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Association of Substance Use Characteristics and Future Homelessness Among Emergency Department Patients with Unhealthy Alcohol or Drug Use: Results from a Linked Data Longitudinal Cohort Analysis

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Abstract

Background: Homelessness and substance use are intricately related, and both are prevalent among emergency department (ED) patients. This study examined the longitudinal association of substance use characteristics with future homeless shelter entry among ED patients with any unhealthy alcohol or drug use.

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Contributions: KMD, EJ, JR, and LG conceived of the study. KMD led data collection for the study, with assistance from RY. EJ oversaw data linkage. KMD conducted the analyses, with assistance from TM. RY and NK interpreted the data and conducted the literature review. RY and KMD drafted the article. All authors provided critical feedback. All authors reviewed and approve of the final version.

Conflicts of Interest: RPM has conducted research and clinical demonstration projects unrelated to the present paper with funding from the NIH (NIAAA, NIDA) and NYC Department of Health and Mental Hygiene. He has received study medication without funding or restrictions from Alkermes for research unrelated to the present paper. JR discloses that he has been an investigator or principal investigator on studies that have received support (financial or medication or both) from Indivior (formerly Reckitt-Benckiser) and from Alkermes and from NIDA/NIH and from NIAAA/NIH. As a principal investigator in NIDA's Clinical Trials Network he collaborates extensively with organizations that seek to provide help with or promote recovery from addiction. He does not have equity in these entities and is not a paid consultant or advisory board member. He is an employee of New York University and formerly of the Department of Veterans Affairs. He sees none of these activities as presenting a conflict of interest with the present paper. RY, NK, EJ, TM, LG, and KMD report no conflicts of interest.

Methods: We present results from a longitudinal cohort study of public hospital ED patients who screened positive for unhealthy alcohol or drug use and who were not homeless at their baseline (index) ED visit. The primary outcome was homeless shelter entry within 12 months of baseline, ascertained in city homeless shelter administrative data. Primary independent variables of interest were alcohol use severity (AUDIT), drug use severity (DAST-10), and types of drugs used, as reported on baseline survey questionnaires.

Results: Analyses included 1,210 ED patients. By 12 months following the baseline ED visit, 114 (9.4%) had entered a homeless shelter. Among patients with the most severe problems related to drug use (DAST-10 score 9–10), 40.9% entered a shelter within 12 months. Past shelter use was the strongest predictor of future shelter entry; once adjusting for historic shelter use the relationship of AUDIT and DAST-10 scores with future shelter entry was no longer statistically significant in multivariable models.

Conclusions: ED patients with past year unhealthy alcohol or drug use had relatively high likelihood of future shelter entry. Risk for homelessness should be addressed in future interventions with this population. Findings illustrate the complexity of relationships between substance use and homelessness.

Keywords

emergency service; homeless persons; social determinants of health; substance-related disorders; alcohol-related disorders; poverty

Introduction

Over half a million people are homeless on any given night in the U.S. and more than 1.5 million experience homelessness each year.[1,2] Estimates of substance use among people experiencing homelessness vary based on samples and definitions used.[3-8] One national survey found that half of people using homeless services programs had recent problems with alcohol or drugs, and even more reported lifetime problems.[9]

Though homelessness and substance use are clearly associated, the exact causal pathways and even the direction of the relationship remain debated.[6,10-21] Substance use may act both as a cause and consequence of homelessness,[7,11,12,22] and each may compound the other.[6,10,12,13,22] Past research has found, for example, that substance use is associated with higher entry rates into and longer durations of homelessness.[11,23-27] Our understanding of the relationships between homelessness and substance use has been hindered by limitations in past research, including cross-sectional design or crude measures of homelessness and substance use.

We sought to fill gaps in the prior research using a dataset that links baseline survey questionnaires including detailed questions on substance use history with longitudinal administrative homeless shelter data. Specifically, we examine substance use types and severity as predictors of shelter entry among patients presenting to an urban emergency department (ED). This topic is particularly relevant given national focus on homelessness *prevention* as part of strategic plans to reduce homelessness,[27] and an increasing interest in using healthcare settings such as EDs to identify and intervene for patients at risk for

homelessness.[29,30] Further, as EDs strive to improve care for patients who use drugs and alcohol, understanding the intersection of homelessness is particularly important.

Materials and Methods

Design

We report results from ED-CARES (Emergency Department Patient Characteristics Associated with Risk for Future ED and Shelter Use), a prospective cohort study in which ED patients completed a baseline questionnaire and were followed longitudinally using shelter administrative data. Baseline results[31,32] and findings on shelter entry among the overall sample[33] have been reported previously. In the current study, we examine the association of substance use characteristics at baseline with homeless shelter use in the next 12 months, among participants with any unhealthy alcohol or drug use who were not already homeless at baseline. The study was approved by the NYU School of Medicine Institutional Review Board. All study participants provided written informed consent.

