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Tuberculosis

Prevention in travellers

This article on tuberculosis forms part of our travel medicine series for 2010, providing a summary of prevention strategies and vaccinations for infections that may be acquired by travellers. The series aims to provide practical strategies to assist general practitioners in giving travel advice, as a synthesis of multiple information sources which must otherwise be consulted.

Background

Tuberculosis is a disease of significant worldwide prevalence, morbidity and mortality. Multi-drug resistant and extensively drug resistant strains, poverty, and co-endemic human immunodeficiency virus infection have hampered efforts to reduce transmission worldwide.

Objective

To outline risk assessment of tuberculosis infection for travellers and discuss potential interventions.

Discussion

Long term travellers to areas of high tuberculosis incidence are potentially at risk of contracting the disease. Infants and children are particularly at risk of severe complications of tuberculosis. There is no consensus about methods to prevent tuberculosis. Health practitioners need to carefully consider the risks and benefits for their patients. Possible strategies include education, personal protection devices, BCG vaccination, tuberculin (Mantoux) skin testing and testing with newer interferon-gamma release assays.

Keywords: travel; preventive medicine; immunisation; communicable diseases; tuberculosis



In the past year alone there have been 2 million deaths from tuberculosis and 9 million new infections. There is more tuberculosis today than at any other time in history.¹

Tuberculosis (TB) is a mycobacterial infectious disease caused by the aerobic, acid-fast bacilli organisms of the *Mycobacterium tuberculosis* complex (M.TB complex). The M.TB complex comprises *M. tuberculosis*, *M. bovis*, *M. microti*,

M. canetti and *M. africanum*. All species of the *M. tuberculosis* complex are closely related.^{2,3}

Tuberculosis infection exists as a clinical spectrum of disease. The most common manifestation in adults is pulmonary disease, although it can affect other body systems. Lung infection commonly presents with cough, fever, haemoptysis, weight loss, and/or night sweats. Children are more likely than adults to present with miliary or meningeal TB. The vaccination of infants at risk is designed to avoid these serious progressive illnesses.

Infected individuals commonly remain asymptomatic, with only a 10% lifetime risk of developing clinical illness.³ Illness is most likely to occur in those with impaired immunity, including infection with human immunodeficiency virus (HIV), alcoholism, inadequate nutrition, and in the elderly and infants. The leading killer of people with HIV worldwide is TB.⁴ The detection of latent bacterial TB infection (LTBI) in returned travellers is an important strategy to avoid active disease.

Epidemiology

Tuberculosis occurs worldwide, with incidence varying significantly throughout different regions and countries. More than 2 billion people are estimated to be infected with TB.⁴ Sub-Saharan Africa has the highest incidence of TB infections. In 1993, the World Health Organization (WHO) declared TB a global emergency.^{2,3} The largest number of new cases occurred in southeast Asia in 2008.

A preventable and curable disease, the global prevalence of TB is attributed to the HIV co-epidemic, the emergence of multi-drug resistant (MDR-TB) and extensively drug resistant (XDR-TB) strains, and the long standing inability of public health systems in underdeveloped countries to deal effectively with the disease.

More than 80% of Australia's 1000 annual cases of TB occur in people born overseas.³ Aboriginal and Torres Strait Islander people have higher rates of TB infection than the non-Indigenous population.³

What is the risk to travellers?

The risk of contracting TB while travelling is difficult to quantify. A recent systematic review using tuberculin skin testing (TST) conversion as a surrogate for LTBI calculated the cumulative incidence of LTBI in long term (median 11 months) travellers to be 2%, which is what could be expected among local populations in many developing countries.⁶

To assess a traveller's potential risk of contracting TB consider:

- destination(s)
- duration of travel
- travel type and potential contacts – including risks associated with working in healthcare and visiting friends and relatives
- age of traveller
- general health of traveller.

