



## **TECHNICAL** REPORT

# Risk assessment guidelines for infectious diseases transmitted on aircraft (RAGIDA)

Tuberculosis

**ECDC TECHNICAL REPORT**

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Tuberculosis



This report of the European Centre for Disease Prevention and Control (ECDC) was coordinated by Lara Payne Hallström and Saara Kotila.

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This document reflects the personal views of the experts in their individual capacity and it does not necessarily represent the views of their institutions.

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# Contents

Abbreviations ..... iv

Introduction ..... 1

Tuberculosis ..... 2

    Literature review ..... 2

    Suggested approach for TB contact tracing ..... 2

    Criteria to be considered in the risk assessment..... 2

        The index case ..... 2

        Effective exposure ..... 2

    Other considerations ..... 3

        Before the flight ..... 3

        During the flight ..... 3

    Q&A sheet: TB contact tracing ..... 3

        When should contact tracing be considered? ..... 3

        When is a patient infectious? ..... 3

        Who should be considered for contact tracing? ..... 3

        Are there special considerations for MDR/XDR TB? ..... 3

        Are there special considerations for individuals with higher susceptibility? ..... 4

References ..... 5

Annex 1. Contact tracing form (following TB exposure on an airplane)..... 7

# Figure

Figure 1. Risk assessment algorithm, TB ..... 4

# Abbreviations

ECDC	European Centre for Disease Prevention and Control
EU	European Union
HIV	Human immunodeficiency virus
MDR TB	Multidrug-resistant tuberculosis
TB	Tuberculosis
TST	Tuberculin skin test
WHO	World Health Organization
XDR TB	Extensively drug-resistant tuberculosis

# Introduction

In order to assist national public health authorities in the European Union (EU) to assess the risks associated with the transmission of infectious agents on board aircraft, and to help in the decision on the most appropriate, operationally possible public health measures for containment, e.g. on whether to contact trace air passengers and crew in case of exposure, the European Centre for Disease Prevention and Control (ECDC) initiated the RAGIDA project (Risk Assessment Guidance for Infectious Diseases transmitted on Aircraft) in 2007.

The RAGIDA project combines evidence retrieved from the literature with expert knowledge for infectious diseases. In 2009 the production of the series of guidance documents for assisting in the evaluation of risk for transmission was initiated for several infectious diseases.

The resulting disease-specific operational documents provide a host of viable options for decision-makers, particularly when faced with the choice of whether to contact trace air travellers and crew that were potentially exposed to infectious diseases during a flight.

Participants in the disease-specific expert panels were selected to include representatives of national public health authorities (particularly those with experience in the investigation and follow-up of incidents involving infectious diseases in travellers), European and other international experts for the diseases under investigation, experts in microbiology, experts in mathematical modelling, experts from the aviation sector, and representatives of ECDC, the European Commission and the World Health Organization (WHO). No conflicts of interest were declared by any of the participants.

# Tuberculosis

## Literature review

The systematic review of the literature identified 21 primary evidence articles on investigations of tuberculosis (TB) transmission on aircraft [1-21]. Since the publication of the previous version of RAGIDA guidelines in 2009 [22], ten new studies presenting data on TB transmission on aircraft have been published [1-3, 7, 9-12, 17, 18]. Overall, there was insufficient evidence of the effectiveness of identifying, tracing and investigating the persons to whom the infection could have been transmitted during the flight. Seven of the 21 studies [6, 8, 12, 14, 18-20] presented some evidence of possible in-flight transmission (one or more contacts without evidence of prior TB exposure or Bacillus Calmette-Guérin vaccination with a positive test for TB infection in contact investigation). Five of these articles [6, 8, 12, 14, 20] described tuberculin skin test (TST) conversion among contacts; however, in one of them [6] the index case as well as her contacts with TST conversions were crew members and transmission on the ground (before and after the flight when the aircraft ventilation system is not fully functional as well as outside the airplane) was possible. Another two involved mostly passengers with possible prior TB exposure, and boosting could not be excluded [14, 20]. Marienau et al. [12] presented aggregated data on 131 incidents evaluated by the Centers for Disease Prevention and Control (USA) where, among 758 successfully traced and tested contacts, one converter with no risk factor for prior TB infection was found.

