Annual report

Tuberculosis notifications in Australia, 2014

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Abstract

In 2014, the National Notifiable Diseases Surveillance System received 1,339 tuberculosis (TB) notifications, representing a rate of 5.7 per 100,000 population. Australia has achieved and maintained good tuberculosis (TB) control since the mid-1980s, sustaining a low annual TB incidence rate of approximately 5 to 6 cases per 100,000 population. The number of multi-drug resistant TB (MDR-TB) cases diagnosed in Australia is low by international standards, with approximately 1-2% of notifications per year being classified as MDR-TB. Australia's overseas-born population continued to represent the majority (86%) of TB notifications and Australia's Aboriginal and Torres Strait Islander population continue to record TB rates around 6 times higher than the Australian born non Indigenous population. Whilst Australia has achieved excellent and sustained control of TB in Australia, sustained effort is still required to reduce rates further and contribute to the achievement of the World Health Organization's goal to end the global TB epidemic by 2035.

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

Introduction

Australia has one of the lowest tuberculosis (TB) incidence rates in the world and has maintained excellent TB control for the last three decades.[1] However, Australia's proximity to some of the highest TB incidence countries in the world and its large migrant intake from these regions means that continued vigilance is required to sustain and improve on Australia's already low TB incidence rate.

At the sixty-seventh World Health Assembly (WHA) in May 2014, the Australian Government endorsed the new *Global strategy and targets for tuberculosis prevention, care and control after 2015*, also known as the World Health Organization (WHO) post 2015 global TB Strategy.[2] The post 2015 global TB Strategy's goal is to end the global TB epidemic by 2035 and sets targets to reduce TB incidence by 90% and TB deaths by 95% worldwide by this time.[3]

Australia is well placed to achieve TB elimination with an excellent health care system and robust surveillance and governance frameworks already in place. However, like other low-incidence countries with positive migration policies, reducing domestic incidence rates will continue to challenge TB control programs. It is likely that the greatest reduction in Australia's TB incidence rates will be achieved through the improvement of TB control globally but in particular the Western Pacific and South-East Asian regions.

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

This report describes the epidemiology of notified cases of TB in Australia in 2014 and includes some discussion on the factors that impact on the control of TB in Australia. Annual reporting of TB notifications in Australia ensures that Australia's TB control progress can be monitored and provides evidence for the development of new TB control strategies.

Methods

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

NNDSS. The primary responsibility for public health action resulting from a notification resides with state and territory health departments.

The Tuberculosis Data Quality Working Group (TBDQWG), a working group of NTAC, has representation from states and territories, the Australian Government and the Australian Mycobacterium Reference Laboratory Network (AMRLN). It ensures routine and timely reporting of trends and emerging issues in TB. The TBDQWG is also responsible for maintaining national consistency and currency in data standards and systems for TB surveillance that are relied upon to produce this report.

With the exception of the premigration screening data, the data presented in this report represent a point-in-time analysis of notified cases of TB in Australia. This report presents data extracted from NNDSS during June 2015. Due to the dynamic nature of the NNDSS, data in this report may vary from data reported in other NNDSS reports and reports of TB notifications at the state or territory level. Detailed notes on case definition, data collection, quality control and the categorisation of population subgroups are available in the 2007 annual report.[4]

In accordance with the Torres Strait Treaty, some Torres Strait Islanders and coastal people from PNG are allowed free movement (without passports or visas) within the northern Torres Strait Islands of Australia and PNG. This free movement is to allow for traditional activities to take place and does not include visits for health treatment.[5] However, at times PNG nationals do still present with TB to QLD health care clinics in the Torres Strait. In these instances, the patient's diagnosis of TB is notified in Australia, and identified in the NNDSS as "Residents of the TSPZ accessing TB treatment in Queensland", but the patient is transferred back to PNG for treatment providing they are well enough to travel.

This report presents data analysed by date of diagnosis, a derived field within the NNDSS. The methodology for date of diagnosis for TB changed in January 2014 and was applied to notifications retrospectively. The diagnosis date for TB is now equivalent to the 'notification received date'[1] , whereas previously the diagnosis date represented either the onset date or where the date of onset was not known, the earliest of the specimen collection date, the notification date, or the notification receive date.

Reported rates were calculated using population data published by the Australian Bureau of Statistics (ABS). Overall population rates were calculated using mid year estimated resident population (ERP) data described by the 3101.0 - Australian Demographic Statistics, Dec 2014 dataset.[6] Rates by country of birth were calculated using 2014 ERP data described by the 3412.0 - Migration, Australia, 2013-14 dataset.[7] Rates for population subgroups (i.e. overseas born, Australian born Indigenous and Australian born non Indigenous) by age and by state and territory were calculated using 2011 ERP data described by the 3412.0 - Migration, Australia, 2013-14 dataset.[8] Note that ERP data by country of birth by state and territory are based on the 2011 Census as data is only available for Census years and ERP data for the Indigenous population is also based on the 2011 Census data.[9, 10]

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

Table 1: Notifications of tuberculosis, Australia, 2009 to 2014, by state and territory and year

State / Territory	2009	2010	2011	2012	2013	2014	5 year mean*	Range*	
								Lower	Upper
ACT	23	10	20	17	18	30	18	10	23
NSW	520	511	540	470	443	472	497	443	540
NT	21	37	35	28	43	28	33	21	43
Qld	159	177	221	171	153	165	176	153	221
SA	58	74	73	83	69	48	71	58	83
Tas	9	10	17	6	8	9	10	6	17
Vic	410	436	360	369	380	448	391	360	436
WA	107	109	123	172	149	139	132	107	172
Australia	**1,307**	**1,364**	**1,389**	**1,316**	**1,263**	**1,339**	**1,328**	**1,263**	**1,389**

** Covers the period 2009 to 2013.*

The premigration screening data represents a calendar year analysis of TB cases detected through the offshore premigration screening process. Cases of TB identified through this process are not included in the NNDSS as they are identified prior to entry to Australia. Premigration screening data are provided by the Australian Government Department of Immigration and Border Protection (DIBP).

Results

Epidemiological situation in 2014

In 2014, 1,339 cases of TB were reported to the NNDSS, representing a rate of 5.7 cases per 100,000 and a 4% increase on the number of cases reported in 2013 (n=1,263) (Table 1). A case classification (whether new or relapse) was reported for 99% of cases in 2014 (n=1,331) and of those, 95% were classified as new (n=1,263) (Table 2). A case is classified as new when a patient has never been treated for TB or when a patient has been treated previously for less than one month. Relapse was reported in 68 cases in 2014 with the majority of those cases (65%, 44/68) having a treatment history of full or partial treatment overseas (Table 3).