Destination(s)

Some publications advise vaccination for those travelling to 'high risk' countries. Definitions of 'high risk' vary from TB incidence of >40/100 000 (UK recommendations) to >100/100 000 (Australian guidelines) (Table 1).⁷

Duration of travel

Cobelens et al⁹ used pre- and post-travel TST conversion to calculate the risk of LTBI in long term (3–12 months) travellers to areas of high endemic TB rates. The incidence rate of TST conversion was 3.5/1000 person/months of travel, or 2.8/1000 when healthcare workers (HWs) were excluded.^{9,10} The incidence rate of active infection was 0.6/1000 person/months of travel.⁹ Longer term travellers display a risk of infection that approximates that of the local population,^{9,11} and HWs display an even higher risk.

Jung and Banks¹² examined Peace Corps data to assess the risk of TB in long term travellers from the US. They found the incidence rate of LTBI to be 1.283/1000 person/months of travel, and active TB 0.057/1000 person/months of travel. These rates are significantly higher than the general US population, but lower than those

Table 1. Annual TB incidence⁸

Annual TB incidence 40–100/100 000

- Africa: Algeria, Benin, Comoros, Eritrea, Sao Tome and Principe
- The Americas: Belize, Brazil, Dominican Republic, Ecuador, Guatemala, Honduras, Nicaragua, Panama, Paraguay
- Eastern Mediterranean: Bahrain, Iraq, Libyan Arab Jamahiriya, Morocco, Qatar, Yemen
- Europe: Armenia, Belarus, Bosnia and Herzegovina, Bulgaria, Latvia, Lithuania, Turkmenistan, Ukraine
- Southeast Asia: Maldives, Sri Lanka
- Western Pacific: Brunei Darussalam, China, Guam, Malaysia, Federated States of Micronesia, Palau, Republic of Korea, Vanuatu

Annual TB incidence >100/100 000

- Africa: Angola, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Côte d'Ivoire, Democratic Republic of Congo, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Swaziland, Togo, Uganda, United Republic of Tanzania, Zambia, Zimbabwe
- The Americas: Bolivia, Guyana, Haiti, Peru, Suriname
- Eastern Mediterranean: Afghanistan, Djibouti, Pakistan, Somalia, Sudan
- Europe: Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Republic of Moldova, Romania, Russian Federation, Tajikistan, Uzbekistan
- Southeast Asia: Bangladesh, Bhutan, Democratic People's Republic of Korea, India, Indonesia, India, Indonesia, Myanmar, Nepal, Thailand, Timor-Leste
- Western Pacific: Cambodia, Kiribati, Lao People's Democratic Republic, Marshall Islands, Mongolia, Papua New Guinea, Philippines, Solomon Islands, Tuvalu, Vietnam

reported by Cobelens et al.

No data exists regarding risk to short term travellers.

Travel type and potential contacts

Transmission of TB is well established as associated with societal forces such as poverty, urbanisation, crowded living conditions, increased population density and migration.¹⁴ People from low socioeconomic groups have a higher likelihood of crowded living¹⁵ and working conditions and more frequent contact with people with active TB.¹⁴ Other factors associated with low socioeconomic status that may contribute to higher likelihood of TB include reduced health literacy, less power to act of health awareness, reduced access to health services, malnutrition and exposure to indoor air pollution.¹⁴

Interestingly, a recent study designed to assess the association between TB and socioeconomic status in two communities in Zambia found higher socioeconomic position to be associated with higher risk of TB infection,¹⁶

suggesting TB exposure may be occurring via a risk factor that is currently undetermined but is associated with higher socioeconomic status.¹⁶ The authors of this study suggest that it is possible their findings are accounted for by the association of relatively increased wealth in developing countries with increased urbanisation and subsequent high density living, crowding and poor household ventilation, suggesting these to be potential risk factors that are independent of socioeconomic status.¹⁶

Given the relationship between proximity and duration of exposure to infective contacts and incidence of TB, HWs likely to be in close contact with patients with TB are a high risk subgroup. Of particular concern are those employed in regions with known MDR-TB and XDR-TB transmission. MDR-TB has higher treatment failures, higher mortality, longer duration of infection and higher treatment costs than drug susceptible TB.¹⁷ Cobelens et al oft quoted study of long term travellers documented a higher risk of TB infection in HWs.⁹ The proportion of MDR-TB

cases worldwide that result from infection in the healthcare setting is unknown.¹⁷

