Tuberculosis in New South Wales

Surveillance Report 2021

NSW GOVERNMENT

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Contents

Summary

- There were 558 tuberculosis (TB) cases notified in New South Wales (NSW) in 2021, 11% lower than the number of cases notified in 2020.
- Notification rate was 6.8 cases per 100,000 population per year.
- Overseas born TB cases accounted for 92% of cases (n=512). The most frequently reported countries of birth were India, Nepal and the Philippines.
- Of the 46 Australian born cases, 4 (9%) identified as Aboriginal or Torres Strait Islander people.
- Notification rates were highest in Western Sydney and Sydney Local Health Districts (LHDs).
- The most frequently reported risk factors were being born, or past residence (≥ 3 months), in a high-risk country for TB; known contact with TB; or previously being treated for TB or having a chest x-ray (CXR) suggestive of old untreated TB.
- 424 cases (76%) were laboratory confirmed by culture or polymerase chain reaction (PCR), with 134 cases (24%) receiving a clinical diagnosis only.
- Of those cases with laboratory confirmation, five cases were classified as having multi-drug resistant TB (MDR-TB), no cases had extensively drug resistant TB (XDR-TB). This represents 1% of culture confirmed cases and is slightly less than previous years.

	2021	**Change since 2020**
TB cases (number)	558	🡻 11% (n=625)
TB notification rate	6.8 per 100,000	🡻 12% (7.6 per 100,000)
Australian born non-Indigenous cases (number)	42	🡻 11% (n=47)
Australian born non-Indigenous rate	0.8 per 100,000	- (0.8 per 100,000)
Australian born Aboriginal cases (number)	4	🡻 33% (n=6)
Australian born Aboriginal notification rate	1.4 per 100,000	🡻 42% (2.4 per 100,000)
MDR-TB cases	5	🡻 29% (n=7)
% cases tested for HIV at diagnosis	94%	🡹 2% (92%)

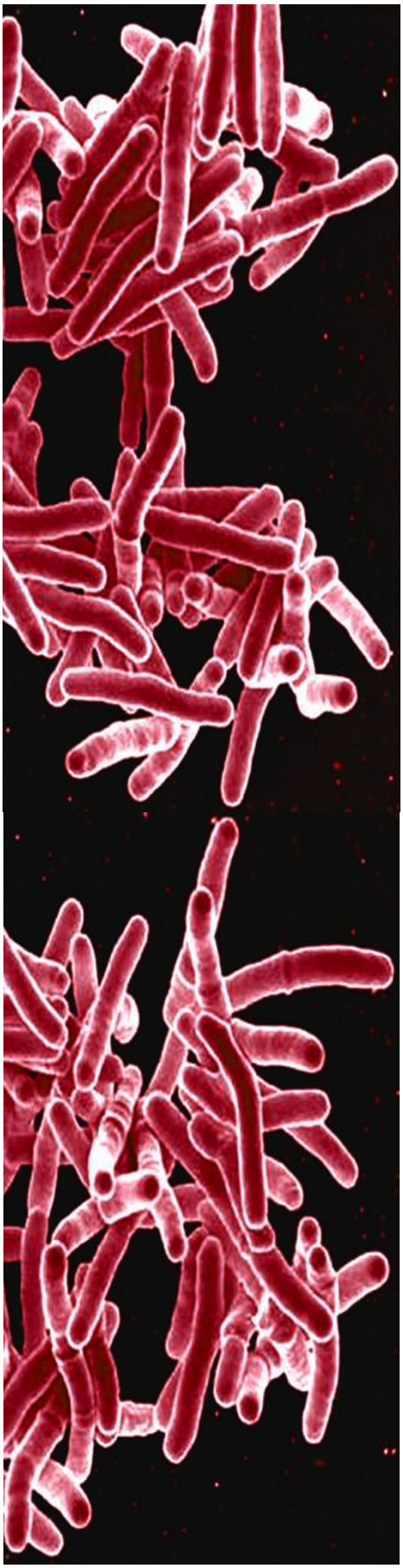


Image: CDC PHIL #18139: Scanning Electron Microscopy image of Mycobacterium Tuberculosis Credit: National Institute of Allergy and Infectious Diseases (NIAID)

Introduction

Tuberculosis (TB) is a bacterial disease caused by infection with *Mycobacterium tuberculosis.* Globally TB remains a disease of public health significance. The World Health Organization (WHO) reported 6.4 million new cases in 2021. This is a 10% decline from 2019 but potentially explained by the delayed diagnosis of cases due to the global COVID-19 pandemic [1]. Drug resistant TB is an increasing threat globally, with over 161,746 cases of drug resistant TB (rifampicin-resistant, multi drug resistant [MDR-TB], pre-XDR, or XDR) worldwide in 2021, of which 15% had pre-XDR or XDR TB [1].

Australia continues to have a low incidence of TB, with the Commonwealth Department of Health reporting a rate of 5.7 cases per 100,000 population in 2021 [2]. The incidence of TB reported in NSW in 2021 decreased from the latter half of the year which is most likely attributable to reduced immigration to Australia since early 2020. Mortality from TB in Australia is very low with 1% of cases reported to have died from TB in 2020 [unpublished].

The NSW TB Program, through a network of dedicated TB services across the state, continue to focus on active case finding, early diagnosis, and effective treatment of cases and contacts to minimise local transmission of TB in NSW.

Surveillance of TB in NSW is conducted under the NSW *Public Health Act 2010*.

The purpose of this report is to describe the epidemiology of TB in NSW in 2021.

Methods

Data were extracted from the Notifiable Conditions Information Management System (NCIMS) on 9 November 2022 for all confirmed cases of TB notified from 1 January 2002 to 31 December 2021. Population data including NSW mid-year population estimates, estimated populations by country of birth and population estimates by local health district (LHD) were obtained from the Australian Bureau of Statistics (ABS) via the Secure Analytics for Population Health Research and Intelligence System (SAPHaRI).

Phenotypic drug susceptibility testing was performed at the NSW Mycobacterium Reference Laboratory using the modified proportion method with the Bactec MGIT 960 system (Becton Dickinson), in liquid culture media. Isolates were tested at World Health Organization (WHO) defined critical concentrations for anti-mycobacterial agents. All isolates received phenotypic testing for isoniazid, rifampicin, pyrazinamide and ethambutol; second-line agents were tested for MDR-TB isolates, and upon clinician request. Select isolates also received testing for pyrazinamide susceptibility using Wayne's pyrazinamide assay. When phenotypic drug susceptibility was unavailable drug resistance was determined by SNP calling using Snippy with inhouse scripts and CRyPTIC database for mutations associated with drug resistance.

High quality DNA of *M. tuberculosis* was extracted from positive cultures for whole genome sequencing by the NSW Mycobacterium Reference Laboratory. Library are prepared by the Microbial Genomics Reference Laboratory as per manufacture procedure for Nextera XT DNA preparation kit (Illumina). Sequencing was performed in NextSeq500 with 2 x 150 bp paired-end chemistry. Sequence data was trimmed with Trimmomatic and lineage determined using Mykrobe Predictor TB. Cluster detection was determined by SNP difference through Reddog pipeline. Cases were considered clustered if there was less than 12 SNPs difference between cases. Only cases notified in 2021 or earlier were included in the analyses.

Statistical analyses

Notification data were analysed using descriptive and analytic methods. Overseas born cases were categorised into regions of birth using ABS standards. Notification rates per 100,000 population per year were calculated for the whole of NSW using select fields from demographic data categories. Notification rates for TB by LHD of residence, and country of birth, were calculated and mapped using R (R core team, Vienna, Austria, 2022). The TB notification rate by country of birth was calculated utilising the 2016 ABS Census Data with country of birth for NSW residents as a denominator. Data were analysed using R (R core team, Vienna, Austria, 2022). The chi squared test was used for cell sizes of 5 or greater and fisher's exact test for samples sizes of less than 5. Significance was tested at the 0.05 level.

Definitions

Clinically diagnosed TB is when a clinician experienced in TB makes a clinical diagnosis of TB disease [4] without a culture or PCR result. Other laboratory suggestive evidence such as smear results for acid fast bacilli or histology may be taken into account. Cases of latent TB infection are not included.

Default is when a person did not commence treatment or ceased treatment early by their own choice.

Ethnicity is the broad ancestral or ethnic group a person belongs to. Ethnicity is a shared identity or similarity of a group of people based on one or more distinguishing characteristic. Including a long-shared history, a cultural tradition, a common geographic origin, a common language, a common literature, a common religion, being a minority, being racially conspicuous.

Extrapulmonary TB is disease affecting any other region of the body, including the pleura.

Extensively drug-resistant TB (XDR-TB) are cases in which isolates demonstrated resistance to isoniazid and rifampicin, as well as additional resistance to any fluoroquinolone, and to at least one injectable second-line drug (capreomycin, kanamycin or amikacin) [5].

High risk countries are those with an annual TB incidence of 40 cases per 100,000 population per year or more in 2020 [1].

Laboratory confirmed TB is isolation of *Mycobacterium tuberculosis* complex (*M. tuberculosis, M. bovis*, or *M. africanum*, excluding *M. bovis var* BCG) by culture or detection of *M. tuberculosis* complex by nucleic acid testing except where this is likely to be due to previously treated or inactive disease.

Medical default is a person who ceased treatment early on the recommendation of the treating medical team.

MDR-TB are cases with isolates that demonstrate resistance to at least isoniazid and rifampicin [5].

Overseas student is a person studying or seeking study, training, or skills development in Australia.

Permanent resident is a person who holds a permanent visa (or has become an Australian citizen) and is usually resident in Australia.

Pre-extensively drug-resistant TB (pre-XDR-TB) are cases in which isolates demonstrated resistance to isoniazid and rifampicin, as well as additional resistance to any fluoroquinolone or at least one injectable second-line drug (capreomycin, kanamycin or amikacin) but not both [5].

Pulmonary TB is disease affecting the lung, excluding the pleura.

Refugee / humanitarian is a person in humanitarian need overseas or a person already in Australia who arrived on a temporary visa or in an unauthorised manner, claiming Australia's protection.

SNP Single nucleotide polymorphisms.

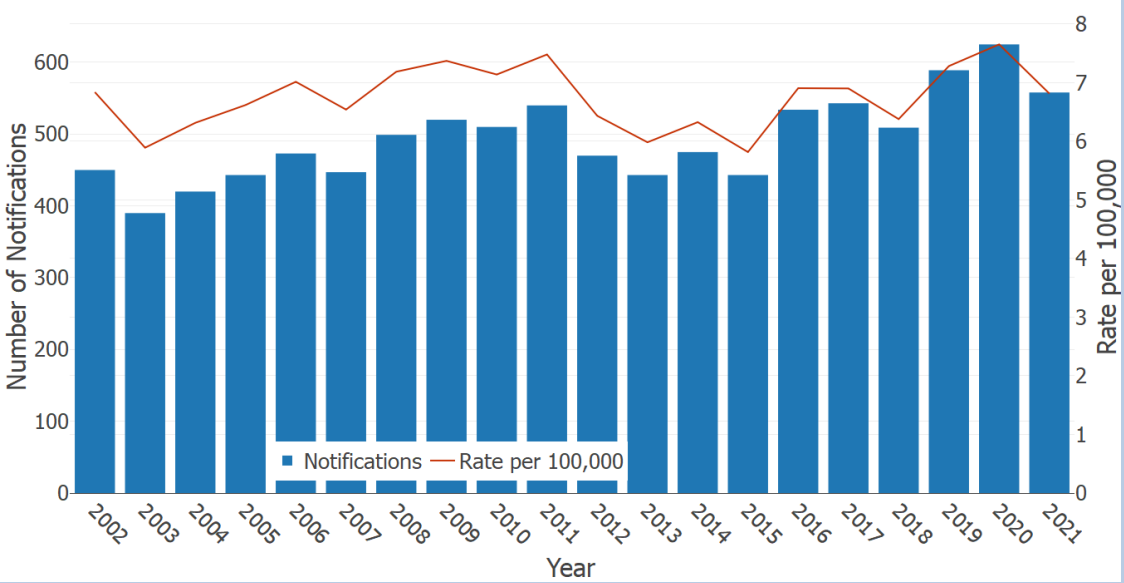
Unauthorized person is an unlawful non-citizen

Visitor is a person entering Australia temporarily for tourism, to visit family and friends, to undergo pre-arranged medical treatment or for business related purposes.

Section 1: Demographics

There were 558 notified cases of TB in 2021 in NSW (Figure 1). These cases compromised 38% of the total notified cases in Australia in 2021 (1472 cases) [2]. The number of notifications received in 2021 was 11% lower than the number notified in 2020, the drop in cases was seen in the latter half of 2021 and may be a delayed result of Covid-19 pandemic related border restrictions in place since March 2020. The annual notification rate of TB in 2021 in NSW was 6.8 per 100,000 population per year (Figure 1).