In the last decade, the rate of TB in Australia has ranged from 5.0 per 100,000 in 2003 to 6.2 per 100,000 in 2010 and 2011. A small but steady rise was observed from 2003 to 2011, followed by a small decline is recent years (Figure 1). A comparison of the 5-year mean rates for the last 20 years shows only a small mean rate rise (range: 5.3 per 100,000 to 5.9 per 100,000) and comparisons between the 5-year means were found not to be statistically significant (Table 4).

Geographic distribution

In 2014, New South Wales and Victoria accounted for just over two thirds of the cases notified in Australia (NSW: n=472; Vic: n=448), while Tasmania reported the least number of cases (n=9) (Table 1). Similar to previous years, the high-

Table 2: Notified cases and rates of tuberculosis, Australia, 2014, by case classification and state or territory

State / Territory	New cases		Relapse cases		Total cases*	
	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000
ACT	25	6.5	3	0.8	30	7.8
NSW	448	6.0	24	0.3	472	6.3
NT	26	10.6	2	0.8	28	11.4
Qld	156	3.3	7	0.0	165	3.5
SA	46	2.7	2	0.0	48	2.8
Tas	9	1.7	0	0.0	9	1.7
Vic	420	7.2	24	0.4	448	7.7
WA	133	5.2	6	0.2	139	5.4
Australia	**1,263**	**5.4**	**68**	**0.3**	**1,339**	**5.7**

** Total includes 8 cases reported without a case classification (ACT n=2, QLD n= 2, Vic n=4).*

Table 3: Notified cases of tuberculosis classified as a relapse, Australia, 2014, by treatment history

Treatment History	Notifications (n)	Percentage of Relapse cases (%)
Relapse following full treatment only in Australia.	19	28%
TB following partial treatment only in Australia	5	7%
Relapse following full or partial treatment overseas.	44	65%
Total	**68**	**100%**

Table 4: Tuberculosis notifications and rates for 5-year intervals, Australia, 1995 to 2014

5-year interval	5-year mean		IRR (95% CI)*	p-value*
	Notifications (n)	Rate per 100,000		
1995-1999	1,009	5.5	-	-
2000-2004	1,045	5.3	0.98 (0.89 - 1.07)	0.5749
2005-2009	1,193	5.7	1.06 (0.98 - 1.16)	0.1399
2010-2014	1,334	5.9	1.04 (0.96 - 1.12)	0.3724

**Incident rate ratio (IRR), confidence intervals (CI) and p-values have been calculated using the previous 5-year interval as the denominator*

est jurisdiction specific rate was reported in the Northern Territory (11.4 per 100,000) and the lowest was reported in Tasmania (1.7 per 100,000) (Table 2).

The Australian Capital Territory recorded a rate of 7.8 per 100,000 (n=48), a 65% increase on the rate in 2013 (4.7 per 100,000) and the highest rate recorded in the Australian Capital Territory since the collection of NNDSS data commenced in 1992. South Australia recorded a rate of 2.8 per 100,000 (n=30), a 31% decrease on the rate in 2013 (4.1 per 100,000) and the lowest rate recorded in the South Australia since 1996 (2.6 per 100,000) (Table 2).

In 2014, the Australian Capital Territory and Victoria reported a jurisdiction specific rate higher than the five-year mean rates of the two preceding five-year intervals for these two jurisdictions (Figure 2).

Tuberculosis in the Australian-born population

In 2014, the rate of TB in the Australian born population was similar to previous years at 1.1 per 100,000 (n=183). The rate of TB in the Australian born Indigenous population was 5.8 per 100,000 (n=39) and remains approximately six times the rate of TB in the Australian born non Indigenous population (0.9 per 100,000, n=183) (Table 5).

The rate of TB in the Australian born non Indigenous population continues to remain relatively stable and has not exceeded 0.9 per 100,000 in the last decade. While the rate in the Australian born Indigenous population has ranged from 3.1 per 100,000 to 6.3 per 100,000 in the last decade (Figure 3).

Tuberculosis in the overseas-born population

In 2014, all but five cases were reported with country of birth information, with 86% (n=1,151) of those notifications being reported as overseas born (Table 5). The proportion of cases reported as being overseas born ranged from 61% of cases in the Northern Territory (n=17) to 96% of cases in South Australia (n=46). In 2014, the rate of TB in the overseas born population (19.1 per 100,000) was approximately 17 times the rate in the Australian born population and a 4% increase on the rate in 2013. In the last decade, the rate of TB in the overseas born population has ranged from 16.2 per 100,000 to 20.2 per 100,000 (Figure 3).

Country of birth

In 2014, the top five most frequently reported countries of birth for TB cases were India, Viet Nam, the Philippines, China and Myanmar and these five countries contributed to half of all the overseas-born cases (575/1,151) (Table 6). Of the most frequently reported countries of birth listed in Table 6, those born in Myanmar (164 per 100,000), Sudan (113 per 100,000), Papua New Guinea (106 per 100,000) and Nepal (103 per 100,000) recorded the highest estimated rates of TB in 2014.

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

Residency status

In 2014, residency status was available for 97% (1,116/1,151) of TB cases reported as overseas born. Residency status is self-reported at the time of diagnosis and is not verified against migration records. In 2014, the majority of overseas born cases reported with a residency status were reported as permanent residents (64%, 718/1,116) (Table 7). The second most reported residency status categories were 'overseas students' (11%, 122/1,116) and 'other'[II] (11%, 122/1,116). The proportion of cases reported as 'overseas students' is similar to the proportion reported in 2013 (12%, 130/1,056).

II. Other – A person not defined by any of the other residency status categories. Please note this data item is self-reported.

Figure 1: Notification rates of tuberculosis, Australia, 1960 to 2014

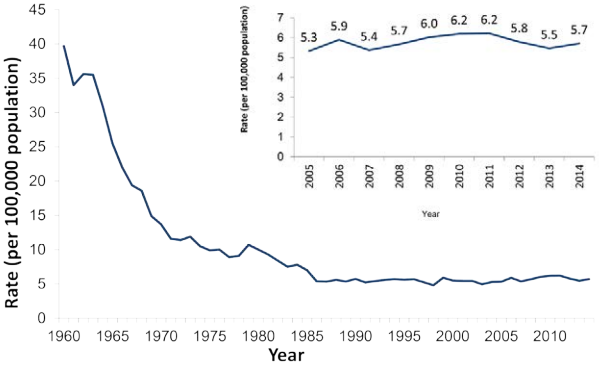


Figure 2: Notification rates of tuberculosis, Australia, 2004-2014, by state or territory

