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Abstract

Over 70% of adults experiencing homelessness are cigarette smokers, a fivefold greater rate than in the general U.S. population. Consequently, tobacco-related conditions are the leading causes of disease and death for this group. Adults experiencing homelessness tend to seek shelter in urban areas. Thus, they not only experience the daily stressors of being homeless, but they may additionally experience unique or additive urban stressors (e.g., stress related to using public services, crime and violence, and/or cultural conflicts with others). For some smokers, stress is known to increase smoking rates and decrease readiness to quit smoking. Likewise, increased smoking rates alone may lead to a lower likelihood of making a quit attempt. The current study examined the potential mediating role of smoking level in the association of urban stress and quit readiness among adults experiencing homelessness (N = 411). Two multinomial logistic regression analyses revealed that urban stress was positively associated with smoking level (p = 0.02). The odds ratio for one-unit increase in stress was 1.047 ($CI_{.95}$:1.014, 1.082) for being a heavy vs. non-daily smoker. Furthermore, analyses revealed smoking level mediated the effect of stress on quit readiness (ab = -0.005, $CI_{.95}$:-0.010, -0.002]). Homeless smokers who report high levels of stress might smoke at higher levels, which could attenuate quit readiness.

Keywords

smoking, tobacco, homelessness, urban stress, smoking level

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Abstract

Over 70% of adults experiencing homelessness are cigarette smokers, a fivefold greater rate than in the general U.S. population. Consequently, tobacco-related conditions are the leading causes of disease and death for this group. Adults experiencing homelessness tend to seek shelter in urban areas. Thus, they not only experience the daily stressors of being homeless, but they may additionally experience unique or additive urban stressors (e.g., stress related to using public services, crime and violence, and/or cultural conflicts with others). For some smokers, stress is known to increase smoking rates and decrease readiness to quit smoking. Likewise, increased smoking rates alone may lead to a lower likelihood of making a quit attempt. The current study examined the potential mediating role of smoking level in the association of urban stress and quit readiness among adults experiencing homelessness (N = 411). Two multinomial logistic regression analyses revealed that urban stress was positively associated with smoking level (p = 0.02). The odds ratio for one-unit increase in stress was 1.047 ($CI_{.95}$:1.014, 1.082) for being a heavy vs. non-daily smoker. Furthermore, analyses revealed smoking level mediated the effect of stress on quit readiness (ab = -0.005, $CI_{.95}$:-0.010, -0.002]). Homeless smokers who report high levels of stress might smoke at higher levels, which could attenuate quit readiness.

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Introduction

Over 580,000 people reported experiencing homelessness in the United States on a single night in 2020, with over one quarter experiencing ongoing, chronic (≥ 1 year) homelessness (HUD, 2021). As many as 70% of adults experiencing homelessness are conventional cigarette smokers, a prevalence 5 times higher than their housed counterparts (Baggett & Rigotti, 2010; Creamer et al., 2019); and tobacco-related conditions have been some of the top leading causes of elevated morbidity and mortality rates within this group (Baggett, Hwang, et al., 2013; Soar et al., 2020; Vijayaraghavan, et al., 2020). For example, one study cited cancer as the second leading cause of death in a large sample of adults experiencing homelessness, with lung cancer constituting more than one third of cancer deaths (Baggett, Tobey, et al., 2013). Consequently, facilitating smoking cessation among adults experiencing homelessness is crucial to

reduce their smoking-related health/cancer disparities.

Cigarette smoking is linked with the chronic stress associated with experiencing homelessness (Businelle et al., 2013; Okuyemi, et al. 2006). Soar and colleagues' (2020) systematic review on smoking cessation among homeless smokers highlighted the importance of the social environment as a key barrier to smoking cessation. Common stressors experienced by this group include fear of victimization, food insecurity, and difficulty obtaining adequate shelter and accessing healthcare (Baggett, Hwang, et al., 2013; Baggett, Tobey, et al., 2013; Baggett & Rigotti, 2010). Moreover, there are potentially unique and additional stressors for those in urban areas (Lecic-Tosevski, 2019), including difficulty accessing public services, high crime and violence, exposure to gang activity, and elevated racism and discrimination (Agrawal et al., 2019; Murphy, 2019; Palepu et al., 2012; Wrighting et al., 2019).

