

UC Irvine

UC Irvine Previously Published Works

Title

Tuberculosis Knowledge, Perceived Risk and Risk Behaviors Among Homeless Adults: Effect of Ethnicity and Injection Drug Use

Permalink

<https://escholarship.org/uc/item/8368m9f0>

Journal

Journal of Community Health, 29(6)

ISSN

0094-5145

Authors

Nyamathi, Adeline

Sands, Heather

Pattatucci-Aragón, Angela

et al.

Publication Date

2004-12-01

DOI

10.1007/s10900-004-3396-2

Copyright Information

This work is made available under the terms of a Creative Commons Attribution License, available at

<https://creativecommons.org/licenses/by/4.0/>

Peer reviewed

TUBERCULOSIS KNOWLEDGE, PERCEIVED RISK AND RISK BEHAVIORS AMONG HOMELESS ADULTS: EFFECT OF ETHNICITY AND INJECTION DRUG USE

Adeline Nyamathi, ANP, PhD, FAAN; Heather Sands, FNP, PhD; Angela Pattatucci-Aragón, PhD; Jill Berg, RN, PhD; Barbara Leake, PhD

ABSTRACT: The objectives of this study were to investigate Tuberculosis (TB) knowledge, perceived risk, and risk behaviors in a sample of homeless persons with latent TB in the Skid Row district of Los Angeles. Particular emphasis was given to comparing these variables among homeless persons of varying ethnic backgrounds and among those who did and did not report a history of injection drug use (IDU). Baseline data were collected from 415 homeless individuals recruited to participate in a Tuberculosis chemoprophylaxis intervention. Areas of interest relative to TB knowledge and perceived risk for infection were behavioral factors surrounding substance use and abuse; personal factors measured in terms of current depression; and sociodemographic and situational factors, such as age, ethnicity, history of incarceration, and duration of homelessness. Findings revealed differences in substance abuse. IDUs were more likely to have histories of daily drug use and alcohol dependency, but were less apt to report recent use of crack cocaine. TB knowledge deficits centered on ignorance with respect to modes of transmission and risk factors for TB infection. IDU was also associated with depression. Latinos and IDUs were most likely to lack TB knowledge. There is a pressing need for accessible, available, culturally acceptable and sustained TB screening and intervention programs designed to address multiple risk factors and knowledge deficits with respect to TB infection in homeless populations.

KEY WORDS: TB; knowledge; homeless; Los Angeles.

Adeline Nyamathi is Professor of Nursing at the University of California, Los Angeles, CA, USA, Heather Sands is Lecturer of Nursing at the University of California, Los Angeles, CA, USA, Angela Pattatucci-Aragón is Professor of Public Health at the University of Puerto Rico, CA, USA, Jill Berg is Assistant Professor of Nursing at the University of California, Los Angeles, CA, USA, Barbara Leake is Senior Statistician of Nursing and Medicine at the University of California, Los Angeles, CA, USA.

Requests for reprints should be addressed to Adeline Nyamathi, ANP, PhD, FAAN, UCLA, School of Nursing, Room 2-250, Factor Building, Box 951720, Los Angeles, CA 90095-1702, USA; e-mail: anyamath@sonnet.ucla.edu.

INTRODUCTION

Despite the fact that tuberculosis (TB) is a preventable and generally treatable disease, it still causes more than two million annual deaths worldwide. The highest prevalence of reported cases nationwide are in California, New York City, and Washington DC. Among these, the greatest number is found in California (3297), specifically in Los Angeles County.¹ Hotspots for TB transmission in California are in prisons and drug-using inner city communities; an increased trend in TB infection among foreign-born persons has also been observed.¹

Homeless people are at high risk for both latent and active TB because they live in homeless shelters and other congregate facilities and are more likely to engage in risk behaviors, such as the use of injection drugs and other substances of abuse.²⁻⁴ Moreover, several studies have demonstrated high rates of substance abuse among tuberculin positive individuals or those at high risk for infection.⁵⁻⁷ In a recent study, Howard et al.⁸ reported independent associations for tuberculin positivity and crack cocaine use, as well as alcoholism, among participants seronegative for human immunodeficiency virus (HIV). Given the connection between substance abuse and TB, along with high rates of reported drug use and abuse,⁹⁻¹² and of alcohol use and abuse among homeless persons,¹³ the potential for TB infection and spread is high among homeless populations.