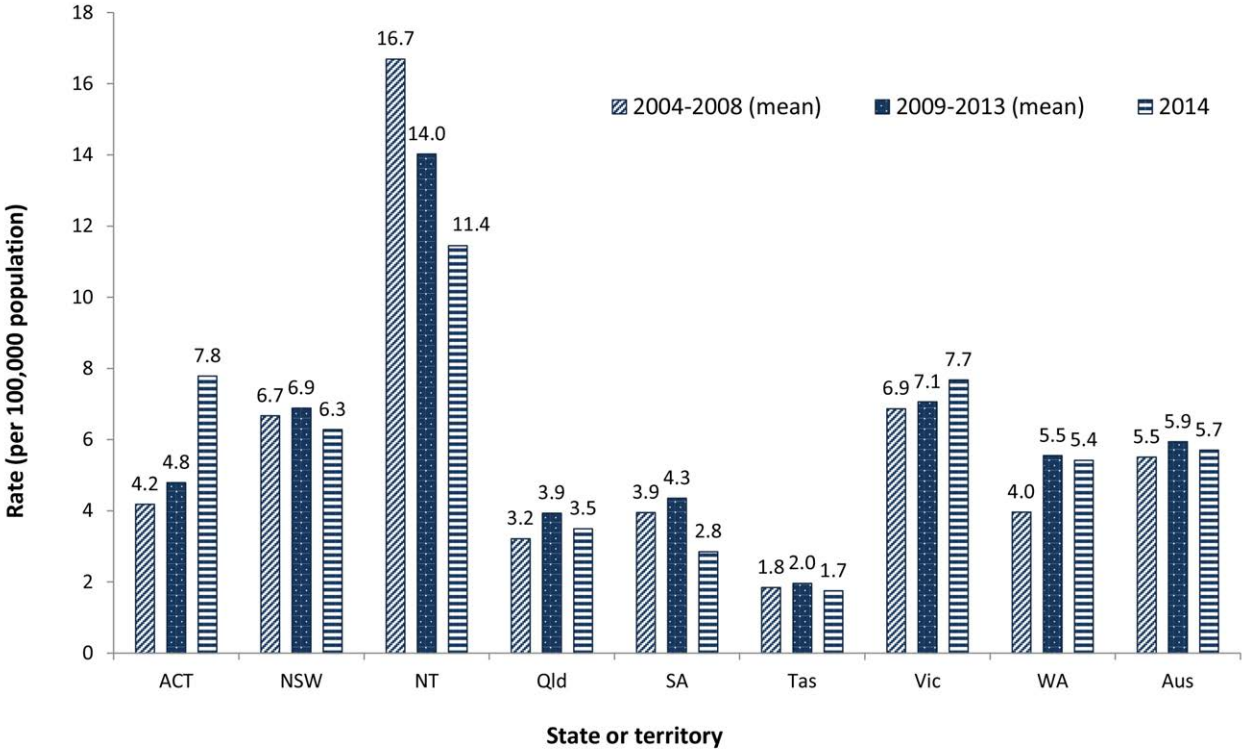


Figure 3: Notified cases and rate of tuberculosis, Australia, 2005 to 2014, by population subgroup

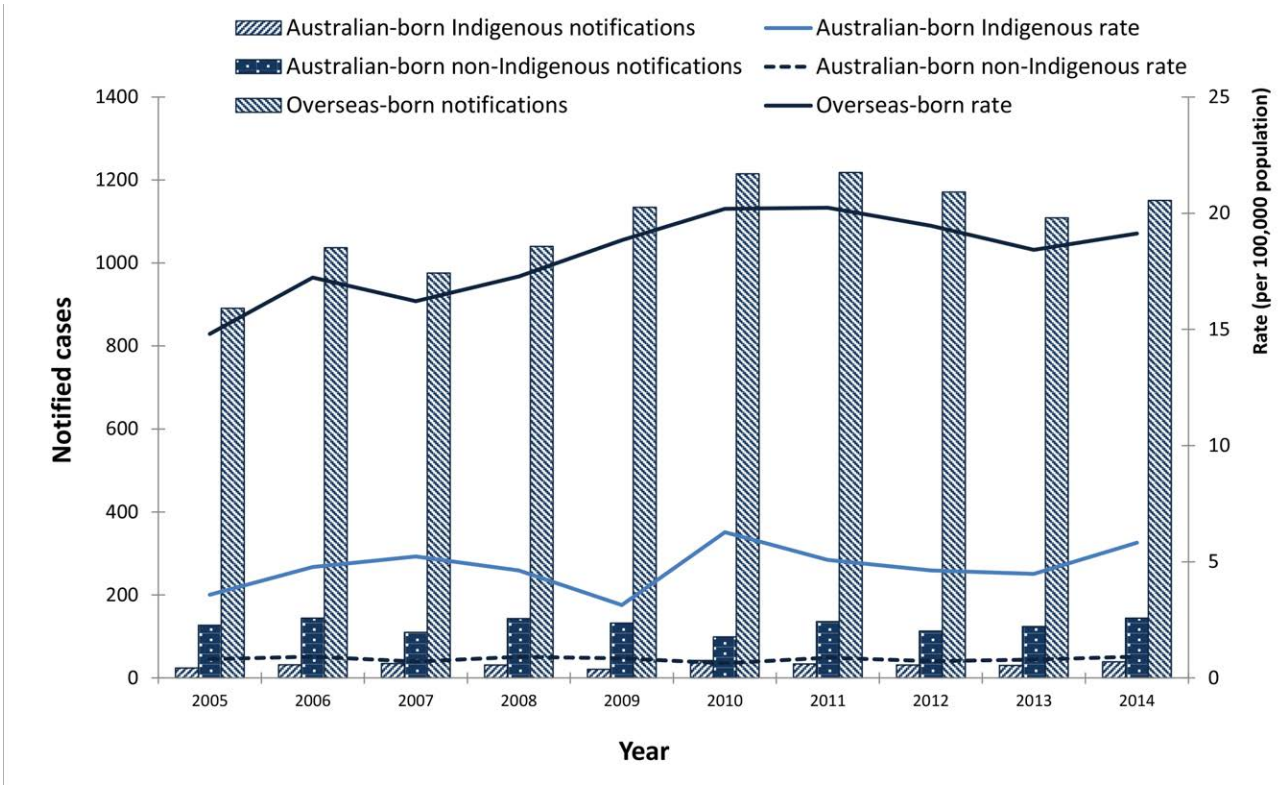


Table 5: Notified cases and rates of tuberculosis, Australia, 2014, by population subgroup and state or territory

NSW	8	3.8	53	1.1	61	1.2	411	20.1
Qld	17	9.0	14	0.4	31	0.9	131	13.0
Tas	0	0.0	3	0.7	3	0.7	6	9.3
WA	1	1.1	12	0.8	13	0.8	126	16.0

* Excludes 5 cases with an unknown country of birth (ACT n=2, QLD n=3)

Table 6: Notified cases and rates of tuberculosis for frequently reported countries of birth, Australia, 2014, by residency status