Adults experiencing homelessness report smoking as a way of coping with acute stressors, including urban stress (Businelle et al., 2013; Okuyemi et al., 2006). In the same vein, previous studies have shown a strong link between stress and nicotine withdrawal (Lawless et al., 2015). More specifically, stress may increase the urge to smoke. As acute stressors may transition to the experience of chronic stress in adults experiencing homelessness, individuals who smoke may increase the number of cigarettes they smoke as a perceived solution to relieve the physiological consequences of stress dysregulation (i.e., smoking to "relieve stress"). A parallel to this is seen in research among domiciled smokers during the COVID-19 pandemic: sizeable portions of smokers reporting high or increased stress during this time also reported increases in smoking rates (Nagawa et al., 2022; Popova et al., 2023; Rigotti et al., 2021), and for some, decreased readiness to quit (Klemperer, 2020). Therefore, it may be that for individuals experiencing homelessness, experiencing greater urban stress may translate to heavier cigarette consumption as a perceived means to cope, while also decreasing the likelihood of quitting (Brown et al, 2022; Lindson-Hawley et al., 2016).

Research on heaviness of smoking (smoking level) and how it links to factors related to quitting has been somewhat limited in homeless groups. Extant work suggests that light smoking is more prevalent among homeless vs. domiciled smokers, and that light homeless smokers report more past-year quit attempts compared to moderate/heavy homeless smokers (Nguyen et al., 2015). Furthermore, work done among domiciled smokers showed that non-daily smokers reported the highest desire to quit smoking, compared to moderate/heavy smokers (Savoy et al., 2014). Further, non-daily smokers were more likely to make a quit attempt within the past year and successfully quit, compared to heavy smokers (Swayampakala et al., 2013). Thus, indirect evidence may suggest that heavier smokers experience less readiness to quit than those who smoke fewer cigarettes per day.

Despite studies reporting associations between urban stress and heaviness of smoking (i.e., smoking level) on the one hand, and heaviness of smoking and less readiness to quit smoking on the other, it is *unclear* whether heaviness of smoking may mediate an association between urban stress and homeless smokers' readiness to quit smoking. However, it is *possible* given that

readiness to quit is a potential precursor to making a quit attempt and achieving smoking abstinence (Smit et al., 2010). A recent review indicated that much more research is needed regarding how to best support individuals experiencing homelessness who use tobacco, particularly in light of their daily stressors (Vijayaraghavan et al., 2020). This study was meant to incrementally add to this literature base. Results may have implications for targeted treatment efforts in homeless shelters where the capacity and resources to address smoking may be limited. It can also suggest the potential utility of reducing cigarette consumption to increase quit readiness. Finally, it may also suggest the importance of emphasizing alternative and positive coping strategies in interventions to reduce urban stress, which may ultimately better position smokers experiencing homelessness to make a smoking quit attempt.

Methods

Participants

Participants were 457 homeless adult conventional cigarette smokers who were a part of a larger study about the health of homeless adults (Neisler et al., 2018; Reitzel et al., 2017**)**. Inclusion criteria for the parent study included being age 18 or over, currently receiving services from at least 1 of 6 homeless serving agencies in Oklahoma City, OK, and > 6th grade English literacy. Additional inclusion criteria for the current study were self-identifying as being currently homeless and having smoked a cigarette in the last 30 days.

Procedures

Enrolled participants completed questionnaires onsite at a service agency and were compensated with a $20 gift card. Data were collected from July-August 2016. The study was approved by affiliated Institutional Review Boards and participants provided informed consent (see Neisler et al., 2018; Reitzel et al., 2017 for more information).

Measures

Participant characteristics. Participant characteristics included sex, age, race, and self-reported history of severe mental illness (major depression, post-traumatic stress or other anxiety disorders, bipolar disorder, and/or schizophrenia; coded 0 = "No" or 1 = "Yes").

Urban life stress. Urban life stress was measured using the 21-item Urban Life Stress Scale (ULSS; Jaffee et al., 2005), which assesses potential sources of daily stress experienced by persons living in medium to large cities (e.g., money or finances, transportation, neighborhood environment). Items, rated on a 5-point Likert scale with 1 = "No stress" and 5 = "Extreme stress," were summed for a total score. The reliability was $\alpha = 0.91$.