Setting and Participants

The study was conducted in an urban, public hospital ED in New York City (NYC). Research assistants followed a random sampling scheme to approach ED patients from November 2016 through January 2018. Adult (≥18 years old) patients were eligible if they spoke English or Spanish, were medically and psychiatrically stable, lived in NYC, were not in prison/police custody, and could understand the informed consent process. After September 2017, eligibility was further restricted to patients who screened positive for unhealthy alcohol or drug use and did not self-report current homelessness, to meet pre-specified sample size targets for this sub-population.

Screening for unhealthy alcohol and drug use used validated single-item screening questions (SISQs).[34,35] Patients screened positive for unhealthy alcohol use if they reported at least one episode of drinking ≥4 drinks (for women) or ≥5 drinks (for men) and positive for drug use if they reported using a drug or medication for nonmedical reasons (including marijuana), in the past year. Participants were excluded from the analytic sample if they did not screen positive for unhealthy alcohol or drug use, as we were focused on detailed substance use characteristics among those with any substance use. Because this study was focused on *future* shelter entry, we also excluded from the analytic sample participants who were *currently* homeless at baseline based on self-report of spending the past night in a shelter or unsheltered (e.g., street) or having had a shelter stay in the past 7 days documented in the administrative data.

Measurements

We used linked data from baseline survey questionnaires and administrative homeless shelter data. Baseline survey questionnaires were administered verbally by trained, bilingual (English/Spanish) research assistants, who recorded responses using REDCap electronic data capture software.[36] The questionnaire, developed using widely used or previously validated questions, has been described previously.[32]

Baseline questionnaires were linked with administrative homeless shelter data from the NYC Department of Homeless Services' (DHS) CARES database. CARES captures approximately 90% of shelter use in NYC (some specialty shelters operated outside the DHS system are excluded). The NYC Center for Innovation through Data Intelligence (CIDI) performed data linkage. CIDI is an agency in the Office of the Mayor that performs cross-sector data analysis to inform NYC policies and programs. CIDI conducted probabilistic and deterministic matching using SAS Link King to link CARES with a dataset containing study participant identifying information (name, date of birth (DOB), and social security number (SSN) if available). SAS Link King uses "fuzzy" matching on names/DOBs/SSNs that are closely related; CIDI manually reviewed borderline cases. The matched dataset was then linked to ED patient survey data using unique study IDs. A de-identified dataset was used for analysis.

The primary outcome was homeless shelter entry within 12 months of the baseline ED visit documented in CARES. We used shelter entry as the primary study outcome because shelter entry date is exact whereas administrative data cannot capture date of entry into unsheltered homelessness (which depends on documentation by street outreach teams), and because the large majority (approximately 95%) of people experiencing homelessness in NYC are sheltered vs. unsheltered.[37]

The primary independent variables (predictors) of interest were substance use disorder severity (measured using AUDIT and DAST-10) and specific types of drugs used, as self-reported on baseline survey questionnaires. Participants screening SISQ-positive for unhealthy alcohol use completed the AUDIT.[38,39] Participants screening positive for drug use via either the SISQ or questions described below about any of ten individual drug classes used completed the DAST-10.[40,41] Participants were asked whether they had used any of ten categories of drugs at least once in the past year: cannabis, synthetic cannabinoids, heroin, prescription opioids, sedatives (including benzodiazepines), hallucinogens, prescription stimulants, methamphetamine, cocaine or crack, and inhalants. Past year number of days of unhealthy alcohol use and drug use was by self-report on SISQs.[34,35]

Analysis

We restricted the analytic sample to participants who were not currently homeless at baseline and who screened positive for unhealthy alcohol or any drug use. We used chi-squared tests of independence to examine bivariate associations for categorical variables and t-tests for continuous variables. As a sensitivity analysis, we repeated analyses excluding participants who had any past shelter use documented in administrative data.

We conducted multivariable logistic regression to examine the independent associations of substance use characteristics with the outcome of shelter entry in the next 12 months, while controlling for variables expected to be potential confounders based on prior literature. In these partially adjusted multivariable models we controlled for: age, sex, race/ethnicity, difficulty meeting essential expenses in the past 12 months (a proxy for income), having a jail/prison stay in the past 6 months, insurance status, highest level of schooling, employment status, lifetime mental illness diagnosis, and overall health status (all self-reported on baseline questionnaires). In fully adjusted multivariable models we added a

variable for past shelter use history documented in the administrative data (which dates back over 20 years), as prior research has shown that past shelter use is a strong predictor of future shelter use.[42] We additionally postulated that including past shelter use in the models would help control for residual unmeasured confounders of the relationship between substance use and future shelter use.

