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Substance use and criminogenic thinking: Longitudinal latent class analysis of veterans with criminal histories

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Abstract

Introduction: The objective of this study was to inform clinical practice by identifying distinct subgroups of US veterans with criminal histories in residential mental health treatment. The study characterized veteran patients on their alcohol and drug use and criminogenic thinking. We also examined predictors and outcomes of subgroup membership.

Methods: Participants were 341 veterans with a criminal history in residential mental health care. A parallel latent growth trajectory model characterized participants' alcohol and drug use and criminogenic thinking at treatment entry and at 6- and 12-month follow-ups.

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CRediT authorship contribution statement

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jsat.2022.108893.

Results: The study identified four distinct classes: 53 % Normative Improvement, 27 % High Criminogenic Thinking, 11 % High Recurrence (of substance use), and 9 % High Drug Use. Compared to the Normative Improvement class, prior to treatment entry, patients in the High Recurrence class were less likely to be on parole or probation, and patients in the High Criminogenic Thinking class were more likely to be chronically homeless. Compared to the Normative Improvement class, at follow-ups, patients in the High Drug Use and High Criminogenic Thinking classes were more likely to recidivate, and patients in the High Drug Use class were more likely to report unstable housing. Depression scores were higher (nearly double) in the High Drug Use, High Recurrence, and High Criminogenic Thinking classes at follow-ups compared to the Normative Improvement class.

Conclusions: That the Normative Improvement class entered mental health residential treatment with relatively low alcohol and drug use and criminogenic thinking, and sustained these low levels, suggests that treatment does not need to be broadened or intensified to improve these domains for these patients with criminal histories. In contrast, findings for the High Drug Use, High Recurrence, and High Criminogenic Thinking classes, which composed 47 % of the sample, suggest that more integrated and sustained treatment may be needed to reduce recidivism, depression, and homelessness among these patients.

Keywords

Drug use; Alcohol use; Criminogenic thinking; Treatment outcomes; Veterans

1. Introduction

Veterans with a criminal history (have been arrested, charged, convicted, and/or incarcerated) are a large and growing segment of patients seen in the Veterans Health Administration (VA) (Finlay et al., 2016; Government Accountability Office, 2016). This growth is due at least partly to the VA's Veterans Justice Programs, which identify and contact justice-involved veterans, and facilitate their access to VA services (Blue-Howells et al., 2013; Finlay et al., 2017; Palframan et al., 2020). Given the increased provision of services to veterans with a criminal history, studies need to follow these individuals during and after treatment. The current study was a secondary analysis of data from a randomized controlled trial of Moral Reconation Therapy (MRT) among veterans with a criminal history who were treated in VA mental health residential treatment programs (Blonigen et al., 2018). MRT is a cognitive behavioral intervention that aims to reduce antisocial cognitions and behaviors. The current study's purpose was to inform treatment services for patients with criminal histories by examining processes associated with patients' substance use and criminogenic thinking before, during, and after a residential program stay.

1.1. Predictors and outcomes of substance use and criminogenic thinking classes

The current study used a framework, as Fig. 1 shows, that was developed from the MRT trial (Blonigen et al., 2018). The model points to the importance of studying patients' substance use and criminogenic thinking in combination, and understanding how these patient characteristics may be related to the outcomes of criminal recidivism, unstable housing, and depression over time. Criminogenic thinking encompasses attitudes supportive

of offending, cognitive processing during the conduct of an offense, and rationalizations for offending (Maruna & Mann, 2006), and is a risk factor for criminal behavior's onset and maintenance (Bonta & Andrews, 2016). A meta-analysis that synthesized evidence from a criminogenic thinking measure (Psychological Inventory of Criminal Thinking [PICTS]; Walters, 1995) found consistent but small-to-moderate effect sizes for criminogenic thinking predicting recidivism (Walters, 2012). Accordingly, the predictive utility of criminal thinking may depend on additional factors (Folk et al., 2018), including alcohol and drug use (Morgan et al., 2020).

