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North Metropolitan Health Service
Mental Health, Public Health and Dental Services

Western Australian Tuberculosis Control Program

Tuberculosis notifications in Western Australia 2020

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EXECUTIVE SUMMARY

In 2020 Western Australia (WA) recorded a very similar number of notifications of tuberculosis (TB) as in the previous 6 years; 138 notifications at a rate of 5.2 cases per 100 000 population. This is less than national average for Australia of 6.2 per 100 000 in 2020, and the trend contrasts with a 21% increase in notifications nationally over the last 5 years. However, the WA TB Control Program's strategic intent, in alignment with *The Strategic Plan for Control of Tuberculosis in Australia, 2016-2020: Towards Disease Elimination*, is to see a reduction in TB notifications towards elimination, and this is clearly not happening yet.

The COVID-19 pandemic has had a substantial adverse effect on TB epidemiology globally with evidence of increased incidence and deaths from TB in high prevalence settings. Even in Australia where there have been prolonged lockdowns to contain COVID outbreaks in Melbourne and Sydney there are unofficial reports of significant disruption to TB control activities and resources, and an increase in TB case numbers. In WA this has not happened but, despite border closures and a substantial reduction in new migrants, especially tertiary students, there has not been a fall in TB cases. There is a risk that TB numbers will, in fact, increase in subsequent years due to increased TB globally.

The epidemiology of TB in WA in 2020 is like previous years, but with some aspects of interest. There was the same predominance of females (60% of cases) seen in the previous 2 years, which is unlike elsewhere in the world. In 2020 TB patients were the youngest ever recorded with 71% less than 45 years old, though there was a smaller proportion of children (5 cases less than 15 years, 4%). There was also the lowest proportion of TB notifications born in Australia (13 cases, 9%), with overseas born patients coming from a similar range of countries (76% from India, Philippines, Indonesia, Bhutan and China). Finally, there was the lowest proportion of TB notifications resident in country WA (7 cases, 5%), which is possibly a consequence of economic or movement constrictions due to COVID-19.

The outcome of active TB treatment, reported from 2019, continues to be positive, with 96% of assessable cases successfully treated. Two patients died as a consequence of TB (case fatality rate = 1.4%), both of whom were relatively young (less than 60 years old) with disseminated TB in the setting of severe immunocompromising disease.

The TB Program is interested to document any evidence of locally acquired TB infection. In 2020 there was considerable genetic diversity in cultured TB, with a clustering rate of only 8%. Of the 7 clusters of 15 notifications, only 2 were confirmed or probably due to direct transmission. Together with the low proportion of Australian born and paediatric cases, this supports the contention that community transmission is very low. It is also reassuring that the proportion of sputum smear positive (infectious) TB cases has fallen, but this does remain relatively high, possibly due to continued high levels of health system delay in diagnosis (median delay of pulmonary TB = 50 days, 52% of all TB cases considered excessively delayed). Further development in the routine use of whole genome sequencing of TB isolates will enhance the Program's understanding of transmission of TB locally.

To reduce future TB notifications the TB Program is focussed on preventing TB through treatment of latent TB infection (LTBI). This report shows reduced diagnosis and treatment of LTBI, which is likely to be due to COVID-19 related travel restrictions and reduced new immigrant screening. This highlights the need for expanded active surveillance for LTBI. There was also a 20% reduction in the number of TB contacts screened and treated for LTBI for uncertain reasons, but possibly due to the reduced number of sputum smear positive (infectious)

cases that require more extensive contact tracing. Outcomes of both contact tracing, and LTBI diagnosis and treatment more broadly, were highly successful.

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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 raw data is collected by TB case managers. Data cleaning, preparation of tables and figures, data analysis and report writing were done by Dr Hussein Farah. The report has been reviewed and endorsed by the Western Australian Tuberculosis & Leprosy Advisory Council (WATLAC).

TB in WA: 2020 SNAPSHOT

- Number of notifications = **138**
- Incidence rate = **5.2/100,000** population
    - Similar to 2019 rate (5.3/100,000)
- Australian-born population: Decreased = **0.7/100,000** population, 1.0/100,000 in 2019
    - **2** Aboriginal cases, **3.5/100,000** population, none recorded in 2019.
- Overseas-born population: **91%** of cases, increased from 88% in 2019
    - More than half (55%) present within **5 years** of arrival.
    - Residency status: permanent residents = **60%**, overseas students =**20%**
- Geospatial distribution: narrower: 28 Local Government Areas, 30 in 2019
    - Most in Perth metropolitan area **95%**, (92% in 2019)
    - Regional TB rate, **2.1/100,000,** slightly decreased (2.5/100,000 in 2019)
- Culture confirmation: **76%** (105 cases), increased from 71% in 2019
    - **14 %** had resistance to any first line drug, similar to 2019
    - **2%** Multi-Drug Resistant (MDR) TB cases, similar to 2019
- Health System Delay: Overall median delay = **62 days** (45 in 2019)
    - Pulmonary TB more likely to be classified as delayed **(OR 1.88)**
- Genotyping: **100%** molecularly typed – **8%** clustering rate
    - One epidemiologically confirmed cluster in 2020
- TB Risk Factors: most common, travel to high risk country **72%** and close contact of TB **26%**
- TB in Health Care Workers: **8.4%** of 2020 cases
    - **6** pulmonary TB (2 in 2019), **4** sputum smear positive (one in 2019)
- Treatment outcome (2019 notifications): – **96%** assessable cases successfully treated (97% in 2018).
    - Death due to TB (case fatality rate) 1.4% less than 2018 (2.2%)
- Latent TB: **438** commenced treatment in 2020, 20% decrease from 2019
    - **91.1%** completion rate, 89.9% in 2019
    - **36.4%** as part of Health Care Workers screening (32.4 in 2019)
- Contact Investigation: **1271** contacts identified in 2020
    - **83.4%** contact of Pulmonary TB, 80.0% in 2019
    - **72.9%** no evidence of TB infection or disease, 75.2% in 2019
    - **21.4%** LTBI, 17.1% in 2019
    - **1.0%** secondary active TB, 0.8% in 2019

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 (2019), 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 2020 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 assist with TB case managers' workload. Measures to ensure the uniformity and completeness of the data collection sheets were introduced to maintain and enhance data quality.

OVERALL NUMBERS AND RATES

In 2020 in Western Australia (WA), a total of 138 cases of TB were notified, at a rate of 5.2 cases per 100,000 population (95% confidence interval (95% CI) = 4.3-6.0) (Figure 1, Tables 1 & 2). This was similar to figures reported in 2019 (138). While TB cases and rates remain higher than the overall trend noted since 1990, the increase in both crude notification numbers and rates was not statistically significant using regression analysis.

