Government of Western Australia
North Metropolitan Health Service
Mental Health, Public Health and Dental Services

Western Australian Tuberculosis Control Program

Tuberculosis notifications in Western Australia, 2018

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EXECUTIVE SUMMARY

The number of tuberculosis (TB) notifications and the TB incidence rate in Western Australia (WA) in 2018 is very similar to the previous 4 years. Though there was an increase in TB numbers in 2012 to 2014, the trend over the last 10 years is of no statistically significant change. The rate of 5.2 cases per 100 000 population annually is close to the lowest reported TB incidence in the world and equivalent to the rate for all of Australia.

The enhanced surveillance data for TB collected and analysed in this report also describe stable characteristics in presentation of the disease. TB mostly occurs in young adults (20 – 50 years old) who are migrants from countries where TB is common (89%) and have usually arrived within the last 5 years (46%). They more often live in Perth, but there is a significant minority (15%) living in country WA. Slightly more than half had pulmonary TB (56%) with 60% of these being sputum smear positive, the more infectious form of TB. HIV co-infection remains rare with no reported cases in 2018. Drug resistance is also uncommon and, for unclear reasons, has been declining over the last 6 years. The outcome data reported for 2017 also demonstrates a consistently high rate of success (95%), though in this year slightly more cases defaulted from treatment (3) or died of TB (3, case fatality rate = 2.4%) before successful completion.

The stability of this data is good evidence of sustained TB control in WA. However, WA has signed up to The Strategic Plan for Control of Tuberculosis in Australia, 2016–2020: Towards Disease Elimination, which, as the name suggests, aims to eliminate TB in Australia, and the data in this report do not show a decline in incidence. The cluster analysis of TB genotype on cultured specimens that has been included in these reports for 3 years consistently shows minimal evidence of transmission of TB in WA. On the contrary, the vast majority of TB cases are considered to have not acquired their TB in WA, but rather are reactivating latent TB infection (LTBI) that was acquired in their country of origin. Therefore, the key to reducing future TB in WA is to detect and treat LTBI to prevent TB developing.

In response to the recognition of the importance of LTBI this report has two new and important sections that go beyond reporting of notification data. Firstly, the LTBI diagnosed and the outcome of treatment at the Anita Clayton Centre is reported. The program achieves an excellent completion rate (81.4%), but recognises the need to expand testing of recently arrived migrants from high risk countries. Secondly the contact tracing activity done by the TB Program is reported, demonstrating the considerable workload that this involves and appropriate levels of identification of secondary cases of LTBI and TB. In furfure reports the TB Program aims to expand the analysis of these data to increase the extent and targeting of these two public health activities.

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Acknowledgements: This report is largely based on data drawn from the TB notifications in the WA Notifiable Infectious Diseases Database (WANIDD), which is maintained by the Communicable Diseases Control Directorate. The report has been reviewed and endorsed by the Western Australian Tuberculosis & Leprosy Advisory Council (WATLAC).

TB in WA: 2018 SNAPSHOT

- Number of notifications = **136**
- Incidence rate = **5.2/100,000** population
  - Similar to 2017 rate (5.1/100,000)
- Australian-born population: slight increase = **1.0/100,000** population, 0.8/100,000 in 2017
  - Proportion Aboriginal cases = **20% (3.7/100,000)**, increased from 15% in 2017.
- Overseas-born population: **89%** of cases
  - Nearly half (46%) present within **5 years** of arrival.
  - Residency status: permanent residents = **64%**, overseas students =**15%**
- Geospatial distribution: wide: 36 Local Government Areas
  - Most in Perth metropolitan area **85%**, (86% in 2017)
  - Regional TB rate, **4.0/100,000,** (3.6/100,000 in 2017)
  - Highest regional rate: **Goldfields-Esperance = 9.1/100,000**
- Culture confirmation: **71%** (99 cases), decrease from 74% in 2017
  - **5 %** had resistance to any first line drug, 9% in 2017
  - No Multi-Drug Resistant (MDR) TB cases, 2% in 2017
- Health System Delay: Overall median delay = **60 days** (56 in 2017)
  - Pulmonary TB more likely to be classified as delayed **(OR 4.8)**
- Genotyping: **100%** molecularly typed – **8%** clustering rate
  - Two epidemiologically confirmed clusters in 2018
- TB Risk Factors: most common, close contact of TB **40%**, travel to high risk country **26%** and being immunosuppressed **15%**
- Treatment outcome (2017 notifications): – **95.2%** assessable cases successfully treated (98% in 2016).
  - Defaulting = **2.4%**, the most common reason for treatment non-completion
  - Death due to TB (case fatality rate) increased to **2.3%** (0.7% in 2017).
- Latent TB: **446** commenced treatment in 2018
  - **81.4%** completion rate
  - **38%** with history of recent TB contact
- Contact Investigation: **1889** contacts identified in 2018
  - **93% contact of Pulmonary TB**
  - **79.5% no evidence of TB infection or disease**
  - **17.4% LTBI**
  - **2.5% secondary active TB**

DATA SOURCES

TB notifications:

Tuberculosis (TB) notification data recorded on the WA Notifiable Infectious Diseases Database (WANIDD), is used in this report. Under the Public Health Act 2016, medical practitioners, including laboratory pathologists are required to notify TB cases to the WA Department of Health Communicable Disease Control Directorate. Notification data includes information such as the type of TB, case demography, clinical details, laboratory results, risk factors and some case management details.

The total number of TB cases is based on persons who were in WA at the time of diagnosis. Persons diagnosed in other parts of Australia or abroad who moved into WA were excluded. Treatment outcomes are given for cases notified in the previous year (2017), because of the length of time taken for the treatment of TB to be completed.

Population data used to calculate disease rates in this report has been derived from the Australian Bureau of Statistics (ABS) Estimated Resident Population data (ERP) for 2018 based on 2016 census data. Molecular typing data is provided by the WA Mycobacterium Reference Laboratory. Most TB culturing and all TB isolates identification and molecular typing in WA is undertaken by the reference laboratory.

Latent TB and Contact Investigation:

Data presented in this report is collated and extracted from the WA TB Control Program (WATBCP) working databases. These are data collection tools setup primarily to manage TB case managers' workload. Measures to ensure the uniformity and completeness of the data collections sheets will be introduced to improve data quality in future reports.

OVERALL NUMBERS AND RATES

In 2018 in Western Australia (WA), a total of 136 cases of TB were notified, at a rate of 5.2 cases per 100,000 population (95% confidence interval (95% CI) = 4.4-6.1) (Figure 1, Table 1). This represented an increase of 3.0% from figures noted in 2017 (132). While TB cases and rates remain higher than the overall trend noted since 1990, the increase in both crude notification numbers and rates from 2009 to 2018 was not statistically significant using regression analysis.