Smoking level. Smoking level was self-reported via status as a non-daily smoker or a daily smoker, which was further categorized using the average cigarettes smoked per day, as follows: light (1-10 cigarettes/day), moderate (11-20 cigarettes/day), or high (21+ cigarettes /day) level smokers. The categorization of smoking level was based on previous work demonstrating clinically significant differences in tobacco related outcomes, including nicotine dependence, between the groups (e.g., Nguyen et al., 2015; Savoy et al., 2014).

Readiness to quit. Readiness to quit was assessed using a modified Biener & Abrams

(1991)'s Contemplation Ladder. This ordinal measure has 8 levels with anchors where 1 = "I enjoy smoking and have decided not to quit smoking for my lifetime. I have no interest in quitting," and 8 = "I still smoke, but I have begun to change, like cutting back on the number of cigarettes I smoke. I am ready to set a quit date."

Statistical Analyses

Of the sample of 457 participants, missing data ranged from 0% to 8.32% with no patterns related to missingness (Little's MCAR test $X^2 = 4.581$, $p = .101$). Therefore, the analyzable sample ($n = 411$) included participants with complete data. Chi-square score tests were used to examine whether the proportional odds assumptions were met for readiness to quit (McCullagh, 1980) with a $p > 0.05$. However, the assumptions of proportional odds were not met; therefore, the effect of urban life stress on smoking level and readiness to quit, respectively, was examined using two multinomial logistic regression analyses. Odds ratio (ORs) and 95% confidence intervals were calculated for each interpretable result. Lastly, mediation analysis was conducted using structural equation modeling to test the indirect effect on urban life stress and readiness to quit via smoking level in a single analysis. Due to the ordinal nature of the mediator and outcome, we conducted Bayesian analyses with 10,000 iterations in line with an ordered probit model and non-normal parameter distributions (Muthén, 2011). The total effect, direct effect, and indirect effects were derived. Age, sex, race, and serious mental illness diagnosis were included as covariates in the multinomial logistic regression models and mediation analysis. Significance was set at $p < 0.05$. Mediation analysis was conducted with the Mplus statistical package (version 7.4); other analyses were run using SAS 9.4 (SAS Institute, Cary, NC, USA).

Results

Sample Descriptive Statistics and Correlations

Of the 411 participants (M_{age} = 43.3±11.8), 64.96% ($n = 267$) were men. Nine percent ($n = 37$) of participants were non-daily smokers, 28.71% ($n = 118$) were light smokers, 46.72% ($n = 192$) were moderate smokers, and 15.57% ($n = 64$) were heavy smokers. See Table 1 (participant characteristics) and Table 2 (correlations between variables).

Multinomial Logistic Regression

Two adjusted multinomial logistic regression analyses were conducted to examine the effect of urban life stress on smoking level (reference group: non-daily smokers) and readiness to quit (reference group: "[…]. I have no interest in quitting."). The overall effect of urban life stress was significant for smoking level ($p = 0.0192$), but not for readiness to quit ($p = 0.7336$). Significant results showed that the odds ratio for a one-unit increase in urban life stress was 1.047 ($CI_{.95} = 1.014, 1.082$) for being a heavy smoker vs. non-daily smoker. The odds ratio was not significant for other smoking levels (see Appendix Table 1).

Table 1

Sociodemographic Characteristics of Adults Experiencing Homelessness Who Smoke (n = 411)

Variables	Mean (SD)	% [n]
Age (years)	43.3 (11.8)	
Male		64.9 [267]
Mental Health Diagnosis (yes)		65.5 [269]
Race		
Non-Hispanic White		59.9 [246]
Black/African American		17.8 [73]
Native American/Alaskan Native		9.7 [40]
Hispanic/Latino		2.7 [11]
Multiracial/Other		9.9 [41]
Urban Life Stress	49.1 (14.5)	
Smoking Level		
Non-daily		9 [37]
Light (1-10/day)		28.7 [118]
Moderate (11-20/day)		46.7 [192]
Heavy (21+/day)		15.6 [64]
Readiness to Quit		
I enjoy smoking and have decided not to quit smoking for my lifetime. I have no interest in quitting.		7.8 [32]
I never think about quitting smoking, and I have no plans to quit.		6.1 [25]
I rarely think about quitting smoking, and I have no plans to quit.		11.2 [46]
I sometimes think about quitting smoking, but I have no plans to quit.		18.5 [76]
I often think about quitting smoking, but I have no plans to quit.		20.9 [86]
I definitely plan to quit smoking within the next 6 months.		16.3 [67]
I definitely plan to quit smoking within the next 30 days.		5.8 [24]
I still smoke, but I have begun to change, like cutting back on the number of cigarettes I smoke. I am ready to set a quit date.		13.4 [55]

