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## **Tuberculosis notifications in Australia, 2015–2018**

Amy Bright, Justin T Denholm, Chris Coulter, Justin Waring and Rick Stapledon on behalf of the National Tuberculosis Advisory Committee, for the Communicable Diseases Network Australia and the Australian Mycobacterium Reference Laboratory Network

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# Tuberculosis notifications in Australia, 2015–2018

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## Abstract

In 2018, the National Notifiable Diseases Surveillance System received 1,438 tuberculosis (TB) notifications, representing a rate of 5.8 per 100,000 population, consistent with the preceding three years. Australia has achieved and maintained good tuberculosis (TB) control since the mid-1980s, sustaining a low annual TB incidence rate of approximately 5 to 6 cases per 100,000 population. The number of multi-drug-resistant TB (MDR-TB) cases diagnosed in Australia is low by international standards, with approximately 2% of TB notifications per year classified as MDR-TB. Australia's overseas-born population continue to represent the majority of TB notifications (between 86% to 89% across the four reporting years) and the Aboriginal and Torres Strait Islander population continues to record TB rates around four to five times higher than the Australian-born Non-Indigenous population. Whilst Australia has achieved and maintained excellent control of TB in Australia, sustained effort is required to reduce local rates further, especially among Aboriginal and Torres Strait Islander populations, and to contribute to the achievement of the World Health Organization's goal to end the global TB epidemic by 2035.

Keywords: Australia, tuberculosis, Mycobacterium tuberculosis, communicable disease surveillance, epidemiology, annual report.

## Introduction

Australia has one of the lowest tuberculosis (TB) incidence rates in the world and has maintained excellent TB control for the last three decades. However, Australia's proximity to some of the highest TB incidence countries in the world and its large migrant intake from these regions means that continued vigilance is required to sustain and improve on Australia's already low TB incidence rate.

At the sixty-seventh World Health Assembly (WHA) in May 2014, the Australian Government endorsed the *Global strategy and targets for tuberculosis prevention, care and control after 2015*, also known as the World Health Organization (WHO) End TB Strategy.<sup>1</sup> At the first global Ministerial Conference on TB in November 2017, United Nations (UN) member states, including Australia, reaffirmed commitment to

the End TB Strategy. The End TB Strategy's goal is to end the global TB epidemic by 2035; it sets targets to reduce TB incidence by 90% and TB deaths by 95% worldwide by this time.<sup>2</sup>

Australia is well placed to achieve TB elimination with an excellent health care system and robust surveillance and governance frameworks already in place. However, like other low-incidence countries with positive migration policies, further reductions in domestic incidence rates are challenged by high rates of people movement and TB importation from high incidence settings. It is likely that the greatest reduction in Australia's TB incidence rates will be achieved through the improvement of TB control globally, in particular in the Western Pacific and South-East Asian regions.

Surveillance of TB in Australia is overseen by the National Tuberculosis Advisory Committee

(NTAC), a subcommittee of the Communicable Diseases Network Australia (CDNA). NTAC has the key role of providing strategic, expert advice to CDNA, and subsequently the Australian Government, on a coordinated national approach to TB control. NTAC also develops and reviews nationally-agreed policy and guidelines for the control of TB in Australia.

This report combines data from 2015–2018. It describes the epidemiology of notified cases of TB in Australia and includes some discussion on the factors that impact on the control of TB in Australia. Reporting of TB notifications in Australia ensures that Australia's TB control progress can be monitored and provides evidence to support the development of new TB control strategies.

## Methods

TB is a nationally notifiable disease in Australia and is monitored using the National Notifiable Disease Surveillance System (NNDSS). Medical practitioners, public health laboratories and other health professionals are required under state and territory public health legislation to report cases of TB to jurisdictional health authorities. The *National Health Security Act 2007* provides the legislative basis for the national notification of communicable diseases and authorises the exchange of health information between the Australian Government and state and territory governments. State and territory health departments transfer these notifications regularly to the NNDSS. The primary responsibility for public health action resulting from a notification resides with state and territory health departments.

The Tuberculosis Data Quality Working Group (TBDQWG), a working group of NTAC, has representation from states and territories, the Australian Government and the Australian Mycobacterium Reference Laboratory Network (AMRLN). It ensures routine and timely reporting of trends and emerging issues in TB. The TBDQWG is also responsible for maintaining

national consistency and currency in data standards and systems for TB surveillance that are relied upon to produce this report.

With the exception of the pre-migration screening data, the data presented in this report represent a point-in-time analysis of notified cases of TB in Australia. This report presents data extracted from NNDSS during February 2020. Due to the dynamic nature of the NNDSS, data in this report may vary from data reported in other NNDSS reports and reports of TB notifications at the state or territory level. Detailed notes on case definition, data collection, quality control and the categorisation of population subgroups are available in the 2007 annual report.<sup>3</sup>

In accordance with the Torres Strait Treaty, some Torres Strait Islanders and coastal people from Papua New Guinea (PNG) are allowed free movement (without passports or visas) within the northern Torres Strait Islands of Australia and PNG. This free movement is to allow for traditional activities to take place and does not include visits for health treatment.<sup>4</sup> However, at times, PNG nationals do still present with TB to Queensland health care clinics in the Torres Strait. In these instances, patients meeting the national case definitions for TB are notified in Australia, and identified in the NNDSS as 'Residents of the Torres Strait Protection Zone (TSPZ) accessing TB treatment in Queensland', but the patient is transferred back to PNG for supervised treatment provided they are well enough to travel.

This report presents data analysed by date of diagnosis, a derived field within the NNDSS. The methodology for date of diagnosis for TB changed in January 2014 and was applied to all notifications. The diagnosis date for TB is now equivalent to the notification received date,<sup>i</sup> whereas previously the diagnosis date represented the onset date or, where the date of

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i The date the notification of the disease was received by the Communicable Disease Section of the Health Authority (i.e. the date the notification was received by the state or territory health department).

onset was not known, the earliest of the specimen collection date, the notification date, or the notification receive date.

Reported rates were calculated using population data published by the Australian Bureau of Statistics (ABS). Overall population rates were calculated using midyear estimated resident population (ERP) data described by the *3101.0 - Australian Demographic Statistics, September 2019* dataset.<sup>ii</sup> Rates by country of birth were calculated using 2016 ERP data described by the *3412.0 - Migration, Australia, 2017–2018* dataset.<sup>iii</sup> Rates for population subgroups (i.e. overseasborn, Aboriginal and Torres Strait Islander peoples and Australianborn nonIndigenous) by age and by state and territory were calculated using 2016 ERP data described by the *3412.0 - Migration, Australia, 2017–2018* dataset. Note that ERP data by country of birth by state and territory are based on the 2016 Census as data are only available for Census years and ERP data for the Aboriginal and Torres Strait Islander population are also based on the 2016 Census data.

The pre-migration screening data represent a calendar year analysis of TB cases detected through the offshore pre-migration screening process. Cases of TB identified through this process are not included in the NNDSS as they are identified prior to entry to Australia. Pre-migration screening data are provided by the Australian Government Department of Home Affairs.

## Results

### Epidemiological situation in 2015–2018

In 2018, a total of 1,438 cases of TB were reported to the NNDSS, representing a rate of 5.8 cases per 100,000 compared with 1,249 cases (5.2 cases per 100,000) in 2015 (Table 1). Over the four year period the absolute number of cases rose by 15%,

ii <https://www.abs.gov.au/statistics/people/population/national-state-and-territory-population/sep-2019>.

iii <https://www.abs.gov.au/statistics/people/population/migration-australia/2017-18>.

with an 11% rise in the notification rate of TB (Table 2). A case classification (whether new or relapse) was reported for 99–100% of cases in each year: 2015 (99%; n = 1,242), 2016 (100%; n = 1,364), 2017 (99%; n = 1,430) and 2018 (99%; n = 1,433). Of those cases with a reported case classification, 95% were classified as new in 2015 (n = 1,185) and 2016 (n = 1,298), and 96% in 2017 (n = 1,376) and 2018 (n = 1,369) (Table 2). A case is classified as new when a patient has never been treated for TB or when a patient has been treated previously for less than one month. Relapse was reported in 57 cases in 2015, 66 cases in 2016, 54 cases in 2017 and 64 cases in 2018, with the majority of those cases across the four-year period having a treatment history of full or partial treatment overseas (Table 3).

In the last decade, the rate of TB in Australia has ranged from 5.2 per 100,000 in 2015 to 6.2 per 100,000 in 2010 and 2011. A small but steady rise was observed from 2003 to 2011, followed by a small decline to 2015, increasing again in recent years (Figure 1).

### Geographic distribution

In 2018, the Australian Capital Territory recorded a rate of 8.3 per 100,000 (n = 34), a 104% increase on the rate in 2015 (4.0 per 100,000) and the highest rate recorded in the Australian Capital Territory since the collection of NNDSS data commenced in 1992. The Northern Territory and Tasmania both recorded declining rates of TB between 2015 and 2018, with reductions of 34% and 32% respectively (Figure 2).

### Tuberculosis in the Australian-born population

In 2018, the rate of TB in the Australian-born population was the same as the preceding three years at 0.9 per 100,000, declining from 1.0 per 100,000 in 2015. The rate of TB in Aboriginal and Torres Strait Islander people born in Australia over the last four years was approximately between five and six times the rate of TB

**Table 1: Notifications of tuberculosis in Australia, 2013 to 2018, by state and territory and year**

State/Territory	Notification numbers						5 year mean <sup>a</sup>	Range <sup>a</sup>	
	2013	2014	2015	2016	2017	2018		Lower	Upper
ACT	18	30	16	24	24	34	22	16	30
NSW	443	475	444	533	542	509	487	443	542
NT	43	29	27	22	21	18	28	21	43
Qld	153	166	182	181	190	199	174	153	190
SA	69	48	85	86	74	83	72	48	86
Tas	8	9	13	9	10	9	10	8	13
Vic	377	447	351	366	442	450	397	366	447
WA	149	139	131	143	132	136	139	131	149
<b>Australia</b>	<b>1,260</b>	<b>1,343</b>	<b>1,249</b>	<b>1,364</b>	<b>1,435</b>	<b>1,438</b>	<b>1,330</b>	<b>1,249</b>	<b>1,438</b>

a Covers the period 2013 to 2017.

in the Australian-born Non-Indigenous population (Table 4). The rate of TB in the Australian-born Non-Indigenous population continues to remain relatively stable and has not exceeded 0.9 per 100,000 in the last decade. The rate of TB in the Aboriginal and Torres Strait Islander population has ranged from 3.8 to 7.5 per 100,000 in the last decade (Figure 3).

### Tuberculosis in the overseas-born population

Between 2015 and 2018, all but three cases were reported with country of birth information (2018, n = 1; 2017, n = 1; 2016, n = 0; and 2015, n = 1). The majority of cases across the four-year period were in people reported as overseas-born: 89% (n = 1,276) in 2018; 89% (n = 1,270) in 2017; 89% (n = 1,215) in 2016; and 87% (n = 1,082) in 2015 (Table 5). Between 2015 and 2018, the rate of TB in the overseas-born population was considerably higher than in the Australian-born population, by a factor of 17 to 20 times higher, consistent with historical trends (Figure 3).

