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Causes and costs of hospitalization of tuberculosis patients in the United States

Z. Taylor[*], **S. M. Marks**[*], **N. M. Ríos Burrows**[*,†], **S. E. Weis**[‡], **R. L. Stricof**[§], and **B. Miller**[*]

[*]Division of Tuberculosis Elimination, National Center for HIV, STD & TB Prevention, Atlanta, Georgia

[†]Division of Diabetes Translation, National Center for Chronic Disease Prevention & Health Promotion, Centers for Disease Control and Prevention, Atlanta, Georgia

[‡]Fort Worth-Tarrant County Public Health Department, Tuberculosis Elimination/Control, Fort Worth, Texas

[§]Bureau of Tuberculosis Control, New York State Department of Health, Albany, New York, USA

SUMMARY

OBJECTIVE—To examine the costs, lengths of stay and patient characteristics associated with tuberculosis (TB) hospitalizations.

METHODS—A prospective cohort study of 1493 TB patients followed from diagnosis to completion of therapy at 10 public health programs and area hospitals in the US. The main outcome measures were the following: 1) occurrence, 2) cost, and 3) length of stay of TB-related hospitalizations.

RESULTS—There were 821 TB-related hospitalizations among the study participants; 678 (83%) were initial hospitalizations and 143 (17%) were hospitalizations during the treatment of TB. Patients infected with human immunodeficiency virus (HIV) (OR 1.8, 95%CI 1.2–2.6), and homeless patients (OR, 1.7 95%CI 1.1–2.8) were at increased risk of being hospitalized at diagnosis. Homeless patients (RR 2.5, 95%CI 1.5–4.3), patients who used alcohol excessively (RR 1.9, 95%CI 1.2–3.0), and patients with multidrug-resistant TB (RR 5.7, 95%CI 2.7–11.8) were at increased risk of hospitalization during treatment. The median length of stay varied from 9 to 17 days, and median costs per hospitalization varied from $6441 to $12 968 among the sites.

CONCLUSION—Important social factors, HIV infection, and local hospitalization practice patterns contribute significantly to the high cost of TB-related hospitalizations. Efforts to address these specific factors are needed to reduce the cost of preventable hospitalizations.

Keywords

tuberculosis; hospitalization; costs

Correspondence to: Zachary Taylor, MD, Division of Tuberculosis Elimination, National Center for HIV, STD & TB Prevention, Centers for Disease Control and Prevention, MS E-10, 1600 Clifton Rd, Atlanta, GA 30333, USA. Tel: (+1) 404-639-8123. Fax: (+1) 404-639-8961. zxt0@cdc.gov.

Prior to the 1960s, most patients in the United States with tuberculosis (TB) were hospitalized for much of their course of treatment in sanatoria. Treatment in such settings included fresh air, bed rest, nourishment, and occasionally thoracic surgery.[1] With the discovery of effective anti-TB drugs in the late 1940s, chemotherapy became the mainstay of treatment and patients began to be treated primarily on an out-patient basis.[1,2]

In spite of the shift to ambulatory care, most of the direct costs of treating TB result from hospitalization. A 1991 study estimated that expenditures for hospitalization comprised 60% of total TB expenditures ($703 million), while out-patient care amounted to only 26%.[3] In addition, the frequency of hospitalizing TB patients appears to be increasing. A 1988 survey on standards of practice of 28 metropolitan health departments found that 18% of reported TB patients were initially hospitalized for treatment.[4] By 1996, that percentage had increased to 38%.[5] Although these studies have provided useful information on the proportion of TB patients who are hospitalized and the costs related to these hospitalizations, they have not examined the factors related to the risks and costs of hospitalization. This study was designed to examine the costs, the lengths of stay, and the patient characteristics associated with TB hospitalizations.

METHODS

Selection of participants and identification of hospitalizations

This study was designed as a prospective cohort study of hospitalizations of TB patients. Ten public health departments applied for and received cooperative agreement funds from the Centers for Disease Control and Prevention (CDC) to participate in the data collection component of this study. The programs participating in the study were Georgia; South Carolina; Mississippi; New York (three counties surrounding New York City); Chicago, Illinois; Houston, Texas; Dallas/Fort Worth, Texas; San Diego, California; Los Angeles, California; and San Francisco, California.