Table 2

Correlations Between Urban Stress, Smoking Level, and Readiness to Quit Smoking in a Sample of Adults Experiencing Homelessness Who Smoke (n = 411)

	2	3	4	5	6
1. Readiness to Quit	-0.25***	0.03	-0.04	0.01	-0.04
2. Smoking Level		0.15**	0.04	-0.06	0.08
3. Urban Life Stress			-0.01	0.11*	0.23***
4. Age				-0.08	0.06
5. Sex (Female)					0.16**
6. Mental Health Diagnosis (Yes)					

Note. *$p < 0.05$; **$p < 0.01$; *** $p < 0.001$

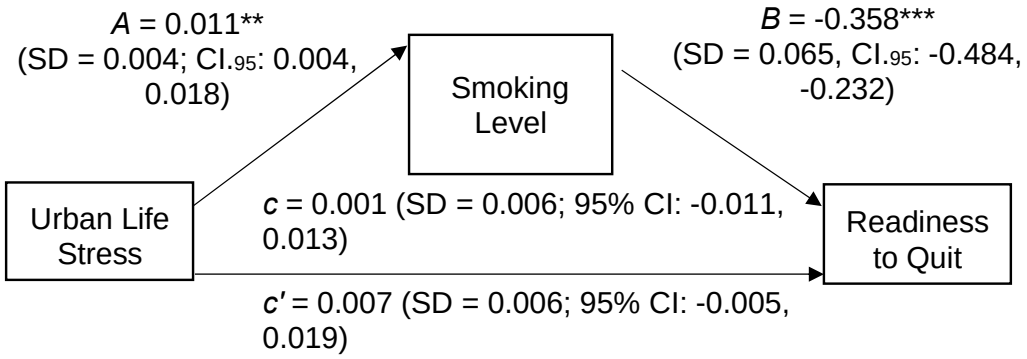

Figure 1. Mediation analysis. Note: SD = standard deviation; CI = confidence interval.

Mediation Analysis

In adjusted Bayesian mediation analyses, urban life stress was again positively associated with smoking level (a = 0.011; $CI_{.95}$: 0.004, 0.018), and smoking level was negatively associated with readiness to quit (b = -0.358, $CI_{.95}$: -0.484, -.232; see Figure 1). Results indicated a statistically significant indirect effect (ab = -0.005, $CI_{.95}$: -0.010, -0.002), but a non-significant direct effect (c' = 0.007, $CI_{.95}$: -0.005, 0.019) and total effect (c = 0.001, $CI_{.95}$: -0.011, 0.013).

Discussion

This study explored how urban stress, smoking level, and quit readiness were associated within a sample of smokers experiencing homelessness. Results supported that urban life stress was indirectly associated with readiness to quit through smoking level, whereby greater urban stress was related to heavier smoking, which was associated with less readiness to quit. Although longitudinal work is required to determine temporal relations, these results appear to be consistent with previous work suggesting that smoking operates as a means of coping with high levels of stress experienced by adults who are homeless (Businelle et al., 2013; Okuyemi et al., 2006), and that experiencing more urban stressors may be linked with heavier smoking habits, which, in turn, may damper readiness to quit smoking.

