



Published in final edited form as:

*Addict Behav.* 2019 August ; 95: 197–201. doi:10.1016/j.addbeh.2019.04.002.

## Income associations with cigarette purchasing behaviors and quit attempts among people experiencing homelessness

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### Abstract

**Introduction:** Cigarette purchasing behavior may reflect quitting intentions. Little is known about how income could modify the association between cigarette purchasing behaviors and quit attempts among smokers experiencing homelessness.

**Methods:** Homeless, current smokers completed a questionnaire on the amount spent weekly on cigarettes (< \$20/week versus > \$20/week), source of cigarettes (store versus other source), quantity of cigarettes purchased (< pack versus ≥ pack), and past-year quit attempts. The association of participant income and these cigarette purchasing behaviors were examined. The relationship between cigarette purchasing behaviors and quit attempts was also examined and monthly income (none versus any) was explored as a potential moderator of this relationship.

**Results:** Of the 472 currently smoking individuals, 55% reported spending > \$20/week on cigarettes, 83% reported purchasing cigarettes from a store, and 86% reported purchasing ≥ pack during their last purchase. Those who reported an income spent a third of their monthly income on cigarettes, and were more likely to spend > \$20/week on cigarettes. The amount spent weekly on

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#### Contributions

Authors contributed as follows: (1) conception and design of the study (all authors); (2) data acquisition (MB and LR); (3) data analysis (MV); and (4) interpretation of findings (all authors). All authors assisted in writing and revising the article, and read and approved the final version of the submitted manuscript.

#### Conflict of interest

All authors declare that they do not have conflicts of interest.

#### Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.addbeh.2019.04.002>.

cigarettes and the source of cigarettes was not associated with quit attempts, nor did income moderate these relationships. Persons without an income who bought a pack or more of cigarettes made fewer quit attempts ( $\beta = -0.4$ , 95% CI  $-0.7, -0.2$ ), whereas the association between quantity of cigarettes purchased and quit attempts was not significant for those with an income ( $\beta = -0.2$ , 95% CI  $-0.4, 0.1$ ).

**Conclusions:** Current smokers experiencing homelessness and who are without an income may find it particularly challenging to engage in attempts to quit smoking. Smoking cessation interventions that highlight relief of financial hardship as a potential benefit of successfully quitting smoking may be useful among this population.

### Keywords

Cigarette purchasing; Homeless adults; Smoking cessation; Financial burden; Socioeconomic disadvantage

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## 1. Introduction

Cigarette smoking is exceedingly common among people experiencing homelessness, with a prevalence estimate between 70% and 80%. (Baggett & Rigotti, 2010; Baggett, Tobey, & Rigotti, 2013; Businelle, Poonawalla, Kendzor, et al., 2014) Smoking-induced chronic diseases are the leading causes of morbidity and mortality for homeless persons aged 45 and older.(Baggett, Chang, Singer, et al., 2015) Tobacco use is also associated with a substantial financial burden: homeless adults spend a third of their monthly income on tobacco use. (Arnsten, Reid, Bierer, & Rigotti, 2004; Baggett, Rigotti, & Campbell, 2016; Wrighting, Businelle, Kendzor, LeBlanc, & Reitzel, 2017) Smokers experiencing homelessness with high nicotine dependence face substantial subsistence challenges, including difficulty finding shelter and food. (Baggett et al., 2016) Smoking cessation could substantially reduce financial burden in this population.

Given the substantial tobacco-related financial burden, understanding how cigarette purchasing behaviors such as the amount spent on cigarettes, the quantity of cigarettes purchased, and the cigarette procurement source are linked with smoking behavior may provide insights into factors that motivate cessation behaviors. These cigarette purchasing behaviors were the focus of a previous study of homeless adults recruited from a single shelter in Dallas, TX that showed that more than two-thirds of smokers purchased cigarettes from a store as opposed to another source, or bought a pack or more of cigarettes as opposed to loose cigarettes, and most spent \$20 a week on cigarettes. (Wrighting et al., 2017) Spending less money on cigarettes during the last cigarette purchase was associated with greater motivation to quit, but only among smokers who reported no income.(Wrighting et al., 2017) None of the cigarette purchasing behaviors were associated with past-year quit attempts. Findings from the aforementioned study highlight the potential role that income could play in moderating the association between cigarette purchasing and quitting behavior, which this study explores further. This study overcomes some limitations of the previous study by offering a larger sample size with more power to examine the moderating role of income in cigarette purchasing and quit attempts, and geographic diversity by including

homeless adults from a different state and multiple services sites, thereby increasing external validity of the assessment tools and findings.

