Association between psychosocial factors and co-morbid cigarette smoking and alcohol use in a population experiencing homelessness

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ABSTRACT

The prevalence of combustible cigarette smoking in populations experiencing homelessness in the United States is five times that of the general population. The psychosocial well-being of persons who smoke and experience homelessness is poorer if such persons also use alcohol heavily. The PTQ2 study was a randomized clinical trial among persons experiencing homelessness who were also current smokers and heavy alcohol consumers. Secondary data analysis of the PTQ2 baseline data was conducted to examine associations among psychosocial variables (anxiety, depression, hopelessness, social network size), heaviness of smoking (cigarettes/day) and alcohol consumption (drinking days/month), and duration and frequency of homelessness. Among the 420 participants, the majority were male (75%), black (70%) and non-Hispanic (94%) with a mean age of 46.6 years ($SD = 11.6$). Bivariate analyses show that heaviness of smoking was positively correlated with social network size ($r = 0.16$, $p = .001$). Heaviness of drinking was positively correlated with the MINI anxiety score ($r = 0.13$, $p = .009$) and marijuana use (median total number of drinks in past 30 days among those who used marijuana in past 30 days vs. did not use: 50 vs. 24, $p < .0001$), and associated with frequency of homelessness (median total number of drinks in past 30 days among those experiencing homelessness once vs. >1 time: 30 vs. 44, $p = .022$). The findings highlight the psychosocial factors that warrant consideration when addressing heavy smoking and alcohol consumption in persons experiencing homelessness.

1. Introduction

Homelessness impacts approximately 1.5% of adults in the United States each year, and up to 4.2% of adults will experience homelessness in their lifetime (Tsai, 2018). Homelessness is associated with many detrimental impacts on health (Hwang, 2001), including mental health (Okuyemi et al., 2013). An area of particular concern is the high rate of cigarette smoking among people experiencing homelessness in the United States, which, at approximately 80%, is more than five times higher than the rate (~15%) among the general adult population (GBD 2015 Tobacco Collaborators, 2017). Offering ways to engage in smoking cessation may be an important strategy to mitigate the impact of

homelessness on preventable smoking related mortality and morbidity (Baggett et al., 2015).

People who smoke and experience homelessness express interest in smoking cessation (Maddox & Segan, 2017; Sung & Apollonio, 2017; Porter et al., 2017; Stewart, Stevenson, Bruce, Greenberg, & Chamberlain, 2015; Baggett, Lebrun-Harris, & Rigotti, 2013). However, there are a variety of opinions on the best mechanism to ensure that these people who are motivated to quit smoking eventually do so. These views are related to concerns about the social environment of the people who smoke and the impact of stressors. For instance, there have been concerns about the increased number of days of reported mental health problems and greater exposure to stressors among persons experiencing

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homelessness in comparison to economically disadvantaged domiciled smokers (Businelle et al., 2013). Other studies have highlighted the complex impact of the social environment such as the attitude of staff of homeless shelters and peer pressure on the outcomes of smoking cessation efforts (Porter et al., 2017; Mullins, O'Hanlon, Shadel, & Tucker, 2018; Pratt et al., 2019).

To date, smoking cessation interventions for people experiencing homelessness have shown limited efficacy. Bonevski, Baker, Twyman, Paul, and Bryant (2012) provided a phone-based intervention with personalized counselling about smoking cessation or reduction and alcohol use in a sample of 12 homeless smokers. Results showed that most participants found the intervention acceptable and feasible and reported positive changes to their health risk behavior. Results from a randomized controlled trial (RCT) among 50 homeless people (25 each in the control and experimental groups) conducted in Boston, M.A., U.S. A. to analyze the effect of financial incentives and text messaging interventions on smoking cessation suggested that financial incentives may be a safe way to promote brief smoking abstinence (Baggett et al., 2018). A Cochrane review on interventions for tobacco use among people experiencing homelessness showed that there is evidence to support longer interventions that address tobacco in the context of substance use, and that contingency management showed promise as an intervention but was not demonstrated to be efficacious, possibly due to the small sample size (Vijayaraghavan et al., 2020). The variable success as highlighted in the Cochrane review points to the fact that we need to better understand this unique population and further tailor interventions specific to them to achieve a consistent level of success in smoking cessation.