We tested for multicollinearity using variance inflation factors (VIF). The largest VIF for fully adjusted models was 2.98 (for DAST-10). All other VIFs were under 1.78. Therefore, all variables were suitable for inclusion in the same model. Complete case deletion was used for a small number of cases with missing data (<5%). Model c-statistics were 0.93 for the fully adjusted and 0.86 for the partially adjusted models, indicating excellent fit. All analyses were conducted using SAS 9.4 (SAS Institute, Cary, NC).

Results

Research assistants screened 11,248 patients for study eligibility. 7,658 were ineligible or refused to complete screening questions (68.1%). The most common reasons for ineligibility were screening negative for unhealthy alcohol or drug use (after the eligibility restriction as described above); in jail/prison; did not speak English or Spanish; or medically unfit. Of 3,590 eligible patients, 2,939 (81.9%) agreed to participate; 102 were later found to have participated more than once and 3 did not give identifying information to allow data linkage, leaving 2,834 unique participants. Of unique participants, 1,453 (51.3%) screened positive for any unhealthy alcohol or drug use. Of them, 192 (13.2%) self-reported spending the last night on the streets or in a shelter and 129 (8.9%) had a documented shelter stay in the past 7 days. 243 total (16.7%) fit either definition of current homelessness and were excluded, leaving a final analytic sample of 1,210 participants.

Study participants were diverse in age, gender, race, and ethnicity (Table 1). They had high levels of socioeconomic marginalization. They frequently had fair or poor health (37.4%), activity limitations due to pain (42.1%), and concomitant mental illness (43.1%). By design, all participants had either unhealthy alcohol use or any drug use in the past 12 months; 33.5% reported both. Only a minority (15.6%) visited the ED on the day of enrollment specifically for substance use issues. The most commonly reported drug used was cannabis (47.7%), followed by cocaine/crack (19.1%), sedatives (9.9%), prescription opioids (8.8%), and heroin (8.1%). Of those reporting unhealthy alcohol use, 15.7% had an AUDIT score ≥20. Of those reporting drug use, 18.1% had a DAST-10 score ≥6.

Of 1,210 study participants (all of whom were not homeless and endorsed unhealthy alcohol or drug use at baseline), 114 (9.4%) entered a homeless shelter within 12 months of the baseline ED visit. Table 2 compares characteristics of patients who did versus did not enter a shelter. Shelter entrants were significantly older than non-entrants and were more commonly male, non-Hispanic Black, insured by Medicaid and/or Medicare, and unemployed. The majority (57.9%) of shelter entrants had a history of past shelter use documented in the NYC administrative shelter data. Study participants with history of a past shelter stay had a high likelihood of future shelter entry; 63.5% of the study sample who had a documented past NYC shelter stay entered a shelter in the 12 months following their ED visit.

Bivariate analyses revealed differences in substance use characteristics of participants who did versus did not go on to enter a shelter in the next year (Table 3). Among participants who reported past year unhealthy alcohol use, shelter entrants had significantly higher mean days of heavy drinking in the past year (151.5 vs. 50.9, p<.0001) and higher mean AUDIT scores (19.1 vs. 9.0, p<.0001). Nearly half (47.6%) had AUDIT scores ≥20 compared to 12.8% of those who did not enter shelter (p<.0001). Among participants who reported any past year drug use, shelter entrants had significantly higher mean days of drug use in the past year (199.6 vs. 142.4, p<.0001) and higher mean DAST-10 scores (5.0 vs. 2.4, p<.0001). Whereas there was no significant difference in cannabis use between shelter entrants and non-entrants, differences were observed for most other categories of drugs. More shelter entrants than non-entrants reported *both* unhealthy alcohol or any drug use (50.9% vs. 31.7%, p<.0001) and had visited the ED the day of their baseline visit for reasons related to substance use (43.0% vs. 12.7%, p<.0001). In a sensitivity analysis excluding participants with any history of shelter use, 48 of 1,106 (4.3%) entered a shelter in the 12 months after the baseline visit. Bivariate associations of substance use characteristics with future shelter entry were similar to those described for the main analysis (eTable 1).

Figure 1 shows the percentage of study participants who entered a shelter within 12 months of the baseline ED visit by AUDIT score, DAST-10 score, and types of drugs used. For both AUDIT and DAST-10, we see an incremental increase in the proportion of participants who enter shelter with each category of increasing alcohol/drug use severity. Differences were also observed for different categories of drug use, with 29.9% of those who reported heroin use and approximately 20% of those who reported prescription opioid, sedative, or cocaine use going on to enter shelter.

