MAJOR ARTICLE

Reporting Patterns and Characteristics of Tuberculosis among International Travelers, United States, June 2006 to May 2008

Surbhi Modi,[1,5] Ann M. Buff,[2,4] Carl J. Lawson,[1] Daniel Rodriguez,[1] Hannah L. Kirking,[1,3] Harvey Lipman,[1] and Daniel B. Fishbein[1]

[1]Division of Global Migration and Quarantine, National Center for Preparedness, Detection, and Control of Infectious Diseases, [2]Epidemic Intelligence Service Program, Office of Workforce and Career Development, and [3]Centers for Disease Control and Prevention Experience Applied Epidemiology Fellowship Program, Office of Workforce and Career Development, and [4]Division of Tuberculosis Elimination, National Center for HIV/AIDS, Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention, and [5]Emory University School of Medicine, Atlanta, Georgia

Background. As part of efforts to prevent the introduction of communicable diseases into the United States, the Centers for Disease Control and Prevention (CDC) conducts surveillance for selected diseases in international travelers. One of these diseases, tuberculosis (TB), received substantial attention in May 2007 when the CDC issued travel restrictions and a federal isolation order for a person with drug-resistant TB who traveled internationally against public health recommendations.

Methods. Reports of TB in international travelers in the CDC's Quarantine Activity Reporting System (QARS) from 1 June 2006 through 31 May 2007 (year 1) were compared with reports from 1 June 2007 through 31 May 2008 (year 2). These reports were classified using the CDC and American Thoracic Society guidelines and analyzed for epidemiologic characteristics and trends.

Results. Among QARS reports, 4.6% were classified as active TB disease and 1.7% as no TB disease. Active TB disease reports increased from 2.5% of QARS reports in year 1 to 6.4% in year 2 ($P < .001$). The proportion of active TB disease reports leading to a federal travel restriction increased from 6.8% in year 1 to 15.4% in year 2 ($P = .08$).

Conclusions. The significant increase in reports of international travelers with TB disease likely represents more attention to and a higher index of suspicion for TB. The increased use of federal travel restrictions was associated with the development of new procedures to limit travel for public health reasons. Continued efforts are needed to decrease the number of persons with TB who travel while potentially contagious.

Because of its public health significance, infectious tuberculosis (TB) remains 1 of the 9 diseases for which the US government has authority to impose mandatory isolation and/or quarantine [1, 2]. In late May 2007, the Centers for Disease Control and Prevention (CDC) issued its first federal isolation order in more than 40 years for a US citizen with suspected extensively drug-resistant (XDR) TB [3–6]. In the weeks that followed, intense media scrutiny was directed toward the federal government's system of identifying illnesses in international travelers and its ability to restrict travel as a mechanism to protect against public health threats. The federal isolation order focused public attention on the ongoing public health challenges surrounding TB control and treatment and highlighted the necessity to identify and intervene when persons with contagious TB disease travel.

The risk of acquiring TB infection depends on a variety of factors, including the contagiousness of the person with TB disease, the duration of exposure to an infectious person, and the susceptibility of the exposed person [7]. Previous investigations have demonstrated *Mycobacterium tuberculosis* transmission to passengers seated close to a traveler with infectious TB during long

Received 4 September 2008; accepted 5 May 2009; electronically published 7 August 2009.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

Reprints or correspondence: Dr Surbhi Modi, Centers for Disease Control and Prevention, 1600 Clifton Rd NE, MS E-04, Atlanta, GA 30333 (smodi@cdc.gov).

Clinical Infectious Diseases 2009; 49:885–91

1058-4838/2009/4906-0009$15.00
DOI: 10.1086/605437

international flights [8–12]. However, there is no current rapid and reliable method for screening all international travelers for TB disease, and only selected groups of travelers, such as immigrants and refugees, are required to undergo medical examinations before entering the United States.

The World Health Organization (WHO) recommends passenger contact investigations when a traveler is identified as having infectious TB disease and has traveled on a flight lasting ⩾8 h [13]. Guidelines for TB passenger contact investigations on other conveyances have not been as clearly defined. However, the general principle that a traveler with infectious TB can transmit *M. tuberculosis* to other nearby passengers during prolonged periods may be applied to maritime and land conveyances [14–22].