Another challenge for smokers experiencing homelessness is the frequent co-occurrence of heavy alcohol consumption. Prior research with community samples of people experiencing homelessness shows that concurrent alcohol use makes smoking cessation more difficult (Okuyemi et al., 2013; Pratt et al., 2019). As many as 95% of smokers experiencing homelessness also have a history of heavy alcohol use or illicit drug use (Baggett & Rigotti, 2010). Psychosocial factors such as levels of depression, anxiety, perceived stress, hopelessness, subsistence difficulties and social network size have been related to cigarette smoking and alcohol consumption in persons experiencing homelessness (Harris, Winetrobe, Rhoades, & Wenzel, 2019; Wang et al., 2019; Baggett et al., 2018a). Despite this, there is paucity of data on the broader psychosocial characteristics of a population of smokers who consume alcohol and are experiencing homelessness in the community. In our prior study, Power to Quit (PTQ), we observed that a reduction in smoking was associated with reduced alcohol consumption (Okuyemi et al., 2013; Pratt et al., 2019).

Studies that have focused on smoking cessation for individuals with alcohol use disorders report low smoking cessation rates (average quit rate 7%) with high rates of relapse (Baggett et al., 2018). Moreover, relapse to smoking increases the likelihood of relapse to alcohol consumption and vice versa (Okuyemi et al., 2013; Reitzel, Nguyen, Eischen, Thomas, & Okuyemi, 2014). Addressing smoking may potentially improve alcohol abstinence, although findings are mixed (Kalman et al., 2010; Holt, Litt, & Cooney, 2012). While smoking and drinking often are related behaviors, addressing these behaviors simultaneously in a cessation program is complex and rarely done (Baggett et al., 2018b). Few intervention/treatment studies have focused on people experiencing homelessness who both smoke and consume alcohol; one study included a significant number of participants experiencing homelessness and reported quit rates of 40% at 12 months follow up for alcohol and smoking cessation (Burling, Seidner Burling, & Latini, 2001). This study focused on people who were undergoing long-term intensive residential treatment, which limits generalizability of the findings. Another recent study evaluated the efficacy of a 6-week smoking and/or alcohol cessation intervention in reducing post-operative complications among patients undergoing bladder cancer surgery who were smokers (Lauridsen et al., 2022). While there were no

differences in post-operative complications between those receiving the cessation intervention and those in the treatment-as-usual control group, those in the intervention arm were twice as likely to be abstinent from smoking and drinking at the end of the intervention than those in the control group; however, this difference did not persist at 12-month follow-up.

In our study, we present baseline data from the Power to Quit 2 (PTQ2) study, a randomized clinical trial designed to evaluate an intervention that concurrently addressed tobacco and alcohol use cessation among people experiencing homelessness. The PTQ2 study was conducted with a community-based sample of people experiencing homelessness that mostly utilized homeless shelters. Despite the high level of alcohol use among people who smoke and are also currently homeless (Baggett and Rigotti, 2010; Harris et al., 2019; Wang et al., 2019), the PTQ2 study is the first in this population to examine the delivery of an alcohol use intervention concurrent with smoking intervention.

This report examines baseline data from the PTQ2 sample to determine associations among psychosocial variables (anxiety, depression, hopelessness, social network size), heaviness of smoking (cigarettes/day) and alcohol consumption (drinking days/month), and duration and frequency of homelessness among 420 adults experiencing homelessness. The psychosocial factors that we examined were chosen for study because available evidence suggests a link between these factors, the homelessness experiences, heaviness of smoking and heaviness of drinking in people experiencing homelessness. The information presented herein is designed to better guide future smoking cessation interventions within at-risk populations experiencing homelessness.

