3	3	0	3	1	0	6	3	4	9	32
Non-Infectious	2	2	2	2	2	1	0	1	10	7	29
Congenital	1	0	0	0	0	0	0	0	0	0	1
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	0	0	0	0
Haemophilus influenzae type b (invasive)	0	1	1	0	0	1	0	0	0	1	4
Influenza	29	66	289	86	189	221	251	230	194	977	2,532
Measles	0	1	0	0	0	0	0	0	0	0	1
Mumps	0	0	0	0	1	13	39	0	0	0	53
Pertussis	15	45	151	38	36	31	18	12	51	7	404
Invasive pneumococcal disease	5	18	16	14	8	11	9	8	11	11	111
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	0	0	0	0	0	0	0	0	0	0	0
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	0	0	0	0	0	0	0	0	0	0
Varicella											
Chicken pox	9	11	22	8	19	14	14	4	15	10	126
Shingles	17	33	37	18	33	40	71	85	58	50	442

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=675	N=1,035	N=1,222	N=871	N=925	N=1,102	N=1,131	N=1,075	N=881	N=1,619	N=10,536
Unspecified	5	3	8	37	29	20	7	0	0	5	114
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	2	27	7	11	3	5	0	0	2	1	58
Chikungunya virus infection	0	0	0	1	0	1	0	0	0	0	2
Dengue virus infection	15	5	15	9	13	11	9	2	0	7	86
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	0	0	1	1	0	1	1	0	0	1	5
Murray Valley encephalitis virus infection	0	1	0	0	0	0	0	0	0	0	1
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	13	34	17	17	58	152	10	22	6	6	335
Typhus	0	0	5	0	0	3	4	1	0	1	14
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	0	1	0	0	0	1
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	0	0	0	0	0	0	0	0	0	0
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	0	0	0	0	0	0	0	0	0	0	0
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=675	N=1,035	N=1,222	N=871	N=925	N=1,102	N=1,131	N=1,075	N=881	N=1,619	N=10,536
Psittacosis	1	0	0	1	0	0	0	2	0	0	4
Q fever	1	1	1	0	0	2	0	0	2	2	9
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	1	0	1
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	1	0	0	0	0	0	0	0	0	1	2
Haemolytic uraemic syndrome	0	0	0	0	0	0	1	0	0	0	1
Legionellosis	3	7	7	4	2	6	4	2	0	1	36
Leprosy	0	0	0	0	0	0	0	0	0	0	0
Melioidosis	0	0	0	0	0	1	0	1	0	0	2
Invasive meningococcal disease	1	3	0	0	1	1	0	1	6	3	16
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	0	3	3	3	0	2	1	3	2	2	19
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 54. ASR (per 100,000 population), by disease and year, in Midwest, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	14.8	18.3	11.6	8.7	12.9	14.3	5.6	17.0	7.3	5.4	12.1
Newly Acquired	-	-	-	-	-	-	-	-	-	-	-
Unspecified	14.8	18.3	11.6	8.7	12.9	14.3	5.6	17.0	7.3	5.4	12.1
Hepatitis C *(Total)*	41.2	56.7	72.1	53.2	59.0	70.3	78.0	77.5	68.1	82.1	69.8
Newly Acquired	3.3	8.3	4.9	8.1	12.0	8.7	10.0	15.2	9.8	9.1	9.4
Unspecified	37.9	48.4	67.2	45.2	47.0	61.6	68.0	62.3	58.3	73.0	60.3
Hepatitis D	-	-	-	-	-	-	-	-	-	-	-
ENTERIC DISEASES											
Botulism	-	-	-	-	-	-	-	-	-	-	-
Campylobacteriosis	70.9	77.0	69.3	80.8	87.4	112.9	120.8	122.1	104.6	79.4	92.8
Cholera	-	-	-	-	-	-	-	-	-	-	-
Cryptosporidiosis	16.1	61.3	1.4	13.4	10.1	4.1	6.1	23.9	1.6	5.4	14.5
Hepatitis A	-	1.9	1.5	-	-	-	-	-	-	1.0	0.4
Hepatitis E	-	-	-	-	-	-	-	-	-	-	-
Listeriosis	-	-	-	-	-	-	-	-	-	-	-
Paratyphoid fever	-	-	-	-	-	-	-	-	-	-	-
Rotavirus infection	17.6	4.4	10.1	8.9	8.9	19.6	7.6	23.7	6.8	27.5	13.4
Salmonellosis	56.2	79.6	65.2	71.0	63.1	93.9	76.2	109.9	70.9	72.1	76.1
Shiga toxin-producing *E. coli* infection	-	-	-	-	-	-	1.5	4.7	4.1	10.4	2.1
Shigellosis	13.8	11.3	5.9	4.7	-	18.2	9.1	52.6	18.2	22.8	15.3
Typhoid fever	-	-	-	-	-	-	-	-	-	-	-
Vibrio parahaemolyticus infection	-	1.7	1.8	1.8	-	1.5	-	-	-	1.6	0.9
Yersiniosis (other than plague)	-	-	-	1.5	-	1.8	1.4	-	-	-	0.5