Travellers visiting friends and relatives comprise 25–40% of travellers from industrialised nations to tropical or subtropical regions, and have a higher risk of travel related health problems.¹⁸ They are less likely to seek pre-travel advice, less likely to be adequately vaccinated, more likely to have contact with local populations, more likely to consume higher risk food and drink, more likely to stay in rural areas, more likely to travel at the last minute, and more likely to travel for longer periods of time.¹⁸

GeoSentinel data found active TB to be 16 times more common among those born in low income countries, living in high income countries and travelling to their region of birth to visit friends and relatives than it was among those born and living in high income countries and travelling to low income countries to visit friends and relatives, and more than 60 times more common than it was among tourist travelers.¹⁸ Data was collected on active infection only.¹⁸ Ansart et al¹⁹ detected 17 cases of active TB among 622 patients who consulted their tropical diseases unit post-travel. Fifteen of these cases occurred in foreign born French residents who were visiting friends and relatives in their home countries. Median duration of travel was 36.9 days. Neither study was able to distinguish between new infections and reactivations.^{18,19}

Travellers to the Hajj have a higher risk of acquiring TB. A study of organisms causing community acquired pneumonia during the 1994 Hajj epidemic found *M. tuberculosis* to be the most common pathogen (20% of participants).²⁰ Using the QuantiFERON®-TB assay to diagnose latent TB, Wilder-Smith et al²¹ found a 10% incidence of new TB infection among Hajj pilgrims, suggesting this is a subgroup that warrants focused attention.

Concern exists among travellers about the potential for transmission of TB on aircrafts. Potential transmission on an aircraft was first reported in 1992²² and has more recently been considered during 2007 and 2008 follow up investigations of travellers with infective TB.²³ Active TB has never been diagnosed following exposure to TB on an aircraft.^{22–24} Contact tracing has resulted in diagnoses of LTBI,^{22,23} however it remains difficult to ascertain whether infection

was a direct result of aircraft transmission.²⁴ Factors likely to contribute to potential TB infection on an aircraft are the same as those in other settings, ie. the infectiveness of the traveller with TB, the duration of exposure (considered significant if >8 hours), and the proximity of the infectious passenger to those who may be exposed.²⁵

Age of traveller

Infants and children aged less than 4 years are at greatest risk of disease following primary infection with *M. tuberculosis*. Risk then declines over the ages of 5–10 years, before climbing during adolescence (age 15–19 years) to a second peak at 20–30 years of age.¹³ Elderly people are also understood to be at higher risk.¹⁴

General health of traveller

Health factors that significantly increase the risk of developing active TB include undernutrition, smoking, diabetes, alcohol misuse,¹⁴ silicosis, and malignant diseases; chronic systemic illnesses and immunosuppressive treatments are further risk factors.¹⁴

HIV is an important risk factor for TB infection. A study of fever in patients within 3 months of travel to the tropics revealed 23% of fever episodes in HIV positive travellers were due to TB.²⁶ Infection can significantly impact the progression of HIV disease and increase mortality.

Assessment

Risk assessment is difficult and involves evaluating the traveller with respect to the above risk factors, the potential interplay between concomitant risk factors and the summation of risk factors. Possible scenarios and risk assessment are shown in *Table 2*.

Figure 1 describes tools available to ameliorate the risk of TB infection in travellers.

Prevention

A search of the available literature regarding the prevention of TB in travellers does not yield a large evidence base. Consideration needs to be given to each of the following aspects of prevention, in conjunction with local guidelines and regulations, and with consideration to the needs of the particular traveller.

- Avoid exposure to patients with active pulmonary TB
- When exposure is unavoidable, such as in a high risk healthcare setting, use personal protective equipment (PPE)
- Consider vaccination with the bacillus Calmette-Guérin (BCG) vaccine
- Consider TST²⁷ or testing with interferon gamma release assays (IGRAs) pre- and post-travel. If a new reaction occurs the traveller should be referred for treatment for latent TB
- Consider referring HIV positive travellers²⁸ to an infectious diseases physician for consideration of the role of drug prophylaxis to prevent infection.