Homeless persons are also more likely to experience mental illness. TB in combination with mental illness may prove to be a serious combination, as persons afflicted with mental illness are less likely to seek health care in a timely manner and they display decreased adherence to medication-taking.¹⁴

Environmental and behavioral risk factors can predispose homeless persons to conversion of an otherwise latent infection into active disease and also negatively affect their motivation to engage in TB screening and treatment.^{15,16} Clearly, health care providers must continue to enhance outreach efforts to educate, screen, and subsequently treat homeless individuals wherever they reside. Although TB testing is an effective means of case finding, the temporary nature of homeless living situations often hinders outreach opportunities. Moreover, with survival concerns tending to take primacy over other matters,³ homeless persons may not regard TB prevention as an important priority, particularly when TB knowledge is lacking. Poor knowledge about TB and its transmission may impact perceived risk of acquiring the disease and create treatment delays.¹⁷ Lack of knowledge is particularly evident among populations that experience language barriers.^{18,19} If TB is not perceived to be a

serious health risk, whether due to language barriers or other reasons, the likelihood of reducing the prevalence of TB in homeless populations will not be diminished.

The prevalence of latent TB is higher among African Americans, Latinos, Asians/Pacific Islanders, and American Indians/Alaskan Natives compared to Whites,²⁰⁻²² with rates consistently highest among African Americans and Latinos.^{8,21,23,24} Prevalence is amplified for minority homeless populations.^{7,25} Among the poor and persons of color, social stigma, isolation and secrecy associated with a diagnosis of TB are additional important barriers that impact their ability to access care, and the ability of health care professionals to promote preventive services.²⁶⁻²⁹ Unless health care providers understand what their patients know about TB and what their misconceptions are, as well as their perceived risk for acquiring TB, it is highly unlikely that they can tailor prevention programs for populations of concern, especially those with multiple physical and social risk factors.

In this study, we examine TB knowledge, perceived risk and behaviors that are established risk factors for TB among a homeless sample with latent TB in the Skid Row area of Los Angeles. Of particular interest is a comparison of these variables among homeless persons of varying ethnic backgrounds and among those who report a history of injection drug use (IDU). Such information can guide the development of culturally appropriate educational programs to target specific ethnic groups in terms of successful access to care and adherence strategies.

The research questions are:

1. What are the differences in TB knowledge, perceived risk and selected risk behaviors among homeless African-American, Latino and white adults?
2. How do these variables differ by injection drug use status?

METHODS

Sample and Setting

Participants in this study include all individuals who were enrolled in a larger study designed to assess the completion rates of TB chemoprophylaxis among homeless adults who were randomized into a Nurse Case Managed Program or a Standard Program and received a 6-month course of INH. Participants resided in homeless shelters or residential

treatment programs in close vicinity to the clinic where the intervention study was conducted. Homeless adults were eligible for the study if they tested positive for Purified Protein Derivative (PPD) on a Mantoux test; met the age criteria of 18–55 years, or over 55 years of age if they self-reported a risk activation factor for TB (such as being an injection drug user, or having an immuno-compromising illness); had been ruled out for active TB based upon negative chest X-Ray and a physical assessment; and had normal liver enzyme test results. A homeless person was defined as an individual who spent the last night in a shelter or substance abuse treatment program for the homeless. Participants were recruited by means of flyers posted at their shelters. All participants meeting study eligibility criteria were informed of the study, asked to read and sign consent forms, and were assured anonymity.

Procedure

Nurses and outreach workers who had experience working with homeless and drug-addicted adults collected data between 1997 and 2002. After obtaining informed consent, an appointment was made for the screening activities. TB-infected persons were excluded from the study if they demonstrated cognitive impairment, such as active hallucinations or stupor during the screening interview. Prior to commencement of the intervention study, nurses and outreach workers administered a questionnaire to the participants that took approximately 1 hour to complete. A nominal cash incentive was provided to compensate for time and inconvenience.

Instruments

Knowledge about TB was measured by a modified 13-item instrument that assessed modes of transmission, ease of contagion and susceptibility.³⁰ The items, which are displayed in Table 2, had a response set that ranged from 1 (definitely true) to 4 (definitely false). The number of correct responses were summed to form a TB knowledge score with values ranging from 0 to 13.

Perceived risk for TB was measured by a single item that asked participants to gauge their risk of acquiring TB in the future. Respondents were asked to respond on a 4-point scale that ranged from 1 (very high) to 4 (no chance).