Figure 1: Tuberculosis notifications numbers and rates, WA, 2011-2020

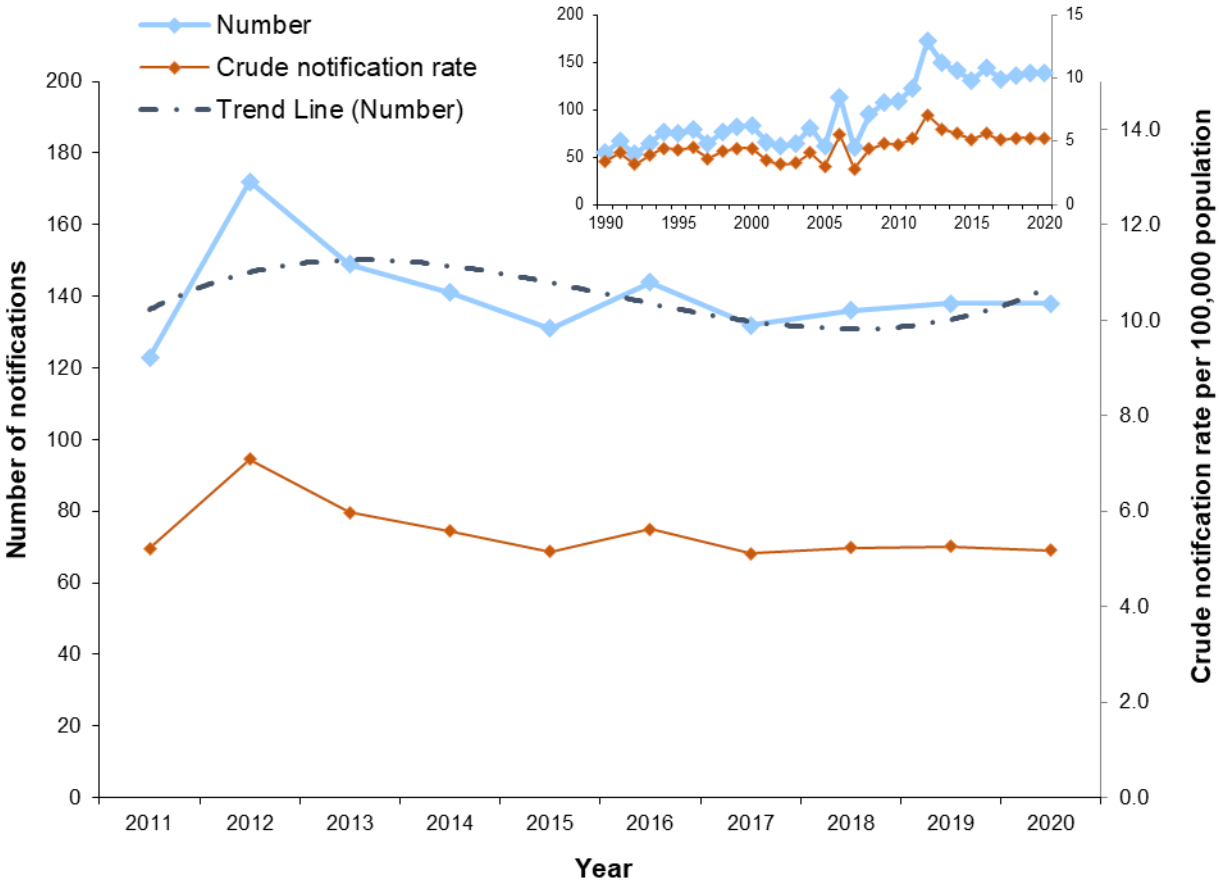


Table 1: Tuberculosis notifications numbers and rates, WA, 2016-2020

Year	Number	Rate[1] (95% CI)[2]	Annual change in case numbers (%)	Annual change in rate (%)
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%
2019	138	5.3 (4.4 – 6.1)	1.5%	0.5%
2020	138	5.2 (4.3 – 6.0)	0.0%	-1.6%

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

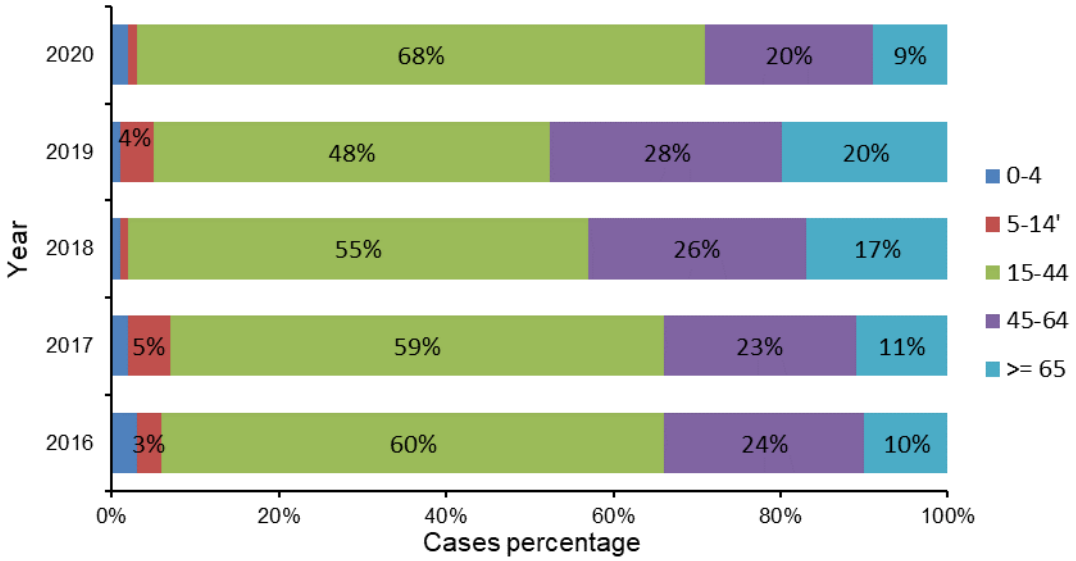
Table 2: Five-year average tuberculosis notifications, WA, 1990-2019

Year	Number	Rate (95% CI)
1990-1994	63	3.8 (2.9 – 4.7)
1995-1999	75	4.2 (3.3 – 5.2)
2000-2004	71	3.7 (2.8 – 4.5)
2005-2009	87	4.1 (3.2 – 5.0)
2010-2014	139	5.7 (4.8 – 6.7)
2015-2019	136	5.3 (4.4 – 6.2)