Substance use and criminogenic thinking are prevalent among veteran patients (Blonigen et al., 2020). More than one-half of veterans seen by the VA's Veterans Justice Programs are diagnosed with substance use or mental health disorders (Finlay et al., 2016, 2017). Among veterans in treatment for substance use or mental health conditions, a criminal history is the norm (Blonigen et al., 2019). For example, in a large, nationally representative sample of male patients in VA addiction treatment programs, 85 % had at least one lifetime criminal charge, and 46 % had at least one lifetime conviction (Weaver et al., 2013). Another study of veterans in addiction or mental health treatment and with trauma exposure found that 46 % reported a history of having a violent or nonviolent legal charge (Bennett et al., 2018). In addition to being interrelated, substance use and criminogenic thinking are strongly associated with reoffending (Timko et al., 2017; Wooditch et al., 2014; Zgoba et al., 2020), unstable housing (Moxley et al., 2020; Nino et al., 2009; Thompson et al., 2013), and depression (Kemal & Asmamaw, 2016; Thompson et al., 2017). Given associations of substance use and criminal thinking with poor outcomes, studies must also examine predictors of different classes representing these factors. As Fig. 1 shows, these include awaiting charges or trial (Clark et al., 2014; Harris et al., 2012; Rastegar et al., 2016), being on parole or probation (Moore et al., 2021; Pew Charitable Trust, 2018), and chronic homelessness (Timko et al., 2020; Tsai et al., 2014).

The current study utilized an advanced modeling approach to examine associations of alcohol and drug use and criminogenic thinking and their predictors and outcomes. Specifically, it applied a person-centered modeling technique to determine latent classes of veteran patients admitted to VA residential mental health treatment programs. It used parallel growth mixture modeling to simultaneously assess patients' alcohol and drug use and criminogenic thinking over a one-year period. This study contributes to the literature by revealing latent (unobserved) patterns in longitudinal data to identify subgroups within the population of patients with a criminal history and to inform treatment approaches. The findings have import for how residential services can best address the treatment needs of these patients to improve outcomes. Improving treatment outcomes of veterans and their family, friends, and communities is a national and societal goal that is shared by the agencies in which justice-involved veterans are seen, including jails and prisons, health care settings in the community, and, in the United States, the VA (Timko et al., 2014; Vest et al., 2021).

2. Material and methods

2.1. Sample and procedure

Study participants were patients in three VA mental health residential treatment programs located in the western, southern, and northeastern regions of the United States. All programs served patients with substance use, mental health, and/or homelessness problems, and were similar on program length (3–6 months), structure (therapeutic activities were offered five days a week), clinical approach (individual and group cognitive behavioral therapy), and staffing (e.g., psychologists, VA Veterans Justice Program specialists). Patients were eligible for the MRT trial if they had a criminal history (had been arrested and charged and/or released from incarceration in the past five years), spoke English, and were cognitively functional. Within the first week of the program, after receiving an introduction to the study, patients provided informed consent and completed a baseline interview, after which they were randomly assigned to Usual Care (UC) or UC plus MRT. At 6 and 12 months postbaseline, research assistants blinded to patients' condition collected data from patients mainly by telephone. However, some participants who were incarcerated at the 6-month (n = 1) and 12-month follow-ups (n = 8) completed assessments by mail. The VA's Central Institutional Review Board approved the study procedures. The study enrolled a total of 341 patients and randomly assigned them to condition; 169 were in UC (73.4 % were followed at 6 months, and 75.7 % at 12 months), and 172 were in MRT (69.2 % were followed at 6 months, and 73.8 % at 12 months). The study asked patients assigned to MRT to attend the program's MRT groups twice per week for one hour for 12 weeks (Little & Robinson, 2013).

2.2. Measures

2.2.1. Determinants of class membership

2.2.1.1. Substance use.: At each time point, participants completed the Timeline Follow-Back to measure alcohol and drug use in the past six months (Sobell et al., 1996). For each time point, the study calculated the number of days the participant had drunk alcohol (n [%] of missing data at baseline, 6 months, and 12 months, respectively: 0 ([0 %], 98 [28.7 %], and 113 [33.1 %]) or used drugs (marijuana, cocaine, amphetamines, heroin, other opioids, benzodiazepines, barbiturates, inhalants, hallucinogens) (missing: 0 [0 %], 98 [28.7 %], and 114 [33.4 %]) during that period.

