



TB transmission on public transportation: A review of published studies and recommendations for contact tracing[☆]

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Summary *Setting:* The risk of transmission when persons with active tuberculosis travel on buses or trains is uncertain and no recommendations have been published for contact investigations on these conveyances.

Design: We conducted a systematic review of the published studies of tuberculosis transmission among bus or train travelers.

Results: Twelve published reports were identified, including one retrospective cohort study and eleven contact investigations. One contact investigation involved train travelers and one involved students on a 6 h bus excursion. The remaining nine involved exposures on school buses or in commuter vans. In eight reports, evidence of tuberculosis infection was found in 8.7%–55% of those tested; six of these studies reported identifying 1–24 cases of active tuberculosis.

Conclusions: These reports support the need to be alert to the possibility of tuberculosis transmission on buses or trains. However, they do not offer the quantitative estimate of risk needed for defining policy regarding contact tracing for persons exposed on buses or trains. Decisions to carry out contact investigations should take into account the proximity to the index case, duration of exposure, and other risk factors that may affect the infectiousness of the case or the susceptibility of the contact. Additional reports taking these factors into consideration would help clarify the risk of tuberculosis transmission on public transport.

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Background

When persons with infectious tuberculosis (TB) travel there is likely to be a certain level of risk to their fellow passengers. On commercial aircraft, studies indicate that the risk of transmission of TB, although low, appears greatest among those passengers on flights with duration of greater than 8 h who sat in close proximity to the infectious individual.^{1,2} Consequently, generally accepted recommendations exist for follow-up of those exposed to an infectious TB case aboard commercial aircraft.³

However when persons with infectious tuberculosis undertake long-distance travel by bus or train, there are no generally accepted recommendations as to when or on who contact investigations should be carried out.

We review published studies of TB transmission on buses, trains or public conveyances other than aircraft or ships, summarize the results and review recommendations for public health follow-up and contact investigations based on the currently available information.

Methods

We conducted a systematic review of the international literature (all Medline languages; 1950–2010) accessed through Medline, using the search terms “tuberculosis” and “transmission” and either “train” or “bus” or “transportation”. Further searches including such terms as “coach”, “railroad”, “public transport”, or “travel” yielded no additional relevant citations. Further relevant studies were identified among articles cited in these papers.

Results

Twelve published reports of TB transmission on trains or buses were identified (Table 1). Eleven of the investigations were the results of case-finding following the identification of an active case; one was a cohort study of persons who were evaluated for TB in a local clinic.⁴ Of the case investigation studies, one involved exposures on a train,⁵ one involved a group of college students on a 6 h bus excursion,⁶ one involved riders in a commuter van,⁷ the remaining eight studies involved children riding to school on a daily basis.^{8–15} In these eleven reports of contact investigations in bus passengers, rates of positivity of the Tuberculin Skin Test (TST), or Interferon–Gamma Releasing Activity (IGRA) test,¹⁵ ranged from 8.7% to 55%. In addition, in seven contact investigation studies, six involving bus travel and one involving a commuter van, from 1–52 cases of active disease in contacts were identified, with a median of four cases.^{6,7,9,11,12,14,15}

Eight of the reports involved repeated exposures on school buses with children aged 6–18 years. Exposure time, typically daily, or twice daily, over several months, in one report was estimated at a total of 16–37.5 h. In several of these, cases were exposed to the ill index case for six months or longer.^{8,9,11,14} A number of the index cases appeared to have been highly infectious, with high rates of TST reactivity in family, friends or school contacts.^{8,10,11,14}

In the seven contact investigations where TST positivity rates of students riding the same bus as the index case were

compared with rates of reactivity among students at the same school who did not ride with the index case, TST reactivity was from 2.50 to 20.86 times higher among the bus riders, and in every case the 95% confidence interval excluded 1.0. Similarly, in the cohort investigation where adult commuters with chronic cough were evaluated for tuberculosis by examination of acid-fast staining of sputum, persons who commuted by minibus had a 4.9 fold increased likelihood of being smear positive.

One report involved a group of students and teachers who made a 6 h bus excursion.⁶ An 18 year old student, who had traveled with other students and faculty, was identified with active tuberculosis and an investigation was carried out among her schoolmates and staff. Forty-nine students, two faculty members, and a driver rode on the excursion bus with the index case. The driver was known to have had a positive skin test previously. Of the 40 students other than the index case who were tested, 18 were reactors, as were the 2 teachers, for a prevalence of skin test reactors among all tested bus riders of 47.6% and four (9.5%) were found to have active disease. Although a total of 355 other students and faculty in the school were studied, bus riders accounted for all active cases identified. Seating information was collected for all but two bus riders who were reactors. Ten reactors, including two cases, were seated among the 12 seats within two rows of the index case, but one active case was seated five rows from the index case and other reactors were seated as much as 12 and 13 rows away. RFLP patterns in the four secondary cases were identical with that of the index case. An odds ratio of 3.406 (95% CI = 1.423–8.151) was estimated for the likelihood of TST reactivity in bus riders as compared with students who were not bus riders. A logistic regression model taking into account age and class contact with an infectious case calculated that having ridden on the excursion bus carried an attributable risk for TST reactivity of 15.88%.

In the train exposure,⁵ most co-travelers were adults (mean age = 47 years), and the mean duration of travel was 12.3 h (range: 1–34.7 h). Of the 15 persons identified as TST positive, only four were considered to have been exposed on the train, and only two appeared to have been infected on the train. Both persons infected had been in close contact with the index case for less than 1 h.

In the contact investigation of the van riders,⁷ five co-workers of the index case were considered to have been infected, with two showing x-ray evidence consistent with active disease. All five were described as having little contact with the index case, other than sharing the same commuter van.

The cohort study⁴ involved a random sample of 142 commuters 15 years of age or older who were evaluated at a health center for productive cough of over 15 days duration. Study participants were considered positive for pulmonary tuberculosis if acid-fast bacilli were found in any of three consecutive daily sputum samples. Overall the prevalence of pulmonary tuberculosis in the study area in persons being screened because of chronic cough was 12%, comparable to other reported rates in poor areas in urban Latin America. While socioeconomic variables in this cohort showed no association with pulmonary TB, working away from home and commuting behaviour showed a significant association with disease. Commuting by minibus carried an odds ratio of 4.9 (95% CI: 1.06–23.09) in favour of disease,

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