Country of birth	Residency Status				Estimated resident population 2014†	Estimated rate per 100,000 population	WHO incidence rate per 100,000 population 2014‡
	International Students	Permanent Residents	Other	Total cases*			
India	16	118	78	213	397,180	54	223
Viet Nam	21	81	19	121	223,180	54	140
Philippines	1	77	28	108	225,110	48	322
China (excludes SARs and Taiwan)	14	58	14	86	447,370	19	69
Myanmar, The Republic of the Union of	2	17	29	48	29,300	164	369
Indonesia	11	22	7	40	81,140	49	399
Nepal	14	14	10	38	36,940	103	158
Papua New Guinea	9	9	17	35	33,100	106	432
Afghanistan	0	19	14	33	39,790	83	189
Pakistan	9	14	8	31	49,770	62	270
Sudan	0	22	4	26	23,090	113	94
Cambodia	1	21	2	24	35,000	69	390
Thailand	3	12	9	24	61,910	39	171
Sri Lanka	1	13	8	22	110,520	20	65
New Zealand	0	19	1	20	616,960	3	7.6
Malaysia	6	4	8	18	153,870	12	93
Other overseas-born	14	199	52	265			
Total overseas-born	122	719	308	1,151			
Australian-born	-	-	-	183			
Unknown Country of Birth	-	-	-	5			
Total	**-**	**-**	**-**	**1,339**			

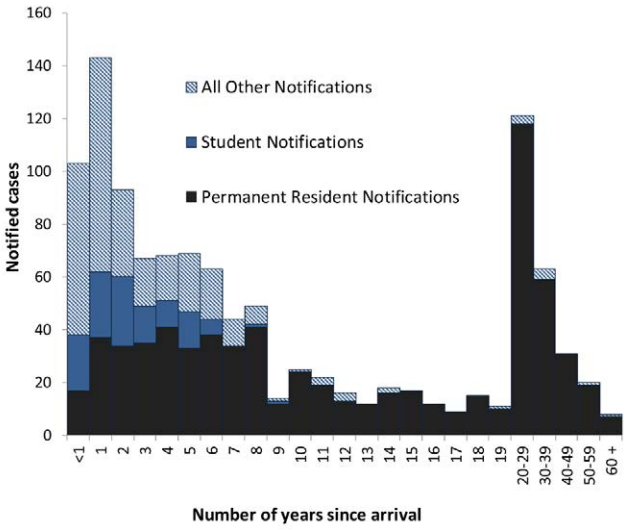
* Total includes cases reported without a residency status.
† 2014 Population data is sourced from the ABS' 3412.0 - Migration, Australia, 2013-14 - Estimated Resident Population by Country of Birth - 1992 to 2014
‡ Rates from the World Health Organization Global Tuberculosis Control Report. [11]

Table 7: Notified cases of tuberculosis in overseas-born people, Australia, 2014 by residency status and state or territory

Residency Status	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Aust
Refugee/ Humanitarian	2	10	2	6	8	3	22	4	**57**
Permanent Resident	18	281	4	70	8	2	257	78	**718**
Overseas Visitor	0	29	1	12	8	0	20	9	**79**
Overseas Student	4	36	1	20	4	1	44	12	**122**
Unauthorised Person	0	1	4	0	0	0	2	1	**8**
Other[ǂ]	0	44	4	14	1	0	41	18	**122**
Illegal Foreign Fisher	0	0	1	0	0	0	0	0	**1**
Residents of the Torres strait treaty zone accessing TB treatment in Queensland	N/A	N/A	N/A	9	N/A	N/A	N/A	N/A	**9**
Unknown or not reported	0	10	0	0	17	0	4	4	**35**
Total overseas-born cases	24	411	17	131	46	6	390	126	**1,151**

ǂ Other – A person not defined by any of the other residency status categories. Please note this data item is self-reported.

Figure 4: Notified cases of tuberculosis in the overseas-born population, Australia, 2014, by residency status and number of years since arrival in Australia



In 2014, there were 9 cases of TB notified amongst Papua New Guinea (PNG) nationals accessing health care in the Torres Strait Protection Zone (TSPZ), an increase on the 3 cases reported in 2013 (Table 7). In 2014, PNG nationals being diagnosed with TB in the TSPZ accounted for 5% (9/165) of Queensland's TB cases.

Time between arrival in Australia and diagnosis

In 2014, data on year of arrival were available for 97% of overseas born cases (1,113/1,151). Of these cases, 43% (474/1,113) were diagnosed with active TB within four years of arrival in Australia. Of those diagnosed within four years of arrival in Australia, the proportion of these being 'overseas students' (20%, 96/474) is similar to the proportion in 2013 (21%, 103/501) (Figure 4).

Premigration health screening

The Migration Regulations 1994, enabled by the Migration Act 1958, stipulate that visa applicants must meet certain Public Interest Criteria; and these criteria include a stipulation that visa applicants must be "… free from TB" and/or not be a … threat to public health in Australia or a danger to the Australian community".[12] Therefore, permanent resident visa applicants, and some temporary resident visa applicants are required to undergo offshore premigration screening which includes a medical examination and a chest x-ray to screen for active TB. Children aged less than 11 years of age are required to undergo a physical

Table 8: Number of cases and case detection rates of tuberculosis identified through offshore premigration screening process, 2011 to 2014

Year	Number of cases†	Case detection rate (estimated rate per 100,000 medical examinations)
2011	287	80
2012	412	116
2013	467	89
2014	425	80

† The number of cases includes cases newly diagnosed through the premigration screening process and cases that were already on treatment for TB at the time of screening.

examination. Visa applicants who are identified as having active TB during premigration screening are required to undergo treatment for the disease prior to entry to Australia.[13]

In 2014, there was a 9% reduction on the number of TB cases detected through offshore premigration screening when compared to 2013 (Table 8). In 2014, the highest rates of TB detected through offshore premigration screening were in the 40 to 44 year old (166 per 100,000) and 70 to 74 year old (159 per 100,000) age groups and similar to 2013, nearly half of all the TB cases detected were in visa applicants from the Philippines (n=97), Viet Nam (n=54) and China (n=50). Just over two thirds (69%) of the TB cases detected through offshore premigration screening were in temporary visa applicants and of those cases, 43% were detected in students visa applicants.

Some form of drug resistance was observed in 26% of TB cases detected through offshore premigration screening, while multi drug resistant TB (MDR TB) was reported in 8.5% of cases and includes two extensively drug resistant TB (XDR TB) cases. MDR TB was identified in applicants from eight different countries, with the majority of cases being identified in applicants from India (n=8), Viet Nam (n=4) and the Philippines (n=3).

Note that since mid 2013, DIBP has implemented an automated premigration screening data collection process resulting in more accurate data collection than previous years. Therefore, the comparison of premigration screening data to previous years should be interpreted with some caution. Further information on the premigration health screening process and related statistics can be obtained from DIBP's Immigration Health Branch[III].

III. Chief Medical Officer, Department of Immigration and Border Protection, +61 2 8666 5760, health@immi.gov.au

Age and sex distribution

Age and sex were reported for all TB cases notified in 2014. Similar to previous years, there were more males than females notified with TB, with a male to female ratio of 1.1:1.