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	628.5	792.4	646.2	629.8	520.7	491.4	594.9	527.5	456.7	393.0	593.7
Donovanosis	-	-	-	-	-	-	-	-	-	-	-
Gonococcal infection	68.5	174.9	157.3	123.9	102.4	93.2	217.5	189.6	132.8	171.7	149.9
Syphilis	-	-	-	-	-	-	-	-	-	-	-
Infectious	5.3	4.7	-	5.0	1.5	-	9.7	4.7	4.9	14.4	5.3
Non-Infectious	2.9	2.7	2.9	3.3	2.6	1.9	-	1.6	13.9	9.8	4.5
Congenital	1.4	-	-	-	-	-	-	-	-	-	0.1
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	-	-	-	-
Haemophilus influenzae type b (invasive)	-	1.5	1.4	-	-	1.5	-	-	-	1.6	0.6
Influenza	43.0	104.3	436.3	130.0	279.2	336.5	391.2	359.9	306.0	1,603.6	390.8
Measles	-	1.6	-	-	-	-	-	-	-	-	0.2
Mumps	-	-	-	-	1.2	22.2	65.5	-	-	-	8.8
Pertussis	21.9	69.0	228.9	52.9	52.5	44.0	27.6	19.9	78.8	9.4	61.1
Invasive pneumococcal disease	8.2	28.8	24.8	20.8	12.0	16.0	13.7	12.6	16.9	15.9	17.2
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	-	-	-	-	-	-	-	-	-	-	-
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	-	-	-	-	-	-	-	-	-	-
Varicella	-	-	-	-	-	-	-	-	-	-	-
Chicken pox	14.0	17.0	34.2	11.9	28.8	21.2	21.3	6.6	25.0	16.7	19.8
Shingles	25.8	51.6	56.7	25.9	49.0	55.9	100.1	128.4	84.0	71.9	64.7
Unspecified	8.2	4.8	12.2	54.5	38.4	31.3	10.8	-	-	8.1	17.1

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	3.3	39.8	10.5	15.8	4.7	6.6	-	-	2.8	1.5	8.5
Chikungunya virus infection	-	-	-	1.1	-	1.7	-	-	-	-	0.3
Dengue virus infection	22.1	8.0	23.3	14.4	19.9	16.9	12.5	2.8	0.0	11.3	13.3
Japanese encephalitis virus infection	-	-	-	-	-	-	-	-	-	-	-
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	-	-	1.4	1.6	-	1.6	1.1	-	-	1.5	0.7
Murray Valley encephalitis virus infection	-	1.6	-	-	-	-	-	-	-	-	0.2
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	20.0	52.4	25.2	26.7	87.6	227.6	16.1	37.2	9.2	10.2	52.0
Typhus	0.0	0.0	8.1	0.0	0.0	4.2	6.8	2.1	-	1.5	2.3
West Nile virus / Kunjin virus infection	-	-	-	-	-	-	-	-	-	-	-
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	-	-	-	-	-	-	1.8	-	-	-	0.2
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	-	-	-	-	-	-	-	-	-	-	-
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	-	-	-	-	-	-	-	-	-	-	-
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	1.6	-	-	1.2	-	-	-	3.9	-	-	0.7
Q fever	1.9	1.9	1.2	-	-	3.4	-	-	3.9	3.7	1.5

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Tularaemia	-	-	-	-	-	-	-	-	-	-	-
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.0	1.6	-	0.1
Amoebic meningitis	-	-	-	-	-	-	-	-	-	-	-
Creutzfeldt-Jakob disease	1.8	-	-	-	-	-	-	-	-	1.1	0.3
Haemolytic uraemic syndrome	-	-	-	-	-	-	1.5	-	-	-	0.1
Legionellosis	4.8	9.7	10.0	6.1	2.3	7.8	5.0	2.1	-	1.5	4.8
Leprosy	-	-	-	-	-	-	-	-	-	-	-
Melioidosis	-	-	-	-	-	1.4	-	1.5	-	-	0.3
Invasive meningococcal disease	1.4	4.5	-	-	1.4	1.5	-	1.6	9.1	4.7	2.4
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	-	4.8	5.2	5.0	-	2.5	1.3	5.5	2.5	2.5	2.9
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 55. Number of notifications, by disease and year, in Pilbara, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,036	N=1,041	N=1,065	N=1,061	N=1,048	N=1,214	N=1,362	N=1,185	N=1,020	N=1,506	N=11,539
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	14	8	16	16	15	19	12	13	14	11	138
Newly Acquired	0	0	1	1	0	1	0	0	1	1	5
Unspecified	14	8	15	15	15	18	12	13	13	10	133
Hepatitis C *(Total)*	21	28	20	26	18	24	27	15	20	17	216
Newly Acquired	0	2	3	2	0	0	4	2	3	4	20
Unspecified	21	26	17	24	18	24	23	13	17	13	196
Hepatitis D	0	0	0	0	0	0	0	0	0	0	0
ENTERIC DISEASES											
Botulism	0	0	0	0	0	0	0	0	0	0	0
Campylobacteriosis	33	41	27	34	48	79	52	58	56	73	501
Cholera	0	0	0	0	0	0	0	0	0	0	0
Cryptosporidiosis	13	24	10	18	19	41	21	20	8	14	188
Hepatitis A	1	0	0	0	0	1	0	0	0	0	2
Hepatitis E	0	0	0	0	0	0	0	0	0	0	0
Listeriosis	0	0	0	0	0	0	0	0	0	0	0
Paratyphoid fever	0	0	0	0	0	0	0	0	0	0	0
Rotavirus infection	26	8	26	32	27	36	3	42	18	12	230
Salmonellosis	42	63	48	50	56	54	48	82	57	60	560
Shiga toxin-producing *E. coli* infection	0	0	0	0	0	0	1	1	2	1	5
Shigellosis	6	5	4	3	3	10	7	35	31	13	117
Typhoid fever	0	0	0	1	1	0	0	0	0	1	3
Vibrio parahaemolyticus infection	2	0	0	0	0	0	1	2	0	2	7