### Country of birth

Over the last four years (2015–2018), the top five most frequently reported countries of birth for TB cases were India, Vietnam, the Philippines, China and Nepal. These five countries across the

last four years contributed to more than half of all the overseas-born cases (2018 = 52%; 2017 = 55%; 2016 = 55%; 2015 = 54%) (Table 5). In 2018, of the most frequently reported countries of birth listed in Table 6, those born in Papua New Guinea (92 per 100,000) Nepal (85 per 100,000) and Myanmar (79 per 100,000) recorded the highest estimated rates of TB.

Note that these estimated rates must be interpreted with caution, as temporary residents are included in Australia's TB notifications (the numerator) but may not be included in the Australian Bureau of Statistics' estimated resident population (the denominator).

**Table 2: Notified cases and rates of tuberculosis in Australia, 2015–2018, by case classification and state or territory**

State/ Territory	New cases		Relapse cases		Total cases <sup>a</sup>	
	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000
<b>2018</b>						
ACT	32	7.8	1	0.2	34	8.3
NSW	476	6.1	33	0.4	509	6.5
NT	17	6.9	1	0.4	18	7.3
Qld	189	3.8	10	0.2	199	4.0
SA	80	4.6	3	0.2	83	4.8
Tas	9	1.7	0	0.0	9	1.7
Vic	436	6.9	10	0.2	450	7.1
WA	130	5.0	6	0.2	136	5.3
<b>Australia</b>	<b>1,369</b>	<b>5.6</b>	<b>64</b>	<b>0.3</b>	<b>1,438</b>	<b>5.8</b>
<b>2017</b>						
ACT	21	5.1	3	0.7	24	5.8
NSW	519	6.6	21	0.3	542	6.9
NT	21	8.5	0	0.0	21	8.5
Qld	181	3.7	8	0.2	190	3.9
SA	71	4.1	3	0.2	74	4.3
Tas	9	1.7	1	0.2	10	1.9
Vic	428	6.8	14	0.2	442	7.0
WA	126	4.9	4	0.2	132	5.1
<b>Australia</b>	<b>1,376</b>	<b>5.6</b>	<b>54</b>	<b>0.2</b>	<b>1,435</b>	<b>5.8</b>
<b>2016</b>						
ACT	24	6.0	0	0.0	24	6.0
NSW	501	6.5	32	0.4	533	6.9
NT	21	8.5	1	0.4	22	9.0
Qld	171	3.5	10	0.2	181	3.7
SA	85	5.0	1	0.1	86	5.0
Tas	9	1.7	0	0.0	9	1.7
Vic	349	5.7	17	0.3	366	5.9
WA	138	5.4	5	0.2	143	5.6
<b>Australia</b>	<b>1,298</b>	<b>5.4</b>	<b>66</b>	<b>0.3</b>	<b>1,364</b>	<b>5.6</b>

State/ Territory	New cases		Relapse cases		Total cases <sup>a</sup>	
	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000
<b>2015</b>						
ACT	14	3.5	2	0.5	16	4.0
NSW	420	5.5	21	0.3	444	5.8
NT	24	9.8	3	1.2	27	11.0
Qld	179	3.7	3	0.1	182	3.8
SA	83	4.9	2	0.1	85	5.0
Tas	13	2.5	0	0.0	13	2.5
Vic	328	5.4	19	0.3	351	5.8
WA	124	4.9	7	0.3	131	5.2
<b>Australia</b>	<b>1,185</b>	<b>5.0</b>	<b>57</b>	<b>0.2</b>	<b>1,249</b>	<b>5.2</b>

a Total case numbers include 17 cases without a case classification (2018 = 5; 2017 = 5; 2016 = 0; and 2015 = 7).

**Table 3: Notified tuberculosis cases classified as relapse, 2015–2018, by treatment history**

Treatment History	Notifications (n)	Percentage of relapse cases (%) <sup>a</sup>
<b>2018</b>		
Relapse following full treatment only in Australia	16	25%
TB following partial treatment only in Australia	6	9%
Relapse following full or partial treatment overseas	42	66%
<b>2017</b>		
Relapse following full treatment only in Australia	16	30%
TB following partial treatment only in Australia	5	9%
Relapse following full or partial treatment overseas	33	61%
<b>2016</b>		
Relapse following full treatment only in Australia	20	30%
TB following partial treatment only in Australia	6	9%
Relapse following full or partial treatment overseas	40	61%
<b>2015</b>		
Relapse following full treatment only in Australia	18	32%
TB following partial treatment only in Australia	2	4%
Relapse following full or partial treatment overseas	37	65%

a Totals may not add up to 100% due to rounding.

Figure 1: Notification rates of tuberculosis, Australia, 1960–2018

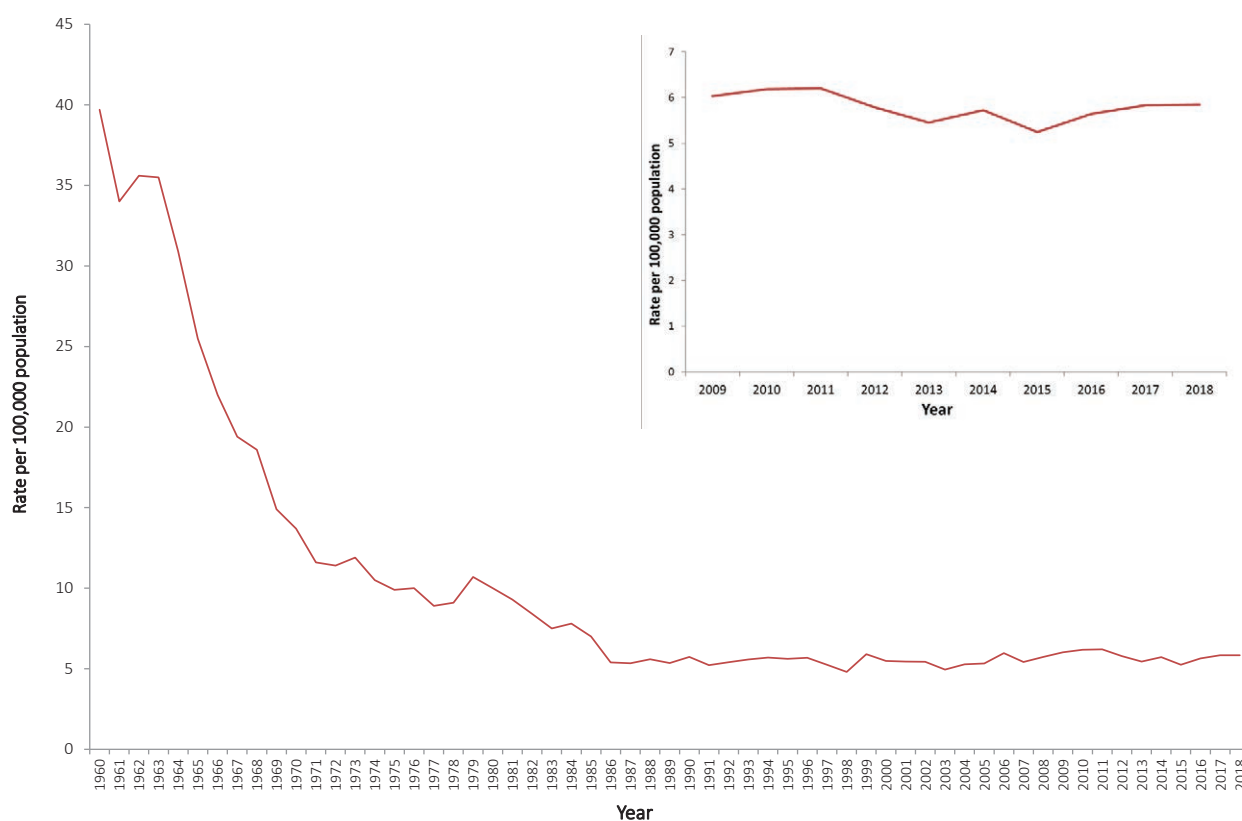


Figure 2: Notification rates of tuberculosis, Australia, 2011–2018, by state or territory