Figure 1: Tuberculosis notifications numbers and rates, WA, 2009-2018

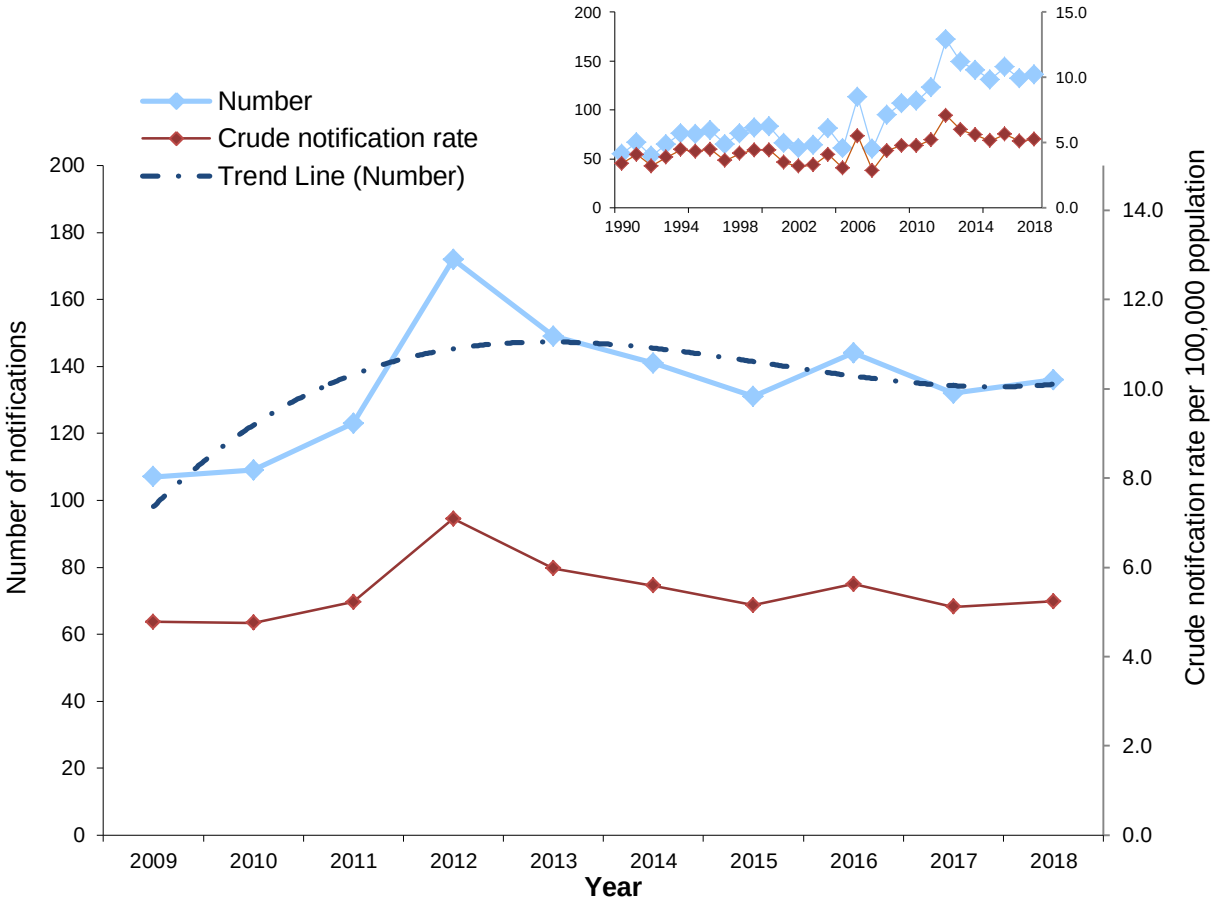


Table 1: Tuberculosis notifications numbers and rates, WA, 1990-2018

Year	Number	Rate[1] (95% CI)[2]	Annual change in case numbers (%)	Annual change in rate (%)
1990	55	3.4 (2.5 – 4.3)	-	-
1991	67	4.1 (3.1 – 5.1)	21.8%	20.1%
1992	53	3.2 (2.3 – 4.1)	-20.9%	-21.9%
1993	65	3.9 (2.9 – 4.8)	22.6%	21.2%
1994	76	4.5 (3.5 – 5.5)	16.9%	15.2%
1995	75	4.3 (3.3 – 5.3)	-1.3%	-3.1%
1996	79	4.5 (3.5 – 5.5)	5.3%	3.5%
1997	65	3.6 (2.7 – 4.5)	-17.7%	-19.1%
1998	76	4.2 (3.2 – 5.1)	16.9%	15.2%
1999	82	4.4 (3.5 – 5.4)	7.9%	6.3%
2000	83	4.4 (3.5 – 5.4)	1.2%	-0.1%
2001	66	3.5 (2.6 – 4.3)	-20.5%	-21.6%
2002	61	3.2 (2.4 – 4.0)	-7.6%	-8.8%
2003	64	3.3 (2.5 – 4.1)	4.9%	3.5%
2004	81	4.1 (3.2 – 5.0)	26.6%	24.7%
2005	61	3.0 (2.3 – 3.8)	-24.7%	-26.0%
2006	113	5.5 (4.5 – 6.5)	85.2%	82.2%
2007	60	2.8 (2.1 – 3.6)	-46.9%	-48.3%
2008	95	4.4 (3.5 – 5.3)	58.3%	53.6%
2009	107	4.8 (3.9 – 5.7)	12.6%	9.2%
2010	109	4.8 (3.9 – 5.6)	1.9%	-0.4%
2011	123	5.2 (4.3 – 6.2)	12.8%	9.8%
2012	172	7.1 (6.1 – 8.2)	39.8%	35.6%
2013	149	6.0 (5.0 – 6.9)	-13.4%	-15.7%
2014	142	5.6 (4.7 – 6.5)	-5.4%	-6.5%
2015	131	5.1 (4.3 – 6.0)	-7.1%	-7.9%
2016	144	5.6 (4.7 – 6.5)	9.9%	9.3%
2017	132	5.1 (4.2 – 6.0)	-8.3%	-9.1%
2018	136	5.2 (4.4 – 6.1)	3.0%	2.4%

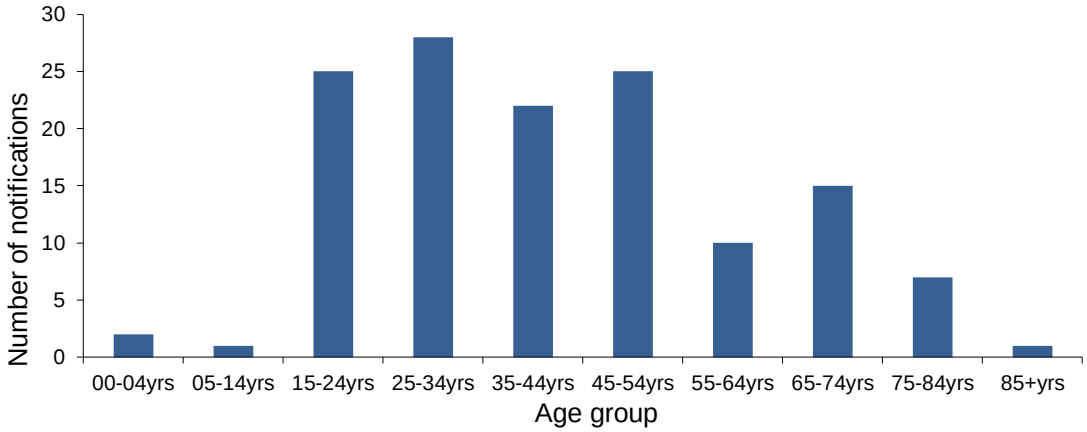
[1] *Crude notification rate per 100,000 population*
[2] *95% Confidence interval*