Those receiving current TB treatment should not travel until the treating physician is able to document that the patient is not infectious.²⁷

Personal protective equipment

Travellers likely to be at high risk of exposure to patients with TB (eg. HWs) should be advised to obtain professionally fitted PPE and appropriate training regarding its use.^{10,29} The World Health Organization advises particular caution to HWs during procedures with high risk of TB transmission (eg. bronchoscopy or sputum induction) and when providing healthcare to patients who may have MDR-TB or XDR-TB.²⁹

The US Centers for Disease Control and Infection (CDC) guidelines recommend the N-95 respirator.¹⁰ Respirators available in Australia are P2 or N95 and can be sourced online – travellers should be advised to source their respirator via an infection control professional to ensure a good fit. In Australia this could be arranged through state hospitals.

There are no studies to suggest travellers in planes or buses derive benefit from PPE.

BCG vaccine

The BCG vaccine is available in Australia as a freeze-dried live vaccine prepared from an attenuated strain on *M. bovis*.³ All BCG vaccines are derived from the strain initially propagated in 1921 at the Institut Pasteur.³

The BCG vaccine provides variable protective efficacy (0–80%^{3,27,30,31}) with an estimate of about 50% across all age groups.³ Host factors (age at vaccination, nutritional status, genetic make-up, HIV status), vaccine factors (different

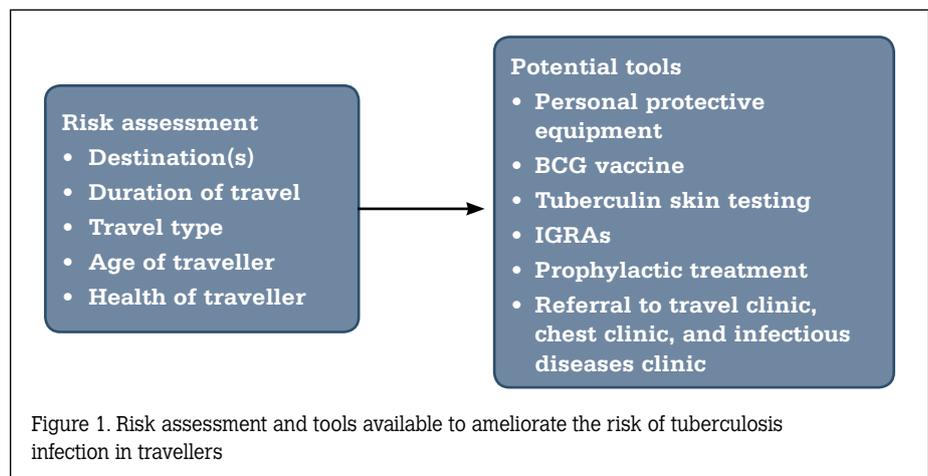
Table 2. Tuberculosis risk assessment scenarios

Scenario	Risk assessment	Potential responses
A 3 year old child travelling to visit friends and relatives in a country of high TB incidence and staying with family in crowded living conditions	Potentially very high risk	Would benefit from BCG vaccination
A 25 year old woman travelling for 2 months to volunteer in a hospital or complete a medical student placement in an area of moderate TB incidence with known transmission of MDR-TB	Potentially very high risk	Consider BCG because of the addition of MDR-TB in her risk analysis She would benefit from TST +/- IGRA testing. Consider infectious diseases physician referral
A healthy 40 year old man travelling to Botswana to spend a month on a game reserve	Potentially moderate risk. Even though transmission in Botswana is very high, the man's own health and the nature of his activities would lower his risk	Would benefit from TST and/or IGRA
A 40 year old man with HIV travelling to Botswana to spend a month on a game reserve	Potentially very high risk	A person who is HIV positive, even if well controlled, should seek advice from an infectious diseases physician before travelling to an area of high TB transmission
A 4 year old travelling for 1 week to a resort in the Solomon Islands	Risk is difficult to assess. 1 week is a short duration and a resort is a low risk environment, but the Solomon Islands has high TB transmission and at 4 years of age the risk of serious sequelae to infection remains high	May or may not benefit from BCG immunisation. Careful risk analysis and discussion with the family is required

strains, phenotype, genotype), geographical factors (latitude) and epidemiological factors (local prevalence of non-TB mycobacteria), among others, have been cited as possible reasons for the variability.^{3,27,31} Recently employed molecular biology techniques have revealed several lineages among stains of *M. tuberculosis*.² These lineages may potentially represent local adaptation and be responsible for variability among the protection afforded by BCG vaccination, virulence, and multi-drug resistance.²

