

# Comparing the Effectiveness of Three Substance Use Interventions for Youth With and Without Homelessness Experiences Prior to Treatment

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**Objective:** Many adolescents and young adults receiving substance use treatment have experienced or are at risk for homelessness. It is unknown whether specific treatment approaches are more or less effective for youth experiencing homelessness (YEH) compared to stably housed youth. The present study compared the effectiveness of the Adolescent Community Reinforcement Approach, Motivational Enhancement Therapy combined with Cognitive–Behavioral Therapy (MET/CBT), and Treatment as Usual (TAU) for these two groups. Further subgroup differences were investigated by age, sex, and sexual and gender minority status.

**Method:** YEH ( $n = 855$ ) and a matched sample of stably housed youth ( $n = 855$ ) were drawn from the Global Appraisal of Individual Needs, a nationwide substance use treatment data set. Multiple-group latent change score modeling was used to examine change in substance use frequency and related problems at baseline, 3-, 6-, and 12-month follow-ups. **Results:** Results indicated significant declines in substance use frequency and problems during treatment for all intervention groups. The TAU group showed the greatest declines in substance use problems during treatment and the greatest declines in frequency post-treatment. Compared to stably housed youth, YEH entered treatment with greater substance use and problems, and had greater declines in substance use in the MET/CBT group only. Other differences were found by age and sex. **Conclusions:** Overall, all three substance use interventions appear to be effective in reducing substance use and related problems. TAU and MET/CBT may be particularly effective for YEH in treatment settings. Implications for future research and practice are discussed.

## What is the public health significance of this article?

This study suggests that a variety of evidence-based treatments are effective at reducing substance use and related problems for adolescents and young adults who experience homelessness prior to treatment. However, Treatment as Usual and Motivational Enhancement Therapy combined with Cognitive–Behavioral Therapy may be particularly effective for this population.

**Keywords:** youth, homelessness, substance use treatment, propensity weighting, latent change score

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Nationwide, an estimated 172,000 (0.7%) adolescents aged 12–17 and 578,000 (1.7%) young adults aged 18–25 in the U.S. received substance use disorder treatment in the past year (Substance Abuse and Mental Health Services Administration, 2020). Adolescents and young adults in treatment present with a variety of complex problems, including victimization, dysfunctional family environments, comorbid mental health conditions, and criminal justice involvement (Chan et al., 2008; Davis et al., 2019; Tripodi & Bender, 2011).

Unfortunately, in addition to these risk factors, some young people receiving treatment also report experiences of homelessness or housing instability (DiGuseppi et al., 2020; Green et al., 2020). Youth experiencing homelessness (YEH) are a diverse population often defined as adolescents and young adults up to age 25 without safe, stable living arrangements (U.S. Administration for Children and Families, 2016). A recent household survey estimates that one in 30 adolescents (4.3%) and one in 10 young adults (12.5%) in the U.S. experienced homelessness in the previous year (Morton et al., 2018). Compared to stably housed youth, YEH are at greater risk for a variety of health problems, including substance use and substance use disorders (Baer et al., 2003; Greene et al., 1997; Johnson et al., 2005) with nearly two-thirds (60.5%) of YEH meeting lifetime substance use disorder criteria, and nearly half (48.1%) meeting past-year criteria (Johnson et al., 2005).

Unfortunately, there is limited research comparing treatment outcomes for YEH and stably housed youth, preventing researchers and practitioners from determining how previous experiences of

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homelessness may influence treatment outcomes. In addition to this gap in the literature, research is inconclusive regarding whether specific intervention approaches may be more or less effective for YEH. Evidence comes from two systematic reviews showing that substance use interventions with YEH have largely been conducted in homeless youth service settings (e.g., drop-in centers and shelters) without a stably housed comparison group (Coren et al., 2016; Xiang, 2013). A variety of interventions have been evaluated among YEH, including manualized interventions with a strong evidence-base, such as brief motivational interventions, Motivational Enhancement Therapy (MET), family therapy, the Community Reinforcement Approach (CRA), and case management. With the exception of family-based interventions, which have demonstrated slightly greater reductions in long-term substance use outcomes (Milburn et al., 2012; Slesnick & Prestopnik, 2005, 2009), systematic reviews conclude that specialized substance use interventions for YEH have not consistently outperformed standard care at drop-in centers and shelters (which typically includes the provision of temporary housing, basic needs, and case management; Coren et al., 2016; Xiang, 2013). In fact, YEH in treatment and standard care groups tend to have similar reductions in substance use over time.

While a variety of substance use interventions may be effective for YEH, there is a need to understand how YEH compare to stably housed youth to determine whether tailored interventions are needed. This is particularly important, considering that treatment outcome studies with YEH have not been conducted in specialty treatment settings, such as residential and outpatient clinics. There is reason to believe that YEH may enter treatment with more severe substance use disorders, given heightened substance use risks when compared with the general population (Greene et al., 1997; Johnson et al., 2005) and the variety of adverse experiences encountered while homeless (Bender et al., 2015; Whitbeck et al., 1999). In addition, although there is little evidence that specific treatments result in more favorable outcomes for YEH, experiences that are common among YEH—such as physical and sexual victimization, association with deviant peers, and physical and mental stress (Whitbeck, 2009)—may be associated with poorer treatment outcomes among YEH overall when compared to stably housed youth. It also follows that longer frequency/duration of homelessness may be associated with worse treatment outcomes; as youth spend more time unstably housed, there may be more opportunity for adverse experiences to contribute to treatment resistant substance use disorders. Frequency/duration of homelessness has seldom been examined as a predictor of treatment outcomes among youth populations. One study found that substance use generally had an inverse relationship with social stability (employment, school attendance, and housing) and that CRA tended to result in increased social stability and decreased substance use over time (compared to MET and case management; Zhang & Slesnick, 2018).

### Age, Sex, and Sexual/Gender Minority Status as Moderators of Treatment Outcomes

YEH are a heterogeneous population. Therefore, treatment studies should examine whether the effectiveness of interventions differ across specific factors, such as age, sex, and sexual and gender minority status. Age is an important factor to consider, given developmental differences between adolescents and young adults (Arnett, 2000). However, YEH may experience an “interrupted

adolescence” in which they assert their independence earlier than stably housed youth (Whitbeck, 2009, p. 3). This may pre-empt a greater reliance on peers for social support and the adoption of adult-like substance use behaviors. Recent research suggests that adolescent YEH may have more troublesome substance use profiles at treatment admission than young adult YEH (Green et al., 2020), but it remains unclear whether age plays an important role in treatment outcomes (Xiang, 2013). Biological sex and sexual/gender minority status are important characteristics to consider as well, but have not been fully explored as moderators of YEH intervention outcomes (Xiang, 2013). In regard to sex, existing research has been mixed. Participant sex was not a significant moderator of treatment effects in YEH studies comparing a brief motivation intervention to controls (Peterson, et al., 2006) or CRA to standard care (Slesnick, Prestopnik, Meyers, & Glassman, 2007). However, in a later study comparing CRA, MET, and case management among a YEH sample, females had significantly greater declines in alcohol use frequency than males in all intervention groups (Slesnick, et al., 2015). Surprisingly, little previous research has examined differential treatment outcomes for sexual/gender minority YEH, despite observational studies showing that sexual/gender minority youth make up a large minority of YEH and report poorer mental health and substance use risks than nonsexual/gender minority YEH (McCann & Brown, 2019).