Table 4 shows results of multivariable analyses. In the multivariable logistic regression model including substance use severity and types together with sociodemographic and other health variables (partially adjusted model), greater severity of alcohol use disorder (AUDIT score ≥20 vs. 0–7) was significantly associated with shelter entry. Additionally, compared to participants with DAST-10 scores of 0, those with scores of 3–5, 6–8, and 9–10 all had significantly higher odds of shelter entry. Individual categories of drugs used did not remain significantly associated with shelter entry in the partially adjusted model. Once past shelter use history was added to the multivariable model (fully adjusted model), none of the substance use variables remained significantly associated with future shelter entry, though a non-significant trend was observed for DAST-10 score 9–10 (aOR 4.34, 95% CI 0.98–19.13). Past shelter use was associated with very high odds of future shelter use (aOR 27.45, 95% CI 14.39–52.37).

Discussion

In this longitudinal analysis of factors associated with future shelter entry among a sample of urban ED patients with unhealthy alcohol or drug use, multiple measures of substance use types and severity were associated with future shelter entry in bivariate models, but these relationships were weakened in multivariable models, and no longer significant after also adjusting for past shelter use history. Our finding that past shelter use was by far the strongest predictor of future shelter use is consistent with prior literature.[42,43] Substance

use may have contributed to these earlier shelter stays, but we did not examine this in our study. Overall, we failed to find a clear unidirectional linear path from substance use to homelessness in our study.

As described by Johnson, et al., substance use may be both a cause ("social selection") and consequence ("social adaptation") of homelessness.[12] We did not formally test the reverse pathway of homelessness leading to substance use in this study, but our findings combined with past research suggest that future research should consider both a model in which shared upstream factors contribute both to homelessness and to substance use, as well as more circular models where each issue can contribute to and compound the other. Future research could specifically examine ways in which substance use types and severity, and risky substance use related behaviors, might change as related to the condition of homelessness. For example, past research has shown that people experiencing homelessness have above average levels of pain and painful chronic health conditions.[44-46] In our cohort of ED patients, nearly half reported pain significant enough to interfere with their daily activities. It is possible that some people experiencing homelessness may use drugs to self-medicate for pain. This observation may be particularly relevant to emergency physicians, as undertreatment of painful conditions could possibly contribute to a cascade of downstream effects. Past qualitative research has contributed depth and detail on *how* substance use may both cause and be a consequence of homelessness, in the words of people experiencing homelessness themselves; future qualitative or mixed methods research may be particularly useful.[47,48]

Our study contributes to the literature because much of the past research on homelessness and substance use has been cross-sectional. Exceptions include a longitudinal study using data from the National Epidemiologic Survey on Alcohol and Related Conditions, which found that alcohol use disorder and drug use disorders were independently associated with increased risk for future first-time homelessness.[49] Another study using an Australian longitudinal cohort found that risky alcohol use was associated with future onset of homelessness.[50] In the same cohort, early life daily cannabis use, but not weekly use of other types of drugs, was associated with small increases in risk of becoming homeless among men.[51] A cohort study of vulnerably housed individuals in three Canadian cities found that higher DAST-10 scores were associated with risk for future homelessness but alcohol use measures were not.[52] Other longitudinal studies have found associations between substance use and ongoing homelessness among people who are already homeless.[25,53-55] Longitudinal studies have also supported the "social adaptation" theory that substance use is a consequence of homelessness. For example, a longitudinal study of Baltimore residents found that homelessness was significantly associated with return to injection drug use.[56] One national study found that early life homelessness, particularly in combination with childhood abuse, was associated with drug use in early adulthood.[57] Research with a community sample in Chicago found that early experiences with homelessness were predictive of later drug use.[22] The authors also suggested that other shared social vulnerability factors may be important contributors to both drug use and homelessness.[22] Regardless of the exact pathways, findings from this study suggest avenues for targeting interventions to prevent homelessness. To our knowledge, ours is among the first studies to closely examine the relationship of substance use and homelessness among

ED patients, a group that has held high interest for interventions to address substance use.[58-60] Most interventions targeting substance use among ED patients have not explicitly addressed risk for homelessness. Our study suggests that patients presenting to an urban, public ED —who are largely low-income—who also have unhealthy alcohol or drug use are at high risk for future homelessness, with nearly 1 in 10 going on to use a shelter in the 12 months following their ED visit. Among patients whose ED visit was substance use related, more than 1 in 4 (26%) went on to use a shelter in the next 12 months – many of whom had some past history of shelter use as well – making this a particularly important group for whom to target future interventions that simultaneously address both substance use and homelessness risk.

Past shelter use history was a particularly strong marker of future shelter use among ED patients with substance use: 63% of individuals fitting this description went on to enter a shelter in the next year. Many of these individuals may be episodically or chronically homeless and stuck in a well-described "institutional circuit," cycling among shelters, hospitals, substance use treatment facilities, and/or jail or prison. On the other hand, while the majority (58%) of future shelter entrants in our study did have a history of past NYC shelter use, 42% had no such history. Indeed, nearly 1 in 20 (4.3%) ED patients with unhealthy alcohol use in this study who did *not* have a past shelter use history newly entered a shelter within one year of their ED visit.