DEMOGRAPHIC CHARACTERISTICS

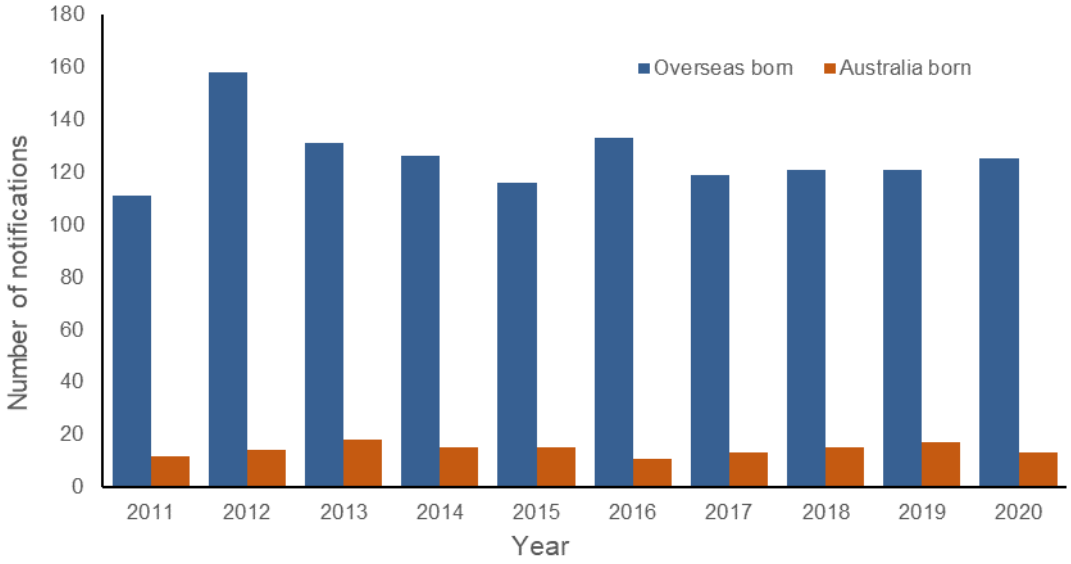
In 2020 the female predominance noted in 2018 and 2019 continued and was further extended with females representing 60% (n=83) of notified TB cases with male to female ratio of 1:1.5. Age distribution (Figure 2) showed an overall younger cohort in 2020 with a median age of 34 years compared to 43 years in 2019. TB continued to predominantly affect young adults with the 15 to 44 age group bearing the highest disease burden and representing 68% (n=94) of cases notified in 2020. Cases aged 45 to 64 years accounted for 20%, and those 65 years and over for 9% of all cases. The number of TB cases among children less than15 years of age remained stable at 4% (n=5) with a rate of 0.96 per 100,000 population compared to the national rate of 1.1/100,000 in this age group. All 5 children (4 Australian born and one overseas born) were secondary TB cases linked to household adult cases who most likely contracted TB overseas.

Figure 2: Tuberculosis by age group, WA 2016-2020



Similar to previous years, information on the place of birth (Australian born/overseas born) was recorded for 100% of cases notified in 2020. The majority of cases, 91% (n=125), were born overseas with an incidence rate of 18.8 per 100,000 population (Figure 3). The proportion of TB in the Australian born population decreased to 9% (n=13) from 12% in 2019 with an incidence rate of 0.7 per 100,000, compared with 1.0/100,000 and 0.9/100,000 in 2019 and 2018 respectively. Of the 13 Australian born TB cases, 2 were Aboriginal with an incidence rate of 3.5 per 100,000, representing 1% of the total TB case load and 15% of those born in Australia. In comparison, no cases were identified as Australian Aboriginal in 2019 and 3 cases were identified as Australian Aboriginal in 2018 representing 20% of the Australian born caseload.

Figure 3: Tuberculosis cases by place of birth, WA, 2011 - 2020



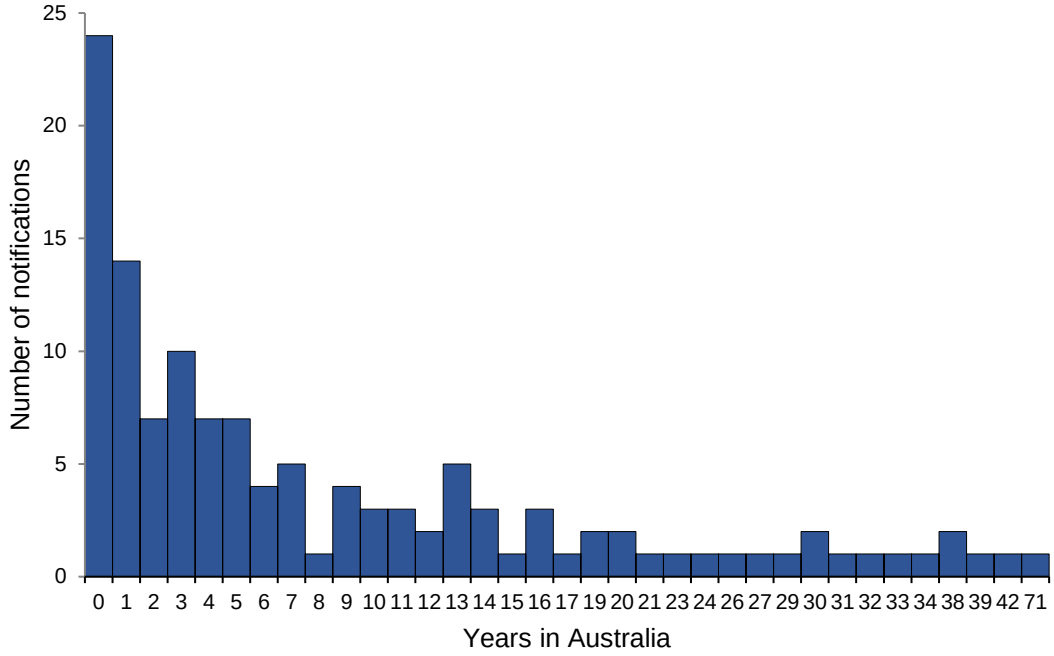
As in previous years, the majority of overseas born cases originated from TB high burden countries e.g. India, Philippines, Indonesia, Bhutan, China, and Viet Nam (Table 3).

Table 3: Tuberculosis cases by place of birth, WA 2020

Country of Birth	Number	% Total
India	26	19%
Philippines	15	11%
Indonesia	14	10%
Australia	13	9%
Bhutan	12	9%
China	9	7%
Viet Nam	6	4%
Burma (Myanmar)	4	3%
South Africa	4	3%
Nepal	3	2%
Other	32	23%
Total	138	100%

The date of entry to Australia was known for 100% (n=125) of overseas born cases. The interval between the date of arrival in Australia and TB notification date ranged from 0 to 71 years, with a median interval of 17 years (Interquartile range (IQR)=8-30). Similar to previous years, new migrants had the highest burden of TB disease among the overseas born population with 36% (n=45) diagnosed within two years and 55% (n=69) 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 100% (n=125) of the cases notified in 2020. Similar to previous years, the majority were identified as permanent residents (58%, n=72) with slightly decrease from the 64% reported in 2019. on the other hand, numbers of TB cases among overseas students increased to 20% (n=25) from 12% (n=15) observed in 2019, while overseas visitors numbers remained stable with 10% (n=12) and 11% (n=13) in 2020 and 2019 respectively. (Table 4). Of those with temporary Australian residence status (n=53), 43% (n=23) were diagnosed with TB as part of immigration health check, these include 9 visitor visa and 8 student visa applicants representing 75% and 32% of cases in the respective visa categories.