The BCG vaccine is used in children as it is accepted that in immune-competent neonates and infants, immunisation with the BCG reduces the likelihood that infection with TB will progress to disease, or to severe disease,³² and is most commonly given at birth or in the first year of life.⁷ The highest protective efficacies are shown in those aged less than 5 years.^{3,7} Children less than 2 years of age are at highest risk for miliary TB and TB meningitis. The estimated protective efficacy of BCG vaccine for TB meningitis is 75–87%, and 70–80% for miliary TB.⁷

The BCG vaccine must be administered intradermally by trained medical or nursing staff conversant with the procedure of administration.³



Contraindications

It is **not** advisable to administer BCG vaccine to the following groups of people:

- HIV infected children²⁷
- individuals with impaired immunity, including due to HIV infection^{3,28,33}
- individuals with a high risk of HIV infection where HIV antibody status is unknown³
- individuals with any serious illness, including malnourishment³
- individuals with generalised septic skin

diseases and skin conditions such as eczema, dermatitis, psoriasis³

- pregnant women. (BCG is not known to be harmful to the developing fetus; however the use of live vaccines in pregnancy is not recommended^{3,28})
- individuals who have previously had TB³
- individuals who have previously have a >5 mm tuberculin (Mantoux) reaction³
- individuals who have had a significant febrile illness in the preceding month.³

Table 3. BCG vaccination in children – recommendations

TB incidence in country visited	Duration of travel	Age of child		
		<1 year	1–5 years	>5 years
High (>100/100 000)	>4 weeks*	BCG	BCG	Consider BCG
	<4 weeks	BCG	Consider BCG	No BCG
Intermediate (40–100/100 000)	>4 weeks*	BCG	Consider BCG	No BCG
	<4 weeks	Consider BCG	No BCG	No BCG

* Or if further travel planned such that cumulative duration of travel is >4 weeks

Reproduced with permission Ritz N, Connell TG, Curtis N. To BCG or not to BCG? Preventing travel-associated tuberculosis in children. *Vaccine* 2008;26:5905–10

Unless given concurrently with BCG vaccine, as per the guidelines for any live vaccines, allow a 4 week interval after administration of another live vaccine (eg. varicella, MMR, yellow fever).³

Booster dosing

The World Health Organization does not recommend booster doses of BCG vaccine.²⁷ BCG revaccination is not known to be harmful, and some countries do re-vaccinate.^{34–36} It is not known whether a second BCG vaccination confers additional protection beyond its initial efficacy. A number of studies show no or minimal effect of revaccination.^{34–36} Duration of protective efficacy remains unresolved.³⁷

Vaccinating travellers with BCG

The National Health and Medical Research Council (NHMRC) recommends giving BCG vaccine to children less than 5 years of age who will be travelling to live in countries of high TB prevalence for longer than 3 months and that BCG vaccine be considered for children aged 5–16 years who will be travelling or living for extended periods in countries with a high TB prevalence.³

The National Tuberculosis Advisory Committee suggests considering BCG vaccination in 'children over 5 years who will be travelling or living in countries with a high prevalence of TB for extended periods.'³²

Ritz et al⁷ suggest a low threshold for recommending BCG vaccination to children who are travelling, particularly children under 5 years of age. Their suggestions are summarised in *Table 3*, and are intended as a guide only.

The NHMRC, WHO and the CDC do not actively suggest vaccinating adults as there is inadequate evidence supporting a protective benefit from BCG in adults, and BCG lowers the

specificity for future TST.³² Pre- and post-travel TST screening is a more widely used strategy (see below).

However, adulthood is not a contraindication to BCG vaccination and BCG deserves consideration in very high risk travellers.