Drug and alcohol use were assessed with a revised version of the Texas Christian University (TCU) Drug History Form.³¹ This questionnaire has been tested with men and women with a history of drug

addiction, prostitution and homelessness. It records the frequency of use of 16 drugs by injection or other means during the past six months and also elicits information about lifetime use. Drugs assessed are: heroin, street methadone, other opiates, cocaine, crack, methamphetamine and other amphetamines, inhalants, marijuana/hashish, hallucinogens, tranquilizers, barbiturates, other sedatives, designer drugs, and alcohol and nicotine. The CAGE questionnaire, assessing history of alcohol dependency, was administered to identify persons with a high likelihood of alcohol dependence or abuse. Injection drug use was defined as any use of drugs by injection, regardless of frequency, during the last 6 months (recent) and lifetime. Objective measures of drug use were not obtained as they only provide relatively short-term evidence of drug use. Further, our research team collected hair samples in a previous study of homeless women and we found reasonable concurrence between self-report and objective evidence of cocaine use.³²

Current depression was measured by the Center for Epidemiological Studies Depression (CES-D) scale.³³ The instrument is a 20-item scale that measures frequency of symptoms on a 4-point continuum and has well-established reliability and validity. Examples of CES-D items are “You felt depressed,” and “You felt fearful.” Scores on the CES-D ranged from 3 to 53. In the current study, Chronbach’s alpha coefficient for the CES-D scale was .85.

A structured instrument assessed age, ethnicity, education, time homeless, marital status, and history of incarceration.

Data Analysis

Differences in sociodemographic characteristics, TB knowledge, perceived risk, and risky drug behaviors of the participants separated by injection drug-using behavior, and subsequently by race, were examined using chi-square tests and ANOVAS, or Kruskal–Wallis tests, depending on the distributions of the variables under consideration.

RESULTS

Sociodemographic Characteristics

Homeless persons in the total sample were predominantly male (80%), African American (82%), single (59%) and, on average, homeless for more than 2.7 years (*SD* 3.5). The mean age of the sample was 41

(*SD* 8.6) and the mean years of education completed was 12 (*SD* 1.82). Table 1 depicts the sociodemographic characteristics and risk behaviors of the sample as a function of lifetime IDU. A total of 415 participants were included in this study, of which 88 (21%) self-reported a history of IDU; the majority of these individuals were African American. IDUs in the sample were older than non-IDUs, and had been homeless for a longer period of time. Compared to non-IDUs, homeless adults who used injection drugs were more likely to be White or Latino. No differences were noted among IDUs compared to non-IDUs with respect to education or veteran status.

TABLE 1

Sociodemographic and Risk Characteristics for TB by IDU Status
(*n* = 412)

| | <i>Ever IDU (n = 88)</i> | | <i>Never IDU (n = 324)</i> | |
|--------------------------------------|--------------------------|-------------|----------------------------|-------------|
| | <i>M</i> | <i>(SD)</i> | <i>M</i> | <i>(SD)</i> |
| Age** | 43.50 | (8.65) | 40.36 | (8.47) |
| Education | 11.85 | (1.82) | 12.14 | (1.82) |
| | <i>n</i> | <i>(%)</i> | <i>n</i> | <i>(%)</i> |
| Race** | | | | |
| Black | 60 | (68.2) | 278 | (85.8) |
| White | 12 | (13.6) | 17 | (5.3) |
| Latino | 14 | (15.9) | 23 | (7.1) |
| Marital Status | | | | |
| Single | 42 | (47.7) | 202 | (62.4) |
| Married | 3 | (3.4) | 24 | (7.4) |
| D/W/S | 43 | (48.9) | 98 | (30.3) |
| Country of Birth | | | | |
| USA | 85 | (96.6) | 299 | (92.6) |
| Mexico/Other | 3 | (3.4) | 23 | (7.1) |
| Homeless for > 6 months* | 63 | (74.1) | 213 | (66.4) |
| History of incarceration* | 63 | (71.6) | 190 | (58.6) |
| History of alcohol dependency*** | 58 | (67.4) | 142 | (44.2) |
| Currently using alcohol | 64 | (73.6) | 213 | (74.0) |
| Ever used crack cocaine* | 17 | (19.3) | 93 | (32.1) |
| Crack cocaine in past 6 months*** | 27 | (30.7) | 231 | (71.3) |
| Daily drug use past 6 months*** | 39 | (44.3) | 77 | (23.8) |
| Daily alcohol/drugs past 6 months*** | 45 | (51.1) | 100 | (31.0) |
| Current depression* | 55 | (62.5) | 153 | (47.2) |

* *p* < .05; ** *p* < .01.

Risk Behaviors

Findings revealed that substance use differed by subgroup. When compared to their non-IDU counterparts, homeless adults who had used injection drugs at some point were more likely to report a history of alcohol dependency (67% vs. 44%, respectively), daily drug use (44% vs. 24%, respectively), and daily drug or alcohol use (51% vs. 31%, respectively). On the other hand, crack was less likely to be used by IDUs compared to non-IDUs (31% vs. 71%, respectively). No significant difference was found with respect to current use of alcohol.