Table 4: Tuberculosis cases among overseas born by immigration status, WA 2020

Immigration Status	Number	% Total
Permanent resident	72	58%
Overseas student	25	20%
Overseas visitor	12	10%
Family visa	7	6%
Work visa	6	5%
NZ resident/citizen	2	2%
Refugee	1	1%
Total	125	100%

GEOGRAPHICAL DISTRIBUTION

The geographical distribution of TB cases in 2020 was relatively narrower than previously observed with TB notified in 28 Local Government Areas (LGA) compared with 30 and 36 in 2019 and 2018 respectively. Numbers of TB cases in country WA continued to decline for the second year and at 5% (n=7) of notified cases in 2020, was the lowest on record since 2014

with an incidence rate of 2.1/100,000 (95% CI 0.5-3.6). Perth metropolitan area accounted for 95%, (n=131) of all cases with a rate of 6.1/100,000 population (95% CI 5.1-7.2) (Tables 5) compared to 92% and 85% in 2019 and 2018 respectively. Local government areas of City of Canning, City of Stirling, City of Gosnells, City of Wanneroo and City of Kwinana, had the highest numbers of TB cases in the state accounting together for 55% (n=76) of all WA TB burden in 2020.

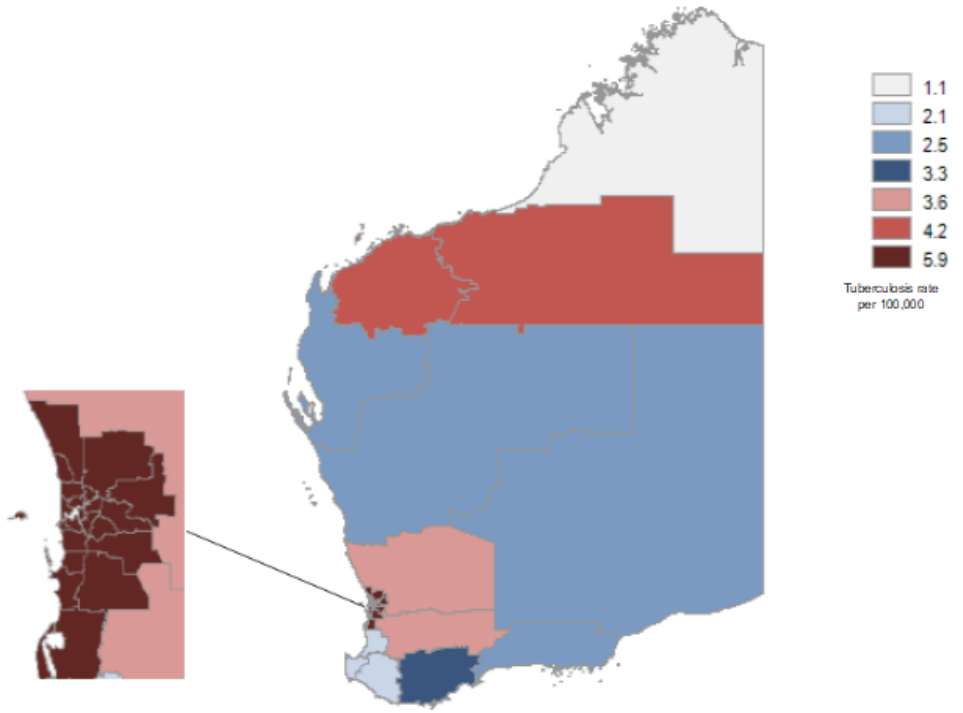
Table 5: Tuberculosis notification numbers and rates, WA Regions 2020

Region	Number	Rate[1] (95% CI)[2]
Metropolitan Perth	131	6.1 (5.1 – 7.2)
South West	3	1.8 (-0.2 – 3.9)
Kimberley	2	5.5 (-2.1 – 13.2)
Pilbara	1	1.6 (-1.5 – 4.7)
Wheatbelt	1	1.4 (-1.3 – 4.1)
Goldfields-Esperance	0	-
Great Southern	0	-
Midwest- Gascoyne	0	-

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

The 5 years average rate of regional TB was highest in Perth metropolitan area with an average rate of 5.9/100,000 population (Figure 5), followed by the Pilbara, the Wheatbelt and the Great Southern regions with average rate of 4.2, 3.6 and 3.3/100,000 population respectively.

Figure 5: Five-year average tuberculosis incidence rates by WA Regions 2016-2020



Compared with TB cases from Perth metropolitan, cases from country WA showed similar age and sex distribution. Place of birth distribution was significantly different between the 2 groups with over 90% of Perth metropolitan cases and only 57% of country patients born overseas. Pulmonary TB was more common in both metropolitan and county patients (57% and 71%) this was in contrast to 2019 data that showed over 60% of country patients diagnosed with extra-

pulmonary TB. 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 clinically significant delays. Although the lag-time was significantly higher among country patients with a median of 76 days delay compared with a median delay of 61 days among metropolitan patients, Metropolitan cases had more clinically significant delay. (Table 6).

Table 6: Regional comparison of tuberculosis notifications, WA 2020

			Metro	Country	P value
Age	Median (IQR)		39 (25-58)	31 (26-40)	>0.05
Sex	Male	N (%)	54 (41.2%)	1 (14.3%)	>0.05
	Female	N (%)	77 (58.8%)	6 (85.7%)	
Place of Birth	Australia	N (%)	10 (7.6%)	3 (42.9%)	<0.05*
	Overseas	N (%)	121 (92.4%)	4 (57.1%)	
TB Type	PTB	N (%)	75(57.3%)	5 (71.4%)	>0.05
	XPTB	N (%)	56 (42.7%)	2 (42.7%)	
HIV Status	Positive	N (%)	1 (0.8%)	0 (0.0%)	>0.05
	Negative	N (%)	127 (96.9%)	7 (100.0%)	
	Not tested or refused	N (%)	3 (2.3%)	0 (0.0%)	
	Unknown	N (%)	6 (4.7%)	0 (0.0%)	
HS lag time	Median (IQR)		61 (27-134)	76 (28-119)	<0.05*
HS Delay	Yes	N (%)	69 (52.7%)	3 (42.9%)	>0.05
	No	N (%)	62 (47.3%)	4 (57.1%)	

*significant difference

CLINICAL CHARACTERISTICS

In 2020, the site of TB was reported for all 138 notified cases. More than half had pulmonary disease (58%, n=80). This was similar to the figures reported in 2019 and 2018. One in five cases with pulmonary disease (n=15) were also reported to have extra-pulmonary disease in at least one additional site (Table 7).

Table 7: Tuberculosis notifications by site of disease, WA 2019

Site	Number	% Total
Pulmonary only	65	47%
Pulmonary plus other sites	15	11%
Extrapulmonary only	58	42%
Total	136	100%

The extra-pulmonary TB disease sites in 2020 was largely similar to 2019 distribution with lymph node, pleural and peritoneal TB being the most reported extra-pulmonary sites representing 68% of 2020 extra-pulmonary cases. (Table 8).