2. Material and methods

PTQ2 was a RCT among people experiencing homelessness who were both currently smoking and using alcohol (Pratt et al., 2019,2022). The study population consisted of participants from the Minneapolis and Saint Paul, Minnesota metro area who were homeless as defined by the U.S government (United States. (2004), 2004). Study questionnaires were completed by hand by research assistants working with the study participants. The inclusion criteria were self-reported smoking of at least 100 cigarettes in lifetime and current everyday smoking or had been smoking for over 7 days prior to the questionnaire interviews. At eligibility, the question asked was "do you now smoke cigarettes, excluding e-cigarettes, every day, some days, or not at all?" They were ineligible if they answered, "not at all." They were then asked about their smoking in the last 7 days and the number of cigarettes they smoked each day during that time. Originally, the eligibility criteria included an Alcohol Use Disorder Identification Test (AUDIT) Score of ≥ 7 (Saunders, Aasland, Babor, de la Fuente, & Grant, 1993). Persons with a score >26, or a score between 20 and 26 who had a Clinical Institute Withdrawal Assessment for Alcohol Revised (CIWA-Ar) score of 15 or more, were excluded due to concerns about safety in managing potential alcohol withdrawal (Ojo-Fati et al., 2017). Discussion with the Data and Safety Monitoring Board (DSMB) and evaluation of the literature indicated that persons with a score in the range of 5–6 typically are considered at high risk of alcohol-related harm, particularly if they are from susceptible groups, therefore participants with AUDIT scores ≥ 5 were included in the study. PTQ2 was a three-arm study with randomization into three groups: (1) Integrated Intensive Smoking plus Alcohol intervention using cognitive behavioral therapy (IS + A); (2) intensive smoking intervention using CBT (IS); (3) Usual Care (brief smoking intervention and brief alcohol counseling). A full explanation of the design and methods can be found in previous studies (Pratt et al., 2019, 2022). Participants were recruited from urban shelters, using community outreach methods to engage potential participants who were interested in stopping smoking, between November 2014 and March 2018 for the PTQ2 study. Of 1,481 who were screened, 647 were eligible, and 420 completed baseline measures and were randomized. Fig. 1 shows the
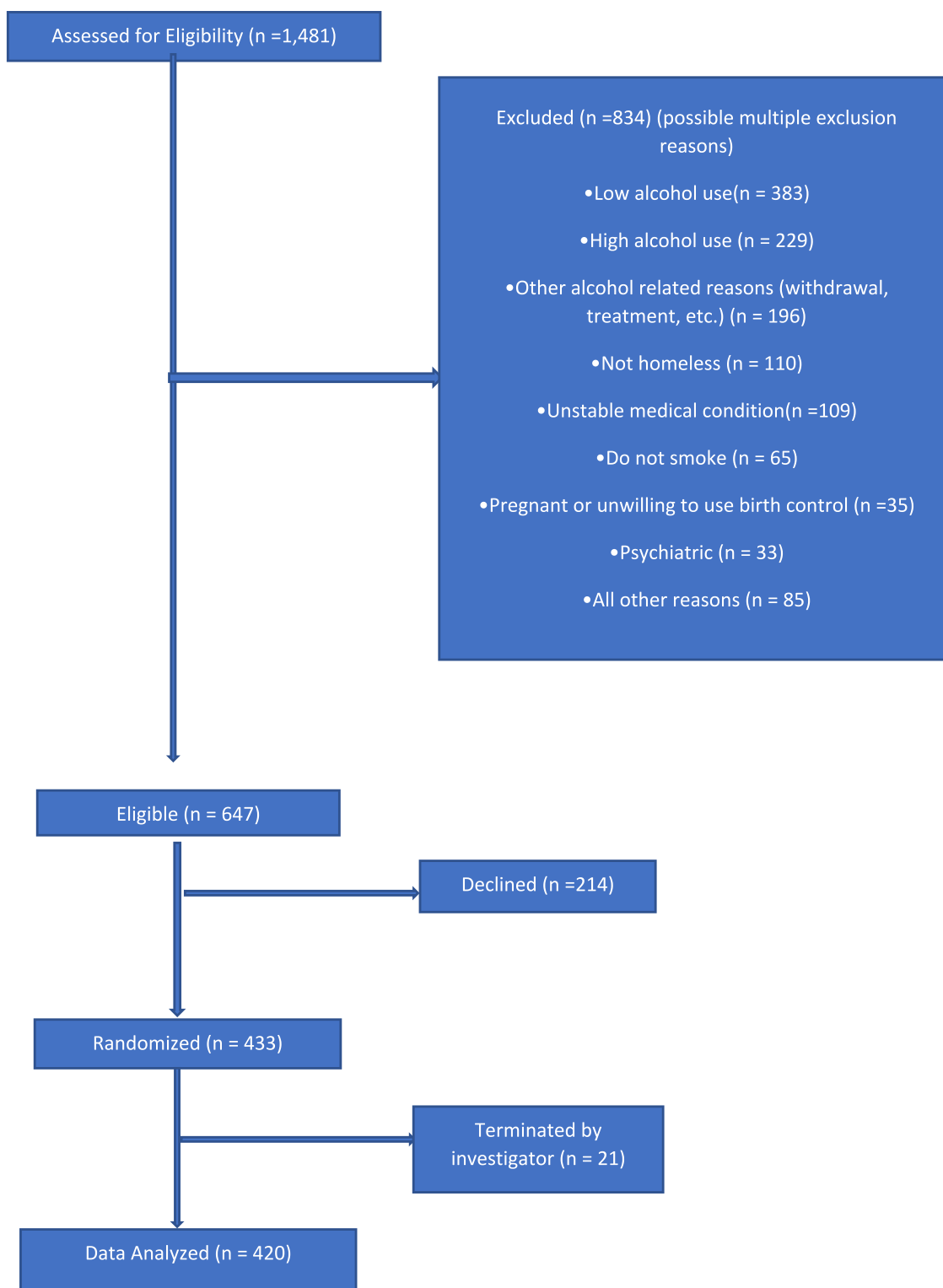
Fig. 1. Number of subjects screened, eligible, randomized, and analyzed and reasons for exclusion.

reasons for non-eligibility. Our aim was to analyze the data from the PTQ2 RCT to determine the association between psychosocial factors and co-morbid cigarette smoking and alcohol use.