Figure 1: Number and rate of TB disease notifications, NSW, 2002-2021



2021

558
Number of cases notified

6.8
Rate per 100,000 population

Demographics

Of the 558 cases of TB notified in 2021, 58% of cases were male (n=325). The median age among males was 39 years (range 2 - 91 years); while the median age among females was 33 years (range 7 months - 91 years). The median age overall was 36 years (range 7 months – 91 years).

Over half of the cases notified were aged between 20 and 39 years (n=290) with a peak in the number of cases in the 25-29 year age group (n=92, rate=15.6 cases per 100,000). A second peak in the notification rate was observed in those aged over 85 years (n=15, rate=8.1 cases per 100,000). There were 6 cases (1%) in the 0-4 year age group (Figures 2 and 3).

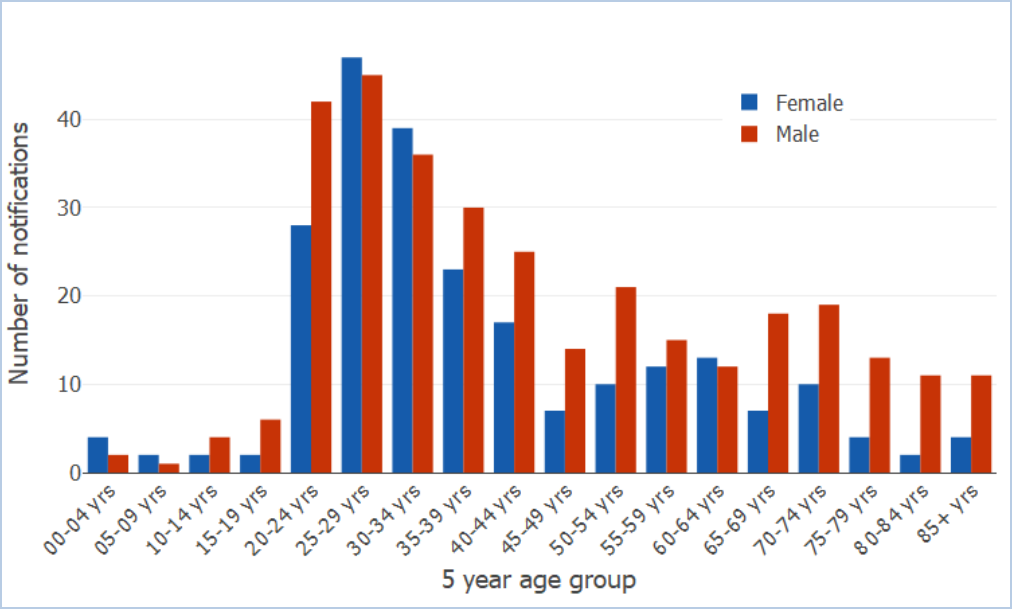
Age and Sex

Sex

58%
Male

42%
Female

Figure 2: Number of TB notifications by age group and sex, NSW, 2021



Age Overall

Range: 7 months-91 years
Median: 36 years

Age by Sex

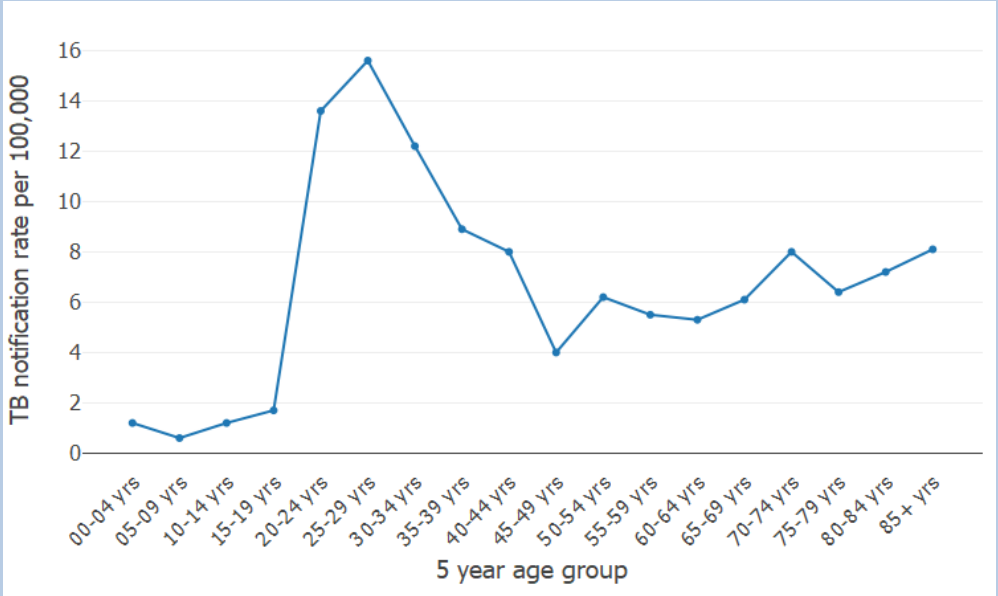
Male

Range: 2-91 years
Median: 39 years

Female

Range: 7 months-91 years
Median: 33 years

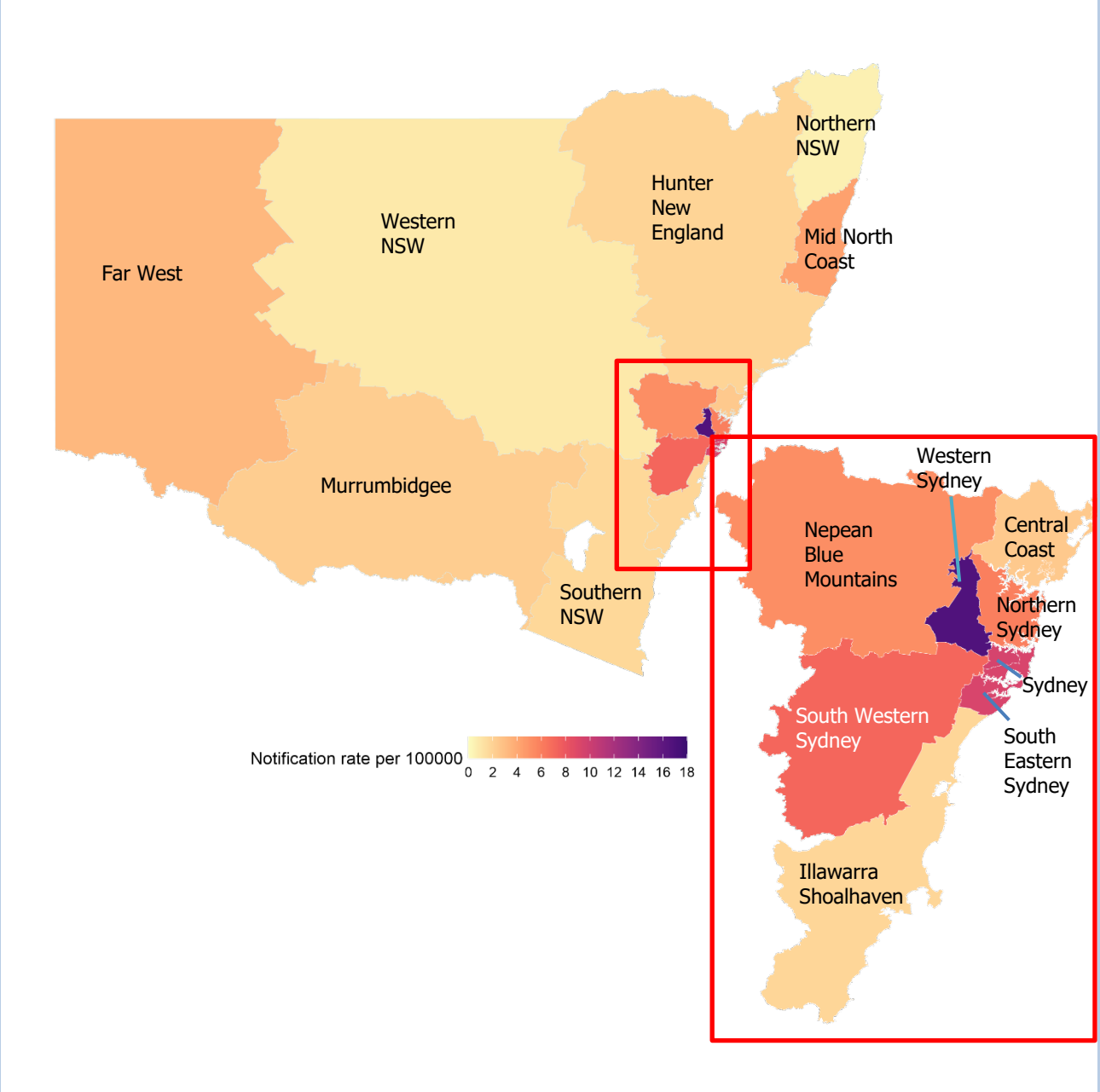
Figure 3: Age specific TB notification rate (per 100,000 population per year), NSW, 2020



Place of residence

Western Sydney LHD had the highest notification rate, with 16.9 per 100,000 population per year (n=182), followed by Sydney LHD with 9.5 cases per 100,000 population per year (n=67) (Figure 4). Of the LHDs in rural and regional NSW, Nepean Blue Mountains LHD had the highest rate at 5.3 cases per 100,000 per year (n=21) along with Mid North Coast LHD with 4.4 cases per 100,000 population (n=10). For data on individual LHDs see Table 1.

Figure 4: Age and sex standardised rate of notified TB cases per 100,000 population per year by Local Health District of residence, NSW, 2021



9.9

Rate per 100,000, Metropolitan Sydney
(Sydney, South Western Sydney, Western Sydney, Northern Sydney and South Eastern Sydney LHDs)

2.4

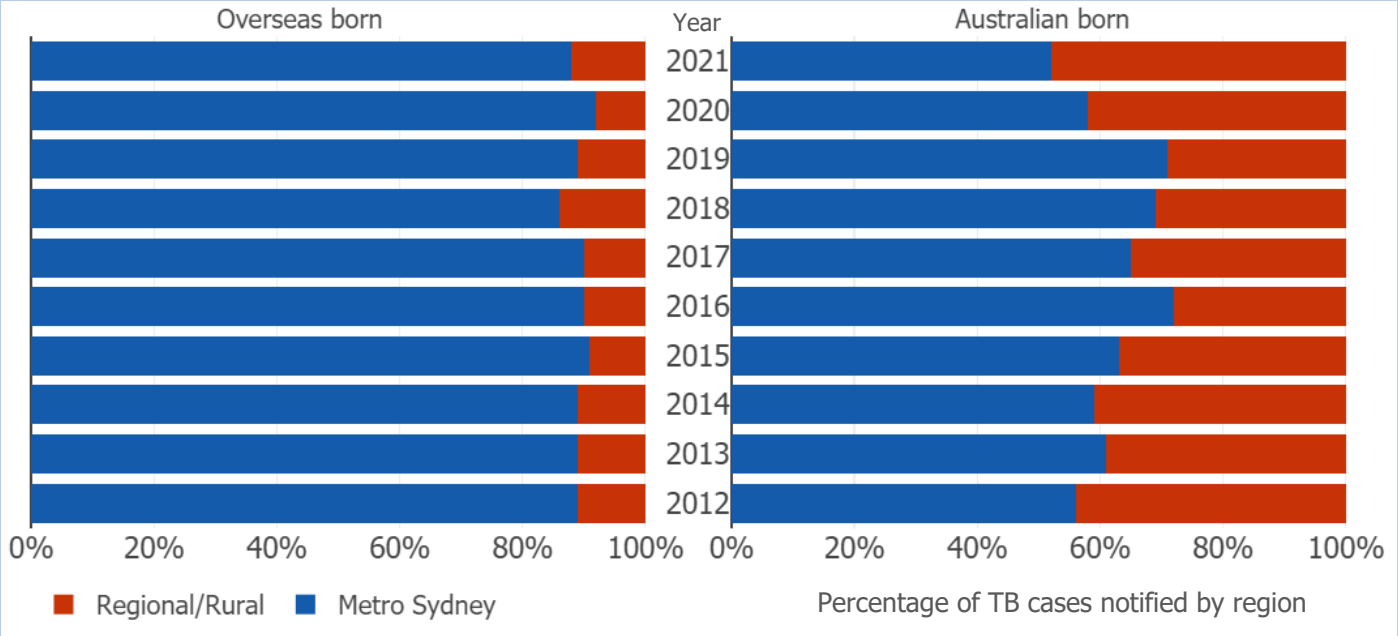
Rate per 100,000, Regional/Rural NSW
(Illawarra Shoalhaven, Central Coast, Nepean Blue Mountains, Far West, Western NSW, Northern NSW, Mid North Coast, Hunter New England, Southern NSW and Murrumbidgee LHDs)

Table 1: Notifications and crude rate of notified TB cases per 100,000 population per year by Local Health District of residence, NSW, 2021

Local Health District	Number	Crude rate
Western Sydney	182	16.9
Sydney	67	9.5
South Eastern Sydney	90	9.3
South Western Sydney	76	7.2
Northern Sydney	58	6.0
Nepean Blue Mountains	21	5.3
Mid North Coast	10	4.4
Far West	1	3.3
Central Coast	9	2.5
Murrumbidgee	7	2.3
Hunter New England	19	2.0
Illawarra Shoalhaven	8	1.9
Southern NSW	4	1.8
Western NSW	3	1.0
Northern NSW	2	0.6

Australian born cases are more likely to reside in regional or rural NSW when compared with overseas born cases. In 2021, 48% (n = 22) of Australian born cases resided in regional or regional NSW compared to 12% (n=62) of overseas born cases. For overseas born TB cases this trend has largely not changed over the past ten years while for Australian born TB cases the number of cases in metropolitan areas fluctuates year to year, the proportion of Australian born cases located in metropolitan areas in 2021 was more than average (Figure 5). Australian born cases in regional or rural NSW were more likely to be older (median 52 years) than Australian born cases in metropolitan areas (median 22 years). The median age for overseas born cases in regional/rural areas was 55 years, and 35 years for metropolitan areas.

