Surveillance of air-travel-related tuberculosis incidents, England and Wales: 2007-2008

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The potential spread of tuberculosis (TB) from infectious passengers during air travel has recently received increasing attention in the media and from public health authorities. We reviewed all air travel-related tuberculosis incidents reported to the Health Protection Agency Centre for Infections between January 2007 and February 2008 in England and Wales and investigated the effectiveness of contact investigation. Incidents involving air travel were defined according to the World Health Organization's guidelines on TB and Air Travel. We collected data on the index case, the incident and the outcome of contact investigation where available. We identified 24 incidents involving 39 flights. The median flight duration was 8.9 hours (inter-quartile range (IQR) 8 to 11.7). Most flights (36) were from or to a high burden country and 19 of the 24 incidents reported had a smear-positive index case. Two index cases had multidrug-resistant tuberculosis. In 17 incidents, no further investigation could be undertaken due to the lack of passenger information. In the remaining seven incidents, the quality of contact information obtained was variable. No further cases of TB infection or disease were identified. This study suggests that the process of investigating passenger contacts of a TB infected individual travelling by air is complicated and usually unsuccessful without dedicated resources and availability of high-quality contact information from airlines. Further research into the effectiveness of contact investigation in this setting is needed.

Introduction

The risk of the spread of tuberculosis (TB) from an infectious passenger during air travel has achieved increasing attention in the media and the public health community due to recent events such as the publication of World Health Organization (WHO) guidelines [1,2], the emergence of extensively drug-resistant (XDR) TB [3] and an incident involving a passenger believed to have XDR TB who travelled between Europe and North America [4] in 2007. Despite these events, the evidence for transmission of TB and the effectiveness of contact investigation in this setting are lacking. We undertook a review of all incidents reported in England and Wales to describe our experience and to investigate the effectiveness of contact investigation.

Method

Incidents with the potential for the transmission of TB are usually reported to the Health Protection Agency Centre for Infections for information or advice. In response to the increasing number of such incidents reported in a range of institutional settings, and a lack of evidence to inform their public health management, a passive system of TB incident and outbreak surveillance (TBIOS) was established in 2004. TBIOS relies on information gathered through a variety of means and sources, such as requests for advice by telephone or email and non-TB-specific incident reporting databases. There is no obligation for public health officers or physicians to report to this system. Incidents reported include those involving a smear-positive or smear-negative culture confirmed index case with a history of air travel.

We reviewed all air travel-related TB incidents reported to the TBIOS system, or identified through active follow-up of additional reports, between January 2007 and February 2008. Incidents involving air travel were defined as all reported events in which the WHO guidelines [1] for initiating contact tracing were met and in which local or national public health officers took a decision to undertake an investigation. Data collected included characteristics of the index case, duration of flight, amount of contact information available from airlines and the outcome of screening, where available. Where incidents were not directly investigated by the national unit, relevant local public health offices were contacted to obtain information. We assessed the effectiveness of the process by evaluating contact information obtained and the proportion of contacts traced.

Results

We identified 24 incidents between January 2007 and February 2008 based on a combination of the passive TBIOS system and active follow-up of other reports. Before January 2007, 21 air travel-related incidents were reported to the TBIOS system between 2004 and 2006 (12 in 2004, seven in 2005, two in 2006).

The 24 index cases were known to have travelled on a total of 39 flights while considered infectious. The median approximate duration of flight was 8.9 hours (inter-quartile range (IQR) 8 to 11.7). Most flights (36) were either from or to a high burden country in Africa or Asia. Table 1 summarises the characteristics of air travel-related TB incidents reported. Nineteen of the 24 incidents reported involved a smear-positive index case. In three cases, the diagnosis was based on bronchoalveolar lavage samples rather than an electively coughed up sputum sample. Results from drug susceptibility tests were available for only six of the 24 index cases. Two incidents involved a passenger with multidrug–resistant (MDR) TB and one with evidence of rifampicin resistance, based on a rapid molecular probe (no other drug susceptibilities were available for this person).