Similar to the findings from our study, a national study found the confluence of poverty and drug use disorders to be strongly predictive of entry to homelessness in the U.S., with 34.7% of individuals who experienced both poverty and drug-use disorders at baseline experiencing first-time homelessness by the time of a second survey 3–4 years later.[49] The authors of that study concluded, "Homelessness does not occur in a vacuum, solely the result of individual traits and behaviors, but rather in a broader social and economic context".[49] It is worth noting that most individuals who have substance use disorders in the U.S. who do *not* simultaneously experience poverty—itself is driven by political and structural issues including structural racism, lack of affordable housing, and an inadequate social safety net —do not become homeless. Thus, while our paper focuses on individual-level factors, it is critical to consider larger structural factors in considering any solutions to homelessness.

Limitations

The study should be interpreted considering a few key limitations. First, study participants were patients from a single ED and results may not be generalizable to other settings. The study ED is an urban, public hospital that sees many homeless and marginally housed patients. Therefore, the magnitude of past and future shelter use observed in our study may be above average. On the other hand, prior studies have shown high prevalence of homelessness among individuals with substance use disorder in localities across the U.S. [61,62] Further, the relationships observed between substance use characteristics and shelter entry corroborate those of prior literature from diverse settings. Second, our outcome variable was limited to shelter entry based on availability of administrative data. We do not have information on whether patients may have become unsheltered (e.g., living on the streets), "doubled up" with friends or family, or in other unstable housing conditions after

their baseline ED visit. However, NYC has a “right to shelter” and the large majority of homeless individuals are sheltered rather than unsheltered in NYC.[37] Therefore, in this study we treated shelter use as a proxy for homelessness, albeit a limited one, which will not be applicable for all localities. Use of administrative data is a strength of our study compared to most past studies that have relied on self-report; our study adds to the prior literature with its the methodologic innovation of using administrative shelter data for longitudinal assessment. Third, we did not have historical substance use data, which limits our ability examine the full picture of temporal association or causality. We also did not examine the role of the substance use treatment system in the interplay between homelessness and substance use, which could be explored in future research. Finally, we used a broad definition of unhealthy alcohol or drug use for inclusion in our study sample. Future research with large samples of people with more severe substance use disorders would allow further elucidation of the homelessness / substance use relationship.

Conclusion

In this study we found that ED patients who use drugs and alcohol—particularly those with more severe problems related to substance use—are at high risk for homelessness. Using combined survey and administrative data, our findings underscored the complexity of the relationship between substance use and homelessness rather than supporting a simple unidirectional pathway. This relationship might be best explored in future mixed methods research that incorporates qualitative interview findings with quantitative findings. In the meantime, our findings highlight the importance of addressing risk for homelessness in ED-based substance use interventions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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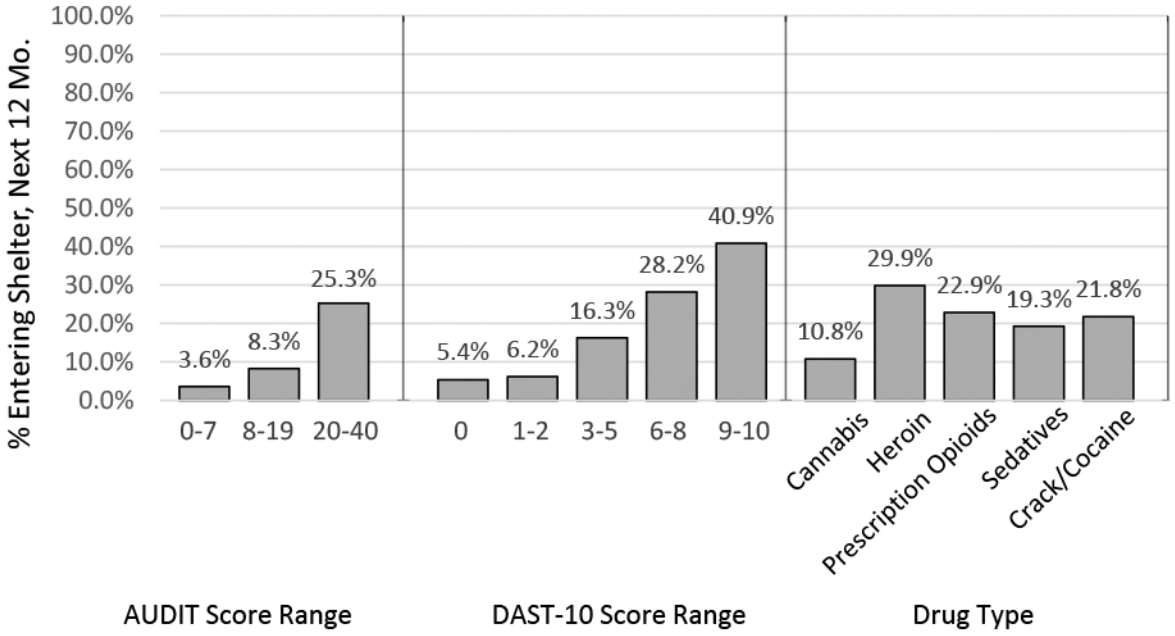