DEMOGRAPHIC CHARACTERISTICS

In 2018 males represented 49% (n=67) of notified TB cases with a male to female ratio of 1:1.03; this gender distribution was in contrast with most of previous years where there was a male predominance. The only other year when this female predominance was noted was in 2016 (1:1.1). On the other hand, the age distribution followed the previously observed trend with young adults representing the biggest proportion of TB cases with the 15 to 44 age group representing 55% (n=75) of cases notified in 2018 (Figure 2). Cases aged 45 to 64 years accounted for 26%, and those 65 years and over for 17% of all cases. Only 3 cases of TB were notified among children less than 15 years representing 2% of the notified TB cases in 2018 (0.6/100,000). This is less than the 4% reported nationally (1.1/100,000) and is a reversal of the increasing trend of TB in this age group noticed since 2015 that peaked in 2017 with 9 cases (1.8/100,000). Two of the 3 children with TB were less than 5 years old (0-4 age

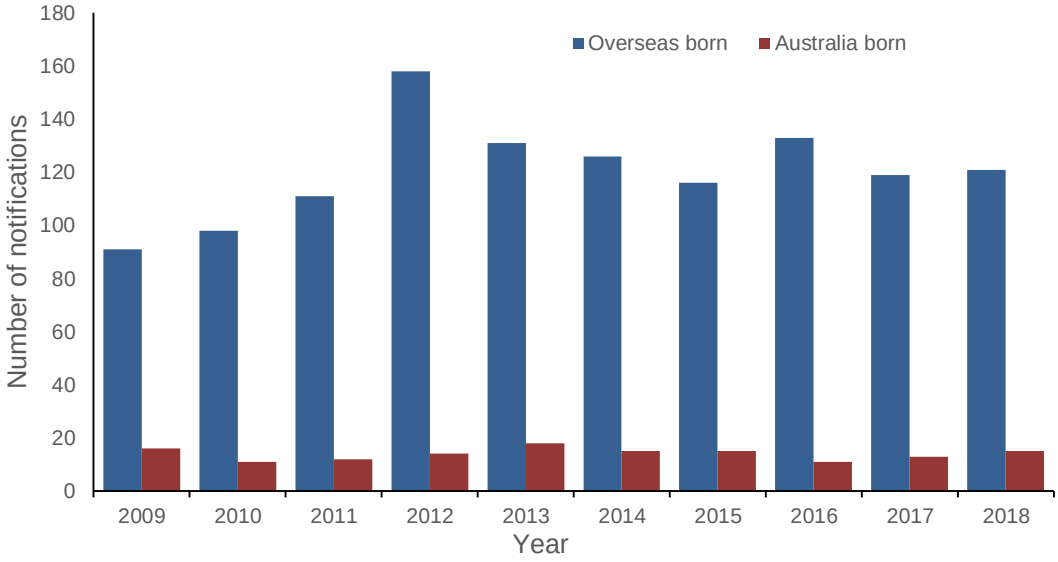
group). Both of these children were Australian born and acquired their TB from a close relative in the same household.

Figure 2: Tuberculosis by age group, WA 2018



Similar to 2017, information on the place of birth (Australian born/overseas born) was recorded for 100% of cases notified in 2018. The majority of cases, 89% (n=121), were born overseas with an incidence rate of 11.7 per 100,000 population (Figure 3). The proportion of TB in the Australian born population continued to increase representing 11% (n=15) of 2018 caseload. This is an incidence rate of 1.0 per 100,000, compared with 0.6/100,000 and 0.8/100,000 in 2016 and 2017 respectively. Of the 15 Australian born TB cases, 3 were Aboriginal with an incidence rate of 3.7 per 100,000, representing 2% of the total TB case load and 20% of those born in Australia. In comparison 2 cases were identified as Australian Aboriginal in 2017 representing 15% of the Australian born cases.

Figure 3: Tuberculosis cases by place of birth, WA, 2009 - 2018



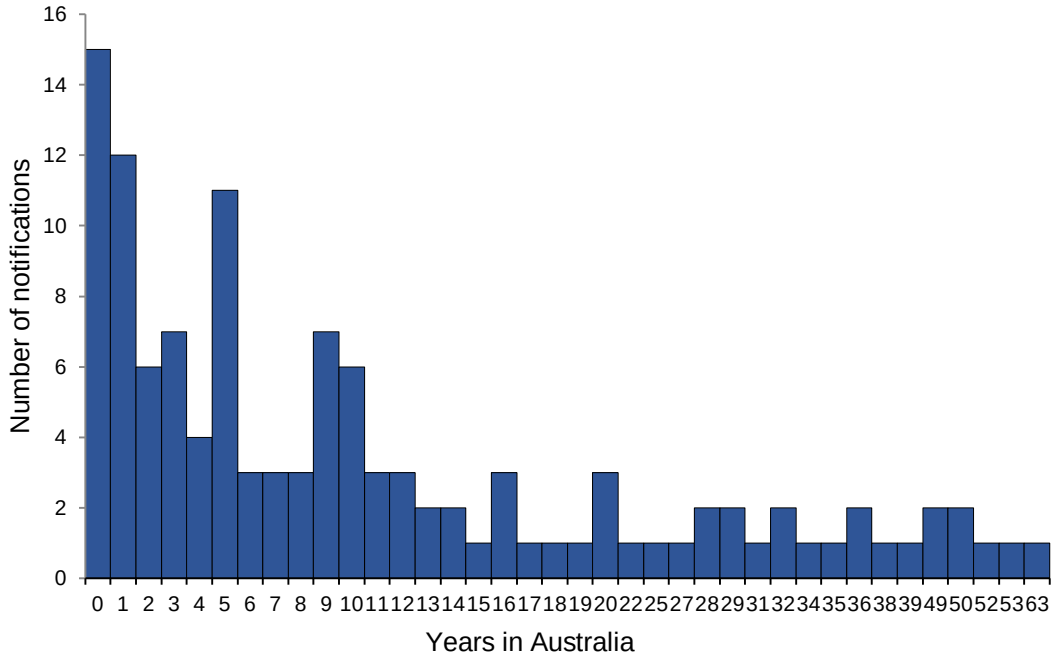
As in previous years, the majority of overseas born cases originated from TB high burden countries e.g. Philippines, India, Bhutan, Vietnam, Burma, and Indonesia (Table 2).

Table 2: Tuberculosis cases by place of birth, WA 2018

Country of Birth	Number	% Total
Philippines	21	15%
India	20	15%
Australia	15	11%
Bhutan	7	5%
Vietnam	6	4%
Burma (Myanmar)	6	4%
Indonesia	6	4%
UK	6	4%
Kenya	5	4%
Nepal	5	4%
Other	39	29%
Total	136	

The date of entry to Australia was known for 100% (n=120) of overseas born cases (excluding one immigration detainee). The interval between the date of arrival in Australia and the TB notification date ranged from 0 to 63 years, with a median interval of 7 years (Interquartile range (IQR)=2-16). Similar to previous years, new migrants had the highest burden of TB disease among the overseas born population with 28% (n=33) diagnosed within two years and 46% (n=55) within five years of entering Australia (Figure 4).