Domestic and international public health authorities or private physicians notify the CDC of persons with TB disease who are planning to travel against medical advice. When such persons are determined to be contagious and pose a potential public health threat to others during travel, the CDC works with the Department of Homeland Security to formally restrict the person's ability to travel. A travel restriction tool called a lookout has long been available to federal officials. A lookout is a mechanism by which the CDC, acting through Customs and Border Protection, can alert border authorities that a person with a communicable disease who poses a potentially serious threat to public health might attempt to enter the country through a seaport, airport, or land border [23]. In late May 2007, federal agencies developed a public health Do Not Board list, which enables domestic and international public health officials to request that persons with communicable diseases who pose a serious threat to the public be restricted from boarding commercial aircraft departing from or arriving in the United States [23]. The CDC uses strict criteria for applying these travel restrictions to meet the dual obligations of protecting the public's health and respecting an individual's autonomy and civil liberties. Travel restrictions are considered only for those travelers who are (1) likely contagious with a communicable disease that could constitute a serious public health threat; (2) unaware of or likely nonadherent with public health recommendations, including treatment; and (3) likely will attempt to board a commercial conveyance.

A tremendous amount of media attention was focused on the May 2007 federal isolation order and travel restrictions for the traveler with suspected XDR TB [3–5, 24]. Subsequently, the CDC Quarantine Stations identified an increase in reporting of possible TB cases among international travelers. To verify this increase and define characteristics of these travelers, we conducted a retrospective review of reports of TB among international travelers and compared reports received from 1 June 2006 through 31 May 2007 (year 1) to reports received from 1 June 2007 through 31 May 2008 (year 2).

METHODS

This analysis is based on data obtained from the Quarantine Activity Reporting System (QARS). QARS is a secure, Internet-based reporting system developed by the CDC to internally track reports of illness, death, or other travel-related public health events that fall within the responsibility of any of the 20 CDC Quarantine Stations at air, land, and maritime ports of entry [25].

For this study, a possible TB case was defined as a report containing the keyword *tuberculosis* or *TB* for a person who traveled or attempted to travel into or out of the United States from 1 June 2006 through 31 May 2008. Domestic travelers were excluded from this study because their travel time is generally <8 h and, on the basis of WHO guidelines, would pose a lesser risk for *M. tuberculosis* transmission [13, 26]. Reports of private medical evacuations were excluded because these individuals did not travel on commercial carriers while contagious. Duplicate reports and reports that contained insufficient clinical information to determine cause of illness were also excluded.

Demographic, travel, and clinical information was collected from each report. When necessary, we contacted the CDC Quarantine Station staff and local or state public health agencies to complete data collection. Each report of possible TB was classified according to the CDC and American Thoracic Society (ATS) classification system, which provides 6 categories: no TB exposure (class 0), TB exposure (class 1), latent TB infection (class 2), clinically active TB disease (class 3), clinically inactive TB (class 4), and TB suspect (class 5) [27]. Characteristics of cases that were classified as clinically active TB disease (class 3) were compared with those of cases classified as class 0, 1, 2, or 4 (hereafter collectively referred to as "no TB disease"). Class 5 represents a temporary classification for persons whose medical evaluations were incomplete at the time of report to QARS. After completing a medical evaluation, each person should have been reclassified into another of the CDC-ATS classes. Any person initially determined to be a TB suspect (class 5) but who could not be reclassified because of loss to follow-up was excluded from the analysis of active TB disease versus no TB disease.

Information related to specific public health interventions, including passenger contact investigations and federal travel restrictions, was also collected. These investigations involve identifying passenger contacts of a traveler with TB and may be initiated by local, state, or federal health authorities or by international health agencies [13, 26]. Persons with TB infection or disease who were identified as part of a passenger contact investigation were not included in our analysis.

Information was recorded on the use of federal travel restrictions from 1 June 2006 through 31 May 2008. Federal travel restrictions include the Customs and Border Protection look-

out list and, after May 2007, the public health Do Not Board list managed by the CDC [23]. Persons with TB were classified according to the reason for the travel restriction and were monitored to determine time to removal of travel restrictions.

Data analysis was completed using Epi Info, version 3.4 (CDC), and SAS, version 9.1 (SAS Institute), and statistical significance was determined using exact methods.