A single study provided convincing evidence of transmission. This study describes exposure in a long-haul flight to a sputum smear-positive patient with evidence of transmission to household contacts prior to air travel. Passenger contacts seated in the proximity of the index patient were more likely to have positive TST results than those in other sections of the cabin [8].

No case of TB disease as a consequence of transmission during air travel has been described in the literature so far. The resource implications of the contact tracing processes are high [13, 19]. Furthermore, evidence for compliance with isoniazid preventive therapy among passengers presenting a positive TST following air travel is limited.

## Suggested approach for TB contact tracing

Contact tracing of passengers exposed to TB during air travel should only be undertaken following a risk assessment based on the infectiousness of the index patient, the amount of effective contact/exposure and, where possible, an assessment of the susceptibility of exposed individuals, as it is done during any routine contact investigation.

An assessment based on the following criteria should follow the outline in Figure 1 (risk assessment algorithm TB). If all conditions presented in this algorithm are met, exposed passengers in the relevant rows should be contacted – using the procedures outlined in the WHO guidelines [23] – and investigated and managed for latent TB infection according to national guidelines. It is recognised that often only limited contact information is available. Therefore, it is accepted that, after reasonable attempts to retrieve the data, the proper public health decision might be to cease the investigation.

A sample form for contact tracing after TB exposure on an aircraft is represented in Annex 1. It provides a standardised format for passing on information related to TB contact tracing to other public health authorities in case of international investigations.

## Criteria to be considered in the risk assessment

### The index case

**Index case with confirmed infectious pulmonary TB:** Defined as culture or molecular probe-confirmed cases with positive sputum smear microscopy (spontaneously produced sputum and/or induced sputum and/or bronchoalveolar lavage).

**The infectiousness of the index case:** Evidence of transmission in other settings, such as transmission to household members or other close contacts.

### Effective exposure

**Duration of flight:** Flight duration equal to or exceeding eight hours of flight time, including ground delays ([www.flightstats.com](http://www.flightstats.com)).

**Location on board:** Evidence for onboard TB transmission is very low for passengers seated more than two rows ahead or two rows behind the index case; therefore, contact tracing is only recommended for passengers sitting in the same row, two rows ahead and two rows behind the index case.

## Other considerations

### Before the flight

Patients with confirmed infectious pulmonary TB should avoid air travel.

If a patient with confirmed infectious pulmonary TB requires an unavoidable flight, ask the patient to delay travel until he or she has received a minimum of two weeks of adequate treatment with clinical improvement. If it is not possible to delay travelling for two weeks, then a travel protocol should be agreed on between the patient, the local public health authority (public health team) and the airline in question [23]. The risk of infection of passengers with multidrug-resistant (MDR) and extensively drug-resistant (XDR) TB should be assessed using national guidelines.

### During the flight

During a flight, if a passenger is suspected of having TB – as with any other respiratory infection – the potentially infectious traveller should be relocated to an isolated seat separate from other travellers (if possible) and be provided with a surgical face mask and a sufficient amount of disposable tissues. Flight attendants should follow International Air Transport Association (IATA) guidelines [24] for infection control and, if possible, collect locator cards from travellers to facilitate contact tracing, if needed.

## Q&A sheet: TB contact tracing

### When should contact tracing be considered?

Contact tracing should be considered:

- if the index case is confirmed as having infectious pulmonary TB (positive smear microscopy in a sample of spontaneously produced or induced sputum, or a sample from bronchoalveolar lavage);  
AND
- there is evidence of transmission to other contacts (refers to cases with evidence of transmission in household or other close contacts);  
AND
- the duration of the flight is longer than eight hours;  
AND
- the time elapsed between flight and diagnosis of the case is no longer than three months.

### When is a patient infectious?

When the index case is sputum smear positive (spontaneously produced or induced sputum sample, or a sample from bronchoalveolar lavage).

