Correlates of depression and anxiety among homeless adults with latent tuberculosis infection

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Abstract

Homeless persons have disproportionate rates of latent tuberculosis infection (LTBI). LTBI treatment can prevent and reduce active tuberculosis spread. We examined associations between mental health, social support, and perceptions of general health in 50 LTBI-positive, homeless adults enrolled in LTBI treatment. Depression and anxiety prevalence were 40% and 48%, respectively. Depression was negatively associated with general health, positive social interaction, and tangible, emotional/informational, and total social support, and positively associated with severe substance use ($ps < 0.05$). Anxiety was negatively associated with emotional/informational, tangible and total social support, and positively associated with severe substance use ($ps < 0.05$). Mental health services may help improve LTBI interventions.

Keywords

community health psychology, depression, anxiety, mental illness, social support, substance abuse, tuberculosis

Introduction

In 2019, prevalence of latent tuberculosis infection (LTBI) in the United States was approximately 13 million (Centers for Disease Control and Prevention, 2019), with persons experiencing homelessness disproportionately affected (Dias et al., 2017). Left untreated, LTBI has a 5–10% chance of progressing to active disease (Hartman-Adams et al., 2014). Interventions targeting LTBI in vulnerable populations help alleviate the burden of active TB. Yet adherence to standard LTBI care, which involves 9 months of daily isoniazid (9H) treatment, is low among adults without stable housing (Hirsch-Moverman et al., 2015). Encouragingly, newer treatments, including directly observed isoniazid and rifapentine (3HP), completed in 12 weekly doses, may help increase adherence in homeless persons (Nwana et al., 2019).

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Understanding contextual psychosocial factors may further bolster treatment adherence.

Persons experiencing homelessness (Gilroy et al., 2016; Schreiter et al., 2017) as well as those with both active and latent TB (Duko et al., 2015) tend to report high rates of depression and anxiety. Prior research among homeless persons with LTBI revealed 30% also reported depression and anxiety (Nyamathi et al., 2007). Yet most prior studies on the topic have been conducted in non-U.S. settings (e.g. Duko et al., 2015; Gilroy et al., 2016). Since mental health issues are critical predictors of Hepatitis C treatment initiation and completion among homeless persons in the U.S. (Beiser et al., 2019), these correlates may be important to understand in homeless persons undergoing LTBI treatment as well.

Substance use in persons experiencing homelessness is also high and can interfere with effective treatment completion. Of persons experiencing homelessness and seeking medical care, 59% reported moderate to high-risk substance use (Stringfellow et al., 2016), substantially higher than the national average of 7.4% (Substance Abuse and Mental Health Services Administration [SAMHSA], 2019). Prior research on the HIV-care continuum suggests severe drug use can impede treatment initiation (Gwadz et al., 2016) and engagement (Celentano et al., 2001) in vulnerable populations. Other factors that can improve treatment outcomes in substance users with infectious disease include addressing additional physical health comorbidities (Altice et al., 2010; Muñoz et al., 2015), which can further thwart effective care.

Low-income individuals with active TB often experience unmet psychosocial needs that may impede treatment (Oshi et al., 2019). Among newly registered TB outpatients, social support has been negatively associated with anxiety and depression (Chen et al., 2016). Moreover, studies have found that supportive relationships and social networks improve medication and treatment adherence (Eastment et al., 2017). Understanding the interrelationship between these protective factors and indicators of risk could help inform more effective TB intervention efforts.

The present study

Recommendations for the reduction, treatment and elimination of TB in homeless populations are rooted in screening and treating LTBI (Gupta et al., 2015). In the present analyses, we draw from the Comprehensive Health Seeking and Coping Paradigm (CHSCP; Nyamathi, 1989), a theoretical model used to inform assessment and strategies used to understand health-seeking and coping. Key factors in this model include personal resources (e.g. emotional health), social resources (e.g. social support), and situational factors (e.g. sociodemographic factors, housing factors, and general health). We describe key factors and analyze the intercorrelations of personal resources, social resources, and situational factors in homeless-experiencing individuals with LTBI.