### Present Study

The main objective of the present study was to compare the effectiveness of three substance use interventions for YEH and a matched sample of stably housed youth. Initial levels and change in substance use frequency and substance use disorder symptoms were compared for youth receiving: (a) the Adolescent CRA (ACRA), (b) MET and Cognitive–Behavioral Therapy (MET/CBT), or (c) standard, nonmanualized treatment practices (i.e., treatment as usual [TAU]). A secondary objective was to investigate subgroup differences by age (adolescents vs. young adults), sex (males vs. females), sexual/gender minority status (vs. nonsexual/gender minority youth), and frequency/duration of homelessness. Given the above cited literature, we hypothesized that compared to stably housed youth, YEH would exhibit greater substance use frequency and substance use disorder symptoms at treatment entry, and less pronounced declines in these outcomes during and after treatment (in all intervention groups). Given the lack of evidence for the superiority of specific treatments for YEH, we made no hypotheses regarding the comparative effectiveness of specific interventions or demographic treatment moderators.

### Method

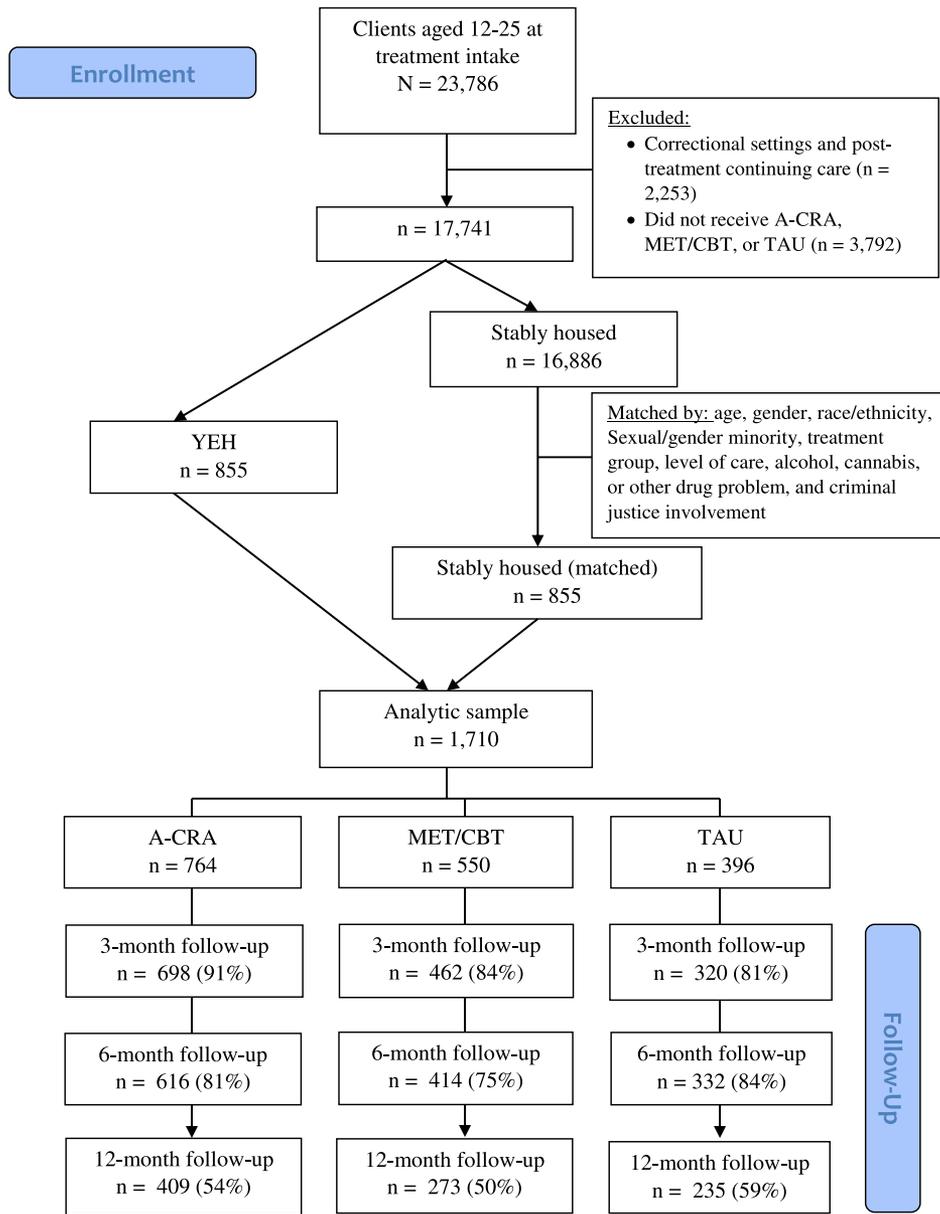
#### Data Source and Participant Selection

The present study uses pooled Global Appraisal of Individual Needs (GAIN) data, one of the largest longitudinal substance use treatment data sets available. The GAIN is a comprehensive, biopsychosocial assessment battery used for diagnosis, treatment planning, and treatment outcome monitoring in over 1,500 treatment sites throughout the United States and internationally (Dennis et al., 2008). Pooled GAIN data were obtained by the authors through a data use agreement with the GAIN coordinating center, and include

self-reported, longitudinal assessment data from 23,786 adolescents and young adults (aged 12-25) receiving treatment in 213 U.S. sites from 2002-2012. Sites received funding from the Substance Abuse and Mental Health Services Administration (SAMHSA), Center for Substance Abuse Treatment to expand the use of evidence-based treatments and facilitate treatment monitoring and evaluation. Clients provided informed consent for their deidentified data to be used for research and evaluation, approved by each site's Institutional Review Board.

Inclusion criteria for the present study were: (a) age 12-25 at treatment intake, (b) recommended outpatient, intensive outpatient, or inpatient/residential level of care at intake (correctional settings and post-treatment continuing care were excluded), and (c) received ACRA, MET/CBT, or TAU ( $n = 17,741$ ). Participants reporting one or more days homeless in the 90 days prior to treatment were then identified ( $n = 855$ ). Our methods used a one-to-one matching procedure with stably housed youth; thus, our final sample size was 1,710 (see Figure 1).

**Figure 1**  
Participant Flow Diagram



Note. See the online article for the color version of this figure.

## Measures

Participants completed the interviewer-administered GAIN Initial (GAIN-I) at treatment intake to aid in diagnosis, placement, and treatment planning. The GAIN monitoring assessment (GAIN-M90) was completed at 3-, 6-, and 12-month post-treatment. Administration time for the GAIN-I is approximately 120 min, and administration for the GAIN-M90 is approximately 45–60 min. The GAIN coordinating center follows a “train-the-trainer” approach, in which clinical site staff undergo a certification process to train regional and local site staff (Dennis et al., 2008). GAIN administration and reporting software is also available for site staff, and includes built-in skip patterns and quality control checks to maximize data accuracy.

## Demographic Variables

Participants reported their age, sex (male, female), race, and Hispanic/Latinx ethnicity at the treatment intake assessment. Sexual/gender minority status is a dichotomous variable where 1 = transgender identity, or sexual attraction, preference, or behavior with the same gender, or “homosexual, bisexual, questioning or curious” sexual identity; 0 = sexual attraction, preference, or behavior with the opposite gender (or no attraction/sexual behavior). Level of care assigned at treatment intake was coded as 1 = outpatient or intensive outpatient or 2 = residential/inpatient care. Problematic alcohol, cannabis, and other drug use are three dichotomous variables, indicating past-year DSM-IV substance abuse and/or dependence criteria or weekly use in the past 90 days for each substance (American Psychiatric Association, 2000). Current criminal justice system involvement (e.g., awaiting trial, sentencing, probation, etc.) and pressure to be in treatment (from an employer, school, legal mandate, or close family member or friend) were also assessed. A number of other participant characteristics (e.g., education, internalizing and externalizing behaviors) were used as covariates in the propensity weighting procedure described below (see Appendix A in Supplemental Material).

## Pre-Treatment Homelessness

Pre-treatment homelessness was assessed using the GAIN item, “During the past 90 days, on how many days have you been homeless or had to stay with someone else to avoid being homeless?” Responses were dichotomized and trichotomized in subsequent analyses, with participants reporting zero days homeless considered stably housed.

## Treatment Outcome Variables

The present study examined two longitudinal substance use outcomes assessed at intake, and 3-, 6-, and 12-month postintake assessment. *Substance use frequency* is a self-report of number of days of alcohol, cannabis, or other drug use (e.g., stimulants, opioids, and barbiturates) in the past 90 days. The GAIN substance frequency scale is assessed with the help of a trained interviewer, and has demonstrated good test–retest reliability and validity among adolescent participants (Dennis et al., 2002; Dennis, Funk, et al., 2004). *Substance use problems* in the past month were assessed using the GAIN substance problem scale, a summed count of 16 DSM-IV substance abuse (e.g., continued use despite persistent

social and legal consequences), and dependence (i.e., tolerance and withdrawal) symptoms from the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV; American Psychiatric Association, 2000). The substance problems scale has demonstrated excellent internal consistency ( $\alpha = 0.90$  for adolescents) and test–retest reliability (Dennis et al., 2008).

## Treatments Received

Treatment data come from the GAIN treatment log and completed by clinical or study staff at each treatment site. ACRA, MET/CBT, and TAU are the most common treatment types in the GAIN data set. Participants were assigned to a single treatment condition based on established clinical procedures at each site and were not assigned at random. Unfortunately, treatment fidelity and adherence data are not available, as they were not routinely collected as part of SAMHSA-funded GAIN studies. Descriptions of ACRA and MET/CBT treatment protocols below come from publicly available treatment manuals and reports.

## ACRA

The CRA is a comprehensive behavioral treatment initially developed for adults with alcohol use disorders (Meyers et al., 2010). CRA utilizes principals of operant conditioning to increase engagement in rewarding substance-free activities, and build community supports in the clients’ social environment (at home, work, and school). The ACRA was adapted for adolescents by focusing on school performance, peer relationships, and involving caregivers in at least four counseling sessions (Godley et al., 2001). The overall session structure involves 10 individual sessions with the adolescent and four sessions with caregivers. Sessions with caregivers focus on positive communication skills, monitoring adolescent behavior, and supporting substance-free activities. ACRA has demonstrated efficacy with adolescents in the Cannabis Youth Treatment Study (Dennis, Godley, et al., 2004; Godley et al., 2001) and YEH in at least three studies (Slesnick et al., 2007, 2013, 2015). A total of 764 participants (including  $n = 311$  young adults) in the current sample received ACRA.

## MET/CBT

MET/CBT are two widely used substance use intervention approaches for adolescents and adults. MET is a client-centered approach to counseling intended to enhance the client’s internal motivation for behavior change, and CBT relies on social learning principles (i.e., operant conditioning) to help clients identify the antecedents and consequences of their substance use and adopt new coping skills to support reduced substance use and prevent relapse (Miller & Rollnick, 2013). A combined MET/CBT intervention for adolescents was first proposed by members of the Cannabis Youth Treatment Study (Dennis, Godley, et al., 2004), who hypothesized that CBT would be more effective if preceded by initial MET sessions to engage adolescents in treatment.

The MET/CBT group in the present study includes participants ( $n = 550$ ) who received one of the four different interventions that combine MET and CBT of varying lengths. These treatment modalities share the same theoretical foundation and have resulted in similar clinical outcomes (Dennis, Godley, et al., 2004). A

majority of participants ( $n = 413$ ) received MET/CBT5, which includes two initial MET sessions and three CBT sessions. A much smaller number ( $n = 11$ ) received MET/CBT7, which adds two family sessions. Eighty-eight participants received MET/CBT-12, which added seven group-based CBT sessions to MET/CBT5. The additional CBT sessions focus on coping skills to resolve interpersonal problems, negative affect (i.e., depression and anger management), and coping with substance use triggers (Dennis, Godley, et al., 2004). Finally, 38 participants received the Family Support Network, which included MET/CBT12 plus six parent education group meetings, four home visits, and case management.

## TAU

TAU consists of a collection of common practices employed in adolescent and young adult substance use treatment (Winters et al., 2014). In the current sample, this includes participants ( $n = 396$ ) classified as receiving “other” treatments in the GAIN treatment log: unspecified individual therapy, group therapy, family therapy, 12-step approaches, and case management.

## Data Analysis

First, a one-to-one case-control matching procedure was used to select a similar group of youth from the pooled sample who reported zero days homeless in the 90 days prior to treatment ( $n = 855$ ). Participants were matched by age, sex, race/ethnicity, LGBT status, treatment group, level of care, alcohol, cannabis, or other drug use problems, and current criminal justice involvement using the match-Controls function of the “e1071” R package (Leisch, 2020).

Next, propensity score weighting was used to minimize selection bias due to nonrandom assignment to each treatment group (Rosenbaum & Rubin, 1983). Weights were derived using the toolkit for weighting and analysis of nonequivalent groups (TWIN) R package (Burgette et al., 2020). TWIN uses generalized boosted models, a nonparametric, machine learning algorithm that combines many piecewise-constant linear functions of the covariates to predict unknown propensity scores. These models handle many covariates of different measurement types and levels of missingness, and outperform pre-existing methods to calculate propensity scores (i.e., logistic regression; McCaffrey et al., 2013). We estimated a model that weighted participants across a variety of pretreatment variables by their assigned treatment (ACRA, MET/CBT, and TAU). Twenty-one variables were used in the weighting procedure, including demographic variables and GAIN scales that assess family dysfunction, internalizing and externalizing problem severity, and social network risk (see Appendix A in Supplemental Material).

Next, using the propensity weights, multiple-group latent change score modeling was used to carry out study objectives using Mplus (Muthén & Muthén, 1998–2017). A latent change score model is a type of structural equation model that uses time-dependent change (a latent variable) as the outcome of interest (Grimm et al., 2017; McArdle, 2009). A conceptual diagram of the proposed model is displayed in Figure 2. Briefly, change from each timepoint to the next is captured by proportional latent change variables  $dy_3$ ,  $dy_6$ , and  $dy_{12}$ . The typical course of treatment for participants in the GAIN data set is completed between the intake and the 3-month follow-up.