In terms of risk behavior by ethnicity, Latinos were more likely to report alcohol use in the last six months (91%) compared with African Americans and whites (72% and 74%, respectively; $p < .05$). They were also more likely to use injection drugs in the last six months when compared to their African-American and White counterparts (32% vs. 10% vs. 24%; $p < .01$). No ethnic differences were found with respect to alcohol dependency.

Psychological Health

In terms of current depression, 63% of IDUs were found to score 16 or above on the CES-D, which is consistent with clinical depression. This rate was higher than that for homeless adults who never reported use of injection drugs (47%). No depression differences were found based upon ethnicity.

Knowledge of TB Injection by Drug Use

Overall, both IDUs and non-IDUs responded similarly to the TB Knowledge items that assessed ease of contagion and susceptibility (data not shown). However, one important difference observed between the two groups was that IDUs were less likely than non-IDUs to know the modes of transmission of TB (42% vs. 57%, respectively; $p < .05$). The sample as a whole (both IDUs and non-IDUs) showed greatest awareness on the item measuring knowledge that people can die from TB if not treated (82% and 75%, respectively). However, less than two-thirds demonstrated awareness that TB is spread by close contact with an infected person, that homeless persons are at greater risk for TB than the general population, that those with a compromised immune system are especially vulnerable to TB, and that it is easier to get TB if one is HIV-infected. Only about one quarter of the respondents were aware that people could become resistant to TB medication.

Knowledge of TB by Ethnicity

The overall TB knowledge score was 17.7 (*SD* 3.19). The scores were normally distributed. No significant differences were found in knowledge score by ethnicity; however, Latinos reported a somewhat lower

TABLE 2

TB Knowledge by Ethnicity (n = 407)

| | <i>Correct Response in</i> | | | | | |
|--|----------------------------|------------|-----------------|------------|-----------------|------------|
| | <i>Black</i> | | <i>White</i> | | <i>Latino</i> | |
| | <i>(n = 341)</i> | | <i>(n = 29)</i> | | <i>(n = 37)</i> | |
| | <i>n</i> | <i>(%)</i> | <i>n</i> | <i>(%)</i> | <i>n</i> | <i>(%)</i> |
| 1. TB cannot be spread by coughing, sneezing or spitting | 189 | (55.5) | 18 | (62.1) | 12 | (32.4)* |
| 2. If you live or work with someone who has TB, you can be infected with TB | 207 | (60.7) | 14 | (48.3) | 23 | (62.2) |
| 3. You do not need to be exposed to someone who has TB many times to be infected with TB | 156 | (45.8) | 14 | (48.3) | 8 | (21.6) |
| 4. People who are homeless are more likely to get TB | 177 | (51.9) | 15 | (51.7) | 19 | (51.4) |
| 5. Minorities are less likely to be infected with TB | 157 | (46.0) | 10 | (34.5) | 10 | (27.1) |
| 6. If your immune system is not working properly, it is easier to get TB | 211 | (61.9) | 17 | (58.6) | 20 | (54.1) |
| 7. If you have HIV/AIDS, it is easier to get TB | 219 | (64.2) | 18 | (62.1) | 21 | (56.8) |
| 8. TB is hard to treat | 153 | (44.9) | 9 | (31.1) | 11 | (29.7)* |
| 9. People can become resistant to the medication used to treat TB | 90 | (26.4) | 9 | (31.0) | 6 | (16.2) |
| 10. TB disease can severely damage a person's lungs | 229 | (67.2) | 21 | (72.4) | 23 | (62.2) |
| 11. You cannot tell if someone you know has TB disease | 200 | (58.7) | 22 | (75.9) | 16 | (42.2) |
| 12. TB is caused by a germ | 246 | (72.1) | 20 | (69.0) | 27 | (73.0) |
| 13. People can die from TB if it is not treated | 267 | (78.3) | 21 | (72.4) | 27 | (73.0) |

*p < .05, chi-square tests for ethnic differences in TB knowledge.

mean score (6.03) compared with African Americans (7.33) and Whites (7.17). Furthermore, no differences were reported by drug use (7.18 for IDUs vs. 7.08 for non-IDUs).

Several important differences emerged when the individual TB knowledge items were assessed by ethnicity (Table 2). Latinos were less likely than African Americans and Whites to respond correctly to items that assessed knowledge of the modes of TB transmission (32% for Latinos vs. 56% and 62% for African Americans and Whites, respectively) and the highly contagious nature of TB (22% for Latinos vs. 46% and 48% for African Americans and Whites, respectively). Latinos were also less likely to know that minorities are at greater risk for TB infection. Both Latinos and African Americans were less likely than Whites to know whether TB infection can be identified by appearance.

Perception of Risk for TB

When asked about their risk for TB, IDUs were more likely than non IDUs to perceive themselves to be at high risk (78% vs. 65%) (data not shown). In terms of ethnicity, African Americans and Latinos were somewhat less likely than Whites to perceive themselves to be at high risk for acquiring TB.