2.2.1.2. Criminogenic thinking.: The study administered the 56-item version of the PICTS at each time point to assess criminogenic thinking. Items were rated on a 4-point scale (1 = disagree, 4 = strongly agree) and summed to create a criminogenic thinking score. Study staff converted scores to a T-score metric (M = 50, SD = 10). Guidelines for interpreting these T-scores describe criminogenic thinking as low (<40), average (40–59), high/clinically significant (60–69), and very high (≥70; Walters, 2006). Internal consistency for these scores was 0.95 at each time point (missing: 1 [0.2 %], 98 [28.7 %], and 88 [25.8 %]).

2.2.2. Predictors of class membership—Potential predictors of class membership at baseline were whether the participant was awaiting charges or trial (self-reported as yes or

no; missing: 0 [0 %]), on parole or probation (self-reported as yes or no; missing: 1 [0.2 %]), and chronically homeless (yes or no, with yes defined as the participant's self-report of being homeless for at least one year prior to program admission or having four or more episodes of homelessness during the prior three years (Tsai et al., 2013; missing: 0 [0 %]). We also considered demographic predictors of class membership (participants' age, gender, race, and marital status) as well as condition assignment to determine whether specific patient subgroups (classes) responded more favorably to intervention.

2.2.3. Outcomes of class membership—Outcomes of class membership were recidivism (yes or no, with yes defined as self-reported new charges, convictions, and/or periods of incarceration since the previous study assessment; missing at 6 months: 99 [29.0 %]; 12 months: 86 [25.2 %]), unstable housing (yes or no, with yes defined as self-reports of being homeless or at risk of losing housing; missing at 6 months: 99 [29.0 %]; 12 months: 115 [33.7 %]), and depression symptoms (missing at 6 months: 105 [30.7 %]; 12 months: 118 [34.6 %]). The study assessed depression with the PHQ-9 (Kroenke et al., 2001). The PHQ-9 consists of nine questions that ask respondents how often they have "been bothered by any of the following problems" (with, e.g., sleep, energy, appetite) in the past two weeks (not at all = 0; nearly every day = 3) and the study summed them.

2.3. Data analyses

Of all participants (n = 341), 107 (31.4 %) were missing the 6-month follow-up, 120 (35.2 %) were missing the 12-month follow-up, 60 (17.5 %) were missing both the 6- and 12-month follow-ups, and 192 (56.3 %) completed both follow-up assessments. The research team compared participants missing both follow-ups (n = 60) to participants with follow-up data (n = 281) on all baseline measures (chi-square test or *t*-test). The study found no significant differences between groups (p = .061 or greater).

The study team conducted parallel latent class trajectory analyses of alcohol and drug use and criminogenic thinking using the Mplus mixture add-on statistical package (Muthén & Muthén, 2017; Nagin & Odgers, 2010). We first conducted a latent class trajectory analysis to identify data-driven classes of participants with similar responding trajectories (intercept, slopes, and quadratic) on measures of alcohol use, drug use, and criminogenic thinking (Jung & Wickrama, 2008; Nagin, 2005; Nylund et al., 2007). The study entered the three measures into the model simultaneously. Next, we implemented the R3STEP approach (Asparouhov & Muthén, 2014a) to identify significant (binary) predictors of class membership, and the BCH approach (Asparouhov & Muthén, 2014b) to examine differences between classes on outcomes at 6- and 12-months. Three-step approaches are recommended when examining covariates and distal outcomes because they account for measurement error associated with the most likely class assignment (Asparouhov & Muthén, 2014a). We handled missing data with a maximum likelihood estimator robust to non-normal data (MLR estimator).

We ran latent class models for 1 to 6 classes to determine the most parsimonious model. We considered both linear and nonlinear models (quadratic equations). The study set all variances for intercepts and slopes to zero (see Supplement 1 growth mixture modeling

approach). As outlined in Nagin (1999, 2005), we increased models in one class increments and examined intercepts, slopes, and quadratic equations and removed nonsignificant parameters from the model (revised models). We then examined multiple model fit indices to guide interpretation and selection of best fit. The study considered fit indices for the Bayes Information Criteria (BIC), entropy, average class membership probability, percent of participants in each class, and the Lo-Mendell-Rubin test (LMR). Class membership probabilities and entropy range from zero to one and are generally considered acceptable at values above 0.80. Although no set guideline exists regarding the percentage of individuals in a class, accounting for our sample size, classes containing <5 % of the sample would be regarded as having limited clinical relevance (Frankfurt et al., 2016). The LMR compares the current model with a model with one fewer class (k-1), and a significant LMR p-value indicates better fit. Last, we examined each of the classes in the final model for clinical interpretability. As Supplement 1 explains, we also computed a growth mixture model that we rejected due to non-convergence issues and extremely small class sizes.