Figure 5. Percentage of overseas born and Australian born cases diagnosed in metropolitan and regional/regional areas, NSW, 2021



#Metropolitan Sydney LHDs –Sydney LHD, Western Sydney LHD, Northern Sydney LHD, South Eastern Sydney LHD, South Western Sydney LHD

#Regional or rural LHDs – Nepean Blue Mountains LHD, Central Coast LHD, Illawarra Shoalhaven LHD, Hunter New England LHD, Mid North Coast LHD, Northern NSW LHD, Western NSW LHD, Far West LHD, Murrumbidgee LHD, Southern NSW LHD.

Country of Birth

In 2021, 92% of cases (n=512) were born overseas. Of these, 90% (n=463) were born in a current high-risk country (HRC) for TB. The proportion of overseas cases from a high-risk country was smaller than both 2020 (96%) and 2019 (97%). There were 62 individual countries of birth reported among NSW TB cases (Figure 6), with the most reported countries of birth being India (20%, n=111), Nepal (14%, n = 78), Philippines (9%, n=48), and Australia and China (8%, n=46 each) (Table 2). The TB notification rate by country of birth was calculated utilising the 2016 ABS Census Data with country of birth for NSW residents as a denominator (Table 2 and Figure 7). Notification rates for the countries with the highest proportion of cases varied from 1.0 cases per 100,000 for Australian born cases to 252.4 per 100,000 for Nepalese born cases. There were five other countries of birth with notification rates greater than 150 per 100,000; four of those countries had five or less TB notifications with high rates due to small population numbers (<2,000) in NSW. The total notification rate for all overseas born cases was 22.0 per 100,000 compared to 0.9 per 100,000 for Australian born cases (Table 2).

Table 2: Countries of birth of TB cases, NSW, 2021

Country of birth	Number of cases	Change in cases since 2020	Notification rate per country of birth per 100,000 population
India	111 (20%)	↓ 17	72.2
Nepal	78 (14%)	↓ 8	226.0
Philippines	48 (9%)	↓ 29	51.0
Australia	46 (8%)	↓ 7	0.9
China (excludes SARs and Taiwan)	46 (8%)	-	18.0
Vietnam	39 (7%)	↓ 10	42.0
Indonesia	19 (3%)	↓ 14	55.8
Pakistan	19 (3%)	↑ 3	69.1
Malaysia	12 (2%)	↓ 3	34.3
Bangladesh	10 (2%)	↓ 2	36.7
Other countries	130 (23)	↑ 19	10.2
Total overseas born	512 (92%)	↓ 60	22.0
Total	**558 (100%)**	↓ 35	**6.8**

Figure 6. Number of TB cases by country of birth, NSW, 2021

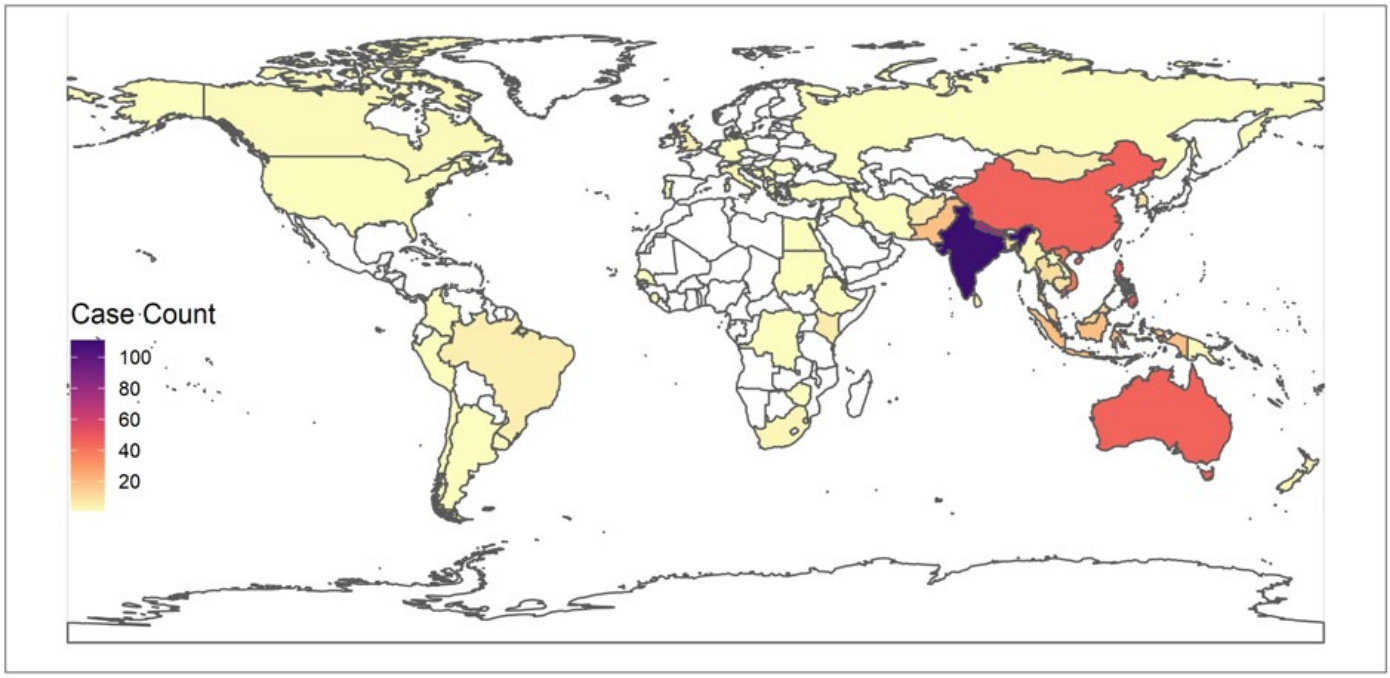
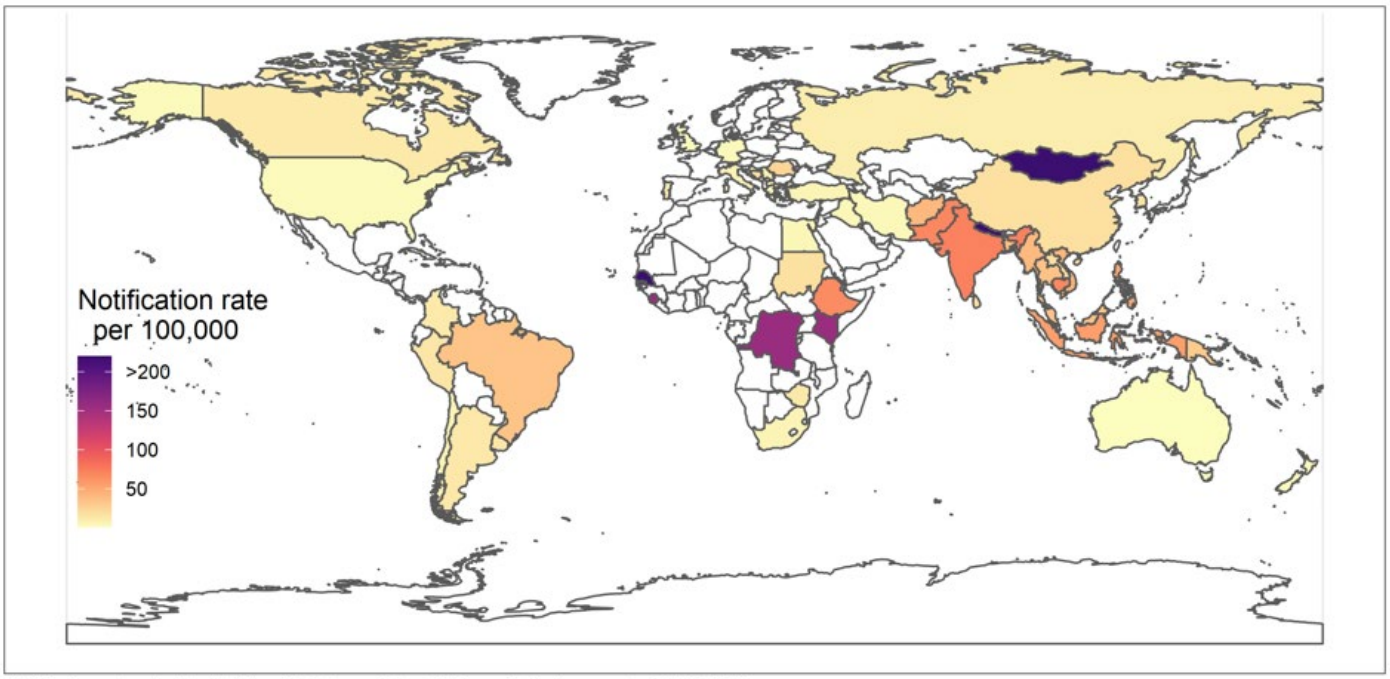


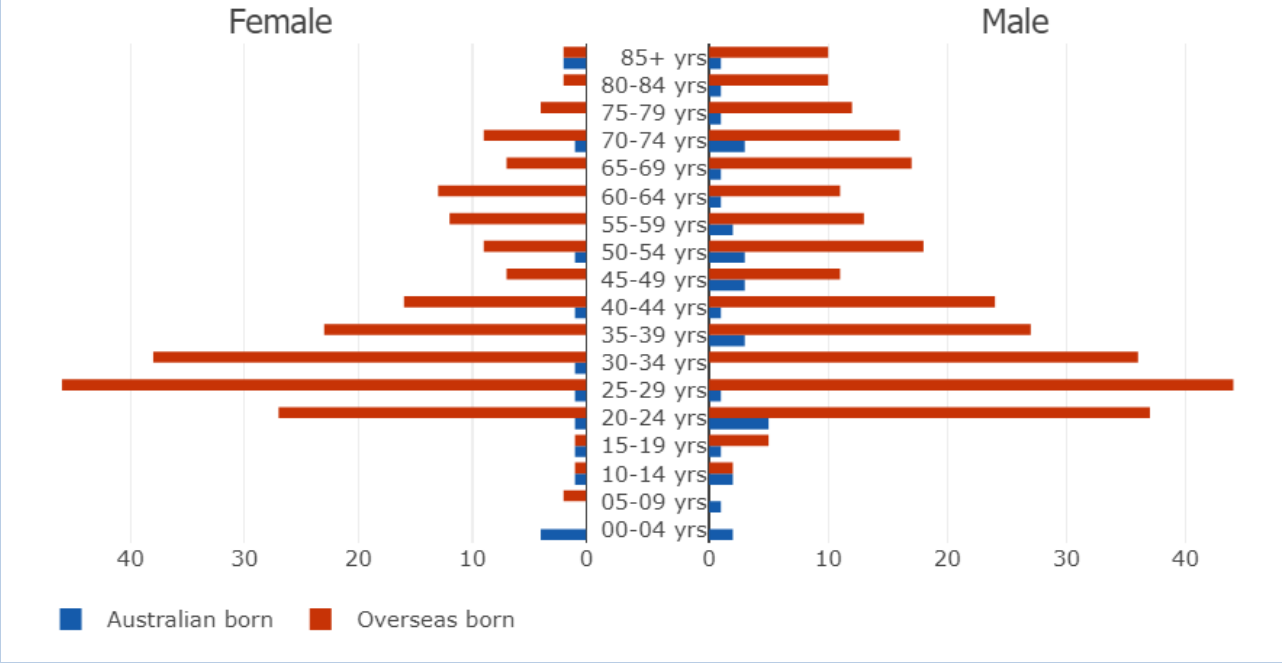
Figure 7. Notification rate of TB cases by country of birth*, NSW, 2021



*Notification rate calculated utilising ABS Census Data 2016, population by country of birth NSW

The median age of Australian born cases is generally higher than the median age of overseas born cases, in 2021 the median ages for Australian born and overseas born cases were similar. Males tended to be older at diagnosis compared to females, this is consistent with previous years. In 2021, the median age at diagnosis for Australian born cases was 38 years; 25 years for females (range 7 months-88 years) and 44 years for males (range 2-91 years). For overseas born cases, the median age at TB diagnosis was 36 years; 33 years for females (range 5-91 years), and 39 years for males (range 11-90 years). Exactly 50% of overseas born cases were aged between 20 and 39 years at diagnosis (Figure 8).