### Who should be considered for contact tracing?

It is recommended to limit contact tracing to passengers sitting in the same row, two rows ahead and two rows behind the index case in accordance with the WHO guidelines [23]. The exposure of the cabin crew is generally less intensive and should be assessed by the airline's medical service.

### Are there special considerations for MDR/XDR TB?

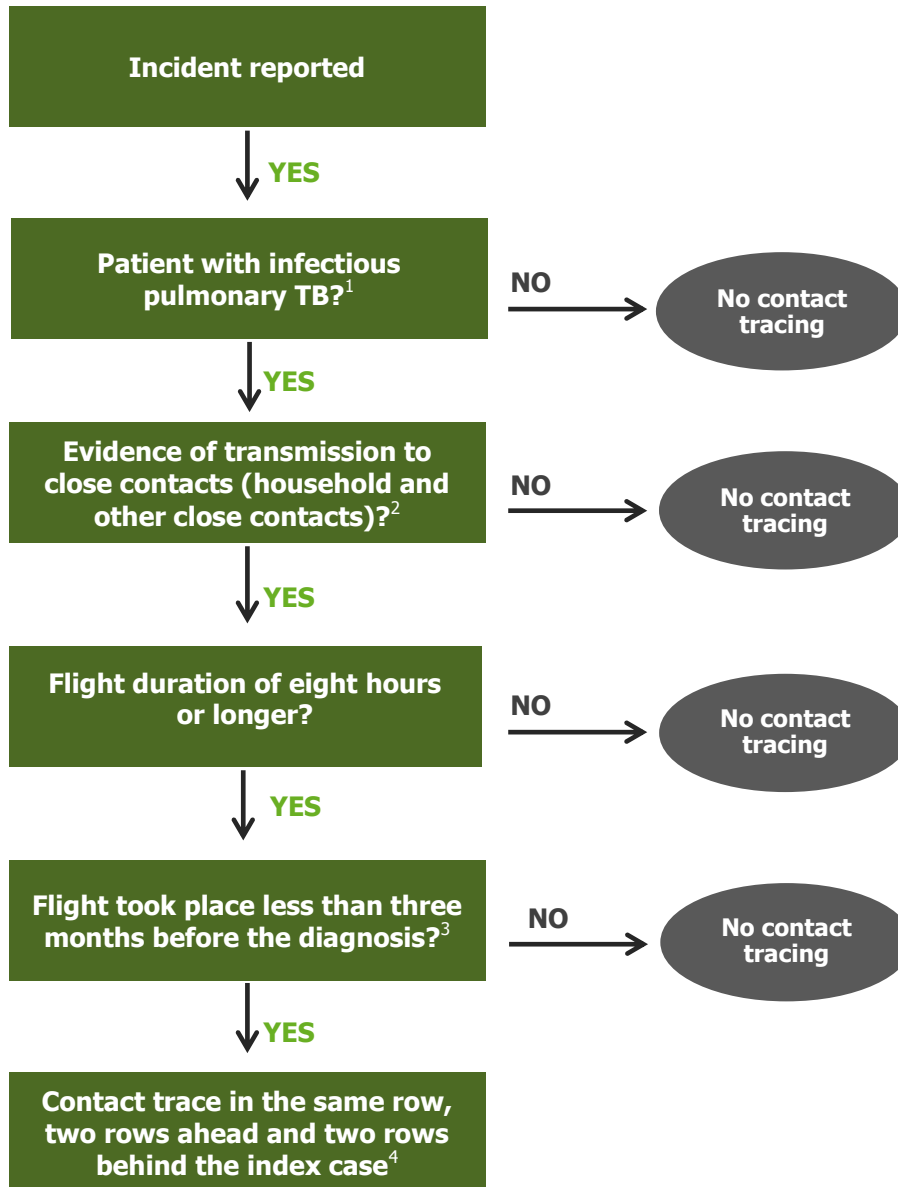
There is no evidence that patients with MDR or XDR TB are more infectious than patients with drug-sensitive TB. However, the potential clinical implications of these conditions are more serious for patients and contacts [25]. The risk of infection of passengers with MDR and XDR TB should be assessed using national guidelines. Furthermore, there is no established treatment regimen for latent TB infection caused by MDR or XDR TB [26-29]. Following contact tracing involving an MDR/XDR TB strain, the infected contacts should be given advice on what actions to take if symptoms develop, such as informing the treating physician of the possibility of infection with a *Mycobacterium tuberculosis* strain requiring a treatment regimen other than the standard one.



