Evaluation of tuberculin skin testing in tuberculosis contacts in Victoria, Australia, 2005–2013

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Aim: To review the programmatic use of the tuberculin skin test (TST) following tuberculosis (TB) exposure in Victoria, Australia.

Methods: A retrospective review of data collected for public health surveillance was performed to identify contact demographic factors, including bacille Calmette-Guérin (BCG) status and age and outcomes of TST.

Results: Contact tracing was performed for 15 094 people, of whom 13 427 (89.0%) had a TST performed. The TST was positive in 31.4% (95%CI 30.6–32.2) of all contacts, and 48.8% of contacts born outside of Australia. Amongst contacts who were TST-negative at baseline, the conversion rate following exposure was 14.8%. Conversion was most common in those aged 45–54 years, with <12% positivity in both the youngest (<5 years) and oldest (≥65 years) age groups. Active TB developed in 1.1% of all contacts. Contacts aged <5 years had the highest risk of developing active TB following exposure (3.8%), while low risk was seen in those aged ≥65 years (0.3%).

Conclusion: Overall, contact tracing and TST in this setting appear to yield a high proportion of people at risk for the development of active TB. The yield of testing in some groups, particularly those aged ≥65 years, was low, and investigation of alternative strategies should be considered.

Screening for latent tuberculous infection (LTBI) amongst sufficiently high-risk groups can be valuable in allowing an opportunity for preventive chemotherapy and preventing tuberculosis (TB) disease.¹ Individuals who have contact with cases of pulmonary TB are known to be at significantly higher risk of progressing to active disease, particularly in low-prevalence settings where relative risk is much higher than background.² In the Australian state of Victoria, current guidelines involve standardised interviews regarding the extent of contact, with a 'break-of-contact' (BOC) tuberculin skin test (TST) defined locally as a TST performed routinely 3 months following exposure and an additional TST performed at baseline for household or other contacts at high risk. While the TST has known limitations, including most significantly potential cross-reactivity with bacille Calmette-Guérin (BCG) vaccination and false-negative reactions in immunocompromised individuals, protocols for its use in identifying contacts at increased risk for progression to active disease following exposure are well established.^{3,4}

The background risk of acquiring LTBI in Victoria is very low, with prevalence studies in Melbourne sec-

ondary school students demonstrating a negligible risk in Australian-born students.⁵ Similar studies in other Australian states have confirmed that the risk of LTBI in unselected populations is mostly confined to children born overseas.⁶ While the general background risk of LTBI may be low in this context, prevalence amongst selected populations with defined risk factors may be quite high. In one recent study of TB contact screening in Australian TB clinics, 35% of the contacts were identified as having LTBI.⁷ Such high-risk groups are likely to benefit from targeted systematic testing and treatment for LTBI.

Current World Health Organization (WHO) guidelines on the management of LTBI recommend systematic testing and treatment of LTBI for adult and child contacts of pulmonary TB cases.⁸ However, relatively little research has been conducted in Australia to fully describe the outcomes of contact tracing in these settings, including the prevalence of LTBI among both adult and child contacts of notified cases of TB. The objectives of this study were to estimate the prevalence of LTBI and the risk of active TB disease in contacts of infectious TB cases.

METHODS

This retrospective cohort study was conducted in Victoria, Australia, which has a population of approximately 5.8 million. The study population was made up of all contacts of notified cases of infectious TB in Victoria between 1 January 2005 and 31 December 2013.

Data were extracted from the Public Health Events Surveillance System (PHESS), an established database of all notifications of TB in Victoria, including contact tracing and testing. There is mandatory reporting of TB cases by doctors and laboratories in Victoria. Data were de-identified to ensure the anonymity of cases and contacts.

A notified case of active TB was classified according to a standard case definition, based on either laboratory definitive evidence requiring isolation of *Mycobacterium tuberculosis* complex by culture or nucleic acid testing, or clinical diagnosis accompanied by treatment.⁹ Extracted variables included the following: age, sex, residential area, country of birth, BCG vaccination status, type of contact (close contact vs. other), TST testing and reading dates, and TST results. Close contact is defined as people who have had frequent, prolonged and close contact in an enclosed environment with an infectious case, such as all people living in the same dwelling; relatives and friends who have frequent, prolonged and close contact; and work col-

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KEY WORDS

latent tuberculous infection; bacille Calmette-Guérin; screening; public health

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TABLE 1 Characteristics of the respondents (*n* = 13 427)