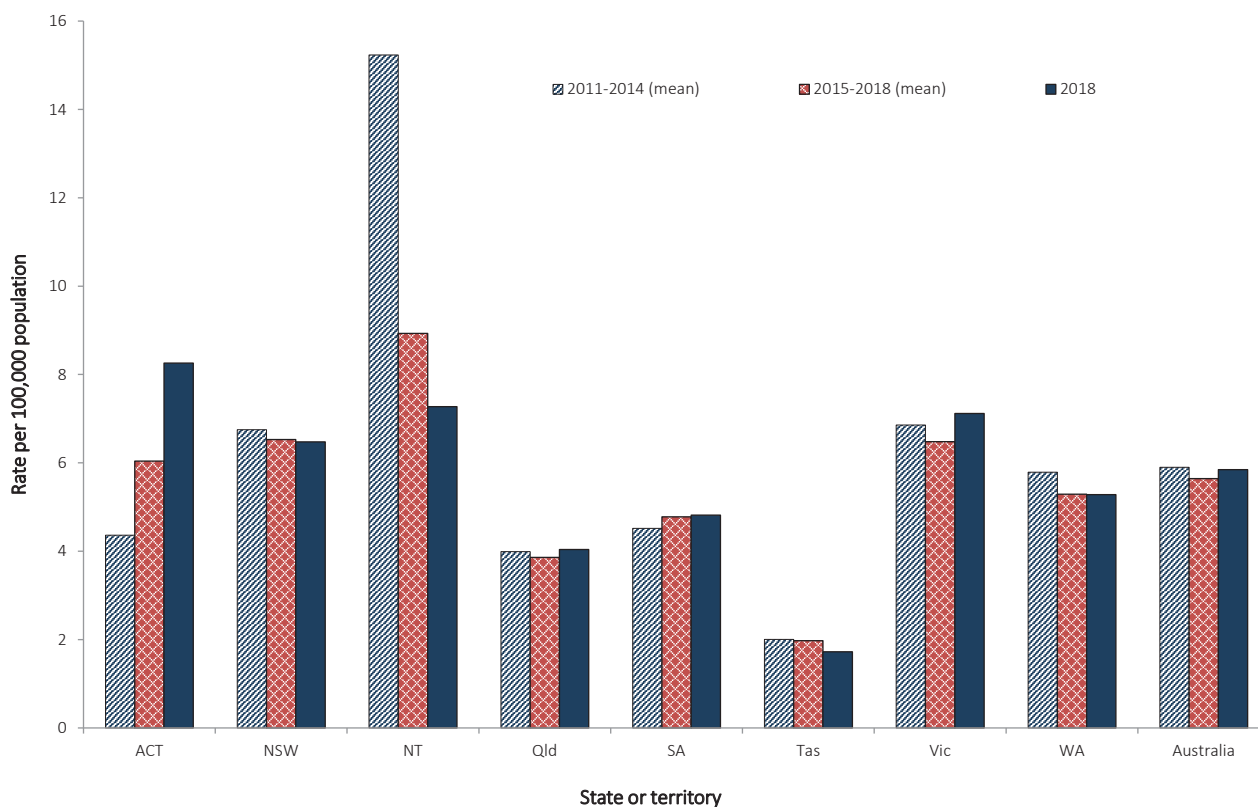


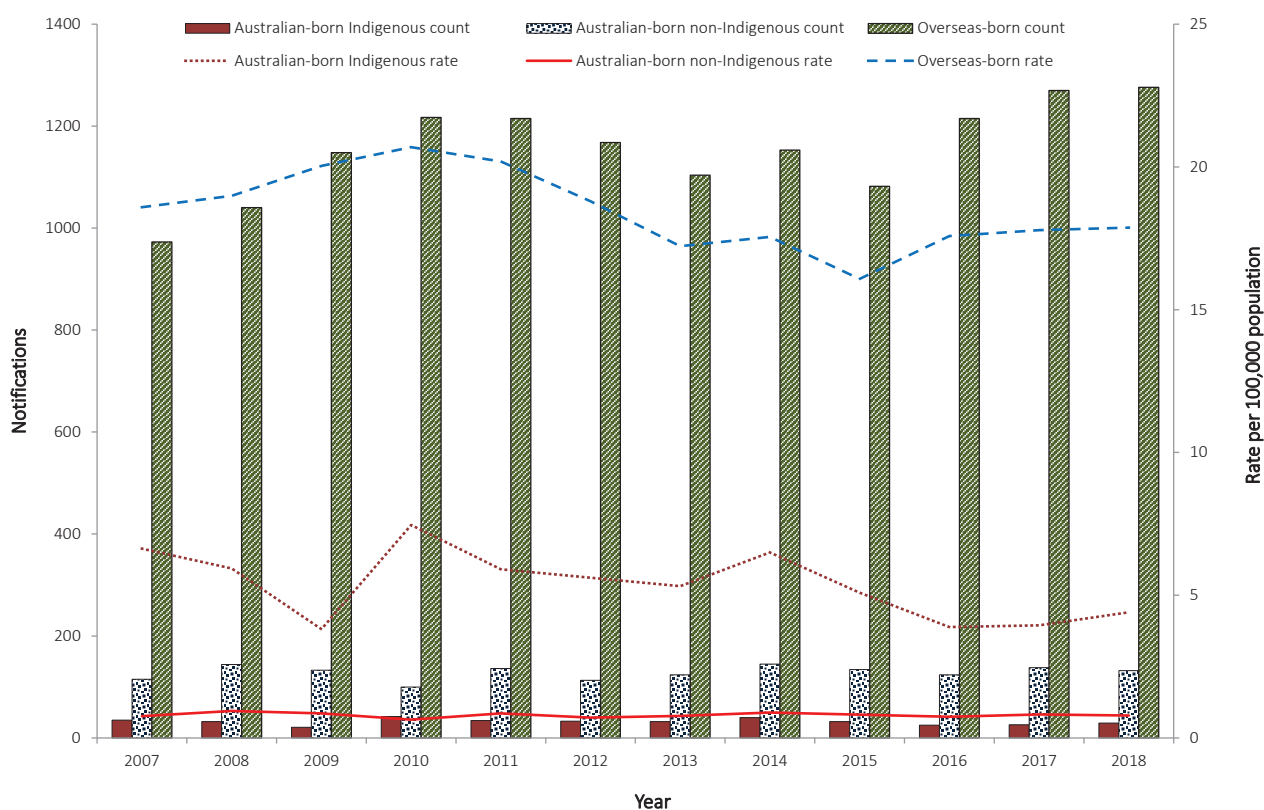
Table 4: Notified cases<sup>a</sup> and rates of tuberculosis in Australia, 2015–2018,<sup>a</sup> by population subgroup and state or territory

State or territory	Australian-born Indigenous		Australian-born Non-Indigenous		Overseas-born	
	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000
<b>2018</b>						
ACT	0	–	6	2.1	28	24.7
NSW	4	1.5	33	0.6	472	20.3
NT	4	5.4	3	2.6	11	19.8
Qld	14	6.3	18	0.5	167	14.6
SA	3	7.1	11	0.9	69	16.5
Tas	0	–	1	0.2	8	11.8
Vic	1	1.7	48	1.1	400	21.1
WA	3	3.0	12	0.8	121	13.5
<b>Australia</b>	<b>29</b>	<b>3.6</b>	<b>132</b>	<b>0.8</b>	<b>1,276</b>	<b>18.5</b>
<b>2017</b>						
ACT	0	–	0	–	24	21.1
NSW	5	1.9	45	0.9	492	21.1
NT	6	8.0	2	1.7	13	23.5
Qld	10	4.5	23	0.7	156	13.7
SA	1	2.4	11	0.9	62	14.8
Tas	0	–	4	0.9	6	8.8
Vic	2	3.5	42	1.0	398	21.0
WA	2	2.0	11	0.7	119	13.3
<b>Australia</b>	<b>26</b>	<b>3.3</b>	<b>138</b>	<b>0.8</b>	<b>1,270</b>	<b>18.4</b>

State or territory	Australian-born Indigenous		Australian-born Non-Indigenous		Overseas-born	
	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000
<b>2016</b>						
ACT	0	–	3	1.1	21	18.5
NSW	7	2.6	50	1.0	474	20.4
NT	7	9.4	2	1.7	13	23.5
Qld	8	3.6	21	0.6	152	13.3
SA	0	–	6	0.5	80	19.1
Tas	0	–	0	–	9	13.3
Vic	2	3.5	31	0.7	333	17.6
WA	1	1.0	9	0.6	133	14.9
<b>Australia</b>	<b>25</b>	<b>3.1</b>	<b>122</b>	<b>0.7</b>	<b>1,215</b>	<b>17.6</b>
<b>2015</b>						
ACT	0	–	3	1.1	13	11.5
NSW	3	1.1	46	0.9	395	17.0
NT	9	12.1	3	2.6	15	27.1
Qld	15	6.8	22	0.6	145	12.7
SA	0	–	8	0.6	76	18.1
Tas	0	–	0	–	13	19.2
Vic	1	1.7	39	0.9	310	16.4
WA	4	4.0	12	0.8	115	12.8
<b>Australia</b>	<b>32</b>	<b>4.0</b>	<b>133</b>	<b>0.8</b>	<b>1,082</b>	<b>15.7</b>

a Excludes one notification in 2018 (unknown COB); 1 notification in 2017 (unknown COB); two notifications in 2016 (Indigenous status unknown); and two in 2015 (One unknown COB and one Indigenous status unknown).

**Figure 3: Notified cases and rate of tuberculosis in Australia, 2007 to 2018, by population subgroup**



### Residency status

Residency status was available for 95% of overseas-born TB cases reported between 2015 and 2018 (2018: 1,215/1,276; 2017: 1,211/1,270; 2016: 1,156/1,215; 2015: 1,032/1,082). Residency status is self-reported at the time of diagnosis and is not verified against migration records. Across the four years, the majority of overseas-born cases reported with a residency status were reported as permanent residents: 58% in 2018 (705/1,215); 60% in 2017 (728/1,211); 61% in 2016 (703/1,156); and 61% in 2015 (633/1,032) (Table 6). The second-most-reported overseas-born residency status category was ‘overseas student’: 17% in 2018 (208/1,215); 18% in 2017 (216/1,211); 14% in 2016 (160/1,156); and 13% in 2015 (139/1,032).

(96%; 1,042/1,082). Of these cases in 2018, 44% (551/1,254) were diagnosed with active TB within four years of arrival in Australia, consistent with the preceding three years: 45% in 2017 (555/1,242); 45% in 2016 (525/1,164); and 44% in 2015 (460/1,042). Of those diagnosed within four years of arrival in Australia, the proportion of ‘overseas students’ in 2018 (33%; 184/551) was similar to the proportion in 2017 (34%; 189/555) but an increase from 26% in both 2016 (137/525) and 2015 (119/460) (Figure 4).

### Time between arrival in Australia and diagnosis

In 2018, data on year of arrival were available for 98% of overseas-born cases (1,254/1,276), the same as 2017 (98%; 1,242/1,270), increasing from 2016 (96%; 1,164/1,215) and 2015

**Table 5: Notified cases and rates of tuberculosis in Australia for frequently-reported countries of birth, 2015–2018, by residency status**

Country of birth	Residency status				Total cases <sup>a</sup>	Estimated resident population <sup>b</sup>	Estimated rate per 100,000 population	WHO incidence rate per 100,000 population <sup>c</sup>
	2018							
	International students	Permanent residents	Other					
India	33	110	60	220	592,310	37	199	
Philippines	10	84	42	143	277,510	52	554	
Vietnam	15	86	18	127	256,310	50	182	
China	16	54	15	90	650,700	14	67	
Nepal	52	11	14	80	94,470	85	151	
Indonesia	13	17	18	50	85,700	58	316	
Afghanistan	0	22	12	35	59,730	59	189	
Papua New Guinea	2	10	17	31	34,690	92	432	
Myanmar	2	20	7	29	36,900	79	338	
Pakistan	7	12	7	28	84,340	33	265	
Malaysia	10	7	9	28	173,680	16	92	
Thailand	3	15	8	27	79,040	34	153	
Sri Lanka	2	16	2	22	134,500	16	64	
Bangladesh	0	16	2	20	52,100	38	221	
New Zealand	0	17	1	20	568,290	4	7	
Other overseas-born	43	209	62	326				
Total overseas-born	208	706	294	1,276				
Australian-born	-	-	-	161				
Unknown country of birth	-	-	-	1				
<b>Total</b>	-	-	-	<b>1,438</b>				

Country of birth	Residency status			2017		Estimated resident population <sup>b</sup>	Estimated rate per 100,000 population	WHO incidence rate per 100,000 population <sup>c</sup>
	International students	Permanent residents	Other		Total cases <sup>a</sup>			
			Other	Other				
India	31	144	60		251	538,070	47	204
Philippines	12	96	37		152	265,780	57	554
Vietnam	21	91	12		133	250,590	53	188
China	24	48	16		92	606,310	15	68
Nepal	41	15	14		72	73,840	98	152
Indonesia	21	11	13		47	82,500	57	319
Malaysia	9	14	11		35	164,680	21	94
Thailand	8	14	9		31	76,220	41	156
PNG	5	8	15		27	34,630	81	432
Myanmar	2	16	8		26	35,490	73	355
Afghanistan	0	18	3		23	56,590	41	189
Bangladesh	4	14	4		23	49,160	47	221
Cambodia	0	20	2		23	36,190	64	326
Pakistan	9	10	3		22	76,580	29	267
Sri Lanka	2	14	4		20	129,530	15	64
Other OS born	27	196	56		293			
Total overseas-born	216	729	267		1,270			
Australian-born	-	-	-		164			
Unknown country of birth	-	-	-		1			
<b>Total</b>	-	-	-		<b>1,435</b>			

Country of birth	Residency status				Total cases <sup>a</sup>	Estimated resident population <sup>b</sup>	Estimated rate per 100,000 population	WHO incidence rate per 100,000 population <sup>c</sup>
	2016							
	International students	Permanent residents	Other					
India	31	132	72	251	489,410	51	211	
Philippines	6	90	37	141	252,690	56	554	
Vietnam	15	82	18	117	243,220	48	193	
China	14	65	11	92	557,690	16	70	
Nepal	32	15	13	63	58,980	107	154	
Indonesia	13	17	14	45	78,970	57	322	
Myanmar	2	21	10	33	34,070	97	372	
Thailand	9	13	7	30	71,250	42	160	
Pakistan	5	18	5	28	69,660	40	268	
Bangladesh	5	15	5	27	46,250	58	221	
Cambodia	1	20	1	24	35,100	68	347	
Malaysia	9	9	6	24	152,900	16	94	
PNG	1	10	10	22	34,260	64	432	
Somalia	0	14	8	22	9,220	239	270	
Afghanistan	0	13	8	22	53,670	41	189	
Other OS born	17	169	68	274				
Total overseas-born	160	703	293	1,215				
Australian-born	-	-	-	149				
Unknown country of birth	-	-	-	-				
<b>Total</b>	-	-	-	<b>1,364</b>				

