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Housing insecurity and lack of public assistance are risk factors for tuberculin skin test conversion among persons who use illicit drugs in New York City

Sumathi Sivapalasingam, MD¹, Robert S. Klein, MD², Andrea Howard, MD, MS³, Angie Qin, MS⁴, Chi-hong Tseng, PhD⁴, and Marc N. Gourevitch, MD, MPH⁵

¹ Division of Infectious Diseases, Department of Medicine, New York University School of Medicine, New York, NY, 10016

² Division of Infectious Diseases, Department of Medicine and Department of Epidemiology and Population Health, Montefiore Medical Center and Albert Einstein College of Medicine, Bronx, NY, 10467

³ Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, NY, 10032

⁴ Department of Environmental Medicine and Biostatistics, New York University School of Medicine, New York, NY, 10016

⁵ Division of General Internal Medicine, Department of Medicine, New York University School of Medicine, New York, NY, 10016

Abstract

Background—Persons who use illicit drugs are at increased risk of new tuberculosis (TB) infection. We conducted a prospective cohort study to assess rates and risk factors for tuberculin skin test (TST) conversion among persons with a history of illicit drug use, who were enrolled in a methadone program and had a negative baseline 2-step TST (eligible participants).

Methods—TST and standardized interviews were administered to 401 eligible participants from 1995 through 1999, every 6 months for a 2-year follow-up time. Analyses were conducted in 2006.

Results—A total of 1,447 repeat TSTs were performed during 843 person-years of follow-up (median: 2.0 years). The TST conversion rate was 3.7 per 100 person-years. In multivariate analysis, participants who converted were more likely to report ever having been homeless (HR, 2.4; 95% CI, 1.2–5.0) or ever having lived in a homeless shelter (HR, 2.4; 95% CI, 1.2–4.9) at the baseline interview, and less likely to have reported receiving public assistance since the last study visit (RR, 0.15; 95% CI, 0.07–0.32).

Conclusions—This is the first study utilizing 2-step TST at baseline to measure the incidence of TST conversion among persons who use illicit drugs. Controlling for homelessness, persons with a lack of current public assistance was identified as a risk factor for TST conversion. These individuals may most benefit from annual tuberculin skin testing.

Address correspondence and requests for reprints to: Marc N. Gourevitch, MD, MPH, 550 First Ave., OBV-616, New York NY 10016, Marc.Gourevitch@nyumc.org.

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Keywords

substance use; tuberculin skin test; tuberculosis; urban; New York City

The incidence of tuberculosis (TB) has decreased in the last decade in New York City and throughout the United States (U.S.) largely due to strengthened public health interventions.¹ In New York City, the rate of TB declined from 51.1 cases per 100,000 persons in 1992, to 13.0 in 2004.² However, some populations remain at high risk for TB infection, including persons who use illicit drugs, the homeless and the incarcerated.^{2–4}

Studies conducted in the U.S. have demonstrated high prevalence rates (14%–32%) of latent TB infection (LTBI) among persons who use illicit drugs.^{5, 6, 7, 8} Though all persons who use illicit drugs are considered to be at elevated risk of TB exposure,³ it is unclear whether sub-groups are at particularly high risk for new TB infection who may warrant closer surveillance and preventive interventions. To define risk factors for incident TB infection in persons who use illicit drugs, prospective data are required. Yet few published studies report TST conversion rates in this population,^{5, 9} and none does so following 2-step testing at baseline to distinguish boosted reactions from new TST conversions. We therefore conducted a prospective study in a well characterized cohort of persons who use illicit drugs attending a methadone clinic in New York City who underwent tuberculin skin testing at regular intervals to identify risk factors for incident TB infection.

Methods

Subjects were recruited from among participants in the Bronx HIV Epidemiologic Research on Outcomes (HERO) study. Initiated in 1985, HERO was a longitudinal study of HIV infection among persons with a history of current or past use of illicit drugs, with and without HIV infection, enrolled from a methadone treatment program in the Bronx, New York.¹⁰ At baseline and semi-annual study visits, data were collected on socio-demographic variables, medical history and behaviors, and blood was drawn for HIV antibody and CD4 T-cell lymphocyte studies.

From May, 1995 through December, 1998, participants in the HERO study were offered enrollment in a sub-study to examine *Mycobacterium tuberculosis* (TB) infection incidence rates in persons who use illicit drugs. Sub-study visits coincided with HERO semi-annual visits, with additional information collected on housing status, employment history, prior incarceration, and tuberculosis exposure using a supplemental standardized interview. Tuberculosis sub-study visits took place from 1995 to 1999.