Variable	Total	TST results		Prevalence % (95%CI)
		Positive <i>n</i> (%)	Negative <i>n</i> (%)	
Overall TST results	13 427	4212 (31.4)	9215 (68.6)	31.4 (30.6–32.2)
Contacts				
Close	6404	2616 (40.9)	3788 (59.2)	40.8 (39.6–42.1)
Other	7020	1596 (22.7)	5424 (77.3)	22.7 (21.8–3.7)
Unknown	3	0	3 (100)	
BCG				
Yes	6316	3377 (53.5)	2939 (46.5)	53.5 (52.2–54.7)
No	7111	835 (11.7)	6276 (88.3)	11.7 (11.0–12.5)
Sex				
Male	6452	2159 (33.5)	4293 (66.5)	33.5 (32.3–34.6)
Female	6951	2047 (29.5)	4904 (70.6)	29.4 (28.4–30.5)
Unknown	24	6 (25.0)	18 (75.0)	
Age group, years				
<5	1030	151 (14.7)	879 (85.3)	14.7 (12.5–16.8)
5–14	1816	411 (22.6)	1405 (77.4)	22.6 (20.7–24.6)
15–24	4609	1021 (22.2)	3588 (77.9)	22.2 (21.0–23.4)
25–34	2247	895 (39.8)	1352 (60.2)	39.8 (37.8–41.9)
35–44	1459	707 (48.5)	752 (51.5)	48.5 (45.9–51.0)
45–54	1222	650 (53.2)	572 (46.8)	53.2 (50.4–56.0)
55–64	679	284 (41.8)	395 (58.2)	41.8 (38.1–5.5)
≥65	316	87 (27.5)	229 (72.5)	27.5 (22.6–32.5)
Unknown	49	6 (12.2)	43 (87.8)	
Country of birth				
High TB incidence	8000	1454 (18.2)	6546 (81.8)	51.5 (50.1–52.8)
Low TB incidence	5271	2714 (51.5)	2557 (48.5)	18.2 (17.3–19.0)
Unknown	156	44 (28.2)	112 (71.8)	

TST = tuberculin skin test; CI = confidence interval; BCG = bacille Calmette-Guérin; TB = tuberculosis.

leagues who share the same indoor work area on a daily basis, following an individual risk assessment. Regions of birth were classified according to the United Nations Statistical Division classification.¹⁰ A high-incidence country was defined as a TB incidence of ≥40 cases per 100 000 population, based on the WHO 2014 global tuberculosis report.¹¹

Data extraction also provided information on subsequent diagnoses of active TB in any person identified as a contact during the study period. Contacts diagnosed with active TB more than 6 months after exposure were considered to have reactivated outside of the contact tracing process.

The standard Australian dose of 10 international units (IU) of tuberculin (Sanofi Pasteur, Ltd, Toronto, ON, Canada) (i.e., 0.1 ml of a 100 IU per ml solution injected intradermally) was used through this period. A positive reaction was defined as an induration of ≥5 mm at 48–72 hours. While in practice alternative cut offs may be used in different populations to guide the evaluation of risk, ≥5 mm was chosen for primary analysis to allow comparison with the existing published literature. Secondary analysis was also conducted with ≥10 mm considered as positive. TST conversion was defined as any increase of >5 mm diameter induration on an individual with a baseline TST result <5 mm.

Cumulative incidence was calculated by dividing the number of new cases during the follow-up period by the total population at risk. The incidence rate was calculated by dividing the number of new cases by the total person-years at risk during the follow-up period per 100 000 person-years.

Approval from the Victorian Department of Health Human Ethics Committee was obtained prior to carrying out this project. As only retrospective and aggregated data were included, no additional consent was sought from participants.

Statistical methods

All data preparation and analysis was conducted using Stata version 12.0 (Stata Corp., College Station, TX, USA). Descriptive analysis, univariate and multivariate logistic regression analysis were performed. Pearson's χ^2 was used to test the association between categorical variables. A *P* value of <0.05 was considered statistically significant. Univariate analysis was performed first to obtain unadjusted odds ratios and 95% confidence intervals (CI). Variables significant at *P* < 0.05 were included in the multivariable model.