All measures reported herein were collected at baseline, prior to study interventions. Homelessness characteristics were determined by self-report of the number of times homeless in the past 3 years (just once vs. >1 time) and duration of current homeless episode (less than 1 year [recent homeless] vs. 1 year and longer [chronic homeless]). Heaviness

of smoking was measured by self-reported cigarettes smoked per day (CPD), collected initially at eligibility screening. Other measures included Contemplation to Quit Smoking and Contemplation to Quit Drinking Scales (Ojo-Fati et al., 2015; Saunders et al., 1993). Heaviness of drinking was calculated as a quantity-frequency index based on self-reported number of days with one or more drinks in the last 30 days times the number of drinks per drinking day in the last 30 days. A drink was defined as one 12- ounce beer, one 1.5 oz of hard liquor or one 5-

ounce glass of wine. Psychosocial characteristics and drinking and smoking patterns were assessed with well-validated questionnaires. Psychosocial measures included the Perceived Stress Scale (Sullivan, Sykora, Schneiderman, Naranjo, & Sellers, 1989), the Mini International Neuropsychiatric Interview (MINI) (psychotic score and anxiety score) (Lecrubier et al., 1997), the Kuopio Ischemic Heart Disease (KIHD) Risk Factor Study Hopelessness Scale (Everson et al., 1996), the Patient Health Questionnaire-9 (PHQ-9) assessment of depressive symptoms (Kroenke, Spitzer, & Williams, 2001), an assessment of social network size which is defined as the total number of close friends and children (Dhand et al., 2018).

Demographic and other baseline characteristics were summarized for the overall sample using mean and standard deviation (*SD*) for continuous variables and frequency and percentage for categorical variables. The bivariate relationship of duration and frequency of homelessness (binary variables) with each baseline demographic and psychosocial characteristic was examined using t-tests for continuous variables and Chi-square tests for categorical variables. The relationship of smoking or drinking heaviness (continuous variables) with baseline variables were estimated using Spearman correlation (*r*) for continuous variables and using ANOVA with *F*-test or the nonparametric Kruskal-Wallis test, as appropriate, for categorical variables. Appropriate descriptive statistics, including mean (with *SD*), median (with inter-quartile range or IQR, which is presented as the first quartile [Q_1] to the third quartile [Q_3]), and frequency (with %) are reported to accompany with the bivariate analyses. Multivariable analyses were performed for each psychosocial measure by using logistic regression for homelessness characteristics and linear regression for smoking or drinking heaviness, adjusting for age, gender, race (African American, white, other), and education (<high school, high school graduate or GED, >high school). Model diagnosis was routinely performed. All tests were two-sided, and *p*-values less than 0.05 were considered statistically significant. All analyses were done using SAS Software 9.4 (SAS Institute Inc., Cary, NC). The date of registration of the trial was 20 November 2014 with ClinicalTrials.gov Identifier: NCT01932996.

3. Results

3.1. Participants

At baseline, participants smoked 16.1 (*SD* = 10.8) cigarettes per day and consumed an average of 76.1 (*SD* = 121.0) drinks during the past 30 days. The most prevalent housing status was emergency shelter (57%), followed by a friend or relative's house (13%), and on the street (11%), with the duration of recent homeless episode ranging from <1 month to >3 years and the number of times being homeless in the past 3 years ranging from one to four or more times. The majority of participants were male (75%), black (70%), and non-Hispanic (94%). On average, participants were 46.6 years old (*SD* = 11.6). The sociodemographic and homelessness characteristics of the participants are shown in Table 1.

3.2. Heaviness of smoking and drinking and associated factors

Heaviness of smoking and heaviness of drinking were not significantly correlated in this study sample (*r* = 0.05, *p* =.35). The heaviness of smoking was positively correlated with social network size in both bivariate analysis (*r* = 0.16, *p* =.001) and multivariable analysis (each 1 person increase in social network is associated with 0.09 increase in CPD [95% CI: 0.02–0.16]), but not with other psychosocial variables or demographics (see Tables 2 and 3).

Heaviness of drinking was significantly, positively correlated with the MINI anxiety score (*r* = 0.13, *p* =.009), marijuana use (median [IQR] total number of drinks in past 30 days among those who used marijuana the past 30 days vs. did not use: 50 [20–108] vs. 24 [6–72], *p* <.0001), and male gender (median [IQR] drinks in past 30 days of males vs.

Table 1

Sociodemographic and homelessness characteristics of 420 homeless adults in the power to quit 2 study.