Figure 8: Age group at TB diagnosis, by place of birth and sex, NSW, 2021



Australian born cases

Of the 46 Australian born cases in 2021, four cases (9%) identified as Aboriginal people (Figure 9). The number of TB cases who identify as Aboriginal and Torres Strait Islander people fluctuates from year to year and the number notified in 2020 is less than the average number notified per year (n=5) since 2012. The average rate of TB among Aboriginal and Torres Strait Islander people over the past 10 years is double that of non-Indigenous Australian born cases (RR 2.1, 95% CI 1.5 – 2.8, p<0.001). In 2021, there was no statistically significant difference between the rate of TB in Aboriginal and Torres Strait Islander people and non-Indigenous Australian born cases (RR 1.8, 95% CI 0.55 – 4.49, p<0.3). In 2021, information was collected for the first time on the ethnicity or ancestry of Australian born cases utilising the definitions on ancestry provided by the ABS. The most common specific ancestry was Australian (41%, n=19), followed by Australian Aboriginal (9%, n=4), and Samoan (7%, n=3) (Figure 10).

Figure 9: Number and rate of notified TB in Australian born cases by Aboriginal and Torres Strait Islander status, NSW, 2012-2021

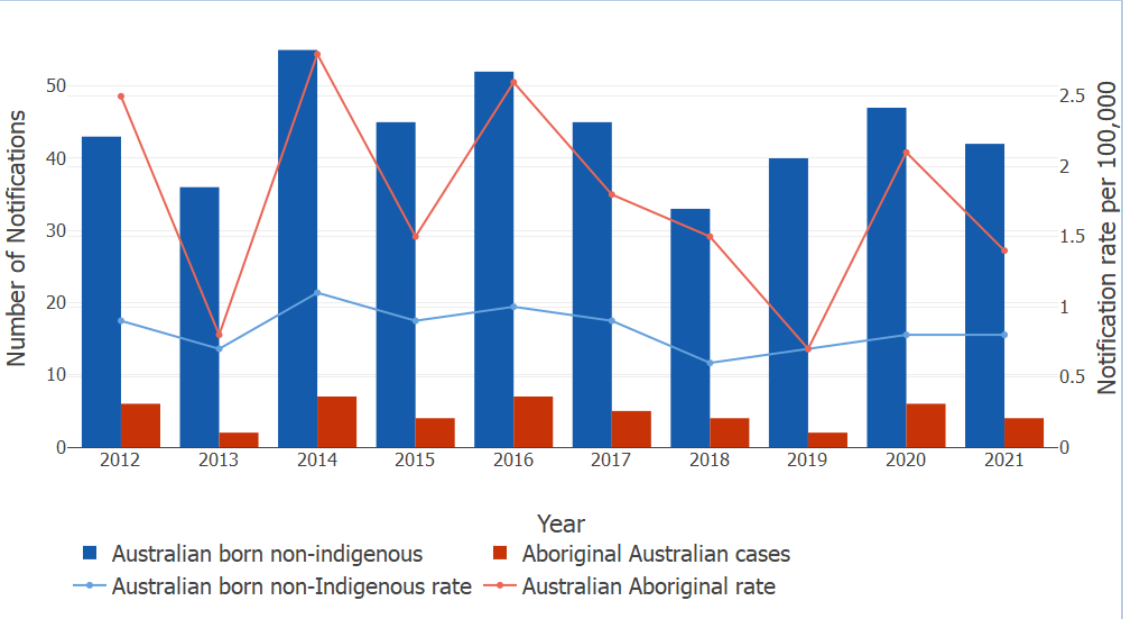
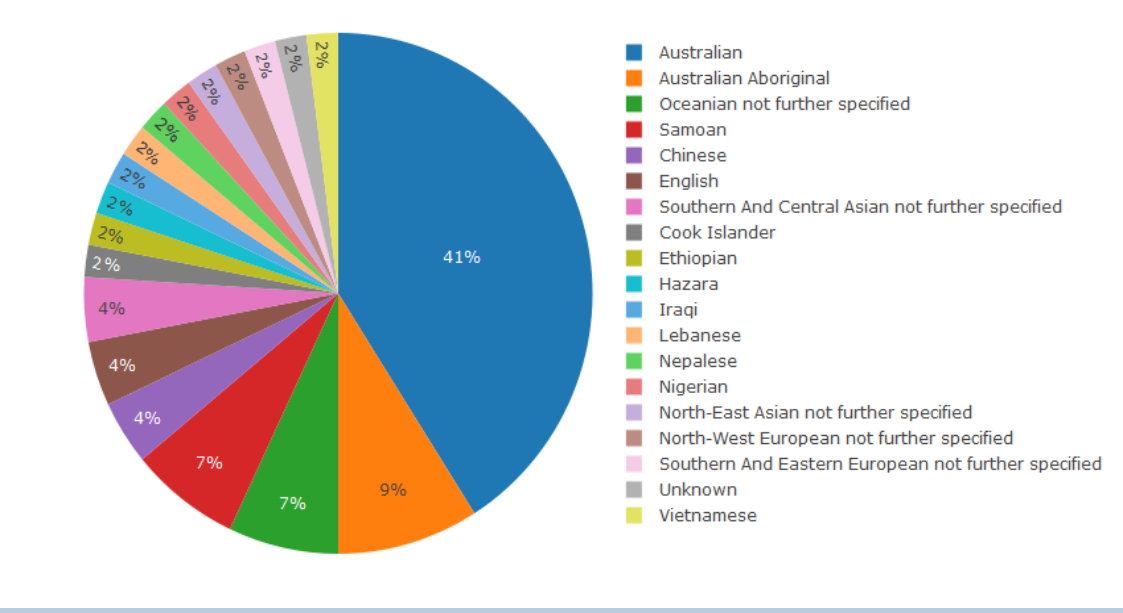


Figure 10: Ethnicity of Australian born TB cases, NSW, 2021



Overseas born cases

Of the 512 overseas born cases in 2021, those who had migrated from a current HRC (as of 2020) for TB (n=463) had a shorter median length of stay in Australia prior to diagnosis of TB (5 years, range 0-72 years) when compared to the other overseas born cases (n=49) (29 years, range 2-73 years) (Figure 10).

Over half of the overseas born cases were permanent residents at the time of diagnosis (n=287, 56%), 20% (n=104) were overseas students, 9% (n=45) were visitors, 1% (n=7) were refugees, <1% (n=1) were unauthorised persons, 12% (n=60) were on other types of visas, and 2% (n=12) had an unknown or missing visa status (Table 3).

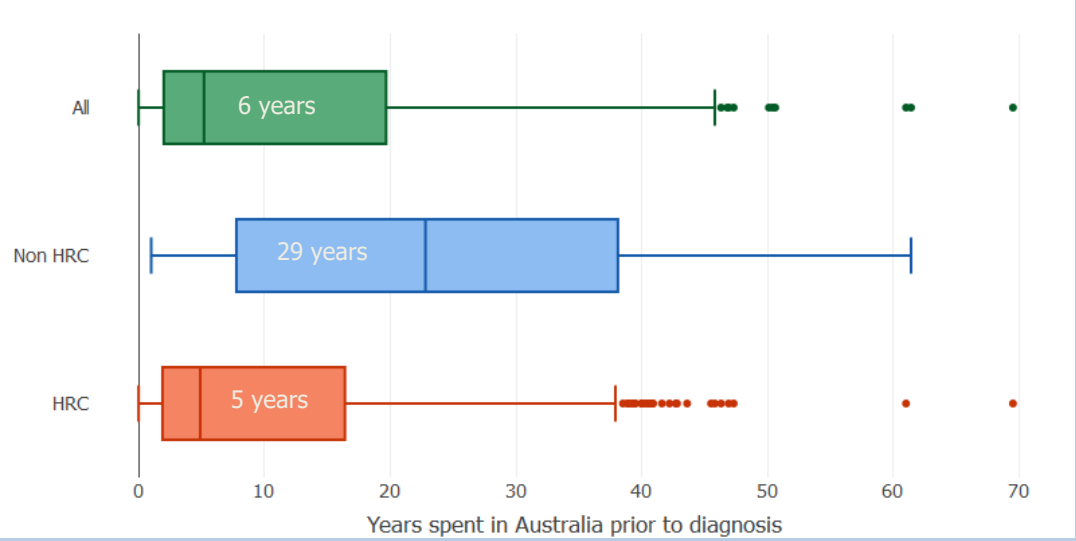
Some Australian visas require the applicant to undergo a medical examination prior to the visa being granted. These include all permanent visa applicants, and some temporary visa applicants depending on how long they intend to stay in Australia, if they intend to work or study, and their country of origin. If the medical examination shows that the visa applicant might be at increased risk of developing active TB, applicants screened overseas are placed on a TB Health Undertaking (TBU) and applicants that apply or re-apply in Australia are placed on an onshore deferral. Both are required to be followed up by TB services in Australia.

Immigration referrals to the NSW TB Program for patients to undergo screening required for a TBU decreased in 2021 (n=465) compared to the pre-COVID-19 yearly average (n=1732). The number of people referred to the TB program and placed on an onshore deferral in 2021 (n=483) was also less than the pre-COVID-19 yearly average (n=651). This is a direct result of reduced immigration to Australia due to border policy changes in response to COVID-19.

Of the 512 TB cases born overseas, 16% (n=81) were on a TBU or onshore deferral at the time of diagnosis, a further 6% (n=32) had previously been on a TBU or an onshore deferral, 77% (n=392) had never been on a TBU or onshore deferral and for 1% (n=7) this was unknown (Figure 11). These numbers are consistent with the proportion of overseas born cases diagnosed on an immigration referral in 2019. The proportion of cases diagnosed while on an TBU decreased from 5% pre-COVID-19 pandemic in 2019 to 2% in 2021. The proportion of cases diagnosed while on an onshore deferral increased from 12% pre-COVID-19 pandemic to 14% in 2021. In particular, an increase was noted in the number of people diagnosed on an onshore referral in the first half of 2021 (Figure 11).