Country of birth	Residency status				Total cases <sup>a</sup>	Estimated resident population <sup>b</sup>	Estimated rate per 100,000 population	WHO incidence rate per 100,000 population <sup>c</sup>
	2015							
	International students	Permanent residents	Other					
India	28	123	58	221	449,040	49	217	
Vietnam	9	94	19	125	235,590	53	199	
Philippines	10	53	31	98	241,130	41	550	
China	17	53	18	92	508,870	18	72	
Nepal	22	15	11	50	50,150	100	156	
Indonesia	15	17	7	40	77,000	52	325	
Myanmar	0	16	14	32	32,160	100	391	
PNG	2	9	20	31	33,510	93	432	
Sudan	1	16	5	23	19,730	117	88	
Thailand	7	6	8	23	66,400	35	163	
Bangladesh	1	15	3	23	43,090	53	221	
Cambodia	0	15	4	20	34,420	58	367	
Afghanistan	0	13	4	19	49,550	38	189	
Ethiopia	0	15	4	19	13,130	145	192	
Malaysia	4	6	7	18	143,420	13	90	
Other OS born	23	166	45	246				
Total overseas-born	139	632	258	1,080				
Australian-born	-	-	-	166				
Unknown country of birth	1	1	1	3				
<b>Total</b>	-	-	-	<b>1,249</b>				

a Total includes cases reported without a residency status.

b 2018 Population data is sourced from the Australian Bureau of Statistics' 3412.0 - Migration, Australia, 2017-2018 - Estimated Resident Population by Country of Birth - 1996 to 2018

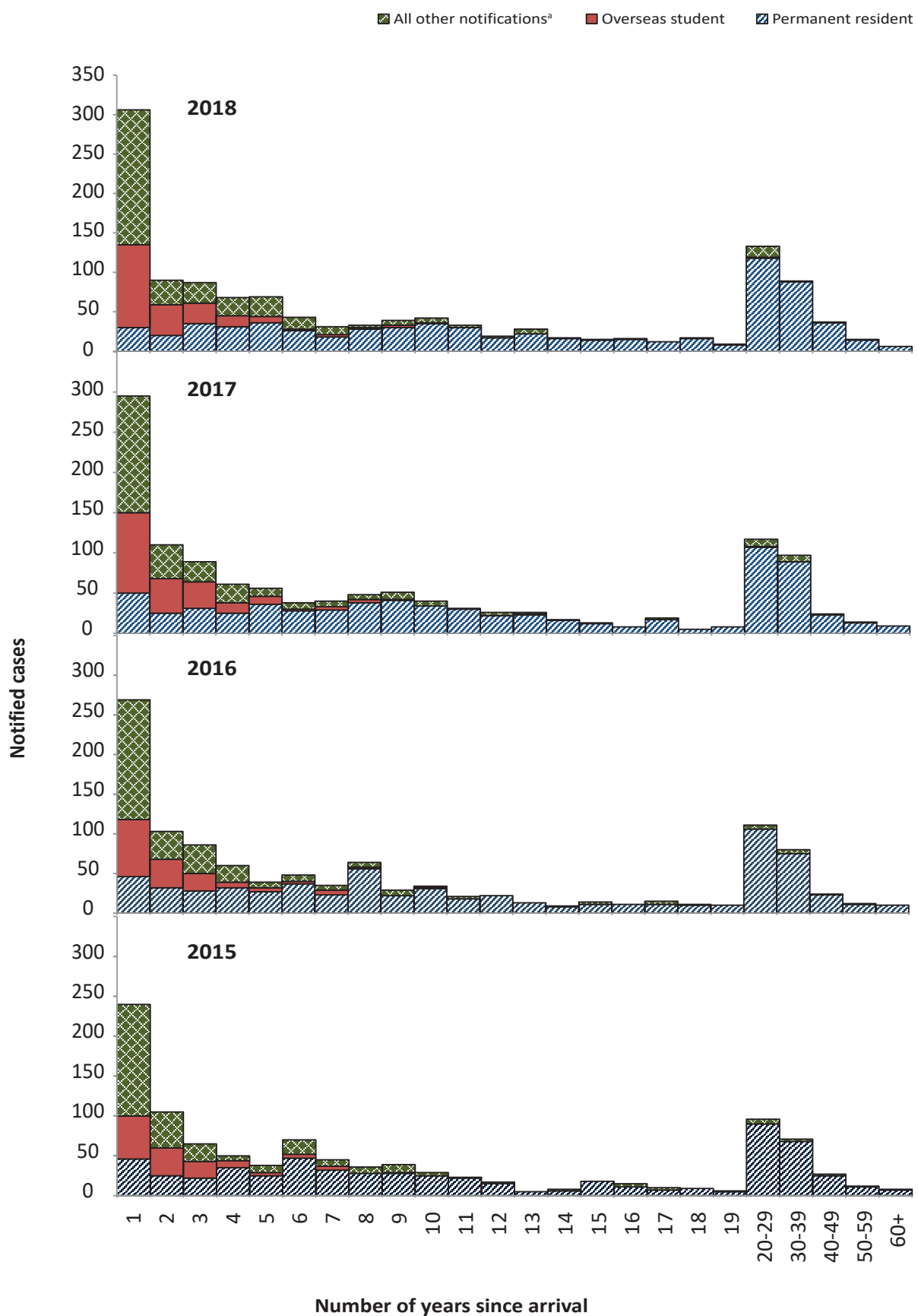
c Rates from the World Health Organization TB Burden Estimates, 2019.

Table 6: Notified cases of tuberculosis in overseas-born people in Australia, 2015–2018, by residency status and state or territory

Residency status	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Australia
<b>2018</b>									
Permanent resident	13	257	7	80	4	2	265	77	705
Refugee	0	13	0	17	11	1	7	0	49
Overseas student	2	102	0	18	12	2	54	18	208
Visitor	6	45	4	11	5	2	20	9	102
Other	6	38	0	27	1	1	42	15	130
Unauthorised person	0	4	0	1	1	0	1	1	8
Resident of the Torres Strait Treaty Zone accessing TB treatment in Queensland	N/A	N/A	N/A	13	N/A	N/A	N/A	N/A	13
Unknown or not reported	1	13	0	0	35	0	11	1	61
<b>Total overseas-born cases</b>	<b>28</b>	<b>472</b>	<b>11</b>	<b>167</b>	<b>69</b>	<b>8</b>	<b>400</b>	<b>121</b>	<b>1,276</b>
<b>2017</b>									
Permanent resident	17	298	7	80	2	0	250	74	728
Refugee	0	8	1	9	3	1	9	3	34
Overseas student	3	87	1	20	11	4	75	15	216
Visitor	3	49	4	12	12	1	14	4	99
Other	0	31	0	27	0	0	40	22	120
Unauthorised person	0	2	0	1	0	0	3	1	7
Resident of the Torres Strait Treaty Zone accessing TB treatment in Queensland	N/A	N/A	N/A	7	N/A	N/A	N/A	N/A	7
Unknown or not reported	1	17	0	0	34	0	7	0	59
<b>Total overseas-born cases</b>	<b>24</b>	<b>492</b>	<b>13</b>	<b>156</b>	<b>62</b>	<b>6</b>	<b>398</b>	<b>119</b>	<b>1,270</b>

Residency status	ACT	NSW	NT	Qld	SA	Tas	Vic	WA	Australia
<b>2016</b>									
Permanent resident	11	287	7	72	8	1	229	88	703
Refugee	0	7	2	16	11	2	6	2	46
Illegal foreign fisher	0	0	1	0	0	0	0	0	1
Overseas student	6	77	2	19	10	2	35	9	160
Visitor	2	46	0	19	9	2	12	9	99
Other	2	45	1	22	0	2	43	21	136
Unauthorised person	0	2	0	1	0	0	3	2	8
Resident of the Torres Strait Treaty Zone accessing TB treatment in Queensland	N/A	N/A	N/A	3	N/A	N/A	N/A	N/A	3
Unknown or not reported	0	10	0	0	42	0	5	2	59
<b>Total overseas-born cases</b>	<b>21</b>	<b>474</b>	<b>13</b>	<b>152</b>	<b>80</b>	<b>9</b>	<b>333</b>	<b>133</b>	<b>1,215</b>
<b>2015</b>									
Permanent resident	6	248	8	73	10	2	220	66	633
Refugee	0	7	1	12	10	6	10	2	48
Illegal foreign fisher	0	0	1	0	0	0	0	0	1
Overseas student	4	53	0	15	8	3	37	19	139
Visitor	1	36	4	17	13	1	13	12	97
Other	2	38	1	17	0	1	24	12	95
Unauthorised person	0	5	0	1	0	0	1	2	9
Resident of the Torres Strait Treaty Zone accessing TB treatment in Queensland	N/A	N/A	N/A	10	N/A	N/A	N/A	N/A	10
Unknown or not reported	0	8	0	0	35	0	5	2	50
<b>Total overseas-born cases</b>	<b>13</b>	<b>395</b>	<b>15</b>	<b>145</b>	<b>76</b>	<b>13</b>	<b>310</b>	<b>115</b>	<b>1,082</b>

Figure 4: Notified cases of tuberculosis in the overseas-born population in Australia, 2015–2018, by residency status and number of years since arrival



a All other notifications include those for whom residency status is unknown.