3. Results

Table 1 presents model fit indices for 1 to 6 classes. The study selected the 4-class (revised) solution as the most parsimonious. The model included 40 parameters, acceptable entropy at 0.80, acceptable class sizes (all 9 % or more of the sample), and the LMR *p*-value was significant at 0.009 (subsequent models were non-significant). Fig. 2 is a graphical illustration of the class trajectories over time (see class descriptions below). Based on responding patterns we named the classes: Class 1, High Drug Use; Class 2, High Recurrence; Class 3, Normative Improvement; and Class 4, High Criminogenic Thinking. Comparisons of the 4 classes revealed no differences on patients' demographic characteristics: age (sample M = 46.21; SD = 12.16), marital status (91 % were not married), gender (95 % self-identified as male), or race (58 % self-identified as White, 28 % as Black).

3.1. Class descriptions

Class 1 – High Drug Use (9 % of the sample [n = 31]; see blue lines in Fig. 2). This class was noted for a high and stable rate of drug use (110 of 180 days) during the 12-month follow-up. The class had modest use of alcohol (45 of 180 days), which remained stable across time. It had the second highest level of criminogenic thinking (M = 61.53; SE = 2.00), which also remained stable across time.

Class 2 – High Recurrence (11 % of the sample [n = 37]; see orange lines in Fig. 2). This class had a reduction in alcohol and drug use from baseline to 6 months, and subsequent rebound (high recurrence) from 6 to 12 months. Specifically, this class reduced alcohol use levels by 50 % (from 105 to 53 days) and drug use levels by 92 % (from 49 to 4 days) from baseline to 6-month follow-up. However, from 6- to 12-month follow-up, alcohol use increased to 126 days, and drug use increased to 67 days (in the past 180 days). Based on Walters' (2006) scoring classification, level of criminogenic thinking in this class was in the "average" range (M = 55.49; SE = 1.45) and was stable across the 6- and 12-month follow-ups.

Class 3 – Normative Improvement (53 % of the sample [n = 181]; see gray lines in Fig. 2). This class is noted for its relatively low levels of alcohol use, drug use, and criminogenic thinking at baseline, each of which decreased substantially at 6 months and then stabilized from 6 to 12 months.

Class 4 – High Criminogenic Thinking (27 % of the sample [n = 92]; see yellow lines in Fig. 2). This class had the highest level of baseline criminogenic thinking (M = 70.17; SE = 2.10), which improved at 6 months (M = 62.44) and leveled off over the remainder of the follow-up period (M = 61.10 at 12 months). Rates of alcohol and drug use were similar to the trajectory patterns of the Normative Improvement class (generally, moderate at baseline with initial improvement by 6 months and leveling off at 12 months).

3.2. Predictors of class membership

Class 3 (Normative Improvement) was the referent class in analyses to examine baseline determinants of class membership: awaiting charges or trial (28.2 % of the full sample), on parole or probation (52.2 %), and chronic homelessness (41.9 %), as well as condition assignment in the MRT trial (49.3 % were in UC, 50.7 % were in UC + MRT). We present results of the R3STEP approach for binary indictors in Table 2. Patients in the High Recurrence class were 4.5 times less likely to have been on parole or probation at baseline (treatment entry) compared to the Normative Improvement class; percentages were 26 % and 56 %, respectively. Additionally, patients in the High Criminogenic Thinking class were 2.2 times more likely to have been chronically homeless at baseline compared to the Normative Improvement class. Whether patients were awaiting charges or trial was not associated with class membership, nor was study condition (not tabled; patients assigned to MRT composed 60 % of class 1, 50 % of class 2, 50 % of class 3, and 52 % of class 4).