RESULTS

Of 15 094 contacts of 1629 pulmonary index cases screened during the study period, 13 427 (89.0%) subsequently underwent TST; 1667 (11.0%) contacts who did not attend at least one TST reading were excluded from subsequent data analysis because they did not meet the selection criteria. Characteristics of contacts are presented in Table 1. The results of the 20.9% of contacts who received both baseline and BOC testing are presented separately. The time from exposure to the end of the follow-up period was a mean of 55.6 months, with a total follow-up time of 61 840.4 years for the cohort.

TABLE 2 Univariate and multivariate analysis of predictors of tuberculin skin test positivity

Variable	Univariate analysis		Multivariate analysis	
	OR (95%CI)	P value	OR (95%CI)	P value
Age ≥65 years (reference group: <65 years)	0.8 (0.6–1.1)	0.131		
BCG-vaccinated (reference group: non-BCG-vaccinated)	8.6 (7.9–9.4)	<0.0001	8.4 (7.6–9.1)	<0.0001
High TB incidence country of birth (reference group: low incidence TB)	4.8 (4.4–5.2)	<0.0001		
Male sex (reference group: female)	1.2 (1.1–1.3)	<0.0001	1.2 (1.1–1.3)	<0.0001
Close contact (reference group: other contacts)	2.3 (2.2–2.5)	<0.0001	2.1 (2.0–2.3)	<0.0001

OR = odds ratio; CI = confidence interval; BCG = bacille Calmette-Guérin; TB = tuberculosis.

Table 1 shows the proportion of contacts with a positive TST, stratified by BCG status, sex and age group. The overall prevalence of TST positivity was 31.4% (95%CI, 30.6–32.2). BCG-vaccinated participants had a higher (53.5%) prevalence of TST positivity than those with no BCG (11.7%). Contacts born in a high TB incidence country were more likely to have a positive TST (51.5%) than those born in a low TB incidence country (18.2%). Australian-born contacts were least likely to have a positive TST, with the highest proportion found in those born in African and Asian regions (data not shown). The 45–54 year age group had the highest prevalence (53.2%) of TST positivity, followed by those aged 35–44 years (48.5%). Contacts aged <5 years had the lowest prevalence (14.7%).

A 10 mm cut-off for those with BCG vaccination was used for comparison with other published articles (results not shown). The overall prevalence of LTBI was 22.2%. BCG-vaccinated contacts had a higher proportion of TST positivity (34.0%) than those not BCG-vaccinated (11.7%).

Table 2 shows univariate and multivariate analysis of the predictors of TST positivity. No linear relationship was observed between age and TST reactivity. Country of birth is not included in the multivariate analysis, as it is highly correlated to BCG. After adjusting for the effect of sex and type of contact in the model, the significant increased odds of a positive TST among contacts with BCG compared to those without remained.

Of all the contacts, 2796 (20.8%) had both baseline and BOC TST. Summary results are presented in Table 3, excluding 0.4% of contacts for whom age was not recorded. Overall, TST conversion occurred in 14.8% (95%CI 13.4–16.1) of those negative at baseline. The risk of TST conversion varied with age, peaking in the group aged 45–54 years (22.4%). Contacts aged <5 years and ≥65 years had the lowest risk (7.0% and 11.4%, respectively). Close contacts had a higher conversion rate (17.8%) than other contacts (7.5%).

Multiple logistic regression was performed to evaluate factors associated with TST conversion (Table 4). BCG vaccination and type of contact both remained significant predictors of TST conversion.

During the study period, 152 contacts developed active TB. Of these, 104 (68.4%) were identified as part of the contact tracing process within 6 months from exposure, while a total of 131 (86.0%) had developed active TB within 2 years of exposure (not shown). Table 5 shows the risk of active TB by age group and BCG status. Contacts aged <5 years had the highest risk, with the lowest found in contacts aged ≥65 years. Contacts with a history of BCG vaccination were also observed to have a lower risk of subsequent development of active disease (1.0%) compared to those with no BCG vaccine (1.2%; $P > 0.05$), although the difference was not statistically significant. The time from exposure to the

end of the follow-up period for those who were TST-positive was 4212 years and for those who were TST-negative it was 9215 years.

Contacts who converted to positive were significantly more likely to develop active TB (5.6%, $P < 0.05$) compared to those with positive results at baseline (3.1%). There were 303 contacts with positive TST at baseline who were tested again at BOC because they had a TST reading of <10 mm and were from high TB incidence countries. This is in accordance with the local LTBI treatment guidelines. Seven of these contacts went on to develop active TB.