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,036	N=1,041	N=1,065	N=1,061	N=1,048	N=1,214	N=1,362	N=1,185	N=1,020	N=1,506	N=11,539
Yersiniosis (other than plague)	1	0	0	0	0	3	1	0	0	0	5
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	408	380	418	426	384	362	384	342	327	366	3,797
Donovanosis	0	0	0	0	0	0	0	0	0	0	0
Gonococcal infection	262	227	190	211	139	172	217	185	216	213	2,033
Syphilis											
Infectious	4	3	1	2	0	2	2	1	45	88	148
Non-Infectious	1	2	4	3	3	1	2	4	12	9	41
Congenital	0	0	0	0	0	0	0	0	0	1	1
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	0	0	0	0
Haemophilus influenzae type b (invasive)	1	0	0	0	0	0	0	0	1	0	2
Influenza	55	73	121	70	122	125	424	190	105	500	1,785
Measles	1	0	0	0	0	0	0	0	0	0	1
Mumps	0	0	1	1	1	172	56	2	0	2	235
Pertussis	46	54	70	31	10	9	4	15	5	2	246
Invasive pneumococcal disease	16	30	25	20	19	7	24	15	18	20	194
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	0	1	0	0	0	0	0	0	0	0	1
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	0	0	0	0	0	0	0	0	0	0
Varicella											
Chicken pox	3	6	3	23	16	16	8	47	16	14	152
Shingles	15	12	6	22	27	28	36	39	34	48	267

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,036	N=1,041	N=1,065	N=1,061	N=1,048	N=1,214	N=1,362	N=1,185	N=1,020	N=1,506	N=11,539
Unspecified	15	10	12	6	2	1	4	0	3	0	53
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	4	8	5	31	3	2	1	8	2	1	65
Chikungunya virus infection	0	0	0	0	0	0	0	0	1	0	1
Dengue virus infection	15	4	14	10	14	8	11	3	4	7	90
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	0	0	1	0	0	0	2	1	1	3	8
Murray Valley encephalitis virus infection	0	3	0	0	0	0	0	0	0	0	3
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	28	47	33	18	118	39	9	59	14	18	383
Typhus	0	0	3	1	0	0	2	0	0	0	6
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	0	0	0	0	0	0
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	0	0	0	0	0	0	0	0	0	0
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	0	0	0	0	0	0	0	0	0	0	0
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,036	N=1,041	N=1,065	N=1,061	N=1,048	N=1,214	N=1,362	N=1,185	N=1,020	N=1,506	N=11,539
Psittacosis	0	1	0	0	0	0	0	0	0	0	1
Q fever	0	0	0	0	0	0	0	0	0	0	0
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	0	0	0	1	0	0	0	0	1	0	2
Haemolytic uraemic syndrome	0	0	0	0	0	0	0	0	0	0	0
Legionellosis	2	2	4	4	1	1	0	1	1	0	16
Leprosy	0	0	0	0	0	0	0	0	0	0	0
Melioidosis	0	0	0	0	1	0	1	0	1	0	3
Invasive meningococcal disease	0	0	2	0	0	0	0	2	3	8	15
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	1	1	1	1	1	2	2	3	4	2	18
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 56. ASR (per 100,000 population), by disease and year, in Pilbara, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	22.8	11.6	28.2	18.9	15.5	26.8	28.5	25.1	15.9	21.8	23.3
Newly Acquired	-	-	1.3	1.4	-	1.5	-	-	1.8	3.1	0.9
Unspecified	22.8	11.6	26.9	17.5	15.5	25.3	28.5	25.1	14.1	18.7	22.4
Hepatitis C *(Total)*	33.0	39.1	27.6	35.9	24.1	30.3	32.0	18.9	25.4	17.8	30.1
Newly Acquired	-	2.8	3.7	3.3	-	-	3.6	2.2	4.9	3.8	2.7
Unspecified	33.0	36.2	23.8	32.6	24.1	30.3	28.4	16.6	20.4	14.0	27.4
Hepatitis D	-	-	-	-	-	-	-	-	-	-	-
ENTERIC DISEASES											
Botulism	-	-	-	-	-	-	-	-	-	-	-
Campylobacteriosis	51.2	60.5	38.4	47.5	69.4	117.9	80.4	83.2	79.4	116.7	74.3
Cholera	-	-	-	-	-	-	-	-	-	-	-
Cryptosporidiosis	19.3	33.7	15.0	24.6	25.5	54.0	26.7	30.9	10.6	19.9	26.1
Hepatitis A	1.6	-	-	-	-	1.2	-	-	-	-	0.3
Hepatitis E	-	-	-	-	-	-	-	-	-	-	-
Listeriosis	-	-	-	-	-	-	-	-	-	-	-
Paratyphoid fever	-	-	-	-	-	-	-	-	-	-	-
Rotavirus infection	39.2	12.4	37.7	43.9	37.1	48.3	4.0	56.0	23.2	17.5	31.8
Salmonellosis	61.9	94.8	101.7	79.2	76.0	93.4	86.4	122.9	92.6	99.0	91.5
Shiga toxin-producing *E. coli* infection	-	-	-	-	-	-	2.2	1.5	3.6	1.4	0.9
Shigellosis	17.9	7.5	6.3	4.0	4.8	14.3	11.2	55.0	48.6	21.6	19.1
Typhoid fever	-	-	-	1.4	1.3	-	-	-	-	1.4	0.5
Vibrio parahaemolyticus infection	-	-	-	-	-	-	1.2	3.2	-	4.4	1.1
Yersiniosis (other than plague)	1.3	-	-	-	-	3.7	1.3	-	-	-	0.7

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	638.0	576.8	637.4	647.2	596.7	593.5	613.3	597.4	564.7	641.7	646.4
Donovanosis	-	-	-	-	-	-	-	-	-	-	-
Gonococcal infection	419.4	359.1	308.6	351.9	214.3	299.3	391.1	327.7	379.1	386.0	358.3
Syphilis											
Infectious	5.8	5.8	0.9	1.8	0.0	2.4	2.1	1.4	81.1	171.6	27.2
Non-Infectious	1.5	8.3	4.2	3.6	4.1	1.3	13.4	4.0	21.5	25.8	9.9
Congenital	-	-	-	-	-	-	-	-	-	1.3	0.1
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	-	-	-	-
Haemophilus influenzae type b (invasive)	1.4	-	-	-	-	-	-	-	1.3	-	0.3
Influenza	113.1	119.8	194.3	119.7	198.6	195.9	1,039.9	320.8	171.4	832.2	315.3
Measles	1.5	-	-	-	-	-	-	-	-	-	0.1
Mumps	-	-	1.3	1.2	1.2	301.0	89.0	4.3	-	4.1	39.4
Pertussis	122.1	82.2	119.9	48.9	17.6	12.6	8.6	26.3	7.8	2.1	42.7
Invasive pneumococcal disease	23.9	44.8	46.1	40.8	27.8	10.7	78.1	23.6	41.5	48.1	37.5
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	-	1.4	-	-	-	-	-	-	-	-	0.1
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	-	-	-	-	-	-	-	-	-	-
Varicella											
Chicken pox	5.7	10.9	4.0	37.5	26.6	25.9	12.9	72.9	24.5	25.7	24.7
Shingles	35.7	19.8	7.4	33.0	54.7	49.6	85.1	56.2	72.4	82.5	49.0
Unspecified	28.7	16.2	16.3	7.6	3.7	1.4	7.1	0.0	6.2	0.0	8.6