Length of Stay in Australia

Figure 10: Median years spent in Australia prior to TB diagnosis among overseas born cases, by country of birth risk category, NSW, 2021



HRC = High risk country (TB incidence >40 cases per 100,000 population per year)

Table 3: Residency status of overseas born TB cases at diagnosis, NSW, 2021

Residency status	Number of cases	Percentage
Permanent resident	287	56%
Overseas student	104	20%
Visitor	45	9%
Refugee / humanitarian entrant	7	1%
Unauthorised person	1	<1%
Other	60	12%
Unknown/ missing status	8	2%
Total	**512**	**100%**

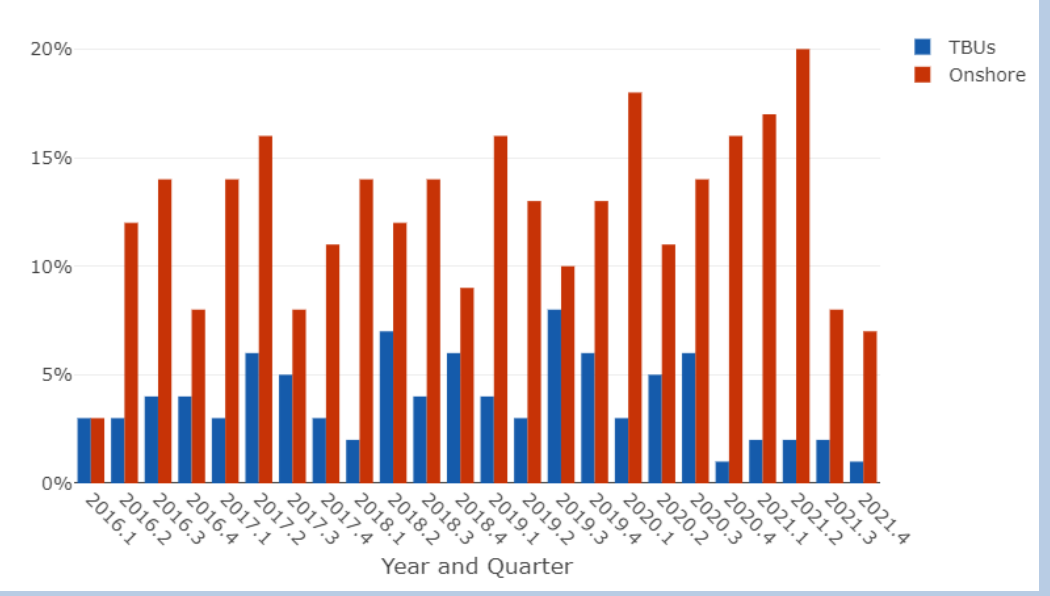
16%

Proportion of NSW TB cases currently on a TB Health Undertaking or Onshore Deferral at diagnosis with TB

6%

Proportion of NSW TB cases who have previously been on a TB Health Undertaking or Onshore Deferral

Figure 11: Proportion of TB cases diagnosed on health undertakings, NSW, 2016-2021



Risk Factors

The most reported risk factor for all cases in 2021 was being born overseas in a HRC for TB (85%, n=474). Being born in a HRC is recorded, as well as country of birth, as some countries may have been high incidence when the person was born but are no longer considered a HRC. Having either a household member or another close contact with TB (16%, n=92) and past residence for three months or more in a HRC (16%, n=87) were the next highest reported risk factors. Immunosuppression (due to health condition or medication) was reported by 10% (n=54) of all cases (Table 4). There was variation in reported risk factors between Australian born and overseas born cases. In Australian born cases, the most frequently reported risk factor was having a household member or close contact with TB (37%, n =17) followed by past residence in a HRC (more than 3 months) (24%, n=11). For overseas born cases, 93% (n=474) were born in a HRC. Other reported risk factors can be found in Table 4.

Table 4: Reported risk factors for TB* among notified case, by place of birth, NSW, 2021

	All cases		Australian born		Overseas born	
	N	%	N	%	N	%
Total	**558**	**100%**	**46**	**100%**	**512**	**100%**
Born in a HRC^	474	(85%)	-	-	474	(93%)
Household member or close contact with TB	92	(16%)	17	(37%)	75	(15%)
Past residence (≥3 months) in a HRC	87	(16%)	11	(24%)	76	(15%)
Previously diagnosed with TB/CXR suggestive of old untreated TB	55	(10%)	4	(9%)	51	(10%)
Immunosuppressive health condition/therapy	54	(10%)	6	(13%)	48	(9%)
Ever employed in healthcare	33	(6%)	1	(2%)	32	(6%)
Other	13	(2%)	5	(11%)	8	(2%)
Australian born child of parent(s) born in HRC	8	(1%)	8	(17%)	-	-
Ever homeless/residing in a shelter	3	(1%)	1	(2%)	2	(<1%)
Ever resided in a correctional facility	1	(<1%)	1	(2%)	0	(0%)
Ever employed in an institution	0	(0%)	0	(0%)	0	(0%)
Not able to be determined	15	(3%)	8	(17%)	7	(1%)

*Multiple risk factors can be recorded
^Born in a HRC is recorded as well as country of birth, as some countries may have been high incidence when the person was born but are no longer considered HRC

Australian born cases

1st Household member or close contact with TB

2nd ≥3 months spent in a high risk country

3rd Australian born child of parent(s) born in HRC

Overseas born cases

1st Born in a high risk country

2nd ≥3 months spent in a high risk country

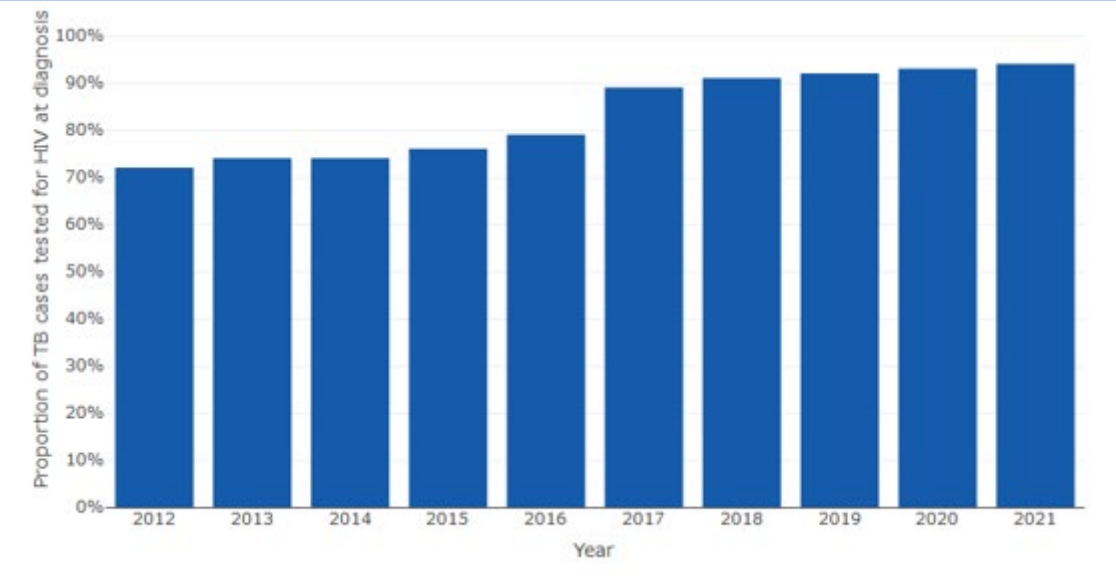
3rd Household member or close contact with TB

HIV Testing

Over the 10 year period to 2021, there has been a 22% increase in the proportion of TB cases tested for HIV at the time of TB diagnosis, from 72% in 2011 to 94% (n=522) in 2021 (Figure 9). Of cases tested in 2021, 1% (n=5) were co-infected with HIV and TB.

Of the five TB-HIV co-infected cases in 2021, 60% (n=3) were female and 80% were overseas born (n=4). Two cases (40%) were newly diagnosed with HIV around the same time as TB, three had been previously diagnosed with HIV (60%).

Figure 12: Proportion of TB cases tested for HIV at TB diagnosis, NSW, 2012 – 2021



94%

Proportion of NSW TB cases tested for HIV at diagnosis

5

Number of NSW TB cases co-infected with HIV

100%

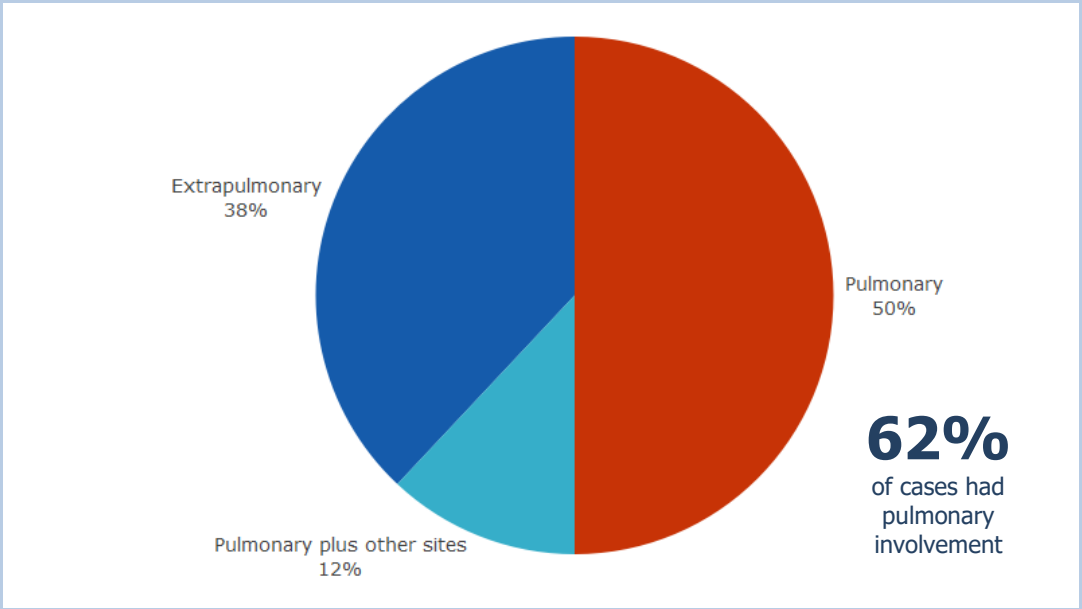
Target for TB cases tested for HIV at diagnosis

Section 2: Clinical Presentation

Site of Infection

In 2021, 62% (n = 345) of all cases had pulmonary involvement. 50% of cases (n=277) had pulmonary disease only, a further 12% (n=68) had pulmonary disease plus other sites. Extrapulmonary TB only was reported for 38% (n=213) of cases (Figure 13). Of extrapulmonary sites reported, lymph node was the most common (n = 116, 45% of cases with extrapulmonary involvement), followed by infection of the pleura (n=35, 14%) and infection of the gastrointestinal tract (n=20, 8%) (Table 5).

Figure 13: Site of disease for NSW TB cases, 2021



50%

Pulmonary only

12%

Pulmonary plus other sites

38%

Extra pulmonary only

Table 5: Extrapulmonary sites* of infection for NSW TB cases with extrapulmonary involvement, 2021

Site	Number of cases	Percentage
Lymph node	132	47%
Pleura	44	16%
Gastrointestinal tract	26	9%
Eye	24	9%
Disseminated disease	23	8%
Brain/central nervous system/meninges, dural sinus, choroid plexus	14	5%
Bone	10	4%
Other abdominal/pelvic disease	10	4%
Other	9	3%
Genitourinary tract	8	3%
Spinal cord	5	2%
Skin	3	1%

*Multiple sites can be recorded

Clinical Presentation and Treatment

Of the 558 cases notified in 2021, 94% (n=527) were new diagnoses of TB; while 5% (n=30) were classified as a TB recurrence, following treatment either in Australia (2%, n=13) or overseas (3%, n=17) (Table 6). TB recurrences may either be due to relapse or reinfection.

Most cases notified in NSW in 2021 (n=378, 65%) were tested for TB as part of an investigation of clinical symptoms. An additional 124 cases (21%) were tested for TB due to screening, while only 16 cases (3%) were identified via contact investigation. The proportion of cases detected while symptomatic has significantly decreased by 14% (p= <0.0001) over the past ten years, while the proportion of cases detected through screening has increased by 9% (p=<0.0001) (Figure 14).

The median time from first health contact to treatment for Australian born cases was 21 days (range 0 – 322 days), and 24 days (range 0 – 1396 days) for overseas born cases. Cases with pulmonary involvement were commenced on treatment sooner (21 days, range 0 – 568 days) than those cases with extrapulmonary disease only (32 days, range 0 - 1396 days). There were two cases where after detection of initial generalised abnormalities the patients did not engage further with the healthcare service, and upon later re-engagement were diagnosed with pulmonary TB. Additionally, there were two cases of delayed referral or follow-up from healthcare providers on detection of abnormalities that were later diagnosed with pulmonary TB.

Almost all cases were commenced on antimicrobial treatment in NSW following diagnosis (98%, n=549). Of the nine cases (2%) that did not commence antimicrobial treatment, three were diagnosed post-mortem, one died prior to starting treatment, four transferred overseas prior to starting treatment and one case with non-pulmonary TB refused treatment.