3.3. Outcomes of class membership

Class 3 (Normative Improvement) was the referent class in analyses to examine outcomes of class membership: recidivism at 6 (16.9 % of the full sample) and 12 (21.6 %) months; unstable housing at 6 (41.3 %) and 12 (29.6 %) months; and depression at 6 (M = 8.83, SE = 0.43) and 12 (M = 8.54, SE = 0.42) months. Table 3 shows the results. Patients in the High Drug Use and High Criminogenic Thinking classes were significantly more likely to recidivate at 6 months compared to the Normative Improvement class; percentages were 38 %, 25 %, and 8 %, respectively. No class differences were indicated for 12-month recidivism rates. No class differences were evident in unstable housing at 6 months, but patients in the High Drug Use class were significantly more likely to report unstable housing at 12 months compared to the Normative Improvement class. Last, scores for depression were significantly higher (nearly double the levels) in the High Drug Use class, the High Recurrence class, and the High Criminogenic Thinking class at both 6 and 12 months when compared to the Normative Improvement class.

4. Discussion

This study applied a person-centered statistical approach to examine distinct subgroups of patterns of substance use and criminogenic thinking in a large sample of VA patients with

criminal histories entering residential mental health treatment and followed for one year. It found four classes of trajectories that are clinically informative. Just more than one-half of the sample (53 %) was characterized by a Normative Improvement class trajectory, with relatively low alcohol use, drug use, and criminogenic thinking at baseline that remained low. About one-quarter (27 %) of the sample was in the High Criminogenic Thinking class, which had a mean baseline criminogenic thinking score interpretable as “very high” (Walters, 2006), and decreased to a “high” level that was still clinically significant during follow-ups. The remaining 20 % of the sample was almost evenly split between two classes. The High Drug Use class, in addition to high levels of drug use across baseline and follow-ups, had stable levels of alcohol use and criminogenic thinking. In contrast, the High Recurrence class also had stable criminogenic thinking, but decreased on its especially high alcohol use, as well as drug use, at 6 months, before increasing at 12 months.

From a clinical and resource allocation perspective, the finding that more than one-half the sample (the Normative Improvement class) receiving residential mental health treatment entered the program with relatively lower alcohol and drug use and criminogenic thinking, and sustained low levels, is informative. This finding suggests that treatment does not need to be broadened or intensified to improve these aspects of functioning for patients with a criminal history and these intake characteristics. In contrast, findings for the High Criminogenic Thinking class suggest that more comprehensive treatment may be needed to reduce recidivism and depression in this subgroup, as these outcomes were poorer than in the Normative Improvement class. They also suggest that chronic homelessness increases risk for high criminogenic thinking.

More comprehensive treatment may involve treating criminogenic thinking and mental health symptoms such as depression with an interdisciplinary approach (e.g., Changing Lives and Changing Outcomes; Morgan et al., 2020) that aims to maximize adaptive behaviors to optimize functioning while reducing mental health symptoms and recidivism. Such approaches go beyond adding a mental health focus to a recidivism-prevention program (e.g., MRT), but rather incorporate treatments that are meaningfully integrated to better address the complex and interwoven concerns of criminogenic thinking and mental health. These treatments can be applied in both mental health treatment settings, such as the programs studied here, and correctional settings (Morgan et al., 2020).

As the study found for the High Criminogenic Thinking class, depression was higher in the High Drug Use and High Recurrence classes at both 6- and 12-month follow-ups when compared to the Normative Improvement class. In addition, the High Drug Use class’s criminogenic thinking stayed in the “high/clinically significant” grouping. This class appears to have a complex clinical presentation with high criminogenic thinking, alcohol use, and especially drug use that is associated with depression, recidivism, and unstable housing. Patients with this complex presentation may have received insufficient treatment in that they did not show improvement over time. Research commonly finds that the more problem areas in an individual’s life, the more difficult it is for them to achieve positive treatment and health outcomes (Morgan et al., 2020). Using the same approach with patients having different presentations (e.g., the Normative Improvement and High Drug Use classes) may result in nonresponsive or ineffective treatment being offered to some patients (Howes et al.,

2021). In contrast to the High Drug Use class, the High Recurrence class, which was less likely to have been on parole or probation at baseline and maintained "average" criminal thinking through follow-up, showed some responsivity to treatment, even though they did not sustain the response. Future research should determine if more sustained monitoring and supervision (McKay, 2021; Timko et al., 2019), possibly in combination with mutual-help group participation postdischarge (Humphreys et al., 2020), prevents recurrent alcohol and drug use in this subgroup of patients. Subsequent research on patients fitting the High Drug Use and High Recurrence classes could also consider whether treatment approaches that do not focus on abstinence are more successful than those that do at engaging and retaining patients in treatment, and whether they improve treatment effectiveness (Paquette et al., 2022). Further, patients in these classes might benefit from postdischarge stays in recovery homes, which are associated with long-term improvement on alcohol, drug, and mental health severity, as well as unemployment and criminal justice involvement (Polcin et al., 2010, 2021).

