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Prior 8-month substance use trajectories predict psychological functioning at start of residential treatment

Abstract

This study explores trajectories of substance use days over the eight months prior to residential treatment among at-risk, diverse women with SUD and assesses whether trajectories are linked to psychological functioning at baseline and subsequent drug/alcohol relapse. Data are from n=245 mostly Hispanic/Latina women undergoing residential SUD treatment. Group-Based Trajectory Modeling identified trajectories of substance use days, measured with the Timeline Followback (TLFB) over the eight months preceding treatment. We compared psychological functioning (measured with the Five Facet Mindfulness Questionnaire-Short Form, FFMQ-SF; Difficulties in Emotion Regulation Scale, DERS; and Depression, Anxiety, and Stress Scale, DASS) and relapse by trajectory. We identified five groups: Low Days, Start High/Early Decrease, Start High/Middle Decrease, High Days/Late Decrease, and Recent Increase/Late Decrease. The High Days/Late Decrease group had higher DERS scores compared with the Low Days and Start High/Middle Decrease groups (p<.001 for both comparisons), and higher DASS scores compared with the Low Days, Start High/Early Decrease, and Start High/Middle Decrease groups (p<.0125 for all comparisons). Substance use trajectories representing a high proportion of using days proximal to treatment predicted worse psychological functioning. It may be worthwhile to develop lower-burden measures that capture substance use trajectories.

Keywords: substance use, treatment, trajectory-based modeling, residential treatment, recovery, NCT02977988

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Introduction

Individuals with Substance Use Disorder (SUD) exhibit diverse substance utilization patterns at treatment entry. For example, trajectory-based analyses[1] reveal heterogeneous patterns of substance use frequency (i.e., proportion of days with use) and changes in use frequency before treatment.[2–5] Individuals seeking treatment for alcohol use disorder show differences in the number of days they drank in the prior 90 days and how recently their drinking days decreased.[3,4] Studies of opioid users experiencing homelessness[2] and incarcerated individuals[5] over longer periods (i.e., 3-5 years) identified subgroups with gradually increasing substance use days before entering treatment. This variability in behavior prior to treatment might in part influence individuals' clinical entry characteristics, and therefore could be informative for clinicians as an additional domain of assessment.

While substance use research often utilizes measures of average use over several days or weeks, these more nuanced, temporal qualities of use patterns (proportion of days and changes) might predict differences in important clinical characteristics and treatment outcomes. For example, an individual who has used very frequently for several months may present with a different treatment entry profile than an individual who now uses with a similar frequency but only recently had an increase in use. Some research has borne this out. Relapse rates are higher among those with relatively frequent substance use days in the years before treatment,[2,5] and more frequent drinking in the 90 days before treatment entry correlates with worse psychiatric symptoms and higher relapse; however, those who tend to drink every day but reduce their drinking days beginning one month before treatment entry demonstrate the lowest symptomology and a reduced risk of relapse.[3,4]

Existing literature spans relatively broad (i.e., annual usage over several years)[2,5] or narrow temporal windows (i.e., 90 days pre-treatment).[3,4] For the present study, we analyze substance use data spanning eight months to explore whether trajectories assessed over this period predict clinical characteristics and treatment outcomes. Prior trajectory studies involve distinct samples such as homeless, incarcerated, or users of opioids or alcohol.[2–5]

Our diverse sample of women receiving intensive residential treatment for SUD provides an opportunity to study trajectories of use in a sample type that is at risk of poor substance use treatment outcomes.[6] Our objective is to categorize trajectories of substance use days over eight months preceding intensive residential treatment among women with SUD and to test if these categorical profiles of use differentially associate with psychological functioning at treatment initiation and subsequent relapse. Findings contribute to profiling substance use trajectories and offer potential prognostic value for clinicians treating SUD.

Methods

Sample

Data originated from a clinical trial evaluating a mindfulness intervention among women undergoing residential SUD treatment where the treatment goal was abstinence.[7,8] Baseline data were collected from N=245 women who screened for the trial. Data were again collected 8.5-months post-baseline assessment. Participants were aged 32.3 years on average (SD=9.1), majority Latina/Hispanic (58%), and most were mandated to residential treatment due to criminal justice involvement (83%). The most used substances at baseline were amphetamines (.38 proportion of days used on average over the prior

eight months), cannabis (.22 days), and alcohol to intoxication (.13 days). See Table 1 for additional clinical characteristics and prior work[7–9] for more detail. Procedures were approved by the Institutional Review Board of author DB.