Similar to previous years, TB was predominantly seen in young adults aged 25-34 years (11.7 per 100,000), and again this was driven by the high rates observed in overseas born cases in this age group. In the Australian born Indigenous population, TB was predominantly seen in adults aged 45 years and over (Table 9).

Tuberculosis in children aged under 15 years

One of the most important measures of TB control is the incidence in children aged less than 15 years because these cases represent recent TB infection. In 2014, children aged less than 15 years contributed 4% of all TB cases (54/1,339) (Table 9). In 2014, just over half of the cases in children were reported in the Australian born non Indigenous population (54%, 29/54) and of these, the most frequently reported risk factor was having one or more parent born overseas (n=23) followed by having a 'household member or close contact with TB' (n=14). Note that more than one risk factor may be reported for each notified case of TB. There were 4 cases reported as Australian born Indigenous and all 4 cases reported having a 'household member or close contact with TB'. One of these cases also reported having one or more parent born overseas as an additional risk factor.

The rate of TB in Australian born non Indigenous children has remained relatively stable over the past decade (range: 0.3 per 100,000 to 0.8 per 100,000), whilst the rate in Australian born Indigenous (range: 0.4 per 100,000 to 2.9 per 100,000) has fluctuated over that time. The rate of TB in overseas born children has ranged from 5.7 per 100,000 to 10.1 per 100,000 but overall rates appear to have declined (Figure 5).

Selected risk factors for tuberculosis

In 2014, selected risk factor data were provided for 93% (n=1,249/1,339) of notified cases. Of those cases assessed for risk factors, overall the most frequently reported risk factor was past travel to or residence in a high-risk country (76%, 956/1,249) with the majority of these cases (79%, 753/956) reporting this as the only risk factor (Table 10). When stratified by population subgroup, the most frequently reported risk factor in both overseas-born cases and in Australian born non Indigenous cases was past travel to or residence in a high-risk

Table 9: Notification rates of tuberculosis, Australia, 2014, by population subgroup and age group

Age group	Australian-born Indigenous		Australian-born non-Indigenous		Overseas-born		Total	
	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000	Notifications (n)	Rate per 100,000
0–4	3	3.6	19	1.4	1	1.6	23	1.6
5–14	1	0.6	10	0.4	20	6.6	31	1.1
0–14	4	1.7	29	0.8	21	5.7	54	1.3
15–24	4	3.0	17	0.7	168	27.4	189	6.2
25–34	1	1.1	17	0.8	354	34.0	373	11.7
35–44	3	3.7	18	0.9	197	20.2	218	6.9
45–54	14	22.2	18	0.9	113	11.2	145	4.8
55–64	9	24.5	19	1.2	108	12.2	137	5.3
65+	4	17.6	26	1.3	190	16.8	223	7.2

country (n=904 and n=47 respectively), while in Australian born Indigenous cases having a 'household member or close contact with TB' was more frequently reported (n=23).

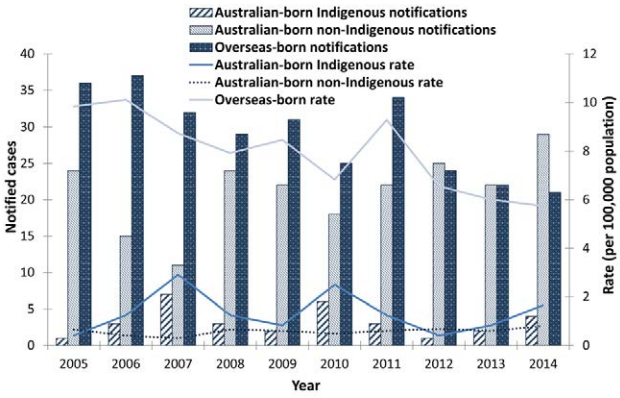
In 2014, a total of 61 cases were reported in people who were currently or had previously worked in a health care setting. Of these, 32 (52%) were reportedly working in a health care setting in Australia at the time of diagnosis or within 12 months of diagnosis and 6 of those reported this as the only risk factor. Of the cases reportedly working in a health care setting in Australia at the time of diagnosis or within 12 months of diagnosis, 50% (16/32) were reported to have extrapulmonary disease only, which is generally not communicable. The remaining 50% (16/32) were reported with pulmonary disease and 3 of those cases were reported as being sputum smear positive.

Tuberculosis and HIV status

According to Australia's 2011 National HIV Testing Policy version 1.3, '…all people with HIV should be tested for tuberculosis, and all people with tuberculosis should be tested for HIV…'[14]. In 2014, the HIV testing history [IV] of notified cases of TB were reported in 97% of cases (n=1,300) and of those cases, 82% (1,069/1,300) were tested for HIV and 55% (716/1,300) were reported with a known HIV status. Of those cases with a known HIV status, 2% (17/716) were reported as HIV positive (Table 11).

In 2014, approximately a quarter of cases with a known HIV testing history were reported as being tested for HIV but the result of that test was unknown (27%, 353/1,300). Nearly all these cases were reported by Victoria (n=335) where policy has prevented the HIV status of an individual being reported with the TB notification to the NNDSS. Victoria has since changed this policy and from 2015 onwards Victoria will report HIV status with TB notifications.

Figure 5: Notified cases and rate of tuberculosis in children aged 0-14 years, Australia, 2005-2014, by population subgroup



Anatomical site of disease

In 2014, all notified cases had a reported anatomical site of TB disease. Pulmonary disease was reported in 63% of cases (847/1,339) with 86% (725/847) of those cases being reported as having pulmonary disease only. Extrapulmonary disease only was reported in 37% (492/1,339) of cases, with the most frequently reported site of extrapulmonary only site of disease being lymph nodes (n=238). Of the more severe forms of TB, the number of cases of miliary (n=9) and meningeal (n=6) TB were the same as the number of cases reported in 2013 (Table 12).

IV. HIV test history means knowing whether or not the person was tested for HIV, not tested for HIV or refused testing for HIV.

Table 10: Notified cases of tuberculosis, Australia, 2014, by population subgroup and selected risk factors

Risk factor*	Australian-born Indigenous	Australian-born non-Indigenous	Overseas-born	Total
Household or other close contact with TB	23	36	106	165
Ever resided in a correctional facility†	0	4	10	14
Ever resided in an aged care facility†	1	2	4	7
Ever employed in an institution†‡	0	0	13	13
Currently or previously† employed in health industry in Australia or overseas	0	4	57	61
Ever homeless	2	3	16	21
Past travel to or residence in a high-risk country	4	47	904	956
Chest X-ray suggestive of old untreated TB	2	4	57	63
Currently receiving immunosuppressive therapy	1	8	44	53
Australian-born child with one or more parent born in a high-risk country	1	27	0	28
None of the above risk factors	10	35	87	132
Total cases assessed for risk factors	**37**	**138**	**1,073**	**1,249**

* More than one risk factor may be reported for each notified case of TB.
† Within the preceding five years.
‡ Institution is defined as a correctional facility, aged care facility or homeless shelter.