4.1. Limitations and conclusions

This study's findings should be considered in light of its limitations. Participants were all veterans treated in the VA, which may limit the generalizability of our findings. However, based on Walters' (2006) scoring classification guidelines, the mean level of criminogenic thinking in this treatment sample was comparable to that among incarcerated persons with justice system involvement, suggesting that the current sample had commonality with other samples of criminally involved patients at intake. In addition, currently, no gold-standard exists regarding latent class analysis global fit indices, such that our interpretation may not be definitive. However, this limitation applies to all studies using latent class analysis.

Even with these limitations, this study extends existing research and informs clinical practice. To our knowledge, this is the first study to directly measure criminogenic thinking among veterans in mental health treatment (rather than using proxy measures, e.g., Black et al., 2005). In addition, this study used the person-centered approach of growth trajectory modeling, instead of an a priori method of assigning predetermined categories, to examine patients' problems in multiple domains across time. That is, the approach uncovered the relevant patient classes based on alcohol and drug use and criminogenic thinking; determined the extent to which meaningful heterogeneity existed in the trajectory classes; and assessed how the trajectory clusters differed in terms of pre-baseline characteristics and outcomes at follow-ups.

Further, this study informs clinical practice by suggesting that critical treatment gaps exist to facilitate improved short- and long-term patient functioning after discharge. One gap is for patients with criminal histories who are admitted to residential mental health treatment with especially severe drug use along with their alcohol use and criminogenic thinking; this group did not show reduced problems at either follow-up. Another gap is for patients with especially severe alcohol use along with their drug use and criminogenic thinking, who may respond to treatment but then return to alcohol and drug use subsequently. Specific gaps include understanding how to best treat depression symptoms seen in all three of the non-normative classes. Clinical practice guidelines on depression indicate that medications

and empirically supported cognitive and behavioral treatments are efficacious (Ormel et al., 2022). However, the long-term effectiveness of depression treatments in real-world settings is modest (Ormel et al., 2022), suggesting that identifying effective approaches for patients with additional problems of substance use and criminogenic thinking may be particularly challenging for future research. Last, the current study's findings suggest that to achieve better outcomes, patients with criminal pasts who enter treatment with high levels of substance use and criminogenic thinking may need integrated treatments for longer durations (Morgan et al., 2020; Timko et al., 2020).

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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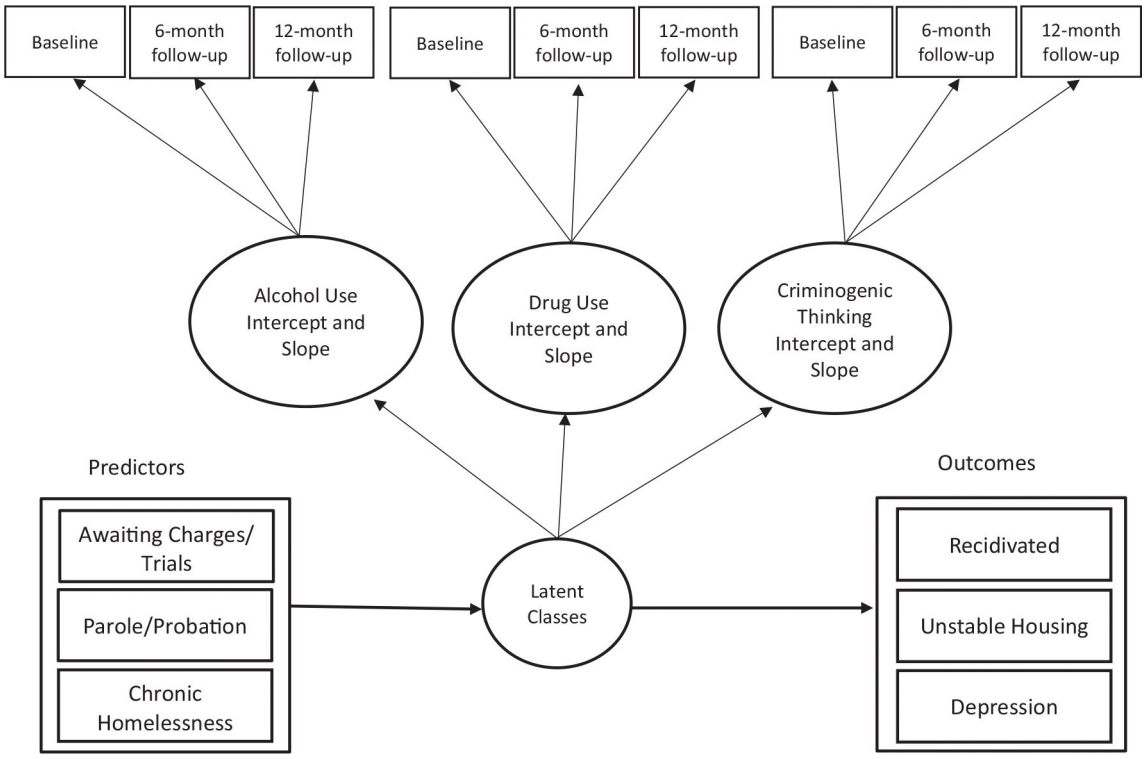