RESULTS

Reports of possible TB. Of the 6498 reports entered into QARS for all types of illness from 1 June 2006 through 31 May 2008, a total of 478 were initially identified as reports of possible TB disease. Subsequently, 63 (13.2%) of these reports were excluded because the report contained insufficient clinical information to categorize ($n = 20$) or because the report was of a domestic traveler ($n = 15$), duplicate entry ($n = 22$), passenger contact of a traveler with TB ($n = 5$), or a medical evacuation ($n = 1$). As a result, the final number of reports used for the analysis included 415 reports (6.4%) of possible TB of a total of 6435 QARS illness reports. Reports of possible TB accounted for 3.1% of QARS illness reports in year 1 and 9% in year 2 ($P < .001$) (Table 1).

The characteristics of the 415 international travelers with possible TB are given in Table 2. The median age of the travelers was 37 years (range, 5 months to 92 years), and 255 travelers (61.4%) were male. They were citizens of 64 countries, most commonly the United States with 82 travelers (19.8%), followed by Mexico (61 [14.7%]), the Republic of the Philippines (45 [10.8%]), and India (40 [9.6%]). Of the 415 reports of possible TB, 312 (75.2%) were associated with air travel, and 275 (66.3%) were reported after travel was completed.

Of the 415 reports of possible TB, 41 travelers (9.9%) were initially suspected of having TB but were later determined to have no evidence of TB exposure or infection (CDC-ATS class 0), 8 (1.9%) were classified as having TB exposure without evidence of infection (class 1), 26 (6.3%) as having latent TB infection with no evidence of disease (class 2), 294 (70.8%) as having active TB disease (class 3), 33 (8.0%) as having clinically inactive TB (class 4), and 13 (3.1%) as being suspected of having TB (class 5) and could not be reclassified because of loss to follow-up. Thus, of the 402 classifiable TB reports, 294 (73.1%) fulfilled CDC-ATS criteria for active TB disease and 108 (26.9%) were classified into CDC-ATS classes 0, 1, 2, or 4 (no TB disease).

Reports of active TB disease. The proportion of QARS reports for both active TB disease and no TB disease increased from year 1 to year 2. Active TB increased from 2.5% of all QARS reports to 6.4% ($P < .001$) (Table 1). No TB disease reports increased from 0.6% of all QARS reports in year 1 to 2.6% in year 2 ($P < .001$). Figure 1 illustrates the distribution by month of active TB disease, no TB disease, and total QARS illness reports.

Table 1. Comparison of Report Characteristics for Study Years 1 and 2

Type of report	No. (%) of reports	
	Year 1[a]	Year 2[b]
Total QARS reports		
No. of reports	2964	3471
Active TB disease	73 (2.5)	221 (6.4)
No TB disease	19 (0.6)	89 (2.6)
TB suspect	2 (0.1)	11 (0.3)
Other illness	2870 (96.8)	3150 (90.8)
Possible TB reports[c]		
No. of TB reports	92	310
Active TB disease	73 (79.3)	221 (71.3)
No TB disease	19 (20.7)	89 (28.7)

NOTE. QARS, Quarantine Activity Reporting System; TB, tuberculosis.

[a] 1 June 2006 to 31 May 2007.

[b] 1 June 2007 to 31 May 2008.

[c] Excludes the 13 Centers for Disease Control and Prevention and American Thoracic Society class 5 cases that were unable to be reclassified because of loss to follow-up.

Two hundred forty-four travelers (83%) with active TB disease were reported in association with air travel, compared with 58 travelers (54%) with no TB disease ($P < .001$). Air travelers with active TB disease were more likely to have passenger contact investigations initiated (143 travelers [58.8%]) than were those who traveled by land or maritime conveyances (8 travelers [15.7%]; $P < .001$). The proportion of active TB disease reports leading to an investigation did not change significantly from year 1 (54.8%) to year 2 (50.2%; $P = .59$).

Drug-susceptibility test results were available for 248 (84.4%) of the 294 travelers with active TB disease. One hundred ninety-six (79.0%) were infected with TB strains that were susceptible to all first-line drugs. Twenty-three travelers (9.3%) were found to have resistance to at least 1 drug, 28 (11.3%) were determined to have multidrug-resistant TB, and 1 traveler (0.4%) was determined to have XDR TB.