In this study, the association of cigarette purchasing behaviors with smoking behavior and quit attempts was examined among a sample of homeless adults recruited from the six largest homeless shelters in Oklahoma City, OK. The percentage of monthly income spent on cigarette purchases was also estimated.

## 2. Methods

### 2.1. Study setting and participants

The current study includes an analysis of cigarette purchasing behaviors and past-year quit attempts among a sample of homeless, current smokers recruited from transitional shelters in Oklahoma City, Oklahoma. Flyers posted at these agencies advertised the need for volunteers for a study focused on the identification of common health problems and unhealthy behaviors among adults who receive services at Oklahoma City homeless shelters. Participants were eligible for the parent study if they earned a score of 4 on the Rapid Estimate of Adult Literacy in Medicine-Short Form (REALM-SF) indicating > 6th grade English literacy level, (Arozullah, Yarnold, Bennett, et al., 2007) were 18 years of age, and were receiving services at the targeted shelters at the time of the survey. A total of 648 individuals were screened, of whom 610 current smokers and non-smokers were enrolled; this study included 472 current smokers (i.e., smoking within the past 30 days) experiencing homelessness.

### 2.2. Study procedures

Data collection took place between July 2016 and August 2016. Trained research staff screened participants for study inclusion, obtained verbal informed consent, and administered a questionnaire (~1 h) on a touch-screen tablet computer. Participants who completed the questionnaire received a \$20 gift card for their participation. All study procedures were approved by the University of Oklahoma Health Sciences Center Institutional Review Board.

### 2.3. Study measures

**2.3.1. Demographic characteristics**—Participants self-reported their age, sex, race/ethnicity, and education (less than high school, high school, some college, college/more), and monthly income (including all sources such as paid work, disability benefits, employment benefits, social assistance, support from family/friend, and criminalized activity {e.g. panhandling}). We categorized sources of income as paid work, employment benefits or self-employment; criminalized activity; disability benefits or social assistance; and support from family/friend or other.

**2.3.2. Cigarette smoking behaviors**—Individuals who endorsed smoking 100 cigarettes in their lifetime and reported current daily or intermittent cigarette smoking were classified as current smokers. Participants reported whether they had smoked in the past 24 h, and the number of cigarettes smoked in the past 24 h. Current smokers completed the

Heaviness of Smoking Index (HSI), a measure of nicotine dependence, which includes time to the first cigarette after waking (smoking < 30 min after waking versus ≥ 30 min) number of cigarettes smoked per day. Participants were categorized as having very low (score 1–2), low to moderate (score = 3), moderate (score = 4), or high levels of nicotine dependence (score ≥ 5). (Kozlowski, Porter, Orleans, Pope, & Heatherton, 1994) Participants self-reported the number of intentional quit attempts that had lasted at least 24 h in the past year.

**2.3.3. Cigarette purchasing behaviors**—Participants reported the amount of money they had spent on cigarettes in the past week (< \$5, \$6 to \$10, \$11 to \$20, \$21 to \$30, \$31 to \$40, \$41 to \$50, \$51 to \$60, \$61 to \$70, ≥ \$71 or more), the quantity of cigarettes purchased during their most recent purchase (1 cigarette, 2 to 19 cigarettes, 20 cigarettes—one pack, multiple packs, a carton, other/do not buy cigarettes), and the source of cigarettes (buy from a store, buy from a friend, ask strangers, ask friends or people, other). Based on sample distributions and using similar cut-offs as in a prior study, (Wrighting et al., 2017) we categorized the amount of money spent on cigarettes as ≤ \$20/week versus > \$20/week, the cigarette source as buying from a store versus any other source, and the quantity of cigarettes purchased as < pack versus ≥ pack based on sample distributions.