**Table 7: Notification rates of tuberculosis, Australia, 2015–2018, by population subgroup and age group**

Age group	Australian-born Indigenous		Australian-born Non-Indigenous		Overseas-born		Total	
	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000
<b>2018</b>								
0–4	0	–	21	1.5	7	10.4	28	1.8
5–14	0	–	7	0.3	14	4.2	21	0.7
0–14	0	–	28	0.7	21	5.3	49	1.1
15–24	4	2.6	18	0.8	200	29.1	222	7.0
25–34	5	4.4	13	0.6	365	27.9	384	10.6
35–44	9	10.3	11	0.5	217	19.2	237	7.3
45–54	5	6.2	9	0.4	136	12.8	150	4.8
55–64	2	3.8	22	1.2	133	14.2	157	5.6
65+	4	11.8	31	1.4	204	14.8	239	6.5
<b>2017</b>								
0–4	0	–	20	1.4	3	4.5	23	1.5
5–14	0	–	14	0.6	16	4.8	30	1.0
0–14	0	–	34	0.9	19	4.8	53	1.2
15–24	2	1.3	25	1.1	200	29.1	227	7.2
25–34	5	4.4	15	0.7	371	28.3	391	10.8
35–44	6	6.8	9	0.4	221	19.5	236	7.3
45–54	6	7.5	11	0.5	116	10.9	133	4.2
55–64	5	9.5	15	0.8	131	14.0	151	5.4
65+	2	5.9	29	1.3	212	15.3	244	6.6

Age group	Australian-born Indigenous		Australian-born Non-Indigenous		Overseas-born		Total	
	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000
	2016							
0-4	1	1.1	10	0.7	3	4.5	14	0.9
5-14	0	-	3	0.1	18	5.4	21	0.7
0-14	1	0.4	13	0.3	21	5.3	35	0.8
15-24	4	2.6	19	0.8	164	23.9	188	5.9
25-34	1	0.9	17	0.8	380	29.0	398	11.0
35-44	0	-	8	0.4	225	19.9	233	7.2
45-54	5	6.2	7	0.3	111	10.4	124	3.9
55-64	7	13.3	20	1.1	122	13.0	149	5.4
65+	7	20.6	38	1.7	192	13.9	237	6.5
2015								
0-4	2	2.1	16	1.1	7	10.4	25	1.6
5-14	2	1.1	8	0.3	11	3.3	21	0.7
0-14	4	1.5	24	0.6	18	4.5	46	1.0
15-24	3	1.9	27	1.2	154	22.4	184	5.8
25-34	3	2.6	17	0.8	338	25.8	359	9.9
35-44	7	8.0	7	0.3	184	16.3	198	6.1
45-54	10	12.4	14	0.7	99	9.3	123	3.9
55-64	2	3.8	16	0.9	121	12.9	139	5.0
65+	3	8.8	28	1.2	168	12.2	200	5.4

## Age and sex distribution

Age and sex were reported for all TB cases notified between 2015 and 2018. Similar to previous years, there were more males than females notified with TB, with females accounting for 49% in 2018; 46% in 2017; and 47% in both 2016 and 2015. Similar to previous years, TB was predominantly seen in young adults aged 25–34 years (2018: 10.6 per 100,000; 2017: 10.8 per 100,000; 2016: 11.0 per 100,000; and 2015: 9.9 per 100,000); this was driven by the high rates observed in overseas-born cases in this age group (Table 7).

## Tuberculosis in children aged under 15 years

One of the most important measures of TB control is the incidence in children aged less than 15 years, because these cases represent recent TB infection. This is especially important in Aboriginal and Torres Islander children in whom disease most likely reflects local transmission. Children aged less than 15 years contributed 3–4% of all TB cases across the four reporting years: 3% in 2018 (49/1,438); 4% in 2017 (53/1,435); 3% in 2016 (35/1,364); and 4% in 2015 (46/1,249) (Table 8). Australian-born Non-Indigenous children represented more than half the total cases in the 0–14 years age group across all reporting years with the exception of 2016: 57% in 2018 (28/49); 64% in 2017 (34/53); 37% in 2016 (13/35); and 52% in 2015 (24/46). Of the Australian-born Non-Indigenous children, the most frequently reported risk factor was having one or more parent born overseas (2018:  $n = 18$ ; 2017:  $n = 21$ ; 2016:  $n = 9$ ; and 2015:  $n = 15$ ) followed by having a 'household member or close contact with TB' (2018:  $n = 15$ ; 2017:  $n = 21$ ; 2016:  $n = 8$ ; and 2015:  $n = 13$ ). Note that more than one risk factor may be reported for each notified case of TB. The rate of TB in Australian-born Non-Indigenous children has remained relatively stable over the past decade (range: 0.3 to 0.9 per 100,000), whilst the rate in Aboriginal and Torres Strait Islander children (range: 0 to 2.6 per 100,000) has fluctuated over that time.

The rate of TB in overseas-born children has ranged from 4.5 to 8.8 per 100,000, but overall rates appear to have declined (Figure 5).

## Selected risk factors for tuberculosis

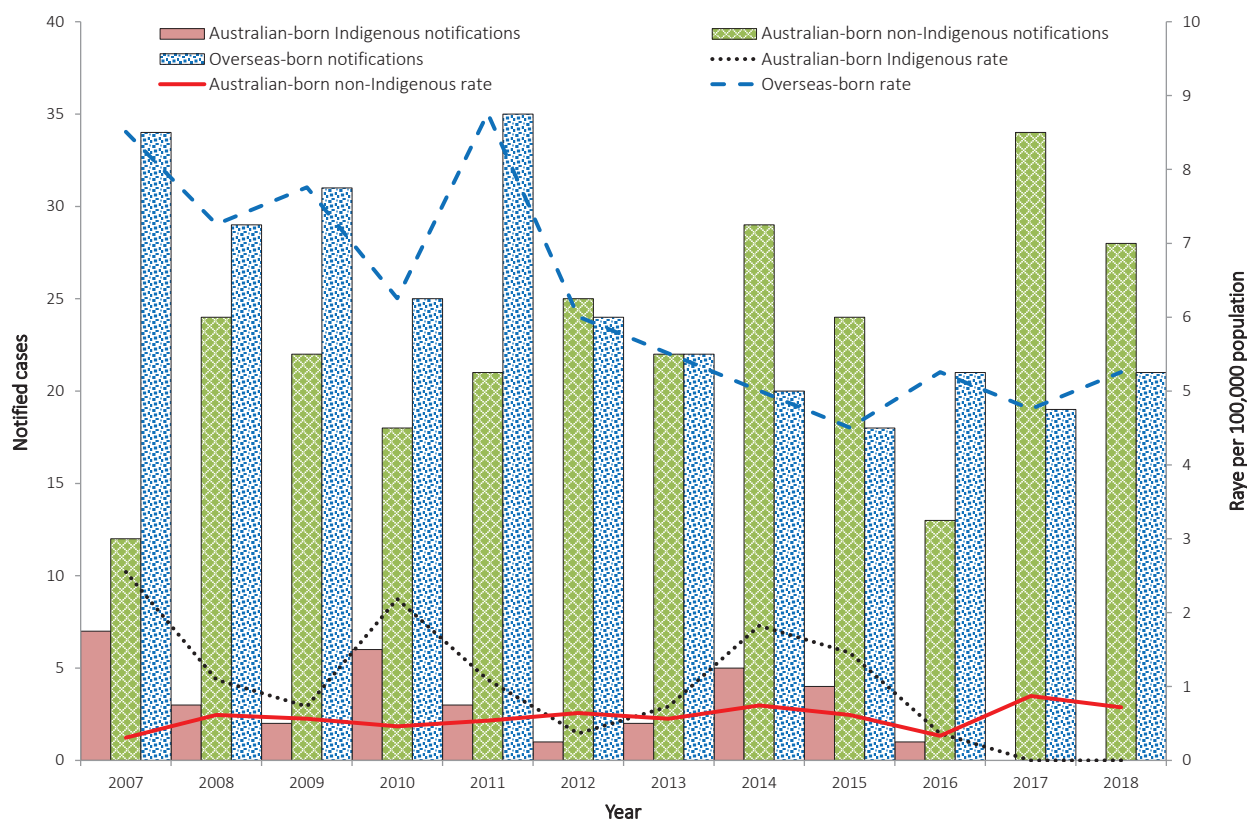
Selected risk factor data were provided for over 90% of notified cases reported between 2015 and 2018: (97% in 2018 (1,395/1,438); 97% in 2017 (1,397/1,435); 97% in 2016 (1,317/1,364); and 92% in 2015 (1,143/1,249). Of those cases assessed for risk factors, the most frequently-reported risk factor was past travel to or residence in a high-risk country: 76% in 2018 (1,065/1,395); 79% in 2017 (1,098/1,397); 78% in 2016 (1,032/1,317); and 77% in 2015 (883/1,143) (Table 8). When stratified by population subgroup, the most frequently reported known<sup>iv</sup> risk factor in both overseas-born cases and in Australian-born Non-Indigenous cases across the four reporting years was past travel to or residence in a high-risk country, while in Aboriginal and Torres Strait Islander cases, having a 'household member or close contact with TB' was more frequently reported).

There were 144 people who were currently or had previously worked in a health care setting in 2018; 124 in 2017; 133 in 2016; and 101 in 2015. Of these cases, 31% (45/144) in 2018 were reportedly working in a health care setting in Australia at the time of diagnosis or within 12 months of diagnosis; 39% (48/124) in 2017; 35% (46/133) in 2016; and 35% (35/101) in 2015. One case in 2018 reported working in an Australian healthcare as their only risk factor; four reported similarly in 2017, five in 2016 and eight in 2015. Of the cases reportedly working in a health care setting in Australia at the time of diagnosis or within 12 months of diagnosis, 42% (19/45) in 2018; 35% (17/48) in 2017; 54% (25/46) in 2016; and 46% (16/35) in 2015 were reported to have extrapulmonary disease only, which is generally not communicable.

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<sup>iv</sup> Excluding the category 'none of the above risk factors'.

**Figure 5: Notified cases and rate of tuberculosis in children aged 0–14 years in Australia, 2007–2018, by population subgroup**



## Tuberculosis and HIV status

People living with HIV are predisposed to re-activation of latent TB and rapid progression of the disease in recently acquired infection.<sup>5</sup> In Australia, it is recommended that all patients with TB are tested for HIV, and all HIV patients are tested for the presence of latent or active TB.<sup>5,6</sup> HIV testing history of notified cases of TB was reported for 98% of cases (n = 1,406) in 2018; 99% (n = 1,422) in 2017; 98% (n = 1,333) in 2016; and 97% (n = 1,211) in 2015. Of the cases with a reported HIV testing history, 89% of cases (1,255/1,406) in 2018 had a known HIV status; 88% (1,256/1,422) in 2017; 79% (1,051/1,333) in 2016; and 69% (841/1,211) in 2015. Of those cases with a known HIV status, 2% of cases (23/1,255) in 2018 were HIV positive; 2% (26/1,256) in 2017; 2% (21/1,051) in 2016; and 2% (20/841) in 2015 (Table 9).

**Table 8: Notified cases of tuberculosis,<sup>a</sup> Australia, 2015–2018, by population subgroup and selected risk factors**

Risk factor <sup>b</sup>	2018				Total
	Australian-born Indigenous	Australian-born Non-Indigenous	Overseas-born	Total	
Household or other close contact with TB	14	30	188	232	
Ever resided in a correctional facility <sup>c</sup>	4	1	7	12	
Ever resided in an aged care facility <sup>c</sup>	–	–	1	1	
Ever employed in an institution <sup>c,d</sup>	–	2	10	12	
Currently or previously <sup>c</sup> employed in health industry in Australia or overseas	–	22	122	144	
Ever homeless	5	2	7	14	
Past travel to or residence in a high-risk country	6	41	1,018	1,065	
Chest X-ray suggestive of old untreated TB	–	6	76	82	
Currently receiving immunosuppressive therapy	1	8	55	64	
Australian-born child with one or more parent born in a high-risk country	–	21	2	23	
None of the above risk factors	13	33	177	223	
<b>Total cases assessed for risk factors</b>	<b>28</b>	<b>125</b>	<b>1,242</b>	<b>1,395</b>	
	<b>2017</b>				
Household or other close contact with TB	11	40	153	204	
Ever resided in a correctional facility <sup>c</sup>	3	2	2	7	
Ever resided in an aged care facility <sup>c</sup>	–	1	1	2	
Ever employed in an institution <sup>c,d</sup>	–	1	13	14	
Currently or previously <sup>c</sup> employed in health industry in Australia or overseas	–	10	114	124	
Ever homeless	5	1	9	15	
Past travel to or residence in a high-risk country	3	41	1,054	1,098	