Federal travel restrictions. Federal travel restrictions were initiated for 45 (10.8%) of the 415 travelers with possible TB. Of the 45 restricted travelers, 38 (84.4%) had active TB disease. The 7 other travelers (15.5%) were restricted on the basis of suspicion of active TB disease and intention to travel before the final diagnosis was confirmed. Four of these travelers were determined by subsequent medical evaluation not to have TB (class 0), 1 had been exposed to TB but was found to have no evidence of infection (class 1), 1 had clinically inactive TB (class 4), and 1 traveler who was suspected of having TB was lost to follow-up (class 5).

Of the 45 restricted travelers, 20 (44.4%) had interrupted treatment against medical advice, 16 (35.6%) had received in-

Table 2. Characteristics of International Travelers with Tuberculosis (TB), 1 June 2006 through 31 May 2008

Characteristic	Possible TB reports (n =415)	Active TB disease reports (n = 294)	Travel restriction (n = 45)	Conveyance type		
				Air (n = 312)	Land (n = 80)	Maritime (n = 23)
Male sex[a]	255 (61.4)	184 (62.8)	28 (62.2)	181 (58.4)	57 (71.3)	17 (73.9)
Median age (range)[b]	37 years (5 months to 92 years)	36 years (5 months to 92 years)	48.5 years (20–77 years)	38 years (5 months to 92 years)	36 years (1–77 years)	36.5 years (23–74 years)
US citizen[c]	82 (19.8)	57 (20.1)	8 (17.8)	64 (21.3)	12 (15.0)	5 (21.7)
Case identified						
Before travel	43 (10.3)	31 (10.5)	16 (35.6)	34 (10.9)	9 (11.3)	0 (0.0)
During travel	97 (23.3)	34 (11.6)	9 (20.0)	41 (13.1)	49 (61.3)	7 (30.4)
After travel	275 (66.3)	229 (77.9)	20 (44.4)	237 (76.0)	22 (27.5)	16 (69.6)
Travel-related contact investigation	151 (36.4)	151 (51.4)	11 (24.4)	143 (45.8)	1 (1.3)	7 (30.4)
Travel restriction	45 (10.8)	38 (12.9)	…	37 (11.9)	8 (10.0)	0 (0)

NOTE. Data are no. (%) of travelers, unless otherwise indicated. International travelers with TB were defined as any persons with a suspected or confirmed diagnosis of TB who traveled or attempted to travel into or out of the United States, including travel to US territories. TB, tuberculosis.

[a] Excludes 2 travelers for whom sex was not available.

[b] Excludes 13 travelers for whom age was not available.

[c] Excludes 12 travelers for whom citizenship information was not available.

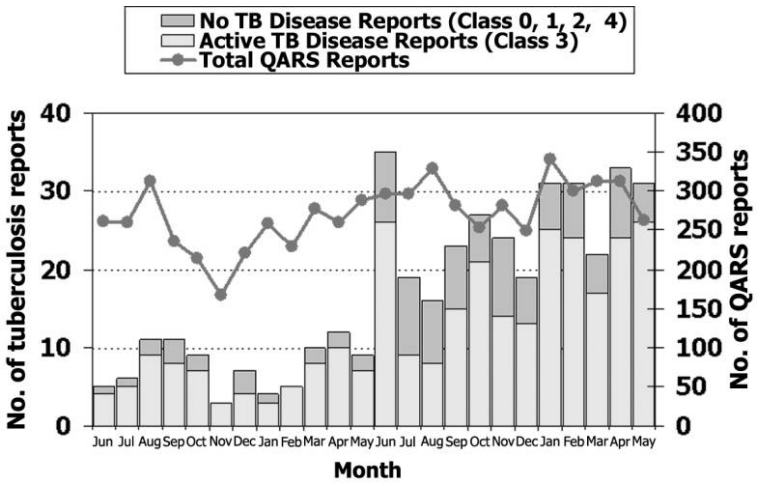

Figure 1. Trends in total illness reports (all diseases) and reports of tuberculosis (TB) to the Quarantine Activity Reporting System (QARS), 1 June 2006 to 31 May 2008.

adequate treatment for TB at the time they were attempting to travel, 7 (15.1%) had not completed medical evaluations and infectious TB could not be medically disproved, and 2 (4.4%) were restricted because they were unaware of their diagnosis and could not be reached by public health authorities before planned travel. The restricted travelers were citizens of 21 countries, including 8 persons (17.8%) from the United States and 7 (15.6%) from Mexico. Twenty-nine persons (64.4%) had already traveled internationally against public health recommendations when they were reported to the CDC and were restricted from further international travel while they were possibly contagious to others. The other 16 (35.6%) had indicated their intentions to travel against recommendations and were restricted before they could initiate travel. The proportion of persons with active TB disease for whom federal travel restrictions were used increased from 6.8% (5 of 73) in year 1 to 15.4% (34 of 221) in year 2 ($P = .08$), whereas the proportion of restricted travelers with no TB disease decreased from 21.1% (4 of 19) in year 1 to 2.2% (2 of 89) in year 2 ($P = .02$).