Variable	*N* = 420
Age (in years), mean (*SD*)	46.6 (11.6)
Gender, *n* (%)	
Male	314 (75)
Female	103 (25)
Transgender female (trans woman)	3 (<1)
Race, *n* (%)	
African American or Black	295 (70)
Asian	3 (<1)
Native American/Alaskan Native	7 (2)
White	74 (18)
More than one race	29 (7)
Not reported	12 (3)
Ethnicity, *n* (%)	
Hispanic or Latino	19 (5)
Not Hispanic or Latino	396 (94)
Not reported	5 (1)
Education, *n* (%)	
<High school	132 (32)
High school graduate or GED*	160 (38)
>High school	127 (30)
Employment, *n* (%)	
Employed full time or part time	65 (16)
Out of work for <1 year	93 (22)
Out of work for >1 year	74 (18)
Unable to work or disabled	172 (41)
Other	16 (4)
Monthly income (US$), *n* (%)	
<$400	209 (52)
$400–$799	98 (24)
≥$800	98 (24)
Usual housing status in past 6 months, *n* (%)	
On street	46 (11)
Emergency shelter	241 (57)
Hotel, motel, rooming or boarding house	9 (2)
Friend or relative's house	54 (13)
Drug, rehabilitation center, or halfway house	2 (<1)
Battered women's shelter	2 (<1)
A house, apartment, mobile home, or condo	34 (8)
Transitional housing	29 (7)
Other	3 (<1)
Duration of current homeless episode, *n* (%)	
<1 month	18 (4)
1–3 months	66 (16)
4–6 months	62 (15)
7–11 months	35 (8)
1–3 Years	152 (36)
>3 years	87 (21)
Number of times homeless in past 3 years, *n* (%)	
Just once	171 (41)
Two times	87 (21)
Three times	47 (11)
Four or more times	115 (27)
Housing stability (self-rating 0–10), mean (*SD*)	3.5 (3.5)

*General Educational Development Test.

Table 2

Bivariate analysis of psychosocial and other correlates of heaviness of smoking (cigarettes per day) and heaviness of drinking[1] at baseline.

Variables	Correlation[2] or Mean (SD)[3]	p-value
Heaviness of smoking		
Heaviness of drinking[1]	0.05	0.35
Perceived stress score	0.03	0.48
MINI psychotic score	−0.07	0.17
MINI anxiety score	0.04	0.40
Hopelessness score[4]	<0.01	0.91
Hopelessness scale category		0.57 ($F_{2,414}$ = 0.57)
Low (0–2)	15.6 (10.0)	
Moderate (3–5)	16.5 (11.8)	
High (6–8)	17.2 (12.2)	
PHQ9	0.01	0.79
PHQ9 category		0.65 ($F_{4,414}$ = 0.62)
None (0–4)	15.8 (10.0)	
Mild (5–9)	15.6 (11.2)	
Moderate (10–14)	17.9 (11.8)	
Moderately severe (15–19)	16.4 (11.2)	
Severe (20–27)	15.6 (12.2)	
Social network size	0.16	**0.001**
Unhealthy days	0.05	0.31
Age (years)	−0.07	0.14
Gender		0.26 ($F_{1,418}$ = 1.27)
Male	15.8 (10.8)	
Female[5]	17.2 (11.0)	
Race		0.17 ($F_{2,417}$ = 1.79)
African American or Black	15.8 (10.6)	
White	18.2 (12.0)	
Other[6]	15.1 (9.9)	
Employment		0.38 ($F_{2,415}$ = 1.05)
Employed full time or part time	14.8 (8.1)	
Out of work for less than 1 year	15.1 (10.3)	
Out of work for >1 year	15.7 (9.9)	
Unable to work or disabled	17.7 (11.6)	
Other/unknown	17.3 (12.2)	
Income		0.55 ($F_{3,416}$ = 0.71)
<$400	16.7 (11.7)	
$400-$799	16.2 (10.7)	
≥$800	15.2 (8.8)	
Unknown	13.6 (10.8)	
Marijuana use in the last 30 days		0.13 ($F_{1,416}$ = 2.31)
Yes	15.3 (10.9)	
No	16.9 (10.7)	

Variables	Correlation[2] or Median [IQR][7]	p-value
Heaviness of drinking[1]		
Heaviness of smoking	0.05	0.35
Perceived stress score	0.05	0.31
MINI psychotic score	<0.01	0.95
MINI anxiety score	0.13	**0.009**
Hopelessness score[4]	−0.03	0.53
Hopelessness scale category		0.95
Low (0–2)	40 [12–90]	

Table 2 (*continued*)