Table 1

Characteristics of air travel related tuberculosis incidents reported in England and Wales, January 2007 to February 2008

			n or Median (IQR*)
Flights N=39	Duration	Hours	8.9 (8 - 11.7)
	High incidence country	Yes	36
	Flight to notification delay	Days	41 (21 - 61)
Index cases N=24	Smear positive case	Yes	19
		No	1
		Unknown	4
	Drug-resistance	MDR**	2
		Rifampicin- resistant	1
		None	3
		Unknown	18
Contact investigation N=24	Availability of contact information from airlines	No further information	13
		Further information available	5
		Airline unwilling to share data	2
		Passenger details deleted by airline	2
		Passenger lists available but no contact details	2

* IQR – inter-quartile range,
** MDR – multidrug-resistant tuberculosis: resistance to at least isoniazid and rifampicin

Table 2

Characteristics and outcomes of air travel related tuberculosis incidents with information on contacts, England and Wales, January 2007-February 2008

Date Reported	Flight origin and destination	Approximate duration	Smear status	Drug-resistance	Contact information
25/06/2007	1. London to Bangalore 2. Bangalore to London	10hr 35 each way	Positive	None	1. 28 contacts: 3 UK, 1 with address 2. 28 contacts: 3 UK, 2 with address
26/07/2007	1. London to Hong Kong 2. Hong Kong to London	11hr 40min each way	Positive	Unknown	1. 22 contacts: 7 UK with personal/travel agent phone numbers 2. 32 contacts: 4 UK with personal/travel agent phone numbers
30/08/2007	1. Japan*** to London 2. London to Japan***	1. 12hr 15min 2. 11hr 30min	Positive	Unknown	1. 4 UK contacts with travel agent phone numbers 2. 2 UK contacts with address and phone numbers (both had a negative Mantoux test)
28/12/2007	1. London to Miami*** 2. Delhi to London 3. Miami*** to London 4. London to Delhi	1. 9hr 45min 2. 9hr 30min 3. 8hr 10min 4. 8hr 10min	Negative	MDR**	1. Followed up by CDC* 2. 41 contacts: 9 UK, 4 with address, 3 with phone, 1 with travel agent details 3. 43 contacts: 15 UK, 1 with address and phone, 1 with address, 4 with phone and e-mail, 9 with travel agent details 4. 47 contacts: 9 UK, 7 with phone numbers
06/02/2008	Vietnam to London	Over 8 hours	Unknown	Unknown	Passenger lists obtained, no further response.

* CDC – US Centers for Disease Control and Prevention, Atlanta
** MDR – multidrug-resistant tuberculosis: resistance to at least isoniazid and rifampicin
*** Non high incidence area

In 17 of the 24 incidents, no further investigation could be undertaken due to lack of passenger information. In two of those incidents, the airline was unwilling to provide data and for an additional two incidents data had been deleted by the airline. In the remaining 13 incidents, no further information could be obtained despite repeated contact with the airlines. In seven of the incidents, some information was available. In two of these, the airlines provided a list of passenger names, but no further information. In the remaining five of the 24 incidents, the airlines provided the passenger names plus variable amounts of contact information (Table 2). Among these five incidents, the results of screening for TB infection were only available on four individuals, including two household contacts, all of whom had a negative Mantoux test.

It has been suggested that longer delays between the date of travel and initiation of contact investigation may decrease the ability to obtain information from airlines. The median duration between the date of flight and notification to a public health authority was 41 days (IQR 21 to 61) with no association between this duration and the availability of information from airlines (k-test for equality of medians, p=0.23).

Discussion and conclusion

This analysis of surveillance data suggests that the process of tracing and investigating contacts of air passengers infected with TB is usually unsuccessful without the availability of appropriate contact information from airlines. Previous studies reported transmission of TB from smear-positive pulmonary TB cases during air travel (5-7). The majority of published investigations, however, did not identify evidence of transmission [1] and the cost of such investigations is reported to be very high [8,9]. This suggests that current recommendations may not be cost effective. McFarland et al. published estimates of costs of $25,000 (over 600 hours of personnel time) [8], and Vassiloyanakopoulos et al. of $4,000 (over 300 hours' personnel time with poor response) per incident [9].

A key limitation of our study is the lack of availability of contact tracing outcome information. Nevertheless, it shows the futility of the process. Furthermore, it is possible that not all air travel-related TB incidents were captured by the surveillance system.

It is occasionally possible to obtain a list of passengers and their contact details. Where this happens, a letter is sent to those passengers identified as contacts; the proportion of contacts who respond is variable. In the few studies where, with substantial resources, it has been possible to achieve good response rates, the proportion with evidence of recent infection of Mycobacterium tuberculosis is invariably negligible [5-7]. Furthermore, the interpretation of tuberculin skin tests in many countries is complicated by previous BCG vaccination and exposure to non-tuberculous mycobacteria. The development of interferon gamma release assays may improve this situation. Evidence for compliance with preventative therapy in this setting is lacking.