Therefore,  $dy_3$  captures change in substance use during the “treatment phase,” and  $g_2$ , a higher order latent variable that uses  $dy_6$  and  $dy_{12}$  as indicators, captures change in substance use during the “post-treatment phase” (from the 3- to 12-month follow-ups). Models used maximum likelihood estimation with robust standard errors, which can handle nonindependence and non-normality of dependent variables (Yuan & Bentler, 2000); fit statistics ( $\chi^2$ , CFI, TFI, and RMSEA) were used to evaluate the model fit.

After fitting an overall dual change model for each outcome (substance use frequency and substance use problems), multiple-group methods (McArdle, 2009) were used to determine whether substance use change parameters differed between the ACRA, MET/CBT, and TAU groups. A stepwise nested model comparison approach was used to test the null hypothesis of no significant differences across groups. The first step was a baseline model where all parameter estimates were constrained to be equal (invariant) across groups. Then, means and variances at treatment intake ( $ly_0$ ), change during treatment ( $dy_3$ ), change post-treatment ( $g_2$ ), and proportional change parameters ( $\pi_1$ ,  $\pi_2$ ) were freely estimated in separate models. Model fit was compared at each step by examining significant reductions in Satorra–Bentler scaled Chi-square difference tests and model fit statistics ( $\chi^2$ , CFI, TFI, and RMSEA).

After estimating the best fitting multiple-group model, a binary variable indicating pretreatment homelessness was added as a predictor of initial substance use outcomes ( $ly_0$ ), change during treatment ( $dy_3$ ), and change post-treatment ( $g_2$ ). Multiple-group models estimated relationships between homelessness and substance use separately for each treatment group, adjusting for age (adolescent vs. young adult), sex (male vs. female), sexual and gender minority status, level of care, and criminal justice involvement. Wald tests of parameter constraints were used to confirm significant between-group differences in parameter estimates. Subgroup differences were further examined by adding two-way interaction terms between pretreatment homelessness and age group, sex, and sexual and gender identity.

## Missing Data

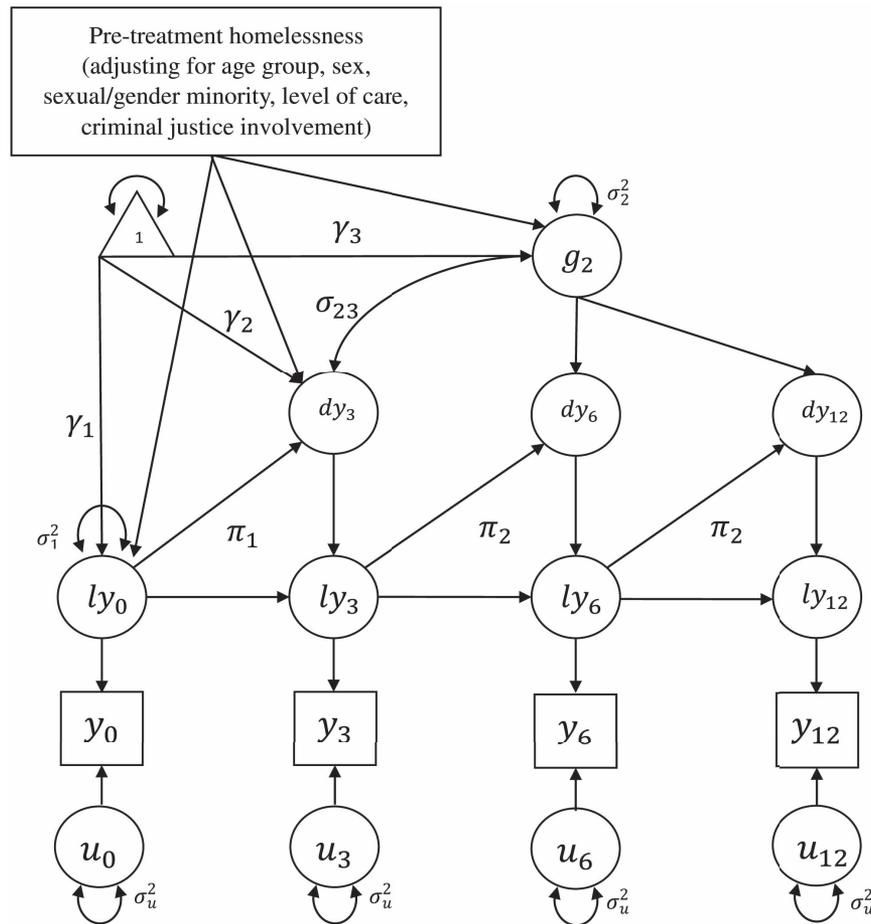
All participants in the pooled GAIN data set have at least one follow-up assessment, but significant attrition occurred at the 12-month follow-up (see Figure 1). Logistic regression was used to identify significant predictors of missingness at 12 months: relative to TAU, participants in ACRA (aOR = 1.47,  $p = .01$ ) and MET/CBT (aOR = 1.73,  $p = .001$ ) had significantly higher odds of missingness at the 12-month follow-up (see Appendix D in Supplemental Material). No other significant differences emerged in the missing data analysis.

## Results

### Participant Characteristics

As shown in Table 1, about two-thirds of participants were adolescents (aged 12–17), with an average age of 17.2 years ( $SD = 2.8$ ). The sample was mostly male (59.2%) and racially/ethnically diverse. Seventy-five percent of participants had current criminal justice involvement, and most (91.3%) were recommended outpatient or intensive outpatient treatment.

**Figure 2**  
 Conceptual Diagram of the Single-Group Latent Change Score Model



*Note.* All paths are estimated separately for each treatment group in the multiple-group model;  $ly_{0-12}$  are latent true scores at each timepoint, adjusting for measurement error ( $u_{0-12}$ ) in observed scores ( $y_{0-12}$ );  $dy_{3-12}$  are latent change scores between each timepoint;  $\pi$  are proportional growth parameters; Proportional change parameters from  $ly_3$  to  $dy_6$  and from  $ly_6$  to  $dy_{12}$  (both labeled  $\pi_2$ ) were constrained to be equal;  $dy_6$  represents change during the treatment phase;  $g_2$  represents change (constant growth) during the post-treatment phase; All unlabeled paths set equal to 1.

**Results of Case–Control Matching and Propensity Weighting Procedure**

As shown in Table 1, results of the case–control matching procedure were largely successful; however, a significantly higher proportion of sexual and gender minority participants remained in the YEH group ( $p = .04$ ). YEH participants also had a significantly higher number of substance use days and related problems at treatment intake ( $p < .001$ ). Results of the propensity weighting procedure showed a significant reduction in absolute maximum standard differences across treatment groups (see Appendices A and B in Supplemental Material), but mean differences for current criminal justice involvement and level of care remained above 0.25 and were therefore added as doubly robust controls in subsequent models (McCaffrey et al., 2013).