Variables	Correlation[2] or Mean (SD)[3]	p-value
Moderate (3–5)	40 [12–90]	
High (6–8)	30 [12–75]	
PHQ9	0.04	0.46
PHQ9 category		0.14
None (0–4)	39 [10–90]	
Mild (5–9)	35 [12–80]	
Moderate (10–14)	40 [12–100]	
Moderately severe (15–19)	30 [12–80]	
Severe (20–27)	70 [38–165]	
Social network size	0.09	0.055
Unhealthy days	0.06	0.22
Age (years)	−0.04	0.45
Gender		**0.042**
Male	40 [12–96]	
Female[5]	30 [9–72]	
Race		0.093
African American or Black	40 [12–96]	
White	29 [12–50]	
Other[6]	40 [12–98]	
Employment		**0.049**
Employed full time or part time	55 [13–100]	
Out of work for less than 1 year	30 [12–75]	
Out of work for >1 year	50 [24–100]	
Unable to work or disabled	35 [12–80]	
Other/unknown	16 [5–50]	
Income		0.79
<$400	40 [12–90]	
$400–$799	30 [10–78]	
≥$800	40 [12–80]	
Unknown	30 [6–160]	
Marijuana use in the last 30 days		**<0.0001**
Yes	50 [20–108]	
No	24 [6–72]	

[1] Heaviness of drinking was calculated as the product of (1) the number of days, during the past 30 days, drinking one or more drinks of alcoholic beverage and (2) the number of drinks on drinking days.

[2] Spearman correlation and *p*-value are presented for continuous variables.

[3] Mean and standard deviation (*SD*) of heaviness of smoking and *F*-test statistic and *p*-value are presented for the analysis of the relationship between categorical variables and heaviness of smoking.

[4] Hopelessness score (range 0–8): the sum of the response to the questions "The future seems to me to be hopeless, and I can't believe things are changing for the better (4 = strongly agree to 0 = strongly disagree)" and "I feel it is impossible for me to reach the goals that would like to strive for (4 = strongly agree to 0 = strongly disagree)".

[5] Including transgender women.

[6] Including Asian, Native American/Alaskan Native, more than one race, and unknown/not reported.

[7] Median and interquartile range (*IQR*) of heaviness of drinking and Kruskal-Wallis test *p*-value are presented for the analysis of the relationship between categorical variables and heaviness of drinking.

females = 40 [12–96] vs. 30 [9–72], *p* =.042), and marginally with employment (*p* =.049) in bivariate analysis (Table 2). After adjusting for age, gender, race, and education in multivariable regression, associations of drinking with MINI anxiety score and marijuana use remained statistically significant (*p* =.002 and 0.016, respectively). Likewise, the associations between drinking and perceived stress score, MINI psychotic score and PHQ9 were statistically significant (*p* =.002, 0.040 and 0.004, respectively; Table 3).

Table 3

Significant multivariable regression analyses[1] results of heaviness of smoking (cigarettes per day) and heaviness of drinking at baseline.

Variables	Estimated Regression Coefficient	95% Confidence Interval	p-value
Heaviness of Smoking (Cigarettes Per Day)			
Social network size	0.093	(0.024, 0.162)	**0.008**
Heaviness of Drinking			
Perceived stress score	5.24	(1.97, 8.51)	**0.002**
MINI* psychotic score	14.88	(0.67, 29.09)	**0.040**
MINI* anxiety score	6.12	(2.91, 9.33)	**0.002**
PHQ9**	2.70	(0.86, 4.53)	**0.004**
Marijuana use in the last 30 days (yes)	28.9	(5.47, 52.38)	**0.016**

* Mini International Neuropsychiatric Interview.

**Patient Health Questionnaire-9.

[1] Multivariable linear regression model for each of the studied psychosocial variables (perceived stress score, MINI psychotic score, MINI anxiety score, hopelessness score, PHQ9, and Social network size) and marijuana use, adjusted for age (years), gender, race (African American, white, other), and education (<high school, high school graduate or GED, > high school). Only models with a significant p-value (*p* <.05) for the studied psychosocial variable are presented in this table.

3.3. Homeless characteristics and associated factors

The duration of the current homeless episode and the frequency of being homeless in the past 3 years were positively associated. The odds of being homeless multiple times were 93% higher (95% CI: 30% to 187%; *p* =.001) in participants who had been homeless for ≥ 1 year compared to participants who had been homeless for less than 1 year.

As shown in Supplementary Tables 1 and 2, in the bivariate analysis, heaviness of drinking was positively related to frequency of homelessness (median [IQR] total number of drinks in past 30 days for homelessness once vs. >1 time: 30 [9–75] vs. 44 [15–100], *p* =.022), but not with duration of homelessness. Heaviness of smoking was not significantly related to any homelessness characteristics.

In addition, age was significantly negatively related to frequency of homelessness (*p* =.049). On average, participants who had been homeless multiple times were younger (mean difference [95% CI]: −2.26 [−4.51, −0.01] years) than participants who had been homeless only once (Table 4). The duration of the current homeless episode was not related with any psychosocial or demographic characteristics, or substance use status in bivariate analysis (see Supplementary Table 1), but multivariable regression analysis (Table 4) revealed that persons with longer duration of homelessness had larger social networks.