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	5.4	12.6	6.8	42.0	3.9	2.4	1.4	14.2	2.9	1.4	9.4
Chikungunya virus infection	-	-	-	-	-	-	-	-	1.6	-	0.2
Dengue virus infection	22.1	5.9	18.1	13.6	17.7	10.4	14.6	3.6	5.7	12.4	12.6
Japanese encephalitis virus infection	-	-	-	-	-	-	-	-	-	-	-
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	-	-	1.6	-	-	-	2.7	1.0	1.2	4.0	1.0
Murray Valley encephalitis virus infection	-	3.9	-	-	-	-	-	-	-	-	0.4
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	59.3	81.3	43.1	22.8	153.9	55.5	12.6	98.1	18.5	25.8	56.5
Typhus	-	-	4.6	0.9	-	-	3.0	-	-	-	0.8
West Nile virus / Kunjin virus infection	-	-	-	-	-	-	-	-	-	-	-
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	-	-	-	-	-	-	-	-	-	-	-
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	-	-	-	-	-	-	-	-	-	-	-
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	-	-	-	-	-	-	-	-	-	-	-
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	-	1.3	-	-	-	-	-	-	-	-	0.1
Q fever	-	-	-	-	-	-	-	-	-	-	-

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Tularaemia	-	-	-	-	-	-	-	-	-	-	-
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-
Amoebic meningitis	-	-	-	-	-	-	-	-	-	-	-
Creutzfeldt-Jakob disease	-	-	-	7.7	0.0	0.0	0.0	0.0	1.4	0.0	1.0
Haemolytic uraemic syndrome	-	-	-	-	-	-	-	-	-	-	-
Legionellosis	4.4	2.7	12.4	5.2	1.2	2.1	-	1.4	1.4	-	3.0
Leprosy	-	-	-	-	-	-	-	-	-	-	-
Melioidosis	-	-	-	-	-	-	1.0	0.0	1.2	0.0	0.4
Invasive meningococcal disease	-	-	2.8	-	-	-	-	2.7	4.1	10.4	2.0
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	5.6	1.2	0.9	2.1	0.9	2.7	3.1	4.5	6.0	2.7	2.8
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 57. Number of notifications, by disease and year, in South West, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,649	N=1,872	N=1,785	N=1,673	N=2,115	N=2,230	N=2,132	N=2,253	N=2,201	N=3,100	N=21,011
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	17	14	18	25	13	18	19	10	21	13	168
Newly Acquired	0	1	1	4	1	3	2	5	2	2	21
Unspecified	17	13	17	21	12	15	17	5	19	11	147
Hepatitis C *(Total)*	82	75	84	52	80	71	77	67	63	81	731
Newly Acquired	6	7	6	6	9	7	3	0	2	4	51
Unspecified	76	68	78	46	71	64	74	67	61	77	680
Hepatitis D	0	0	0	0	0	0	0	0	0	0	0
ENTERIC DISEASES											
Botulism	0	0	0	0	0	0	0	0	0	0	0
Campylobacteriosis	211	170	162	167	249	239	271	251	283	265	2,268
Cholera	0	0	0	0	0	0	0	0	0	0	0
Cryptosporidiosis	17	39	7	36	26	20	14	18	17	28	222
Hepatitis A	5	0	1	0	5	1	0	1	1	0	14
Hepatitis E	0	0	0	0	0	0	0	0	0	0	0
Listeriosis	1	0	1	0	0	0	0	0	0	0	2
Paratyphoid fever	0	0	0	1	0	1	0	0	0	0	2
Rotavirus infection	39	6	14	10	29	37	4	18	7	26	190
Salmonellosis	97	80	79	77	94	98	136	128	135	146	1,070
Shiga toxin-producing *E. coli* infection	1	0	1	1	0	0	5	5	4	12	29
Shigellosis	5	3	2	1	3	1	4	7	5	4	35
Typhoid fever	3	2	0	0	0	0	0	1	0	0	6
Vibrio parahaemolyticus infection	1	1	1	1	1	1	0	0	0	0	6

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,649	N=1,872	N=1,785	N=1,673	N=2,115	N=2,230	N=2,132	N=2,253	N=2,201	N=3,100	N=21,011
Yersiniosis (other than plague)	0	0	0	0	2	2	0	1	0	2	7
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	506	590	537	548	563	579	561	521	567	570	5,544
Donovanosis	0	0	0	0	0	0	0	0	0	0	0
Gonococcal infection	17	19	21	20	31	56	95	86	97	157	599
Syphilis											
Infectious	0	3	2	1	0	1	8	8	7	3	33
Non-Infectious	1	3	8	0	1	3	2	4	6	5	33
Congenital	0	0	0	0	0	0	0	0	0	0	0
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	0	0	0	0
Haemophilus influenzae type b (invasive)	0	0	0	0	0	0	1	0	0	0	1
Influenza	76	57	153	94	340	317	330	445	379	1,348	3,539
Measles	0	1	0	0	1	0	0	0	2	6	10
Mumps	1	0	0	0	0	0	2	1	0	8	12
Pertussis	316	455	300	101	243	413	156	200	194	38	2,416
Invasive pneumococcal disease	17	11	6	14	10	6	19	10	12	17	122
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	0	0	1	0	0	0	0	0	0	0	1
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	1	0	0	0	0	1	0	0	0	2
Varicella											
Chicken pox	38	28	35	27	27	35	27	75	70	40	402
Shingles	83	71	93	62	74	100	126	205	235	235	1,284