Figure 1. Percentage of study participants entering a homeless shelter within 12 months of the baseline ED visit by AUDIT score, DAST-10 score, and types of drugs used

Graph showing the percentage of study participants who entered a homeless shelter within the 12 months following their baseline emergency department visit by a) AUDIT score, b) DAST-10 score, and c) self-reported types of drugs used (not exclusive). AUDIT scores ≥8 represent hazardous drinking and ≥20 represent the highest risk category. DAST-10 scores 3–5 indicate moderate, 6–8 substantial, and 9–10 severe problems related to drug use. Individual drug use types were self-reported any use in the past 12 months; participants could answer affirmatively to more than one drug type.

Table 1.

Study participant characteristics

	n(%) n=1,210
Age (years)	
Mean (sd)	39.2 (14.1)
Range	18-81
Female	364 (30.3)
Race/ethnicity	
Hispanic/Latino	640 (52.9)
Non-Hispanic Black	249 (20.6)
Non-Hispanic White	205 (17.0)
Other	115 (9.5)
Insurance	
Uninsured	314 (26.0)
Medicaid and/or Medicare	613 (50.7)
Private / Other	283 (23.4)
Education	
Less than high school diploma	320 (26.5)
High school graduate or GED	329 (27.2)
Some college or higher	560 (46.3)
Employment	
Working (full or part-time)	686 (56.7)
Unemployed	274 (22.7)
Unable to work	193 (16.0)
Retired	56 (4.6)
Unable to meet essential expenses (past 12 mo)	482 (39.8)
Spent a night in jail/prison (past 6 mo)	77 (6.4)
Past shelter use history	104 (8.6)
Overall health fair or poor	452 (37.4)
Pain interferes with functioning[a]	509 (42.1)
Mental illness diagnosis[b]	520 (43.1)
Substance Use Characteristics	
Unhealthy alcohol use, past 12 mo[c]	999 (82.6)
Any drug use, past 12 mo[c]	616 (51.0)
Both unhealthy alcohol & drug use	405 (33.5)
AUDIT score[d, e]	
0–7	552 (56.1)
8–19	278 (28.3)
20–40	154 (15.7)

	n(%) n=1,210
DAST-10 score[d]	
0	112 (16.6)
1–2	305 (42.3)
3–5	135 (20.0)
6–8	78 (11.6)
9–10	44 (6.5)
Drugs used, past 12 mo	
Cannabis	572 (47.7)
Synthetic Cannabinoids	30 (2.5)
Heroin	97 (8.1)
Prescription Opioids	105 (8.8)
Sedatives (including benzodiazepines)	119 (9.9)
Hallucinogens	79 (6.6)
Prescription stimulants	58 (4.8)
Methamphetamine	31 (2.6)
Cocaine or Crack	229 (19.1)
Inhalants	10 (0.8)
ED visit today substance use related	188 (15.6)

Percentages are among those who answered each question; missing data <1.4%.

[a]Responses of moderately or extremely to SF-12 question on how much pain interfered with functioning in past 4 weeks.

[b]Self-report of diagnosis given by a healthcare professional of at least one of 8 different mental health problems (depression, anxiety, panic attacks, schizophrenia, bipolar disorder, PTSD, borderline personality, or other mental health disorder).

[c]By single-item screening questions (SISQ), Smith PC, et al. 2009; Smith PC, et al. 2010. Note that study analyses were restricted to participants who endorsed at least one of unhealthy alcohol use or any drug use.

[d]Participants screening positive for unhealthy alcohol use via the SISQ completed the AUDIT. We classified AUDIT scores using World Health Organization (WHO) guidance: scores ≥8 represent hazardous drinking and ≥20 represent the highest risk drinking category. Participants screening positive for drug use via either the SISQ or questions described below about any of ten individual drug classes used completed the DAST-10. We used NIDA-recommended DAST-10 score ranges to classify moderate (3–5), substantial (6–8), and severe (9–10) problems related to drug use.

[e]We acknowledge a small oversight in the AUDIT screener used in the study where English-speaking participants were asked how often they have ≥6 drinks in a day and Spanish-speaking participants were asked how often they have ≥5 drinks in one day. Both cut-offs have been used in different versions of the AUDIT and, while it would have been preferable to have the same version administered to all study participants, we do not expect based on our examinations that this had a significant effect on our results.

Table 2.