Table 6 presents a multivariate analysis of risk for progression to active TB. After adjusting for the effect of country of birth, TST conversion and type of contact in the model, the significantly increased odds of LTBI reactivation among contacts aged <5 years and close contacts persisted, while being born in a high TB incidence country was protective.

TABLE 3 TST conversion results by age group

Variable	TST conversion results		Cumulative incidence % (95%CI)
	Positive n (%)	Negative n (%)	
TST conversion	414 (14.8)	2382 (85.3)	14.8 (13.4–16.1)
Age group, years			
<5	31 (7.0)	414 (93.0)	7.0 (4.6–9.3)
5–14	82 (12.9)	555 (87.1)	12.9 (10.3–15.5)
15–24	103 (15.7)	552 (84.3)	15.7 (13.0–18.5)
25–34	70 (17.5)	331 (82.5)	17.5 (13.7–21.2)
35–44	54 (20.6)	208 (79.4)	20.6 (15.7–25.5)
45–54	45 (22.4)	156 (77.6)	22.4 (16.6–28.2)
55–64	20 (17.2)	96 (82.8)	17.2 (10.3–24.1)
≥65	9 (11.4)	70 (88.6)	11.4 (4.3–18.4)
BCG-vaccinated			
Yes	306 (25.6)	888 (74.4)	25.6 (23.1–28.1)
No	108 (6.7)	1504 (93.3)	6.7 (5.5–7.9)
Country of birth			
High TB incidence	253 (24.7)	770 (75.3)	24.7 (22.1–27.4)
Low TB incidence	155 (8.9)	1592 (91.1)	8.9 (7.5–10.2)
Unknown	6 (16.7)	30 (83.3)	
Sex			
Male	199 (14.4)	1185 (85.6)	14.4 (12.5–16.2)
Female	215 (15.1)	1205 (84.9)	15.1 (13.3–17.0)
Unknown	0	2 (100)	
Type of contact			
Close	352 (17.8)	1623 (82.2)	17.8 (16.1–19.5)
Other	62 (7.5)	769 (92.5)	7.5 (5.7–9.2)
Unknown	0	0	

TST = tuberculin skin test; CI = confidence interval; BCG = bacille Calmette-Guérin; TB = tuberculosis.

TABLE 4 Univariate analysis of predictors of tuberculin skin test conversion-incidence

Variable	Univariate analysis		Multivariate analysis	
	OR (95%CI)	P value	OR (95%CI)	P value
Age ≥ 65 years (reference group: <65 years)	0.7 (0.4–1.5)	0.388		
BCG-vaccinated (reference group: non-BCG-vaccinated)	4.8 (3.8–6.1)	<0.0001	4.5 (3.5–5.7)	<0.0001
High TB incidence country of birth (reference group: low TB incidence)	3.4 (2.7–4.2)	<0.0001		
Male sex (reference group: female)	0.9 (0.8–1.2)	0.570		
Close contact (reference group: other contacts)			2.3 (1.7–3.0)	<0.0001

OR = odds ratio; CI = confidence interval; BCG = bacille Calmette-Guérin; TB = tuberculosis.

TABLE 5 Development of active tuberculosis amongst identified contacts

Variable	LTBI reaction		Incidence rate/100 person-years
	Reactivation <i>n</i> (%)	No reactivation <i>n</i> (%)	
Age, years			
<5	39 (3.8)	991 (96.2)	0.9
5–14	47 (2.6)	1769 (97.4)	0.6
15–24	26 (0.6)	4583 (99.4)	0.1
25–34	24 (1.1)	2223 (98.9)	0.2
35–44	8 (0.6)	1451 (99.5)	0.1
45–54	3 (0.3)	1219 (99.8)	0.1
55–64	4 (0.6)	675 (99.4)	0.1
≥ 65	1 (0.3)	315 (99.7)	0.1
Unknown	0	49 (100)	
Total	152 (1.1)	13 275 (98.9)	
BCG			
Yes	66 (1.0)	6250 (99.0)	0.2
No	86 (1.2)	7025 (98.8)	0.3
Country of birth			
High TB incidence	75 (1.4)	5196 (98.6)	0.3
Low TB incidence	76 (1.0)	7924 (99.1)	0.2
Unknown	1 (0.6)	155 (99.4)	
Sex			
Male	84 (1.3)	6368 (98.7)	0.3
Female	68 (1.0)	6883 (99.0)	0.2
Unknown	0	24 (100)	
Type of contact			
Close	133 (2.1)	6271 (97.9)	0.5
Other	19 (0.3)	7001 (99.7)	0.1
Unknown	0	3 (100)	
TST results			
Baseline positive without follow-up test	111 (3.2)	3384 (96.6)	18.4
Baseline positive and negative at follow-up test	7 (2.3)	296 (97.7)	15.9
Converted	23 (5.6)	391 (94.4)	1.3
Baseline negative and not converted	0	2089 (100)	0.0
Baseline negative without follow-up test	11 (0.2)	7 115 (99.9)	0.0
Duration of follow-up, years	<i>n</i>	median [IQR]	
TST-positive	4212	4.8 [2.6–6.9]	
TST-negative	9215	4.5 [2.8–6.7]	