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,649	N=1,872	N=1,785	N=1,673	N=2,115	N=2,230	N=2,132	N=2,253	N=2,201	N=3,100	N=21,011
Unspecified	28	33	30	85	91	87	96	10	4	0	464
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	5	15	26	96	9	10	2	11	10	3	187
Chikungunya virus infection	1	1	0	1	0	1	0	1	1	0	6
Dengue virus infection	33	19	25	55	42	38	47	10	7	22	298
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	3	3	5	6	1	4	5	0	0	1	28
Murray Valley encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	33	154	152	181	162	77	105	148	60	59	1,131
Typhus	2	3	4	3	1	1	2	1	4	3	24
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	0	0	0	0	0	0
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	0	0	0	0	0	0	0	0	0	0
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	1	0	1	0	1	0	3	1	0	0	7
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=1,649	N=1,872	N=1,785	N=1,673	N=2,115	N=2,230	N=2,132	N=2,253	N=2,201	N=3,100	N=21,011
Psittacosis	0	1	0	1	1	0	0	0	0	0	3
Q fever	1	1	1	0	1	0	1	0	2	0	7
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	0	1	0	0	1	0	2	2	0	1	7
Haemolytic uraemic syndrome	0	0	0	0	0	0	0	0	0	1	1
Legionellosis	3	7	7	5	7	8	5	2	2	4	50
Leprosy	0	0	0	0	0	0	0	0	0	0	0
Melioidosis	1	0	0	1	1	0	0	0	0	0	3
Invasive meningococcal disease	1	3	3	0	0	1	1	1	1	0	11
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	3	2	5	1	5	4	5	4	5	2	36
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 58. ASR (per 100,000 population), by disease and year, in South West, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	11.9	9.6	11.9	15.7	8.5	11.2	11.1	5.5	11.2	6.3	10.5
Newly Acquired	-	0.7	0.6	2.4	0.6	1.8	1.2	2.7	1.0	0.7	1.2
Unspecified	11.9	8.9	11.3	13.3	7.9	9.4	9.9	2.8	10.2	5.5	9.3
Hepatitis C *(Total)*	56.0	50.9	53.5	32.4	51.5	44.3	45.6	37.6	36.5	45.8	46.6
Newly Acquired	4.7	5.1	4.2	3.8	6.3	4.9	2.1	-	1.4	2.9	3.7
Unspecified	51.3	45.8	49.3	28.6	45.2	39.4	43.5	37.6	35.1	42.9	42.9
Hepatitis D	-	-	-	-	-	-	-	-	-	-	-
ENTERIC DISEASES											
Botulism	-	-	-	-	-	-	-	-	-	-	-
Campylobacteriosis	134.5	107.2	95.2	98.3	142.9	136.7	153.6	140.8	161.0	149.1	132.1
Cholera	-	-	-	-	-	-	-	-	-	-	-
Cryptosporidiosis	11.0	25.0	4.7	22.5	16.0	12.6	8.9	11.1	10.2	17.5	13.9
Hepatitis A	3.2	-	0.8	-	3.2	0.6	-	0.7	0.6	-	0.9
Hepatitis E	-	-	-	-	-	-	-	-	-	-	-
Listeriosis	0.5	-	0.5	-	0.0	-	-	-	-	-	-
Paratyphoid fever	-	-	-	0.6	-	0.4	-	-	-	-	0.1
Rotavirus infection	24.4	3.6	8.0	5.7	16.5	20.6	2.3	9.7	4.4	14.8	10.9
Salmonellosis	62.9	50.8	48.9	45.6	55.9	56.9	81.3	75.3	79.0	82.0	64.1
Shiga toxin-producing *E. coli* infection	0.7	-	0.8	0.7	-	-	2.4	2.9	2.9	6.4	1.7
Shigellosis	3.2	1.8	1.3	0.6	1.6	0.7	2.2	4.1	2.9	2.4	2.1
Typhoid fever	2.4	1.4	-	-	-	-	-	0.8	-	-	0.4
Vibrio parahaemolyticus infection	0.7	0.6	0.5	0.6	0.6	0.6	-	-	-	-	0.4
Yersiniosis (other than plague)	-	-	-	-	1.2	1.0	-	0.6	-	1.0	0.4

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	373.5	432.4	379.3	379.2	385.2	397.2	374.1	344.9	371.9	368.4	395.1
Donovanosis	-	-	-	-	-	-	-	-	-	-	-
Gonococcal infection	12.1	13.6	15.0	13.3	20.3	37.3	61.7	55.1	61.1	98.3	41.8
Syphilis											
Infectious	-	2.1	1.2	0.6	-	0.6	4.5	5.2	4.0	1.7	2.1
Non-Infectious	0.8	2.2	5.0	-	0.7	1.9	1.2	2.5	3.5	3.1	2.1
Congenital	-	-	-	-	-	-	-	-	-	-	-
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	-	-	-	-
Haemophilus influenzae type b (invasive)	-	-	-	-	-	-	0.6	-	-	-	-
Influenza	51.2	35.3	92.0	54.6	195.2	175.6	182.8	237.6	211.3	756.9	204.4
Measles	-	0.6	-	-	0.6	-	-	-	1.3	3.9	0.7
Mumps	0.7	-	-	-	-	-	1.0	0.7	-	5.4	0.8
Pertussis	200.4	280.5	181.6	59.5	139.5	233.9	88.4	115.2	112.4	22.4	141.2
Invasive pneumococcal disease	10.3	6.3	3.7	7.9	5.5	2.8	9.8	4.7	6.5	9.3	6.7
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	-	-	0.7	-	-	-	-	-	-	-	-
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	0.7	-	-	-	-	0.6	-	-	-	0.1
Varicella	-	-	-	-	-	-	-	-	-	-	-
Chicken pox	24.5	18.2	21.4	16.2	16.3	21.2	16.2	44.3	41.4	23.8	24.4
Shingles	50.8	41.4	54.1	35.0	40.1	51.6	65.2	105.5	118.9	123.9	69.6
Unspecified	17.1	19.4	17.3	49.5	49.8	48.2	49.9	4.5	2.3	0.0	25.7