**Change in Substance Use Frequency**

The single-group, unconditional latent change score model of substance use frequency fit the data well,  $\chi^2 = 15.05$ ,  $df = 4$ ,  $p = .005$ , CFI = 0.97, TLI = 0.96, RMSEA = 0.04, 90% CI [0.02, 0.06]. Multiple-group model comparisons resulted in a final model where initial substance use frequency means ( $\mu_{ly0}$ ), initial substance use frequency variances ( $\sigma_{ly0}^2$ ), and average growth in substance use frequency post-treatment ( $\mu_{g2}$ ) were freely estimated across groups, see Model 5 in Appendix E in Supplemental Material;  $\chi^2 = 41.91$ ,  $df = 18$ ,  $p = .01$ , CFI = 0.96, TLI = 0.97, RMSEA = 0.04, 90% CI [0.02, 0.05]. Predicted trajectories of the multiple-group latent change models begin with a mean of 38.8 substance use days in the past 90 days at intake in ACRA, a mean of 38.3 days in MET/CBT, and a mean of 40.2 substance use days in TAU. Pairwise Wald

**Table 1**  
Participant Characteristics Reported at GAIN-I Treatment Intake Assessment

Variable	Homeless ( <i>n</i> = 855)		Stably housed ( <i>n</i> = 855)		Total ( <i>N</i> = 1,710)	
	<i>M</i> or <i>n</i>	( <i>SD</i> or %)	<i>M</i> or <i>n</i>	( <i>SD</i> or %)	<i>M</i> or <i>n</i>	( <i>SD</i> or %)
Age	17.2	(2.8)	17.2	(2.8)	17.2	(2.8)
Adolescents (12-17)	577	(67.5%)	583	(68.2%)	1,160	(67.8%)
Young adults (18-25)	278	(32.5%)	272	(31.8%)	550	(32.2%)
Gender						
Male	494	(57.8%)	519	(60.7%)	1,013	(59.2%)
Female	360	(42.1%)	336	(39.3%)	696	(40.7%)
Transgender (male to female)	1	(0.1%)	0	(0%)	1	(0.1%)
Race/Ethnicity						
Native American/Alaskan	20	(2.3%)	21	(2.5%)	41	(2.4%)
Asian	7	(0.8%)	2	(0.2%)	9	(0.5%)
Black/African American	92	(10.8%)	87	(10.2%)	179	(10.5%)
White (non-Hispanic)	324	(37.9%)	329	(38.5%)	653	(38.2%)
Hispanic/Latinx	220	(25.7%)	232	(27.1%)	452	(26.4%)
Mixed race	186	(21.8%)	186	(21.3%)	368	(21.5%)
Other	6	(0.7%)	2	(0.2%)	8	(0.5%)
Sexual/Gender minority <sup>a</sup>	98	(11.5%)	71	(8.3%)	169	(9.9%)
Days homeless <sup>a</sup>	23.7	(27.4)	0	(0)	11.8	(22.7)
Substance problem type (Past year)						
Problematic/weekly alcohol use	323	(37.8%)	318	(37.2%)	641	(37.5%)
Problematic/weekly cannabis use	574	(67.1%)	570	(66.7%)	1,144	(66.9%)
Problematic/weekly other drug use	452	(52.9%)	445	(52.1%)	897	(52.5%)
Current criminal justice involvement	639	(74.7%)	645	(75.4%)	1,284	(75.1%)
Pressured to be in treatment	236	(67.2%)	297	(68.1%)	533	(67.7%)
Substance use						
Substance use days (past 90) <sup>a</sup>	43.2	(31.9)	34.7	(32.3)	39.0	(32.4)
Substance problem scale (past month) <sup>a</sup>	4.1	(4.6)	3.3	(4.2)	3.7	(4.4)
Residential level of care	79	(9.2%)	69	(8.1%)	148	(8.7%)
Treatment received						
ACRA	383	(44.8%)	381	(44.6%)	764	(44.6%)
MET/CBT	274	(32.1%)	276	(32.3%)	550	(32.2%)
TAU	198	(23.2%)	198	(23.2%)	396	(23.2%)

*Note.* SUD = substance use disorder; ACRA = adolescent community reinforcement approach; MET/CBT = motivational enhancement therapy and/or cognitive-behavioral therapy; TAU = treatment as usual. Percentages are expressed as the proportion of participants with nonmissing data: *n* = 18 missing LGBT identity; *n* = 3 missing criminal justice involvement; *n* = 923 missing pressure to be in treatment; *n* = 10 missing # of substance use days; *n* = 5 missing substance use problems scale.

<sup>a</sup>Significant between-group differences at *p* < .05.

tests of parameter constraints indicated that initial substance use means did not significantly differ between groups (all *ps* > .05). This was followed by mean decreases in substance use frequency during treatment that were similar across groups (ACRA: −17.5 days, MET/CBT: −17.3 days, TAU: −18.2 days). The post-treatment mean growth parameter ( $\gamma_3$ ) was allowed to vary across groups, and was significantly lower in the TAU group ( $\gamma_3 = 1.71$ ) MET/CBT ( $\gamma_3 = 5.91$ ; Wald  $\chi^2 = 41.9$ , *df* = 1, *p* = .01), and in the ACRA group ( $\gamma_3 = 3.12$ ) versus MET/CBT ( $\gamma_3 = 5.91$ ; Wald  $\chi^2 = 4.4$ , *df* = 1, *p* = .04). This resulted in predicted substance use frequencies at the 12-month follow-up that were lower in TAU versus MET/CBT (17.2 vs. 24.1 days) and in ACRA versus MET/CBT (19.2 vs. 24.1 days; see Figure 3).

### Effects of Pre-Treatment Homelessness

As shown in Table 2 (Model 1), pre-treatment homelessness was associated with greater substance use (reported at intake) in ACRA ( $\gamma_{\text{hmls}} = 9.45$ , *p* < .001) and MET/CBT ( $\gamma_{\text{hmls}} = 11.29$ , *p* < .001). Compared to stably housed participants, YEH had significantly greater substance use declines during treatment in the MET/CBT group ( $\gamma_{\text{hmls}} = -8.44$ , *p* = .01), but not in ACRA ( $\gamma_{\text{hmls}} = -0.38$ ,