In children aged less than 15 years, pulmonary disease was reported in 63% (34/54) of cases and extrapulmonary disease only was reported in 37% (20/54) of cases. Of the extrapulmonary disease only cases, the most frequently reported extrapulmonary site of disease was lymph nodes (n=8) and there were two cases of miliary TB and two cases of meningeal TB.

Anatomical site of disease

In 2014, all notified cases had a reported anatomical site of TB disease. Pulmonary disease was reported in 63% of cases (847/1,339) with 86% (725/847) of those cases being reported as having pulmonary disease only. Extrapulmonary disease only was reported in 37% (492/1,339) of cases, with the most frequently reported site of extrapulmonary only site of disease being lymph nodes (n=238). Of the more severe forms of TB, the number of cases of miliary (n=9) and meningeal (n=6) TB were the same as the number of cases reported in 2013 (Table 12).

In children aged less than 15 years, pulmonary disease was reported in 63% (34/54) of cases and extrapulmonary disease only was reported in 37% (20/54) of cases. Of the extrapulmonary disease only cases, the most frequently reported extrapulmonary site of disease was lymph nodes (n=8) and there were two cases of miliary TB and two cases of meningeal TB.

Bacteriologically confirmed cases

In 2014, 88% (1,177/1,339) of cases were laboratory confirmed as TB. The remaining 12% of cases were diagnosed using clinical and radiological evidence only.

Of the total number of cases reported with pulmonary disease [V] , 91% (775/847) were bacteriologically and/or histologically confirmed and of those, 87% (676/775) were either sputum culture positive or bronchoscopy washings/aspirate culture positive with half of these cases also being smear positive (50%, 335/676). Smear positive cases of pulmonary TB can be up to ten times more infectious than smear negative cases and are usually the main source of TB transmission in the community.[15, 16]

Of the extrapulmonary only cases, 80% (396/492) were bacteriologically and/or histologically confirmed and of those, 69% (273/396) were 'other culture' [VI] positive. Cases with extrapulmonary disease only are generally not infectious and rarely are a source of transmission.[15]

In 2014, 54% (29/54) of cases in children aged less than 15 years were bacteriologically and/or histologically confirmed as TB. Of these cases, half (17/34) of the cases reported with pulmonary disease and 60% (12/20) of the cases reported with extrapulmonary disease only were bacteriologically and/or histologically confirmed. The WHO

V. Pulmonary cases include both pulmonary only cases and pulmonary cases that also have extrapulmonary sites detected
VI. 'Other culture' includes specimens, other than sputum or bronchoscopy washings/aspirate' in which mycobacteria tuberculosis complex was isolated by culture, at the time of diagnosis.

Table 11: Notified cases of tuberculosis, Australia, 2014, by population subgroup and HIV status

HIV testing history	Australian-born Indigenous	Australian-born non-Indigenous	Overseas-born	Unknown population subgroup	Total
HIV positive	0	1	16	0	17
HIV negative	33	67	599	0	699
HIV tested, result unknown	2	35	314	2	353
Not tested	3	36	185	0	224
Refused testing	1	2	4	0	7
Total - known HIV testing history	39	141	1,118	2	1,300
Total - unknown HIV testing history	0	3	33	3	39
Total	**39**	**144**	**1,151**	**5**	**1,339**

Table 12: Notified cases of tuberculosis, Australia, 2014, by site of disease and case classification

Site	New cases	Relapse cases	Unknown case classification	Total cases
Pulmonary				
Pulmonary only	674	46	5	725
Pulmonary plus other sites	117	4	1	122
Pulmonary - Total	791	50	6	847
Extrapulmonary only†				
Pleural	57	4	0	61
Lymph nodes	230	8	0	238
Bone/joint	33	1	1	35
Genito/urinary	22	0	0	22
Miliary	9	0	0	9
Meningeal	6	0	0	6
Peritoneal	36	1	0	37
Other	67	4	1	72
Unknown extrapulmonary site	29	0	0	29
Extrapulmonary - Total	471	19	2	492
Unknown site of disease - Total	0	0	0	0
Total	**1,262**	**69**	**8**	**1,339**

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

recommends that wherever possible, a diagnosis of TB in a child should be bacteriologically confirmed.[17]

Of the bacteriologically confirmed cases in 2014, 17% (200/1,171) of cases recorded a positive microscopy or culture result on a bronchoscopy obtained washing or aspirate which is a similar proportion to previous years. Of these cases, 12% (23/200) were also reported as being sputum smear positive with one of those cases being identified as MDR TB.

Drug resistant tuberculosis in Australia

In 2014, DST results were available for just over three quarters of the TB cases notified (77%, 1,027/1,339) and of those cases, 12% (125/1,027) had resistance to at least one of the standard first line anti-tuberculosis agents reported. Rifampicin mono-resistance remains low and is reported in less than 1% (0.7%, 7/1,027) of cases with DST results available. Isoniazid mono-resistance is again more common than Rifampicin mono-resistance and was reported in 4.6% (47/1,027) of cases with DST results available. In 2014, there were 17 cases of MDR TB (1.7%, 17/1,027) and one case of XDR TB reported (Table 13).

The majority of Australia's MDR TB and XDR TB cases are reported in the overseas-born population. Of the MDR TB cases, 88% (15/17) were reported in overseas-born persons and of those, three cases were born in Papua New Guinea with two of those cases identified as residents of the TSPZ accessing TB treatment in Queensland. The remaining 12 cases were identified in persons born in Viet Nam (n=4), the Philippines (n=2), China (n=2), Myanmar (n=2), India (n=1) and Nepal (n=1). Of the Australian born MDR TB cases (n=2), both cases were reported as having pulmonary disease with extrapulmonary site involvement but only one case was reported as sputum smear positive at the time of diagnosis. One of the Australian born MDR TB cases was reported as being Indigenous and as having died of the TB infection. Both cases reported having past travel or residence (for a least 3 cumulative months) in a high-risk country or countries, with one case also reporting household or close contact with TB and the other as currently receiving immunosuppressive therapy.

The XDR TB case was reported in a person born in Nepal who was diagnosed with pulmonary disease only but was sputum smear negative at the time of diagnosis. This XDR TB case reported two risk factors – 'past travel to or residence in a high-risk country' and having a 'household member or close contact with TB'.Treatment outcomes of the 2013 tuberculosis patient cohort

The treatment outcomes of an annual patient cohort are reported in the following year's annual report. This allows adequate time for all cases notified in a single year to begin treatment and for the treatment outcomes to be recorded in the NNDSS. Treatment outcomes for the 2013 patient cohort are reported in this annual report. Treatment outcomes for the 2014 patient cohort will be reported in the 2015 annual report.