Since the creation of the public health Do Not Board list, 36 travelers have had their travel restricted via this mechanism. As of 15 April 2009, 30 (83.3%) had been removed from the list. The median time to removal was 79 days. Twenty-six (86.7%) were removed from the restriction lists after they received TB treatment and were no longer considered to pose a threat of infecting others during travel. Three travelers (10.0%) were removed after they were determined not to have active TB disease, and 1 (3.3%) was removed from the list after death.

DISCUSSION

After the highly publicized federal isolation order in late May 2007, reports of TB in international travelers markedly increased and remained at higher levels throughout the subsequent 12 months. The percentage of all illness reports due to both active TB disease and no TB disease increased significantly after 1 June 2007, although the increase was greater for reports of no TB disease. An increase in reporting of illnesses after intense media attention has been previously noted in the setting of a passive surveillance system, such as that used by the CDC's Quarantine Stations [28]. Heightened public awareness likely lowered the threshold of suspicion for TB among travelers, which resulted in an increase in identification of travelers with active TB disease and an even greater increase in reports of travelers determined to have no TB disease.

Identification of a traveler with TB often depends on recognition of symptoms by nonmedically trained crew members or port officials. Without a focused medical examination, including radiology and laboratory testing, recognizing and diagnosing TB disease in a traveler are virtually impossible. With the current system, it is inevitable that some, and perhaps many, contagious persons are not detected during brief encounters with nonmedical personnel at land, air, and sea ports of entry. The definitive diagnosis of TB depends on a combination of clinical and diagnostic laboratory testing, and culture results may not be received for weeks or months after the initial evaluation [29]. Not surprisingly, most reports received by the CDC were of persons who had TB diagnosed after they had completed their travel.

Although most persons in our analysis traveled before TB disease had been diagnosed, our study also shows that a small subset of persons traveled after receiving a diagnosis of TB. Persons who received a diagnosis of infectious TB are generally advised by physicians and public health officials to avoid situations, such as travel on commercial airlines, in which they could transmit infection to others [13, 26, 30]. The reasons

that persons with infectious TB disease may disregard these public health recommendations and decide to travel have not been closely studied.

Several strategies have been implemented to decrease the number of persons with TB who travel internationally when contagious. The technical instructions for TB screening and treatment required for immigration to the United States were revised in 2007 to include a more thorough evaluation for TB disease [31]. The WHO has also updated its guidelines for prevention and control of TB in the setting of air travel, including guidance on restriction of air travel for persons with infectious TB disease [13, 32]. Local and state health officials are increasingly aware of and use federal assistance for contagious persons who have disregarded public health recommendations and have expressed intent to travel. The CDC aims to exercise its legal authorities and federal travel restriction tools as sparingly as possible and only in individuals posing a clear threat to the health of fellow travelers. Most persons are removed from travel restriction lists within 3 months, usually because they are determined to no longer be contagious and the public health risk has been eliminated.

This study has several limitations. The reports received by the CDC likely reflect only a fraction of the actual number of travelers with TB disease. Given the volume of travelers through US ports of entry and the high prevalence of TB in many of the countries in which travelers originate, the current system can be expected to detect only a small number of travelers who might have infectious TB disease [33–36]. For travelers with TB disease who were detected, we found that the QARS data were occasionally incomplete, necessitating secondary data collection from local and state health departments. However, not all case information was available through this mechanism, and some cases were ultimately excluded from our study because of insufficient clinical information. Finally, this study did not attempt to determine whether transmission of *M. tuberculosis* occurred on airlines or other modes of travel.