Method

We present baseline data from a single-arm pilot study of 3HP for homeless adults. Eligibility included: self-reported homelessness in last 6 months, aged 18+, willing to take LTBI medication, and reported current or recent substance use within the last 3 years. Homelessness was defined as having spent the previous night in a public or private shelter or on the street (Hoben, 1995). Exclusion criteria included: screened positive for active TB or currently being treated for LTBI; history of treatment for active TB or LTBI; serum aspartate aminotransferase (AST) level of five times the upper limit of normal; not English or Spanish speaking; pregnant; or cognitively impaired.

The study was approved by the Institutional Review Board (IRB) Human Subjects Protection Committee at the University of California, Irvine, and acted as the IRB of record for University of California, Los Angeles.

Sample and setting

Participants were recruited via community outreach from multiple homeless shelters in the Los Angeles, Skid Row area (i.e. The Union Rescue Mission (URM), Midnight Mission and

Los Angeles Mission) as well as the streets of the Los Angeles, Skid Row area. The shelters were homogeneous in terms of demographics and are in close proximity to each other. These shelters provide housing and resources including social services, employment opportunities, and assistance obtaining permanent housing.

Participants were recruited to participate in an intervention study that sought to improve completion of treatment for LTBI using a short-course regimen of 3HP. Trained research staff, composed of nurses and community health workers distributed posters and gave presentations about the study in public areas within the shelters. Homeless persons who lived on the streets were also invited into the shelter research space to learn about the study. Those interested were screened for eligibility and administered informed consent, if eligible. Participants were administered a sociodemographic and a TB-health history screener. Research staff assessed LTBI status using QuantiFERON-TB Gold Plus (QFT-Plus), or a combination of screening with the Tuberculin Skin Test followed by the QFT-Plus, as well as other routine testing (e.g. liver function test, HIV test). All participants were paid $3 for the screening questionnaire, and if eligible, $5 for further laboratory tests at the clinic.

Individuals testing positive for LTBI returned for a follow-up chest x-ray to rule out active TB. After clearance, informed consent for the intervention procedures was obtained. Subsequently, research staff administered a 60-minute questionnaire that assessed psychosocial factors and self-reported general health structured assessments; participants were compensated $20.

Measures

Drug and alcohol use. The Texas Christian University (TCU) Screen V (Knight et al., 2018) is a 17-item measure screening for mild to severe substance use disorder (SUD). Participants indicated "yes" or "no" responses to substance dependency questions and the frequency of substance use based on a 5-point scale from 1

(*never*) to 5 (*daily*). The TCU Screen V is scored on a point-system ranging from 0 to 11. Participant scores correspond to the number of symptoms endorsed by the participant and the severity of SUD: mild disorder (2–3 points), moderate disorder (4–5 points), or severe disorder (6 or more points).

Social support. The Medical Outcome Study (MOS) Social Support Survey (Sherbourne and Stewart, 1991) is a 19-item instrument with endpoints 1 (*none of the time*) to 5 (*all of the time*) that assesses availability of social support. It includes four subscales: emotional/informational support (eight items, $\alpha=0.95$); tangible support (four items, $\alpha=0.94$); positive social interaction (three items, $\alpha=0.98$); and affectionate support (three items, $\alpha=0.96$). An overall support index was also calculated. Reliability was excellent, $\alpha=0.98$.

Anxiety. The Generalized Anxiety Disorder-7 is a self-report 7-item meaure (Spitzer et al., 2006). Example items include "worrying too much about different things," "trouble relaxing," and "not being able to control worrying" (endpoints 0=*not at all*; 3=*nearly every day*). Scores are summed. Severity of anxiety was determined with cut-off scores 5 (*mild anxiety*), 10 (*moderate anxiety*), 15 (*severe anxiety*). Reliability was very good, $\alpha=0.87$.

Depression. The Center for Epidemiological Studies Short Depression Scale Revised (CESD-R-10) is a 10-item measure (Eaton et al., 2004) for depressive symptoms in the past week (endpoints 0=*rarely or none of the time*; 3=*most of the time*). Example items include "I was bothered by things that don't usually bother me," "I felt depressed," and "I felt fearful." Responses were summed (range 0–30). A total score of 10 or higher indicates depression. Reliability was good, $\alpha=0.79$.

General health. General health was measured using five items from the general health perceptions subscale of the RAND 36-Item Short Form Health Survey (SF-36; Ware and

Sherbourne, 1992). Participants responded to five statements such as "my health is excellent" or "I expect my health to get worse." Response options range from *true* to *definitely false*, with cutpoints 100, 75, 50, 25, and 0 (with several items reverse scored). Items were averaged; higher scores represent higher perceived health. Reliability was good, α=0.78.

Data analysis

Descriptive statistics were calculated for sociodemographic factors and key psychosocial variables. A series of bivariate regression analyses examined the relationships between two continuous dependent variables – depression and anxiety – and the following independent variables: social support, substance use, and general health. All analyzes were conducted using STATA 15.

Data sharing statement. A labeled, deidentified STATA dataset with variables used the analyses, data dictionary, associated syntax, and detailed notes will be available indefinitely on Figshare and as supplementary material on the SAGE journals platform. Other data formats will be provided from authors to interested parties upon request. Original study protocol is available on ClinicalTrials.gov (NCT03702049).

Results

Demographic characteristics of the sample

In terms of demographic characteristics, the majority of participants were male (*n*=37, 74.0%) and were on average 53.7 years old (*SD*=12.09; range 27–76 years). The ethnic makeup was primarily Black (*n*=23, 46.0%) and Latinx (*n*=21. 42.0%), with fewer White (*n*=2, 4.0%), Asian (*n*=2, 4.0%), and Native Hawaiian/Pacific Islander (*n*=1, 2.0%) participants. Of participants, 64% (*n*=32) were U.S. born. Seven (14.0%) were living with a family or friend, 32 (64.0%) were living in a shelter, and 11 (22.0%) were residing on the street.

Correlates of depression and anxiety

Mean depression score was 8.96 (*SD*=6.0; range 0–23), with 40% (*n*=20) meeting cutpoint for probable depression (CESD-score ⩾10). Mean anxiety was 5.22 (*SD*=4.89, range 0–19), with 32% (*n*=16) meeting criteria for mild and 16% (*n*=8) having moderate/severe anxiety. Of the sample, 64% (*n*=32) did not have a substance use disorder, 22.0% (*n*=11) had mild/moderate substance use and 14.0% (*n*=7) had severe substance use. Mean general health score=69.2 (*SD*=22.6, range 15–100). Mean total social support=3.01 (*SD*=1.29, range 1–5), with mean scores for emotional/ informational support=3.14 (SD=1.26, range 1–5), tangible support=2.86 (*SD*=1.48, range 1–5), affectionate support=3.0, *SD*=1.50, range 1–5), and positive social interaction=2.92 (*SD*=1.49, range 1–5).

Table 1 presents results from inferential statistics. Higher depression scores were negatively associated with self-reported general health and with tangible, emotional/informational, and total social support and positive social interaction (*p*s < .05). Depression was positively associated with severe substance use (*p* < .05). Anxiety was negatively associated with higher emotional/informational, tangible and total social support, and positively associated with severe substance use (*p*s < .05).

Discussion

These results describe key situational factors (i.e. demographics, housing status, health status), personal factors (i.e. anxiety, depression, substance use), and social resources (i.e. social support) in a sample of homeless adults living in the U.S. Severe substance use was correlated with higher anxiety and depression. In contrast, higher general health and some types of social support were associated with improved mental health.

There is a paucity of data concerning depression in LTBI homeless populations in the extant literature. In our sample, over a third experienced high depressive symptoms and almost half

Table 1. Bivariate relationships between mental health (anxiety and depression) and psychosocial predictors (*N* = 50).

	Depression				Anxiety			
	beta	b	95% CI	*p-value*	*beta*	b	95% CI	*p-value*
General Health	−0.33	−0.09	−0.16, −0.01	0.019	−0.25	−0.05	−0.12, 0.01	0.077
Social Support								
Emotional/Informational Support	−0.32	−1.52	−2.83, −0.23	0.022	−0.39	−1.51	−2.54, −0.48	0.005
Affectionate Support	−0.25	−1.00	−2.13, 0.12	0.079	−0.20	−0.64	−1.57, 0.29	0.173
Tangible Support	−0.35	−1.44	−2.54, −0.33	0.012	−0.31	−1.02	−1.93, −0.10	0.030
Positive Social Interaction	−0.30	−1.19	−2.30, −0.07	0.037	−0.25	−0.80	−1.72, 0.12	0.086
Total Social Support	−0.33	−1.53	−2.80, −0.27	0.019	−0.32	−1.22	−2.26, −0.19	0.021
Substance Use								
None (reference group)								
Mild/Moderate	0.05	0.71	−3.00, 4.42	0.702	0.12	1.48	−1.84, 4.80	0.375
Severe	0.52	8.87	4.44, 13.29	<0.001	0.33	4.60	0.65, 8.57	0.024
Total Score	0.45	0.92	0.39, 1.46	0.001	0.29	0.50	0.03, 0.96	0.038