Figure 4: Overseas born notified tuberculosis cases by time since entry to Australia



NOTIFICATION BY IMMIGRATION CATEGORIES

Immigration status of those born overseas, as reported by cases at time of diagnosis, was available for 99% (n=120) of the cases notified in 2018. Similar to previous years, the majority were identified as permanent residents (64%, n=77). Overseas students (15%, n=18) was the second most common immigration category, followed by overseas visitors (8%, n=9) and work visa holders/applicants (7%, n=8) (Table 3).

Table 3: Tuberculosis cases among overseas born by immigration status, WA 2018

Immigration Status	Number	% Total
Permanent resident	77	64%
Overseas student	18	15%
Overseas visitor	9	8%
Work visa	8	7%
Family visa	5	4%
NZ resident/citizen	2	2%
Unauthorised person	1	1%
Total	120	

The decline of TB cases notified among immigration detainees noticed since 2014 was maintained in 2018 with only one case of TB notified from this setting. While this may be an outcome of the current immigration policies that significantly reduced the numbers of unauthorised arrivals, it could also indicate a decline in TB screening and control activities among these population.

GEOGRAPHICAL DISTRIBUTION

The wide geographical distribution observed in previous years was noted again for TB case in 2018 with notifications received from 36 different local government areas (LGA's). Similar to 2017, metropolitan Perth area (including Peel) accounted for the highest proportion of cases in WA (85%, n=115) with a rate of 5.6/100,000 population (95% CI 4.5 -6.6) (Tables 4). On the other hand, TB cases and incidence rate continue to increase in country regions (outside Perth metropolitan area) with 15% (n=21) of TB cases in 2018 notified among country residents, This represented an incidence rate of 4.0/100,000 (95% CI 2.3-5.7) and was an increase from the 2.6/100,00 and 3.6/100.00 reported for 2016 and 2017 respectively. Local government areas of City of Stirling, City of Canning, City of Gosnells and City of Swan had the highest numbers of TB cases in the state accounting together for 40% of all WA TB burden in 2018.

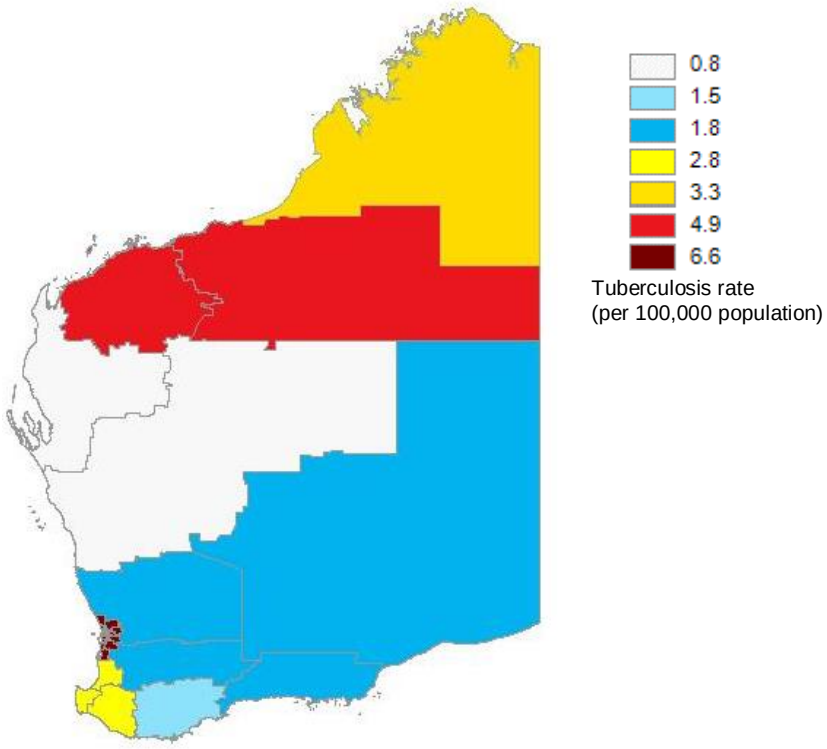
Table 4: Tuberculosis notification numbers and rates, WA Regions 2018

Region	Number	Rate[1] (95% CI)[2]
Metropolitan Perth	115	5.6 (4.5 – 6.6)
Goldfields-Esperance	5	9.1 (1.1 – 17.0)
South West	5	2.8 (0.3 – 5.3)
Pilbara	4	6.5 (0.1 – 12.8)
Great Southern	3	4.9 (-0.6 – 10.5)
Midwest- Gascoyne	2	3.2 (-1.2 – 7.6)
Wheatbelt	2	2.8 (-1.1 – 6.6)
Kimberley	0	-

[1] *Crude notification rate per 100,000 population*
[2] *95% Confidence interval*

The highest 5 years average of regional TB rates was observed in Perth metropolitan area with an average rate of 6.6/100,000 population (Figure 5), followed by the Pilbara, the Kimberley and South West regions with average rate of 4.9, 3.3 and 2.8/100,000 population respectively.

Figure 5: Five-year average tuberculosis incidence rates by WA Regions 2014-2018



Compared with TB cases from Perth metropolitan area, cases from country areas showed similar age distribution, while gender distribution showed males predominance (male to female ratio of 2.6:1) compared to the ratio of 1:1.2 among cases notified in Perth metropolitan area. Place of birth distribution was significantly different between metropolitan and country cases with over 90% of metropolitan cases born overseas compared to only 66% of country cases being born overseas. In 2018 significantly more pulmonary TB was diagnosed among country cases (66.7%) this was a reversal of the higher extra-pulmonary disease among country cases noticed in the previous year and similar to the distribution noted in 2015 and 2016. Health system (HS) delay, defined as time from patient's first presentation to treatment start, was measured by number of days (lag time) as well as determination of significant delays. Both these indicators were longer for metropolitan cases (Table 5).

Table 5: Regional comparison of tuberculosis notifications, WA 2017

			Metro	Country	P value
Age	Median (IQR)		37 (26-53)	36 (24-43)	>0.05
Sex	Male	N (%)	53 (46.1%)	14 (66.7%)	>0.05
	Female	N (%)	62 (53.9%)	7 (33.3%)	
Place of Birth	Australia	N (%)	8 (7.0%)	7 (33.3)	<0.05*
	Overseas	N (%)	107 (93.0%)	14 (66.7%)	
TB Type	PTB	N (%)	59 (51.3%)	17 (81.0%)	<0.05*
	XPTB	N (%)	56 (48.7%)	4 (19.0%)	
HIV Status	Positive	N (%)	0 (0.0%)	0 (0.0%)	>0.05
	Negative	N (%)	99 (86.1%)	20 (95.2%)	
	Not tested or refused	N (%)	10 (8.7%)	0 (0.0%)	
	Unknown	N (%)	6 (5.2%)	1 (4.8%)	
HS lag time	Median (IQR)		62 (35-115.5)	46.5 (19.5-102.5)	>0.05
HS Delay	Yes	N (%)	57 (50.4%)	9 (45.0%)	>0.05
	No	N (%)	56 (49.6%)	11 (55.0%)	

*significant difference

CLINICAL CHARACTERISTICS

In 2018, the site of TB was reported for all 136 notified cases. More than half had pulmonary disease (56%, n=76). This was similar to the figure reported in 2016. One in seven cases with pulmonary disease (n=9) were also reported to have extra-pulmonary disease in at least one additional site (Table 6).