Risk factor <sup>b</sup>	Australian-born Indigenous	Australian-born Non-Indigenous	Overseas-born	Total
Chest X-ray suggestive of old untreated TB	1	3	56	60
Currently receiving immunosuppressive therapy	3	7	55	65
Australian-born child with one or more parent born in a high-risk country	–	23	1	24
None of the above risk factors	11	44	157	212
<b>Total cases assessed for risk factors</b>	<b>26</b>	<b>132</b>	<b>1,239</b>	<b>1,397</b>
<b>2016</b>				
Household or other close contact with TB	12	24	138	174
Ever resided in a correctional facility <sup>c</sup>	–	1	7	8
Ever resided in an aged care facility <sup>c</sup>	1	1	5	7
Ever employed in an institution <sup>c,d</sup>	2	–	12	14
Currently or previously <sup>c</sup> employed in health industry in Australia or overseas	1	13	119	133
Ever homeless	3	2	7	12
Past travel to or residence in a high-risk country	3	48	981	1,032
Chest X-ray suggestive of old untreated TB	–	2	37	39
Currently receiving immunosuppressive therapy	2	8	55	65
Australian-born child with one or more parent born in a high-risk country	–	14	2	16
None of the above risk factors	4	31	158	193
<b>Total cases assessed for risk factors</b>	<b>24</b>	<b>111</b>	<b>1,182</b>	<b>1,317</b>

Risk factor <sup>b</sup>	Australian-born Indigenous	Australian-born Non-Indigenous	Overseas-born	Total
	2015			
Household or other close contact with TB	17	29	133	179
Ever resided in a correctional facility <sup>c</sup>	2	3	7	12
Ever resided in an aged care facility <sup>c</sup>	-	-	3	3
Ever employed in an institution <sup>c,d</sup>	-	-	9	9
Currently or previously <sup>c</sup> employed in health industry in Australia or overseas	1	3	97	101
Ever homeless	3	2	8	13
Past travel to or residence in a high-risk country	2	43	838	883
Chest X-ray suggestive of old untreated TB	-	4	47	51
Currently receiving immunosuppressive therapy	-	9	39	48
Australian-born child with one or more parent born in a high-risk country	1	21	0	22
None of the above risk factors	9	29	98	136
<b>Total cases assessed for risk factors</b>	<b>27</b>	<b>119</b>	<b>997</b>	<b>1,143</b>

a Excludes cases with no reported risk factors and unknown country of birth.

b More than one risk factor may be reported for each notified case of TB.

c Within the preceding five years.

d Institution is defined as a correctional facility, aged care facility or homeless shelter.

Table 9: Notified cases of tuberculosis, Australia, 2015–2018, by population subgroup and HIV status

HIV testing history	2018				Unknown population subgroup	Total
	Australian-born Indigenous	Australian-born Non-Indigenous	Overseas-born			
HIV positive	0	3	20	0	0	23
HIV negative	26	93	1,113	0	0	1,232
HIV tested, result unknown	0	1	16	0	0	17
Not tested	2	30	97	0	0	129
Refused testing	0	0	5	0	0	5
<b>Total - known HIV testing history</b>	<b>28</b>	<b>127</b>	<b>1,251</b>	<b>0</b>	<b>0</b>	<b>1,406</b>
Total - unknown HIV testing history	1	5	25	1	1	32
<b>Total</b>	<b>29</b>	<b>132</b>	<b>1,276</b>	<b>1</b>	<b>1</b>	<b>1,438</b>
2017						
HIV positive	1	3	22	0	0	26
HIV negative	23	94	1,113	0	0	1,230
HIV tested, result unknown	0	2	13	0	0	15
Not tested	2	34	109	0	0	145
Refused testing	0	1	5	0	0	6
<b>Total - known HIV testing history</b>	<b>26</b>	<b>134</b>	<b>1,262</b>	<b>0</b>	<b>0</b>	<b>1,422</b>
Total - unknown HIV testing history	0	4	8	1	1	13
<b>Total</b>	<b>26</b>	<b>138</b>	<b>1,270</b>	<b>1</b>	<b>1</b>	<b>1,435</b>

HIV testing history	Australian-born Indigenous	Australian-born Non-Indigenous	Overseas-born	Unknown population subgroup	Total
HIV positive	0	2	18	1	21
HIV negative	24	81	925	0	1030
HIV tested, result unknown	0	7	88	0	95
Not tested	1	28	156	1	186
Refused testing	0	0	1	0	1
<b>Total - known HIV testing history</b>	<b>25</b>	<b>118</b>	<b>1,188</b>	<b>2</b>	<b>1,333</b>
Total - unknown HIV testing history	0	4	27	0	31
<b>Total</b>	<b>25</b>	<b>122</b>	<b>1,215</b>	<b>2</b>	<b>1,364</b>
2015					
HIV positive	0	0	20	0	20
HIV negative	26	77	717	1	821
HIV tested, result unknown	0	12	151	0	163
Not tested	6	39	156	1	202
Refused testing	0	0	5	0	5
<b>Total - known HIV testing history</b>	<b>32</b>	<b>128</b>	<b>1,049</b>	<b>2</b>	<b>1,211</b>
Total - unknown HIV testing history	0	5	33	0	38
<b>Total</b>	<b>32</b>	<b>133</b>	<b>1,082</b>	<b>2</b>	<b>1,249</b>

**Table 10: Notified cases of tuberculosis in Australia, 2015–2018, by site of disease and case classification**

Site	New cases	Relapse cases	Unknown case classification
<b>2018</b>			
Pulmonary			
<i>Pulmonary only</i>	700	45	2
<i>Pulmonary plus other sites</i>	171	5	2
<b>Pulmonary cases – Total</b>	<b>871</b>	<b>50</b>	<b>4</b>
Extrapulmonary only <sup>a</sup>			
<i>Pleural</i>	59	2	0
<i>Lymph nodes</i>	256	5	0
<i>Bone/joint</i>	28	1	0
<i>Genito/urinary</i>	30	0	0
<i>Miliary/disseminated</i>	14	0	0
<i>Meningeal</i>	13	1	0
<i>Peritoneal</i>	30	1	0
<i>Other</i>	97	3	1
<b>Extrapulmonary cases – Total</b>	<b>498</b>	<b>14</b>	<b>1</b>
<i>Unknown site of disease – Total</i>	2	1	0
<b>Total anatomical sites<sup>a,b</sup></b>	<b>1,609</b>	<b>69</b>	<b>7</b>
<b>Total cases</b>	<b>1,369</b>	<b>64</b>	<b>5</b>
<b>2017</b>			
Pulmonary			
<i>Pulmonary only</i>	687	32	1
<i>Pulmonary plus other sites</i>	168	6	0
<b>Pulmonary cases – Total</b>	<b>855</b>	<b>38</b>	<b>1</b>
Extrapulmonary only <sup>a</sup>			
<i>Pleural</i>	56	1	0
<i>Lymph nodes</i>	268	12	2
<i>Bone/joint</i>	30	0	1
<i>Genito/urinary</i>	21	0	0
<i>Miliary/disseminated</i>	12	0	0
<i>Meningeal</i>	17	0	0
<i>Peritoneal</i>	31	1	0
<i>Other</i>	108	2	0
<b>Extrapulmonary cases – Total</b>	<b>521</b>	<b>16</b>	<b>3</b>
<i>Unknown site of disease – Total</i>	5	0	0
<b>Total anatomical sites<sup>a,b</sup></b>	<b>1,604</b>	<b>60</b>	<b>4</b>
<b>Total cases</b>	<b>1,376</b>	<b>54</b>	<b>5</b>

Site	New cases	Relapse cases	Unknown case classification
<b>2016</b>			
Pulmonary			
<i>Pulmonary only</i>	679	38	0
<i>Pulmonary plus other sites</i>	154	5	0
<b>Pulmonary cases – Total</b>	<b>833</b>	<b>43</b>	<b>0</b>
Extrapulmonary only <sup>a</sup>			
<i>Pleural</i>	68	5	0
<i>Lymph nodes</i>	249	11	0
<i>Bone/joint</i>	25	0	0
<i>Genito/urinary</i>	18	0	0
<i>Miliary/disseminated</i>	8	1	0
<i>Meningeal</i>	6	0	0
<i>Peritoneal</i>	23	1	0
<i>Other</i>	92	6	0
<b>Extrapulmonary cases – Total</b>	<b>465</b>	<b>23</b>	<b>0</b>
<i>Unknown site of disease – Total</i>	3	0	0
<b>Total anatomical sites<sup>a,b</sup></b>	<b>1,496</b>	<b>67</b>	<b>0</b>
<b>Total cases</b>	<b>1,298</b>	<b>66</b>	<b>0</b>
<b>2015</b>			
Pulmonary			
<i>Pulmonary only</i>	633	29	6
<i>Pulmonary plus other sites</i>	122	5	0
<b>Pulmonary cases – Total</b>	<b>755</b>	<b>34</b>	<b>6</b>
Extrapulmonary only <sup>a</sup>			
<i>Pleural</i>	57	1	0
<i>Lymph nodes</i>	223	14	1
<i>Bone/joint</i>	25	5	0
<i>Genito/urinary</i>	28	1	0
<i>Miliary/disseminated</i>	4	0	0
<i>Meningeal</i>	8	0	0
<i>Peritoneal</i>	25	0	0
<i>Other</i>	83	2	0
<b>Extrapulmonary cases – Total</b>	<b>430</b>	<b>23</b>	<b>1</b>
<i>Unknown site of disease – Total</i>	4	0	0
<b>Total anatomical sites<sup>a,b</sup></b>	<b>1,349</b>	<b>62</b>	<b>7</b>
<b>Total cases</b>	<b>1,185</b>	<b>57</b>	<b>7</b>

a More than one extrapulmonary site may be reported for each notified case of TB.

b Includes anatomical sites from pulmonary cases with other sites of infection.

## Anatomical site of disease

Across the four reporting years (2015–2018), 99% of notified cases had a reported anatomical site of TB disease. Pulmonary disease was reported in 64% of cases (925/1,438) in 2018; 62% (894/1,435) in 2017; 64% (876/1,364) in 2016; and 64% (795/1,249) in 2015. Of those cases 81% in 2018 (747/925) were reported as having pulmonary disease only; 81% (720/894) in 2017; 82% (717/876) in 2016; and 84% (668/795) in 2015. Extrapulmonary disease only was reported in 36% of cases (513/1,438) in 2018; 38% (540/1,435) in 2017; 36% (488/1,364) in 2016; and 36% (454/1,249) in 2015. The most frequently-reported extrapulmonary only site of disease across the four reporting years was the lymph nodes (2018: n = 256; 2017: n = 268; 2016: n = 249; and 2015: n = 223). Of the more severe forms of TB, the numbers of cases of miliary and meningeal TB were higher in 2017 and 2018 than in 2015 and 2016 (Table 10).

In children aged less than 15 years, pulmonary disease was reported in 78% of cases (38/49) in 2018; 83% (44/53) in 2017; 71% (25/35) in 2016; and 80% (37/46) in 2015. Extrapulmonary disease only was reported in 22% of cases (11/49) in 2018; 17% (9/53) in 2017; 29% (10/35) in 2016; and 20% (9/46) in 2015. Of the extrapulmonary-disease-only cases, the most frequently-reported extrapulmonary site of disease was the lymph nodes (2018: n = 4; 2017: n = 2; 2016: n = 4; and 2015: n = 5). One case of meningeal TB was reported in 2018; two in 2017; one in 2016; and one in 2015. One case of miliary TB was reported across the four reporting years in 2018.