LTBI = latent tuberculous infection; BCG = bacille Calmette-Guérin; TB = tuberculosis; TST = tuberculin skin test; IQR = inter-quartile range.

DISCUSSION

Significant variation in TST positivity amongst the contacts tested was seen in relation to a number of demographic factors, including country of birth, BCG vaccination status and age. While many of these associations are well described, several, particularly

our findings in relation to age, have implications for the programmatic management of TB.

In contexts where ongoing exposure to TB is likely, TST surveys tend to demonstrate rising rates of LTBI with increasing age. However, such surveys rarely test the older members of the population, as was done in this setting. The few previous studies that

TABLE 6 Univariate logistic regression of predictors of active TB

Variable	Univariate analysis		Multivariate analysis	
	OR (95%CI)	P value	OR (95%CI)	P value
Age <5 years (reference group: ≥5 years)	4.3 (2.9–6.2)	<0.0001	6.9 (4.4–11.0)	<0.0001
BCG-vaccinated (reference group: non-BCG-vaccinated)	0.9 (0.6–1.2)	0.369		
High TB incidence country of birth (reference group: low TB incidence)	1.5 (1.1–2.1)	0.013	0.6 (0.4–0.8)	0.003
Male sex (reference group: female)	1.3 (1.0–1.8)	0.078		
Close contact (reference group: other contacts)	7.8 (4.8–12.7)	<0.0001	4.2 (2.5–7.3)	<0.0001
Tuberculin skin test conversion (reference group: positive at baseline)	1.8 (1.2–2.9)	0.010	1.1 (0.7–1.8)	0.634

TB = tuberculosis; OR = odds ratio; CI = confidence interval; BCG = bacille Calmette-Guérin.

have included those aged ≥65 years have shown that rates of LTBI continue to rise, contrary to our report.¹² One explanation for these findings could be the waning of TST positivity with age in our low-transmission context, due to impaired immunity or reflecting more distant exposure prior to migration.¹³ However, regardless of the basis for this result, the programmatic management of TB contacts typically reserves consideration of preventive chemotherapy for those with a positive TST.

The marked variation in baseline TST reactivity in relation to country of birth is also worthy of note. While this could be related to different patterns of community contact while resident in Victoria, it may be more likely to reflect variations in risk of TB exposure prior to migration. As some regions had rates of TST reactivity above 60%, this raises the question as to whether migrants from some regions may benefit from recommendations for more routine screening, even outside the context of contact tracing. Given the high rates of TB reported in post-migration cohorts, screening could be an important adjunct to contact tracing following the diagnosis of active cases in low-prevalence settings.¹⁴ However, such screening programmes are controversial, and ethical and human rights issues must be considered.¹⁵ A history of BCG vaccination was also common in this cohort, raising the question as to whether interferon-gamma release assays (IGRA) may be helpful in contact tracing in this setting given the greater LTBI specificity in BCG-vaccinated individuals.¹⁶ Overall, the strongest predictor of both positive TST at baseline and conversion was history of BCG vaccination. Although there is controversy in the literature regarding the significance of childhood BCG vaccination in relation to adult TST reactivity, this effect remained in our cohort when the analysis was limited to adult contacts.^{17,18} We would argue that BCG vaccination remains relevant to the interpretation of TST in adult contacts, and that it should be considered as part of an evaluation of risk of LTBI acquisition.

It is important to note that some of the contacts who were negative at baseline testing and did not have BOC testing went on to develop active TB. These results demonstrate the relevance and importance of performing BOC testing where there is a high clinical suspicion of transmission.