Table 6: Tuberculosis notifications by site of disease, WA 2018

Site	Number	% Total
Pulmonary only	67	49%
Pulmonary plus other sites	9	7%
Extrapulmonary only	60	44%
Total	136	100%

The extra-pulmonary TB disease sites remained largely stable except for a noticeable decrease in disseminated TB from 8% (n=6) in 2017 to only 3 cases in 2018 representing 4% of extra-pulmonary TB cases. It is also worth noting that ocular TB after featuring as the second most reported extra-pulmonary site after lymph node in 2017, maintained that position again in 2018 with 8 case representing 11% of the extra-pulmonary TB caseload (Table 7).

Table 7: Extra-pulmonary TB notifications by site of disease, WA 2018

Site of extra-pulmonary TB	Number	% Total
Lymph Node	35	50%
Ocular	8	11%
Pleural	8	11%
Bone-Joint	4	6%
Genitourinary	4	6%
Disseminated TB	3	4%
Peritoneal (includes all GI sites)	3	4%
Meningeal	2	3%
Cutaneous	1	1%
Other	2	3%
Total	70	100%

Of the 136 TB cases reported in 2018, 96% (n=130) were new cases while 4% (n=6) had relapsed after previous treatment. One case relapsed after full treatment in Australia. The remaining 3 cases relapsed after treatment overseas.

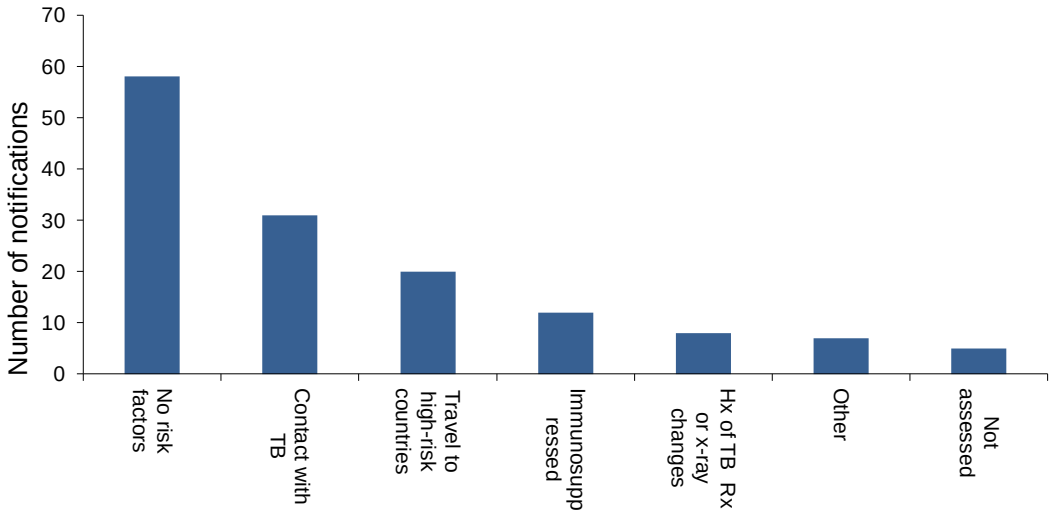
The proportion of TB cases with known HIV status in 2018 was the lowest since 2015. Only 88% (n=119) of the notified cases had an HIV testing result recorded. This was a decrease from the 93% and 90% testing rates noted in 2017 and 2016, respectively. None of the tested cases with known results were HIV positive, compared with 4% HIV positive cases in 2017. Those without HIV status recorded were of unknown status (5%, n=7) or were not tested (7%, n=10). Of the 10 not tested cases, one declined testing while the remaining 9 were not offered HIV screening.

TB RISK FACTORS

TB risk factors are situations and conditions that increase the risk of TB infection or the subsequent progression from latent TB infection (LTBI) to active TB disease. The identification of these factors will provide opportunities for control of TB through screening and treatment of LTBI among exposed or affected individuals.

In 2018, the percentage of cases with available information for the various risk factors was 96%. No risk factors were identified in 41% (n=58) of the cases. For those with identified risk (n=78), the most common risk factor reported was being household member or close contact with TB (40%), followed by past travel to, or residence in, high risk country(ies) (26%) and being immunosuppressed (illness/medications) (15%) (Figure 7).

Figure 6: Risk factors reported for tuberculosis notifications, WA 2018



HEALTH SYSTEM (HS) DELAY

In 2018 and similar to the previous year, health system delay, defined as time from first TB related health contact to starting TB treatment, was known for 98% (n=133) of cases. Of these, 22.6% (n=30) started treatment within 30 days of first health contact, 45.1% (n=60) started treatment between 30 and 90 days and 32.3% (n=43) started treatment more than 90 days after their initial health contact. The median time from the first health contact to the start of treatment in 2018 was 60 days (IQR=33-113) compared to 56 days (IQR=23-132) in 2017. Delay by TB type showed that pulmonary TB cases had a median delay of 59 days (IQR=30-107) compared to 65 days median delay (IQR=37-117) for extra-pulmonary cases.

Significant delay was again recognized, using the delay matrix introduced in 2016 report. The matrix classifies the lag time from patient first presentation to treatment start as delayed or not delayed, according to several parameters including: TB type, disease severity, transmissibility and adverse outcomes. Based on this, delayed TB treatment was noted in 50.4% of 2018 cases (n=67), this was an increase from the 45.7% delay observed among 2017 cases. Similar to 2016 and 2017 results, pulmonary TB cases were significantly more likely to be delayed in comparison to extra-pulmonary cases (66.2% vs 28.8%) with an odds ratio of 4.8 (95% CI= 2.3-10.2). Similar to the past 2 years, these results highlight the apparent discrepancy between the length of treatment lag time and the findings of the delay matrix, emphasising the importance of a more comprehensive assessment of treatment delay than just measuring time lag.

MYCOBACTERIAL LABORATORY DATA

In 2018, the percentage of culture confirmed TB cases were 71% (n=97); this was slightly less than the 74% reported in 2017. Pulmonary TB cases had higher percentage of positive cultures when compared with extra-pulmonary cases (90% versus 48%). This was similar to 2017 figures and slightly less than the 93% observed in 2016, but exceeded the target of 80% culture confirmation of all new pulmonary TB cases set by the European Centre for Disease Prevention and Control[1]. Culture confirmation of extra-pulmonary TB cases decreased from 57% in 2017 to 48% in 2018. All 98 cultures positive cases were identified with *Mycobacterium tuberculosis* infection (Table 9).