DISCUSSION

Despite inroads made by TB prevention programs, TB remains an important health problem in the United States.³⁴ Respondents of a recent U.S. study, reported perceived knowledge of TB at a high level, while their actual knowledge was lower. Gender, education, income, and ethnicity were associated with knowledge and perceived risk.³⁵ Contributing factors for transmission of TB include residence in congregate settings and a high prevalence among persons born in countries where TB is endemic.³⁴ Acceptance of screening and any necessary chemoprophylaxis is poor when knowledge about the disease is limited or inaccurate.^{36,37} This link is not surprising in light of evidence that individuals take recommended health actions based on perceptions of personal susceptibility to a health threat, degree of severity of the threat, potential benefits of the health action, and any barriers to implementing the required action.³⁸ To a large extent, health and risk perceptions are driven by knowledge about the disease, in this case TB.^{39,40}

TB Knowledge and Perceived Risk: Influence of Ethnicity

Our findings revealed that Latinos were less likely to correctly identify factual information about TB than were African Americans and Whites. The gap in knowledge was greatest for TB transmission. Compared to the rest of the sample, Latinos were less likely to correctly identify that coughing and sneezing facilitated TB spread. They were also more likely to incorrectly assume that TB is readily recognizable. Moreover, Latinos were least likely to identify minority status as a potential risk factor for TB. These findings are consistent with those of other studies, including that of Ailinger and Dear¹⁸ who reported that only 28% of low-income Latino immigrants understood their TB infection to be the result of person-to-person transmission and almost half had no explanation for the cause of their infection. Findings of our study likewise revealed that Latinos and African Americans were somewhat less likely to perceive themselves to be at risk for TB than Whites. Inaccurate assumptions about risks associated with minority status and modes of TB transmission have the potential to increase Latino susceptibility to infection. Lack of knowledge about TB, a low perceived risk for acquiring it, and increased risk related to foreign-born status further increase Latinos' risk of becoming infected and transmitting TB infection to others.

Although the Centers for Disease Control and Prevention (CDC)³⁴ notes that the TB rate has declined tenfold from 53 cases per 100,000 in 1953 to 5.6 cases in 2001, rates remain comparatively high among homeless populations and among the urban poor, ethnic and racial minorities, and the foreign born. These groups often fall under the radar of large-scale prevention and detection efforts because they present language and other barriers that require specific tailoring of prevention messages and they often are overwhelmed with daily survival needs. According to the California Department of Health and Human Services,¹ the proportion of foreign-born TB cases has continued to rise in the last decade. For example, in 1991, 61% of California's TB cases were among foreign-born persons compared to 72% in 2000. During 2000, the largest percentage of foreign-born TB cases reported in CA originated from Mexico (32%), followed by the Philippines (19%) and Vietnam at 13%.¹ An even more disturbing statistic highlights Los Angeles County as the leading metropolitan statistical area with a population of > 500,000 for total TB cases (n = 1113), with 76% of these cases among foreign-born persons.³⁴ While the number of Latinos in our sample was small (9%), a full 70% were foreign-born (Mexico). With increasing numbers of immigrants from Mexico and Central America, it will be important to

integrate essential information about transmission of TB infection in prevention programs offered to Latinos. It is also imperative that investigators evaluate the impact of difficult life circumstances and the role they play as a barrier to health screening and care.

No significant differences were found for perceptions of TB risk between African Americans and Latinos as compared with Whites. Nevertheless, as membership in either of these minority groups adds additional potential risk, outreach efforts to provide education will be particularly important for significant reductions in TB prevalence to occur.

Injection Drug Use

Our examination of TB knowledge relative to IDU status revealed that IDUs were less likely to know the modes of TB transmission than non-injection drug users. This finding is consistent with those of Salomon et al.⁴¹ who reported that only 15% of 610 drug users engaging in a syringe exchange program in New York could correctly answer questions related to TB transmission, even though 92% knew that the disease is contagious. Similarly, Durante et al.⁴² found that participants in a drug treatment program had widespread misconceptions about TB transmission, with many believing that TB could be prevented by bleaching needles or by not sharing drug paraphernalia. These data suggest that IDUs may be paying selective attention to prevention messages related to AIDS and other diseases acquired through parenteral transmission while relegating other important information to lower priority status. This practice can have severe consequences. For example, a recent study in Thailand found that individuals with strong AIDS knowledge, but with deficits in knowledge about TB, often misinterpret TB symptoms as an indication that they have AIDS and therefore delay seeking treatment or are non-adherent when they do seek it.⁴³ Programs must become better at linking TB prevention messages to the context of injection drug users' lives and their drug use behavior patterns, while at the same time remaining sensitive to issues of information overload.