Table 6: Disease classification*, NSW TB cases 2021

Disease classification	Number of cases	Percentage
New	527	94%
Recurrence following full treatment only in Australia	10	2%
Recurrence following partial treatment only in Australia	3	1%
Recurrence following full treatment overseas	15	3%
Recurrence following partial treatment overseas	2	<1%
Unknown	1	<1%
Total	**558**	**100%**

*Recurrence may include cases who have relapsed or have been reinfected

98%

Proportion of cases commenced on antimicrobial therapy in NSW

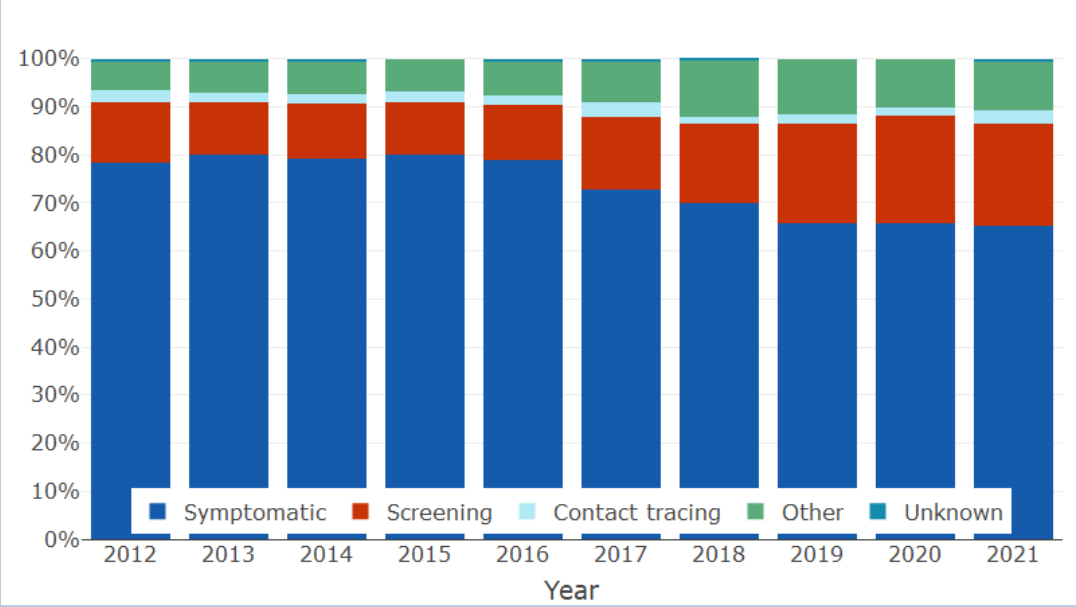
24 days

Median time to treatment from first health presentation

10 days

Difference in median time to treatment between pulmonary and extrapulmonary cases

Figure 14: Proportion of TB cases identified through different detection methods, NSW 2021



65%

Proportion of TB cases identified via investigation of symptomatic disease

21%

Proportion of NSW TB cases identified via immigration, occupational or other health screening

9%

Increase in NSW TB cases detected through screening since 2011

Section 3: Laboratory

Laboratory Testing

Of the 558 TB cases in 2021, 76% of diagnoses (n=424) were laboratory confirmed; 64% (n=356) were cultured, and 12% diagnosed by polymerase chain reaction (PCR) only (n=68). The remaining 24% of cases (n=134) were diagnosed clinically (Figure 15). Laboratory confirmation was more commonly obtained for pulmonary involvement (81%, n=280), compared to those with extrapulmonary disease only (68%, n=144). Extrapulmonary cases were more likely to be diagnosed clinically (32%, n=69) or by PCR (18%, n=38) compared to pulmonary cases (19%, n=65 diagnosed clinically; 9%, n=30 diagnosed by PCR). For the ten-year period to 2021 there has been a significant increase (p=<0.0001) in the proportion of cases confirmed using PCR only and a significant decrease in the proportion of cases confirmed using culture (p=<0.0001).

81%

Proportion of NSW TB cases with pulmonary involvement with laboratory confirmation

68%

Proportion of NSW TB cases with extrapulmonary disease only with laboratory confirmation

Figure 15: Method of diagnosis of TB, laboratory vs. clinical, NSW, 2021

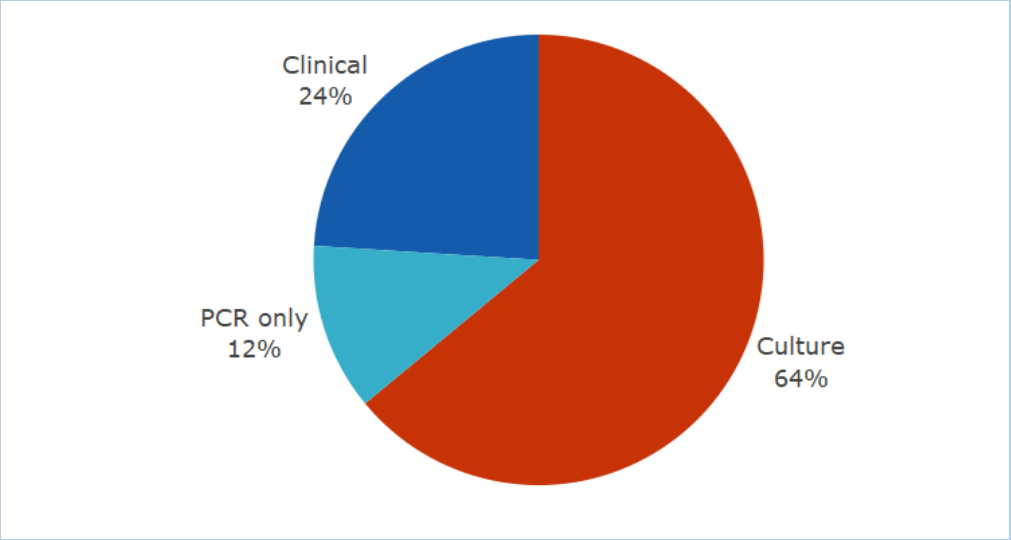
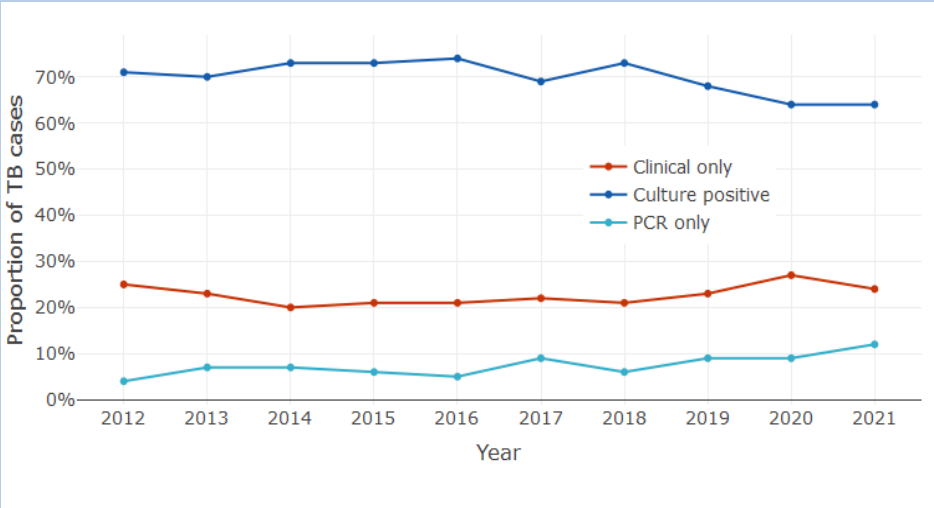


Figure 16: Method of laboratory confirmation of diagnosis of TB cases, NSW, 2012-2021



8%

Increase in proportion of diagnoses confirmed by PCR only since 2012

7%

Decrease in proportion of diagnoses confirmed by culture since 2012

Drug susceptibility testing (DST)

Of the 356 culture positive TB cases in NSW in 2021, 99% (n=353) had drug susceptibility results reported. Of these, 89% (n=315) were fully susceptible to first line TB drugs, 9% (n=33) were resistant to one or more first line drugs, and 1% (n=5) were classified as MDR-TB or pre-XDR-TB (Figure 17). These proportions have not significantly changed over the last ten years (Table 7). Of the three cases without DST, two were mixed infections with another mycobacterium which prevented DST from being performed and one specimen could not have DST performed due to viability issues. The countries of birth for the MDR-TB cases were India, (n=1), Korea, Republic of (South), (n=1), Nepal, (n=1), Philippines, (n=1), Vietnam, (n=1).

89%

Proportion of culture positive cases (with DST) fully susceptible to first line TB drugs

9%

Proportion of culture positive cases with any kind of mono-resistance to a first line TB drug

1%

Proportion of culture positive cases which were MDR-TB

Figure 17: Drug susceptibility of culture confirmed cases, NSW, 2012-2021

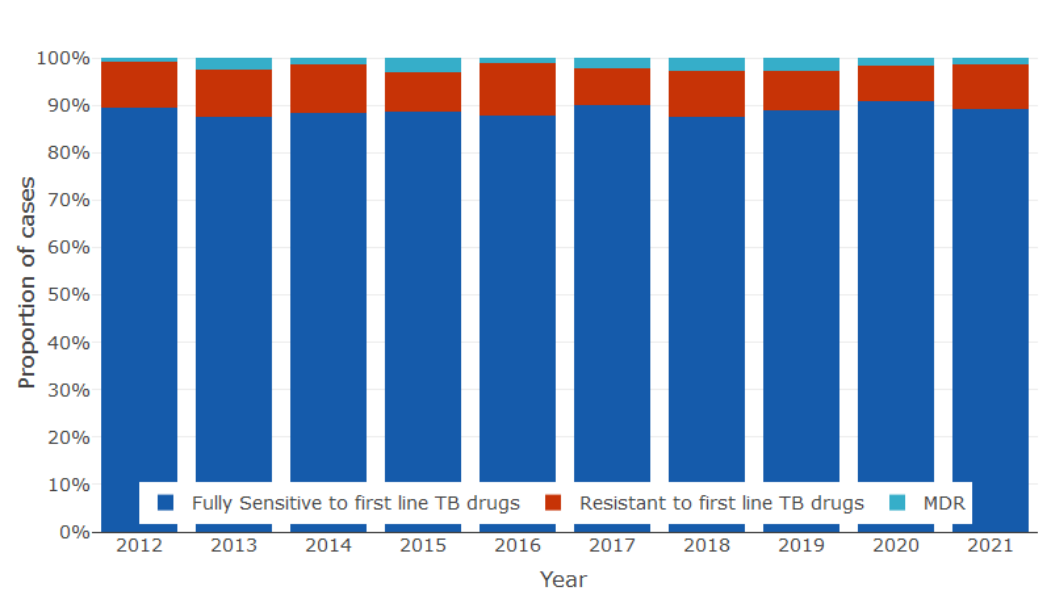


Table 7: Drug susceptibilities of culture confirmed TB cases with DST results available, NSW, 2011-2020

Drug Susceptibility		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Fully susceptible		283 (90%)	269 (88%)	305 (88%)	281 (89%)	316 (88%)	332 (90%)	318 (88%)	351 (89%)	365 (91%)	315 (89%)
Ethambutol	Mono-resistance	1 (<1%)	2 (1%)	2 (1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	1 (<1%)	0 (0%)	0 (0%)
Isoniazid		26 (8%)	25 (7%)	26 (8%)	21 (7%)	36 (10%)	23 (6%)	28 (8%)	27 (7%)	24 (6%)	29 (8%)
Pyrazinamide		2 (1%)	3 (1%)	4 (1%)	1 (<1%)	3 (1%)	6 (2%)	3 (1%)	3 (1%)	2 (<1%)	1 (<1%)
Rifampicin		0 (0%)	0 (0%)	0 (0%)	2 (1%)	0 (0%)	0 (0%)	3 (1%)	0 (0%)	3 (1%)	1 (<1%)
Resistant to ≥2 first line drugs (but not MDR)		1 (<1%)	2 (1%)	3 (1%)	2 (1%)	1 (<1%)	0 (0%)	1 (<1%)	2 (<1%)	1 (<1%)	2 (1%)
MDR*		3 (1%)	7 (2%)	4 (1%)	9 (3%)	2 (1%)	8 (2%)	10 (3%)	10 (3%)	5 (1%)	5 (1%)
Pre-XDR**		0 (0%)	1 (<1%)	1 (<1%)	0 (0%)	2 (1%)	0 (0%)	0 (0%)	1 (<1%)	2 (<1%)	0 (0%)
XDR***		0 (0%)	0 (0%)	0 (0%)	1 (<1%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)

* Multi Drug Resistant: Resistance to at least Isoniazid AND Rifampicin
**Pre-Extensively Drug Resistant: Resistance to Isoniazid AND Rifampicin, AND any fluoroquinolone OR at least one injectable drug
*** Extensively Drug Resistant: Resistance to Isoniazid AND Rifampicin, AND any fluoroquinolone AND at least 1 injectable TB drug

Cluster analysis

In 2021, 349 (98%) of culture positive cases had whole genome sequencing (WGS) performed on one or more isolated. Of these, 47 (13%) were found to be part of a cluster with another TB case notified in NSW from 2021 or earlier. The remaining 302 culture positive cases (87%) were not linked to any other NSW case in or prior to 2021 at the time of analysis.