## Are there special considerations for individuals with higher susceptibility?

If contact tracing is decided after the risk assessment and there is evidence that passengers with higher susceptibility to TB, such as infants or children, travelled in the same row or two rows ahead or behind the index case, special efforts should be initiated to trace them.

**Figure 1. Risk assessment algorithm, TB**



<sup>1</sup> Infectious pulmonary TB is defined as culture- or molecular-probe-confirmed cases with positive smear microscopy (in spontaneously produced/induced sputum or bronchoalveolar lavage).

<sup>2</sup> In instances where (despite extensive efforts) no information on evidence of transmission to close contacts can be obtained, the national authority can decide to nevertheless initiate contact tracing in exceptional circumstances.

<sup>3</sup> Consideration of the time elapsed from the flight until the notification of the incident is left to the discretion of the relevant authorities. However, contact tracing after long notification delays will give poorer results.

<sup>4</sup> In large aircraft with many seats per row, it might be useful to consider that the risk of transmission is likely to be highest within two seats of the index case; it might thus not be necessary to trace all passengers of the five rows.

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## Annex 1. Contact tracing form (following TB exposure on an airplane)

<b>Flight</b>	
Airline and flight number	
Origin – destination (airports)	
Date of departure	
Duration of flight (hours)	
<b>Source case</b>	
Seating during flight	Row number:      Seat:
Results of microscopic examination of a respiratory sample: Sampling date  Type of sample (spontaneously produced/induced sputum? Broncho-alveolar lavage?)	<input type="checkbox"/> Positive <input type="checkbox"/> Negative  DD/MM/YY
Results of molecular methods  <i>Mycobacterium tuberculosis</i> present  Mutation/s conferring resistance  Type of mutation and affected drug	(Method: GeneXpert MTB/RIF [Cepheid], GenoType MTBDR <sub>plus</sub> [Hain Lifescience], other)  <input type="checkbox"/> Yes <input type="checkbox"/> No  <input type="checkbox"/> Yes <input type="checkbox"/> No
Result of culture  Type of sample  Species  Date sample taken	<input type="checkbox"/> Positive <input type="checkbox"/> Negative    DD/MM/YY
Drug susceptibilities (concentration and method, if available)  Rifampicin Isoniazid Pyrazinamide Ethambutol Quinolone Second-line injectable	Susceptible      Concentration (mg/l)  <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Yes <input type="checkbox"/> No
If drug testing is unavailable: Risk of MDR?  Previous treatment?  Origin: High MDR prevalence?	<input type="checkbox"/> Yes <input type="checkbox"/> No  <input type="checkbox"/> Yes <input type="checkbox"/> No
X-ray/CT scan and date (cavitary disease?)	DD/MM/YY
Symptoms during the flight (cough?)	
Date of start of present treatment	DD/MM/YY
Drugs used for start of treatment	

<b>Contact investigation</b>	
Results of contact investigation among other exposed persons (type of contact: family, friends, other passengers, etc.).  Note: For tests (tuberculin skin test or interferon-gamma release assay) to be considered as definitely negative, at least eight weeks must have elapsed after the last exposure.	List of all contacts (type of contact and result)  <input type="checkbox"/> positive <input type="checkbox"/> negative  <input type="checkbox"/> positive <input type="checkbox"/> negative  <input type="checkbox"/> positive <input type="checkbox"/> negative
Further contacts to be investigated: • seat location • name, address, telephone, e-mail	If several, attach a list as an annex
Other information	
<b>Rationale for investigation of exposed passengers</b>	
1. Infectiousness (positive microscopy in sample from respiratory tract)	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. Other close contacts tested and found to have been infected by the source case	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Are the exposed passengers known to be particularly susceptible persons (small children, HIV positive)?	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Other	

Contact (authority initiating contact tracing among passengers):

Name:

Telephone:

E-mail: