

Hospitalization of Homeless Persons With Tuberculosis in the United States

ABSTRACT

Objectives. This study assessed whether homeless patients are hospitalized for tuberculosis (TB) more frequently and longer than other patients and possible reasons for this.

Methods. We prospectively studied hospitalizations of a cohort of TB patients.

Results. HIV-infected homeless patients were hospitalized more frequently than other patients, while homeless patients who had no insurance or whose insurance status was unknown were hospitalized longer. Hospitalization cost \$2000 more per homeless patient than for other patients. The public sector paid nearly all costs.

Conclusions. Homeless people may be hospitalized less if given access to medical care that provides early detection and treatment of TB infection and disease and HIV infection. Providing housing and social services may also reduce hospital utilization and increase therapy completion rates. (*Am J Public Health.* 2000;90:435–438)

Suzanne M. Marks, MPH, MA, Zachary Taylor, MD, Nilka Ríos Burrows, MT, MPH, Mohamed G. Qayad, MD, MSCM, MPH, and Bess Miller, MD, MSc

Homelessness is believed to increase rates and lengths of hospitalization for tuberculosis (TB).¹ Possible reasons for hospitalization of the homeless include the following: lack of regular medical providers or money to pay them, severity of disease, adverse reactions to TB medications due to alcohol or drug abuse, a decision by providers to hospitalize to ensure adherence, or, simply, because they have no place to stay.

In 1997, the Centers for Disease Control and Prevention (CDC) reported 1242 TB cases among homeless persons.² The proportion of reported cases accounted for by homeless persons has increased from 5.7% in 1994 to 6.5% in 1997, suggesting that TB remains a problem for the homeless despite overall declines in US TB cases since 1992.^{2–5}

To decrease inpatient TB costs, which make up 60% of direct costs of caring for US TB patients,⁶ we need to know who is hospitalized and why. This study tested the hypothesis that homeless patients are hospitalized for TB more frequently and longer than other TB patients. Hospitalization rates, lengths, and costs were examined, and factors associated with homelessness were identified to assess reasons for TB hospitalizations.

Methods

We prospectively studied a cohort of 1493 patients with TB disease reported to the CDC by 10 US TB programs during 6 months in 1995 to examine their medical records and assess reasons for TB hospitalizations. The composition of the cohort and data collection methods are described elsewhere (Z. Taylor et al., [zxt0@cdc.gov] unpublished data, September 1999).

The following TB hospitalization outcomes were measured: rates, lengths of stay, and costs. The hospitalization rate was calculated by dividing the number of TB hospitalizations by the number of person-days from TB diagnosis until therapy ended. Charges were converted to costs,⁷ adjusted to a US average,⁸ and converted to 1997 dollars.⁹ Physician costs were not included. Lengths of stay and costs were aggregated for all TB hospitalizations per patient. Median values of lengths of stay and costs are reported. Analyses were limited to participants aged 15 years and older (n = 1365).

Factors associated with homelessness were assessed by Mantel-Haenszel relative risk statistics. For multivariate analyses, we used Cox proportional hazards models to analyze separately the outcome variables of hospitalization rate and length of stay. Included in the models were potential confounders and interactions with the exposure variable of homelessness. Risk ratios, with their associated 95% confidence intervals, were calculated. Patients who died or who were discharged against medical advice were excluded from the multivariate analysis of hospitalization length because, owing to physician decisions, they did not have the same opportunity as the other patients for lengthy hospital stays.

Results

Homeless TB Patients vs Other TB Patients

Compared with other TB patients, homeless TB patients were more likely to be male, aged 25 to 44 years, or non-Hispanic Black. They were less likely to be aged 15 to 24 years, older than 64 years, foreign born, or Asian/Pacific Islander.

Homelessness, HIV status, and substance abuse were significantly correlated. Twenty-five percent of homeless patients were HIV positive, compared with 12% of other patients. Over 60% of homeless patients were substance abusers: half abused alcohol, one third used noninjection drugs, and one seventh were injection drug users. Men abused alcohol and other substances more often than did women. Among HIV-infected patients, 26% of substance abusers were homeless, compared with 6% of non-substance abusers.

Seventy percent of homeless patients were hospitalized at least once for TB, compared with 50% of other patients. An addi-

At the time of the study, all of the authors worked for the Division of Tuberculosis Elimination, National Center for HIV, STD, and TB Prevention, Centers for Disease Control and Prevention, Atlanta, Ga.

Requests for reprints should be sent to Suzanne M. Marks, MPH, MA, CDC/NCHSTP/DTBE, MS E-10, 1600 Clifton Rd, Atlanta, GA 30333. (e-mail: sgm3@cdc.gov).

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tional 6% of homeless patients with TB and 6% of other TB patients were hospitalized during the study period for reasons other than TB.

Hospitalized Homeless TB Patients vs Other Hospitalized TB Patients

Fifteen percent of patients hospitalized for TB were homeless. Eighteen percent of homeless patients were hospitalized for TB more than once (14% twice, 4% thrice), compared with 8% of other patients.

The demographics of hospitalized homeless TB patients reflected the distribution of all homeless TB patients in this study. Compared with nonhomeless TB patients, a greater percentage of homeless patients were residing in correctional facilities when they were diagnosed with TB. Eighty-four percent of hospitalized homeless TB patients were substance abusers, of whom 75% used alcohol excessively, 23% were injection drug users, and 48% were noninjection drug users. Homeless hospitalized TB patients were more likely to be HIV infected (26%) than nonhomeless TB patients (17%).

Eighty-four percent of homeless TB patients (vs 56% of other TB patients) were treated in public rather than private hospitals. Homeless patients, especially those who were HIV infected, entered the hospital through the emergency room more often than did other patients. Nearly half of homeless patients had no medical insurance or unknown insurance status (no/unknown insurance), compared with a third of other patients. HIV-infected homeless patients were more likely than other homeless patients to have government insurance, with two thirds covered by Medicaid, Medicare, the Veterans Administration, or state/local governments; the remaining third had no/unknown insurance.

After stratifying the cohort by HIV status, we found that homeless patients were not more likely to be acid-fast-bacilli smear positive or to have cavitary or multidrug-resistant disease. Examining hospital discharge diagnoses, we found that homeless patients were not more likely than others to have cancer, heart disease, or respiratory diseases other than TB. However, homeless patients were more likely to be diagnosed with drug/alcohol dependence or with HIV disease than others.

TB therapy completion rates were lower (although the difference was not statistically significant) for nonhospitalized homeless patients (79%) than for hospitalized homeless patients (91%). Completion rates for nonhomeless nonhospitalized and hospitalized patients were identical (93%).

Hospitalization Rates

Homeless patients had the highest rate of TB hospitalization (107.3 hospitalizations per 100 person-years, compared with 70.4 for other patients) among patients grouped by characteristic. The multivariate model indicated that HIV-infected homeless patients were hospitalized at a higher rate than other patients, after race/ethnicity and alcohol abuse were controlled for. Homeless patients who were uninfected with HIV or whose HIV status was unknown and HIV-infected nonhomeless patients were not more likely to be hospitalized than nonhomeless patients who were not infected with HIV (Table 1).

Lengths of Stay and TB Hospitalization Costs

The median length of stay was 18 days for homeless patients, compared with 12 days for other patients. The multivariate model indicated that homeless patients with no/unknown medical insurance were hospitalized significantly longer than others, after age, race/ethnicity, residence in a correctional or long-term care institution, multidrug-resistant TB, and alcohol abuse were controlled for. Those who had insurance did not have significantly longer stays than other patients (Table 2).

Both increased hospitalization rates and longer stays resulted in greater average hospitalization costs for homeless patients than for nonhomeless patients (\$9834 vs

\$7967). The homeless disproportionately represented more hospital patients, episodes, days, and costs than did their 10% composition of the cohort (Figure 1). Public sources paid directly for 50% of hospitalized homeless patients through government insurance. Since 84% of homeless patients were treated in public hospitals and half had no/unknown insurance, public sources paid for an additional 42% of homeless patients. Consequently, the public sector paid the hospitalization costs for nearly all (92%) homeless patients.

Discussion

HIV-infected homeless patients were hospitalized with TB more frequently than nonhomeless HIV-infected patients, while homeless TB patients with no/unknown insurance were hospitalized longer than other TB patients. Hospitalization cost \$2000 more per homeless patient than for other patients—a minimum estimate, since it excludes physician costs. The public sector paid nearly all these costs. Lack of stable housing may have been the primary reason for increased hospital utilization. However, greater disease severity (due to HIV and substance abuse) and lack of access to early medical care may have contributed to increased hospital utilization.

We found that homeless TB patients were more likely than other TB patients to have drug/alcohol dependence or HIV. Our findings are consistent with those of a Boston

TABLE 1—Risk of Tuberculosis (TB) Hospitalization

Factors Related to TB Hospitalization Rate	Unadjusted Risk Ratio (95% CI)	Adjusted Risk Ratio (95% CI)
Homelessness	1.43 (1.16, 1.75)	1.14 (0.90, 1.45)
Male	1.09 (0.97, 1.22)	...
Age, y		
15–24	0.86 (0.72, 1.04)	...
25–44	1.05 (0.95, 1.17)	...
45–64	0.82 (0.88, 1.11)	...
65 and older	1.03 (0.89, 1.19)	...
Race/ethnicity		
Non-Hispanic White	0.92 (0.87, 1.16)	...
Non-Hispanic Black	1.36 (1.22, 1.51)	1.19 (1.05, 1.34)
Hispanic	0.96 (0.84, 1.08)	...
American Indian/Alaska Native	3.25 (1.54, 6.84)	...
Asian/Pacific Islander	0.70 (0.61, 0.80)	0.80 (0.68, 0.93)
Foreign born	0.75 (0.67, 0.84)	...
Substance use		
Excess alcohol	1.34 (1.17, 1.53)	1.17 (1.02, 1.35)
Injection drug	1.32 (1.00, 1.75)	...
Noninjection drug	1.22 (1.02, 1.46)	...
HIV+	1.23 (1.05, 1.44)	1.05 (0.89, 1.24)
Homeless HIV+	2.42 (1.62, 3.59)	1.72 (1.06, 2.80)

Note. CI = confidence interval.

TABLE 2—Risk of Long Tuberculosis Hospitalization

Factors Related to Long Hospital Stays	Unadjusted Risk Ratio (95% CI)	Adjusted Risk Ratio (95% CI)
Homelessness	1.54 (1.23, 1.92)	1.13 (0.83, 1.53)
Male	1.19 (1.01, 1.41)	...
Age, y		
15–24	1.03 (0.77, 1.38)	
25–44	0.76 (0.66, 0.89)	0.67 (0.57, 0.78)
45–64	1.16 (0.99, 1.37)	...
65 or older	1.23 (1.00, 1.52)	...
Race/ethnicity		
Non-Hispanic White	1.20 (0.97, 1.47)	...
Non-Hispanic Black	1.11 (0.95, 1.29)	...
Hispanic	0.93 (0.77, 1.11)	...
American Indian/Alaska Native	0.28 (0.13, 0.59)	...
Asian/Pacific Islander	0.69 (0.54, 0.88)	0.72 (0.55, 0.93)
Foreign born	0.79 (0.67, 0.94)	...
Substance use		
Excess alcohol	1.19 (1.02, 1.38)	1.18 (1.00, 1.40)
Injection drug	1.16 (0.88, 1.53)	...
Noninjection drug	1.11 (0.92, 1.34)	...
HIV+	1.06 (0.88, 1.29)	...
Sputum smear+	1.20 (1.03, 1.39)	...
Cavitary disease	1.02 (0.87, 1.21)	...
Multidrug-resistant TB	1.42 (0.86, 2.33)	2.08 (1.25, 3.46)
Correctional facility resident	2.42 (1.66, 3.53)	2.82 (1.89, 4.22)
Long-term care-resident	1.74 (1.14, 2.63)	1.78 (1.16, 2.73)
Public hospital	1.13 (0.96, 1.32)	...
Emergency room admission	0.91 (0.78, 1.07)	...
Private insurance	0.62 (0.49, 0.78)	0.67 (0.52, 0.85)
Government insurance	1.28 (1.10, 1.48)	...
No/unknown insurance	0.93 (0.80, 1.09)	0.82 (0.69, 0.99)
Homeless HIV+	1.13 (0.74, 1.73)	...
Homeless uninsured	1.75 (1.28, 2.40)	1.84 (1.17, 2.90)

Note. CI = confidence interval.

study of AIDS patients; this suggests that substance abusers are more likely to be homeless.¹⁰ However, after controlling for substance abuse, we found that the risk of TB hospitalization was influenced by the combination of HIV and homelessness rather than by homelessness or HIV alone. Homeless persons with HIV and TB are probably more ill than persons with TB alone and thus require hospitalization.

Since data on insurance status, as an indicator of income and early access to medical care, were unavailable for all TB patients, it was impossible for us to determine the effect of insurance status on the hospitalization rate. However, there is evidence in the literature that lack of income and/or insurance may result in hospital utilization when there are no alternatives^{11,12} and that providing access to medical care may reduce utilization without reducing adherence to medications.^{13,14}

We found that homeless patients with no insurance or unknown insurance status had significantly longer hospital stays than did other patients. It may take providers longer to link uninsured patients to services and to plan for their management through the completion of TB treatment than it does for other patients. Having no alternatives, physicians may hospitalize these homeless patients longer than is medically indicated.¹⁵

Homelessness also affects adherence to TB treatment. A study in New York City

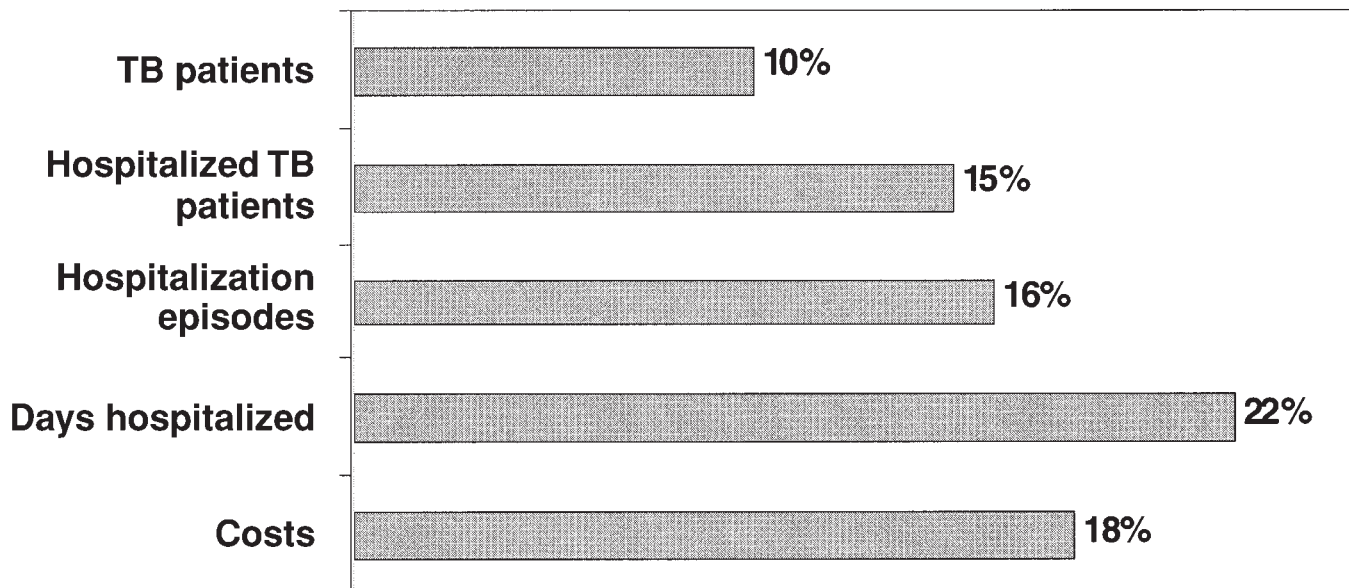


FIGURE 1—Representation of homeless patients in the cohort.

reported a significant association between homelessness and nonadherence to TB treatment.¹⁶ In another report, Moore et al. documented lower TB therapy completion rates for homeless patients than for other patients.¹⁷ We found lower TB therapy completion rates for nonhospitalized homeless patients than for hospitalized homeless patients. These lower rates reflect frequent moves, losses to follow-up, refusals, or other reasons for not completing therapy. Hospitalizing homeless patients may allow providers to monitor clinical response to therapy and ensure adherence to TB treatment. However, provision of housing along with access to care may offer similar benefits at lower cost.^{18,19}

In 1992, the CDC recommended the establishment of special treatment-housing centers to provide continuous shelter, food, and treatment for homeless TB patients for the duration of their therapy.²⁰ However, Brudney cautions about the need to provide directly observed therapy in such locations and to monitor housing quality; crowded shelters are especially inappropriate for homeless AIDS patients.²¹ Housing funding is available from the US Department of Housing and Urban Development through Continuum of Care Homeless Assistance Awards, the Shelter Plus Care Program, or Housing Opportunities for Persons With AIDS (US Dept of Housing and Urban Development, Community Connections [1-800-998-9999]). However, the need exists for the provision of stable housing for TB patients who do not qualify for existing programs or who reside in areas without current funding.

Limitations

One limitation of this study is that the cohort was not necessarily representative of US TB patients. Florida, New Jersey, and New York City, which report high rates of HIV/TB and multidrug-resistant TB, were not represented. However, data from Moore et al. confirm that the proportion and the characteristics of the study's homeless cohort were similar to those of all homeless TB patients from 1994 to 1996.¹⁷

Another limitation is the underreporting of HIV infection because providers may not offer HIV testing to all TB patients, despite the fact that testing is recommended, and because those offered testing may refuse. In addition, state laws and regulations or confidentiality concerns may limit data exchange among TB programs, health providers, and HIV/AIDS programs.

Conclusion

Since the public sector pays nearly all the costs of hospitalizing homeless TB patients, a societal perspective is necessary to determine a cost-beneficial reallocation of resources. It may be possible to reduce hospitalization frequency and length by providing the homeless with access to primary care services to detect TB infection, active TB disease, and HIV infection and to provide care coordination and preventive medications for TB and AIDS. The provision of housing, along with needed social services, may also reduce hospitalization and increase TB treatment completion rates. These alternatives are reasonable and may be more cost-beneficial than greater hospital utilization by homeless TB patients. □

Contributors

S. M. Marks coordinated final data collection, determined data analysis methods, analyzed the data, and wrote the paper. Z. Taylor assisted in designing the study, interpreting the data analysis, and editing the paper. N. Ríos Burrows coordinated site involvement, supervised data collection, and assisted in editing the paper. M. G. Qayad assisted in determining the data analysis methods, interpreting the results, and editing the paper. B. Miller designed the study and contributed to editing the paper.

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