## Bacteriologically-confirmed cases

In 2018, 88% of cases (1,259/1,438) were laboratory confirmed as TB; in 2017 86% (1,235/1,435); in 2016 87% (1,190/1,364); and 88% (1,095/1,249) in 2015. The remaining cases in each of the reporting years were diagnosed using clinical and radiological evidence only. Of the total number of cases reported with pulmonary

disease in 2018,<sup>v</sup> 90% were bacteriologically confirmed (837/925); 89% (799/894) in 2017; 92% (805/876) in 2016; and 92% (729/795) in 2015. Of the bacteriologically-confirmed cases with pulmonary disease, 78% (650/837) were either sputum culture positive or bronchoscopy washings/aspirate culture positive in 2018; 77% (619/799) in 2017; 84% (678/805) in 2016; and 85% (622/729) in 2015.

Of the extrapulmonary-only cases, 82% (422/513) in 2018 were bacteriologically and/or histologically confirmed; 81% (435/540) in 2017; 79% (385/488) in 2016; and 81% (366/454) in 2015. Of those, 69% (293/422) in 2018 were 'other culture' positive;<sup>vi</sup> 75% (325/435) in 2017; 77% (296/385) in 2016; and 75% (276/366) in 2015. Cases with extrapulmonary disease only are generally not infectious and rarely are a source of transmission.<sup>7</sup>

## Children aged less than 15 years

In 2018, 61% of cases (30/49) in children aged less than 15 years were bacteriologically and/or histologically confirmed as TB; 49% (26/53) in 2017; 54% (19/35) in 2016; and 52% (24/46) in 2015. Of those, 73% (22/30) in 2018 were reported with pulmonary disease; 73% (19/26) in 2017; 74% (14/19) in 2016; and 71% (17/24) in 2015.

Of the extrapulmonary-only cases in children aged less than 15 years, 73% (8/11) in 2018 were bacteriologically and/or histologically confirmed; 78% (7/9) in 2017; 50% (5/10) in 2016; and 78% (7/9) in 2015. The WHO recommends that wherever possible, a diagnosis of TB in a child should be bacteriologically confirmed.<sup>8</sup>

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v Pulmonary cases include both pulmonary-only cases and pulmonary cases that also have extrapulmonary sites detected.

vi 'Other culture' includes specimens, other than sputum or bronchoscopy washings/aspirate, in which mycobacteria tuberculosis complex was isolated by culture, at the time of diagnosis.

**Table 11: Notified cases of tuberculosis with drug susceptibility testing (DST) results available, Australia, 2015–2018, by drug susceptibility profile**

Drug susceptibility testing (DST) profile	Notifications (n)	Percentage of notifications (%)
<b>2018</b>		
Resistance to at least one first line anti-tuberculosis agents <sup>a</sup>	133	12%
Mono-resistance to rifampicin <sup>b</sup>	4	<1%
Mono-resistance to isoniazid <sup>b</sup>	61	5%
MDR-TB <sup>c</sup>	27	2%
XDR-TB <sup>d</sup>	1	<1%
<b>Total cases with DST results</b>	<b>1132</b>	
<b>2017</b>		
Resistance to at least one first line anti-tuberculosis agents <sup>a</sup>	117	11%
Mono-resistance to rifampicin <sup>b</sup>	2	<1%
Mono-resistance to isoniazid <sup>b</sup>	56	5%
MDR-TB <sup>c</sup>	22	2%
XDR-TB <sup>d</sup>	0	–
<b>Total cases with DST results</b>	<b>1101</b>	
<b>2016</b>		
Resistance to at least one first line anti-tuberculosis agents <sup>a</sup>	130	12%
Mono-resistance to rifampicin <sup>b</sup>	3	<1%
Mono-resistance to isoniazid <sup>b</sup>	55	5%
MDR-TB <sup>c</sup>	25	2%
XDR-TB <sup>d</sup>	0	–
<b>Total cases with DST results</b>	<b>1068</b>	
<b>2015</b>		
Resistance to at least one first line anti-tuberculosis agents <sup>a</sup>	135	14%
Mono-resistance to rifampicin <sup>b</sup>	6	1%
Mono-resistance to isoniazid <sup>b</sup>	54	5%
MDR-TB <sup>c</sup>	29	3%
XDR-TB <sup>d</sup>	2	<1%
<b>Total cases with DST results</b>	<b>990</b>	

a Isoniazid, rifampicin, pyrazinamide, ethambutol and streptomycin.

b Mono-resistance is a case that is resistant to only the specified anti-TB agent and susceptible to all other anti-TB agents.

c Resistance to at least isoniazid and rifampicin but not XDR-TB.

d Resistance to isoniazid and rifampicin, and any of the fluoroquinolones, and to at least one of the three injectable second-line drugs.

## Drug-resistant tuberculosis in Australia

Drug susceptibility test (DST) results were available for just over three quarters of the TB cases notified across the four reporting years (2018: 79%, 1,132/1,438; 2017: 77%, 1,101/1,435; 2016: 78%, 1,068/1,364; and 2015: 79%, 990/1,249). Of those cases, 12% (133/1,132) in 2018 had resistance to at least one of the standard first line anti-tuberculosis agents reported; 11% (117/1,101) in 2017; 12% (130/1,068) in 2016; and 14% (135/990) in 2015. Rifampicin mono-resistance remained low and was reported in less than 1% of cases (0.4%, 4/1,132) for which DST results were available in 2018; 0.2% (2/1,101) in 2017; 0.3% (3/1,068) in 2016; and 0.6% (6/990) in 2015. Isoniazid mono-resistance was more common than rifampicin mono-resistance and was reported in 5% of cases with DST results available across all four reporting years (2018: 61/1,132; 2017: 56/1,101; 2016: 55/1,068; and 2015: 54/990). In 2018, there were 27 cases of MDR TB (2%, 27/1,132); 22 (2%, 22/1,101) in 2017; 25 (2%, 25/1,068); and 29 (3%, 29/990) in 2015. There was one case of extensively drug-resistant (XDR) TB reported in 2018 and two reported in 2015.<sup>vii</sup> No XDR TB cases were reported in 2016 and 2017 (Table 11). The majority of Australia's MDR TB and XDR TB cases are reported in the overseas-born population. Of the MDR TB cases in 2018, 74% (20/27) were reported in overseas-born persons; 91% (20/22) in 2017; 96% (24/25) in 2016; and 79% (23/29) in 2015. Four cases in 2018; one in 2017; none in 2016; and three in 2015 were born in Papua New Guinea, with all cases in 2018 and two in 2015 identified as residents of the TSPZ accessing TB treatment in Queensland. Of the remaining cases, the most commonly-reported countries of birth across the four reporting years were Vietnam, China, India and the Philippines, which is consistent with previous years. The XDR TB case reported in 2018 was in an overseas student born in Nepal who was diagnosed with pulmonary disease only but was sputum smear negative at

the time of diagnosis. No other risk factors were reported for this case. The two XDR TB cases reported in 2015 were in permanent residents, born in Myanmar and Vietnam. The case born in Myanmar was diagnosed with pulmonary disease and extrapulmonary site involvement (pleural) but was sputum smear negative at the time of diagnosis. This case reported travel to or through or residence in a high-risk country/countries other than Myanmar. The case born in Vietnam was diagnosed with extrapulmonary disease (lymph nodes) with reported travel to or through or residence in a high-risk country/countries other than Vietnam.

## Australian-born MDR TB

Of the Australian born MDR TB cases, in 2018 five of the seven cases reported pulmonary disease only and the remaining two cases were reported as having pulmonary disease with extrapulmonary site involvement. Of the two cases in 2017, one was reported with pulmonary disease only and one with extrapulmonary site only, in 2016 the single Australian-born case was reported as having pulmonary disease with extrapulmonary site involvement and in 2015 four out of the six cases had pulmonary disease only one had pulmonary disease and extrapulmonary site involvement and one had extrapulmonary sites only. Four of the Australian born MDR TB cases in 2018 and two cases in 2015 were reported as being Indigenous.

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vii Resistance to isoniazid and rifampicin, and any of the fluoroquinolones, and to at least one of the three injectable second-line drugs.

Table 12: Notified cases of tuberculosis, Australia, 2015–2017, by population subgroup and treatment outcome

Treatment outcome	Australian-born Indigenous		Australian-born Non-Indigenous		Overseas-born		Total	
	Notifications (n)	Percentage of notifications (%)	Notifications (n)	Percentage of notifications (%)	Notifications (n)	Percentage of notifications (%)	Notifications (n)	Percentage of notifications (%)
	2017		2016		2017		2016	
Cured	4	15%	6	4%	63	5%	73	5%
Completed treatment	15	58%	114	83%	1,037	82%	1,166	81%
Interrupted treatment <sup>a</sup>	0	0%	0	0%	3	0%	3	0%
Died of tuberculosis	3	12%	6	4%	11	1%	20	1%
Defaulted <sup>b</sup>	3	12%	2	1%	21	2%	26	2%
Failure <sup>c</sup>	0	0%	1	1%	0	0%	1	0%
Not followed up, outcome unknown	0	0%	1	1%	7	1%	9	1%
Transferred out of Australia	0	0%	0	0%	66	5%	66	5%
Died of other causes	1	4%	2	1%	38	3%	41	3%
Still under treatment	0	0%	6	4%	24	2%	30	2%
<b>Total</b>	<b>26</b>	<b>100%</b>	<b>138</b>	<b>100%</b>	<b>1,270</b>	<b>100%</b>	<b>1,435</b>	<b>100%</b>
Cured	2	8%	11	9%	57	5%	70	5%
Completed treatment	20	80%	89	73%	992	82%	1,102	81%
Interrupted treatment <sup>a</sup>	0	0%	2	2%	4	0%	6	0%
Died of tuberculosis	1	4%	3	2%	12	1%	16	1%
Defaulted <sup>b</sup>	0	0%	3	2%	18	1%	21	2%
Failure <sup>c</sup>	0	0%	0	0%	1	0%	1	0%
Not followed up, outcome unknown	0	0%	3	2%	2	0%	5	0%

Treatment outcome	Australian-born Indigenous		Australian-born Non-Indigenous		Overseas-born		Total	
	Notifications (n)	Percentage of notifications (%)	Notifications (n)	Percentage of notifications (%)	Notifications (n)	Percentage of notifications (%)	Notifications (n)	Percentage of notifications (%)
Transferred out of Australia	0	0%	0	0%	75	6%	75	5%
Died of other causes	1	4%	11	9%	37	3%	49	4%
Still under treatment	1	4%	0	0%	17	1%	19	1%
<b>Total</b>	<b>25</b>	<b>100%</b>	<b>122</b>	<b>100%</b>	<b>1,215</b>	<b>100%</b>	<b>1,364</b>	<b>100%</b>
<b>2015</b>								
Cured	3	9%	7	5%	53	5%	64	5%
Completed treatment	19	59%	108	81%	843	78%	970	78%
Interrupted treatment <sup>a</sup>	1	3%	1	1%	5	0%	7	1%
Died of tuberculosis	1	3%	3	2%	9	1%	13	1%
Defaulted <sup>b</sup>	1	3%	1	1%	16	1%	18	1%
Failure <sup>c</sup>		0%		0%		0%	0	0%
Not followed up, outcome unknown	0	0%	0	0%	7	1%	7	1%
Transferred out of Australia	0	0%	3	2%	67	6%	70	6%
Died of other causes	2	6%	5	4%	20	2%	27	2%
Still under treatment	5	16%	5	4%	62	6%	73	6%
<b>Total</b>	<b>32</b>	<b>100%</b>	<b>133</b>	<b>100%</b>	<b>1082</b>	<b>100%</b>	<b>1248</b>	<b>100%</b>

a 'Interrupted treatment' is defined as treatment interrupted for two months or more but completed.

b 'Defaulted' is defined as failed to complete treatment.

c 'Failure' is defined as sputum culture positive at five months or later.