Table 8: Extra-pulmonary TB notifications by site of disease, WA 2020

Site of extra-pulmonary TB	Number	% Total
Lymph Node	35	43%
Pleural	11	14%
Peritoneal (includes all GI sites)	9	11%
Bone-Joint	8	10%
Disseminated TB	5	6%
Meningeal	4	5%
Ocular	4	5%
Genitourinary	2	2%
Laryngeal	1	1%
Pericardial	1	1%
Cutaneous	1	1%
Total	81	100%

Of the 138 TB cases reported in 2020, 96% (n=133) were new cases while 4% (n=5) had relapsed after previous treatment. One case relapsed after full treatment in Australia, the patient was initially treated empirically for culture negative extra-pulmonary TB and relapsed with culture proven MDR TB. The remaining four cases relapsed after treatment overseas.

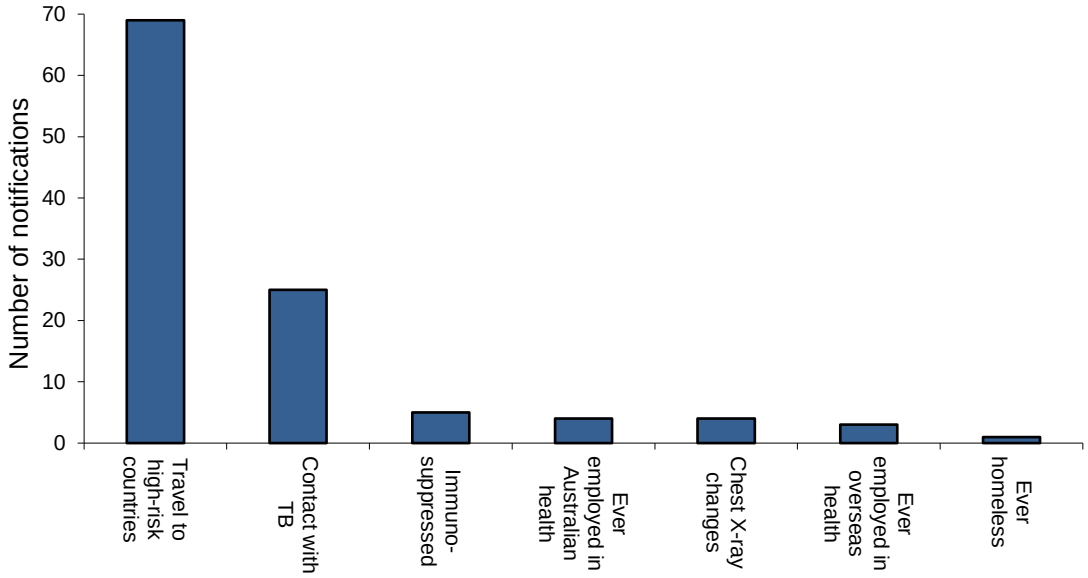
TB RISK FACTORS

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.

The proportion of TB cases with known HIV status increased in 2020 to 98% (n=135) from 91% and 88% in 2019 and 2018 respectively. One of the tested cases with known results was HIV positive. Those without HIV status recorded were not tested (2%, n=3).

In 2020, no risk factors were identified in 30% (n=42) of the cases, while for those with identified risk (n=96), the most common risk factor reported was past travel to, or residence in, high risk country(ies) (72%) followed by being household member or close contact with TB (26%). (Figure 6).

Figure 6: Risk factors reported for tuberculosis notifications, WA 2020



TB AMONG HEALTH CARE WORKERS

Even in TB low risk countries like Australia, evidence suggest that Health Care Workers (HCW) are at higher risk of acquiring TB compared to the general population[1]. The importance of TB among health care worker is further highlighted by the risk of transmission within health care facilities to those under their care requiring control measures that often involve extensive and occasionally sensitive contact investigation.

In 2020, information on occupation was known for 99% (n=115) of the 116 cases aged between 20 and 64 years. Of those with known occupation, 13% (n=14) reported working as health care workers. Six of these patients had pulmonary TB with 4 considered potentially infectious due to sputum smear positive disease. Contact investigation of the smear positive patient revealed 218 contacts from which 3 case of active TB were identified, all among household contacts, and 38 contacts were diagnosed with Latent TB Infection (LTBI). All 14 health care workers were overseas born from high TB risk countries.

HEALTH SYSTEM (HS) DELAY

In 2020 health system delay, defined as time from first TB related health contact to starting TB treatment, was recorded for all 138 notified cases. Of these, 31.9% (n=44) started treatment within 30 days of first health contact, 32.6% (n=45) started treatment between 30 and 90 days and 35.5% (n=49) 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 2020 was 62 days (IQR=27-133) compared to 45 days (IQR=14-129) and 60 days (IQR=33-113) in 2019 and 2018 respectively, this increase in delay was not statistically significant using the Wilcoxon Rank-Sum test. Delay by TB type showed that pulmonary TB cases had a median delay of 50 days (IQR=28-90) (30 days in 2019) compared to 89 days median delay (IQR=29-210) for extra-pulmonary cases (88 days in 2019).

Significant delay was again assessed, using the delay matrix introduced in 2016. 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 52.2% of 2020 cases (n=72), this was higher than the delay observed among 2019 cases (48.5%) but the difference was not statistically significant using Chi-square test. The matrix also showed delay difference between pulmonary and extra-pulmonary TB cases with pulmonary TB more likely to be delayed (58.8% vs 43.1%). This difference was not statistically significant with an odds ratio of 1.88 (95% CI= 0.95-3.7). In comparison in 2019, health system delay was similar for pulmonary and extra-pulmonary TB (odd ratio 1.04).

MYCOBACTERIAL LABORATORY DATA

The percentage of culture confirmed TB cases increased from 71% (n=98) in 2019 to 76% (n=105) in 2020. This was due to a 20% increase in culture positive extra-pulmonary TB with 36 culture confirmed cases (62%) compared with 30 cases (50%) in 2019. On the other hand, culture confirmation of pulmonary TB cases was similar to 2019 with 88% culture positive cases (88% and 90% in 2019 and 2018 respectively). These culture results were still exceeding the target of 80% culture confirmation of all new pulmonary TB cases set by the European Centre for Disease Prevention and Control[2]. Of the TB cases with no culture confirmation, 81% (n=26) had samples setup for TB culturing with no growth after prolonged incubation (10 pulmonary and 16 extra-pulmonary), of these, 1 pulmonary and 2 extra-pulmonary cases were confirmed with positive Nucleic Acid Amplification Test (NAAT). Culture was not done for the remaining 19% (n=6) cases who mostly had TB in sites that were not easily amenable to tissue sampling (e.g. ocular TB). All 106 cultures positive cases were identified with *Mycobacterium tuberculosis* infection (Table 8).

Sputum smear positive cases decreased from 33% in 2019 to 30% (41/138) of all TB notifications and from 65% in 2019 to 59% (41/70) of cases with culture positive pulmonary disease. (Table 9).

Table 9: Tuberculosis Notifications by culture and sputum smear result, WA 2020

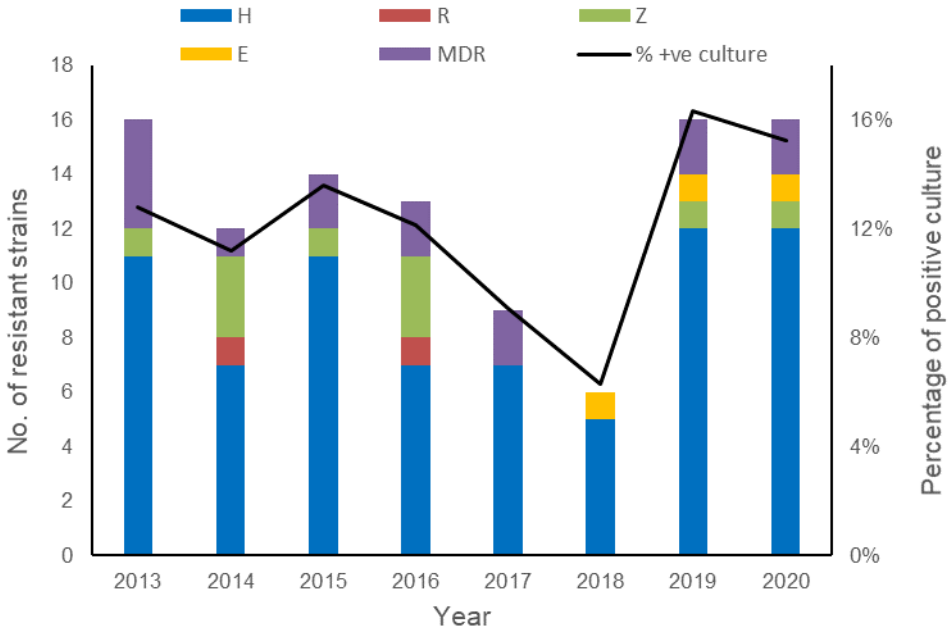
	Culture Positive		Sputum Smear Positive	
Site	**Number**	**% Site**	**Number**	**% Site***
All TB notifications	106	77%	41	30%
Pulmonary only	57	88%	34	52%
Pulmonary plus other sites	13	87%	7	47%
Extrapulmonary only	36	62%	0	0%

*Percentage of all cases including culture negative

Drug susceptibility

Drug susceptibility test (DST) results for first-line TB drugs were available for all 106 culture confirmed cases. Of these, 87% (n=92) were fully susceptible to all first line TB drugs and 11% (n=12) were resistant to isoniazid. These figures were similar to 2019 but significantly higher than the 5% (n=5) isoniazid resistance reported in 2018 ($P < 0.05$). The number of multi-drug resistant TB (MDR-TB) cases was also similar to 2019 with 2 cases, resistant to all first-line TB drugs, detected in 2020. Except for one case, all patient with drug resistant TB were born overseas. Two cases relapsed after previous TB treatment. One with isoniazid resistant-TB relapsed after treatment overseas and one with MDR-TB relapsed after empirical TB treatment in Australia

Figure 7: Tuberculosis cases with drug resistance, WA, 2013-2020



GENOTYPING AND STRAIN IDENTIFICATION

In the presented results, a genotyped cluster is defined as isolates sharing identical 15/24 loci VNTR-MIRU type[3]. Also, to allow for the lag time between exposure and disease development, often observed in TB, the data from the previous 4 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[4].

In 2020, TB molecular typing results were available for 99% (n=105) of culture-positive TB cases. Of these, 15 cases were in 7 molecular clusters, with a median cluster size of two cases and 90 cases had a unique strain type with an overall clustering rate of 8% *(Clustering rate = (nc-c) / n, where nc is the total number of clustered isolates, c is the number of isolate clusters, and n is the total number of isolates in the sample)*[5]. Of the 7 molecular clusters, one cluster was epidemiologically confirmed, one cluster was epidemiologically probable, 3 clusters were epidemiologically possible while no clear epidemiological links were identified in the remaining 2 clusters

Overall, for culture confirmed cases notified between 2016 and 2020, 501 isolates had strain typing with MIRU-VNTR completed for at least 15 loci. Of these, 99 (20%) had non-unique molecular types and were in 34 separate molecular clusters with a median cluster size of 2 cases (range 2-10). Beijing and East African Indian (EAI) strains were the most common strains among molecular clusters accounting for 11 clusters and 51% of the clustering strains.

Strain identification was completed for 61.8% of the typed isolates between 2016 and 2020. Indo-Oceanic (lineage 1) was the most prevalent representing 25.0%, followed by the East-Asian (lineage 2) (19.2%), Euro-American (lineage 4) (10.6%) and East African-Indian (lineage 3) (5.4%) (Table 10).

Table 10: MIRU-VNTR tuberculosis strains, WA 2016-2020

Global lineage	Sub-lineage	(%)
Indo-Oceanic (lineage 1)	East African-Indian (EAI)	25.0%
East-Asian (lineage 2)	Beijing	19.2%
East African-Indian (lineage 3)	Delhi/Central Asian (Delhi/CAS)	5.4%
Euro-American (lineage 4)	Haarlem	3.2%
	LAM	2.0%
	NEW-1	1.6%
	TUR	1.2%
	Cameroon	0.8%
	S	0.6%
	X	0.4%
	Uganda II	0.4%
	Uganda I	0.2%
	Ghana	0.2%
West African 1 (lineage 5)	West African 1	0.2%
	Multiple matches	0.4%
	Unknown	39.2%

TREATMENT OUTCOMES, 2019

Due to the length of time taken for the treatment of TB to be completed, the data presented in this section are for the 138 TB cases notified in 2019. Of those, 135 cases were commenced on treatment for TB, one case deceased and 2 case transferred overseas before starting treatment. Treatment outcome was assessed for 93% (n=126) of the 135 cases which started TB treatment in 2019 after further excluding those transferred outside of Australia, or died of other causes while on treatment. There were no cases still on treatment.

The proportion of cases successfully treated (including cured and completing treatment) was 96% (n=121) of assessable cases, slightly decreasing from the 97% reported in 2018 (Table 11).

Table 2: Tuberculosis treatment outcome, WA, 2019

Outcome	Number	% Total
Assessable outcomes		
Treatment success	121	96%
Cured (bacteriologically confirmed)	0	0%
Completed treatment	121	96%
Interrupted treatment	0	0%
Died of TB (died during treatment of TB, as a result of TB disease)	2	2%
Defaulter	3	2%
Failure	0	0%
Not followed up, outcome unknown	0	0%
Total assessable	126	100%
Non-assessable outcomes		
Transferred out of Australia	4	3%
Died of other cause (died during treatment of cause other than TB)	5	4%
Still under treatment	0	0%
Total	135	100%

For assessable outcomes, the reported reasons for not completing treatment were death due to TB (2%) and defaulting before treatment completion (2%). Death during TB treatment from other cause (4%) was the most common reason for non-assessable treatment outcomes. Death from all causes represented 5%, this was a decrease from the 6% reported in 2018. On the other hand, TB caused or contributed to 2 deaths, giving a TB case fatality rate of 1.4%. This was less than rates noted in 2018 and 2017 (2.2% and 2.3% respectively) but was an increase from the 0.7% and 0.8% case fatality rates reported for 2016 and 2015 respectively. The 2 TB related deaths were in mid-thirties and mid-fifties patients with disseminated TB on background of severe immunocompromising medical conditions.

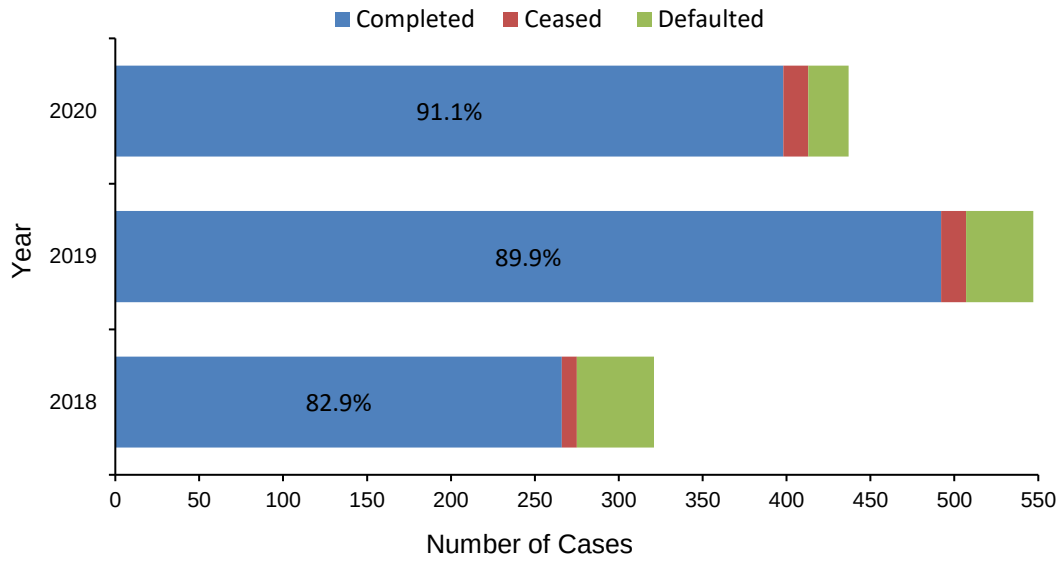
LATENT TB

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[6].

In 2020, the limited international travel arrangements as part of the ongoing COVID-19 pandemic response has led to a noticeable decrease in the numbers of recent arrivals. This likely contributed to the observed decrease of LTBI treatment in 2020 with 438 individuals starting LTBI preventive treatment, a 20% decrease from the 2019 LTBI treatment figures (n=549).

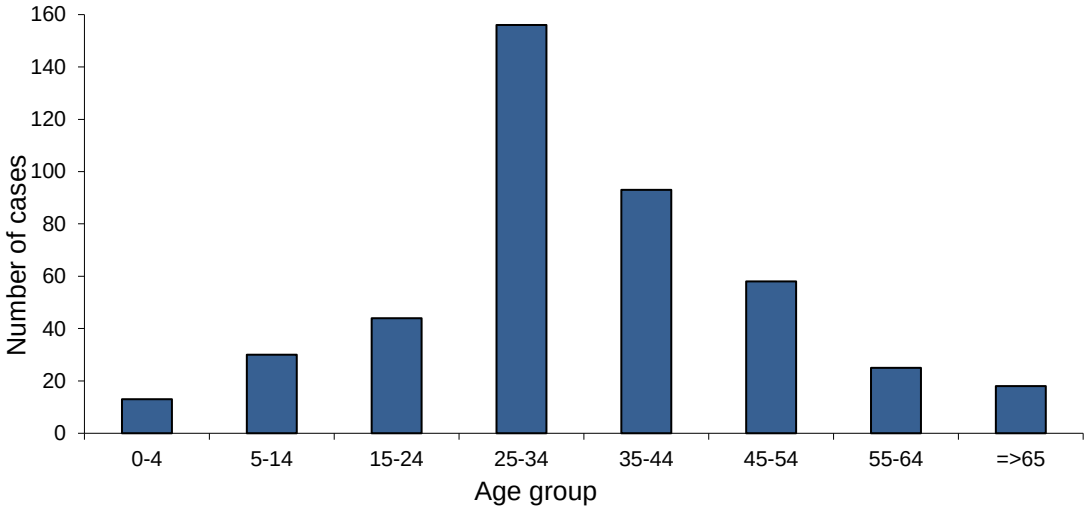
Treatment outcomes were available for all cases after excluding one case who deceased from unrelated cause whilst on treatment. Treatment completion rates continued to improve with 91.1% (n=398) completing the prescribed treatment course compared to 89.9% and 82.9% completion rate in 2019 and 2018 respectively (Figure 8).

Figure 8: LTBI treatment outcomes, WA 2018 - 2020



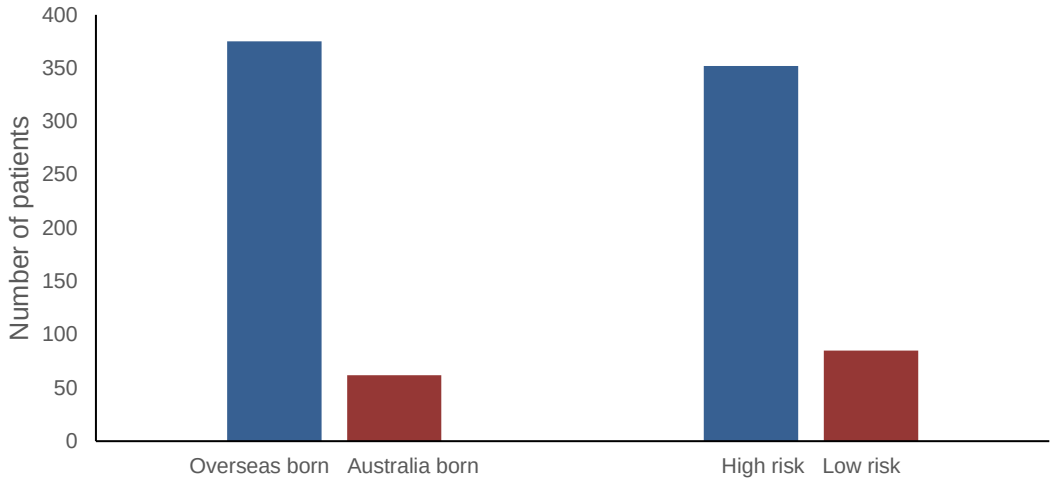
Gender distribution among those starting LTBI treatment was similar to previous years with males representing 45.1% (n=235) and male to female ratio of 1:1.2 (1:1.3 in 2019). the majority were less than 35 years of age (55.6%) with the age group 25-34 representing the biggest age group and accounting for 35.7% of those starting LTBI treatment (Figure 9).

Figure 9: LTBI treatment by age group, WA 2020



Where place of birth was recorded, 85.8% of those starting LTBI treatment were among overseas born individuals and 80.5% were born in TB high risk countries (countries with annual TB rate of ≥ 40/100,000 population) (Figure 10).