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	3.2	9.0	15.8	56.0	5.0	5.4	1.4	5.8	5.6	1.7	10.8
Chikungunya virus infection	0.6	0.5	-	0.6	-	0.4	-	0.4	0.6	-	0.3
Dengue virus infection	21.0	12.2	16.0	32.6	26.1	22.4	27.9	5.8	5.1	12.9	18.1
Japanese encephalitis virus infection	-	-	-	-	-	-	-	-	-	-	-
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	1.9	1.9	3.1	3.6	0.4	2.5	3.0	-	-	0.4	1.7
Murray Valley encephalitis virus infection	-	-	-	-	-	-	-	-	-	-	-
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	21.0	95.2	93.4	105.7	94.1	44.5	61.2	83.8	34.7	32.6	66.5
Typhus	1.2	2.0	2.9	1.9	0.4	0.4	0.7	0.7	2.2	1.4	1.4
West Nile virus / Kunjin virus infection	-	-	-	-	-	-	-	-	-	-	-
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	-	-	-	-	-	-	-	-	-	-	-
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	-	-	-	-	-	-	-	-	-	-	-
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	0.8	-	0.7	-	0.6	-	1.6	0.8	-	-	0.4
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	-	0.4	0.0	0.7	0.7	-	-	-	-	-	0.2
Q fever	0.6	0.5	0.4	-	0.6	-	0.7	-	1.4	-	0.4

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
Tularaemia	-	-	-	-	-	-	-	-	-	-	-
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	-
Amoebic meningitis	-	-	-	-	-	-	-	-	-	-	-
Creutzfeldt-Jakob disease	-	0.6	-	-	0.4	-	0.8	0.9	-	0.4	0.3
Haemolytic uraemic syndrome	-	-	-	-	-	-	-	-	-	0.5	-
Legionellosis	1.7	4.3	3.5	3.1	3.6	3.7	2.3	0.8	0.7	1.8	2.5
Leprosy	-	-	-	-	-	-	-	-	-	-	-
Melioidosis	0.5	-	-	0.6	0.4	-	-	-	-	-	0.1
Invasive meningococcal disease	0.7	1.9	1.7	-	-	0.6	0.6	0.6	0.6	-	0.6
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	2.3	1.2	2.9	0.4	3.2	2.1	3.2	2.7	3.5	0.8	2.2
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 59. Number of notifications, by disease and year, in Wheatbelt, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=608	N=771	N=765	N=667	N=832	N=674	N=716	N=847	N=612	N=1,087	N=7,583
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	13	4	3	8	12	2	9	7	3	1	62
Newly Acquired	0	0	0	3	0	0	1	0	0	0	4
Unspecified	13	4	3	5	12	2	8	7	3	1	58
Hepatitis C *(Total)*	29	17	21	18	28	32	41	50	25	33	294
Newly Acquired	1	1	2	2	3	4	2	7	1	0	23
Unspecified	28	16	19	16	25	28	39	43	24	33	271
Hepatitis D	0	0	0	0	0	0	0	0	1	0	1
ENTERIC DISEASES											
Botulism	0	0	0	0	0	0	0	0	0	0	0
Campylobacteriosis	83	92	50	70	72	67	81	109	104	85	813
Cholera	0	0	0	0	0	0	0	0	0	0	0
Cryptosporidiosis	11	14	4	11	9	6	6	14	3	2	80
Hepatitis A	0	1	0	0	0	0	0	0	0	0	1
Hepatitis E	0	0	0	0	0	0	0	0	0	0	0
Listeriosis	0	0	0	0	0	0	1	0	1	0	2
Paratyphoid fever	0	0	0	0	0	0	0	0	0	0	0
Rotavirus infection	20	3	7	7	9	21	4	8	4	10	93
Salmonellosis	40	46	25	38	43	54	38	63	46	55	448
Shiga toxin-producing *E. coli* infection	0	0	0	0	0	0	0	1	1	5	7
Shigellosis	9	0	0	0	1	1	1	4	0	4	20
Typhoid fever	0	0	0	0	0	0	0	0	0	0	0
Vibrio parahaemolyticus infection	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=608	N=771	N=765	N=667	N=832	N=674	N=716	N=847	N=612	N=1,087	N=7,583
Yersiniosis (other than plague)	0	0	0	0	0	0	1	0	0	0	1
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	0	0	0	0	0	0	0	0	0	0	0
Chlamydial infection	162	199	206	185	200	173	174	177	153	181	1810
Donovanosis	0	0	0	0	0	0	0	0	0	0	0
Gonococcal infection	7	11	25	20	19	21	28	36	26	36	230
Syphilis											
Infectious	1	0	0	5	2	0	5	2	4	5	27
Non-Infectious	1	0	2	0	0	0	0	0	1	4	8
Congenital	0	0	0	0	0	0	0	0	0	0	0
VACCINE PREVENTABLE DISEASES											
Diphtheria	0	0	0	0	0	0	0	0	0	0	0
Haemophilus influenzae type b (invasive)	0	0	0	0	0	0	0	0	0	0	0
Influenza	68	81	186	59	215	135	156	141	96	525	1662
Measles	1	0	0	0	0	0	0	1	1	1	4
Mumps	1	0	0	0	0	1	8	0	0	1	11
Pertussis	48	157	74	70	32	27	21	33	20	11	493
Invasive pneumococcal disease	4	6	9	5	10	9	7	2	7	4	63
Poliovirus infection	0	0	0	0	0	0	0	0	0	0	0
Rubella	0	0	0	0	0	0	0	0	0	0	0
Smallpox	0	0	0	0	0	0	0	0	0	0	0
Tetanus	0	0	0	0	0	0	0	0	0	0	0
Varicella											
Chicken pox	21	7	12	8	26	3	9	15	18	18	137
Shingles	46	52	56	59	76	49	48	80	78	66	610