Of the 47 clustered cases, 25 (53%) were male, the median age was 33 years (range 14-72 years) and 36 (77%) lived in a metropolitan LHD. Cases with pulmonary involvement accounted for 32 (68%), with 16 (52%) with a positive smear on a respiratory specimen.

Of the 302 non-clustered cases, 191 (63%) were male, the median age was 38 years (range 12-91 years) and 259 (86%) lived in a metropolitan LHD. Cases with pulmonary involvement accounted for 212 (70%), with 71 (34%) of cases with a culture positive respiratory specimen also smear positive.

The top countries of birth for clustered cases were Australia (n=12, 26%), Nepal (n=8, 17%) and China (excludes SARs and Taiwan) (n=6, 13%). For non-clustered cases the top countries of birth were India (n=63, 21%), Nepal (n=35, 12%) and Philippines (n=31, 10%).

Cases who identified as Aboriginal or Torres Strait Islander were more likely to be clustered than cases who were not Indigenous (RR 7.86, 95% CI 5.97-10.36, p=<0.01). Cases who identified as having Pasifika ethnicity were also more likely to be clustered compared to those of non-Pasifika ethnicity (RR 7.15, 95% CI 4.71-10.85, p = <0.01). There was no significant difference found in regard to gender, place of residence, site of infection, or respiratory smear status.

Cases born in Australia (RR 3.93, CI 2.31 to 6.68; p=<0.01) and cases born in Thailand (RR 3.33, CI 1.36 – 8.18, p = 0.02) were more likely to be clustered then cases born in other countries. Cases born in India were less likely to be clustered than cases born in other countries (RR 0.19, CI 0.05 to 0.78, p=<0.01). There was no significant difference found for cases born in other countries analysed (Table 9).

Table 8: Demographic and clinical analysis for whole genome sequenced cases, NSW, 2021

		Clustered		Not clustered		Relative risk
		N	%	N	%	
Cases	Total number of cases	**47**	**100%**	**302**	**100%**	**-**
Age	Median age (age range)	33 years (14-72 years)		38 years (12-91 years)		-
Gender	Male	25	53%	191	63%	RR = 0.70 (95% CI 0.41 – 1.19) p = 0.19
	Female	22	47%	111	37%	
Indigenous status (Australian born)	Aboriginal	3	7%	0	0%	RR = 7.86 (95% CI 5.97 – 10.36) p = <0.01
	Not Aboriginal	44	93%	302	100%	
Pasifika ethnicity	Pasifika	6	13%	1	<1%	RR 7.15 (95% CI 4.71 – 10.85) p = <0.01
	Not Pasifika	41	87%	301	100%	
Place of residence	Metropolitan Sydney	36	77%	259	86%	RR = 0.60 (0.33 – 1.10) p = 0.11
	Rural or regional NSW	11	33%	43	14%	
Site of infection	Pulmonary involvement	32	68%	212	70%	RR = 0.92 (95% CI 0.52 – 1.62) p = 0.77
	Extrapulmonary only	15	2%	90	30%	
Respiratory smear positive	Smear positive	16	52%	71	34%	RR = 1.90 (95% CI 0.99 – 3.66) p = 0.07
	Smear negative	15	48%	140	66%	

Table 9: Countries of birth of whole genome sequenced cases, NSW, 2021

	Clustered		Not clustered		Relative risk
	N	%	N	%	
Total number of cases	**47**	**100%**	**302**	**100%**	**-**
India	2	(4%)	63	(21%)	RR =0.19 (95% CI 0.05 – 0.78) p = <0.01
Nepal	8	(17%)	35	(12%)	RR = 1.46 (95% CI 0.73 – 2.91) p = 0.29
China	6	(13%)	29	(10%)	RR = 1.31 (95% CI 0.60 – 2.88) p = 0.50
Philippines	1	(2%)	31	(10%)	RR = 0.22 (95% CI 0.03 – 1.51) p = 0.10
Australia	12	(26%)	16	(5%)	RR = 3.93 (95% CI 2.31 – 6.68) p = <0.01
Vietnam	0	(0%)	24	(8%)	RR = 0.14 (95% CI 0.01 – 2.16) p = 0.16
Indonesia	0	(0%)	13	(4%)	RR = 0.25 (95% CI 0.02 – 3.90) p = 0.33
Pakistan	0	(3%)	10	(3%)	RR =0.33 (95% CI 0.02 – 4.94) p = 0.42
Malaysia	0	(0%)	8	(3%)	RR = 0.40 (95% CI 0.03 – 6.00) p = 0.51
Thailand	3	(6%)	4	(1%)	RR = 3.33 (95% CI 1.36 – 8.18) p = 0.02
Bangladesh	2	(4%)	5	(2%)	RR = 2.17 (95% CI 0.65 – 7.23) p = 0.23
Cambodia	0	(0%)	7	(2%)	RR = 0.45 (95% CI 0.03 – 6.69) p = 0.56
Korea	0	(0%)	7	(2%)	RR = 0.45 (95% CI 0.03 – 6.69) p = 0.56

*RR = Relative Risk, CI = Confidence Interval

The 47 clustered cases were in 28 different clusters ranging in time from first case of 2000 to 2021.

There were 9 clusters (32%) which had a total of five or more cases diagnosed in 2021 or earlier years. Three clusters, 16-0006, 18-0001 and 21-0002, accounted for 43% (n=20) of clustered cases notified in 2021. There were five clusters (18%) involving only transmission within households. Seven clusters (25%) involved some household transmission with also community, casual or unknown links. These clusters were generally larger and had sustained transmission over several years. There were eight (29%) clusters where the epidemiological links were unknown at the time of reporting, these clustered tended to have a larger variation between cases (>6 single nuclear polymorphisms).

Cluster 14-0003 which predominantly involves Aboriginal people has been ongoing since the year 2000 and has been described in previous reports and elsewhere [6, 7]. Both 2021 cases added to this cluster had known epidemiological links to previous cluster cases in the preceding years. They are not believed to represent new community transmission events.

There were five cases diagnosed in 2021 in cluster 21-0002 associated with transmission amongst work colleagues working in a non-patient contact area of a large metropolitan hospital.

As of the end of 2021, cluster 18-0001 consisted of 23 cases with WGS available and four clinical cases without WGS. The origin of the cluster is 2012. The cluster began with a case from Ethiopia diagnosed in 2012. Transmission chains were unknown for many earlier cases but did occur among some household and other close contacts. Around 2018 the demographics of the cluster cases changed to consist predominantly of cases with Pasifika ethnicity.

A second cluster 16-0006 consists of 15 cases with WGS available and five clinical cases without WGS also predominantly involves cases of Pasifika background. The origin of the cluster is 2013. Transmission chains are mainly occurring among household and close contacts.

Contact tracing is ongoing to attempt to halt transmission within all of these clusters.

Table 10: Whole genome clusters with 2021 cases*

Cluster name	Year cluster detected	Number of 2021 cases	Year of first case	Total number of WGS cases	SNP differences	Epidemiological links#	Epidemiological links description^
14-0003	2007	2	2000	42	0 – 7	B, C, D	Household, casual & community
15-0003	2015	1	2015	4	0-3	B, D	Household & community
16-0006	2018	2	2013	15	0-2	B, D	Household & community
16-0013	2020	1	2007	5	0-2	B, C, D	Casual, community & unknown
17-0001	2017	1	2016	3	3-12	D	Unknown
17-0008	2017	3	2017	10	0-12	B, D	Household & casual
17-0016	2017	1	2004	8	0-5	B, D	Household & casual
18-0001	2018	6	2013	23	0 - 11	B, C, D	Household, casual & community
18-0011	2018	1	2018	3	1-3	A	Household
18-0016	2018	1	2018	4	0-7	D	Unknown
19-0008	2019	1	2019	5	0-2	B, D	Household & casual
19-0015	2019	1	2019	8	0-3	B, D	Casual
20-0011	2021	1	2020	2	0	A	Household
20-0012	2021	1	2015	2	4	C	Community
21-0001	2021	2	2021	2	2	D	Unknown
21-0002	2021	5	2021	5	0	A	Casual
21-0003	2021	2	2021	2	0	A	Household
21-0004	2021	2	2021	2	3	A	Casual
21-0005	2021	2	2021	2	0	D	Unknown
21-0006	2021	1	2015	2	4	D	Unknown
21-0007	2021	1	2016	2	4	A	Casual
21-0009	2021	1	2019	2	8	D	Unknown
21-0012	2021	1	2018	2	2	A	Casual
21-0014	2021	1	2017	3	4 - >12	D	Unknown
21-0016	2021	2	2021	2	1	A	Household
21-0017	2021	2	2021	2	0	A	Casual
21-0018	2021	1	2019	2	8	D	Unknown
22-0015	2021	1	2020	2	0	A	Household

*Excludes clinically diagnosed cases or cases without WGS links.

#Epidemiological links	^Epidemiological links description
A. Confirmed epidemiological links all cases; B. Confirmed epidemiological links some cases; C. Plausible community transmission (when the index case was infectious it is plausible that they could have transmitted their infection to another member, or members, of the cluster in a place where both cases were known to have been); D. Unable to be determined.	Household contacts – Cases who live together in the same house. Casual contacts – Cases who either know each other socially or have come into contact with each other in other casual situations such as in a public place, workplace, or educational facility. Community contacts – Cases with no known social or casual links but transmission is plausible based on based on the infectious period of the index case and travel to a common place Unknown – epidemiological links are unknown

Section 4: Outcomes

Clinical Outcomes

Clinical outcomes are reported for cases diagnosed in the previous year (for non-MDR TB cases) or two years previously (for MDR-TB cases) to allow time for treatment completion. Clinical outcomes for non-MDR cases from 2020 and MDR-TB cases from 2019 are recorded in Table 11. Of the non-MDR cases in 2020, 91% (559) completed treatment, consisting of 7% (n=38) who were considered cured (sputum culture positive prior to treatment and sputum culture negative after completion of treatment) and 93% (n=521) who completed treatment (without demonstrated of cure). There were 4 TB-related deaths reported. There were 11 cases (2%) that defaulted before completion of treatment of which none were medical defaults. Two cases remained on treatment at the time of reporting, while both did not meet the definition of MDR-TB due to absence of isoniazid resistance they were being treated with extended therapies due to the presence of rifampicin resistance. The remaining 7% (n=41) had either transferred overseas, died of a non-TB related cause, or the cause of death was unknown.

Of those cases in 2019 where the outcome was known (excluding transferred overseas, died unrelated or unknown if related to TB and outcome unknown), 95% of cases successfully completed treatment.

Of the eleven cases classified as MDR-TB in 2019, one (9%) had transferred overseas and could not be assessed. Out of the remaining MDR-TB cases, 100% (n=10) successfully completed treatment.