Sputum smear positive cases represented 30% (41/136) of all TB notifications and 60% (41/68) of cases with culture positive pulmonary disease. This was slightly higher than 59% smear positive pulmonary TB reported in 2017 but less than the 64% noted in 2016 (Table 8).

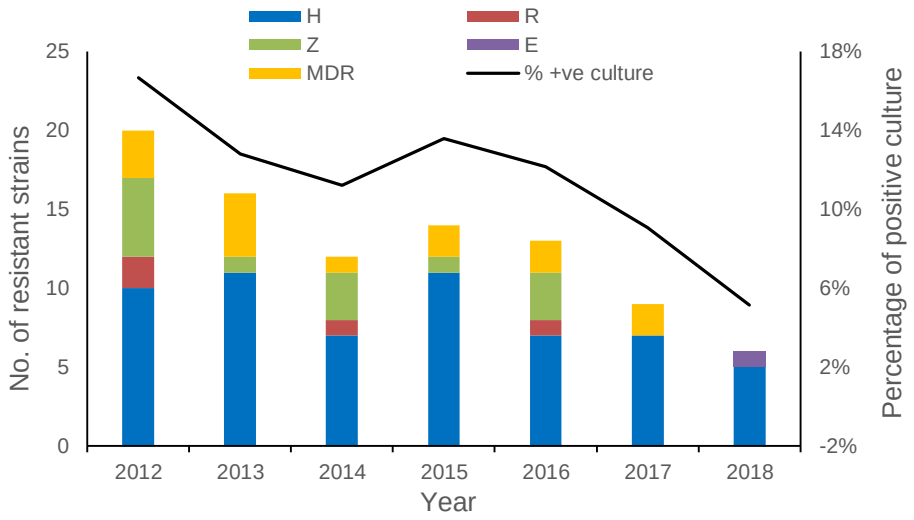
Table 8: Tuberculosis Notifications by culture and sputum smear result, WA 2018

	Culture Positive		Sputum Smear Positive	
Site	**Number**	**% Site**	**Number**	**% Site**
All TB notifications	97	71%	41	30%
Pulmonary only	60	90%	36	54%
Pulmonary plus other sites	8	89%	5	56%
Extrapulmonary only	29	48%	-	-

Drug susceptibility

WA continues to have low rates of drug resistant TB with a declining trend over the past 6 years (Figure 6). In 2018, drug susceptibility testing (DST) results for first line TB drugs were available for all 97 culture-confirmed cases. Of these, 95% (n=92) were fully susceptible to all first line drugs and 5% (n=5) were resistant to isoniazid with one of these 5 cases also resistant to ethambutol. This was a slight decrease from the 7% (n=7) isoniazid resistance reported in 2017. No multi-drug resistant TB (MDR-TB) was detected in 2018, this was the first year since 2008 with no MDR-TB cases notified in WA. All of cases with drug resistance were overseas born adults.

Figure 7: Tuberculosis cases with drug resistance, WA, 2012-2018



GENOTYPING AND STRAIN IDENTIFICATION

In the presented results, a genotyped cluster is defined as isolates sharing identical 15/24 loci VNTR-MIRU type[2]. Also, to allow for the lag time between exposure and disease development, often observed in TB, the data from the previous 3 years as well as the current year were included in the reported genotype analysis. The MIRU-VNTRplus website (http://www.miru-vntrplus.org) was used to assign each of the 15/24 MIRU-VNTR patterns into lineages[3].

TB molecular typing results were available for all of the 97 culture-positive TB cases in 2018. Of these 13 cases were in 5 molecular clusters, with a median cluster size of two cases (range 2-4) and 84 cases had a unique strain type with an overall clustering rate of 8%. Epidemiological links were identified in 2 of the clusters involving household setting providing strong evidence of recent transmission. One of these clusters involved a 4 year old Australian born child. In the remaining 3 clusters there were no clear epidemiological links, although some of cases shared weak links e.g. same country of origin.

Overall, for culture confirmed cases notified between 2015 and 2018, 398 isolates had strain typing with MIRU-VNTR completed for at least 15 loci. Of these, 74 (19%) had non-unique molecular types and were in 28 separate molecular clusters with a median cluster size of 2 cases (range 2-6). Beijing strains were most common among molecular clusters accounting for 11 clusters (39%). Interestingly, the Beijing strains were also the most common in the epidemiologically linked cases (67%). This is consistent with the Beijing strains reported ubiquity and frequent association with outbreaks.

Strain identification was completed for 89% of the typed isolates between 2015 and 2018. Indo-Oceanic (lineage 1) was the most prevalent representing 28%, followed by the East-Asian (lineage 2) (27%), Euro-American (lineage 4) (20%) and East African-Indian (lineage 3) (11%) (Table 9).

Table 9: MIRU-VNTR tuberculosis strains, WA 2015-2018

Global lineage	Sub-lineage	(%)
Indo-Oceanic (lineage 1)	East African-Indian (EAI)	28%
East-Asian (lineage 2)	Beijing	27%
East African-Indian (lineage 3)	Delhi/Central Asian (Delhi/CAS)	11%
Euro-American (lineage 4)	Haarlem	4%
	LAM	4%
	NEW-1	3%
	Uganda II	2%
	TUR	2%
	Cameroon	2%
	S	2%
	X	0.8%
	Ghana	0.3%
West African 1 (lineage 5)	West African 1	0.3%
	Multiple matches	3%
	Unknown	11%

TREATMENT OUTCOMES, 2017

Due to the length of time taken for the treatment of TB to be completed, the data presented in this section are for the 132 TB cases notified in 2017, all of which were commenced on treatment for TB.

Treatment outcome was assessed for 95% (125/132) of cases notified in 2017 after excluding those transferred outside of Australia, or died of other causes. There were no cases still on treatment. The proportion of cases successfully treated (including cured and completing treatment) was 95% (119/125) of assessable cases, decreasing from the 98% reported in 2016 (Table 10).

Table 10: Tuberculosis treatment outcome, WA, 2017

Outcome	Number	% Total
Assessable outcomes		
Treatment success	119	95.2%
Cured (bacteriologically confirmed)	0	0%
Completed treatment	119	95.2%
Interrupted treatment	0	0%
Died of TB (died during treatment of TB, as a result of TB disease)	3	2.4%
Defaulter	3	2.4%
Failure	0	0%
Not followed up, outcome unknown	0	0%
Total assessable	125	100%
Non-assessable outcomes		
Transferred out of Australia	4	57.1%
Died of other cause (died during treatment of cause other than TB)	3	42.9%
Still under treatment	0	0%
Total	7	100%

