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Experiencing homelessness as a risk factor for negative treatment outcomes among individuals receiving outpatient treatment for opioid use disorder in the United States

Erik Loewen Friesen, MSc[1-3]; Samantha Young, MD[1,4,5]

[1] Institute for Health Policy, Management & Evaluation, University of Toronto, Toronto, Ontario
[2] Centre for Addiction and Mental Health, Toronto, Ontario
[3] MD/PhD Program, Temerty Faculty of Medicine, University of Toronto, Toronto, Ontario
[4] Division of General Internal Medicine, Department of Medicine, St. Michael's Hospital, Unity Health Toronto, Toronto, Ontario
[5] Interdepartmental Division of Addiction Medicine, St. Paul's Hospital, Vancouver, British Columbia

Abstract

Introduction: people experiencing homelessness (PEH) have disproportionately high rates of opioid use disorder (OUD) and are at high risk of opioid-related morbidity and mortality. The purpose of this study was to evaluate the impact of homelessness on treatment-related outcomes among individuals receiving outpatient treatment for OUD.

Methods: the data for this study came for the Treatment Episodes Data Set - Discharges (TEDS-D), a large, nationally representative discharge database for addiction treatment facilities in the United States (US). The cohort was restricted to individuals receiving outpatient treatment for OUD. Four treatment-related outcomes were explored: the use of opioid agonist therapy (OAT), treatment retention, treatment discontinuation, and treatment completion. The associations between homelessness and these four outcomes were analyzed using multivariable logistic regression models adjusted for clinically relevant covariates (age, sex, primary OUD type, psychiatric comorbidity, and polysubstance use). State-level differences in the association between homelessness and treatment outcomes were assessed and mapped.

Results: 49,213 discharge records were included in the analyses. Experiencing homelessness, relative to living independently in stable housing, was associated with a lower odds of receiving OAT (adjusted odds ratio (aOR): 0.75, 95% confidence interval (CI): 0.69 - 0.80, p<0.001) and treatment retention (aOR: 0.67, 95% CI: 0.62 - 0.71, p<0.001). Homelessness had a smaller but statistically significant effect on treatment discontinuation and completion, where it increased the odds of client dropout (aOR: 1.20, 95% CI: 1.11 - 1.29, p<0.001) and decreased the odds of completion (aOR: 0.84, 95% CI: 0.78 - 0.92, p<0.001). The associations between homelessness and OAT use and homelessness and retention varied substantially between states.

Conclusion: in this large, US cohort of individuals receiving outpatient treatment for OUD, experiencing homelessness was associated with worse treatment outcomes than clients who were stably housed. Further research into the specific barriers to OAT and engagement in treatment for PEH are needed to target interventions to improve OUD treatment outcomes for this population that already faces numerous forms of structural marginalization associated with poorer health outcomes.

Introduction

The overdose epidemic is one of the greatest public health crises facing North America, with over 70,000 deaths attributable to overdose each year in the United States (US).[1] This is largely due to the presence of illicitly manufactured fentanyl, a potent synthetic opioid, and its analogues within the drug supply in many regions.[2-4] Among people experiencing homelessness (PEH), there are disproportionately high rates of substance use disorders compared to the general population.[5,6] Due to various forms of structural marginalization, PEH are also at increased risk of harm due to substance use; opioid overdose was found to be a leading cause of death among PEH in Boston.[5]

For individuals with an opioid use disorder (OUD) the use of opioid agonist therapy (OAT), including methadone and buprenorphine/naloxone, has been widely shown to reduce illicit opioid use, overdose, and all-cause mortality.[7-11] Although there is

Corresponding Author:
Erik Loewen Friesen
erik.friesen@mail.utoronto.ca

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robust evidence to suggest that OAT is effective in reducing mortality, overdose, and use of acute care services, there is still a large gap in overall access to OAT.[7,8] Non-pharmacologic treatment remains the most common overall treatment pathway for OUD, with less than 15% of people receiving OAT in the US.[7] For PEH, barriers to OAT are even greater than for the general population due to stigma, program requirements, and unique care needs.[6,12,13]

Despite high rates of OUD among PEH, several studies have shown that homelessness is associated with negative treatment-related outcomes including failure to complete induction with buprenorphine, and low rates of retention in methadone treatment.[14-18] However, many of these studies focus on small or regional cohorts of people who use drugs and have not examined the impact of homelessness across both pharmacologic and non-pharmacologic treatment outcomes in the outpatient setting, specifically.[15,17] This study therefore sought to examine the impact of experiencing homelessness on four key treatment outcomes: the use of OAT, treatment discontinuation, treatment retention, and treatment completion among a large US national cohort of patients accessing publicly-funded outpatient substance use treatment. With over 500,000 PEH in the US on any given night,[19] this has important implications to target barriers in accessing evidence-based OUD treatment for this high-risk group.

Methods

Data source

This study made use of data from the Treatment Episode Data Set – Discharges (TEDS-D),[20] a nationally representative US dataset containing client-level discharge data from publicly funded addiction treatment centers. Annual TEDS-D data is compiled by the Substance Abuse and Mental Health Services Association (SAMHSA) based on data submitted by individual states. The 2015, 2016 and 2017 TEDS-D datasets were combined to create a single concatenated dataset. A 3-year timeframe was chosen to align our study with the methodology used in multiple recent TEDS-D studies.[21,22] The cohort was restricted to individuals with OUD (i.e., primary substance at admission = heroin or 'other opioid') and who were receiving treatment in outpatient settings (i.e., service setting at admission = 'Ambulatory - intensive outpatient' or 'Ambulatory - non-intensive outpatient'). In addition, because TEDS-D consists of discharges not clients, it is possible that a single client is responsible for multiple discharges in the dataset. Therefore, the cohort was further restricted to first-time clients (i.e., number of prior addiction treatment episodes = 0) to ensure that each discharge represented a unique client (Figure 1).

Outcomes

Four outcomes of interest were explored in this study: (1) the use of OAT as a part of the OUD treatment program, (2) treatment discontinuation, which was broken down into two outcomes based on whether the facility terminated treatment ('facility termination') or the client dropped out of treatment ('client dropout'), (3) treatment retention, and (4) treatment completion. For study outcomes 2-4, "treatment" included both pharmacologic (i.e., OAT) and nonpharmacologic OUD treatments. OAT use was defined as when the variable "medication-assisted opioid therapy" was coded as "yes"; of note, this variable pertains to the planned use of OAT rather than

the confirmed use of OAT during the treatment program. Client dropout and facility termination were defined as when the "reason for discharge or discontinuance of treatment" was coded as "dropped out of treatment" or "terminated by facility", respectively. Treatment discontinuation was separated into client dropout and facility termination based on a recent report that composite discontinuation outcomes can hide more nuanced associations that exist between clinical variables and addiction treatment outcomes.[21] Client dropout refers to scenarios when a client chooses to terminate treatment (including against medical advice) or is lost to follow up, whereas facility termination refers to scenarios when treatment is terminated by the facility due to a violation of treatment rules or procedures or client non-compliance. Retention was defined as a length of stay (LOS) ≥ 90 days, based on the methodology used in previous studies using the TEDS-D dataset.[23,24] Treatment completion was defined as when the "reason for discharge or discontinuance of treatment" was coded as "treatment completed" by the treatment facility.

Each outcome was dichotomous (i.e., either coded as 'yes' or 'no') based on the above criteria and was coded as 'yes' if the event occurred (or was planned, in the case of OAT) at any point during the treatment program. The median length of treatment in the cohort was 75 days (interquartile range (IQR): 30-365 days). Discharge records in where the reason for discontinuation of treatment was death, incarceration, transfer to different facility, or not specified were removed (Figure 1).

Exposures and covariates

The primary exposure was living arrangement, i.e., whether the client was experiencing homelessness at the time of admission. In the TEDS-D dataset, there are three possible living arrangements: (1) homeless, (2) dependent living, and (3) independent living. Those categorized as 'homeless' are defined as having no fixed address or living in a shelter. The 'dependent' category is highly heterogeneous (includes clients living in a supervised setting, such as a residential institution, halfway house, or group home; as well as children living
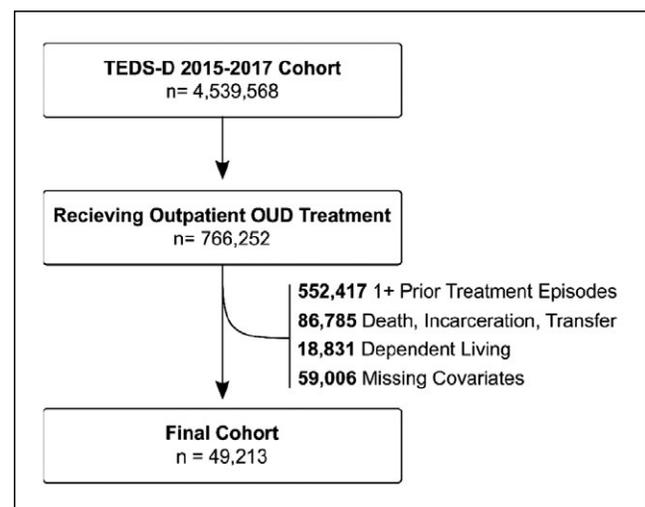
Figure 1. Flow chart of cohort creation. The complete 2015-2017 TEDS-D data was restricted to individuals receiving outpatient OUD treatment. Discharge records were further restricted based on a series of inclusion and exclusion criteria detailed in the methods section to create a final cohort of 49,213 unique clients.

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Table 1. Descriptive Statistics of the Cohort.