Table 4

Multivariable regression analyses[1] results of duration and frequency of homelessness at baseline.

Variables	Estimated Odds Ratio	95% Confidence Interval	p-value
Duration of Homelessness (≥1 year)			
Social network size	1.018	(1.001, 1.035)	**0.033**
Frequency of Homelessness (>1 time)			
MINI* anxiety score	1.09	(1.02, 1.15)	**0.007**
Hopelessness score	1.09	(1.00, 1.18)	**0.048**

*Mini International Neuropsychiatric Interview.

[1] Multivariable logistic regression model for each of the studied psychosocial variables (perceived stress score, MINI psychotic score, MINI anxiety score, hopelessness score, PHQ9, and Social network size) and marijuana use, adjusted for age (years), gender, race (African American, white, other), and education (<high school, high school graduate or GED, > high school). Only models with significant result (*p* <.05) for the studied psychosocial variable are presented in this table.

Specifically, the odds of being homeless for ≥1 year increased by 1.8% (95% CI: 0.1–3.5%; *p* =.033) for each person increase in social network (or equivalently, increased by 20% [95% CI: 1–41%] for each 10-person increase in social network), after adjusting for age, gender, race and education.

Frequency of homelessness was significantly related with greater anxiety in bivariate analysis (*p* =.008; see Supplementary Table 2), and remained statistically significant after adjusting for age, gender, race, and education (*p* =.007; see Table 4). Each 1-point higher M.I.N.I. Anxiety score was related to 9% greater odds of experiencing homelessness two or more times. Frequency of homelessness was positively related to hopelessness score; this association was marginally significant in the initial bivariate analysis (p =.056; see Supplementary Table 2) and statistically significant in the multivariable adjusted model (*p* =.048; see Table 4). Each 1-point higher score on the Hopelessness Scale was associated with 9% increased odds of having experienced homelessness two or more times. In bivariate analyses, duration of homelessness was not significantly associated with anxiety, hopelessness or depression (with respective *p*-values of 0.12, 0.39 and 0.33; see Supplementary Table 1).

4. Discussion

This study provided a valuable opportunity to evaluate associations among cigarette smoking and alcohol consumption behaviors, demographic characteristics, experiences of homelessness, and psychosocial factors in a sample of adults experiencing homelessness participating in a cessation RCT. Surprisingly, heaviness of smoking and heaviness of drinking were not significantly correlated, which contrasts with several prior studies (Baggett & Rigotti, 2010; Harris et al., 2019; Wang et al., 2019). This discrepancy in findings indicates that the relationship between heaviness of smoking and drinking may be different in this population compared to the general population, although the analysis is constrained by the limited range of severity of alcohol use among participants' behaviors in this sample. This difference from the stably housed population highlights the importance of examining the psychosocial variables that are influential for smokers experiencing homelessness. This study examined baseline psychosocial characteristics of the study sample to better understand factors that may inform future cessation strategies with homeless smokers. These findings fill an important gap in the current literature and help to reflect the real-world complexities facing tobacco and alcohol users experiencing homelessness (Porter et al., 2017; Mullins et al., 2018; Pratt et al., 2019).

Addressing smoking cessation in homeless shelters where the cultural norms are usually pro-smoking (Stewart et al., 2015; Harris et al., 2019) adds to the complexities and unique challenges experienced by smokers who are homeless. Stable housing can mitigate some of these challenges and complexities (Baggett et al., 2013. Moreover, some shelter environments offer much-needed access to health services, which can lead to improvements in health (Moriarty, Zack, & Kobau, 2003). There is some indication that supportive family and friend networks are positively associated with successful quit attempts (Glenn, Lapalme, McCready, & Frohlich, 2017; Vijayaraghavan, Hurst, & Pierce, 2017), but the presence of other smokers in the social network can lead to relapse (Schanzer et al., 2007). For this sample of participants, a larger social network was positively associated with an increased heaviness of smoking and duration of homelessness, which may be due in part to the study participants mostly residing in shelters. This is consistent with prior research that highlights the role of peer pressure, or the pro-smoking norms in shelter settings (Stewart et al., 2015; Harris et al., 2019; Kroenke et al., 2001). Therefore, tailoring cessation programs to consider the potential impact of peers and social networks, or programs that can target social networks or groups of peers, may be important in this population.

In addition, in this study the duration of the current homeless episode and the frequency of being homeless in the past 3 years were

positively associated. Being homeless for longer was associated with more frequent transitions to and from homelessness during this 3-year period. Previous studies in the U.S have used housing histories to identify the reasons people move from place to place. The length of stay in each homelessness episode was found to be linked with future homelessness experiences (Desmond, 2015; García & Rúa, 2018; Kim & Garcia, 2019).