Although past studies have established associations between IDU and TB infection,^{41,44} investigations targeted to identify specific behaviors among IDUs that are placing them at elevated risk for TB, independent of other comorbid conditions such as HIV infection, are lacking. Vulnerability of IDUs to TB due to immunosuppression is one possibility⁷ and prevalence of HCV and TB co-infection has been found to surpass that of HIV in IDU and homeless populations.^{45,46} However, the relationship between these two infections remains unspecified.

Factors surrounding injection drug use are equally important to consider. As tuberculosis transmission declines in the general population, a proportional increase of cases attributable to activation will occur in persons with latent infection.⁴⁷ Control of tuberculosis requires preventing disease from developing in infected persons. Strong associations of TB with living in crowded conditions among the homeless and urban poor, with being incarcerated, and with use of IDU shooting galleries have been established.^{5,7,34} Additionally, substance abuse has been found to be associated with poor adherence to treatment regimens.^{16,25,48} Poor treatment adherence identifies perhaps the strongest argument for developing targeted and sustainable TB prevention efforts directed toward substance abusers, especially among those that are homeless. Environmental and behavioral risk factors can predispose homeless persons to conversion of latent infection into active disease,^{15,16} which, in turn, has a high potential for becoming multidrug resistant due to poor adherence to treatment regimens. Couple this with crowded living conditions, poor hygiene and malnutrition, along with a constellation of specific behavioral risk factors, and the potential spread of multidrug resistant strains of TB in homeless populations is substantial.

In this sample of homeless persons with a history of IDU, risk for TB infection existed on a number of fronts. These include chronic homelessness, history of imprisonment, behavioral factors, such as alcohol dependency and crack use, and demographic factors, such as race, age, and country of birth. To optimize screening and treatment programs, clinicians and lay workers providing TB prevention services to homeless persons need to be aware of the multitude of risk factors and knowledge deficits presented by this population. Among the most important issues are ensuring an understanding of the modes of TB transmission and that infection requires only a single exposure, developing cultural as well as contextual competency for delivering prevention messages, confirming that TB prevention messages are not inappropriately merged with others to create potentially serious misconceptions, and using targeted strategies to reach and intervene with IDUs to alter poor adherence to treatment regimens. Chaisson et al.⁴⁹ report improved adherence to TB treatment by IDUs when they are under supervised care and receive peer counseling. Reductions in Tuberculin positivity have also been observed when injection drug users are placed in methadone clinics and receive TB treatment under directly observed therapy.^{16,42}

Because this study was cross-sectional, inferences about cause and effect relationships between the variables of interest, ethnicity and injection drug status, with TB knowledge and perceived risk are limited.

Moreover, the homeless persons sampled in this study resided only in sheltered conditions in the Skid Row district of Los Angeles and did not include individuals living on the streets or on a temporary basis with friends or relatives. Additionally, the number of subjects in some of the subgroups of interest was small, thus limiting power for selected comparisons. Despite these limitations, important relationships between ethnicity, IDU, and TB knowledge among homeless individuals provide solid direction for outreach efforts and the design of TB prevention programs.

Ten years ago, the CDC⁵⁰ outlined a series of recommendations directed at controlling TB in at-risk communities. Among these were launching public awareness campaigns about increasing TB incidence and prevalence, training public and private health-care providers in skills necessary to intervene; empowering those at risk with resources to influence community TB programs; establishing coalitions to assist in the design and implementation of intensified community TB prevention and control efforts; and improving the availability and quality of TB health-care services. Our data suggest that these recommendations are just as relevant today as they were in 1992 and point to a pressing need for their serious and sustained implementation.

ACKNOWLEDGMENT

This study was funded by the National Institute on Drug Abuse, DA11145.

REFERENCES

1. CA DHS (2001). California Department of Health Services: Report on Tuberculosis in California, 2000. Available: <http://www.applications.dhs.ca.gov/pressreleases/store/pressreleases/02-09.html>.
2. D'Amore J, Hung O, Chiang W, Goldfrank L. The epidemiology of the homeless population and its impact on an urban emergency department. *Acad Emerg Med* 2001; 8:1051-5.
3. Gelberg L, Panarites C, Morgenstern H, Leake B, Andersen R, Koegel P. Tuberculosis skin testing among homeless adults. *J Gen Intern Med* 1997; 12:25-33.
4. Raoult D, Foucault C, Brouqui P. Infections in the homeless. *Lancet* 2001; 1:77-84.
5. Bock NN, McGowan JE Jr, Blumberg HM. Few opportunities found for tuberculosis prevention among the urban poor. *Int J Tuberc Lung Dis* 1998; 2:124-9.
6. Hernández-Garduno E, Kunimoto D, Wang L, Rodríguez M, Elwood RK, Black W, Mak S, FitzGerald JM. Predictors of clustering of tuberculosis in Greater Vancouver: a molecular epidemiologic study. *CMAJ* 2002; 167:349-52.
7. Zolopa AR, Hahn JA, Gorter R, Miranda J, Włodarczyk D, Peterson J, Pilote L, Moss AR. HIV and tuberculosis infection in San Francisco's homeless adults. Prevalence and risk factors in a representative sample. *JAMA* 1994; 272:455-61.
8. 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; 35:1183-90.