Participants without a history of severe local reaction to TSTs underwent 2-step tuberculin testing, regardless of whether they reported a prior positive tuberculin reaction. A dose of 5-tuberculin unit purified protein derivative (PPD; Tubersol; Connaught Laboratories, Ontario, Canada) was administered as previously described⁶. All participants with a negative baseline TST test received a second (“booster”) TST 1 week later (2-step test) and underwent follow-up TST placement semi-annually. For the present study, we included only participants with a negative booster TST and at least one documented follow-up TST. The study protocol was approved by the Institutional Review Board of Montefiore Medical Center.

Tuberculin negativity was defined as < 5 mm induration in HIV-seropositive individuals and as < 10 mm in HIV-seronegative individuals in response to both baseline and booster PPD tests.³ TST conversion for persons who undergo repeat skin testing was defined as an increase in reaction size of ≥10 mm and is thought to be indicative of recent infection with *M. tuberculosis*.³¹

A reported “significant TB contact” was defined as living, working, or spending ≥ 2 hours weekly with someone believed by the participant to have active TB in the preceding six months. A history of heavy alcohol consumption was considered present if two or more positive responses were given to the CAGE questions, referring to the previous six months¹¹. A person was identified as receiving “public assistance” if they reported receiving any of the following forms of aid: Aid to Families with Dependent Children; disability benefits; Home Relief Welfare; Social Security; unemployment benefits; food stamps; rent supplementation; NY State Division of AIDS Services benefits; or Veterans’ Benefits.

Statistical analysis

TST conversion rates are reported as incidence densities (TST conversions per 100 person-years) to allow for the differing durations of observation¹². For each individual, the period of observation began on the date of the first documented negative booster TST results and ended on the earliest of the following dates: TST conversion, loss to follow-up, or final follow-up visit for subjects who completed the study.

With the exception of variables recorded only at baseline (e.g., sex, age, ever been homeless and other “ever” variables), predictor variables for TST conversion were those reported for the period since the previous study visit.

Predictors of TST conversion (hazard ratios and 95% confidence intervals [CI]) were calculated using Cox proportional hazards regression with time-dependent and non-time dependent covariates. The covariates “ever homeless” and “ever live in a shelter” were highly correlated. Therefore the combined term of “ever homeless or lived in a shelter” was used in the final multivariate model. Backward selection was used to select the final model from factors whose *P* value was <0.20 in univariate analysis. A two-sided *P* value of < 0.05 was considered significant in the final model.

Results

A total of 793 HERO study participants enrolled in the Tuberculosis Sub-study and had at least one TST performed. Of 417 persons with negative baseline and booster TST results, 401 had at least one follow-up TST result available, and these participants comprised the sample for the current study (Figure 1). In this group, a total of 1,447 repeat TSTs were performed during 843 person-years of follow-up (median: 2.0 years).

Table 1 shows the baseline characteristics of the 401 participants. The median age was 43 years, 237 (59%) were males, 277 (69%) were African-American, and 133 (33%) were HIV positive. Among the 129 HIV positive persons with CD4 cell count available at baseline, the median CD4 lymphocyte count was 338 (range, 6–1,732 cells/mm³) and 39 (30%) had CD4 ≤ 200 cells/mm³. A substantial proportion of participants reported a baseline history of ever having been incarcerated (65%), been homeless (38%) or living in a shelter (25%), and having ever injected drugs (55%).

TST conversion rates

Thirty-one (8%) TST conversions occurred among 401 participants during the study period. The incidence density was 3.68 cases per 100 person-years during 843 person-years of follow

³Analysis using the HIV-specific definition for a TST converter identified the same risk factors as the analysis using the CDC definition (data not shown).

¹The standard CDC definition³ does not differentiate between persons who are HIV infected and uninfected. Therefore, we also analyzed the data using a second definition for TST conversion: an absolute induration size of > 5 mm after a previously negative TST test in HIV-infected persons and an increase in induration size of ≥ 10 mm in all others. We refer to this definition as the “HIV-specific definition.”

up (95% confidence interval [95% CI], 2.50–5.22). The TST conversion rate by HIV status was 4.46 per 100 person-years among HIV-uninfected subjects and 1.92 per 100 person-years among HIV-infected subjects (hazard ratio [HR], 0.42, 95% CI, 0.16–1.1) (Table 1).²

The median time to conversion was 1 year (range, 0.50–3.00). The TST conversion rate in the first 6 months after the negative booster TST was 6.06 per 100 person-years, followed by conversion rates ranging from 0 to 1.31 per 100 person-years in each subsequent 6 month period (Figure 2). The mean size of TST induration at time of conversion was similar for those who converted ≤ 6 months and > 6 months after a negative booster ($p=0.42$). Among 13 persons converting within the 6 months following baseline TST, 62% of them converted in 1996 and 38% converted in 1997. Among 18 participants converting > 6 months following baseline TST, 22% converted in 1996, 22% in 1997, and 50% in 1998.

Predictors of TST conversion

In univariate analysis (Tables 1 and 2), participants who converted were more likely to have a baseline history of ever having been homeless (HR, 2.44; 95% CI, 1.20–4.99) or ever having lived in a shelter (HR, 2.38; 95% CI, 1.16–4.88), and were less likely to have received public assistance in the inter-current period before conversion (RR, 0.15; 95% CI, 0.07–0.32).

Although not statistically significant, hazard ratios for TST conversion were increased for the following factors: male sex, being homeless since last interview, being foreign born, a baseline history of being incarcerated, and living in a shelter since last interview. Current illicit drug use or report of contact with a person with active tuberculosis was not significantly associated with TST conversion.³

Independent predictors of TST conversion on multivariate analysis included a baseline history of homelessness or having lived in a shelter and an inter-current history of not having been on public assistance since the previous study visit (Table 3).

Discussion

In this prospective study of current and former users of illicit drugs attending a methadone clinic in New York City, the rate of TST conversion was 3.68 cases per 100 person-years. A history of ever having been homeless or ever having lived in a shelter significantly increased the risk of TST conversion, while receipt of public assistance since last interview was significantly associated with a decreased risk of conversion. Although the association did not reach statistical significance, persons who use illicit drugs who converted were 3.11 times more likely to have been homeless since the last interview, compared to those who did not convert. This weak association likely reflects the modest number of converters in our sample; a larger study would likely have found a more robust association between recent homelessness or shelter living and new TB infection.

The incidence of tuberculosis decreased by 40% in New York City during the study period, from 33.4 per 100,000 persons in 1995 to 19.9 in 1999.¹³ This may explain our finding of higher conversion rates in the period soon after baseline testing, since 8 (62%) of 13 of these early conversions occurred in 1996 when the risk of TB exposure was higher than in subsequent study years.

²HIV-specific definition: When the HIV-specific definition for TST conversion was used, there were an additional nine HIV-infected converters identified, for a total of 40 (10%) converters and a conversion rate of 4.74 per 100 person-years (95% CI, 3.39–6.46). Among the nine additional HIV-infected converters identified, the increase in induration that resulted in their classification as converters was 5 mm (n=4), 6 mm (n=3), 7 mm (n=1) and 9 mm (n=1). The median CD4 cell count of these nine participants did not differ significantly between baseline and time of conversion (316 vs. 323/mm³, $P=0.198$).

TB transmission among homeless persons continues to be substantial despite decreasing incidence in the general population, as witnessed by reports of outbreaks of disease in homeless shelters in the U.S.^{15–17} In New York City, from 2001 through 2003, the average annual age-adjusted TB rate among homeless persons living in shelters was 176 per 100,000 population, compared to the citywide average annual age-adjusted TB rate of 4 per 100,000¹⁸. TB disease characteristics in homeless persons may also contribute to higher transmission in this population.¹⁹ One recent study found that compared with non-homeless persons, homeless persons were more likely to have pulmonary TB disease that was culture- or smear-positive disease, making them more infectious than non-homeless persons with TB.¹⁹ Furthermore, homeless persons with TB disease were less likely to complete a course of TB treatment.¹⁹ Finally, there is increased opportunity for transmission of TB in congregate settings for the homeless, such as shelters. Therefore, it is not surprising that our study identified housing insecurity to be a key risk factor for TST conversions in persons who use drugs.

Although there was a significant association between low rates of TST conversion and receipt of public assistance since last interview, the receipt of such assistance may merely represent persons who use illicit drugs who are highly motivated to obtain such assistance and, similarly, may be motivated to avoid exposure to persons with active TB or areas of high TB transmission, such as shelters. Because this is an observational study and risk factors were self-reported, we cannot determine a causal relationship between public assistance and lower TB infection rates.

The present study did not find a significant association between current drug use or alcohol consumption and TST conversion, although previous reports have demonstrated that high rates of TB transmission can occur in places where drug use and alcohol consumption occur.²⁰²¹ Several studies have also reported that a history of crack cocaine or injection drug use are independent risk factors for prevalent LTBI among persons who use illicit drugs.^{6, 7, 9} Indeed, one of these studies found that 38% of persons who use illicit drugs who used drugs for > 30 years were TST positive compared to 11% who used for ≤ 10 years ($P=0.001$).⁷ That a longer duration of drug use was a risk factor for being TST positive suggests that persons who use illicit drugs are at ongoing risk for infection and should be screened for latent TB in a periodic manner rather than a sporadic one.⁷ Our data suggest that persons with a history of illicit drugs use who report housing insecurity may especially benefit from annual testing for LTBI through earlier detection of new infection.³

This study has several limitations. Some risk factors for TST conversion, such as recent contact with persons with active TB or recent drug use were identified by self-report, and therefore may be inaccurate. A history of BCG vaccination was not included in our analysis. Several studies have highlighted the possibility of boosting among BCG-vaccinated individuals who subsequently receive repeat TST testing.^{22–24} We used 2-step testing to avoid misclassifying boosting as a new TST conversion. Finally, we were unable to exclude the possibility that a delayed booster phenomenon was the reason for the high proportion of converters identified within the first 6 months of their negative booster test.

In summary, a history of unstable housing identified persons who use illicit drugs at highest risk for TST conversion. Such persons would likely benefit from annual screening for latent TB infection even if not enrolled in methadone treatment. The association of receipt of public assistance with lower TST conversion rates among persons who use drugs lends urgency to calls for sustaining health insurance and related benefits in marginalized populations to benefit individual health and improve public health²⁵.

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References

1. Trends in tuberculosis incidence--United States, 2006. *MMWR Morb Mortal Wkly Rep* 2007;56:245–250. [PubMed: 17380106]
2. New York City Department of Health and Mental Hygiene. Tuberculosis Annual Summary. [Accessed August 08, 2008]. <http://www.nyc.gov/html/doh/html/tb/tb-reports.shtml>
3. Targeted tuberculin testing and treatment of latent tuberculosis infection. American Thoracic Society. *MMWR Recomm Rep* 2000;49:1–51.
4. Reichman LB, Felton CP, Edsall JR. Drug dependence, a possible new risk factor for tuberculosis disease. *Arch Intern Med* 1979;139:337–339. [PubMed: 426578]
5. Selwyn PA, Hartel D, Lewis VA, et al. A prospective study of the risk of tuberculosis among intravenous drug users with human immunodeficiency virus infection. *N Engl J Med* 1989;320:545–550. [PubMed: 2915665]
6. Howard AA, Klein RS, Schoenbaum EE, Gourevitch MN. Crack cocaine use and other risk factors for tuberculin positivity in drug users. *Clin Infect Dis* 2002;35:1183–1190. [PubMed: 12410478]
7. Salomon N, Perlman DC, Friedmann P, Ziluck V, Des Jarlais DC. Prevalence and risk factors for positive tuberculin skin tests among active drug users at a syringe exchange program. *Int J Tuberc Lung Dis* 2000;4:47–54. [PubMed: 10654644]
8. Friedman LN, Sullivan GM, Bevilacqua RP, Loscos R. Tuberculosis screening in alcoholics and drug addicts. *Am Rev Respir Dis* 1987;136:1188–1192. [PubMed: 3674581]
9. Durante AJ, Selwyn PA, O'Connor PG. Risk factors for and knowledge of *Mycobacterium tuberculosis* infection among drug users in substance abuse treatment. *Addiction* 1998;93:1393–1401. [PubMed: 9926545]
10. Schoenbaum EE, Hartel D, Selwyn PA, et al. Risk factors for human immunodeficiency virus infection in intravenous drug users. *N Engl J Med* 1989;321:874–879. [PubMed: 2770823]
11. Ewing JA. Detecting alcoholism. The CAGE questionnaire. *Jama* 1984;252:1905–1907. [PubMed: 6471323]
12. Rothman, KJ.; Greenland, S. *Modern epidemiology*. 2. Philadelphia, PA: Lippincott-Raven; 1998.
13. New York City Department of Health and Mental Hygiene. Bureau of Tuberculosis Control New York City, Information Summary. 1999 [Accessed February 15, 2008]. <http://www.nyc.gov/html/doh/html/tb/tb-arch-ar.shtml>
14. Targeted tuberculin testing and treatment of latent tuberculosis infection. *Am J Respir Crit Care Med* 2000;161:S221–247. [PubMed: 10764341]
15. Tuberculosis transmission in a homeless shelter population--New York, 2000–2003. *MMWR Morb Mortal Wkly Rep* 2005;54:149–152. [PubMed: 15716807]
16. Public health dispatch: tuberculosis outbreak in a homeless population--Portland, Maine, 2002–2003. *MMWR Morb Mortal Wkly Rep* 2003;52:1184. [PubMed: 14654768]
17. Lofy KH, McElroy PD, Lake L, et al. Outbreak of tuberculosis in a homeless population involving multiple sites of transmission. *Int J Tuberc Lung Dis* 2006;10:683–689. [PubMed: 16776457]
18. Macaraig M, Agerton T, Driver CR, et al. Strain-specific differences in two large *Mycobacterium tuberculosis* genotype clusters in isolates collected from homeless patients in New York City from 2001 to 2004. *J Clin Microbiol* 2006;44:2890–2896. [PubMed: 16891508]
19. Haddad MB, Wilson TW, Ijaz K, Marks SM, Moore M. Tuberculosis and homelessness in the United States, 1994–2003. *Jama* 2005;293:2762–2766. [PubMed: 15941806]
20. Leonhardt KK, Gentile F, Gilbert BP, Aiken M. A cluster of tuberculosis among crack house contacts in San Mateo County, California. *Am J Public Health* 1994;84:1834–1836. [PubMed: 7977929]
21. Kline SE, Hedemark LL, Davies SF. Outbreak of tuberculosis among regular patrons of a neighborhood bar. *N Engl J Med* 1995;333:222–227. [PubMed: 7791838]
22. Kraut A, Coodin M, Plessis R, McLean D. Predictors of positive tuberculin skin test (TST) results after 2-step TST among health care workers in Manitoba, Canada. *Clin Infect Dis* 2004;39:e113–118. [PubMed: 15578349]

23. Horowitz HW, Luciano BB, Kadel JR, Wormser GP. Tuberculin skin test conversion in hospital employees vaccinated with bacille Calmette-Guerin: recent *Mycobacterium tuberculosis* infection or booster effect? *Am J Infect Control* 1995;23:181–187. [PubMed: 7677263]
24. Hoft DF, Tennant JM. Persistence and boosting of bacille Calmette-Guerin-induced delayed-type hypersensitivity. *Ann Intern Med* 1999;131:32–36. [PubMed: 10391813]
25. Pollack HA, Reuter P. Welfare receipt and substance-abuse treatment among low-income mothers: the impact of welfare reform. *Am J Public Health* 2006;96:2024–2031. [PubMed: 17018836]

Figure 1.

Tuberculin skin test (TST) results for current or former users of illicit drugs enrolled in the Bronx HIV Epidemiologic Research on Outcomes (HERO) sub-study on tuberculosis, Bronx, New York, 1995–1999

¹ The standard CDC definition³ does not differentiate between persons who are HIV infected and uninfected. Therefore, we also analyzed the data using a second definition for TST conversion: an absolute induration size of > 5 mm after a previously negative TST test in HIV-infected persons and an increase in induration size of ≥ 10 mm in all others. Using the HIV-specific definition, the TST conversion occurred in 40 individuals for a rate of 10% while 361 (90%) remained TST negative.

No. at Risk for Conversion	401	361	311	266	216	158	96	35
Rate/100 P-Y	6.06	1.10	1.31	0.57	0	0.87	0.61	0

Figure 2.
Tuberculin skin test conversion rate per 100 person-years (P-Y) by time since baseline negative TST result

Table 1

Baseline characteristics and univariate analysis of baseline risk factors for tuberculin skin test (TST) conversion, Bronx, NY, 1995–1998

Risk factor	No. at risk for TST conversion	TST conversion N (%)	Rate (per 100 person-years)	Univariate Hazard Ratio (95% CI)	P
Sex					
Male	237	23 (10)	4.83	2.20 (0.98–4.9)	0.05
Female	164	8 (5)	2.19	1	
Race					
African American	277	3 (7)	0.52	1.02 (0.35–2.99)	0.96
Hispanic	71	5 (7)	3.12	0.82 (0.22–3.07)	0.77
White	50	5 (8)	4.63	1	
Age					
>35	325	24 (7)	3.40	0.67 (0.28–1.56)	0.36
≤35	76	7 (9)	5.07	1	
Birthplace					
Foreign (includes Puerto Rico)	150	15 (10)	5.31	1.89 (0.93–3.84)	0.08
USA	251	16 (6)	2.84	1	
HIV positive					
Yes	128	5 (4)	1.92	0.43 (0.16–1.1)	0.08
No	242	26 (10)	4.46	1	
CD4 cell count, cells/mm ³ (only in HIV+)					
>200	90	5 (6)	2.62	1.56 (0.18–13.5)	0.69
≤200	39	1 (3)	1.61	1	
Ever work in a shelter?					
Yes	20	0 (0)	0	0.04 (0.0–28.70)	0.35
No	376	31 (8)	3.97	1	
Ever work as a home health aide?					
Yes	24	0 (0)	0	0.04 (0–19.69)	0.32
No	371	31 (8)	4.03	1	
Ever work in a hospital?					
Yes	96	5 (5)	2.34	0.57 (0.22–1.48)	0.25
No	367	36 (9)	5.80	1	
Ever work in a prison?					

Risk factor	No. at risk for TST conversion	TST conversion N (%)	Rate (per 100 person-years)	Univariate Hazard Ratio (95% CI)	P
Yes	35	2(6)	2.73	0.67 (0.16–2.80)	0.58
No	361	29(8)	3.85	1	
Ever homeless?					
Yes	149	18(12)	6.12	2.44 (1.20–4.99)	0.01*
No	239	13(5)	2.47	1	
Ever lived in shelter?					
Yes	99	13(13)	6.81	2.38 (1.16–4.88)	0.02*
No	295	18(6)	2.82	1	
Ever incarcerated?					
Yes	255	23 (9)	4.39	1.88 (0.81–4.39)	0.14
No	140	7 (5)	2.29	1	
Ever inject drugs?					
Yes	202	16 (8)	3.59	1.11 (0.52–2.39)	0.79
No	166	11 (7)	3.22		
Ever use crack cocaine?					
Yes	118	10 (9)	3.61	1.08 (0.49–2.36)	0.85
No	250	17 (7)	3.32	1	

NOTE. TST, tuberculin skin testing; CI, confidence interval.

Bold indicates statistically significant associations at the level of $P < 0.05$.

Table 2

Univariate analysis of time-dependent risk factors for tuberculin skin test (TST) conversion, Bronx, NY, 1995–1998

Risk Factors	Univariate Hazard Ratio (95% CI)	P
Received public assistance since last interview		
Yes	0.15 (0.07–0.32)	<0.001*
No	1	
Worked in a hospital since the last interview		
Yes	1.00 (0.13–7.87)	1
No	1	
Worked in a prison since the last interview		
Yes	0 (0–∞)	1.0
No	1	
Worked in a shelter since the last interview		
Yes	0 (0–∞)	1.0
No	1	
Worked as an aide since the last interview		
Yes	0 (0–∞)	1.0
No	1	
Lived in a shelter since last interview		
Yes	2.42 (0.57–10.27)	0.23
No	1	
Homeless since last interview		
Yes	3.11 (0.93–10.35)	0.06
No	1	
TB contact since last interview		
Yes	0 (0–∞)	0.99
No	1	
Uses methadone currently		
Yes	1.81 (0.43–7.64)	0.42
No	1	
Positive CAGE test for period since last interview		
Yes	1.68 (0.58–4.82)	0.34

Risk Factors	Univariate Hazard Ratio (95% CI)	P
No	1	
Injected any drug since in past 6 months		
Yes	1.48 (0.63–5.51)	0.37
No	1	
Snorted cocaine or heroin in past 6 months		
Yes	1.39 (0.56–3.47)	0.48
No	1	
Any drug use by any route in past 6 months (crack, cocaine or heroin)		
Yes	1.15 (0.51–2.60)	0.73
No	1	

NOTE. CI, confidence interval.

Bold indicates factors that are statistically significant at the level of $P < 0.05$.

Table 3

Multivariate analysis of risk factors for tuberculin skin test (TST) conversion, Bronx, NY, 1995–1998

Risk Factors	Hazard Ratio [†] (95% CI)	P
Ever homeless or ever live in a shelter [‡]		
Yes	2.95 (1.29–6.72)	0.01
No	1	
Received public assistance since last interview		
Yes	0.11 (0.05–0.26)	<0.0001
No	1	

NOTE.

[†] CI, confidence interval.

[‡] The covariates “ever homeless” and “ever live in a shelter” were highly correlated.

Therefore the combined term of ever homeless or shelter was used in the final multivariate model.

Bold indicates factors that are statistically significant at the level of $P<0.05$.