The majority of flights (36) involved passengers originating from or travelling to a high TB burden country. This, in part, reflects the prevalence of disease in such countries as well as the nature of air traffic to the United Kingdom due to historical links with African and Indian sub-continent nations.

There are no reliable data on the extent of transmission of TB on aircrafts. The WHO estimates that there are currently over nine million new cases of active TB diagnosed annually worldwide, of which four million are estimated to be potentially infectious [10]. Some of these will travel by air and several will do so for eight hours or more. Many will also travel by train, bus or car [12,13]. The cases identified following recent air travel are likely to represent a very small proportion of potentially infections cases undertaking travel. How likely is transmission of TB infection among air passengers? Byrne estimated that the incidence of TB among air passengers is 0.05 per 100,000 using data from one airline [11]. As only a small proportion of potentially infectious cases travelling by air will ever be identified, and as the rate of transmission of infection is very low, it is reasonable to ask whether contact investigation of air passengers is an effective method in the control of TB or cost-efficient method for identifying cases. Further research is needed into the contribution of air travel-related TB transmission to the burden of this disease and the cost effectiveness of contact investigation.

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References

1. World Health Organisation. Tuberculosis and Air Travel: Guidelines for Prevention and Control - 2nd Edition. Dowdall N, Evans A, Figuerosa J, Ijaz K, Maloeny S, Martinez L et al., editors. WHO/HTM/TB/2006.363. 2006. World Health Organisation.
2. Falzon D, Fernandez de la Hoz K, EuroTB Advisory Committee. Tuberculosis and air travel: towards improved control. Euro Surveill. 2006;11(31):pii=3016. Available from: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=3016
3. Wright A, Bai G, Barerra L, Martín-Casabona N, Gilpin C, Drobniewski F. et al. Emergence of Mycobacterium tuberculosis with Extensive Resistance to Second-Line Drugs - Worldwide, 2000-2004. MMWR Morb Mortal Wkly Rep. 2006;55(11):301-305.
4. Centers for Disease Control and Prevention, United States. CDC Investigation of Traveler with Extensively Drug-Resistant tuberculosis. 3 June 2007. Available from: www.cdc.gov/tb/xdrtb/TravelerFactsheet1.pdf
5. Driver CR, Valway SE, Morgan WM, Onorato IM, Castro KG. Transmission of Mycobacterium tuberculosis associated with air travel. JAMA. 1994; 272(13):1031-1035.
6. Kenyon TA, Valway SE, Ihle WW, Onorato IM, Castro KG. Transmission of multidrug-resistant Mycobacterium tuberculosis during a long airplane flight. N Engl J Med. 1996; 334(15):933-938.
7. Centers for Disease Control and Prevention, United States. Exposure of passengers and flight crew to Mycobacterium tuberculosis on commercial aircraft, 1992-1995. JAMA. 1995; 273(12):911-912.
8. McFarland JW, Hickman C, Osterholm M, MacDonald KL. Exposure to Mycobacterium tuberculosis during air travel. Lancet. 1993; 342(8863):112-113.
9. Vassiloyanakopoulos A, Spala G, Mavrou E, Hadjichristodoulou C. A case of tuberculosis on a long distance flight: the difficulties of the investigation. Euro Surveill. 1999;4(9):pii=83. Available from: http://www.eurosurveillance.org/ViewArticle.aspx?ArticleId=83
10. World Health Organization. Global tuberculosis control - surveillance, planning, financing. WHO/HTM/TB/2008.393. 2008. Geneva, WHO.
11. Byrne N. Low prevalence of TB on long-haul aircraft. Travel Med Infect Dis. 2007; 5(1):18-23.
12. Moore M, Valway SE, Ihle W, Onorato IM. A train passenger with pulmonary tuberculosis: evidence of limited transmission during travel. Clin Infect Dis. 1999; 28(1):52-56.
13. Neira-Munoz, Smith J, Cockcroft P, Basher D, Abubakar I. Extensive transmission of Mycobacterium tuberculosis amongst children on a school bus. Pediatric Infectious Diseases Journal. 2008 (In press).

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