#### 2.4. Statistical analysis

Descriptive statistics were calculated for variables of interest including demographics, cigarette smoking behaviors, and cigarette purchasing behaviors. We estimated the income spent on tobacco use in the past year using the mid-point estimate of the amount spent weekly on cigarettes and self-reported total income in the past year. We examined the bivariate associations of cigarette purchasing behaviors with frequency of cigarette smoking (daily versus non-daily), cigarettes per day, time to first cigarette after waking (< 30 min versus ≥ 30 min), and number of past-year quit attempts. Using logistic regression, we examined the associations of cigarette purchasing behaviors with monthly income (none versus any), adjusting for covariates (i.e., age, sex, race/ethnicity, and heaviness of smoking index). We used Poisson regression to examine the association between cigarette purchasing patterns and quit attempts in the past year, adjusting for the same covariates. We examined the modifying role of income in these analyses. We conducted the analyses using Stata, version 11.

### 3. Results

Of the 472 individuals who reported current smoking, 86% smoked daily (Table 1). Participants who smoked in the past 24 h reported smoking an average of 12.4 cigarettes per day. A total of 55% reported spending > \$20/week on cigarettes, 83% reported purchasing cigarettes from a store, and 86% reported purchasing ≥ pack of cigarettes. The primary sources of income among those who reported an income was employment-related income (26.2%), disability income (35.7%), and support from family/friend (35.3%). Individuals with an income spent approximately 31% of their yearly income on cigarettes. Persons who bought cigarettes from a store compared to another source were more likely to have a higher cigarette consumption and smoked within 30 min of waking (Supplementary Table 1). Persons who spent > \$20/week or who bought ≥ pack of cigarettes were more likely to

smoke daily and within 30 min of waking, have a higher cigarette consumption, and make fewer quit attempts in the past-year compared to their counterparts (Supplemental Table 1).

In adjusted multivariable logistic regression analysis, higher income (> \$500/month) was associated with higher odds of spending > \$20/week on cigarettes (AOR 2.2, 95% CI 1.3,3.6) and lower odds of obtaining cigarettes from another source (AOR 0.3, 95% CI 0.1,0.6) (Table 2). A higher score on the heaviness of smoking index was associated with higher odds of spending > \$20/week on cigarettes (AOR 1.8, 95% CI 1.5,2.1) and buying pack of cigarettes (AOR 1.3, 95% CI 1.1,1.6), and lower odds of obtaining cigarettes from a source other than a store.

In adjusted analysis, spending > \$20/week on cigarettes ( $\beta$  coefficient  $-0.01$ , 95% CI  $-0.2$ ,  $-0.2$ ) or buying cigarettes from another source ( $\beta$  coefficient  $0.1$ , 95% CI  $-0.1$ ,  $0.3$ ) was not significantly associated with quit attempts, whereas purchasing pack of cigarettes was associated with fewer quit attempts in the past year ( $\beta$  coefficient  $-0.4$ , 95% CI  $-0.7$ ,  $-0.2$ ) (Supplemental Table 2). While there was no relationship between income and amount spent on cigarettes in the past week ( $p = 0.1$ ) or the source of cigarettes ( $p = 0.1$ ), there was a relationship between income and the quantity of cigarettes purchased ( $p < 0.008$ ). Persons without an income who bought a pack or more of cigarettes made fewer quit attempts ( $\beta$  coefficient  $-0.4$ , 95% CI  $-0.7$ ,  $-0.2$ ), whereas the association between quantity of cigarettes purchased and quit attempts was not significant for those with an income ( $\beta$  coefficient  $-0.2$ , 95% CI  $-0.4$ ,  $0.1$ ). Higher nicotine dependence was associated with fewer past-year quit attempts in all models.

#### 4. Discussion

In this study of current smokers seeking services at homeless shelters, 55.3% of the participants spent > \$20/week on cigarettes, 83.4% purchased cigarettes from a store, and 85.5% purchased pack of cigarettes. Consistent with a previous estimate (Baggett et al., 2016), individuals who reported an income spent 31% of their yearly income on cigarettes. The burden of tobacco use was highest among those without an income who purchased a greater quantity of cigarettes in the past week and attempted to quit less frequently. Our findings suggest a role for smoking cessation as an intervention that can relieve financial burden among this population.