In 2013, treatment success, which includes those bacteriologically confirmed as cured and those who completed treatment, was reported in 96% (1,084/1,134) of cases with assessable outcomes. Treatment success ranged from 93% (25/27) in Australian-born Indigenous cases to 96% (953/995) in overseas born cases. In 2013, treatment failure was reported in just one case, while 11 (1%, 11/1,134) cases were reported to have died of TB (Table 14).

National performance indicators

In 2014, the performance criterion for annual incidence (less than 1 per 100,000) was met only in the Australian born non-Indigenous cases and incidence rates in Australian born children continue to exceed the performance criteria of less than 0.1 per 100,000. The reporting of HIV testing history continues to improve but still remains just short of the reaching the target of 100%. In 2013, outcome reporting fell just short of the performance criteria with 2% of cases with assessable outcomes reported with an unknown outcome. The performance indicators for treatment success and treatment failure were both achieved in 2013 (Table 15).

Discussion

The 2014 report shows that the incidence of TB in Australia remains at a low level despite increased migration from high TB burden countries. Since 1995, the mean rates for 5 yearly intervals have increased marginally over time from 5.5 to 5.9 per 100,000 population. However, if we consider the mean absolute numbers of cases for the 5 year intervals since 1995, there has been a 32% increase in notifications and this excludes the substantial numbers identified and managed pre-migration (Table 3). This increase represents a significant additional burden to State TB programs and highlights the need to maintain clinical, laboratory and public health expertise, infrastructure and commitment to meet this demand.

The epidemiology of TB in Australia and its steady growth in absolute terms in the past two decades continue to reflect the impact from migration of persons from high burden regions, which is also influenced by national education and employment policies. While there was a 4% increase in overall case numbers from 2013, the significance of this small variation is unclear. In 2014, the overseas

Table 13: Notified cases of tuberculosis with drug susceptibility testing (DST) results available, Australia, 2014, by drug susceptibility profile

Drug Susceptibility Testing (DST) Profile	Notifications (n)	Percentage of notifications (%)
Resistance to at least one first line anti-tuberculosis agents*	125	12%
Mono-resistance to rifampicin†	7	0.7%
Mono-resistance to isoniazid†	47	4.6%
MDR-TB‡	17	1.7%
XDR-TB§	1	0.1%
Total cases with DST results	**1,027**	

*Isoniazid, rifampicin, pyrazinamide, ethambutol and streptomycin
† Mono-resistance is a case that is resistant to only the specified anti-TB agent and susceptible to all other anti-TB agents
‡Resistance to at least isoniazid and rifampicin but not XDR-TB.
§Resistance to isoniazid and rifampicin, and any of the fluoroquinolones, and to at least one of the three injectable second-line drugs 18.

Table 14: Notified cases of tuberculosis, Australia, 2013, by population subgroup and treatment outcome

Treatment outcome	Australian-born Indigenous cases		Australian-born Non-Indigenous		Overseas-born		Total cases	
	Notifications (n)	Percentage assessable (%)	Notifications (n)	Percentage assessable (%)	Notifications (n)	Percentage assessable (%)	Notifications (n)	Percentage assessable (%)
Assessable outcomes								
Treatment success	25	92.6	106	94.6	953	95.8	1084	95.6
Cured (bacteriologically confirmed)†	0	0.0	6	5.4	46	4.6	52	4.6
Completed treatment	25	92.6	100	89.3	907	91.2	1032	91.0
Interrupted treatment‡	0	0.0	0	0.0	5	0.5	5	0.4
Died of tuberculosis	1	3.7	2	1.8	8	0.8	11	1.0
Defaulted §	0	0.0	0	0.0	13	1.3	13	1.1
Failure ||	0	0.0	1	0.9	0	0.0	1	0.1
Not followed up, outcome unknown	1	3.7	3	2.7	16	1.6	20	1.8
Total assessable	27	100.0	112	100.0	995	100.0	1134	100.0
Non-assessable outcomes								
Transferred out of Australia	0	0.0	2	1.6	63	5.7	65	5.1
Died of other causes	3	10.0	8	6.5	31	2.8	42	3.3
Still under treatment	0	0.0	2	1.6	20	1.8	22	1.7
Total	**30**	**100.0**	**124**	**100.0**	**1109**	**100.0**	**1263**	**100.0**

† Cured is defined as the bacteriologically confirmed sputum smear and culture positive at the start of treatment and culture negative in the final month of treatment and on at least one previous occasion.
‡ Interrupted treatment is defined as treatment interrupted for two months or more but completed
§ Defaulted is defined as failed to complete treatment.
|| Failure is defined as sputum culture positive at five months or later.

born accounted for 86% of the 1339 cases, with 64% occurring in permanent residents and 11% in overseas students. These latter figures are not significantly different from the previous year.

Premigration Screening

Premigration screening has become an important contributor to TB control in Australia. Although there was a 9% reduction in cases reported pre-migration when compared to 2013, the 425 cases diagnosed and treated would represent an addition of approximately 24% of total TB cases were all to have been diagnosed following travel to Australia. Of these cases 57% were from the Philippines, Vietnam, China and India and 61% were temporary visa applicants. Student and visitor groups predominated, representing more than 50% of applicants, but the highest rate was observed in the refugee/humanitarian group (372 per 100,000) who contributed 11.8% of cases. This data highlights how the make-up of the Australian migration programme influences the trends in the TB epidemiology.

As expected in a screening programme, a high proportion pre-migration were either sputum smear negative/culture positive (48%) or chest x-ray positive/culture negative (28%). Detecting these cases earlier in the disease process benefits the individual by limiting morbidity and the Australian community by preventing future transmission. An important finding from pre-migration screening was the significant level of drug resistance (any resistance 26%, isoniazid 9.4%, MDR-TB 8.5%). Although not necessarily representative of the overall migrating population, this is still a concern and will be an important trend to monitor in terms of the potential implications for TB control in Australia. It also raises a question about the future of isoniazid as the key preventive agent for management of latent TB infection.

Australian born population

The overall rate of TB in the Australian born population remains relatively static at approximately 1 per 100,000 population and has been so since 2005 (figure 3). In Australia's Aboriginal and Torres Strait Islander population, the rate has fluctuated at around 6 times that of the non-indigenous population but the actual numbers and annual rates remain low by international standards. A capacity to respond to each new case with a measure of TB control for the individual, contacts and the community remains a high priority to achieve the incidence level of the non-indigenous Australian born population.