reported some form of anxiety, substantially higher than national averages, which estimate past-year prevalence of depression at 13% and anxiety at 6% for adults over the age of 18 (SAMHSA, 2018). This difference reflects the need to prioritize mental health when creating targeted treatment plans for homeless-experiencing persons with LTBI. Indeed, rates of mental illness in those with active TB have been estimated at up to 70% (Doherty et al., 2013). Moreover, prior research suggests depression contributes to high rates of non-adherence in homeless populations receiving treatment for other infectious disease (Waldrop-Valverde and Valverde, 2005). Our findings suggest depression and anxiety are likely targets for intervention with homeless adults with LTBI as well.

Prior research on homeless populations has found associations between substance use and depression (Vogel et al., 2019), with high depressive symptom scores associated with severity of substance use (Nyamathi et al., 2006; Spinelli et al., 2017), consistent with our findings. Prior research in primary healthcare settings indicated substance use as significantly higher in homeless populations, which in turn led to poorer health outcomes (Stringfellow et al., 2016). Our study, using a community sample of homeless adults, showed that severe substance use was correlated with depression

and anxiety, but mild and moderate substance use were not. Such findings imply that harm reduction strategies, which may be more effective and feasible in homeless adults compared to abstinence-based programs (Collins et al., 2019; Pauly, 2018), may be recommended to help reduce psychopathology with the goal of administering more effective LTBI care.

Our results extend findings from a recent systematic review of LTBI interventions that highlight the importance of integrating social support in LTBI interventions (Stuurman et al., 2016). More specifically, our findings indicated that emotional/informational, tangible and total social support were associated with lower anxiety. Emotional/informational, tangible, and total social support and positive social interaction were also found to be associated with lower depression. This highlights the importance of having healthy relationships and having supportive individuals in one's life that can help with practical needs. Previous research has indicated the importance of such types of support for promoting effective infectious disease treatment outcomes (Wu et al., 2015) and for LTBI treatment acceptance specifically (Colson et al., 2011).

Finally, higher self-reported general health was associated with lower depression, highlighting the interconnection between self-reported physical and mental health outcomes.

This also suggests that addressing mental health factors could play an important role in effective LTBI treatment, and effective medical treatment may, in turn, lead to better mental health outcomes. This is in alignment with prior research that suggests that persons treated for LTBI report improved psychosocial outcomes compared with persons who have active TB (Bauer et al., 2013). Future research should clarify these relationships in homeless-experiencing individuals with LTBI and extend them to explore relationships with other physical health comorbidities.

Strengths of this study include a focus on a much understudied population: homeless-experiencing adults with LTBI in the U.S. Other strengths include medically confirmed LTBI diagnosis and in-person interviews. We are limited by the small sample size, which inhibits our ability to control for covariates or test for complex interrelationships (e.g. moderation and mediation). Those who agree to participate in an LTBI treatment program may be different than those who do not; however, those who do not chose to participate may have *higher* rates of psychopathology (Waldrop-Valverde and Valverde, 2005) further emphasizing the need to address mental health in this population. We have a truncated assessment of physical health comorbidities and our analyses are cross-sectional. Nonetheless, we believe our finding provide important preliminary insights into the interrelationships between psychosocial factors in this rarely studied population.

It is imperative that health professionals understand how psychosocial variables interrelate to produce downstream effects on homeless-experiencing persons with LTBI, particularly with respect to their perceptions of their health and role in the treatment process. Neglecting to do so could present yet another barrier to effective LTBI treatment in an already underserved and high-risk group. Future research should evaluate the effect of mental health interventions on LTBI treatment outcomes and completion. Providing mental health resources, creating programs that facilitate social support, and addressing severe substance use could improve adherence and overall treatment outcomes for LTBI in homeless-experiencing persons in the U.S.

Declaration of conflicting interests

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Supplemental material

Supplemental material for this article is available online.

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