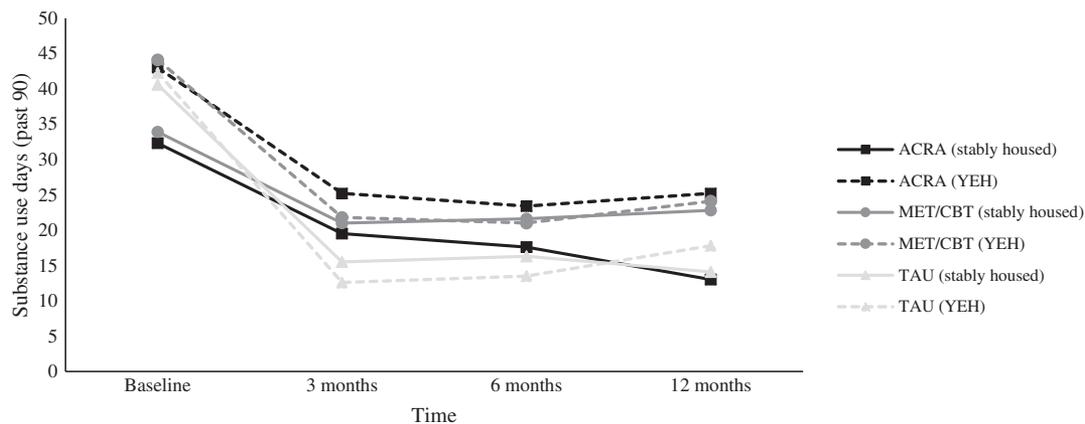
*p* = .86) or TAU ( $\gamma_{\text{hmls}} = -2.82$ , *p* = .48). YEH (vs. stably housed) also had significantly greater substance use post-treatment in the ACRA group ( $\gamma_{\text{hmls}} = 4.52$ , *p* = .002), but not in MET/CBT ( $\gamma_{\text{hmls}} = 2.74$ , *p* = .27) or TAU ( $\gamma_{\text{hmls}} = -1.54$ , *p* = .49). In a separate model (results not shown), pretreatment homelessness did not significantly interact with age, sex, or sexual/gender minority status to predict initial levels, or change in substance use frequency during or after treatment.

### Post-Hoc Analyses

A set of post-hoc analyses examined whether frequency/duration of homelessness prior to treatment resulted in differential substance use outcomes. YEH were grouped into tertiles based on short (1-4 days, *n* = 262, 31% of YEH), medium (5-26 days, *n* = 307, 36% of YEH), or long (27-90 days, *n* = 286, 33% of YEH) durations of homelessness. Dummy coded predictor variables were used, with stably housed participants as reference.

Results of post-hoc analyses examining the frequency/duration of homelessness were largely consistent with the above findings (see Appendix G in Supplemental Material). At treatment intake, YEH with short ( $\gamma = 10.42$ , *p* = .01) and medium ( $\gamma = 11.52$ ,

**Figure 3**  
Observed Mean Trajectories of Substance Use Frequency (Past 90 Days)



Note. ACRA = adolescent community reinforcement approach; MET/CBT = motivational enhancement therapy combined with cognitive-behavioral therapy; TAU = treatment as usual; YEH = youth experiencing homelessness.

$p < .001$ ) durations of homelessness in the ACRA group, and all YEH in the MET/CBT group ( $\gamma_{\text{short}} = 9.55, p = .01$ ;  $\gamma_{\text{med}} = 11.59, p = .01$ ;  $\gamma_{\text{long}} = 13.26, p = .01$ ) evidenced greater substance use than stably housed youth. Substance use reductions were significantly greater for YEH with medium ( $\gamma = -12.16, p = .001$ ) and long ( $\gamma = -12.49, p = .01$ ) durations of homelessness during treatment in the MET/CBT group, and increases in substance use following treatment were greater for YEH with short ( $\gamma = 6.78, p = .003$ ) and medium ( $\gamma = 4.71, p = .03$ ) durations of homelessness in the ACRA group.

### Change in Substance Use Problems

The single-group, unconditional LCS model of substance use problems had excellent model fit,  $\chi^2 = 4.43, df = 4, p = .35, CFI = 1.00, TLI = 1.00, RMSEA = 0.01, 90\% CI [0.00, 0.04]$ . The best fitting MG-LCS model for substance use problems freely estimated initial means ( $\mu_{y0}$ ), initial variances ( $\sigma_{y0}^2$ ), and mean change during treatment,  $\mu_{dy3}$ ; see Model 3 in Appendix F in Supplemental Material;  $\chi^2 = 25.66, df = 24, p = .37, CFI = 0.99, TLI = 1.00, RMSEA = 0.01, 90\% CI [0.00, 0.04]$ . The model estimated 3.7 substance use problems at treatment intake in ACRA, 3.4 in MET/CBT, and 4.0 in TAU, with no significant between-group differences (all Wald  $\chi^2$  test  $ps > .05$ ). During treatment reductions in substance use, problems were significantly greater in the TAU group versus ACRA (Wald  $\chi^2 = 8.44, df = 1, p = .004$ ) and in the TAU group versus MET/CBT (Wald  $\chi^2 = 10.5, df = 1, p = .001$ ). On average, participants reduced their substance use problems by 1.5 in the ACRA group, 1.2 in the MET/CBT group, and 2.5 in the TAU group. This was followed by small post-treatment reductions in substance use problems that were invariant across groups (see Figure 4).

### Effect of Pre-Treatment Homelessness

Adjusting for covariates, pretreatment homelessness was associated with greater substance use problems at intake in ACRA ( $\gamma_{\text{hmls}} = 0.97, p < .003$ ) and MET/CBT ( $\gamma_{\text{hmls}} = 1.14, p < .003$ ), but not in

TAU ( $\gamma_{\text{hmls}} = 0.30, p < .60$ ; see Table 2, Model 2). In addition, YEH reported about one-half more substance use problems than stably housed youth after treatment in the ACRA group ( $\gamma_{\text{hmls}} = 0.49, p < .003$ ). A separate multiple-group latent change score model revealed a number of significant interactions in the TAU group. First, pretreatment homelessness significantly interacted with sex to predict initial substance use problems ( $\gamma_{\text{hmls}} = -2.83, p < .04$ ) and change in substance use problems during treatment ( $\gamma_{\text{hmls}} = 2.42, p < .02$ ). Simple slopes analysis showed that, relative to stably housed males, males who experienced homelessness had marginally higher substance use problems at treatment intake,  $\gamma_{\text{hmls}} = 1.24, p < .10$ ; this was not found for females ( $p < .23$ ). Furthermore, relative to stably housed females, females who experienced homelessness reported greater substance use problems during treatment ( $\gamma_{\text{hmls}} = 1.79, p < .06$ ) in TAU; this was not found for males ( $p < .27$ ). Second, pretreatment homelessness interacted with age to predict post-treatment change in substance use problems in TAU ( $\gamma_{\text{hmls}} = 1.12, p < .02$ ). Relative to stably housed young adults, young adults who experienced homelessness reported one additional substance use problem, on average, post-treatment ( $\gamma_{\text{hmls}} = 1.00, p < .02$ ; this was not found for adolescents in TAU,  $p < .96$ ).

### Pos-Hoc Analyses

Post-hoc analyses of frequency/duration of homelessness in Appendix G in Supplemental Material showed that compared to stably housed youth, greater initial substance use problems at treatment intake were present among YEH with short ( $\gamma = 1.36, p = .01$ ) and medium ( $\gamma = 1.72, p < .001$ ) durations of homelessness in the ACRA group, and short ( $\gamma = 1.31, p = .01$ ) and long ( $\gamma = 1.53, p = .03$ ) durations of homelessness in the MET/CBT group. Reductions in substance use problems were only significant among those with medium ( $\gamma = -0.84, p < .05$ ) durations of homelessness in the MET/CBT group. Finally, increases in substance use problems were significant among those with short ( $\gamma = 0.66, p = .02$ ) and long ( $\gamma = 0.47, p = .03$ ) durations of homelessness in the ACRA group.

**Table 2**  
*Effects of Pre-Treatment Homelessness on Change in Substance Use Outcomes (N = 1,688)*

Parameter estimates	Model 1: Substance use frequency			Model 2: Substance use problems		
	ACRA γ (SE)	MET/CBT γ (SE)	TAU γ (SE)	ACRA γ (SE)	MET/CBT γ (SE)	TAU γ(SE)
<b>Substance use frequency at baseline (ly0)</b>						
Young adult (vs. adolescent)	0.41 (2.46)	-0.33 (4.21)	-1.04 (4.56)	<b>0.87 (0.36)</b>	0.33 (0.59)	-0.41 (0.64)
Female (vs. male)	-4.70 (2.66)	-6.40 (3.36)	-3.44 (4.71)	0.54 (0.39)	-0.75 (0.43)	0.45 (0.66)
SGM (vs. cisgender heterosexual)	4.61 (3.77)	8.63 (5.62)	2.29 (7.71)	0.04 (0.59)	0.61 (0.68)	-1.37 (0.96)
Residential/Inpatient (vs. outpatient)	-7.82 (7.30)	-12.79 (12.94)	6.15 (4.24)	0.28 (1.24)	<b>-2.65 (0.60)</b>	0.15 (0.60)
Criminal justice involvement (vs. not)	<b>-8.28 (2.63)</b>	<b>6.19 (3.14)</b>	-14.73 (9.40)	<b>-0.94 (0.38)</b>	-0.24 (0.43)	-1.45 (1.07)
Homeless (vs. stably housed)	<b>9.45 (2.44)</b>	<b>11.29 (3.02)</b>	-2.05 (4.26)	<b>0.97 (0.33)</b>	<b>1.14 (0.38)</b>	0.30 (0.56)
<b>Change during treatment (dy<sub>3</sub>)</b>						
Young adult (vs. adolescent)	0.80 (2.02)	-3.80 (4.36)	-0.14 (4.20)	-0.34 (0.26)	<b>-1.10 (0.43)</b>	0.43 (0.54)
Female (vs. male)	-3.45 (2.26)	-6.14 (3.36)	-1.62 (4.29)	-0.32 (0.28)	0.08 (0.34)	0.05 (0.57)
SGM (vs. cisgender heterosexual)	2.33 (3.31)	-1.13 (5.46)	2.66 (6.89)	-0.02 (0.41)	0.35 (0.81)	-0.05 (1.07)
Residential/Inpatient (vs. outpatient)	<b>-15.35 (6.02)</b>	-9.23 (9.90)	-5.13 (4.34)	<b>-1.87 (0.68)</b>	1.92 (2.76)	-0.01 (0.47)
Criminal justice involvement (vs. not)	-1.45 (2.43)	-0.82 (2.94)	<b>-16.12 (6.69)</b>	-0.15 (0.29)	0.53 (0.37)	-0.92 (1.19)
Homeless (vs. stably housed)	-0.38 (2.15)	<b>-8.44 (3.00)</b>	-2.82 (3.96)	0.19 (0.25)	-0.26 (0.35)	-0.04 (0.45)
<b>Change post-treatment (g<sub>2</sub>)</b>						
Young adult (vs. adolescent)	2.08 (1.46)	5.01 (3.78)	-0.93 (2.13)	0.25 (0.18)	0.15 (0.39)	-0.13 (0.24)
Female (vs. male)	-1.50 (1.66)	0.69 (2.73)	-2.65 (2.15)	0.01 (0.20)	-0.08 (0.26)	<b>-0.67 (0.31)</b>
SGM (vs. cisgender heterosexual)	0.78 (1.97)	-5.46 (4.49)	3.35 (2.37)	0.15 (0.30)	-0.33 (0.62)	-0.40 (0.46)
Residential/Inpatient (vs. outpatient)	4.48 (4.17)	8.86 (16.8)	<b>5.49 (2.46)</b>	0.05 (0.30)	0.50 (0.43)	0.21 (0.23)
Criminal justice involvement (vs. not)	1.07 (1.51)	3.07 (2.01)	6.03 (4.54)	0.16 (0.17)	0.33 (0.21)	<b>0.62 (0.28)</b>
Homeless (vs. stably housed)	<b>4.52 (1.43)</b>	2.74 (2.50)	-1.54 (2.21)	<b>0.49 (0.17)</b>	-0.04 (0.23)	0.05 (0.25)
Chi-square test of model fit	81.42(42), <i>p</i> < .001			52.75(42), <i>p</i> = .12		
CFI, TLI	0.94, 0.87			0.98, 0.95		
RMSEA	0.04, 90% CI [0.03, 0.05]			0.02, 90% CI [0.00, 0.04]		

*Note.* Not all parameter estimates are shown for simplicity; ACRA = adolescent community reinforcement approach; MET/CBT = motivational enhancement therapy and/or cognitive-behavioral therapy; TAU = treatment as usual; SGM = sexual or gender minority; CFI = comparative fit index; TLI = Tucker Lewis index; RMSEA = root mean square error of approximation; Bold text indicates statistically significant associations at *p* < 0.05.

**Discussion**

The present study sought to compare the effectiveness of three commonly used substance use interventions for youth who experienced homelessness prior to treatment and a matched sample of their stably housed peers. We also examined how pretreatment homelessness influenced outcomes across the three interventions, and subgroup differences by age, sex, sexual/gender minority status, and frequency/duration of homelessness. Our analysis revealed a nuanced set of results. First, as expected, pretreatment homelessness was associated with higher rates of substance use and related problems in two out of three treatment groups (ACRA and MET/CBT) at treatment intake. Although there has been a dearth of research comparing substance use behaviors of YEH and stably housed youth entering treatment (see Green et al., 2020), this is consistent with epidemiological research showing greater substance use risks among YEH (Greene et al., 1997; Johnson et al., 2005). The Risk Amplification Model and qualitative research suggest that YEH use substances as a means to cope with the accumulation of traumatic life events and peer influences (Nyamathi et al., 2007; Whitbeck et al., 1999); factors which may contribute to these observed substance use disparities.

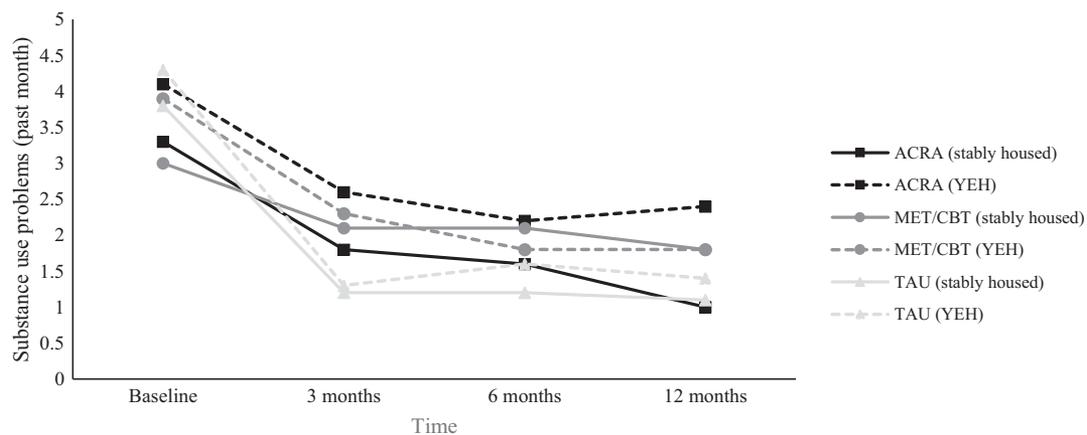
Second, our analysis of longitudinal outcomes for youth in the ACRA, MET/CBT, and TAU groups revealed that while all treatment groups reduced their frequency of substance use and related problems during treatment, YEH and stably housed youth in the TAU group showed the greatest declines in substance use problems during treatment and substance use frequency after treatment.