**Table 13: Number of cases and case detection rates of tuberculosis identified through offshore pre-migration screening process, 2015–2018**

Year	Number of cases <sup>a</sup>	Case detection rate (estimated rate per 100,000 medical examinations)
2015	431	78
2016	445	76
2017	502	81
2018	614	94

a The number of cases includes cases newly diagnosed through the pre-migration screening process and cases that were already on treatment for TB at the time of screening.

Note: Comparison of pre-migration screening data to previous years should be interpreted with some caution.

## Treatment outcomes

The treatment outcomes of an annual patient cohort are reported in the following year’s annual report. This allows adequate time for all cases notified in a single year to begin treatment and for the treatment outcomes to be recorded in the NNDSS. Treatment outcomes for the 2015, 2016 and 2017 patient cohorts are reported in this annual report. Treatment outcomes for the 2018 patient cohort will be reported in the 2019 annual report.

In 2017, treatment success, which included those who completed treatment and were reported as cured, was reported in 86% of cases (1,239/1,435), consistent with historical trends (2016: 86%, 1,168/1,435; and 2015: 83%, 1,034/1,248).

Twenty (20) cases (1%) were reported to have died from TB in 2017; 16 cases (1%) in 2016; and 13 cases (1%) in 2015. Deaths due to TB were predominately people who were overseas-born (Table 12).

## Pre-migration health screening

The Migration Regulations 1994, enabled by the *Migration Act 1958*, stipulate that visa applicants must meet certain Public Interest Criteria; and these criteria include a stipulation that visa applicants must be free from TB or not be a “[.] threat to public health in Australia or a danger to the Australian community”.<sup>9</sup> Therefore, permanent resident visa applicants, and some

temporary resident visa applicants, are required to undergo offshore pre-migration screening which includes a medical examination and a chest x-ray to screen for active TB. Children aged less than 11 years of age are required to undergo a physical examination. Children aged 2 to 11 years from higher risk countries who are applying for permanent visas are also required to undergo either an Interferon Gamma Release Assay (IGRA) blood test or Tuberculin Skin Test (TST) and, if the result is positive, a chest x-ray. Visa applicants who are identified as having active TB during pre-migration screening are required to undergo treatment for the disease before entry to Australia. Children identified with latent TB (active TB excluded) are asked to present to a state- or territory-based TB service for assessment after migration but are not required to have latent TB treated before migration.

In 2018, there was a 22% increase in the number of TB cases detected through offshore pre-migration screening compared with 2017 (Table 13). In 2018, the highest rate of TB detected through offshore pre-migration screening was in the 65 to 69 year old age group (189 per 100,000). As was also seen for 2017, in 2018 the Philippines (n = 164) and India (n = 100) again made up over 40% of all TB cases detected in visa applicants. Nepal’s number of identified TB cases increased significantly in both 2017 and 2018: from 46 TB cases identified in 2017, 2018 saw an 85% increase in TB identified with 85 TB cases. Of the 614 TB cases detected through offshore

**Table 14: Australia milestones<sup>a</sup> to achieve TB elimination**

Goal	2018	Milestone	Targets	
		2020	2035	2050
To reduce overall TB incidence rate in Australia	5.8 per 100,000	3.1 per 100,000 (10% reduction per annum)	< 1 per 100,000	< 1 per million (WHO elimination target)
To reduce the rate of TB in Indigenous Australians	4.4 per 100,000	1.6 per 100,000 (20% reduction per annum)	< 1 per 1 million (WHO elimination target)	–
To reduce the rate of TB in Australian-born Non-Indigenous Australians	0.8 per 100,000	Maintain pre-elimination rates (< 1 per 100,000)	< 1 per million (WHO elimination target)	–

a The proposed annual reductions have been set to achieve the WHO elimination targets for low-incidence countries.

pre-migration screening in 2018, 80% were temporary visa applicants (n = 484) and 20% were permanent visa applicants (n = 130). This was perhaps a reflection of the increase of temporary visa immigration medical examinations (IME) from 515,687 in 2017 to 563,484 in 2018, whilst the permanent visa IME caseload decreased from 105,003 to 87,122 over the same period.

The largest number of TB cases identified within temporary visa applicants in 2018 were detected in the Visitor visa cohort (n = 231), followed by the Student visa cohort (n = 166). These rates follow a similar trend to 2017; however, 2018 volumes indicate an overall increase in both Visitor visa applicants (by 7%) and Student visa applicants (by 17%) compared to 2017.

Some form of drug resistance was observed in 10% of TB cases that underwent resistance testing in 2018 (n=33), detected through offshore pre-migration screening, while MDR-TB was reported in 10 of the 33 cases. A total of six cases of MDR-TB were identified in applicants from five different countries, Vietnam, Bhutan, China, India and Philippines.

## TB elimination

The rate of TB in Australia in 2015–2018 remains amongst the lowest recorded globally. Together with a relatively small number of other coun-

tries where TB incidence is < 10 per 100,000, Australia is in a position where TB elimination, defined as < 1 case per million population, may be feasible by 2050, noting that there is an ongoing risk of imported cases from countries with high TB incidence (Table 14).

Further information on Australia’s Strategic Plan for Control of TB can be found in *The Strategic Plan for Control of Tuberculosis in Australia, 2016–2020: Towards Disease Elimination*.<sup>viii</sup>

viii <https://www1.health.gov.au/internet/main/publishing.nsf/Content/ohp-ntac-tb-strat-plan.htm>

## Discussion

In many ways, the picture presented in this report is a familiar one for those engaged in TB services in Australia. Overall, the annual TB incidence between 2015 and 2018 has remained at less than 6 per 100,000, with low rates of multidrug resistance, low mortality and high treatment success. The considerable majority of TB cases continue to occur in migrants from higher incidence settings, with notifications in the Australian born population consistently less than 1 per 100,000. However, these relatively stable numbers risk masking the considerable activity occurring in TB services across Australia, and the substantial impact of the disease on individuals and families. They also stand in contrast with Australia's stated timeline for moving towards TB elimination by 2035, towards which little progress is yet evident. Careful review of this data, then, is important for consideration of opportunities to further strengthen TB management in Australia, particularly with relation to those groups at highest risk.

This report includes consolidated data from several years of TB notifications in Australia. While our intention is for future reports to return to an annual format, this current digest allows for comment on several important themes arising from across this period.

While most cases of TB in Australia are new, a small proportion of cases do occur after prior local treatment. Recurrent cases have historically often been assumed to represent relapse after initial therapy; however, it is increasingly recognised that a considerable proportion in some context relates to reinfection. In Australia, expansion of whole genome sequencing availability now means that more than 60% of isolates are routinely sequenced, with further programmatic incorporation planned. This will allow a greater capacity to distinguish relapse from reinfection, which we hope to include in future reports.

Several demographic groups are at increased risk of TB in Australia, and programmatic

responses must engage with relevant communities in ways that allow effective diagnosis, treatment and prevention to occur. Foremost are migrants to Australia, with > 88% of cases occurring in people born outside Australia. However, migrant communities are diverse, and health system responses must be more nuanced in their engagement and response. In this report, we note that migrants from India, the Philippines and Vietnam contributed more than a third of Australian notifications in 2018, highlighting the importance of considering these communities in national planning. In line with increased population size, the total numbers of TB cases continues to grow. TB services must accordingly expand, reflecting both increased numbers of cases and the diverse patient populations which they serve. We also note that around 15% of TB cases in 2015–2018 occurred in international students, who may benefit from additional support through prevention and early detection efforts. Although the burden of TB in Australian Aboriginal and Torres Strait Islander people is low (3.6 per 100,000 in 2018), it is more than four times the rate of disease in other Australian-born people. 'Closing the Gap' in TB notifications calls for a better understanding of TB in Aboriginal and Torres Strait Islander communities. While this should involve a closer consideration of TB epidemiology, a better understanding of the social determinants of TB and the holistic impact of both TB disease and response is warranted.

TB antimicrobial resistance (AMR) is a significant barrier to TB elimination and a substantial component of AMR epidemiology globally. At approximately 2% of notified cases where DST was performed, MDR-TB remains uncommon in Australia. Failure to address emerging drug resistance in our region may lead to an increasing number of drug-resistant cases in the Australian migrant population; but over the reporting period, both isoniazid resistance and MDR tuberculosis resistance remain low and stable.<sup>10</sup> Of Australian-born MDR-TB cases in 2015–2018, 6 of 19 cases were in Aboriginal and/or Torres Strait Islander people. Careful epidemiological analysis and application of

next-generation sequencing technologies should be applied jurisdictionally to understand the reasons for any MDR-TB cases in Australian-born people including Aboriginal and Torres Strait Islander people.

The detrimental synergies between TB and HIV coinfection are well-recognised, and Australia continues to have low rates of coinfection. Historically, Australia has had limited data reporting regarding HIV infection in people with TB, related both to low levels of reported testing and to policy impediments to centralised data collection. Across the 2015–2018 reporting period, significant improvement has been seen, with the proportion of cases with known HIV status increasing from 69% to 89%. This increase in testing and reporting has not been accompanied by an increase in the number or proportion of people with HIV/TB coinfection, which has remained  $\leq 2\%$  across this period.

As most TB notifications in Australia are connected with international migration, inclusion of pre-migration screening information in this report provides useful insight. Over the reporting period, both the absolute number and rate of TB diagnoses have increased in pre-migration assessments. By 2018, the rate of TB diagnosis was  $> 90$  per 100,000 applicants, which is 16-fold higher than the Australian annual incidence. This underscores the value of pre-migration testing for active TB, both in facilitating access to care for applicants and in reducing the TB burden in Australia after arrival. We also note the expansion of pre-migration testing during this period to include LTBI assessment for children in the 2–11 years age group. The impact of such assessment, and evaluation of the health value of testing other groups for latent TB infection as part of pre-migration evaluation, will be considered in future investigations.

Australia's national system for recording and reporting TB remains strong, but this report also allows an opportunity to consider data that are not available or presented here. No systematic data collection has occurred regarding the financial impact of TB in Australia, for example, and availability of this information would enhance understanding of the burden of TB in

our context. While information is presented here on TB mortality, greater standardisation of definitions would be valuable, as would systematic collection of data on TB morbidity.

Overall, while the consistency of TB incidence and good clinical outcomes reported here support continuation of current service models, this very stability in light of limited progress towards TB elimination invites consideration of alternative approaches to disease prevention and a consideration of how disease importation can be minimised. Future reports will seek to include data on additional program indicators, including latent TB management, and will continue to monitor Australian TB program activity and outcomes towards elimination.

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