Basic participant characteristics by shelter entry within 12 months of baseline

	Shelter Entrant n(%) n=114	Not Shelter Entrant n(%) n=1096	p-value
Demographics			
Age, years, mean (sd)	47.4 (12.6)	38.3 (14.0)	<.0001
Female	12 (10.6)	352 (32.3)	<.0001
Race/ethnicity			<.0001
Hispanic/Latino	40 (35.1)	600 (54.8)	
Non-Hispanic Black	49 (43.0)	200 (18.3)	
Non-Hispanic White	14 (12.3)	191 (17.4)	
Other	11 (9.7)	104 (9.5)	
Socioeconomic Factors			
Insurance			<.0001
Uninsured	11 (9.7)	303 (27.7)	
Medicaid and/or Medicare	89 (78.1)	524 (47.8)	
Private / Other	14 (12.3)	269 (24.5)	
Education			0.219
Less than high school diploma	34 (29.8)	286 (26.1)	
High school graduate or GED	36 (31.6)	293 (26.8)	
Some college or higher	44 (38.6)	516 (47.1)	
Employment			<.0001
Working (full or part-time)	32 (28.1)	654 (59.7)	
Unemployed	48 (42.1)	226 (20.6)	
Unable to work	22 (19.3)	171 (15.6)	
Retired	12 (10.5)	44 (4.0)	
Unable to meet essential expenses	67 (58.8)	415 (37.9)	<.0001
Spent a night in jail/prison (past 6 mo)	26 (23.0)	51 (4.7)	<.0001
Past shelter use history	66 (57.9)	38 (3.5)	<.0001
Physical and Mental Health			
Overall health fair or poor	52 (45.6)	400 (36.6)	0.057
Pain interferes with functioning[a]	54 (47.8)	455 (41.6)	0.201
Mental illness diagnosis	74 (66.1)	446 (40.8)	<.0001

Percentages are among those who answered each question; missing data <0.8%.

[a]Responses of moderately or extremely to SF-12 question on how much pain interfered with functioning in past 4 weeks.

Table 3.

Substance use characteristics by shelter entry within 12 months of baseline

	Shelter Entrant n(%) n=114	Not Shelter Entrant n(%) n=1096	p-value
Alcohol Use			
Unhealthy alcohol use, past 12 mo	86 (75.4)	913 (83.3)	0.035
# days[a], past 12 mo, mean (sd)	151.5 (158.2)	50.9 (94.2)	<.0001
AUDIT score, mean (std dev)	19.1 (12.4)	9.0 (8.7)	<.0001
AUDIT score category			<.0001
0–7	20 (24.4)	532 (59.0)	
8–19	23 (28.0)	255 (28.3)	
20–40	39 (47.6)	115 (12.8)	
Drug Use			
Any drug use, past 12 mo	86 (75.4)	530 (48.5)	<.0001
# days[a], past 12 mo, mean (sd)	199.6 (186.0)	142.4 (191.5)	<.0001
DAST-10 score, mean (sd)	5.0 (3.3)	2.4 (2.5)	<.0001
DAST-10 score category			<.0001
0	6 (6.9)	106 (18.1)	
1–2	19 (21.8)	286 (48.7)	
3–5	22 (25.3)	113 (19.3)	
6–8	22 (25.3)	56 (9.5)	
9–10	18 (20.7)	26 (4.4)	
Drugs used, past 12 mo			
Cannabinoids	63 (55.8)	512 (47.2)	0.081
Cannabis	62 (54.9)	510 (47.0)	0.109
Synthetic Cannabinoids	13 (11.5)	17 (1.6)	<.0001
Opioids	38 (33.6)	109 (10.0)	<.0001
Heroin	29 (25.7)	68 (6.3)	<.0001
Prescription Opioids	24 (21.2)	81 (7.5)	<.0001
Sedatives	23 (20.4)	96 (8.8)	<0.001
Hallucinogens	9 (8.0)	70 (6.4)	0.536
Stimulants	53 (46.9)	201 (18.5)	<.0001
Prescription stimulants	8 (7.1)	50 (4.6)	0.243
Methamphetamine	9 (8.0)	22 (2.0)	0.0002
Cocaine or Crack	50 (44.3)	179 (16.5)	<.0001
Inhalants	3 (2.7)	7 (0.7)	0.025
Other			
Both unhealthy alcohol & drug use	58 (50.9)	347 (31.7)	<.0001
ED visit today substance use related	49 (43.0)	139 (12.7)	<.0001

Percentages are among those who answered each question; missing data <0.9% unless otherwise noted for all variables except AUDIT (1.8%) and DAST-10 (2.5%).

[a]Among those screening positive using single-item screening questions (SISQ)

Table 4.