However, subgroup analyses suggest that TAU may not be as effective in reducing substance use problems for female YEH (relative to stably housed females) during treatment, or for young adult YEH (relative to stably housed young adults) post-treatment. Aside from these caveats, our hypothesis that YEH would exhibit less favorable outcomes was not supported in the TAU group. Although this is the first known longitudinal study of substance use treatment outcomes for YEH and stably housed youth, this is consistent with prior intervention studies conducted in homeless youth service settings, demonstrating that standard care is at least as efficacious in reducing substance use and related problems as specialized substance use interventions, such as MET and ACRA (Coren et al., 2016; Xiang, 2013). This suggests that commonly used treatment practices in TAU, such as nonspecific individual and group therapy, 12-step facilitation, and case management (Winters et al., 2014) are effective options for YEH and stably housed adolescents and young adults alike.

A third key result revealed that MET/CBT may be more effective at reducing substance use frequency during treatment for YEH than for stably housed youth. Moreover, during-treatment reductions in substance use were more pronounced for YEH with “medium” and “longer” frequency/duration of homelessness prior to treatment. This runs contrary to our hypothesis that YEH would exhibit less marked declines in substance use outcomes, relative to stably housed youth. Considering heightened substance use risks for YEH at treatment admission, it appears that MET/CBT leads to more pronounced reductions in substance use for YEH during treatment, making them comparable to their stably housed peers

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**Figure 4**  
Observed Mean Trajectories of Substance Use Problems (Past Month)



*Note.* ACRA = adolescent community reinforcement approach; MET/CBT = motivational enhancement therapy combined with cognitive-behavioral therapy; TAU = treatment as usual; YEH = youth experiencing homelessness.

by the 3-month follow-up. As noted earlier, participants in the MET/CBT group received manualized MET/CBT protocols of varying session lengths, the most common being the five-session MET/CBT-5. Following the theory of MET/CBT (Dennis, Godley, et al., 2004), YEH may have better responded to initial attempts to enhance internal motivation for change prior to engaging in group-based CBT sessions. Qualitative research has noted that YEH are wary of judgmental and authoritative counseling approaches, which can be a barrier to substance use treatment engagement (Nyamathi et al., 2007). Thus, motivational interviewing techniques and/or concrete coping skills acquired during the CBT sessions may have been particularly helpful for YEH. The group-based CBT sessions are another unique aspect of MET/CBT. Recent research suggests that interventions delivered in a peer-group context may be particularly helpful for YEH (Kidd et al., 2019). In a recent example, a brief (four-session) group-based motivational interviewing intervention was shown to reduce high-risk alcohol and sexual behaviors among young adult YEH (Tucker et al., 2017). The success of this intervention may have been partly due to group facilitators' use of motivational interviewing skills (open-ended questions and reflections), which led to greater "change talk," and in turn, decreased heavy drinking (D'Amico et al., 2017). It should also be noted that some participants in TAU also received group counseling. Although the content of these groups is unknown, this may have contributed to the effectiveness of TAU for both YEH and stably housed participants.

Finally, compared to stably housed participants, YEH in the ACRA group evidenced greater substance use and related problems following treatment than stably housed youth in the ACRA group, with few remarkable differences depending on YEH's frequency/duration of homelessness. This amounts to a small, but significant, increase in substance use behaviors for YEH in the 9 months following treatment completion. One reason for this may be *because* of ACRA's focus on building community supports. Research has shown that YEH tend to be disconnected from familial and social institutions such as schools (Whitbeck, 2009), and therefore, encouraging YEH to re-engage in these systems may have led to

a significant increase in substance use and related problems for some YEH after treatment if these efforts were unsuccessful. Despite these observations, post-treatment substance use outcomes for YEH in the ACRA group were a significant improvement from pretreatment levels. Therefore, the relatively small increases in substance use and related problems observed for YEH following treatment should not detract from ACRA's overall effectiveness.

### Study Strengths and Limitations

This study advances the literature in at least three ways. This is the first known study of the effectiveness of specific treatment approaches for YEH and stably housed youth in specialized substance use treatment settings, using a nationwide sample. Further advances have been made with the use of sophisticated statistical methods (case-control matching, propensity score weighting, and latent change score models), and by analyzing demographic moderators (subgroup differences). A number of limitations of this study are noteworthy. First, this study was not a randomized controlled trial, but the use of propensity score weighting may have helped reduce bias stemming from nonequivalent groups at baseline. Second, it is possible that the matching procedure used to select the stably housed reference group was not optimal if important matching variables were omitted. Third, comparisons between treatment groups are complicated by the variety of interventions used in the MET/CBT and TAU groups. There is also a risk of social desirability or recall bias, as data were collected via self-report. Future studies may want to examine the use of specific substances (alcohol, cannabis, etc.) and focus on other relevant treatment outcomes, such as mental health, housing, and social stability (see Slesnick et al., 2015). We also did not assess how experiences of homelessness during or post-treatment may influence changes in our outcomes. This is an interesting empirical question that requires utilizing time varying covariates to predict contemporaneous changes in substance use during and after treatment. Future research may wish to consider this, as it could shed light on how experiences of homelessness during and after treatment influence outcomes. Finally, results may

not be generalizable to transgender clients, as only one participant identified as transgender.

### Implications for Research and Practice

Results from this study should inspire optimism, since youth in all three treatment groups had significant declines in substance use and related problems during treatment, and generally maintained these reductions up to 1 year after treatment admission. Overall, TAU appeared to be the most effective intervention for a majority of YEH and stably housed youth. Providers may also consider using MET/CBT, which may be more effective in reducing substance use during treatment for YEH with more prolonged recent episodes of homelessness than for stably housed youth. More research may be needed to investigate why certain intervention approaches may result in less optimal outcomes for specific subgroups (e.g., female and young adult YEH in TAU). With these caveats aside, positive results from this study underscore the importance of removing barriers to treatment for YEH with problematic substance use, who likely enter treatment with more severe substance use disorders than stably housed young people. This is important, considering that approximately 92% of adolescents and young adults with substance use disorders do not receive treatment (SAMHSA, 2020), and significant barriers to treatment exist for YEH (Nyamathi et al., 2007). Although we believe that our results can inform clinical practice, more randomized controlled trials in homeless youth service settings and specialty substance use treatment clinics will help resolve some inconsistencies in the literature. Finally, more work is needed (including qualitative research with youth and providers) to develop practical recommendations for YEH who enter substance use treatment and to implement evidence-based practices in the various settings where YEH are served.

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