	Overall (n = 49,213) n (%)	PEH (n = 4,173) n (%)	Non-PEH (n = 45,040) n (%)	SD	*p*
Sex					
Male	28,181 (57.3%)	2,578 (61.8%)	25,603 (56.8%)	0.10	<0.001
Female	21,032 (42.7%)	1,595 (38.2%)	19,437 (43.2%)		
Age					
18-24	8,152 (16.6%)	622 (14.9%)	7,530 (16.7%)	0.06	<0.001
25-54	37,195 (75.6%)	3,179 (76.2%)	34,016 (75.5%)		
55+	3,866 (7.9%)	372 (8.9%)	3,494 (7.8%)		
Psychiatric Comorbidity					
Yes	14,471 (29.4%)	1,365 (32.7%)	13,106 (29.1%)	0.08	<0.001
No	34,742 (70.6%)	2,808 (67.3%)	31,934 (70.9%)		
Primary opioid used at admission					
Heroin	32,405 (65.8%)	3,373 (80.8%)	29,032 (64.5%)	0.36	<0.001
Other Opioid	16,808 (34.2%)	800 (19.2%)	16,008 (35.5%)		
Number of substances used at admission					
1	23,380 (47.5%)	1,503 (36.0%)	21,877 (48.6%)	0.26	<0.001
2	17,508 (35.6%)	1,857 (44.5%)	15,651 (34.7%)		
3+	8,325 (16.9%)	813 (19.5%)	7,512 (16.7%)		

SD: standardized difference

with parents, relatives, or guardians, or in foster care) and was therefore excluded from our analyses. This resulted in the formation of a binary primary exposure, where a client was either categorized as experiencing homelessness or not (i.e., 'independent'). These two categories will hereafter be referred to as people experiencing homelessness ('PEH') and not ('non-PEH').

Covariates included in the multivariable models were selected a priori by selecting covariates associated with homelessness and/ or OUD treatment outcomes or those that could modify the association between homelessness and treatment outcomes based on clinical rationale. These variables included: age, sex, number of prior addiction treatment episodes, primary SUD type, the presence of a psychiatric comorbidity (any, based on clinical diagnosis or self-report), and polysubstance use (i.e., the number of substances the client was using at admission).[21-27] Discharge records missing values for any of these covariates were removed (Figure 1).

Statistical analysis

Baseline characteristics of the cohort were summarized using descriptive statistics, after stratifying by living arrangement (PEH versus non-PEH). All variables were categorical and presented as counts and percentages. Baseline differences between PEH and non-PEH groups were evaluated using both chi-square tests for independence and standardized differences, where p<0.01 and a |standardized difference| ≥ 0.10 indicated a significant difference between groups, respectively.[28]

The association between living arrangement and treatment outcomes was evaluated using a series of sequentially adjusted logistic regression models: (1) unadjusted, (2) adjusted for the above-mentioned clinical and demographic covariates, and (3) adjusted for all covariates as well as state fixed effects (included as a dummy variable in the multivariable models). The inclusion of state fixed effects using dummy variables in the multivariable models was done to account for known geographic clustering in addiction

treatment outcomes in the TEDS-D dataset.[29] We hypothesized that the association between living arrangement and treatment outcomes would vary based on whether OAT was planned for the treatment episode. Therefore, as a sensitivity analysis, we re-ran the multivariable logistic regression models to assess the association between living arrangement and each outcome after the cohort had been stratified by whether the client received OAT.

We also assessed how the association between living arrangement and treatment outcomes varied between states, given that addiction treatment outcomes are known to have regional variation.[29] In adherence with the methods initially developed by Arndt et al. (2013)[29] and recently used by our team (Friesen et al. (2020)),[21] this was accomplished in two steps. First, an interaction term between living arrangement and state was included in the multivariable models, and a significant interaction (p<0.01) was taken to indicate that the association between living arrangement and the outcome varied between states. Second, this interaction was interpreted and visualized by calculating risk differences for each state where the proportion of individuals experiencing homelessness who experienced the outcome (e.g., OAT, treatment retention, etc.) was subtracted from the proportion of non-homeless individuals who experiences the outcome. In this scenario, risk differences are preferable to odds ratios, which are more susceptible to bias based on the relative prevalence of an outcome between states (see Arndt et al. (2013)[29] for a more detailed explanation). The standard error (SE) for risk differences were calculated, where a risk difference with a SE that crossed 0 indicated a non-significant difference in that state.

Software

Statistical analyses were performed using SAS version 9.4 and figures were generated using the ggplot2 package in R version 4.0.2.[30-32] Risk differences were mapped across the United States using ArcGIS Pro (version 2.4.0).[33]

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Results

Cohort Demographics

The final cohort consisted of 49,213 clients receiving outpatient treatment for OUD between 2015 and 2017. 57.3% of the cohort was male, 65.8% used heroin, and 8.5% were categorized as PEH (Table 1). 44.4% of the cohort received OAT as a part of their treatment plan. There were significant baseline differences between clients based on living arrangement. Namely, clients categorized as PEH, relative to non-PEH, were more likely to be male (PEH: 61.8%, non-PEH: 56.8%, standardized difference (SD): 0.10, p<0.001, Table 1) and use more than 1 substance at admission (PEH: 64.0%, non-PEH: 51.4%, SD: 0.26, p<0.001, Table 1). There were no differences between PEH and non-PEH clients in terms of age or presence of a psychiatric comorbidity insofar as the standardized difference between groups was < 0.10 for these variables.

The association between living arrangement and treatment outcomes

The associations between living arrangement and the four treatment outcomes are presented in Table 2. In the fully adjusted model (including relevant covariates and state fixed effects, column 3), homelessness substantially reduced the odds of receiving OAT (adjusted odds ratio (aOR): 0.75, 95% confidence interval (CI): 0.69 - 0.80, p<0.001) as well as the odds of treatment retention (aOR: 0.67, 95% CI: 0.62 - 0.71, p<0.001). Experiencing homelessness had less of an impact on the other outcomes but did increase the odds of client dropout (aOR: 1.20, 95% CI: 1.11 - 1.29, p<0.001) and decrease the odds of treatment completion (aOR: 0.84, 95% CI: 0.78 - 0.92, p<0.001).

The association between living arrangement and treatment outcomes were subsequently assessed after stratifying the cohort based on whether OAT was used as part of the treatment plan. The results of these analyses are presented in Table 3. In terms of facility termination of treatment, PEH had a lower odds of facility termination when they received OAT (aOR: 0.78, 95% CI: 0.77 - 0.78), but were not significantly different from non-PEH clients when they did not (aOR: 1.08, 95% CI: 0.92 - 1.27, p = 0.36). For client dropout, PEH had a higher odds of dropout when they received OAT (aOR: 1.57, 95% CI: 1.37 - 1.80, p<0.001), but were not significantly different from non-PEH clients when they did not (aOR: 1.07, 95% CI: 0.97 - 1.18, p = 0.16). For treatment completion, PEH had a lower odds of treatment completion when they received OAT (aOR: 0.62, 95% CI: 0.53 - 0.73, p<0.001), but were not significantly different from non-PEH clients when they did not (aOR: 0.91, 95% CI: 0.82 - 1.00, p = 0.05). Interestingly, however, for treatment retention, the use of OAT did not moderate the effect of homelessness on treatment retention, i.e., PEH had a reduced the odds of treatment retention regardless of whether OAT was used (aOR: 0.72, 95% CI: 0.65 - 0.80, p<0.001) or not (aOR: 0.64, 95% CI: 0.59 - 0.71, p<0.001).

State-level variations in the impact of homelessness on OAT use and retention

A significant interaction (p<0.0001) was observed between state and living arrangement in all multivariable models presented in Table 2, indicating that the association between experiencing homelessness and treatment outcomes varied significantly between states. This interaction was interpreted by calculating state-specific

Table 2. Logistic regression analyses for the association between homelessness and treatment outcomes.

Outcome	Unadjusted OR (95% CI)	Adjusted for Covariates OR (95% CI)	Adjusted for Covariates & State Fixed Effects OR (95% CI)
OAT	0.99 (0.93 - 1.05)ns	0.85 (0.79 - 0.91)*	0.75 (0.69 - 0.80)*
Facility termination	0.68 (0.60 - 0.76)*	0.68 (0.60 - 0.76)*	0.93 (0.93 - 0.93)*
Client Dropout	1.51 (1.41 - 1.62)*	1.43 (1.34 - 1.54)*	1.20 (1.11 - 1.29)*
Retention	0.65 (0.61 - 0.70)*	0.65 (0.61 - 0.70)*	0.67 (0.62 - 0.71)*
Completion	0.73 (0.67 - 0.78)*	0.77 (0.71 - 0.84)*	0.84 (0.78 - 0.92)*

*p < 0.001, ns = not significant (p>0.05)

Table 3. Logistic regression analyses for the effect of living arrangement on treatment outcomes after stratifying by the use of opioid agonist therapies.

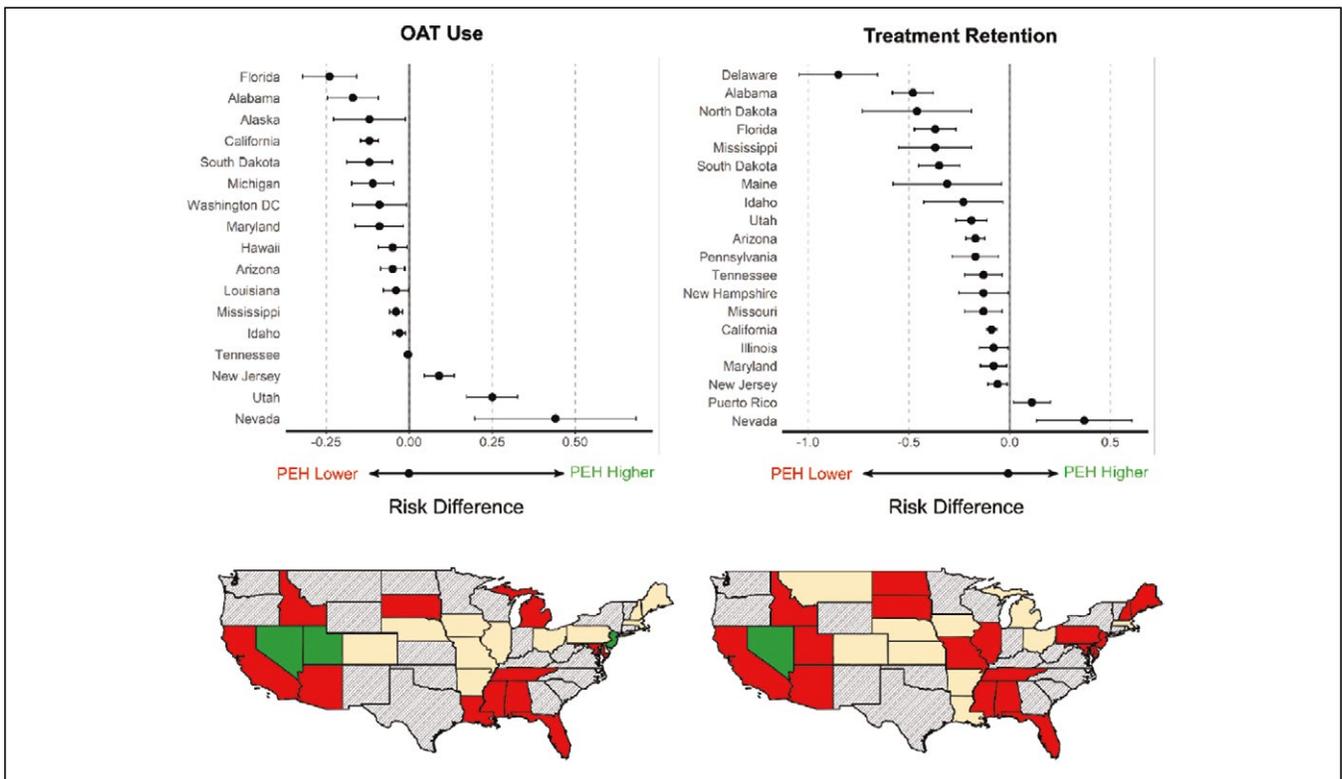| Outcome	OAT part of treatment strategy	
	Yes OR (95% CI)	No OR (95% CI)
Facility termination	0.78 (0.77 - 0.78)*	1.08 (0.92 - 1.27)ns
Dropout	1.57 (1.37 - 1.80)*	1.07 (0.97 - 1.18)ns
Retention	0.72 (0.65 - 0.80)*	0.64 (0.59 - 0.71)*
Completion	0.62 (0.53 - 0.73)*	0.91 (0.82 - 1.00)ns

*p < 0.001, ns = not significant (p>0.05)

risk differences for OAT use and treatment retention and visualized by mapping these risk differences across the United States (Figure 2). We chose to only evaluate state-level differences for OAT use and treatment retention because homelessness had the largest impact on these two outcomes, relative to treatment discontinuation and treatment completion. This analysis illustrated that the impact of homelessness on OAT use is highly variable between states. Indeed, in some states, experiencing homelessness was associated with an increased likelihood of receiving OAT (green states) whereas in others it was associated with a decreased likelihood of receiving OAT (red states). A similar pattern was observed for state-level differences in the impact of homelessness on treatment retention.

Discussion

In this large, nationally representative cohort of individuals receiving outpatient treatment for OUD in the US, we found that homelessness was associated with several negative treatment outcomes. Specifically, PEH had substantially lower odds of receiving OAT and treatment retention. Experiencing homelessness had a smaller impact on treatment completion and client dropout but was nonetheless significantly associated with a lower odds of treatment completion and a higher odds of client dropout.

Overall, slightly less than half (44.4%) of the cohort received OAT as a part of their treatment plan. While this rate is higher than has been shown in residential or inpatient treatment settings (where rates are as low as 16%) and outpatient receipt of OAT has been encouragingly increasing over the past several years in the US, this is in keeping with previous work in that indicates a large gap in care for evidence-based treatment.[7,8,34] While there is no agreed upon target for the percentage of people engaged in OAT, given that OAT is first-line treatment for OUD and has the greatest evidence for benefit compared to non-pharmacologic treatment,[7,8,35] it should be offered

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Figure 2. Risk differences in the use of OAT (left) and retention (right) among PEH versus those not. Maps on the bottom are a visualization of the risk differences presented on the top. Those states that were missing data or those where there was a non-significant risk difference in OAT use or retention between PEH and non-PEH (i.e., the risk difference crossed zero) are not included in the graphs (top). Risk differences were calculated by subtracting the proportion experiencing the outcome in the PEH group from the proportion experiencing the outcome in the non-PEH group. For the maps (bottom), red = states where individuals who are homeless are less likely to have the outcome than those who are not, green = states where individuals who are homeless are more likely to have the outcome than those who are not, beige = states where the difference in the likelihood of the outcome not significantly different between homeless and non-homeless individuals, grey = states with no data available. Alaska, Hawaii & Puerto Rico are not shown on the maps, significant risk differences for these regions can be observed in the graphs (top).

to all individuals engaging in treatment for OUD in any setting. While some people will choose not to engage in OAT for various reasons, there is evidence that stigma, prescriber comfort, and patient awareness remain ongoing yet modifiable barriers to engagement in OAT.[36-40] The overall rate of receipt of outpatient OAT in our study across the US is also lower than has been found in some studies, indicating variable gaps in care across the country; for example, in Maryland, over 70% of patients treated for OUD in the outpatient setting received OAT.[41] Our finding that experiencing homelessness further reduces the odds of receiving OAT is particularly concerning given the other forms of structural marginalization this population faces that portend a higher risk of worse health outcomes.[6,12,42]

The associations between homelessness and facility termination, client dropout, and treatment completion were moderated by whether OAT was used as a part of treatment. Among individuals who received OAT, homelessness decreased the odds of facility termination, increased the odds of client dropout, and decreased the odds of treatment completion. In contrast, among individuals who did not receive OAT, homelessness had no statistically significant impact on the odds of facility termination, client dropout or treatment completion. Of note, the association between homelessness and treatment retention was not moderated by OAT use, as homelessness reduced the odds of treatment retention in either scenario. Given

that OAT should be standard of care for treatment of OUD,[43, 44] the finding that, among those receiving OAT, homelessness portended a lower odds of treatment completion and retention and increased odds of treatment dropout warrants further study into why this association may exist and how it can be mitigated. The need for more robust primary and interdisciplinary care, stigma, barriers to engagement in follow-up, and the need for increased harm reduction services in this population may all be contributing factors.

The associations between homelessness and OAT use as well as homelessness and treatment retention varied between states, as evidenced by a significant interaction between state and living arrangement in the multivariable models for these outcomes. These state-level variations were visualized in the maps presented in Figure 2, which illustrated that homelessness increased the likelihood of receiving OAT in some states but reduced the odds in others, and a similar pattern was observed for treatment retention. This may reflect differing availability of community and addiction supports for PEH. For example, in Vancouver, Canada, where there are fairly intensive community supports and addiction services for PEH compared to some other cities in North America, homelessness was found to increase the odds of receiving OAT.[45]

Similar to our study, a previous study using the TEDS-D dataset also found homelessness to be associated with a decreased odds of

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receiving OAT specifically in the detoxification treatment setting.[18] Our study builds upon this finding to illustrate that homelessness is associated with lower odds of receiving OAT across all outpatient treatment settings.[39] Beyond the impact of homelessness on OAT, treatment outcomes were worse overall for PEH with lower rates of retention and treatment completion. This includes both people receiving and not receiving OAT. In the case of discontinuation of OAT, this is known to be a significant risk factor for subsequent overdose and death in the context of loss of tolerance.[46, 47] In all cases, this loss of engagement in care may represent a significant factor for increased morbidity among PEH who are already at risk for negative health outcomes. Our study is not able to determine what specific factors or circumstances led to treatment discontinuation, but this is an important target for future studIES to identify modifiable factors to improve client-centered substance use care for PEH.

Our study has several limitations that must be acknowledged. First, each entry in the TEDS-D represents a unique treatment episode not a unique client (i.e., clients could be included more than once); however, the impact of this limitation was mitigated by restricting the cohort to first-time clients, ensuring that each record represented a unique individual. Second, the outcome variable of OAT tells us whether medication for OUD was planned as part of the clients' treatment but cannot confirm whether that medication was actually taken by the client at the corresponding treatment episode. With respect to our primary analyses, we hypothesize that this would result in either nondifferential misclassification bias whereby both PEH and non-PEH would have similar rates of planned but not initiated OAT or, based on extrapolation from literature showing homelessness to portend lower rates of OAT treatment adherence,[17] differential misclassification bias. Indeed, if PEH were less likely to initiate planned OAT compared to non-PEH, our results would be biased toward the null for the outcome of OAT use, in turn, underestimating the negative impact of homelessness on receiving OAT in this cohort. Third, this study compared people experiencing homelessness to individuals who are stably housed and live independently, excluding those in a dependent living situation such as foster care, a group home, etc. Therefore, the results of this study may not generalize to individuals who reside in these types of dependent living scenarios. Finally, the TEDS-D dataset contains data pertaining only to state-licensed or certified substance use treatment programs that receive public funds which may not be generalizable across all treatment settings in the US or elsewhere. However, the large sample size and the representation of addiction treatment facilities from the majority of states enhances generalizability.

Conclusion

Experiencing homelessness was found to be associated with several negative outcomes for OUD treatment in the outpatient setting among a large US cohort, including receipt of OAT and treatment retention. Given the high prevalence of OUD amongst PEH as well as the increased risk of overdose-related mortality in this group, our findings support the need for interventions to improve access to OAT and retention in outpatient OUD treatment. In particular, given the strong evidence base for OAT as standard of care for OUD, further work is needed in identifying barriers to receipt of OAT for PEH.

References

1. Provisional drug overdose death counts. National Center for Health Statistics. (2020)
2. Bisaga A. What should clinicians do as fentanyl replaces heroin? Addiction. 2019;114(5):782-783
3. Karamouzian M, Dohoo C, Forsting S, McNeil R, Kerr T, Lysyshyn M. Evaluation of a fentanyl drug checking service for clients of a supervised injection facility, Vancouver, Canada. Harm reduction journal. 2018;15(1):1-8
4. O'Donnell JK, Halpin J, Mattson CL, Goldberger BA, Gladden RM. Deaths involving fentanyl, fentanyl analogs, and U-47700—10 states, July–December 2016. MMWR Morbidity and mortality weekly report. 2017;66(43):1197
5. Baggett TP, Hwang SW, O'Connell JJ, et al. Mortality among homeless adults in Boston: shifts in causes of death over a 15-year period. JAMA internal medicine. 2013;173(3):189-195
6. Palepu A, Gadermann A, Hubley AM, et al. Substance use and access to health care and addiction treatment among homeless and vulnerably housed persons in three Canadian cities. PLoS One. 2013;8(10):e75133. doi:10.1371/journal. pone.0075133
7. Wakeman SE, Larochelle MR, Ameli O, et al. Comparative effectiveness of different treatment pathways for opioid use disorder. JAMA Network Open. 2020;3(2):e1920622-e1920622.
8. Larochelle MR, Bernson D, Land T, et al. Medication for opioid use disorder after nonfatal opioid overdose and association with mortality: a cohort study. Annals of internal medicine. 2018;169(3):137-145.
9. Faggiano F, Vigna-Taglianti F, Versino E, Lemma P. Methadone maintenance at different dosages for opioid dependence. Cochrane Database of Systematic Reviews. 2003;(3):CD002208
10. Mattick RP, Breen C, Kimber J, Davoli M. Methadone maintenance therapy versus no opioid replacement therapy for opioid dependence. Cochrane database of systematic reviews. 2003;(2):CD002209
11. Mattick RP, Breen C, Kimber J, Davoli M. Buprenorphine maintenance versus placebo or methadone maintenance for opioid dependence. Cochrane database of systematic reviews. 2014;(2):CD002207
12. Frankish CJ, Hwang SW, Quantz D. Homelessness and health in Canada: research lessons and priorities. Can J Public Health. Mar-Apr 2005;96 Suppl 2:S23-9
13. Pauly BB, Reist D, Belle-Isle L, Schactman C. Housing and harm reduction: what is the role of harm reduction in addressing homelessness? Int J Drug Policy. Jul 2013;24(4):284-90. doi:10.1016/j.drugpo.2013.03.008
14. Simon CB, Tsui JI, Merrill JO, Adwell A, Tamru E, Klein JW. Linking patients with buprenorphine treatment in primary care: Predictors of engagement. Drug Alcohol Depend. Dec 1 2017;181:58-62. doi:10.1016/j.drugalcdep.2017.09.017
15. Maina G, Crizzle A, Maposa S, Fournier B. Sociodemographic Profiles and Clinical Outcomes for Clients on Methadone Maintenance Treatment in a Western Canadian Clinic: Implications for Practice. Journal of forensic nursing. 2019;15(4):231-241
16. Parpouchi M, Moniruzzaman A, Rezansoff SN, Russolillo A, Somers JM. Characteristics of adherence to methadone maintenance treatment over a 15-year period among homeless adults experiencing mental illness. Addictive behaviors reports. 2017;6:106-111
17. Lo A, Kerr T, Hayashi K, et al. Factors associated with methadone maintenance therapy discontinuation among people who inject drugs. J Subst Abuse Treat. Nov 2018;94:41-46. doi:10.1016/j.jsat.2018.08.009
18. Dunn KE, Huhn AS, Strain EC. Differential adoption of opioid agonist treatments in detoxification and outpatient settings. Journal of substance abuse treatment. 2019;107:24-28
19. Henry M, Watt R, Rosenthal L. The 2017 Annual Homeless Assessment Report (AHAR) to Congress. Washington, DC: The US Department of Housing and Urban Development (HUD), 2017
20. Substance Abuse and Mental Health Services Association. Data from: Treatment Episode Data Set (TEDS). 2015-17. Rockville, MD
21. Friesen EL, Kurdyak P. The impact of psychiatric comorbidity on treatment discontinuation among individuals receiving medications for opioid use disorder. Drug and alcohol dependence. 2020;216:108244
22. Krawczyk N, Feder KA, Saloner B, Crum RM, Kealhofer M, Mojtabai R. The association of psychiatric comorbidity with treatment completion among clients admitted to substance use treatment programs in a U.S. national sample. Drug Alcohol Depend. Jun 1 2017;175:157-163. doi:10.1016/j.drugalcdep.2017.02.006
23. Mennis J, Stahler GJ, Abou El Magd S, Baron DA. How long does it take to complete outpatient substance use disorder treatment? Disparities among Blacks, Hispanics, and Whites in the US. Addictive behaviors. 2019;93:158-165
24. Stahler GJ, Mennis J. The effect of medications for opioid use disorder (MOUD) on residential treatment completion and retention in the US. Drug and alcohol dependence. 2020:108067

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25. Pro G, Utter J, Haberstroh S, Baldwin JA. Dual mental health diagnoses predict the receipt of medication-assisted opioid treatment: Associations moderated by state Medicaid expansion status, race/ethnicity and gender, and year. Drug Alcohol Depend. Apr 1 2020;209:107952. doi:10.1016/j.drugalcdep.2020.107952

26. Mennis J, Stahler GJ. Racial and Ethnic Disparities in Outpatient Substance Use Disorder Treatment Episode Completion for Different Substances. J Subst Abuse Treat. Apr 2016;63:25-33. doi:10.1016/j.jsat.2015.12.007

27. Stahler GJ, Mennis J, DuCette JP. Residential and outpatient treatment completion for substance use disorders in the U.S.: Moderation analysis by demographics and drug of choice. Addict Behav. Jul 2016;58:129-35. doi:10.1016/j.addbeh.2016.02.030

28. Austin PC. Balance diagnostics for comparing the distribution of baseline covariates between treatment groups in propensity-score matched samples. Stat Med. Nov 10 2009;28(25):3083-107. doi:10.1002/sim.3697

29. Arndt S, Acion L, White K. How the states stack up: disparities in substance abuse outpatient treatment completion rates for minorities. Drug Alcohol Depend. Oct 1 2013;132(3):547-54. doi:10.1016/j.drugalcdep.2013.03.015

30. SAS Institue Inc. Data from: SAS/STAT. 2020. Cary, NC

31. R: A language and environment for statistical computing. R Foundation for Statistical Computing; 2020. http://www.R-project.org/

32. Wickham H. ggplot2. Wiley Interdisciplinary Reviews: Computational Statistics. 2011;3(2):180-185

33. ArcGIS Pro. Version 2.4.0. Esri Inc.; 2019. https://www.esri.com/en-us/arcgis/products/arcgis-pro/

34. Mojtabai R, Mauro C, Wall MM, Barry CL, Olfson M. Medication treatment for opioid use disorders in substance use treatment facilities. Health Affairs. 2019;38(1):14-23

35. Morgan JR, Barocas JA, Murphy SM, et al. Comparison of Rates of Overdose and Hospitalization After Initiation of Medication for Opioid Use Disorder in the Inpatient vs Outpatient Setting. JAMA Netw Open. Dec 1 2020;3(12):e2029676. doi:10.1001/jamanetworkopen.2020.29676

36. Nixon LL, Marlinga JC, Hayden KA, Mrklas KJ. Barriers and facilitators to office-based opioid agonist therapy prescribing and effective interventions to increase provider prescribing: protocol for a systematic review. Syst Rev. Jul 25 2019;8(1):186. doi:10.1186/s13643-019-1076-7

37. Weicker SA, Hayashi K, Grant C, Milloy MJ, Wood E, Kerr T. Willingness to take buprenorphine/naloxone among people who use opioids in Vancouver, Canada. Drug Alcohol Depend. Dec 1 2019;205:107672. doi:10.1016/j.drugalcdep.2019.107672

38. Piske M, Zhou H, Min JE, et al. The cascade of care for opioid use disorder: a retrospective study in British Columbia, Canada. Addiction. Aug 2020;115(8):1482-1493. doi:10.1111/add.14947

39. Yang JC, Roman-Urrestarazu A, Brayne C. Differences in receipt of opioid agonist treatment and time to enter treatment for opioid use disorder among specialty addiction programs in the United States, 2014-17. PLoS One. 2019;14(12):e0226349. doi:10.1371/journal.pone.0226349

40. Leshner AI, Dzau VJ. Medication-Based Treatment to Address Opioid Use Disorder. JAMA. Jun 4 2019;321(21):2071-2072. doi:10.1001/jama.2019.5523

41. Krawczyk N, Mojtabai R, Stuart EA, et al. Opioid agonist treatment and fatal overdose risk in a state-wide US population receiving opioid use disorder services. Addiction. 2020;115(9):1683-1694

42. Hwang SW. Homelessness and health. Cmaj. 2001;164(2):229-233

43. Cunningham C, Edlund FMJ, Fishman M, et al. The ASAM National Practice Guideline for the Treatment of Opioid Use Disorder: 2020 Focused Update.

44. A Guideline for the Clinical Management of Opioid Use Disorder. British Columbia Centre on Substance Use. (2020)

45. Socías ME, Wood E, Kerr T, et al. Trends in engagement in the cascade of care for opioid use disorder, Vancouver, Canada, 2006–2016. Drug and alcohol dependence. 2018;189:90-95

46. Degenhardt L, Bucello C, Mathers B, et al. Mortality among regular or dependent users of heroin and other opioids: a systematic review and meta-analysis of cohort studies. Addiction. 2011;106(1):32-51

47. Ravndal E, Amundsen EJ. Mortality among drug users after discharge from inpatient treatment: an 8-year prospective study. Drug and alcohol dependence. 2010;108(1-2):65-69