Because of the global burden of TB and the increasing volume of international travel, detection of TB disease among travelers and the potential for *M. tuberculosis* transmission during air travel will continue to challenge public health officials worldwide. Tremendous resources are expended during public health responses to travelers with TB disease through activities such as passenger contact investigations and implementation of legal measures to prevent travel [8, 10, 13, 15, 37]. Despite increased public awareness of the risks of *M. tuberculosis* transmission during international travel, the challenge of preventing persons with infectious TB disease from traveling remains. Shifting the emphasis toward prevention of exposure by preventing the travel of persons with infectious TB disease and other illnesses of public health significance will be a critical step in protecting the health of all passengers.

Acknowledgments

We thank the Quarantine and Border Health Services Branch staff, Division of Global Migration and Quarantine, CDC, for contributions to data collection; the Informatics Team, Division of Global Migration and Quarantine, CDC, for assistance with the Quarantine Activity Reporting System; Clive Brown, for advice regarding statistical analysis; and Jane Keir and Thomas R. Navin, for editorial contributions.

Potential conflicts of interest. S.M., A.M.B., C.J.L., D.R., H.L.K., H.L., and D.B.F. are all employed by the CDC. H.L.K. is a fellow in the CDC Experience Applied Epidemiology Fellowship Program, which is a public-private partnership supported jointly by the CDC and Pfizer via a grant to the CDC Foundation from Pfizer.

References

1. Regulations to control communicable diseases. Public Health Service Act. 42 USC §264–272. **2004**.
2. Centers for Disease Control and Prevention. Legal authorities for isolation and quarantine. December **2007**. Available at: http://www.cdc.gov/ncidod/dq/pdf/legal_authorities_isolation_quarantine.pdf. Accessed 3 April 2008.
3. Markel H, Gostin LO, Fidler DP. Extensively drug-resistant tuberculosis: an isolation order, public health powers, and a global crisis. JAMA **2007**; 298:83–6.
4. Parmet WE. Legal power and legal rights: isolation and quarantine in the case of drug-resistant tuberculosis. N Engl J Med **2007**; 357:433–5.
5. Sampathkumar P. Dealing with threat of drug-resistant tuberculosis: background information for interpreting the Andrew Speaker and related cases. Mayo Clin Proc **2007**; 82:799–802.
6. Fidler DP, Gostin LO, Markel H. Through the quarantine looking glass: drug-resistant tuberculosis and public health governance, law, and ethics. J Law Med Ethics **2007**; 35:616–28, 512.
7. Division of Tuberculosis Elimination. Tuberculosis information for international travelers. **2007**. Available at: http://www.cdc.gov/tb/pubs/tbfactsheets/TravelInfo.pdf. Accessed 28 August 2007.
8. 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**; 334:933–8.
9. McFarland JW, Hickman C, Osterholm M, MacDonald KL. Exposure to *Mycobacterium tuberculosis* during air travel. Lancet **1993**; 342:112–3.
10. Driver CR, Valway SE, Morgan WM, Onorato IM, Castro KG. Transmission of *Mycobacterium tuberculosis* associated with air travel. JAMA **1994**; 272:1031–5.
11. Centers for Disease Control and Prevention. Exposure of passengers and flight crew to *Mycobacterium tuberculosis* on commercial aircraft, 1992–1995. MMWR Morb Mortal Wkly Rep **1995**; 44:137–40.
12. Miller MA, Valway S, Onorato IM. Tuberculosis risk after exposure on airplanes. Tuber Lung Dis **1996**; 77:414–9.
13. World Health Organization. Tuberculosis and air travel: guidelines for prevention and control. **2008**. Available at: http://www.who.int/tb/publications/2008/WHO_HTM_TB_2008.399_eng.pdf. Accessed 10 June 2008.
14. Hollingsworth TD, Ferguson NM, Anderson RM. Frequent travelers and rate of spread of epidemics. Emerg Infect Dis **2007**; 13:1288–94.
15. Al-Jahdali H, Memish ZA, Menzies D. Tuberculosis in association with travel. Int J Antimicrob Agents **2003**; 21:125–30.
16. Yusuf HR, Braden CR, Greenberg AJ, Weltman AC, Onorato IM, Valway SE. Tuberculosis transmission among five school bus drivers and students in two New York counties. Pediatrics **1997**; 100:E9.
17. Moore M, Valway SE, Ihle W, Onorato IM. A train passenger with pulmonary tuberculosis: evidence of limited transmission during travel. Clin Infect Dis **1999**; 28:52–6.
18. Buff A, Deshpande S, Harrington T. Investigation of *Mycobacterium tuberculosis* transmission aboard U.S.S. Ronald Reagan, 2006. Mil Med **2008**; 173:588–93.
19. Horna-Campos OJ, Sanchez-Perez HJ, Sarkar S, Bedoya A, Martin M.