Sharing cigarettes, smoking discarded cigarette butts or filters, and borrowing cigarettes are common cigarette procurement practices among homeless adults (Aloot, Vredevoe, & Brecht, 1993). Yet, in this study purchasing cigarettes from a store was customary as was purchasing cigarettes by the pack. In analysis adjusted for nicotine dependence and demographics, a higher income was associated with a higher likelihood of purchasing cigarettes from a store and spending > \$20 in the past week on cigarettes. Previous studies have shown that increasing income leads to an increase in tobacco consumption, especially among low-income smokers (U.S. National Cancer Institute and World Health Organization, 2016). An income elasticity of 0.2 suggests that with a 10% increase in income, there is a 2% increase in demand for tobacco products (U.S. National Cancer Institute and World Health Organization, 2016). Among smokers experiencing homelessness, an increase in

disposable income and the resultant increase in cigarette purchasing suggests that tobacco may be perceived as a 'normal good' as opposed to a high risk behavior.(World Health Organization, 2018)

Persons who bought 10 pack of cigarettes were more likely to smoke daily and heavily compared to those who bought < 10 pack of cigarettes, and to report fewer quit attempts in the past year after adjusting for demographics, income, and nicotine dependence. A higher quantity of cigarettes purchased may independently reflect decreased quitting intentions, and has particular implications for smokers without a steady income. Amount spent weekly on cigarettes was associated with fewer quit attempts in bivariate analysis but not in multivariable analysis after adjusting for income and nicotine dependence. The high correlation between income and the amount spent on cigarettes in the past week could explain the lack of association in multivariable analysis. Cigarette procurement source may not be a purchasing behavior that is associated with quit attempts as observed in both bivariate and multivariable analysis.

This study had several limitations. Findings were limited by self-report, and may be subject to recall bias. We were unable to make inferences on causality. The study may not be generalizable to homeless adults receiving shelter services in other parts of the U.S. Our findings on the association between quantity of cigarettes purchased and quit attempts differed from a previous study where there was no association observed, perhaps because of the inclusion of intermittent and light smokers in our study sample.(Wrighting et al., 2017) Because cigarette purchasing behaviors is dependent on state cigarette price and available financial resources, responses to these questions may not be comparable across states. However, we used price paid for cigarettes in the past week to calculate income attributable to tobacco use, and our estimate of 31% is consistent with studies conducted in Dallas, TX and Boston, MA.(Baggett et al., 2016; Wrighting et al., 2017) thereby increasing external validity of our findings.

Smoking represents a substantial financial burden. This burden is felt by all smokers, but especially among people experiencing homelessness who often lack a stable or adequate source of income or who may be using some of their limited disability and/or employment income for cigarettes instead of food or housing. Reframing smoking cessation counseling as an intervention that not only improves health and wellbeing, but that has the potential to increase financial stability and a lifeline for people trying to exit homelessness may resonate with this population and its service providers.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

### Funding

Funding for this research was primarily provided by the Oklahoma Tobacco Research Center at the University of Oklahoma Health Sciences Center (to MSB) and the Oklahoma Tobacco Settlement Endowment Trust (092-016-0002) (to MSB) Stephen Cancer Center NCI Cancer Center Support Grant (P30CA225520), with

additional support from the University of Houston (to LRR and JN). This study was also supported by funding from the American Cancer Society grant MRS-GT-12-114-01-CPPB (to MSB), and the National Institutes of Health grants: R21-DA031897, P50-DA009241, P60-AA003510, R01-AA021446, and R01-HD075630 (to CR).

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**HIGHLIGHTS**

- Homeless adults spend a third of their monthly income on tobacco.
- Having an income is associated with more cigarette spending among homeless smokers.
- Those without an income who purchase a larger quantity of cigarettes are less likely to initiate quit attempts.
- Smoking cessation interventions may have an important role in relieving financial hardship in this vulnerable population.