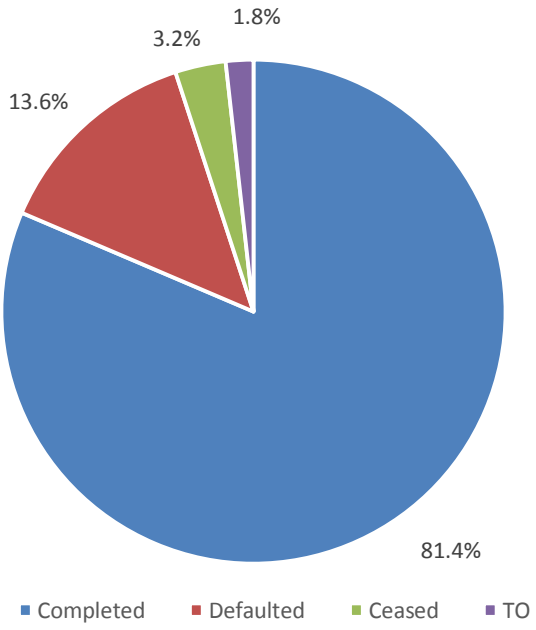
For assessable outcomes, the reported reasons for not completing treatment were defaulting before treatment completion (2%) and died of TB (2%). Transfer out of Australia (57%) was the most common reason for non-assessable treatment outcomes. Death of all causes represented 5%, this was an increase from the 4% and 2% reported in 2016 and 2015 respectively. On the other hand, TB caused or contributed to 3 death, giving a TB case fatality rate of 2.3%. This was an increase from the 0.7% and 0.8% case fatality rates reported for 2016 and 2015 respectively. Two of the 3 TB related deaths were in cases above 80 years of age (83 and 96 years). The third case was in early fifties, the patient had disseminated TB on a background of multiple co-morbidities and end-stage organ failure.

LATENT TB

The detection and treatment of Latent TB Infection (LTBI) as a fundamental strategy in TB control in Australia is highlighted by the fact that most of TB cases are the result of reactivation of LTBI[4].

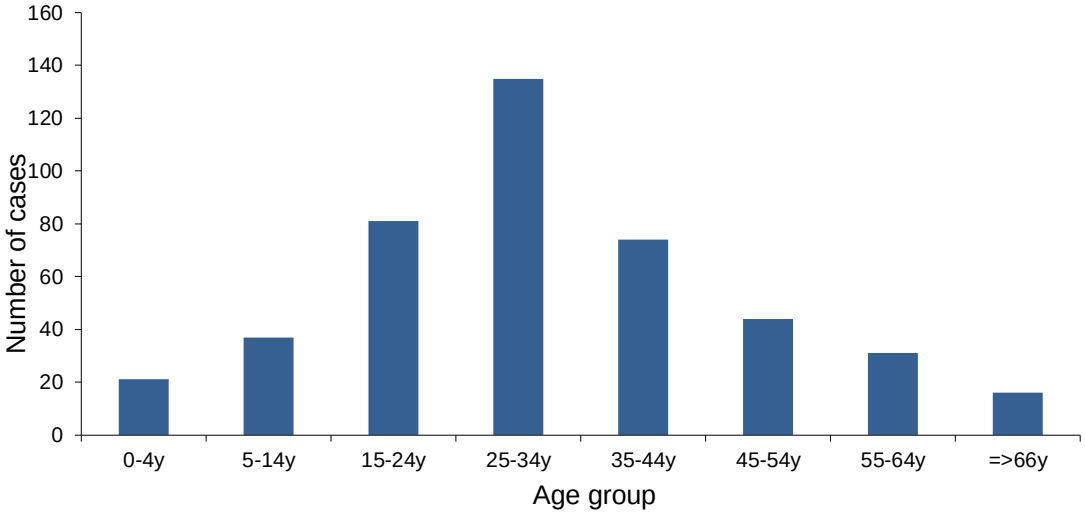
In 2018, a total of 446 individuals started LTBI preventive treatment. Treatment outcomes were available for 76% (n=339). Of these 81.4% (n=276) completed treatment satisfactorily (Figure 7).

Figure 8: LTBI treatment outcomes, WA 2018



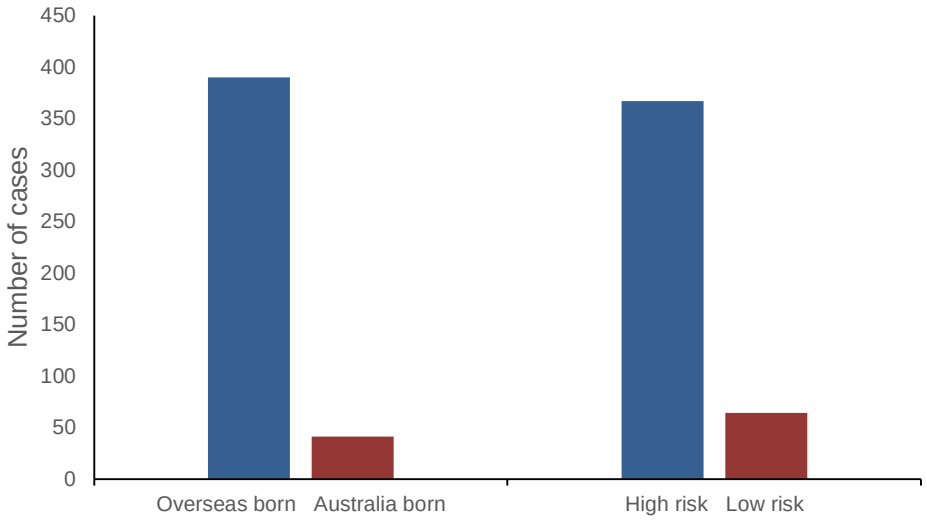
Males represented 45.5% (n=197) of those starting LTBI treatment TB in 2018 with a male to female ratio of 1:1.2. the majority were less than 35 years of age (62.4%) with the age group 25-34 representing the biggest age group and accounting for 30.8% of those starting LTBI treatment (Figure 8).

Figure 9: LTBI treatment by age group, WA 2018



Where place of birth was recorded, 90.5% of those starting LTBI treatment were among overseas born individuals and 85% were born in TB high risk countries (countries with annual TB rate of ≥ 40/100,000 population) (Figure 9).

Figure 10: LTBI cases by place of birth, WA 2018



The reason for LTBI screening and treatment was recorded for 82.3% (n=367) of 2018 LTBI cases. Of these 38.1% had recent history of TB contact, 29.2% were identified with LTBI as part of healthcare worker (HCW) screening, 20.4% were either recent migrants or newly arrived refugees and 6.5% were screened prior to starting immunosuppressive treatment. (Table 11)

Table 11: LTBI cases by screening reason, WA 2018

Country of Birth	Number	% Total
TB Contacts	140	38.1%
Healthcare worker screening	107	29.2%
Recently arrived refugee	39	10.6%
Recent migrant	36	9.8%
Immunosuppressive treatment	24	6.5%
Other	21	5.75

Of those failing to satisfactorily complete treatment in 2018, 5% (n=17) did so for reasons that are not amenable to intervention (adverse drug reactions (3.2%) and leaving the state (1.8%)), on the other hand, 13.6% (n=46) failed to complete LTBI treatment for reasons that can potentially be improved with additional targeted interventions (non-adherence, lost to follow up). There were no significant association between LTBI treatment outcomes and the different assessment factors (Table 12).