Fig. 1.

Predictors and outcomes of latent classes of patients' alcohol and drug use and criminogenic thinking.

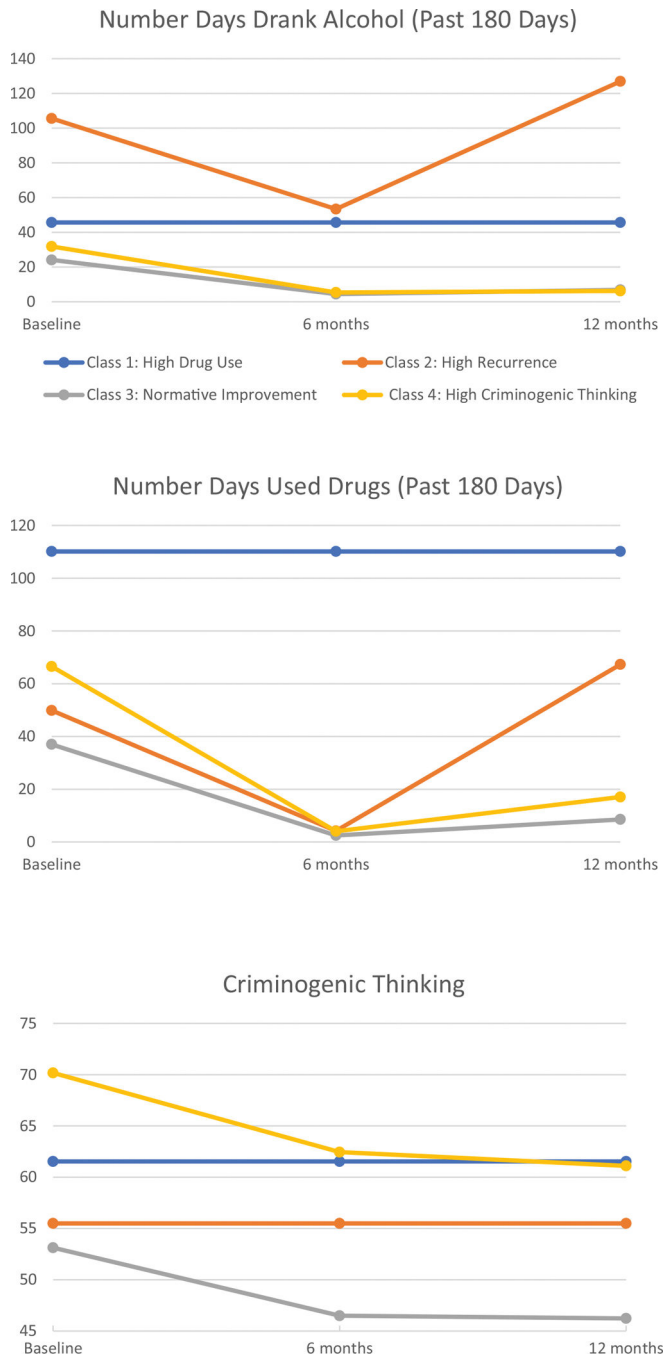

Fig. 2.
Latent classes of patients' alcohol and drug use and criminogenic thinking.