Persons with active TB, regardless of age or site of disease, who were alive at diagnosis and were reported as cases to the participating programs during a 6-month period in 1995 or early 1996, were eligible for participation in the study. All reporting areas (i.e., the 50 states, the District of Columbia, New York City, US dependencies and possessions, and independent nations in free association with the US) report TB cases to the CDC using a standard case report form, Report of a Verified Case of Tuberculosis (RVCT).[6] Reported TB cases are verified according to the TB case definition for public health surveillance.[7] Depending on the expected number of cases during the study period, eligible patients were approached consecutively or in a systematic manner (every other one or two reported patients) to participate in the study. Most participants were reported as cases and enrolled in the study in 1995; participants at two sites (New York and Houston) were reported and enrolled in the first half of 1996. All eligible patients (or the parents or guardians of minors) who agreed to participate in the study provided signed informed consent. Participants were asked to report all hospitalizations occurring 3 months prior to their diagnosis of TB and all hospitalizations occurring during their treatment of TB. Participants were followed and routinely questioned about hospitalizations until they completed their TB treatment or until 30 November 1997.

Data sources and collection

Socio-demographic and clinical information for each participant was obtained from the RVCT submitted for each TB case. The RVCT form collects clinical data such as the results of sputum smear examination and culture, chest radiograph findings, drug susceptibility results for initial and final *Mycobacterium tuberculosis* isolates from culture-positive patients, results of human immunodeficiency virus (HIV) testing, drug treatment regimens, and reasons for stopping therapy. In addition, the RVCT form also collects information on employment, history of substance abuse and homelessness, and residence in correctional or long-term care facilities.

There was incomplete reporting of HIV status for TB cases reported in 1995 and 1996. Reasons for incomplete reporting include concerns about confidentiality, which may limit the exchange of data between TB and HIV/AIDS programs, and laws or regulations in selected states and localities. In addition, health care providers may not offer HIV counseling and testing to all TB patients. Information on HIV status not included on the RVCT form was supplemented by several sites; however, this information was not obtained for all participants in this study.

Trained study staff inspected each medical record to confirm hospitalization and abstracted information about each hospitalization. Information collected included dates of admission and discharge, type of hospital, payer, dates of respiratory isolation, HIV status, history of homelessness and substance abuse, International Classification of Diseases (ICD-9) and Current Procedural Terminology diagnostic and procedure codes,[8,9] and the results of mycobacterial smears and cultures. Total charges per hospitalization were obtained from UB-92 forms or other billing forms generated by the hospital. The UB-92 (UB-92 HCFA-1450) is a standard billing form developed by the Health Care Financing Administration (HCFA). Physician charges were not included. Charges were converted to costs using HCFA cost-to-charge ratios for each hospital.[10] Costs were further adjusted for comparability among the sites using the US Bureau of the Census cost-of-living index for metropolitan areas,[11] and then converted to 1998 dollars.[12]

Outcomes

Outcomes of interest were the number, duration and cost of TB-related hospitalizations. We identified two types of TB-related hospitalizations: those occurring at the time of diagnosis of TB, which were termed ‘initial’ hospitalizations, and those occurring during treatment of TB. As a date of diagnosis was not available for each participant in the study, two dates found on the RVCT form were used to define an initial hospitalization. A hospitalization for TB was identified as initial if one of the following conditions was present: 1) the hospitalization dates included the collection date of an isolate that was culture positive for *M. tuberculosis* and from which initial susceptibility testing was obtained (date from RVCT form), regardless of whether or not TB was listed as a diagnosis; 2) the hospitalization dates included the date TB treatment was begun (date from RVCT form), regardless of whether or not TB was listed as a diagnosis; or 3) a hospitalization occurring prior to the two dates above, provided the principal diagnosis was TB (ICD-9 codes 010-018). A TB-related hospitalization during treatment was identified as any hospitalization with a principal diagnosis of TB (ICD-9 codes 010–018) occurring after the latter of the two dates above. Although TB patients were hospitalized for other reasons, this analysis and report is limited to the TB-related hospitalizations defined above.

It is common for a patient to be admitted to one hospital, discharged, and transferred or readmitted to another hospital within a 24-hour period. Consecutive hospitalizations within a 24-hour period were categorized as one episode of care. In our analysis, the term 'hospitalization' refers to these episodes of care.