95%

Proportion of cases with a successful outcome in 2020

100%

Proportion of successfully treated MDR-TB cases in 2019

Table 11: Clinical outcomes of non MDR-TB cases diagnosed in 2020 and MDR-TB cases diagnosed in 2019*

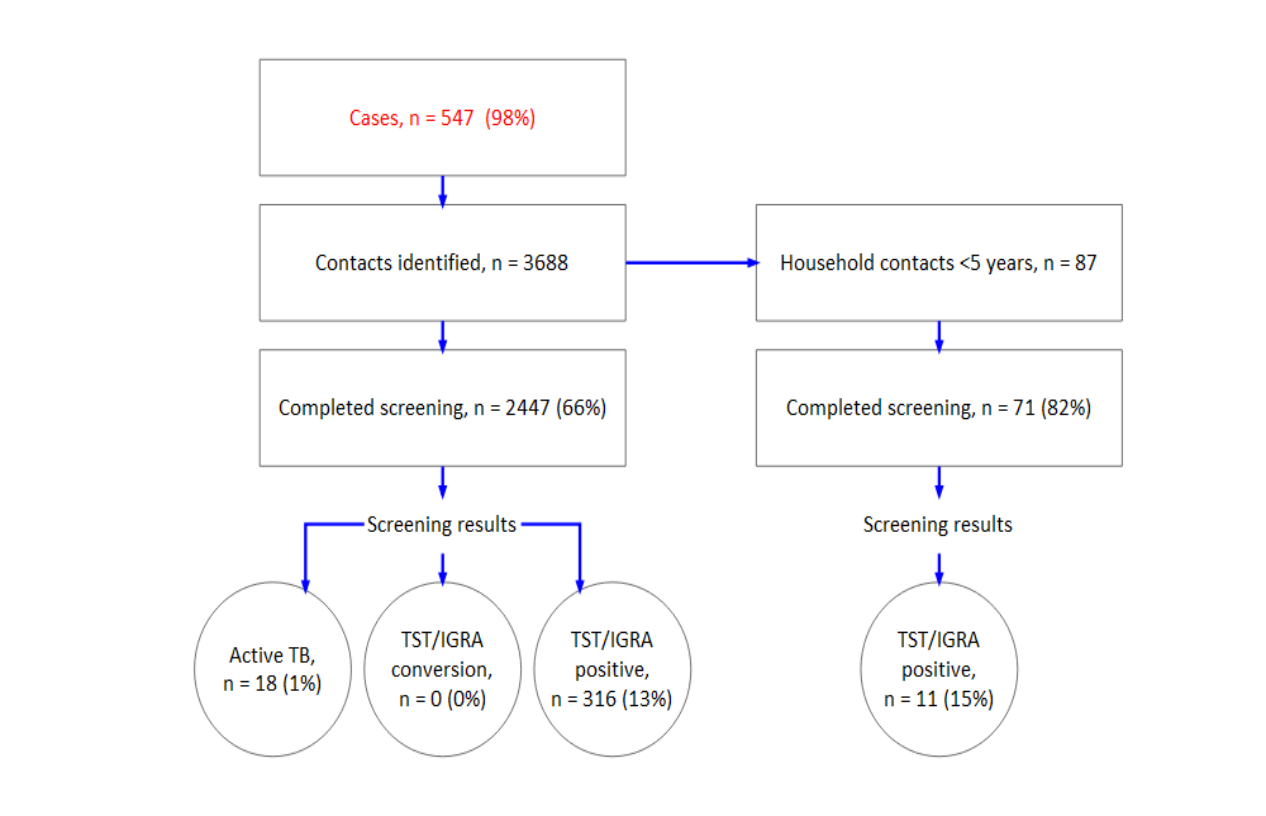
		Year of diagnosis	
		2020 Non MDR cases	2019 MDR-TB
Total cases		**618 (100%)**	**11 (100%)**
Alive	Completed treatment	559 (91%)	10 (91%)
	Defaulted	11 (2%)	-
	Transferred overseas	19 (3%)	1 (9%)
	Treatment failure	0 (0%)	-
	Outcome unknown	1 (<1%)	-
	Remains on treatment	1 (<1%)	
Died	Cause related to TB	4 (1%)	-
	Unrelated to TB	20 (3%)	-
	Unknown if related to TB	2 (<1%)	-

*Outcome data are reported for the year prior for non MDR cases and 2 years prior for MDR cases to allow time for treatment completion

Contact Investigations

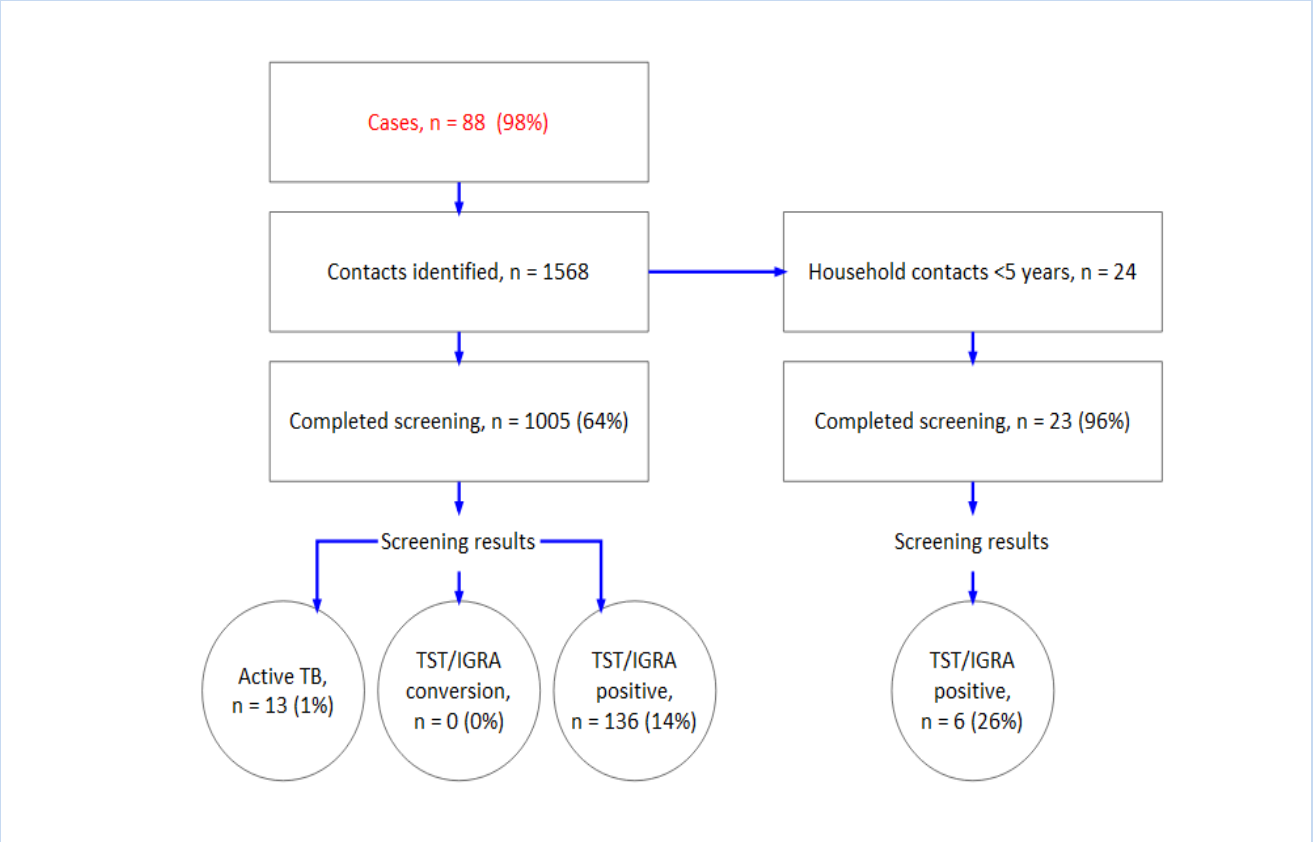
Of the 558 TB notifications received in 2021, 545 (98%) (n=545, 13) had contact information completed at the time of analysis. The median number of contacts per case was two (range 0-322), and 5% (n=26) of contact investigations involved more than 25 contacts. A total of 3,569 contacts had been identified, including 85 household contacts under the age of five years, and of these 66% (n=2,363) were recorded to have completed screening. Of the 2,363 contacts screened, 1% (n=18) were found to have active TB disease, 0% (n=0) had a tuberculin skin test (TST) or interferon gamma release assay (IGRA) conversion (indicating recent tuberculosis infection from the case patient), and 13% (n=311) had a positive TST or IGRA result on a single screen. Screening outcomes are shown in Figure 18.

Figure 18: Contact investigation outcomes from TB cases diagnosed in 2021, NSW



There were 90 sputum or respiratory smear positive cases notified in 2021, these cases are generally considered to be more infectious than smear negative cases. Ninety-eight per cent of smear positive cases (n=88) had contact information available identifying 1444 contacts, including 24 household contacts under 5 years of age. Of these contacts, 913 (63%) were recorded as having completed screening where 13 (1%) were found to have active TB disease, 0 (0%) had TST or IGRA conversion, and 133 (15%) had a positive TST or IGRA result on initial screening. Screening outcomes are shown in Figure 19.

Figure 19: Contact investigation outcomes from TB pulmonary smear positive cases diagnosed in 2021, NSW



Section 5: Discussion

TB notifications decreased in 2021, most likely due to the extended border closures reducing immigration to Australia from early 2020 to the end of 2021. TB cases in NSW continue to occur more frequently in persons born overseas, particularly among those born in countries with a high incidence of TB. The burden of TB disease in NSW is concentrated in LHDs with large populations of migrants from countries in the South-East Asian and Western Pacific regions; reflective of both the global epidemiology of TB, and current trends in migration patterns. The rate of TB in NSW remains low by global comparison [1].

The proportion of Australian born TB cases has decreased over the past ten years for both Aboriginal and Torres Strait Islander people as well as non-Indigenous Australians. The notification rate in the Australian born non-Indigenous population in NSW has remained relatively steady for more than a decade and has overall decreased over the last five years with some yearly fluctuation. The rate in Australian born Aboriginal and Torres Strait Islander people in NSW is over two times higher than in non-Indigenous Australian born people over the past 10 years, this is lower than the national rate which is five to six times higher on average [3]. In 2021, the rate in Australian born Aboriginal and Torres Strait Islander people in NSW was not significantly higher than the non-Indigenous Australian born people rate.

Over the past ten years the proportion of cases detected while symptomatic in NSW has significantly decreased, while the proportion of cases detected through screening has significantly increased, demonstrating the impact of immigration and contact screening programmes on earlier detection of TB. This was notable in 2021 as an increase in onshore deferrals received by the NSW TB Program in 2020 led to an increased proportion of TB cases diagnosed on an onshore deferral in the first half of 2021.

Risk factors reported among NSW TB cases in 2021 were similar to those reported in previous years in NSW and nationally [3]. Birth in an HRC, or household member or close contact with another TB case are the most reported risk factors.

Drug resistant TB continue to pose a challenge to the control and management of TB, both globally and within NSW. There has been no significant change to the proportions of drug resistant cases as a group or to individual drugs over a 10-year period in NSW. Monitoring and review of NSW TB cases identified as drug resistant continues to be a priority of the NSW TB Program. There were significant changes made in the management recommendations of multi-drug resistant TB by the WHO in 2019 which include standardised shorter MDR-TB regimens which at the time of report have not been used in NSW [8].

The proportion of NSW TB cases tested for HIV at the time of diagnosis continues to increase, with 94% tested in 2021. The prevalence of HIV among NSW TB cases remains low, with one per cent of cases tested found to have HIV.

Ninety-five per cent of non MDR-TB cases in 2020 successfully completed treatment (excluding cases, transferred overseas or died unrelated or unknown if related to TB). Mortality among NSW TB cases remained stable (4%), there were four cases reported to have died due to TB in 2020. NSW continued to see low rates of treatment default (2%) and treatment failure (0%), among TB cases in 2020. Of the ten MDR-TB cases in 2019, one transferred overseas prior to completing treatment and the rest all successfully completed treatment within NSW.

NSW released revised Tuberculosis Contact Investigation guidelines in 2019 which provided stronger guidance on recommendations on contact identification and screening for TB. In the three years since the guidelines were released

(2019-2021), an average of 4763 contacts were identified per year, compared to 2423 in the three years preceeding (2016-2018). The average contact screening completeness for 2016-2018 and 2019-2021 was 60%; with the average numbers of contacts per year screened by NSW TB services doubling from 1455 to 2881. Further work is currently underway to improve both the data collection of contact data as well as the follow-up and completenesss of TB contact screening.

Despite the low incidence, management and prevention of TB in Australia remains an ongoing challenge. TB cannot be viewed in the context of one country alone, and the global epidemiology of this disease has significant impact on control measures in low incidence countries, due to increasing international travel to and migration from high incidence countries. Prior to the COVID-19 pandemic, in 2019-2020 South and Central Asia was the most common region for migrants to Australia accounting for 120,441 arrivals followed by the Pacific with 91,703 arrivals [9]. These areas remain high incident TB areas [1]. In 2021, seven of the top ten countries of birth for overseas-born residents in Australia were classified as high-risk countries for TB by the WHO [9] and these countries are featured in the most frequent countries of birth for TB cases in NSW.

Overall, migration to Australia decreased in the June 2020-June 2021 period fell to 146,000 compared to 507,000 the previous reporting year [10], due to changes in border policies implemented in March 2020 due to the COVID-19 pandemic which prevented non-Australian citizens or permanent residents from entering Australia during 2020. This resulted in a decline in the number of TB undertakings received by the NSW TB Program of individuals migrating to Australia and requiring screening. The decline in TB numbers in 2021 – evident from the second half of the year – may be due to the decreased immigration since 2020 due to the delay between arrival in Australia and TB disease activation and diagnosis. The border closures to Australia ended at the end of 2021 so it remains to be seen how long the decreased case numbers will last.

Conclusion:

The number of TB cases in NSW decreased in 2021 from the previous twenty-year high seen in 2020. It is important to remember that although the number of cases and notification rate in NSW and Australia remain low compared to global incidence, the control and elimination of TB in an individual country must be considered in the context of the global epidemiology of TB. Increasing rates of travel and migration from high burden countries remains one of the ongoing challenges to TB elimination in Australia, it remains to be seen what impact COVID-19 related migration changes will have on TB notification rates in the future.

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