Characteristics and associated odds of homeless shelter entry within 12 months of baseline

	Unadjusted OR (95% CI)	Partially Adjusted OR (95% CI)[a]	Fully Adjusted OR (95% CI)[a]
Age (ref: 18-34)			
35-45 years	**3.84 (2.05–7.21)**	**2.94 (1.44–6.02)**	**2.61 (1.15–5.89)**
46-59 years	**5.76 (3.19–10.41)**	**3.37 (1.63–6.98)**	**3.11 (1.35–7.16)**
60+ years	**6.40 (3.11–13.17)**	**4.73 (1.99–11.22)**	**5.07 (1.88–13.68)**
Male (vs. female)	**4.20 (2.22–7.94)**	**2.26 (1.11–4.61)**	**2.25 (1.02–4.99)**
Race/ethnicity (ref: Hispanic/Latinx)			
Black Non-Hispanic	**3.78 (2.39–5.98)**	1.73 (0.99–3.01)	1.83 (0.97-3.47)
White Non-Hispanic	1.03 (0.53-2.02)	0.53 (0.24–1.18)	0.63 (0.26–1.54)
Other Non-Hispanic	1.51 (0.73-3.13)	1.32 (0.56–3.10)	0.98 (0.36–2.70)
Education (ref: less than high school)			
High school diploma or GED	1.00 (0.60-1.68)	1.09 (0.59-2.01)	2.03 (0.95-4.36)
Some college or more	0.73 (0.45-1.19)	1.39 (0.77-2.51)	**3.28 (1.53-7.05)**
Insurance (re: uninsured)			
Medicaid and/or Medicare	**4.84 (2.47-9.47)**	**2.24 (1.06-4.70)**	1.61 (0.70-3.71)
Private insurance	1.59 (0.69-3.64)	1.56 (0.63-3.87)	1.25 (0.46-3.45)
Trouble meeting basic expenses	**2.39 (1.59-3.59)**	1.49 (0.92–2.40)	1.28 (0.73–2.24)
Employed (vs. not working)	**0.24 (0.15-0.38)**	0.64 (0.37–1.09)	0.70 (0.38–1.29)
Overall health (ref: excellent/very good)			
Good	1.53 (0.88-2.67)	1.07 (0.56–2.05)	1.32 (0.63–2.75)
Fair/poor	**1.89 (1.11-3.22)**	0.83 (0.44–1.56)	0.99 (0.48–2.07)
Psychiatric diagnosis	**3.03 (1.98-4.61)**	1.54 (0.92–2.58)	1.31 (0.72–2.36)
Past shelter use history	**41.52 (24.89-69.26)**	N/A	**27.45 (14.39–52.37)**
Jail/prison history (past 6 mo)	**5.91 (3.45–10.11)**	**2.84 (1.42–5.66)**	2.00 (0.86–4.65)
AUDIT score (ref: 0–7)[b]			
8–19	1.34 (0.79–2.27)	1.25 (0.68-2.28)	1.47 (0.75–2.88)
20–40	**5.51 (3.43–8.84)**	**2.26 (1.25-4.09)**	1.79 (0.87–3.70)
DAST-10 score (ref: 0)[b]			
1–2	**2.00 (1.09–3.67)**	1.52 (0.75–3.10)	1.17 (0.51–2.68)
3–5	**5.77 (3.10–10.72)**	**2.64 (1.16–6.00)**	2.44 (0.94–6.36)
6–8	**10.38 (5.38–20.05)**	**2.87 (1.10–7.48)**	1.91 (0.62–5.87)
9–10	**17.97 (8.45–38.22)**	**5.20 (1.55–17.45)**	4.34 (0.98–19.13)
Drugs used[d]			
Cannabis	1.47 (0.98–2.19)	1.01 (0.59–1.73)	1.41 (0.73–2.72)
Heroin	**5.46 (3.31–9.00)**	1.36 (0.64–2.87)	1.64 (0.68–3.96)
Prescription Opioids	**3.51 (2.09–5.88)**	1.04 (0.47–2.28)	0.64 (0.24–1.74)
Sedatives	**2.73 (1.63–4.57)**	0.73 (0.33–1.63)	0.81 (0.31–2.09)
Cocaine/crack	**4.21 (2.78–6.38)**	0.97 (0.53–1.75)	0.69 (0.34–1.42)

[a] Both adjusted models include age, gender, race/ethnicity, education, insurance status, difficulty meeting essential expenses, employment, physical health, mental health, and recent jail/prison stay history. Fully adjusted models additionally add prior shelter use history.

[b] AUDIT ≥8 signifies hazardous use and ≥20 possible dependence. NIDA-recommends DAST-10 cut-offs for moderate (3–5), substantial (6–8), and severe (9–10) problems related to drug use. Study participants who screened negative for any unhealthy alcohol or drug use (and thus were not administered the AUDIT and/or DAST-10) are included in the reference categories for the logistic regression analyses.