Following the 2000 study by Cobelens et al, the risks and benefit of BCG vaccine in travelling adults, and in particular, HWs was debated in the literature.^{9,38–40} One side of the argument is that BCG vaccine offers some protection against TB,⁴¹ is safe, and protection is provided by a single dose. Thus, in the context of demonstrably higher risk of infection in HCWs, BCG vaccine should be considered,⁴⁰ especially in a HCW working in an area with known MDR-TB or XDR-TB transmission.³² Potential side effects of preventive isoniazid therapy are also considered to lend weight to the argument for BCG vaccine in HCWs.⁴⁰

The converse argument is that studies suggesting a protective benefit are methodologically flawed, BCG vaccine does not seem to prevent primary infection, the rate of serious side effects of isoniazid are low, and alternatives are available in the instance of isoniazid resistance.^{38,39}

Tuberculin skin testing

Tuberculin skin testing (Mantoux test) involves injection of 0.1 mL of tuberculin purified protein derivative (PPD) intradermally in the left anterior forearm. The site is examined 48–72 hours later to assess the degree of reaction. Guidelines vary regarding what is considered as positive. An experienced clinician measures the indurated skin in millimeters with positive reactions being regarded as >5 mm or >10 mm as chosen (protocols vary). In some circumstances, a two-step Mantoux testing process is used. Certain

individuals will have a negative initial TST followed by a strongly positive TST 1–2 weeks later. Two-step testing is recommended for contact tracing and monitoring of high risk groups.³

The TST can be used as part of the diagnosis of active TB, the detection of latent TB, and as a pre-BCG vaccination screen. The diagnosis of TB is unlikely to be made on TST alone; TST is known to be sensitive, but not adequately specific to diagnose TB. Previous vaccination with BCG is likely to yield a positive TST even in the absence of TB infection. Previous non-TB exposure may also yield a false positive result. Nakano notes concern that due to the routine use of BCG in infancy in Japan, Japanese students in the US have been mistakenly diagnosed with, and treated for, TB on the basis of TST.⁴²

Latent tuberculosis infection is characterised by:

- a positive TST
- chest X-ray findings that are either normal or reveal evidence of a healed TB lesion, and
- no signs of symptoms of active TB disease.³⁰

When using TST to detect LTBI in moderate to high risk travellers, TST should occur approximately 4 weeks pre-travel, then again 1–2 weeks later. This completes the two-step process recommended for monitoring high risk groups.³

Conversion to a positive TST occurs within 3–8 weeks of initial infection.² The CDC recommend TST (and/or IGRA) testing 8–10 weeks post-travel.¹⁰ No publication details an outside limit to the post-travel testing window.

TST is indicated in pregnancy and is interpreted in the same manner as in non-pregnant individuals.⁴³

The CDC recommends that travellers who are likely to experience prolonged exposure to TB, or who expect to stay for years in an endemic country, should have a two-step TST or

an IGRA (see below) before departing the US.¹⁰ This approach to prevention is hampered by the 2–4 visits required for TST, the long duration of prophylactic treatment, and the possibility of false positive or false negative results.

Tuberculin skin testing is an important strategy in detecting latent TB in returned travellers, enabling treatment and avoiding progression to active TB. An example of chemoprophylaxis is 12 months of isoniazid for those who convert to a positive test.¹¹

Interferon-gamma release assays

A number of IGRAs are available that may aid diagnosis of latent and active TB infection.

QuantiFERON[®]-TB Gold is available in Australia.

Assessment of the accuracy of IGRAs has proven difficult in the absence of a gold standard for the diagnosis of TB infection⁴⁴ and more studies are continuing. IGRAs thus far appear to have greater specificity than TST. In an analysis of HWs Girardi et al⁴⁴ found TST to have a sensitivity of 99.9% and a specificity of 64.2%, and QuantiFERON[®]-TB to have a sensitivity of 76.3% and a specificity of 93.6% in the detection of LTBI.

Similar patterns of improved specificity in the diagnosis of LTBI with QuantiFERON[®]-TB are seen in other studies.^{31,45} Vinton et al showed QuantiFERON[®]-TB correlated with the presence of risk factors of TB exposure in a population of HWs, while TST correlated more strongly with a history of BCG vaccination.⁴⁶ Longitudinal studies are required to assess the value of IGRAs in predicting the development of active TB infection.⁴⁵

In most cases IGRAs are not covered by the Medicare Benefits Schedule.