If this pattern of results is replicated in future longitudinal work, there may be several treatment implications to reduce the health impact of smoking on adults experiencing homelessness. Firstly, the experience of urban life stress can be intervened upon directly through the provision of practical aides to reduce its impact on affected persons. This might be achieved through the provision of assistance in navigating public transportation, obtaining needed health care and other public services, or behavioral psychotherapy for anxiety by professionals or trained peers. Additionally, efforts in the community and within shelter settings to improve perceptions of safety, reduce criminal activity, and curb the violence experienced by this vulnerable group are needed to reduce urban stress. Secondly, education and intervention efforts for smokers experiencing homelessness can

emphasize the use of healthy alternative approaches to coping with experienced stress (as opposed to smoking and/or smoking more cigarettes). Likewise, teaching emotional regulation coping strategies may be necessary for handling unavoidable stressors.

Study limitations include a cross-sectional design and the use of convenience sampling. Longitudinal studies are needed to shed light on the long-term effects of urban life stressors and smoking level on readiness to quit across time among this group. Studies are also needed to examine behavioral outcomes (e.g., quit attempts, cessation). Moreover, dual or poly-tobacco use was not accounted for in the analyses. Furthermore, this study was conducted among homeless-serving agencies in Oklahoma City and may not be representative of other homeless smokers across the United States. Additionally, the sample only represents homeless adults utilizing services and excluded homeless adults who did not access services, who may have different health risk factors and/or outcomes than this sample. Finally, the failure to meet the proportional odds assumptions in the present study may suggest that an alternate measurement of readiness to quit with fewer categories might be used in future research so that ordinal logistic regression can be employed.

Implications for Health Behavior Research

There may be implications for a stepped reduction in cigarette consumption as a strategy toward eventual abstinence (Lindson et al., 2019), which would require provider and patient acknowledgement that smoking fewer cigarettes is an important and significant goal in the journey toward eventual abstinence. Initial research indicates that a reduction in combustible cigarettes smoked amongst smokers experiencing homeless may be achieved through harm reduction strategies that rely on nicotine replacement (e.g., e-cigarettes; Scheibein et al., 2020). Successes in reducing combustible cigarette consumption might be used to reduce overall nicotine dependence and build self-efficacy to quit. Furthermore, cognitive intervention strategies, like motivational interviewing, can be used to directly bolster quit readiness (Fiore et al., 2008). As intent to quit smoking is associated with making quit attempts and achieving long-term abstinence (Martínez et al., 2015; Smit et al., 2010), this should have downstream effects on increasing smoking cessation rates in this population. Although multi-level interventions incorporating attention to each of these factors would be desirable, treatment resources are often limited in settings that provide services to adults experiencing homelessness; therefore, targeting smokers most likely to successfully quit may be important. These results might suggest that lighter smokers should be prioritized for abstinence-promoting programs and may be more successful due to greater quit readiness, whereas heavier smokers might benefit most from an initial focus on strategies to cut down on cigarette intake while building quit motivation before entering a formal cessation program. More work is needed, however, to confirm the veracity of these suppositions.

Discussion Question(s)

1. How might the findings from this study guide clinicians and trained peers to provide the most effective smoking cessation treatment for adults who smoke and are homeless?

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Appendix

Supplementary Table 1

Multinomial Logistic Regression Analyses: The Effect of Urban Life Stress on Smoking Level/Readiness to Quit Among a Sample of Adults Who Smoke and Are Homeless (n = 411)

Variables	Odds Ratio (95% CI)
Smoking Level (reference: Non-daily smoker)	
Light	1.014 (0.986, 1.044)
Moderate	1.026 (0.997, 1.056)
Heavy	1.047 (1.014, 1.082)**
Readiness to Quit (reference: I enjoy smoking and have decided not to quit smoking for my lifetime. I have no interest in quitting.)	
I definitely plan to quit smoking within the next 30 days.	1.029 (0.991, 1.068)
I definitely plan to quit smoking within the next 6 months.	1.012 (0.981, 1.044)
I never think about quitting smoking, and I have no plans to quit.	0.997 (0.959, 1.037)
I often think about quitting smoking, but I have no plans to quit.	1.012 (0.982, 1.043)
I rarely think about quitting smoking, and I have no plans to quit.	1.005 (0.972, 1.04)
I sometimes think about quitting smoking, but I have no plans to quit.	1.005 (0.975, 1.036)
I still smoke, but I have begun to change, like cutting back on the number of cigarettes I smoke. I am ready to set a quit date.	0.999 (0.967, 1.032)

Note. ** $p < 0.01$; analyses controlled for age, sex, race, and mental health diagnosis.