In this study, we found that heaviness of drinking was related to the frequency of homelessness (based on the bivariate analysis finding only) and higher anxiety (confirmed by both bivariate and multivariable findings). Frequency of homelessness was associated with increased levels of anxiety and hopelessness (by both bivariate and multivariable findings). In the general population, depression is associated with smoking and impacts cessation (Park, Schultz, Tudiver, Campbell, & Becker, 2004; Sun et al., 2009) whereas anxiety has been less consistently associated with smoking or quitting (Sun et al., 2009; Matheny & Weatherman, 1998). Nonetheless, our study suggests that addressing mental health needs, including anxiety, is an important consideration for tailoring cessation programming among homeless adults and may be critical to address prior to implementing smoking cessation interventions.

Hopelessness emerged as an important psychosocial variable associated with frequency of homelessness, with potential impact on efforts to address both smoking and drinking. The literature reports hopelessness as influential on the use of alcohol (Weinberger et al., 2017; Steger, Mann, Michels, & Cooper, 2009; McClave et al., 2009; Baines, Jones, & Christiansen, 2016) and an important indicator for future risk for poor cardiovascular health (Everson et al., 1996; Everson, Kaplan, Goldberg, & Salonen, 2000; Whipple et al., 2009). Hopelessness has mainly been explored in relation to groups experiencing health-related issues alongside smoking, such as pregnancy (Petersen, Steyn, Everett-Murphy, & Emmelin, 2010) and lung cancer (Berg et al., 2013) but it has not been explored in relation to smoking cessation for people experiencing homelessness. Addressing hopelessness alongside anxiety may be important when targeting homeless smokers who also consume alcohol.

Moreover, drug availability and affordability could impact the cigarette and alcohol consumption patterns of homeless populations. The social context of housing, feelings of security and hope and the different housing situations have been linked to this trend in U.S studies (Johnson, 1997; Polcin, 2016; Dickson-Gomez, McAuliffe, & Quinn, 2017).

We also found that in contrast to some available literature on the general population, there was no correlation between the heaviness of smoking and alcohol consumption (Picone et al., 2004; Wetzels, Kremers, Vitória, & de Vries, 2003; Falk, Yi, & Hiller-Sturmhöfel, 2006; Dawson, 2000; DiFranza & Guerrera, 1990; Friedman, Tekawa, Klatsky, Sidney, & Armstrong, 1991). However, our finding agrees with another study which suggested that reported associations between smoking and alcohol were unlikely to be causal and may have been the result of confounding factors or reverse causation (Taylor et al., 2018). Another important take away from the Taylor et al., 2018 article was that interventions that target reductions in tobacco consumption may not necessarily also lead to any change in alcohol consumption, and interventions that seek to target both smoking and alcohol will need to incorporate active ingredients for each substance. This supports the need for interventions such as PTQ2 that target both alcohol and tobacco instead of relying on treating one substance with the hopes of also reducing use of the other. This observation may be applicable to our unique population and should be considered in designing policy interventions to address psychosocial problems among people experiencing homelessness.

4.1. Limitations

The data were collected in the Upper Midwest of the US and may not be representative of other groups of smokers also experiencing homelessness. The generalizability of these data is further limited by this group of smokers also being drinkers. In addition, the participant eligibility for inclusion into the study led to a limited range of smoking and drinking behaviors. This study was not designed to carefully evaluate mental health or psychosocial needs of homeless smokers, so to more fully understand the relationships observed, additional data on psychiatric history would be needed. In addition, the use of cross-sectional and self-reported data prevents making any causal inferences. For example, we did not explore the potential mediation effect of hopelessness in the relationship between alcohol and tobacco use and homelessness experiences due to the difficulty in interpreting mediation effects in the context of a cross-sectional study design. Longitudinal studies may be better suited for examining the pathways among the factors presented in this study.

5. Conclusions

Improved knowledge of psychosocial characteristics of smokers experiencing homelessness may provide insights into how to best meet the needs of this population. The findings point to the importance of anxiety, depression, peer support for smoking and alcohol use, and hopelessness in the design of interventions to address smoking and alcohol use in people experiencing homelessness.

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CRediT authorship contribution statement

Olanrewaju Onigbogi: Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Rebekah Pratt:** Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Xianghua Luo:** Data curation, Formal analysis, Methodology, Software, Writing – original draft, Writing – review & editing. **Susan A. Everson-Rose:** Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Ned L. Cooney:** Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. **Sheila Specker:** Data curation, Formal analysis, Methodology, Supervision, Writing – original draft, Writing – review & editing. **Kolawole Okuyemi:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Resources, Supervision, Validation, Writing –

original draft, Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data presented in this study are available on request from the Principal Investigator (PI), Dr Kolawole Okuyemi. The data are not publicly available due to privacy restrictions.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.abrep.2023.100523.

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