9. Nyamathi A, Bayley L, Anderson N, Keenan C, Leake B. Perceived factors influencing the initiation of drug and alcohol use among homeless women and reported consequences of use. *Women Health* 1999; 29:99-114.
10. Nyamathi A, Leake B, Gelberg L. Sheltered versus nonsheltered homeless women differences in health, behavior, victimization, and utilization of care. *J Gen Intern Med* 2000; 15:565-72.
11. Robertson MJ, Zlotnick C, Westerfelt A. Drug use disorders and treatment contact among homeless adults in Alameda County, California. *Am J Public Health* 1997; 87:221-8.
12. Wenzel S. *Unpublished data*. Drug abuse, violence, and HIV/AIDS in Impoverished women project, RAND Corporation, 2002.
13. Tessler R. Comparison of homeless veterans with other homeless men in a large clinical outreach program. *Psychiatr Q* 2002; 73:109-19.
14. Turner BJ, Laine C, Cosler L, Hauck WW. Relationship of gender, depression, and health care delivery with antiretroviral adherence in HIV-infected drug users. *J Gen Intern Med* 2003; 18:248-57.
15. Brudney K, Dobkin J. Resurgent tuberculosis in New York City: human immunodeficiency virus, homelessness, and the decline of tuberculosis control programs. *Am Rev Respir Dis* 1991; 144:745-9.
16. Pablos-Méndez A, Knirsch CA, Barr RG, Lerner BH, Frieden TR. Nonadherence in tuberculosis treatment: predictors and consequences in New York City. *Am J Med* 1997; 102:164-70.
17. Marinac JS, Willis SK, McBride D, Hamburger SC. Knowledge of tuberculosis in high-risk populations: survey of inner city minorities. *Int J Tuberc Lung Dis* 1998; 2:804-10.
18. Ailinger R, Dear M. Adherence to tuberculosis preventive therapy among Latino immigrants. *Public Health Nurs* 1998; 15:19-24.
19. Carey JW, Oxtoby M, Nguyen L, Huynh V, Morgan M, Jeffrey M. Tuberculosis beliefs among recent Vietnamese refugees in New York State. *Public Health Rep* 1997; 112:66-72.
20. Grossman DC, Krieger JW, Sugarman JR, Forquera RA. Health status of urban American Indians and Alaska Natives. A population-based study. *JAMA* 1994; 271:845-50.
21. Hu DJ, Fleming PL, Castro KG, Jones JL, Bush TJ, Hanson D, Chu SY, Kaplan J, Ward JW. How important is race/ethnicity as an indicator of risk for specific AIDS-defining conditions? *J Acquir Immune Defic Syndr Hum Retroviro* 1995; 10:374-80.
22. Pablos-Méndez A, Blustein J, Knirsch CA. The role of diabetes mellitus in the higher prevalence of tuberculosis among Hispanics. *Am J Public Health* 1997; 87:574-9.
23. Borgdorff MW, Behr MA, Nagelkerke NJ, Hopewell PC, Small PM. Transmission of tuberculosis in San Francisco and its association with immigration and ethnicity. *Int J Tuberc Lung Dis* 2000; 4:287-94.
24. Moss AR, Hahn JA, Tulskey JP, Daley CL, Small PM, Hopewell PC. Tuberculosis in the homeless. A prospective study. *Am J Respir Crit Care Med* 2000; 162(2 Pt 1):460-4.
25. Frieden TR, Woodley CL, Crawford JT, Lew D, Dooley SM. The molecular epidemiology of tuberculosis in New York City: the importance of nosocomial transmission and laboratory error. *Tuberc Lung Dis* 1996; 77:407-413.
26. Kelly P. Isolation and stigma: the experience of patients with active tuberculosis. *J Community Health Nurs* 1999; 16:233-41.
27. Poss J. The meanings of tuberculosis for Mexican migrant farm workers in the United States. *Soc Sci Med* 1998; 47:105-202.
28. Rubel A, Garro L. Social and cultural factors in the successful control of tuberculosis. *Public Health Rep* 1992; 107:626-36.
29. Yamada S, Caballero J, Matsunaga D, Agustin G, Magana M. Attitudes regarding tuberculosis in immigrants from the Philippines to the United States. *Fam Med* 1999; 31:477-82.
30. Morisky DE, Malotte CK, Choi P, Davidson P, Rigler S, Sugland B, Langer M. A patient education program to improve adherence rate with anti-tuberculosis drug regimens. *Health Educ Q* 1990; 17:253-68.
31. Simpson D, Chatham L. TCU/DATAR Forms Manual. Ft. Worth, TX: Institute of Behavioral Research, Texas Christian University, 1995.
32. Nyamathi A, Leake B, Longshore D, Gelberg L. Reliability of homeless women's reports: Concordance between hair assay and self-report of cocaine use. *Nursing Res* 2001; 50:165-71.
33. Radloff S. The CES-D scale: a self-report depression scale for research in the general population. *Applied Psychological Measurement* 1977; 1:385-401.
34. Centers for Disease Control and Prevention (CDC). Tuberculosis morbidity among U.S.-born and foreign-born populations—United States, 2000. *MMWR* 2002; 51:101-4.