Measures

Pre-treatment substance use: At study baseline, the Timeline Followback (TLFB)[10] assessed daily substance use over the prior eight months. For each day, participants indicated (Yes/No) use of alcohol to intoxication, heroin, non-prescription methadone, other opiates, marijuana, barbiturates, sedatives & benzodiazepines, cocaine & crack, amphetamines, methamphetamines, and hallucinogens & inhalants. We calculated the proportion of days with any substance use for each month of the eight months assessed.

Substance use relapse: Participants' substance use through the follow-up period was evaluated via both an interviewer assisted TLFB and a urine drug screen at the time of the follow-up assessment. A binary relapse variable (Yes/No) indicated substance use captured by either method.

Psychological functioning: Mindfulness was assessed using the 24 item Five-Facet Mindfulness Questionnaire – Short Form (FFMQ-SF).[11] Participants rated items (e.g., "I observed my feelings without getting carried away by them") from 1 ("Never or Very Rarely") to 5 ("Very Often or Always"). Emotion regulation was assessed using the 36 item Difficulties in Emotion Regulation Scale (DERS).[12] Items (e.g., "I felt overwhelmed and out of control by my emotions") were rated from 1 ("Almost Never") to 5 ("Almost Always"). Depressive, anxious, and stressful emotions were assessed using the 21 item Depression, Anxiety, and Stress Scale (DASS-21).[13] Items (e.g., "I felt easily irritated or on edge.") ranged from 0 ("Never") to 3 ("Almost always"). Capacities reflected by these measures hold relevance for SUD treatment programs that commonly deliver mindfulness-based interventions (e.g., Mindfulness Based Relapse Prevention)[14] and cognitive behavioral interventions (e.g., Seeking Safety, Relapse Prevention).[15,16]

Analysis

Group-Based Trajectory Modeling (GBTM)[1] identified trajectories of substance use days over eight months before residential treatment entry. We used the Stata GBTM plugin and employed a censored normal distribution to handle missingness.[17] Results provide posterior probabilities of group assignment, with participants placed in their highest probability group. Model evaluation utilized Bayesian Information Criterion, where a smaller value indicates better fit. Additionally, models with lower average posterior probabilities were considered poorer representations of the data. Models included the proportion of pre-treatment days in a restricted living environment from the Addiction Severity Index – Lite[18] as a covariate, as this variable improved model fit and is conceptually relevant to pre-treatment substance use. We examined models including age, race/ethnicity, homelessness, and legal and family problems, but these did not improve fit.

We compared psychological functioning at treatment entry and relapse rate at follow up by trajectory group. Continuous variables were analyzed using pairwise linear contrasts with 20% trimmed means, a robust method for handling deviations from normality.[19] Categorical data were analyzed using a technique designed to preserve the nominal Type I error level.[19,20] P-values were adjusted for familywise error and we applied a Bonferroni correction (.05/4) in this secondary data analysis to account for four prediction models (FFMQ, DERS, DASS, and relapse) leaving interpretations of the hypothesis in relation to p =.0125. Five participants were excluded from all analyses due to insufficient restricted living environment data. In the post-treatment-entry relapse analysis, 45 additional participants were excluded for not entering the study trial (due either to not meeting trial criteria or ultimately declining to participate), one due to site dropout before beginning the intervention, and 17 more due to missing substance use data at follow-up (either could not be located by study staff or declined to provide data).