Data analysis

Results for TB-related hospitalizations are presented as proportions, odds ratios, and relative risks by subgroups of interest. Initial hospitalizations and those during treatment were analyzed separately. Homelessness, excess alcohol use, and other substance use were included for analysis only for participants 15 years of age or older. Factors related to initial hospitalization and hospitalization during treatment were examined by calculating crude odds ratios and relative risks with the associated 95% confidence intervals (95%CI). Next, factors related to initial hospitalization alone were also examined simultaneously by logistic regression analysis. Factors related to hospitalization during treatment were examined simultaneously by Cox Proportional Hazards analysis using time to hospitalization as the dependent variable. Analyses were performed using SAS, version 6.11.[13]

Numbers of hospitalizations, median length of stay (LOS), median cost per day, median cost per hospitalization episode, and total hospitalization costs are all reported for the different sites and subgroups. Costs per case were calculated by dividing the total hospitalization costs for each site by the total number of participants, including participants who were hospitalized and those who were not.

RESULTS

In 1995, 22 860 cases of TB were reported in the US.[14] Of these, 6267 (27.6%) were reported to the 10 TB control programs participating in this study. Of the 6267 persons reported as cases at the 10 sites, the 2023 (32%) who were reported during the study period were eligible for the study, and were selected to participate in the study. Of these, 1533 (76%) agreed to participate and were enrolled in the study. Forty were excluded from the analysis because of incomplete data about their hospitalizations. The final sample consisted of 1493 persons, representing 6.5% of all cases reported in the US in 1995.

The proportion of persons selected to participate who agreed to participate in the study varied among the sites from 50% to 100%, with 76% agreeing to participate overall. Compared to persons who were selected to participate but declined enrollment, participants were significantly ($P < 0.05$) more likely to be Hispanic (25% vs 18%) and less likely to be Asian (17% vs 22%); less likely to be aged 0 to 14 (9% vs 12%) or 65 years or older (14% vs 19%); more likely to receive care from the health department (81% vs 73%); more likely to use alcohol excessively (18% vs 11%) and use non-injecting drugs (9% vs 6%); and more likely to have pulmonary disease than extra-pulmonary disease (85% vs 78%). There were no significant differences in participation rates with regard to being aged 15 to 64, sex, black or white race, homelessness, injecting drug use, HIV status, TB multidrug resistance, or employment status.

The characteristics of the participants are reported in Table 1 by site and for the total sample. The differences in demographic characteristics observed among the participants from different sites reflect the regional variations in the characteristics of TB patients in the US. For comparison, the characteristics of all TB patients reported in 1995[14] are also presented in the Table. Compared to all persons with reported cases, participants were more likely to be aged 25 to 44 and less likely to be older than 65 years of age. In addition, participants were more likely to be black, less likely to be white, more likely to be on directly observed therapy, and more likely to receive their TB treatment from the health department than from private providers.

Overall, there were 821 TB-related hospitalizations among the study participants; 678 (83%) were initial hospitalizations and 143 (17%) were hospitalizations during the treatment of TB. Forty-nine per cent ($n = 733$) of the participants had at least one TB-related hospitalization; 45% ($n = 678$) were hospitalized initially for TB, and 8% ($n = 124$) had a TB-related hospitalization during treatment. Of the 733 participants with TB-related hospitalizations, 659 had one hospitalization episode, 62 had two episodes, 10 had three episodes, and two had four episodes.

Initial hospitalization

Table 2 presents the results of univariate and multivariate analysis of factors related to initial hospitalization for TB. Black race, age 65 and older, having acid-fast bacilli (AFB) positive sputum smears, HIV infection, and homelessness were all significantly related to initial hospitalization. Asians were significantly less likely to be initially hospitalized. Although not statistically significant at all sites, this increased risk of initial hospitalization for blacks and reduced risk for Asians was consistently found at every site. Black participants in this study were more likely to be HIV-positive, to use alcohol excessively, to use injecting or non-injecting drugs, or to be homeless; however, black participants with none of those characteristics were still significantly more likely to be hospitalized (OR 2.4, 95%CI 1.8–3.2). On the other hand, among Asians who were either homeless, using alcohol excessively, or using injecting or non-injecting drugs, the risk of initial hospitalization was significantly less than among non-Asians with those characteristics (OR 0.2, 95%CI 0.05–0.9). Participants from New York, Mississippi, Chi-cago, Houston and Los Angeles were significantly more likely to be hospitalized initially than participants from other sites, even after controlling for age, sex, race/ethnicity, HIV infection, homelessness, and sputum smear AFB positivity.

Hospitalization during treatment

Table 3 presents the results of univariate and multivariate analysis of risk factors for being hospitalized for TB during treatment, exclusive of initial hospitalizations. Race/ethnicity and sex were not significantly associated with hospitalization for TB during treatment. Persons aged 65 and older had an adjusted relative risk of 4.7 (95%CI 1.6–14.0) of being hospitalized during treatment compared to persons aged 15 to 24 (referent group).

Participants from New York had an adjusted relative risk of 4.1 (95%CI 1.5–10.8) of being hospitalized during treatment; participants from all the other sites were not significantly more or less likely to be hospitalized during treatment. Having multidrug-resistant TB (organism resistant to at least isoniazid and rifampin), using alcohol excessively, and being homeless were all significant risk factors for hospitalization during treatment.

Length of stay, and costs of TB-related hospitalizations

For all TB-related hospitalizations, the median LOS was 11 days, the median cost per day of hospitalization was $644, and the median cost per hospitalization episode was $7545. Table 4 presents the median LOS, the median cost per day, the median cost per episode, total hospitalization costs, and mean cost per case for each site. For nine of the 10 sites, the median LOS varied from 9 to 13 days; the median LOS was 17 days, for participants from New York. After adjustment for variations in the cost of living among the sites, the median cost per day varied from $490 in Georgia to $927 in Los Angeles; the median cost per episode at these 10 sites varied from $6441 in Georgia to $12 968 in New York, and the mean cost per case ranged from $4038 in San Francisco to $13 007 in New York.

Homeless persons comprise 9.9% of the study population aged 15 or older, but 15.9% of the hospitalization episodes and 17.7% of the total hospitalization costs were incurred by homeless persons (Table 5). Similarly, excess alcohol users, injecting drug users, and non-injecting drug users also have disproportionately more hospitalization episodes and greater costs. For participants aged 15 and older, hospitalizations occurring in homeless and/or substance abusers (36% of the sample) resulted in 54% of the total TB-related hospitalization costs. In contrast, the 64% of participants 15 years and older who were not homeless and were not reported as substance abusers incurred only 46% of the total TB-related hospitalization costs.

DISCUSSION

In the US, tuberculosis is no longer treated primarily in hospital; however, hospitalization remains an important component of care for TB patients. Almost 50% of the participants in our study were hospitalized at least once because of TB.

Our study is unique in following a cohort of reported patients from diagnosis and in having available data included in the RVCT. Other studies have examined causes and costs of TB-related hospitalizations, but have depended on hospital discharge records to identify those hospitalizations.[15–17] Our approach allowed us to determine the frequency of TB-related hospitalizations and to compare the characteristics of TB patients who were hospitalized with those who were not hospitalized.

One of the surprising findings of this study is the considerable variation in hospitalizations among the participating sites. Even after adjustment for other factors, participants in New York, Chicago, Mississippi, Los Angeles and Houston were significantly more likely to be hospitalized initially, and participants from New York were significantly more likely to be hospitalized during treatment of TB. It is possible that these findings are due to selection bias, as at two of the sites, Houston and New York State, the proportions of persons who agreed to participate were respectively 50% and 61% lower. In addition, in New York State, study participants were more likely to have been hospitalized compared to cases that declined to participate.

Geographic variations in rates of procedures, hospitalization, and other health care services have been noted for other conditions.[18–21] Since our study was based on persons diagnosed with active TB, the observed variations in hospitalization were not due to differences in the prevalence of TB at the different sites. Nor were they due to differences among the sites in demographics, homelessness, substance abuse, or HIV status of patients. There are several possible explanations for these observed variations in hospitalization: 1) differences in the severity of illness; 2) different patterns of practice; and 3) differences in alternatives for care.

It is not known whether the observed variations in hospitalization resulted from differences in the presenting condition of the patients, since we did not have a consistent measure of the severity of illness in the study participants. As more than 80% of the TB-related hospitalizations occurred at the time of diagnosis of TB and most of the variations in hospitalization among the sites were due to these initial hospitalizations, it may be that TB patients at these sites presented later in the course of their illness and were more severely ill. Episodes of hospitalization have been shown to increase when access to primary care services is not available,[22,23] and access to medical care early in the disease may differ among the areas.

Geographic variations in health care services have been shown to result from a lack of consensus among physicians as to whether treatment, hospital care, or procedure is efficacious or warranted.[20] Variations in hospitalization among these sites may result from differences in opinion concerning the use of hospitalization in the initial evaluation and treatment of patients who are not acutely ill or do not require isolation.

Variations may also result from a lack of alternatives to hospitalization such as convenient, comprehensive out-patient services. Our study found increased hospitalization for homeless persons and substance abusers. Homeless persons were significantly more likely to have TB-related hospitalizations at any time, while persons who use alcohol excessively were significantly more likely to be hospitalized during treatment. These groups were not mutually exclusive. Homeless participants in our study were more likely to use alcohol excessively and use injecting or non-injecting drugs than were persons with stable housing. Similarly, participants with substance abuse habits were more likely to abuse other substances and were more likely to be homeless. These problems with housing and substance abuse affect access to health care, which may result in delayed diagnosis and increased severity of the patient's illness. These in turn may result in increased hospital use. In addition, substance abusers may have increased rates of adverse drug reactions requiring hospitalization. Previous studies have shown that persons with substance abuse problems use more health care resources and are hospitalized for longer periods of time; these studies have noted the importance of stable housing in the treatment and case management of persons with TB.[24,25] Within these complex relationships of factors, lack of stable housing is predominant,[25,26] a finding supported by our study.

Although we were unable to determine the cause of the variations in hospitalization, we can observe the effects. The hospitalization costs were higher at sites with greater numbers of hospitalizations and were also higher for homeless persons and substance abusers. These findings have implications for hospitals and policymakers. There is a need to explore appropriate cost-effective alternatives to hospitalization by substituting more intensive out-patient case management for costlier in-patient care. Prevention of hospitalizations may be possible through better outreach and provision of primary care services to these homeless persons and substance abusers. In addition, provision of housing for homeless TB patients may be a cost-beneficial alternative to hospitalization.[27,28] Aggressively treating substance abuse problems, especially alcohol abuse, during treatment of TB may also reduce the need for expensive hospitalizations. An integrated, case management approach to TB care using public health nurses, physicians, social workers, and outreach staff can provide a comprehensive program of care needed by these populations.

There are some limitations to our study. The participating sites are predominantly urban, and patients agreeing to participate in this study are not necessarily representative of all TB patients. Given the lower proportions participating at some sites, it is possible that the results may be biased towards or against higher rates of hospitalization. Finally, as pointed out earlier in the discussion, the lack of a measure of disease severity limits the ability of our analysis to determine the true contribution of the different factors to increased rates of hospitalization.

Overall, our findings indicate that almost half of TB patients are hospitalized at least once during treatment for TB and that there are important differences in hospitalization among the different geographical locations participating in this study. There are also important social factors related to hospitalization. All of these factors justify careful evaluation to reduce the high economic and personal costs of potentially preventable hospitalizations.

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Table 1

Characteristics of study participants (%)

	Sites											
Characteristic	**CHI 189**	**DFW 197**	**GA 192**	**HOU 124**	**LA 270**	**MS 92**	**NY 68**	**SD 111**	**SF 137**	**SC 113**	**Total 1493**	**US (1995) 22 860**
Age group (years)												
0–4	6.3	2.5	7.8	8.1	4.4	15.2	0	7.2	0.7	8.0	5.8	4.0
5–14	3.2	1.5	2.6	3.2	4.1	2.2	0	2.7	1.5	5.3	2.8	2.8
15–24	5.3	9.1	7.3	7.3	11.9	4.3	17.6	10.8	6.6	3.5	8.3	7.5
25–44	41.3	42.6	43.2	45.2	38.1	29.3	45.6	39.6	36.5	37.2	40.1	36.1
45–64	31.2	28.9	30.7	33.9	27.8	31.5	16.2	27.0	29.2	25.7	28.9	26.2
65+	12.7	15.2	8.3	2.4	13.7	17.4	20.6	12.6	25.5	20.4	14.2	23.4
Male	68.2	61.9	66.2	74.2	61.1	71.7	58.8	66.7	65.0	65.5	65.5	63.4
Race/ethnicity												
Black, not Hispanic	67.2	32.0	76.0	50.0	15.6	60.9	22.1	9.0	11.7	72.6	41.5	33.0
White, not Hispanic	6.3	16.2	12.0	14.5	8.1	32.6	33.8	11.7	22.6	23.0	15.4	26.7
Hispanic	15.9	29.4	2.1	29.0	50.0	3.3	36.8	46.8	14.6	2.7	24.5	21.2
Asian/Pacific Islander	9.5	14.7	9.9	4.8	25.2	3.3	7.4	32.4	51.1	0.9	17.1	17.5
Other/Unknown	1.1	7.6	0	1.6	1.1	0	0	0	0	0.9	1.6	2.1
Homeless	3.7	9.1	7.8	4.8	5.9	2.2	2.9	8.1	16.8	2.6	6.8	6.3
Any substance abuse *	34.4	16.2	28.1	12.9	14.8	20.7	10.3	21.6	28.5	36.3	22.6	Not available
Excess alcohol use	27.5	11.7	25.0	10.5	11.9	19.6	4.4	19.8	21.2	31.0	18.4	15.9
Non-injecting drug use	14.8	5.1	10.9	3.2	6.3	6.5	4.4	5.4	16.8	13.3	8.9	7.5
Injecting drug use	8.5	4.1	1.6	0.8	1.9	1.1	5.9	0.9	8.0	0.9	3.4	4.3
HIV-positive	13.8	10.2	15.1	20.2	11.1	4.4	16.2	11.7	13.9	5.3	12.3	Not available
Foreign-born	11.0	36.2	13.1	20.0	69.2	5.4	50.0	70.3	63.5	2.6	36.1	34.7
DOT	54.9	47.0	70.7	85.7	33.6	100.0	66.2	38.9	31.1	77.5	55.6	21.6
Health department provider												
	56.7	90.1	83.4	100.0	82.3	100.0	73.4	47.2	81.5	99.1	81.0	69.2

* Any substance abuse: excess alcohol use and/or non-injecting drug use and/or injecting drug use noted on the RVCT form.

CHI = Chicago; DFW = Dallas/Fort Worth; GA = Georgia; HOU = Houston; LA = Los Angeles; MS = Mississippi; NY = New York; SD = San Diego; SF = San Francisco; SC = South Carolina; HIV = human immunodeficiency virus; DOT = directly observed treatment; RVCT = Report of a Verified Case of Tuberculosis.

Table 2

Factors related to TB-related initial hospitalizations

Factors	Hospitalized (%)	Crude OR (95%CI)	Adjusted OR (95%CI)
Race/ethnicity			
White	46.2	*	*
Black	61.4	1.9 (1.4–2.5)	1.8 (1.3–2.6)
Hispanic	43.9	0.9 (0.6–1.3)	1.0 (0.7–1.4)
Asian	24.8	0.4 (0.3–0.6)	0.5 (0.3–0.7)
Age group (years)			
15–24	40.3	*	*
25–44	49.0	1.4 (0.9–2.1)	1.1 (0.7–1.7)
45–64	48.0	1.4 (0.9–2.1)	1.3 (0.8–2.0)
65+	47.2	1.3 (0.8–2.1)	1.7 (1.0–2.9)
Female	44.7	*	*
Male	49.1	1.2 (0.9–1.5)	1.0 (0.7–1.2)
Site			
South Carolina	44.9	*	*
New York	72.1	3.2 (1.6–6.1)	5.5 (2.7–11.6)
Chicago	62.6	2.1 (1.2–3.4)	2.2 (1.3–3.7)
Mississippi	59.2	1.8 (1.0–3.3)	2.3 (1.2–4.5)
Houston	57.3	1.6 (1.0–2.8)	2.0 (1.1–3.7)
Georgia	54.1	1.4 (0.9–2.4)	1.5 (0.9–2.6)
Los Angeles	45.8	1.0 (0.6–1.7)	1.9 (1.1–3.4)
San Francisco	36.8	0.7 (0.4–1.2)	1.5 (0.8–2.7)
San Diego	32.0	0.6 (0.3–1.0)	1.1 (0.6–2.2)
Dallas/Fort Worth	29.1	0.5 (0.3–0.8)	0.7 (0.4–1.3)
Sputum smear-negative	35.8	*	*
Sputum smear-positive	63.3	3.1 (2.5–3.8)	2.9 (2.3–3.7)
HIV-negative	45.4	*	*
HIV-positive	62.3	2.0 (1.4–2.7)	1.8 (1.2–2.6)
Stable housing	46.4	*	*
Homeless	63.6	2.0 (1.3–3.1)	1.7 (1.1–2.8)

*Referent group.

OR = odds ratio; CI = confidence interval; HIV = human immunodeficiency virus.

Table 3

Factors related to hospitalization during TB treatment

Factors	Hospitalized (%)	Crude RR (95%CI)	Adjusted RR (95%CI)
Race/ethnicity			
White	9.0	*	*
Black	9.1	1.0 (0.9–1.2)	1.2 (0.7–2.1)
Hispanic	10.1	1.1 (0.8–1.3)	1.3 (0.7–2.3)
Asian	5.2	0.7 (0.5–1.1)	0.8 (0.4–1.7)
Age group (years)			
15–24	3.2	*	*
25–44	8.9	1.1 (1.0–1.3)	2.6 (0.9–7.2)
45–64	8.4	1.2 (1.0–1.4)	2.8 (1.0–8.2)
65+	10.9	1.4 (1.1–1.8)	4.7 (1.6–14.0)
Sex			
Female	6.9	*	*
Male	9.5	1.1 (1.0–1.3)	1.2 (0.8–1.9)
Site			
South Carolina	7.1	*	*
New York	17.7	1.7 (1.0–2.7)	4.1 (1.5–10.8)
Los Angeles	12.2	1.2 (0.9–1.4)	2.2 (0.9–5.3)
Mississippi	11.8	1.3 (0.8–2.2)	2.0 (0.7–5.3)
San Diego	10.0	1.2 (0.7–1.9)	1.8 (0.6–5.0)
Chicago	7.6	1.0 (0.7–1.4)	1.0 (0.4–2.5)
Georgia	7.6	1.0 (0.7–1.4)	1.2 (0.5–3.1)
San Francisco	6.7	1.0 (0.6–1.5)	1.0 (0.4–2.9)
Houston	5.5	0.9 (0.5–1.5)	1.2 (0.5–3.1)
Dallas/Fort Worth	3.7	0.8 (0.5–1.2)	0.7 (0.2–1.9)
Not MDR TB	8.0	*	*
MDR TB	37.5	6.5 (3.2–13.2)	5.7 (2.7–11.8)
No excess alcohol use	7.2	*	*
Excess alcohol use	13.8	1.7 (1.3–2.3)	1.9 (1.2–3.0)
Stable housing	7.7	*	*
Homeless	19.2	2.6 (1.6–4.1)	2.5 (1.5–4.3)

*Referent group.

Table 4

Length of stay and median costs of hospitalization episodes by site

Site	Median LOS per episode	Median cost per day	Median cost per episode	Total hospitalization costs	Mean cost per case*
Chicago	13	$602	$8 194	$1 414 554	$7 484
Dallas/Fort Worth	12	$743	$7 974	$1 351 104	$6 858
Georgia	11	$490	$6 441	$1 259 700	$6 561
Houston	9	$670	$5 703	$926 908	$7 475
Los Angeles	9	$927	$8 222	$2 025 330	$7 501
Mississippi	11	$710	$8 937	$953 145	$10 360
New York	17	$652	$12 968	$884 468	$13 007
San Diego	12.5	$556	$7 641	$914 946	$8 243
San Francisco	9	$624	$6 458	$553 169	$4 038
South Carolina	11	$730	$7 756	$598 474	$5 296
All sites	11	$644	$7 545	$10 881 799	$7 288

* Total hospitalization costs for participants from the site/total number of participants from site (including those not hospitalized).

LOS = length of stay.

Table 5

Number and total cost of hospitalization episodes by homelessness/substance abuse

Characteristic	Participants *n* (%)	Episodes *n* (%)	Total hospitalization cost (%)	Mean cost per case*
Homeless				
Substance abuse	108 (8)	106 (14)	$1 496 516 (14)	$13 856
No substance abuse	27 (2)	19 (2)	$342 680 (3)	$12 692
Not homeless				
Substance abuse	351 (26)	275 (35)	$3 752 677 (36)	$10 691
No substance abuse	879 (64)	385 (49)	$4 836 094 (46)	$5 502
Total	1365 (100)	785 (100)	$10 427 967 (100)	$7 640

*Total hospitalization costs for participants with characteristic/total number of participants with characteristic (including those not hospitalized).