35. Ailinger RL, Lasus H, Dear M. Americans' knowledge and perceived risk of tuberculosis. *Public Health Nurs* 2003; 20:211–5.
36. Sebastian M, Bothamley G. Tuberculosis preventive therapy: Perspective from a multi-ethnic community. *Respir Med* 2000; 94:648–53.
37. Tulsy JP, Pilote L, Hahn JA, Zolopa AJ, Burke M, Chesney M, Moss AR. Adherence to isoniazid prophylaxis in the homeless. A randomized controlled trial. *Arch Intern Med* 2000; 160:697–702.
38. Janz N, Becker M. The health belief model: A decade later. *Health Educ Q* 1984; 11:1–47.
39. Kitazawa S. Tuberculosis health education needs in homeless shelters. *Public Health Nurs* 1995; 12:409–16.
40. Poss J. Developing an instrument to study the tuberculosis screening behaviors of Mexican migrant farm workers. *J Transcult Nurs* 1999; 10:306–19.
41. Salomon N, Perlman DC, Friedmann P, Perkins MP, Ziluck V, Jarlais DC, Paone D. Knowledge of tuberculosis among drug users. Relationship to return rates for tuberculosis screening at a syringe exchange. *J Subst Abuse Treat* 1999; 16:229–35.
42. Durante A, Selwyn P, O'Connor P. Risk factors for and knowledge of mycobacterium tuberculosis infection among drug users in substance abuse treatment. *Addiction* 1998; 93:1393–401.
43. Ngamvithayapong J, Winkvist A, Diwan V. High AIDS awareness may cause tuberculosis patient delay: Results from an HIV epidemic area, Thailand. *AIDS* 2000; 14:1413–9.
44. Torres L, Arazo P, Blas Pérez J, del Pilar Amador M, Antonia Lezcano M, José Revillo M, Bautista García-Moya J. Resistance of Mycobacterium tuberculosis in Zaragoza, Spain (1993–1997) and related factors. *Med Clin (Barc)* 2000; 115:605–9.
45. El-Serag HB, Anand B, Richardson P, Rabeneck L. Association between hepatitis C infection and other infectious diseases: A case for targeted screening? *Am J Gastroenterol*, 2003; 98:167–74.
46. Portilla J, Esteban J, Llinares R, Belda J, Sánchez-Paya J, Isabel Manso M. Prevalence of chronic hidden infections in a cohort of patients in substitutive treatment with methadone. *Med Clin (Barc)* 2001; 116:330–2.
47. Bock NN, Metzger BS, Tapia JR, Blumberg HM. A tuberculin screening and isoniazid preventive therapy program in an inner-city population. *Am J Respir Crit Care Med* 1999; 159:295–300.
48. Batki SL, Gruber VA, Bradley JM, Bradley M, Delucchi K. A controlled trial of methadone treatment combined with directly observed isoniazid for tuberculosis prevention in injection drug users. *Drug Alcohol Depend* 2002; 66:283–93.
49. Chaisson RE, Barnes GL, Hackman J, Watkinson L, Kimbrough L, Metha S, Cavalcante S, Moore RD. A randomized, controlled trial of interventions to improve adherence to isoniazid therapy to prevent tuberculosis in injection drug users. *Am J Med* 2001; 110:610–5.
50. Centers for Disease Control and Prevention (CDC). Prevention and control of tuberculosis in U.S. communities with at-risk minority populations. Recommendations of the Advisory Council for the Elimination of Tuberculosis (ACET). *MMWR* 41(RR-5), 1–11.