Figure 10: LTBI cases by place of birth, WA 2020



The reason for LTBI screening and treatment was recorded for all of 2020 LTBI cases. Of these 36.4% were identified with LTBI as part of healthcare worker (HCW) screening, 30.0%, had recent history of TB contact, 10.8% were recent migrants, 9.2% were screened prior to starting immunosuppressive treatment and 5.5% were newly arrived refugees. (Table 12)

Table 3: LTBI cases by screening reason, WA 2020

Country of Birth	Number	% Total
Healthcare worker screening	159	36.4%
TB Contacts	131	30.0%
Recent migrant	47	10.8%
Immunosuppressive treatment	40	9.2%
Recently arrived refugee	24	5.5%
Other	36	8.2%

Of those failing to satisfactorily complete treatment in 2020, 3.4% (n=15) did so for reasons that are not amenable to intervention (adverse drug reactions), on the other hand, 5.5% (n=24) failed to complete LTBI treatment for reasons that can potentially be improved with additional targeted interventions (non-adherence, lost to follow up) (Table 13).

Table 4: LTBI treatment outcomes, WA 2020

		Treatment Outcomes					
		Completed		Did not complete		Total	
Sex	Male	187	94.9%	10	5.1%	197	45.1%
	Female	211	89%	29	12.1%	240	54.9%
Age Category	0-4y	13	100%	0	0%	13	3.0%
	5-14y	30	100%	0	0%	30	6.9%
	15-24y	38	86.4%	6	13.6%	44	10.1%
	25-34y	140	89.7%	16	10.3%	156	35.7%
	35-44y	84	90.3%	9	9.7%	93	21.3%
	45-54y	54	93.1%	4	6.9%	58	13.3%
	55-64y	24	96.0	1	4.0%	25	5.7%
	=>65y	15	83.3%	3	16.7%	18	4.1%
Place of Birth	Australia	59	95.2%	3	4.8%	62	14.2%
	Overseas	339	90.4%	36	9.6%	375	85.8%
TB Risk	Low risk	46	93.9%	3	6.1%	49	11.2%
	High risk	352	91.0%	35	9.0%	387	88.6%
LTBI Medication	H	50	86.2%	8	13.8%	58	13.3%
	R	237	89.4%	28	10.6%	265	60.6%
	HR	111	97.4%	3	2.6%	114	26.1%
Reason for Screening	TB Contact	119	90.8%	12	9.2%	131	30.0%
	Refugee	23	95.8.9%	1	4.2%	24	5.5%
	HCW	141	88.7%	18	11.3%	159	36.4%
	Migrant	46	97.9%	1	2.1%	47	10.8%
	Immuno-suppressed	38	95.0%	2	5.0%	40	9.2%
	Other	31	86.1%	5	13.9%	36	8.2%

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

TB CONTACT INVESTIGATION

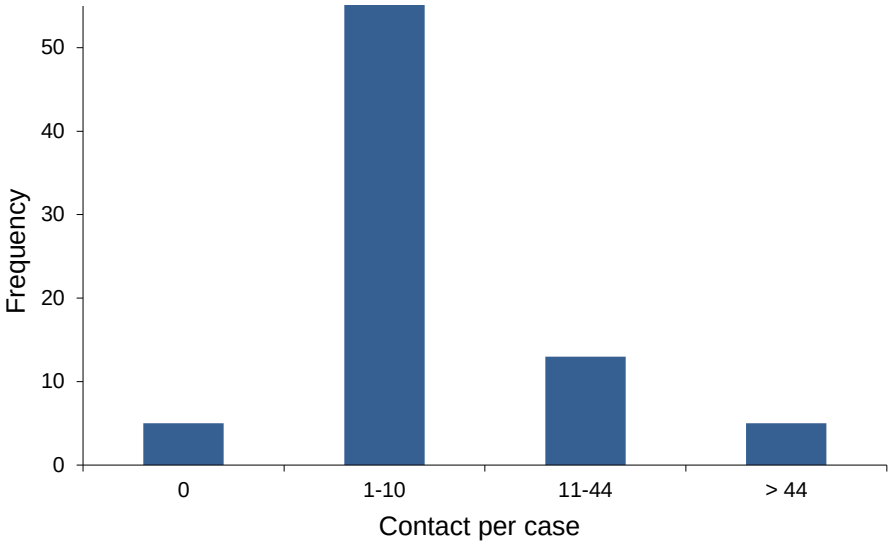
Contact investigation involves identifying individuals who may be at risk of having TB infection or active TB disease as a result of sharing air space with an active TB case. Contacts investigation is prioritised based on to the type of TB, duration of contact, and contact risk factors. The data presented 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 2020, a total of 1271 contacts were identified and were associated with 138 active TB cases. Of these, 83.4% (n=1060) were contacts of 75 pulmonary TB (PTB) cases and 16.6% (n=211) were contacts of 56 extra-pulmonary TB (XPTB) cases. No contacts were identified for 5 pulmonary TB cases and 2 extra-pulmonary TB cases.

The maximum number of contacts associated with a single case was 151 contacts with a mean number of contacts of 9.2 per case and a median of 4 contacts per case. The minimum number of one contact per case was identified in 17 TB cases.

The mean number of contacts of pulmonary TB cases was 13.3 contacts with a median of 5 contacts per case. Majority of pulmonary TB cases (76.0% n=57) had 10 or fewer listed contacts. Thirteen cases (17.3%) had 11 to 44 contacts while five cases (6.7%) had more than 44 contacts identified (Figure 11). There were 25 children less than 5 years of age identified as contacts, representing 2.4% of pulmonary TB contacts.

Figure 11: number of contacts per respiratory case, WA 2020



Contact investigation outcomes

In 2020, 25.5% of all contacts (n=324) did not attend, did not complete or there was no recorded outcome of their TB screening, this was a decrease of the 35.0% contacts with no outcome recorded in 2019. Eight contacts (0.7%) died before screening completion and 12 contacts (0.9%) were transferred to the jurisdiction of their residence. Of those fully screened, 72.9% (n=676) had negative screening results, 21.4% (n=198) were diagnosed with LTBI, 2.7% (n=25) had a past history of TB or LTBI and 1.0% (n=9) represented secondary active TB cases identified by contact investigation. Only 2 of the pulmonary TB contacts less than 5 years of age had no screening outcome recorded due to non-attendance and transfer out while 15 had negative screening results, 6 were diagnosed with LTBI and 2 with secondary active TB.

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. Data cleaning undertaking as part of this report preparation continues to contribute to this data quality improvement.

Enhanced TB surveillance data

All audited enhanced surveillance variables were complete except for ‘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 variables with empty fields.

Latent TB and contact investigation data

The quality of LTBI data showed marked improvement in 2020 with only 2 variables having missing values. The 2 variables with missing values were ‘Risk Factor’ with and ‘year of Australia entry’ that had 65.7% and 39.6% incomplete records respectively.

Contact investigation outcome data improved in 2020 with only 1.7% missing data compared to 10% in 2019. On the other hand, gaps still existed in basic demographic data with contacts date of birth missing from 22.4% of the case (17% in 2019) and country of birth (new variable in 2020) missing from 65.0% of the cases.

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