NSW and Victoria continue to experience the highest proportion of TB cases. In 2014 the two states accounted for approximately two thirds of all cases. However compared with the 5 year mean annual rates since 2004, the mean annual rate for NSW has remained relatively steady while in Victoria the mean rate has increased from 6.9 to 7.7 per 100,000. The highest rate recorded was in the Northern Territory and while case num-

Table 15: National tuberculosis performance indicators, performance criteria* and the current status of tuberculosis, Australia, 2013 and 2014

National tuberculosis performance indicator	Performance criteria	2014	2013
Annual incidence of TB (cases per 100,000 population)			
Total	<6.0†	5.7	5.5
Australian-born Indigenous cases	<1.0	5.8	4.5
Australian-born non-Indigenous cases	<1.0	0.9	0.8
Overseas-born cases	*	19.1	18.4
Incidence in children <15 years, by risk group (per 100,000 population)			
Australian-born Indigenous cases	<0.1	1.7	0.8
Australian-born non-Indigenous cases	<0.1	0.8	0.6
Overseas-born cases	*	5.7	6.0
Collection of HIV testing history			
Collection of HIV testing history in all tuberculosis cases	100%	97%	96%
Treatment outcome measures (%)			
Cases evaluated for outcomes	100%	TBA‡	98%
Cases that have treatment completed and are cured (treatment success)	>90%	TBA‡	96%
Cases recorded as treatment failures	<2%	TBA‡	0.1%

* Performance criteria currently under review.
† This performance criterion is based on the key performance indicator published in the DIBP 2014-15 Portfolio Budget Statements under Programme 1.2 Migration and Citizenship Key Performance Indicators, page 31.
‡ TBA is to be assessed: 2014 patient cohort outcomes

bers were low, all cases were in the indigenous Australian and overseas born groups. In contrast South Australia experienced a noticeable fall in case numbers. This was extensively reviewed and concluded to be a natural occurrence unrelated to any significant environmental, policy or procedural changes. As previously reported, the variances across Australia may reflect changing patterns in migrant and temporary resident intakes and placements.

TB notifications in PNG nationals detected in the cross border Torres Strait Protection Zone rose to 9 cases (2 MDR-TB) in 2014 compared to 3 in the previous year. This still remains well below the number reported in 2011 (47) after which bilaterally agreed changes to cross border management of patients were implemented.

The number of re-treatment cases is a measure of TB control program effectiveness. In 2014, 68 (5.1%) notifications were classified as "relapse". However 44 related to previous treatment overseas which does not reflect on the quality of treatment in Australia. The proportion previously treated in Australia was 1.8% (target <2%) but the dataset does not discriminate whether these cases had relapsed following recent or more distant treatment or whether there were contributing factors such as diabetes or HIV co-infection, and additional research into these factors will be of value. Further, the possibility of re-infection either from significant travels to a high burden country or recent transmission in Australia needs to be considered. In low incidence countries the contribution from re-infection to the retreatment group of cases should be low in the absence of recent travel.

TB in children, particularly those less than 5 years, is an important indicator of recent transmission of infection in the community. In the under 15 age group, this proportion has remained steady at 4% of all cases with non-indigenous Australian born contributing 54% (29/54) and overseas born 39% (21/54). In the non-indigenous Australian born group, the key risk factors identified were having at least one parent born overseas (23/29, 80%) and a history of TB contact (14/29, 48%). This latter group of children who were identified as close contacts of an active case were potentially missed opportunities to prevent disease. TB contact investigation is an important public health activity that aims to identify those at risk from recent infection and target with preventive therapy. TB in indigenous Australian born children generally remains low but to maintain this will depend on continued public health capacity to respond in a timely and appropriate manner to any new TB cases.

As routine BCG vaccination is no longer undertaken in Australia, monitoring severe forms of TB in children is important. There were two cases classified as miliary and two as meningeal. These very low numbers based on international recommendations for use of the BCG vaccine in low incidence countries support the present approach.

HIV co-infection

HIV and TB co-infection continues to have minimal impact on TB control in Australia. Of the 55% reported with a known HIV status, only 2% were HIV positive. This rate has not altered significantly over time but routine HIV testing in all new TB cases is still recommended nationally.

Bacteriology /Method of diagnosis/ Bronchoscopy

In 2014, a high proportion (88%) of cases were confirmed based on laboratory evidence. Of the extra-pulmonary cases where a higher proportion of non-bacteriologically confirmed cases is anticipated, the proportion was 80%. An acceptable target is 80% for all cases and these results suggest that over-diagnosis is unlikely to be significant.

In the diagnosis of pulmonary cases, concerns have previously been raised about the use of bronchoscopy, particularly in smear positive patients who represent the most infectious group.[19] Of the 847 pulmonary cases notified, 676 (79.8%) were culture confirmed and of these 335 (50%) were smear positive. Bronchoscopy was the source of a positive culture result in 200 (29.6%) with 12% being smear positive and one case also multidrug-resistant. Despite the recommended infection control precautions (personal protective equipment, negative pressure ventilation and air exchange requirements), these cases can still represent risk to staff and unnecessary morbidity for the patient.[20] The use of "induced sputum" (with appropriate infection control precautions) is strongly encouraged in preference to bronchoscopy in those where obtaining satisfactory spontaneous sputum specimens has not been possible.[21]

Drug Resistance

The rate of isoniazid resistance is low and lower than would be seen in countries of origin for many TB patients diagnosed in Australia. While the absolute number of MDR TB cases is small (n=17) the percentage in new cases (1.7%) is higher than in some of our regional neighbours (New Zealand 0.9%, Hong Kong SAR 0.97%; Malaysia 0.4%) or Canada (1.4%), USA (1.1%) and the UK (1.2%) albeit with overlapping confidence intervals.[11] The most common countries contributing

to Australia's migrant arrivals (India, Viet Nam, China Philippines and Myanmar) all have MDR TB rates in new cases between 2.0 and 5.7%.[11] The number of PNG residents diagnosed with MDR TB in the TSPZ is less in this reporting period than the previous 5 year average.

Treatment Outcomes

Surveillance of TB treatment outcomes is important for monitoring the capacity of jurisdictional programmes to ensure treatment completion and standards of patient management. The high overall treatment success rate (95%) and the low rate of adverse outcomes (deaths 1%, treatment failure 0.1% and loss to follow-up 1.1%) overall have altered little from the previous five years and support the ongoing effectiveness of the State and Territory TB programmes and good standard of management practices.

Concluding comments

If Australia is to achieve the bold target towards TB elimination set by the WHO Global "End TB" Strategy of a 90% reduction in TB incidence by 2035 compared with 2015, then an annual rate of reduction of approximately 18% is required. Based on the present rate (WHO annual estimate for Australia 2000-12 is minus 0.8%) this is a daunting prospect and not achievable using current strategies. Although Australia's rate of TB in Australian born is at pre-elimination levels (<10 per million), its progress towards elimination of TB will be heavily aligned with national policies and global improvements in TB care and prevention. This latter association also highlights the importance of Australia contributing to TB Control efforts beyond its borders particularly with regional partners in the Western Pacific and South East Asian regions.

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