Current WHO recommendations suggest that all close contacts of pulmonary TB cases should be investigated, without consideration of age.⁸ Our finding that the youngest contacts were at significant risk of developing active TB is unsurprising, and encourages efforts to monitor this group vigilantly. However, the low rates of both TST reactivity and subsequent active disease in those aged ≥65 years raise questions regarding the value of current approaches to contact tracing in this cohort, particularly in light of the increased risk of hepatotoxicity due to isoniazid chemoprophylaxis in older people.¹⁹ Further programmatic evaluation of strategies for older contacts will be of use.

This report is strengthened by the use of systematically collected, state-wide longitudinal data, and limited by the reliance on retrospective data and the inherent limitations of surveillance data. Historical data may not capture a small subset of contacts followed up by other providers such as general practitioners or hospitals. Due to the decentralised structure of clinical TB services in Victoria, limited information was available on the use of preventive chemotherapy, including documented treatment completion and adverse effects. Finally, active TB in contacts has been assumed in this report to relate to the defined period of exposure. While the high rates of TB seen during the 6 months following exposure suggest that these episodes were appropriately categorised, we cannot exclude the possibility that some contacts may have acquired TB from alternative sources. Further genomic studies in this setting are planned, and may assist in providing additional clarity.

In conclusion, this study provides additional information for planning targeted TB screening programmes in low-incidence settings. Overall, the efficiency of contact screening is high, and supports continued efforts to implement and strengthen such programmes: however, the relatively low yield of both active TB and LTBI in those aged ≥65 years suggests that the benefits of current approaches in this age group may need consideration. Further prospective studies regarding the outcomes following TB screening in older contacts would assist in better defining evidence-based practice in this area.

References

- 1 American Thoracic Society. Targeted tuberculin testing and treatment of latent tuberculosis infection. *MMWR* 2000; 49: 1–51.
- 2 Smieja M J, Marchetti C A, Cook D J, Smail F M. Isoniazid for preventing tuberculosis in non-HIV infected persons. *Cochrane Database Syst Rev* 2000; 2: CD001363.
- 3 Li J, Munsiff S S, Agerton T B. Prevalence of tuberculin skin test positivity in clinical population in New York City. *J Immigr Minor Health* 2010; 12: 816–822.
- 4 Thomson R M, NTM Working Group at Queensland TB Control Centre and Queensland Mycobacterial Reference Laboratory. Changing epidemiology of pulmonary nontuberculous mycobacteria infections. *Emerg Infect Dis* 2010; 16: 1576–1583.
- 5 Johnson P D, Carlin J B, Bennett C M, et al. Prevalence of tuberculosis infection in Melbourne secondary school students. *Medical J Aust* 1998; 168: 106–110.
- 6 Alperstein G, Morgan K R, Fett M J, et al. Prevalence of tuberculosis infection among primary school-entry children in Sydney. *Aust N Z J Public Health* 1996; 20: 123–128.
- 7 Dobler C C. What do we know about the outcomes of tuberculosis contact investigations in NSW? *NSW Public Health Bull* 2013; 24: 34–37.
- 8 World Health Organization. Guidelines on the management of latent tuberculosis infection. WHO/HTM/TB/2015.01. Geneva, Switzerland: WHO, 2015.
- 9 Australian Government Department of Health. Tuberculosis case definition. Canberra, Australia: Australian Government Department of Health, 2010. http://www.health.gov.au/internet/main/publishing.nsf/Content/cda-surveil-nndss-casedefs-cd_tb.htm Accessed July 2015.