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=608	N=771	N=765	N=667	N=832	N=674	N=716	N=847	N=612	N=1,087	N=7,583
Unspecified	9	11	5	8	7	20	11	1	2	20	94
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	3	3	6	11	3	1	1	0	3	0	31
Chikungunya virus infection	0	0	0	1	2	1	0	0	0	0	4
Dengue virus infection	10	10	9	8	4	12	11	2	0	3	69
Japanese encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Kokabera virus infection	0	0	0	0	0	0	0	0	0	0	0
Malaria	4	0	0	0	1	0	0	3	0	2	10
Murray Valley encephalitis virus infection	0	0	0	0	0	0	0	0	0	0	0
Other flavivirus infection	0	0	0	0	0	0	0	0	0	0	0
Plague	0	0	0	0	0	0	0	0	0	0	0
Ross River virus infection	13	48	57	71	50	32	46	88	10	11	426
Typhus	0	1	1	0	0	1	0	1	0	1	5
West Nile virus / Kunjin virus infection	0	0	0	0	0	0	0	0	0	0	0
Yellow fever	0	0	0	0	0	0	0	0	0	0	0
Zika virus infection	0	0	0	0	0	0	0	0	0	0	0
ZOONOTIC DISEASES											
Anthrax	0	0	0	0	0	0	0	0	0	0	0
Brucellosis	0	0	0	0	0	0	0	0	0	0	0
Hendra virus infection	0	0	0	0	0	0	0	0	0	0	0
Leptospirosis	0	0	1	0	0	0	0	0	0	0	1
Lyssavirus infection (ABL, rabies, other)	0	0	0	0	0	0	0	0	0	0	0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
	N=608	N=771	N=765	N=667	N=832	N=674	N=716	N=847	N=612	N=1,087	N=7,583
Psittacosis	0	0	1	0	1	0	0	0	0	0	2
Q fever	2	1	1	3	1	2	5	2	1	2	20
Tularaemia	0	0	0	0	0	0	0	0	0	0	0
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2	0	0	2
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0	0	0	0
Creutzfeldt-Jakob disease	0	1	0	0	0	0	0	0	1	0	2
Haemolytic uraemic syndrome	0	0	0	0	0	0	0	0	0	0	0
Legionellosis	0	5	3	2	6	2	3	0	0	1	22
Leprosy	0	0	0	0	1	0	0	0	0	0	1
Melioidosis	0	0	0	0	0	0	0	0	2	0	2
Invasive meningococcal disease	2	0	0	0	0	0	0	1	0	0	3
Middle East respiratory syndrome coronavirus (MERS)	0	0	0	0	0	0	0	0	0	0	0
Severe acute respiratory syndrome (SARS)	0	0	0	0	0	0	0	0	0	0	0
Tuberculosis	0	1	1	0	2	2	1	4	1	0	12
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	0	0	0	0	0	0	0	0	0	0	0

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136

Table 60. ASR (per 100,000 population), by disease and year, in Wheatbelt, 2010 to 2019

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
BLOOD-BORNE VIRUSES											
Hepatitis B *(Total)*	18.3	5.9	4.3	10.6	16.2	3.2	13.6	10.8	4.5	1.3	8.9
Newly Acquired	-	-	-	3.6	-	-	1.6	-	-	-	0.5
Unspecified	18.3	5.9	4.3	7.0	16.2	3.2	11.9	10.8	4.5	1.3	8.4
Hepatitis C *(Total)*	44.4	26.2	32.3	25.3	39.6	43.7	57.4	68.9	35.6	47.3	42.7
Newly Acquired	1.8	1.7	3.1	3.3	4.9	6.3	1.9	11.5	1.6	0.0	3.7
Unspecified	42.6	24.5	29.3	22.0	34.8	37.5	55.5	57.5	34.0	47.3	39.0
Hepatitis D	-	-	-	-	-	-	-	-	1.3	-	0.1
ENTERIC DISEASES											
Botulism	-	-	-	-	-	-	-	-	-	-	-
Campylobacteriosis	109.8	118.0	66.4	91.8	84.9	85.4	100.2	136.4	132.9	110.4	103.2
Cholera	-	-	-	-	-	-	-	-	-	-	-
Cryptosporidiosis	14.9	18.9	6.3	13.5	13.1	8.7	9.5	20.0	5.1	3.0	11.4
Hepatitis A	-	1.9	-	-	-	-	-	-	-	-	0.2
Hepatitis E	-	-	-	-	-	-	-	-	-	-	-
Listeriosis	-	-	-	-	-	-	0.8	-	0.8	-	0.2
Paratyphoid fever	-	-	-	-	-	-	-	-	-	-	-
Rotavirus infection	25.5	3.4	9.0	8.7	12.5	26.7	4.9	11.5	6.2	12.5	12.0
Salmonellosis	56.7	65.3	31.7	48.4	55.5	69.5	48.0	86.6	55.8	82.0	59.5
Shiga toxin-producing *E. coli* infection	-	-	-	-	-	-	-	1.0	1.8	3.9	0.7
Shigellosis	12.8	-	-	-	1.6	0.7	1.3	5.1	-	6.3	2.8
Typhoid fever	-	-	-	-	-	-	-	-	-	-	-
Vibrio parahaemolyticus infection	-	-	-	-	-	-	-	-	-	-	-
Yersiniosis (other than plague)	-	-	-	-	-	-	0.8	-	-	-	0.1