Other strategies

HIV positive travellers may benefit from targeted preventive strategies such as isoniazid prophylaxis or early highly active antiretroviral therapy (HAART).²⁶ At the very least, close post-travel follow up TST or IGRA testing is indicated.²⁶ WHO recommends preventive therapy with isoniazid for people with HIV who are at risk of TB.¹⁴

New vaccines

A number of potential vaccines are currently being developed and investigated. Foremost in clinical

trials is the MVA85A candidate vaccine, which began phase II-b trials in March 2009.⁴⁷

Pre-travel recommendations

The assessment of the risk to a traveller becoming infected with TB is difficult and no single recommendation will suffice for all very high risk travellers, let alone those of high, moderate or low risk. It is not possible to advise exactly which traveller should receive the BCG vaccine, or should be considered for TST or IGRA testing. *Table 2* outlines possible recommendations for different scenarios.

In light of the evidence reviewed, we suggest health practitioners:

- give serious consideration to the prevention of TB in all travellers presenting to general practices, travel clinics or other clinical services, either before or after travel
- perform a detailed risk assessment of all travellers including:
 - destination(s)
 - duration of travel
 - travel type
 - age of traveller
 - general health of traveller
- consider vaccination of children 5 years and under according to their destination and duration of travel as suggested in *Table 3*.⁷ This would result in more BCG vaccine being given in Australia than is currently recommended in the *Australian Immunisation Handbook*, which restricts the recommendation to children travelling for more than 3 months to areas with an annual incidence of >100/100 000³
- consider vaccination of children more than 5 years of age if risk assessment determines they are travelling to an area of high prevalence for an extended period of time
- consider vaccination of very high risk adults such as HWs travelling to areas with known MDR-TB and/or XDR-TB transmission. Consider referring such travellers to an infectious diseases physician for further opinion and management
- refer any HIV positive patients – regardless of current health status – in whom risk assessment uncovers any risk of TB infection to an infectious diseases physician for consideration of preventive, prophylactic therapy

- in all travellers of all ages not accounted for by BCG or the listed referral guidelines, have a low threshold for pre- and post-travel TST and/or IGRA screening for latent TB
- educate all patients presenting for pre- or post-travel consultation regarding strategies to reduce the risk of TB transmission.

Post-travel consultation

The post-travel consultation should include an assessment of risk of TB infection given the destination(s), duration of travel, age of traveller, travel type and potential contacts, and the health of the traveller.

Depending on risk assessment and on baseline infection screening methods used pre-travel, the unwell returned traveller should be investigated for any possibility of active TB infection and the well returned traveller evaluated for latent TB infection.

Travellers with results positive for TB infection should be treated in conjunction with an infectious diseases physician.

Resources

- Chest clinics are available throughout Australia and can provide services in TB education, screening, diagnosis and management
- BCG vaccines and Mantoux skin testing are available at chest clinics as well as many specialist travel medicine practices
- Australian state TB clinics. The following details are a guide only and may not remain correct. Clinics also exist in regional and rural centres:

Queensland

Queensland Tuberculosis Control Centre
Specialised Health Services Building
(Princess Alexandra Hospital campus)
24–28 Cornwall Street, Annerley 4151
Tel 07 3896 3963

New South Wales

TB Services
Communicable Diseases Branch
NSW Health Department
Locked Mail Bag 961, North Sydney 2059
Tel 02 9391 9277

Victoria

Public Health Branch
Department of Human Services
Level 14, 50 Lonsdale St, Melbourne 3001
Tel 03 9096 5144

Australian Capital Territory

Department of Thoracic Medicine
Canberra Hospital
PO Box 11, Woden 2606
Tel 02 6244 2066

South Australia

Thoracic Medicine, Chest Clinic and TB Services
275 North Terrace, Adelaide 5000
Tel 08 8222 5434

Western Australia

Department of Health, Chest Clinic
17 Murray Street, Perth 6000
Tel 08 9219 3222

Northern Territory

TB Clinic
Block 4
Royal Darwin Hospital
PO Box 40596, Casuarina 0811
Tel 08 8922 8804

Tasmania

5th floor
A Block
Royal Hobart Hospital
Liverpool Street, Hobart 7001
Tel 03 6222 7293.

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