Public transportation and pulmonary tuberculosis, Lima, Peru. Emerg Infect Dis **2007**; 13:1491–3.
20. Hardy MA, Schmidek HH. Epidemiology of tuberculosis aboard a ship. JAMA **1968**; 203:175–9.
21. DiStasio AJ, Trump DH. The investigation of a tuberculosis outbreak in the closed environment of a U.S. Navy ship, 1987. Mil Med **1990**;155: 347–51.
22. LaMar JE, Malakooti MA. Tuberculosis outbreak investigation of a U.S. Navy amphibious ship crew and the Marine expeditionary unit aboard, 1998. Mil Med **2003**; 168:523–7.
23. Centers for Disease Control and Prevention. Federal air travel restrictions for public health purposes—United States, June 2007-May 2008. MMWR Morb Mortal Wkly Rep **2008**; 57:1009–12.
24. Valentine V. A Timeline of Andrew Speaker's infection. 7 June **2007**. Available at: http://www.npr.org/news/specials/tb/. Accessed 29 Aug 2007.
25. Sivitz LB, Stratton K, Benjamin GC, eds. Quarantine stations at ports of entry: protecting the public's health. Washington, DC: Institute of Medicine, **2005**.
26. World Health Organization. Tuberculosis and air travel: guidelines for prevention and control. **2006**. Available at: http://whqlibdoc.who.int/hq/2006/WHO_HTM_TB_2006.363_eng.pdf. Accessed 12 October 2007.
27. Diagnostic Standards and Classification of Tuberculosis in Adults and Children. This official statement of the American Thoracic Society and the Centers for Disease Control and Prevention was adopted by the ATS Board of Directors, July 1999. This statement was endorsed by the Council of the Infectious Disease Society of America, September 1999. Am J Respir Crit Care Med **2000**; 161:1376–95.
28. Olowokure B, Clark L, Elliot AJ, Harding D, Fleming A. Mumps and the media: changes in the reporting of mumps in response to newspaper coverage. J Epidemiol Community Health **2007**; 61:385–8.
29. Fitzgerald D, Haas DW. *Mycobacterium tuberculosis.* In: Mandell GL, Bennett JE, Dolin R, eds. Mandell, Douglas and Bennett's principles and practice of infectious diseases. 6th ed. Amsterdam, the Netherlands: Elsevier, **2005**:2852–85.
30. Jensen PA, Lambert LA, Iademarco MF, Ridzon R. Guidelines for preventing the transmission of *Mycobacterium tuberculosis* in health-care settings, 2005. MMWR Recomm Rep **2005**; 54:1–141.
31. Centers for Disease Control and Prevention. Tuberculosis component of technical instructions for the medical examination of aliens in the United States. **2008**. Available at: http://www.cdc.gov/ncidod/dq/civil_tb_ti_2008.htm. Accessed 30 April 2009.
32. Updated guidelines on tuberculosis and air travel. Wkly Epidemiol Rec **2008**; 83:209–213. Available at: http://www.who.int/wer/2008/wer8323.pdf. Accessed 10 June 2008.
33. Dye C. Global epidemiology of tuberculosis. Lancet **2006**; 367:938–40.
34. Rekha B, Swaminathan S. Childhood tuberculosis: global epidemiology and the impact of HIV. Paediatr Respir Rev **2007**; 8:99–106.
35. Macpherson DW, Gushulak BD. Balancing prevention and screening among international migrants with tuberculosis: population mobility as the major epidemiological influence in low-incidence nations. Public Health **2006**; 120:712–23.
36. Centers for Disease Control and Prevention. Background on the 2007 Technical Instructions for Tuberculosis Screening and Treatment. 10 January **2008**. Available at: http://www.cdc.gov/ncidod/dq/titb_background_2007.htm. Accessed 12 May 2008.
37. Byrne N. Low prevalence of TB on long-haul aircraft. Travel Med Infect Dis **2007**; 5:18–23.