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
SEXUALLY TRANSMISSIBLE INFECTIONS											
Chancroid	-	-	-	-	-	-	-	-	-	-	-
Chlamydial infection	280.5	350.0	353.0	313.0	345.4	301.8	298.1	306.7	271.2	320.9	321.0
Donovanosis	-	-	-	-	-	-	-	-	-	-	-
Gonococcal infection	12.0	18.5	40.7	30.8	32.8	35.1	45.4	59.3	41.6	62.6	38.7
Syphilis											
Infectious	1.6	-	-	7.3	2.2	-	8.0	2.7	6.1	8.1	4.3
Non-Infectious	0.9	-	2.5	-	-	-	-	-	0.8	6.6	1.1
Congenital	-	-	-	-	-	-	-	-	-	-	-
VACCINE PREVENTABLE DISEASES											
Diphtheria	-	-	-	-	-	-	-	-	-	-	-
Haemophilus influenzae type b (invasive)	-	-	-	-	-	-	-	-	-	-	-
Influenza	92.7	108.6	240.5	74.4	276.5	163.3	184.2	162.3	114.4	698.1	211.4
Measles	1.8	-	-	-	-	-	-	1.9	1.9	2.1	0.7
Mumps	1.4	-	-	-	-	1.8	13.5	-	-	0.7	1.7
Pertussis	63.8	219.0	93.0	91.8	43.1	33.4	26.6	45.7	27.4	13.9	66.7
Invasive pneumococcal disease	5.1	6.7	11.9	6.3	12.5	11.2	7.5	2.5	8.3	4.8	7.8
Poliovirus infection	-	-	-	-	-	-	-	-	-	-	-
Rubella	-	-	-	-	-	-	-	-	-	-	-
Smallpox	-	-	-	-	-	-	-	-	-	-	-
Tetanus	-	-	-	-	-	-	-	-	-	-	-
Varicella											
Chicken pox	28.9	9.2	16.7	12.6	37.1	4.9	13.9	22.8	27.0	26.5	19.9
Shingles	58.8	61.7	64.8	68.4	86.0	57.7	51.2	90.0	88.1	67.3	69.3
Unspecified	10.8	14.8	6.6	7.8	8.1	23.5	11.7	1.3	2.5	23.4	11.0

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
VECTOR-BORNE DISEASES											
*Barmah Forest virus infection	2.8	3.0	6.4	14.5	2.9	1.3	0.7	-	3.4	-	3.5
Chikungunya virus infection	-	-	-	1.1	2.2	1.1	-	-	-	-	0.5
Dengue virus infection	13.3	15.0	10.9	10.7	6.5	16.6	16.2	1.5	0.0	3.5	9.6
Japanese encephalitis virus infection	-	-	-	-	-	-	-	-	-	-	-
Kokabera virus infection	-	-	-	-	-	-	-	-	-	-	-
Malaria	5.1	-	-	-	1.4	-	-	3.9	-	1.4	1.2
Murray Valley encephalitis virus	-	-	-	-	-	-	-	-	-	-	-
Other flavivirus infection	-	-	-	-	-	-	-	-	-	-	-
Plague	-	-	-	-	-	-	-	-	-	-	-
Ross River virus infection	17.4	64.0	67.7	83.2	62.5	37.5	56.0	109.3	11.6	11.4	52.5
Typhus	-	1.6	1.8	-	-	0.8	-	1.3	-	1.9	0.7
West Nile virus / Kunjin virus infection	-	-	-	-	-	-	-	-	-	-	-
Yellow fever	-	-	-	-	-	-	-	-	-	-	-
Zika virus infection	-	-	-	-	-	-	-	-	-	-	-
ZOONOTIC DISEASES											
Anthrax	-	-	-	-	-	-	-	-	-	-	-
Brucellosis	-	-	-	-	-	-	-	-	-	-	-
Hendra virus infection	-	-	-	-	-	-	-	-	-	-	-
Leptospirosis	-	-	1.8	-	-	-	-	-	-	-	0.2
Lyssavirus infection (ABL, rabies, other)	-	-	-	-	-	-	-	-	-	-	-
Psittacosis	-	-	0.8	-	0.7	-	-	-	-	-	0.1
Q fever	2.1	1.4	1.4	4.1	1.4	2.6	5.6	1.9	0.7	2.5	2.4
Tularaemia	-	-	-	-	-	-	-	-	-	-	-

Disease	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2010 to 2019
OTHER DISEASES											
Acute post-streptococcal glomerulonephritis (APSGN)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2.7	-	-	0.3
Amoebic meningitis	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-	-	-	0.0
Creutzfeldt-Jakob disease	-	1.1	-	-	-	-	-	-	0.8	-	0.2
Haemolytic uraemic syndrome	-	-	-	-	-	-	-	-	-	-	-
Legionellosis	-	5.0	3.1	1.8	6.0	2.1	4.0	-	-	0.9	2.2
Leprosy	-	-	-	-	0.8	-	-	-	-	-	0.1
Melioidosis	-	-	-	-	-	-	-	-	1.9	-	0.2
Invasive meningococcal disease	2.7	-	-	-	-	-	-	1.4	-	-	0.4
Middle East respiratory syndrome coronavirus (MERS)	-	-	-	-	-	-	-	-	-	-	-
Severe acute respiratory syndrome (SARS)	-	-	-	-	-	-	-	-	-	-	-
Tuberculosis	-	1.2	1.1	-	2.2	2.5	1.1	7.3	1.2	-	1.6
Viral haemorrhagic fevers (Crimean-Congo, Ebola, Lassa, Marburg)	-	-	-	-	-	-	-	-	-	-	-

*Note: HIV not reported by region; false positive Barmah Forest virus infection notifications in 2013 have not been removed. See text on page 136