Results

The final model included five trajectory groups (Figure 1). Fit improved with each additional trajectory group, but the 6-group model had unstable parameter estimates and little improvement in fit over the 5-group model. The average probability of group assignment exceeded 95%. A chi-square test revealed no significant differences in trial intervention group assignment (MMWR vs. control) between trajectory groups ($X^2(4) = 8.25$, $p = .083$). The High Days/Late Decrease group had higher scores on the DERS (Mean = 102.7, SD = 31.1) compared with the Low Days (Mean = 83.8, SD = 28.9) and Start High/Middle Decrease (Mean = 77.2, SD = 27.4) groups ($p <$ .001 for both comparisons), and higher scores on the DASS (Mean = 0.79, SD = 0.62) compared with the Low Days (Mean = 0.61, SD = 0.49), Start High/Early Decrease (Mean = 0.58, SD = 0.58), and Start High/Middle Decrease (Mean = 0.68, SD = 0.48) groups ($p <$ .0125 for all three comparisons). Group differences for FFMQ, relapse, and abstinence were not significant after the Bonferroni correction. Results did not differ after controlling for age, housing instability, SUD type, minority race/ethnicity, and trial intervention group in linear regression models (group differences were similar in magnitude in linear models and the same differences remained significant for DERS and DASS at $p <$ .0125). Table 1 presents additional information on psychological functioning at treatment entry and subsequent relapse in each group and in the full sample.

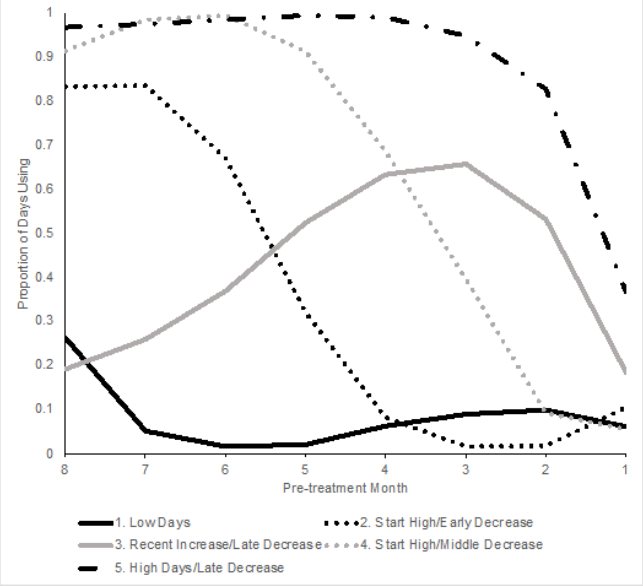

Figure 1 Pre-treatment trajectories of monthly heterogeneous substance use in the 8 months prior to entering residential treatment for SUD.

Note: Time begins at month 8 before treatment entry (8) and ends at month prior to treatment entry (1).

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Table 1 Psychological functioning at SUD residential treatment entry and subsequent relapse by substance use trajectory (1-5)

	1. Low days	2. Start high/ early decrease	3. Recent increase/ late decrease	4. Start high/ middle decrease	5. High days/ late decrease	Full sample	Pairwise differences
Psychological functioning at treatment entry							
Group size	n = 41	n = 39	n = 40	n = 53	n = 67	n = 240	
FFMQ	79.6(12.4)	74.7(11.4)	78.3(13.2)	78.2(13.2)	72.0(13.0)	76.4(13.1)	1 > 5*; 4 > 5*
DERS	79.6(24.9)	83.8(28.9)	88.4(28.1)	77.2(27.4)	102.7(31.1)	87.0(30.0)	**1 < 5*****; 2 < 5*; **4 < 5*****
DASS	0.61(0.49)	0.58(0.52)	0.92(0.61)	0.68(0.48)	1.09(0.73)	0.79(0.62)	**1 < 5**; 2 < 5**; 4 < 5****
Post-treatment-entry relapse							
Group size	n = 34	n = 29	n = 30	n = 36	n = 49	n = 178	
Abstinent	70.60%	58.60%	40.00%	55.60%	61.20%	57.90%	1 > 3*
Relapse	29.40%	41.40%	60.00%	44.40%	38.80%	42.10%	3 > 1*

For pairwise differences: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; **BOLD** = Significant after Bonferroni correction ($p < .015$).

Note: Mean and (SD) are reported for psychological functioning variables. Five participants were excluded from all analyses due to insufficient restricted living environment data. In the post-treatment-entry relapse analysis, 45 additional participants were excluded for not entering the study trial, one participant due to site dropout before beginning the study intervention, and 17 more due to missing substance use data at follow-up (either could not be located by study staff or declined to provide data). FFMQ = Five Facet Mindfulness Questionnaire (range: 24-120 and higher scores indicate greater mindfulness); DERS = Difficulties in Emotion Regulation Scale (range: 36-180 and higher scores indicate greater problems with emotion regulation); DASS = Depression Anxiety Stress Scale (range: 0-63 and higher scores indicate greater distress). The relapse variable was operationalized as follows: A participant was noted as having relapsed in the 10-month post-entry period if they reported any use of the following substances during that timeframe: Alcohol to Intoxication; Marijuana; Cocaine & Crack; Heroin; Other Opiates; Sedatives & Benzodiazepines; Hallucinogens & Inhalants; Non-Prescription Methadone; Barbiturates.

Discussion

We used trajectory modeling to uncover eight-month categories of trajectories of substance use days, and their associations with psychological functioning and relapse, among a sample of at-risk, diverse women with SUD. Our analysis resulted in five trajectory groups of use differing by frequency and the timing of directional change in relation to initiating clinical treatment. In line with prior studies that measured use over broader intervals[2,5] or assessment windows,[3,4] consistently frequent substance use predicts worse outcomes. Our study provides additional nuance by measuring trajectories and their correlates over a several-month time interval. For example, we identified three groups that initially exhibited equally frequent usage but differed in the recency of their decrease in frequency, while another group displayed an increase in frequency eight months before treatment followed by a subsequent decrease. The group exhibiting consistently highest usage frequency (using over 90% of days in the initial five months, followed by a late reduction) displayed the lowest relative scores on emotion regulation and highest relative scores on depression, anxiety, and stress.

The single group with increasing daily use frequency was the only group with higher relapse than another group; however, this difference was no longer significant after the Bonferroni correction, which also may be due to the smaller analytic sample for this outcome. Though our binary relapse variable may not entirely capture the complexity of substance use, using more nuanced approach was infeasible given our sample's distribution of post-treatment substance use, and a binary relapse outcome is in line with treatment goals in this setting (complete abstinence). Though the TLFB has been validated for capturing substance use over relatively large (3-6 month) response windows,[21] it is possible present study participants misremembered their substance use from early in the response window; though urine drug screens were intended to compliment self-report, they would only capture use during a relatively narrow detection period. Our study involved a mostly Hispanic/Latina sample and a single treatment site and may also not generalize to males. Our observational analysis precludes causal interpretation. While results did not change when controlling for several known determinants of treatment outcomes, substance use is complex and multifactorial, and there are likely other variables that influence trajectories and outcomes concurrently.

Conclusion

Our trajectory study adds to the literature in a mostly Hispanic/Latina sample with complex legal and social histories, a group that is likely at risk of poor treatment outcomes.[6] Findings suggest that mindfulness levels may be consistent across use trajectories; while prior intervention work has demonstrated mindfulness training is associated with reductions in use,[22] our etiological (non-intervention) study suggests mindfulness as a psychological skill might stabilize relatively quickly after cessation of use and be leveraged from the very start of treatment. Our mindfulness measure was of self-report and there are other measures, such as the Applied Mindfulness Process Measure that more closely assess practice-related mindfulness,[23] that might have been affected differently by each trajectory category. As emotion dysregulation and distress symptoms differ, they might need additional remediation with pharmacotherapy or individualized counseling to stabilize among those with a consistently high proportion of using days. While the trend for the relapse outcome was nonsignificant after the Bonferroni correction, all in all we add to a growing literature demonstrating there may be variable treatment entry capacities associated with specific use trajectories. Analyses should be replicated in larger and differing (e.g., male) samples, and determine whether trajectory patterns replicate and predict treatment entry variables. To advance both clinical practice and research in this area, it may be worthwhile to develop low-burden measures that concisely capture substance use trajectories frequency and recent changes over prior months. Simpler measures could be used to operationalize trajectory differences in a more accessible way for researchers, and their clinical prognostic value could be explored. Future research should also examine patterns and change in specific substances, as well as polysubstance use – and consider whether other determinants of treatment outcomes interact with use trajectories.

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Conflicts of interest

The author declares that there are no conflicts of interest.

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