Table 12: LTBI treatment outcomes, WA 2018

		Treatment Outcomes					
		Completed		Did not complete		Total	
Sex	Male	117	85%	21	15%	138	43.0%
	Female	149	81%	34	19%	183	57.0%
Age Category	0-4y	15	94%	1	6%	16	4.8%
	5-14y	25	96%	1	4%	26	7.9%
	15-24y	54	84%	10	16%	64	19.4%
	25-34y	74	73%	27	27%	101	30.6%
	35-44y	47	85%	8	15%	55	16.7%
	45-54y	28	85%	5	15%	33	10.0%
	55-64y	20	91%	2	9%	22	6.7%
	=>66y	10	77%	3	23%	13	3.9%
Place of Birth	Australia	27	82%	6	18%	33	10.0%
	Overseas	248	83%	50	17%	298	90.0%
TB Risk	Low risk	41	80%	10	20%	51	15.4%
	High risk	234	84%	46	16%	280	84.6%
LTBI Medication	H	202	82%	43	18%	245	73.8%
	R	28	78%	8	22%	36	10.8%
	HR	45	90%	5	10%	50	15.1%
	Mfx	1	100%	0	0%	1	0.3%
Reason for Screening	TB Contact	101	83%	21	17%	122	36.7%
	Refugee	33	94%	2	6%	35	10.5%
	HCW	82	81%	19	19%	101	30.4%
	Migrant	28	85%	5	15%	33	9.9%
	Immuno-suppressed	18	75%	6	25%	24	7.2%
	Other	14	82%	3	18%	17	5.1%
Location	Metro	173	81%	41	19%	214	84.3%
	Country	34	85%	6	15%	40	15.7%

Did not complete = Defaulted +Treatment ceased
H: isoniazid, R: rifampicin, Mfx: moxifloxacin

TB CONTACT INVESTIGATION

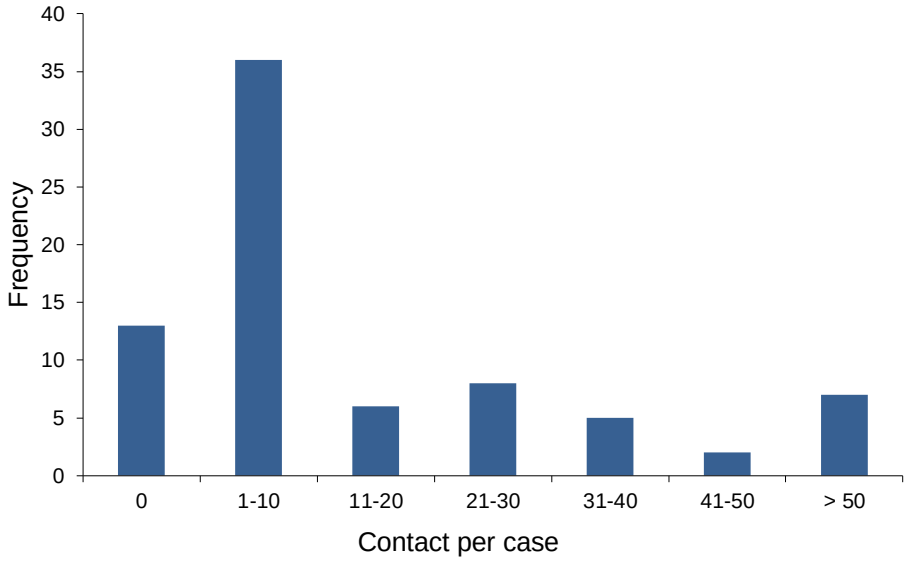
Contact investigation involves identifying individuals who may be at risk of having TB infection or active TB disease as a result of sharing air space with an active TB case. Contacts investigation is prioritised based on to the type of TB, duration of contact, and contact risk factors. The data presented in this report is for contact investigation of notified cases in WA as well as contacts of cases diagnosed in other jurisdictions and airplane contacts of non-resident cases.

In 2018, a total of 1889 contacts were identified and associated with 113 active TB cases. Of these, 93% (n=1750) were contacts of 64 pulmonary TB (PTB) cases and 7% (n=139) were contacts of 49 extra-pulmonary TB (XPTB) cases. Twenty-five cases (14 PTB and 11 XPTB) had no contact investigation recorded.

The maximum number of contacts associated with a single case was 297 contacts with a mean number of contacts of 16.7 per case and a median of 4 contacts per case. The minimum number of one contact per case was identified in 21 TB cases.

The mean number of contacts of pulmonary TB cases was 27.3 contacts with a median of 7.5 contacts per case. Majority of pulmonary TB cases (56% n=36) had 10 or fewer listed contacts. Twenty-one cases (33%) had 11 to 50 contacts while seven cases (11%) had more than 50 contacts identified (Figure 11). There were 23 children less than 5 years of age identified as contacts, representing 1% of pulmonary TB contacts.

Figure 11: number of contacts per respiratory case, WA 2018



Contact investigation outcomes

In 2018, 30.0% of all contacts (n=567) did not attend or did not complete TB screening. Five percent (n=97) were transferred to the jurisdiction of their normal residence and 4% (n=77) could not be located. Of those fully screened, 79.5% (n=913) had negative screening results, 17.4% (n=200) were diagnosed with LTBI, 2.5% (n=29) had a past history of TB or LTBI and 0.5% (n=6) represented secondary active TB cases identified by contact investigation. Of the pulmonary TB contacts less than 5 years of age, 18 had negative screening results, 2 were lost to follow up, one transferred out and 2 were diagnosed with active PTB.

DATA QUALITY AND COMPLETENESS

Notification data

TB notification data is collected through core notification data similar to all other notifiable infectious diseases and an enhanced TB database that collects disease specific information not captured by the core notification data. A completion audit of primary notification data fields is presented. Fields that had their records extracted from other database fields were excluded.

Core notification data

All audited variables were complete with no missing values. This was a significant improvement of the 49% missing values reported in 2017. Data cleaning undertaking as part of this report preparation contributed to this data quality improvement.

Enhanced TB surveillance data

Only 3 of the audited 16 enhanced surveillance variables had missing values, this was a significant improvement of 40% reported in 2017. Similar to previous years, 'treatment end date' had the highest percentage of missing data, which is expected, giving TB relatively long treatment duration, and does not reflect data quality issues. The other variables with missing values were 'residence time in Australia' and 'Australia arrival date'. As noted in previous reports these were not actual missing values but were not recorded for Australian born cases and is primarily a reflection of the database design limitation that continues to identify Australian born cases in these fields with empty fields.

Latent TB and contact investigation data

Five of the seven Latent TB database variables had missing values and 57.2% (n=255) of the cases had one or more missing values. The Five variables with missing values were 'LTBI medications', 'gender', 'referral reason', 'location' and 'treatment outcome' that had 2%, 3%, 18%, 18%, and 24% incomplete records respectively. Overall, there were 287 (9%) missing values of the total possible 3122 values.

In 2018, 24 TB cases had no documented contact tracing activities. Of these, 13 had pulmonary TB including 4 cases with smear positive disease. It is unlikely that none of these cases had contacts identified and is more likely to represent a recording error. Of the 1889 identified contacts, 4% (n=77) had no contact investigation outcome recorded. A new contact investigation database has been introduced and is currently being used to record all contact investigation activities in 2019 and it is envisaged that this will significantly improve the quality and completeness of contact investigation data.

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