- 10 United Nations Statistics Division. Composition of macro geographical (continental) regions, geographical sub-regions, and selected economic and other groupings. New York, USA: United Nations, 2013. <http://unstats.un.org/unsd/methods/m49/m49regin.htm> Accessed July 2015.
- 11 World Health Organization. Global tuberculosis report, 2014. WHO/HTM/TB/2014.08. Geneva, Switzerland: WHO, 2014.
- 12 Bennett D E, Courval J M, Onorato I, et al. Prevalence of tuberculosis infection in the United States population: the National Health and Nutrition Examination survey, 1999–2000. *Am J Respir Crit Care Med* 2008; 177: 348–355.
- 13 Dorken E, Grzybowski S, Allen E A. Significance of the tuberculin test in the elderly. *Chest* 1987; 92: 237–240.
- 14 McBryde E S, Denholm J T. Risk of active tuberculosis in immigrants: effects of age, region of origin and time since arrival in a low-exposure setting. *Med J Aust* 2012; 197: 458–461.
- 15 Denholm J T, McBryde E S, Brown G V. Ethical evaluation of immigration screening policy for latent tuberculosis infection. *Aust N Z J Public Health* 2012; 36: 325–328.
- 16 Goebel K M, Tay E L, Denholm J T. Supplemental use of an interferon-gamma release assay in a state-wide tuberculosis contact tracing program in Victoria: a six-year review. *Communicable Diseases Intelligence* 2015 (in press).
- 17 Wang L, Turner M O, Elwood R K, et al. A meta-analysis of the effect of bacille Calmette Guérin vaccination on tuberculin skin test measurements. *Thorax* 2002; 57: 804–809.
- 18 Farhat M, Greenaway C, Pai M, Menzies D. False-positive tuberculin skin tests: what is the absolute effect of BCG and non-tuberculous mycobacteria? *Int J Tuberc Lung Dis* 2006; 10: 1192–1204.
- 19 Saukkonen J J, Cohn D L, Jasmer R M, et al. An official ATS statement: hepatotoxicity of antituberculosis therapy. *Am J Respir Crit Care Med* 2006; 174: 935–952.

Objectif : Revoir l'utilisation par les programmes du test cutané à la tuberculine (TST) après exposition à la tuberculose (TB) dans l'état de Victoria, en Australie.

Méthode : Une revue rétrospective des données recueillies pour la surveillance en matière de santé publique a été réalisée afin d'identifier les caractéristiques démographiques des contacts, notamment le statut en matière du vaccin bacille Calmette-Guérin et l'âge et le résultat du TST.

Résultats : La recherche des contacts a été réalisée auprès de 15 094 personnes dont 13 427 (89,0%) ont eu un TST. Le TST a été positif chez 31,4% (95%IC 30,6–32,2) de tous les contacts et chez 48,8% des contacts nés hors d'Australie. Parmi les contacts qui ont été TST négatifs au départ, le taux de conversion après exposition a été de

14,8%. La conversion a été plus fréquente chez les personnes âgées de 45–54 ans, avec <12% de positivité à la fois dans les tranches d'âge les plus jeunes (<5 ans) et les plus âgées (≥65 ans). Une TB active s'est développée chez 1,1% de tous les contacts. Cependant, les contacts âgés de <5 ans ont eu le risque le plus élevé de développer une TB active après exposition (3,8%), tandis que le risque a été le plus faible chez les personnes âgées de ≥65 ans (0,3%).

Conclusion : Dans l'ensemble, la recherche de contacts et le TST réalisés dans ce contexte semblent aboutir à une proportion élevée de personnes à risque de développer une TB active. Le rendement du dépistage dans certains groupes, en particulier ceux âgés de ≥65 ans, a été faible, et il faudrait envisager des stratégies alternatives d'investigation.

Objetivo: Analizar el uso programático de la prueba cutánea de la tuberculina (TST) tras la exposición a la tuberculosis (TB) en el estado de Victoria en Australia.

Método: Fue este un estudio retrospectivo de los datos recogidos en la vigilancia de salud pública, con el propósito de determinar los factores demográficos incluidos el antecedente de vacunación antituberculosa y la edad y evaluar los resultados de la TST.

Resultados: Se investigaron 15 094 contactos y en 13 427 de ellos se había practicado la TST (89,0%). La reacción TST fue positiva en el 31,4% de todos los contactos (IC95% 30,6–32,2) y en el 48,8% de los contactos nacidos en el extranjero. De los contactos con una TST inicial negativa, la tasa de conversión después de la exposición fue 14,8%. La conversión fue más frecuente en el grupo de edad de

45–54 años y los grupos extremos, es decir, de <5 años y de ≥65 años de edad, obtuvieron una positividad de <12%. Se observó evolución hacia la enfermedad tuberculosa activa en el 1,1% de todos los contactos. Sin embargo, los contactos de edad <5 años presentaron una mayor probabilidad de sufrir TB activa tras la exposición (3,8%) y a partir de los 65 años el riesgo fue bajo (0,3%).

Conclusión: En general, la investigación de los contactos y la práctica de la TST en este entorno pusieron de manifiesto una alta proporción de personas vulnerables a la enfermedad activa. El rendimiento diagnóstico de la prueba en algunos grupos, en especial a partir de los 65 años de edad, fue bajo y es preciso considerar la posibilidad de usar otras estrategias diagnósticas.