**Table 1**Demographic, smoking behaviors, and cigarette purchasing among current smokers ( $N = 472$ ).

	<u>Total</u>
	<u>N = 472</u>
Age (Mean, SD)	43.1 (11.8)
Sex, No., %	
Male	306 (64.8)
Female	166 (35.2)
Race/ethnicity	
White	339 (52.9)
African American	133 (20.8)
Latino	42 (6.6)
Asian/Native Hawaiian/Pacific Islander	6 (0.9)
American Indian/Alaskan Native/Mixed	120 (18.8)
Education	
Less than high school	157 (25.8)
High school	253 (41.5)
Some college	165 (27.1)
College or more	34 (5.6)
Monthly income	
No income	182 (41.7)
Any income	255 (58.4)
Sources of income among those with any income	
Paid work, employment benefits, or self-employed	66 (26.2)
Criminalized activity	7 (2.8)
Disability or social assistance	90 (35.7)
Support from family or friends or other	89 (35.3)
Smoking characteristics	
Non-daily smoking	65 (13.7)
Daily smoking	407 (86.2)
Average cigarette consumption in the past 24 h, Mean (SD) <sup>a</sup>	12.4 (8.1)
Time to first cigarette after waking, No., (%)	
> 30 min	123 (26.1)
30 min	348 (73.9)
Number of quit attempts in the past year, Mean (SD)	2.4 (2.9)
Heaviness of smoking index, No. (%)	
Very low	172 (36.5)
Low to moderate	123 (26.1)
Moderate	125 (26.5)
High	51 (10.8)
Cigarette procurement, No. (%)	
Buy from store	393 (83.4)

	<b>Total</b>
	<b>N = 472</b>
Buy from friend	12 (2.6)
Ask strangers	12 (2.6)
Ask friends or people	37 (7.9)
Other	17 (3.6)
Cigarette purchasing quantity, No. (%)	
1 cigarette	36 (7.6)
2 to 19 cigarettes	28 (5.9)
20 cigarettes/pack	300 (63.7)
Multiple packs	45 (9.6)
A carton	34 (7.2)
Other/Do not buy cigarettes	28 (5.9)
Amount paid for cigarettes/week, No. (%)	
\$5	77 (16.3)
\$6 to \$10	69 (14.6)
\$11 to \$20	65 (13.8)
\$21 to \$30	149 (31.6)
\$31 to \$40	68 (14.4)
\$41 to \$50	9 (1.9)
\$51 to \$60	28 (5.9)
\$61 to \$70	3 (0.6)
\$71 or more	4 (0.9)

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**Table 2**

Adjusted associations of cigarette purchasing patterns and income among current smokers.

	> \$20/week on cigarettes		Non-store source		Pack of cigarettes	
	Adjusted odds ratio (95% CI)		Adjusted odds ratio (95% CI)		Adjusted odds ratio (95% CI)	
No income	Ref.		Ref.		Ref.	
Any income	1.9 (1.2–2.9) <sup>**</sup>		0.4 (0.2–0.6) <sup>***</sup>		0.9 (0.5–1.7)	
Age	0.9 (0.9–1.0) <sup>*</sup>		0.9 (0.9–1.0)		1.0 (0.9–1.0)	
Male	Ref.		Ref.		Ref.	
Female	1.3 (0.9–2.2)		1.6 (0.9–2.7)		1.2 (0.7–2.3)	
Race/ethnicity						
White	Ref.		Ref.		Ref.	
African American	0.7 (0.4–1.3)		1.3 (0.6–2.7)		0.6 (0.3–1.2)	
Latino	0.8 (0.3–1.8)		0.8 (0.2–2.4)		0.5 (0.2–1.6)	
Asian/Native Hawaiian/Pacific Islander	0.4 (0.03–5.8)		0.9 (0.1–9.5)		–	
American Indian/Alaskan Native/Mixed	0.9 (0.5–1.5)		0.6 (0.3–1.4)		0.8 (0.4–1.8)	
Heaviness of smoking index	1.8 (1.5–2.1) <sup>***</sup>		0.8 (0.7–0.9) <sup>*</sup>		1.3 (1.1–1.6) <sup>*</sup>	

\*  $p < 0.05$ .

\*\*  $p < 0.005$ .

\*\*\*  $p < 0.001$ .