Table 1

Model fit indices and estimated profile sizes.

Model	Par	AIC	BIC	Δ BIC	Class size	Entropy	LMR-LRT	P
1 Class	18	23,499	23,568	–	100 %	–	–	–
2 Class	28	23,085	23,192		86 %, 14 %	0.84	426.89	0.004
2 Class R	26	23,086	23,185		86 %, 14 %	0.85	420.27	0.004
3 Class	36	22,923	23,061		81 %, 10 %, 9 %	0.85	173.97	0.389
3 Class R	30	22,884	22,999		80 % 11 %, 9 %	0.89	290.79	0.042
4 Class *	40	22,733	22,887		53 %, 27 %, 11 %, 9 %	0.80	129.88	0.009
4 Class R *	**40**	**22,733**	**22,887**		**53 %, 27 %, 11 %, 9 %**	**0.80**	**129.88**	**0.009**
5 Class	50	22,612	22,804		51 %, 28 %, 9 %, 7 %, 5 %	0.81	142.37	0.235
5 Class R	46	22,601	22,777		52 %, 27 %, 11 %, 7 %, 3 %	0.82	131.36	0.219
6 Class	56	22,496	22,711		52 %, 27 %, 7 %, 6 %, 5 %, 3 %	0.83	117.82	0.295

Note: R = Revised Model, LCA = Latent Class Analysis, BIC = Bayesian Information Criterion, AIC = Akaike Information Criterion, LMR-LRT = Lo-Mendel-Rubin Likelihood Ratio Test, Par. = Parameters in model. Bold typeface indicates model chosen for best overall fit and interpretability.

* denotes that these classes were identical because no modifications needed to be made from the 4-class to the 4-class revised model.

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Table 2

Predictors of class membership.

	Class 1 High drug use	Class 2 High recurrence	Class 3 Normative (referent)	Class 4 High criminogenic thinking
Awaiting Charges or Trial	32 %	16 %	27 %	35 %
	1.32 (0.52–3.41)	0.45 (0.14–1.50)	————	1.64 (0.82–3.30)
On Parole or Probation	44 %	**26 %**	56 %	58 %
	0.59 (0.24–1.41)	**0.22 (0.08–0.59)**	————	1.08 (0.56–2.09
Chronic Homelessness	52 %	42 %	36 %	**51 %**
	2.10 (0.88–5.06)	1.40 (0.61–3.22)	————	**2.21 (1.31–4.30)**

Notes. Values shown from the R3STEP analysis component are the percentage of class members with the predictor and the Odds Ratio (95 % Confidence Interval). Bolded items indicate that the Odds Ratio Confidence Intervals did not contain 1 and were significantly different than the referent group.

Table 3

Outcomes based on latent class membership.

	Class 1 High drug use	**Class 2 High recurrence**	**Class 3 Normative (referent)**	**Class 4 High criminogenic thinking**
Recidivated 6 months	38 % 7.98	19 %	8 %	25 %
	7.98 (0.005)	1.43 (0.232)	————	4.42 (0.036)
Recidivated 12 months	13 %	38 %	18 %	26 %
	0.31 (0.578)	3.56 (0.059)	————	1.08 (0.298)
Unstable housing 6 months	59 %	49 %	37 %	40 %
	3.76 (0.053)	0.93 (0.333)	————	0.11 (0.743)
Unstable housing 12 months	55 %	37 %	20 %	35 %
	8.63 (0.003)	1.81 (0.178)	————	1.93 (0.165)
Depression 6 months	**14.54 (1.56)**	**10.09 (1.27)**	5.74 (0.59)	**12.35 (0.99)**
	27.23 (0.001)	**9.28 (0.002)**	————	**8.56 (0.001)**
Depression 12 months	**10.85 (1.36)**	**12.85 (1.30)**	5.78 (0.56)	**11.74 (1.07)**
	11.61 (0.001)	**23.99 (0.001)**	————	**21.07 (0.001)**